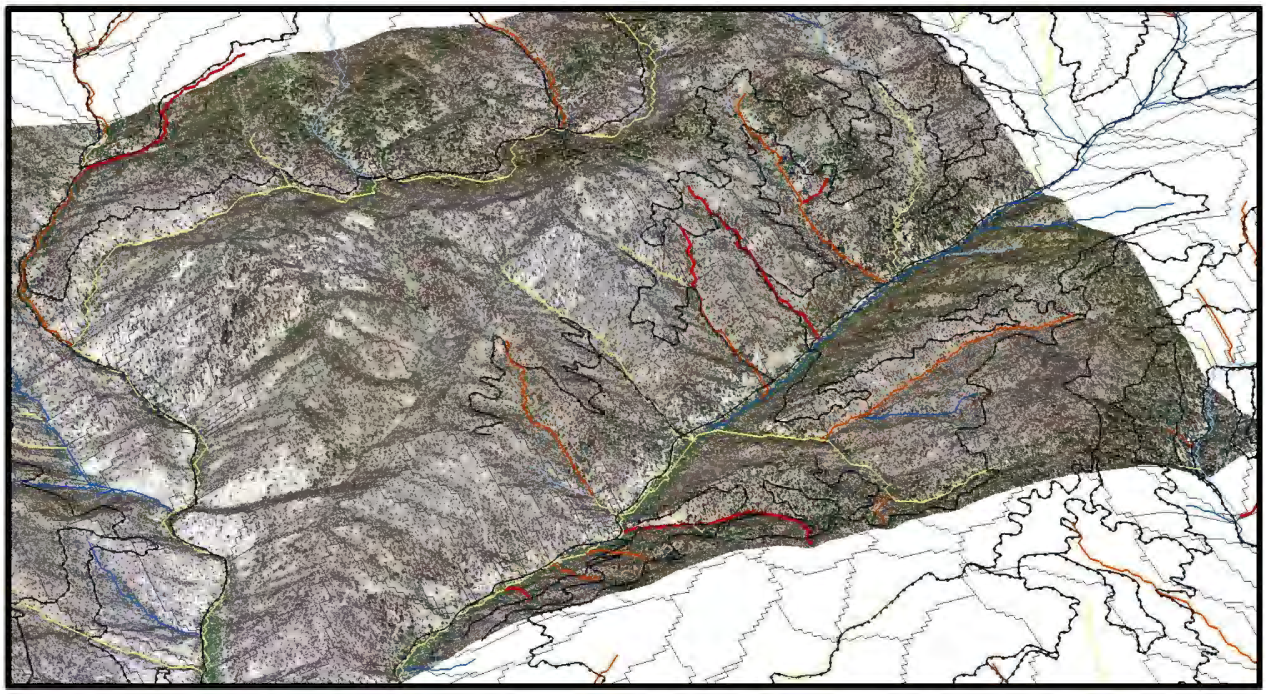
GRAIP_Lite: A System for Road Impact Assessment



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January 2019

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Abstract

GRAIP_Lite is a system of tools developed for ArcGIS that is used to model road-related sediment impacts to stream habitats. GRAIP_Lite uses a topographic model, along with other inputs, to create road segments, applies average vegetation parameters and calculates sediment production from individual road segments, uses a local polynomial fit to describe stream connection probabilities and fractional sediment delivery based on flow distance to streams, and accumulates routed sediment throughout the modelled stream network. Road-related sediment impact is described using specific sediment (Mg/yr/km2) in the modelled stream network. This metric can easily be used to determine areas where roads present a higher risk to stream habitats when prioritizing areas for restoration or remediation efforts. When used for alternatives analysis, GRAIP_Lite allows the user to specify various treatment options for individual roads and then models the road-related sediment conditions at the initial condition (before work begins), disturbed condition (immediately post-work or during haul), and the recovered condition (once vegetation has recovered to normal values). GRAIP_Lite also has reporting tools that generate basic maps for use in reports based on the model results.

Acknowledgements

We would like to thank Brian Anderson, Terry Hardy, John Thornton, Melanie Vining, Brian Staab, Richard Cissel, and others who gave us encouragement and advice in our efforts to adapt the GRAIP_Lite model into a tool that would fit the needs and abilities of management and regulatory agencies.

Leigh Woodruff, Lynn Hood, Dwight Atkinson, and Teresa Kubo at the U.S. Environmental Protection Agency secured the funding for the development and programming of the GRAIP_Lite model and tools.

We would also like to thank Christine Dartiguanave at ESRI, who has done all the programming for the GRAIP_Lite tools.

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Introduction

Fine sediment accumulations in streams reduce the quality of critical stream habitats by impairing spawning gravels and reducing productivity. Forest roads are common sources of chronic fine sediment delivery in otherwise clear mountain streams. While the amounts delivered may be small compared to long-term sedimentation rates and sediment transport capacity (Goode et al., 2012), short-term road-related sediment can be significant and represent a large portion of the stream's short-term sediment load. Furthermore, the chronic nature of road erosion inputs may have important consequences for fish habitat (Maturana et al., 2014).

Road density is one tool that has been used to estimate road-related sediment risks to streams. It is generally assumed that where there are higher densities of roads there should also be greater road-related sedimentation, and to some extent this is true. The issue is that this approach treats all roads and environments as equals, even though anyone who has spent time exploring or working on forest roads knows that not all roads are created equal; there is substantial variability in road design, location, and maintenance practices (e.g. Luce et al., 2001). The one benefit of the road density approach is that it is quick, easy, and inexpensive to apply.

Road inventories are a fairly direct approach to identifying the unique qualities of each road. For instance, the Geomorphic Roads Analysis and Inventory Package (GRAIP, Black et al., 2012, Cissel et al., 2012) uses a GPS inventory to map the road network hydrology at the scale of individual road segments and drainpoints. An empirical model is used to estimate road sediment production on individual road segments, and the estimated sediment production is routed to the observed drainpoints and to the stream network, if the drainpoint was observed to be hydrologically connected to the stream network. This allows GRAIP to provide a detailed map of road sediment production, delivery, and accumulation in streams within a watershed. GRAIP also addresses a number of other potential road related risks, including landslide and gully initiation risks and stream crossing problems. The detailed information comes at greater cost than road density information; however such costs are a tiny fraction of actual road treatment costs, and targeting treatments to where they will have the greatest outcomes can more than offset inventory expenses. The amount of information provided by field surveys is suitable for project planning and some design level decisions. Such detail may be much greater than is necessary for many broad planning-level exercises.

Practical, intermediate information-content tools would be useful to managers. GRAIP_Lite leverages empirical patterns and information from several watershed studies done using GRAIP inventories and analyses to substantially refine the information that can be extracted from GIS map-level information. In keeping with a modeling philosophy that seeks to match decision maker information needs to modeling effort (Figure 1), GRAIP_Lite can be implemented using only existing GIS data, or it can be supported using a field-collected calibration data set to inform a statistical estimation of vegetation cover and delivery curves. Existing GRAIP data can be used to supply this calibration data set or new calibration data can be collected in areas where existing GRAIP data is not available or applicable. We also offer a calibration survey design that takes less time and expense than complete inventories. Again, the intent is to provide a spectrum of tools to allow managers to match their needs for precision and accuracy to the level of effort expended (Figure 1).

Figure 1: The information-effort scale for road erosion estimation.

Calculations

Supporting Data

GRAIP_Lite was developed from data associated with several large GRAIP watershed inventories, which provided the means of determining the underlying relationships between sediment delivery and flow distance to streams. Over 77,000 drainpoint observations were used to test various predictive variables and model relationships. Road segment data was used to derive average vegetation states for different surface type and maintenance level classes. The more detailed GRAIP model provided the basic structure, with the GRAIP_Lite model being similarly composed of separate components for sediment production, sediment delivery, and sediment accumulation.

GRAIP_Lite uses a single flow path road model where each road segment drains completely at a single drainpoint located at the downhill end of the road segment. This is a simplification from the GRAIP model, which allows two flow paths and more complex flow routing through multiple road segments, but without the complete road inventory there is no way to predict such routing. What can be done, and what GRAIP_Lite does, is to use topography and maintenance level as the bases to break up the road network into individual road segments, each of which can be assigned a drainpoint, model sediment production from that road segment based on several factors, model sediment delivery based on connection probabilities, and then accumulate the delivered sediment through the stream network to assess sediment loads and risks.

Components

GRAIP_Lite estimates sediment production and delivery separately. The first component calculates an estimate of the amount of sediment produced from each segment of, and the second component then models how much of that sediment is actually delivered to the stream network, where it can impact aquatic habitat.

Sediment Production

Sediment production is the amount of sediment eroded from the road surface, and is estimated for each road segment as

$$E = BRSV$$

where E is the total sediment production for the road segment, B is the baserate, R is the elevation difference between road segment ends, S is the surface type factor, and V is the vegetation factor. These components are shown in Figure 2.

Figure 2: Components of the Sediment Production equation.

Baserates

The baserate is used to describe the erodibility of the road surface and the power of rainfall to detach and transport sediment, and is used to take into account different variables including local geologic and climatic factors. In most cases, baserates are measured using plot studies, as described in Black and Luce (2013). In some cases, baserates have been inferred from other methods, including WEPP model runs (e.g. Tysdal et al., 1999). The "base" condition is a graveled road segment 80 meters long with no vegetation low traffic and a 6% slope (so R is about 5m). The default baserate is 79 kg/yr/m vertical drop along the road based on a field site in western Oregon (Luce and Black, 1999). Baserates for other calibrations can be found in Appendix A.

Surface Factors

The surface factors used in GRAIP_Lite are dependent on the surface type and the traffic level of the road being modelled. This allows GRAIP_Lite to account for differences observed between roads with varying amounts of traffic and with different surface types. The surface type "Not a road" is used to model planned roads that do not yet exist as part of how GRAIP_Lite models different treatment alternatives. These factors are shown in Table 1. The entries for the "Low" traffic level and varying surfacing are based on field data in western Oregon (Luce and Black, 1999). There have been a limited number of studies examining the effect of vehicle traffic on road surface erosion. These studies have typically measured erosion at the bottom of a road segment under different traffic levels with different levels of road maintenance that generally accompany increased road use. Kochenderfer and Helvey 1987, Bilby et al. 1989, Fahey and Coker 1989, Foltz 1999, and Sheridan et al 2006 found that a change from light vehicle use to more than 5 heavy truck passes a day resulted in an increase by a factor of 2-5 in the observed erosion. This traffic change is typical of a US Forest Service maintenance level 2 or 3 road that is being used as a haul route for a timber sale. Observations on erosion from closed, gated and unused roads are rare. In a study on the Lolo National Forest (Black et al. unpublished) we found that erosion on unused road with vegetation on the surface was less than 10% of that on similar roads with occasional light vehicle use.

Table 1: Surface Factors by Surface Type and Traffic Level.

Surface Type	Traffic Level			
	None	Low	Medium	High
Crushed Rock	0.1	1.0	2.0	4.0
Native	0.5	5.0	10.0	20.0
Paved	0.1	0.2	0.2	2.0
Not a road	0.0	0.0	0.0	0.0

Vegetation Factors

Vegetation growing in the flowpath on the road's surface acts to reduce sediment production by increasing surface roughness and by anchoring material. The vegetation factor is calculated as

$$V = 1 - 0.86\,x$$

where x is the fraction of the road segments where the flowpath vegetation cover is greater than 25%, as observed in a calibration data set. This is calculated for each combination of surface type and maintenance level and represents the average vegetation on those resulting classes of roads.

Sediment Delivery

Data from GRAIP inventories shows that not all sediment eroded from the road surface is delivered to streams, and that the majority of the sediment that is delivered to the stream network is delivered by a small portion of the total road network. With the GRAIP model, sediment delivery is based on a direct field observation indicating if each individual drain point is hydrologically connected to the stream network. Since GRAIP_Lite does not use those direct observations, a different method of modelling sediment delivery is required.

Stream Connection Probability as Fractional Delivery

GRAIP_Lite uses a fractional delivery model instead of the yes/no model that GRAIP uses. Calibration data is used to define a set of curves describing the probability that a drainpoint would be observed to be stream connected based on the modeled flow distance to the modeled stream network and the length of the road segment it drains (Figure 3). We define the fractional sediment delivery to be equal to the probability of observed stream connection, and use a local polynomial regression (Loader, 2013) to estimate those probabilities conditioned on distance to stream and road segment length class. Given that a probability is mapped to fractional delivery, this approximation is only applicable when averaging across a number of potential delivery sites. It is an application of risk assessment, where the cost is the amount of sediment and the probability of delivery is the hazard.

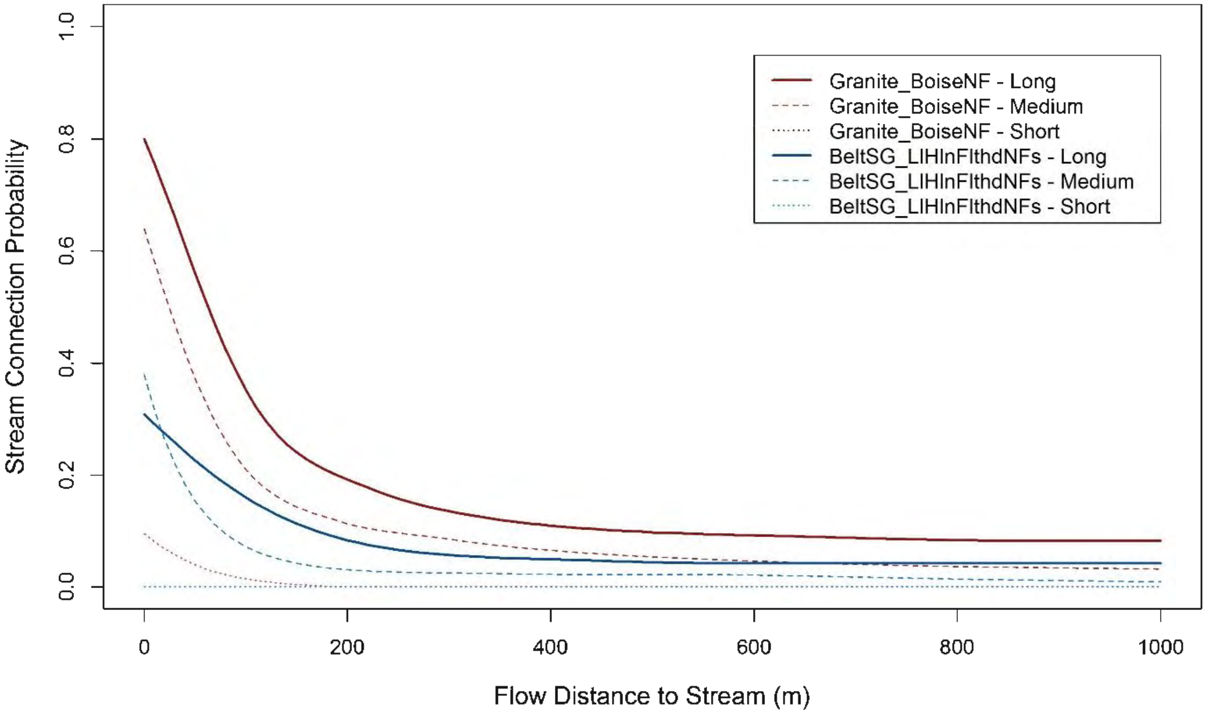


Figure 3: A comparison of the different calibration curves used by two local calibrations.

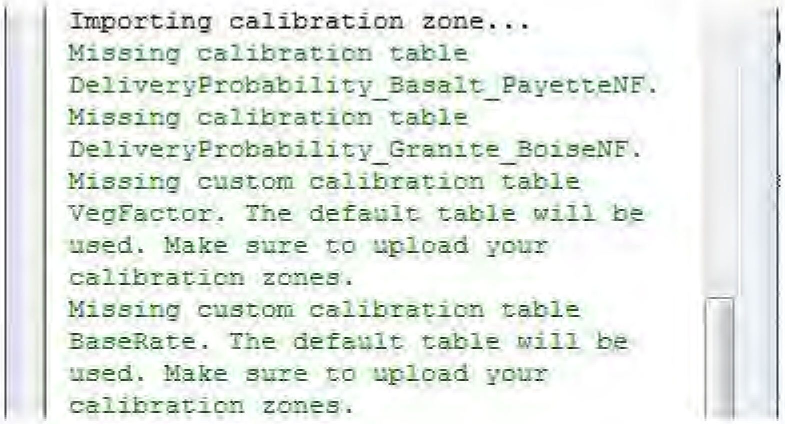
Sediment Accumulation

The very fine sediments originating in road surface erosion move fairly readily through steeper headwater streams and it is reasonable to ignore Sediment accumulation within the stream network is calculated by the ArcHydro tools in the same way that GRAIP uses the TauDEM tools to route sediment through the stream network and calculate contributing areas and specific sediment loads.

Calibration

Calibration data is collected in the field using GPS and data entry at each site. At each sample drainpoint, the crew collects data on drain type, stream connection, road surface type, recent road maintenance, and flowpath vegetation and records the data in the database. Excepting road maintenance, GRAIP data can be used to derive a calibration data set if there is pre-existing GRAIP data available. The observations of stream connection provide the basis for local polynomial regression curves used to predict the probability of stream connection as a function of stream distance. Stream distance is the modelled flow distance from the observed drainpoint and the stream network modelled by the ArcHydro tools. The road surface type, maintenance level, and flowpath vegetation records are used to calculate the vegetation factor for road surface type and maintenance level combinations.

If you are using one of the included calibrations, you will see a message in green text advising you that the delivery probability, vegetation factor, and baserate tables are missing (Figure 4). The table values are already in the tables and so this is not an issue when using these calibrations.



```
Importing calibration zone...
Missing calibration table
DeliveryProbability_Basalt_PayetteNF.
Missing calibration table
DeliveryProbability_Granite_BoiseNF.
Missing custom calibration table
VegFactor. The default table will be
used. Make sure to upload your
calibration zones.
Missing custom calibration table
BaseRate. The default table will be
used. Make sure to upload your
calibration zones.
```

Figure 4: Messages advising that calibration tables are missing.

Prerequisites and Installation

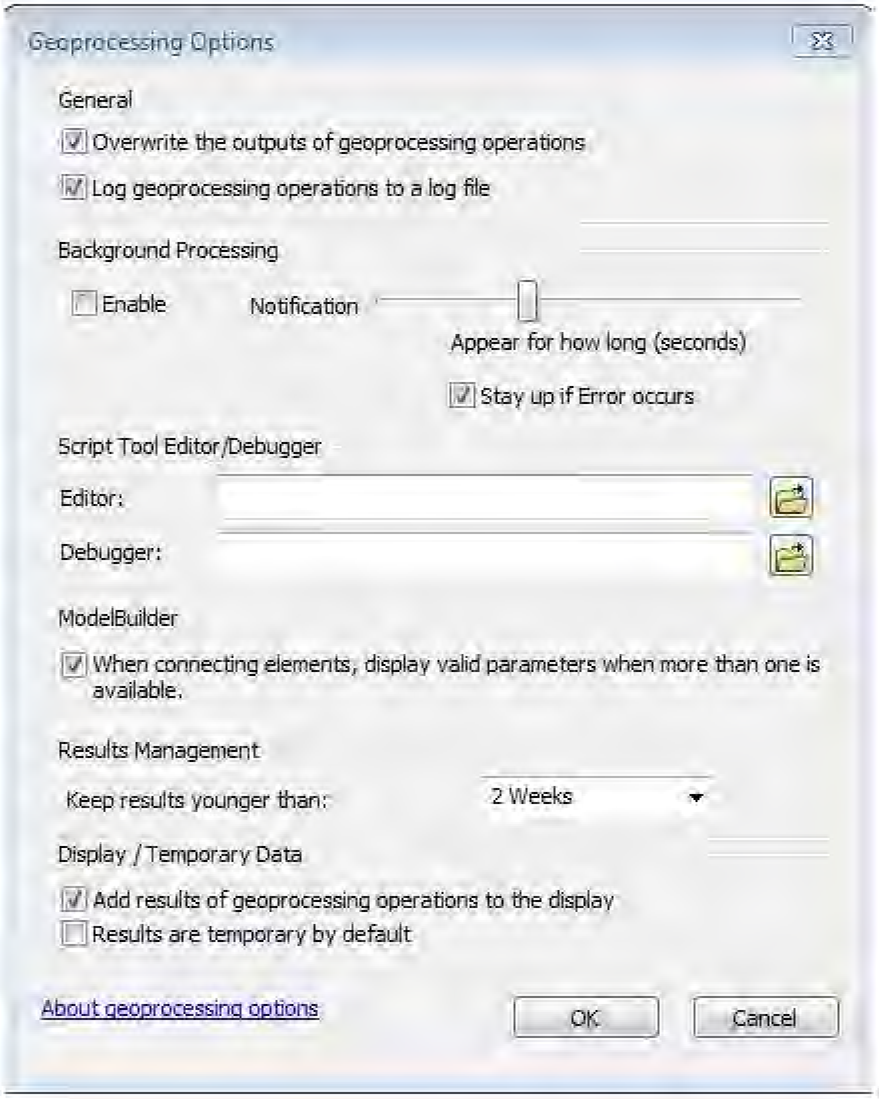
To install GRAIP_Lite, make sure that the computer has ArcGIS 10.3.1 or higher, with the Spatial Analyst and 3D Analyst extensions and the Advanced License, then install the most recent version of Arc Hydro Tools (10.3.172 or later). GRAIP_Lite is part of the Arc Hydro Tools package, available at http://downloads.esri.com/archydro/archydro/setup/.

Further information on GRAIP_Lite can be found at https://www.fs.usda.gov/GRAIP/GRAIP_Lite.html.

ArcMap setup.

There are a couple things in the ArcMap settings that are necessary to let GRAIP_Lite run smoothly. These should be set before starting the GRAIP_Lite tools; once set, they should remain set, but they are good places to start when troubleshooting.

First, using the Geoprocessing menu, open Geoprocessing Options (Figure 5). Make sure that the boxes are checked for “Overwrite the outputs of geoprocessing operations” and “Add results of geoprocessing operations to the display” that Background Processing is not enabled. This should eliminate errors where GRAIP_Lite cannot overwrite certain temporary files (like the out_splitlineatpoint feature classes). Background processing is generally less stable than foreground processing.



Geoprocessing Options

General

☑ Overwrite the outputs of geoprocessing operations

☑ Log geoprocessing operations to a log file

Background Processing

☐ Enable

Notification

Appear for how long (seconds)

☑ Stay up if Error occurs

Script Tool Editor/Debugger

Editor:

Debugger:

ModelBuilder

☑ When connecting elements, display valid parameters when more than one is available.

Results Management

Keep results younger than: 2 Weeks

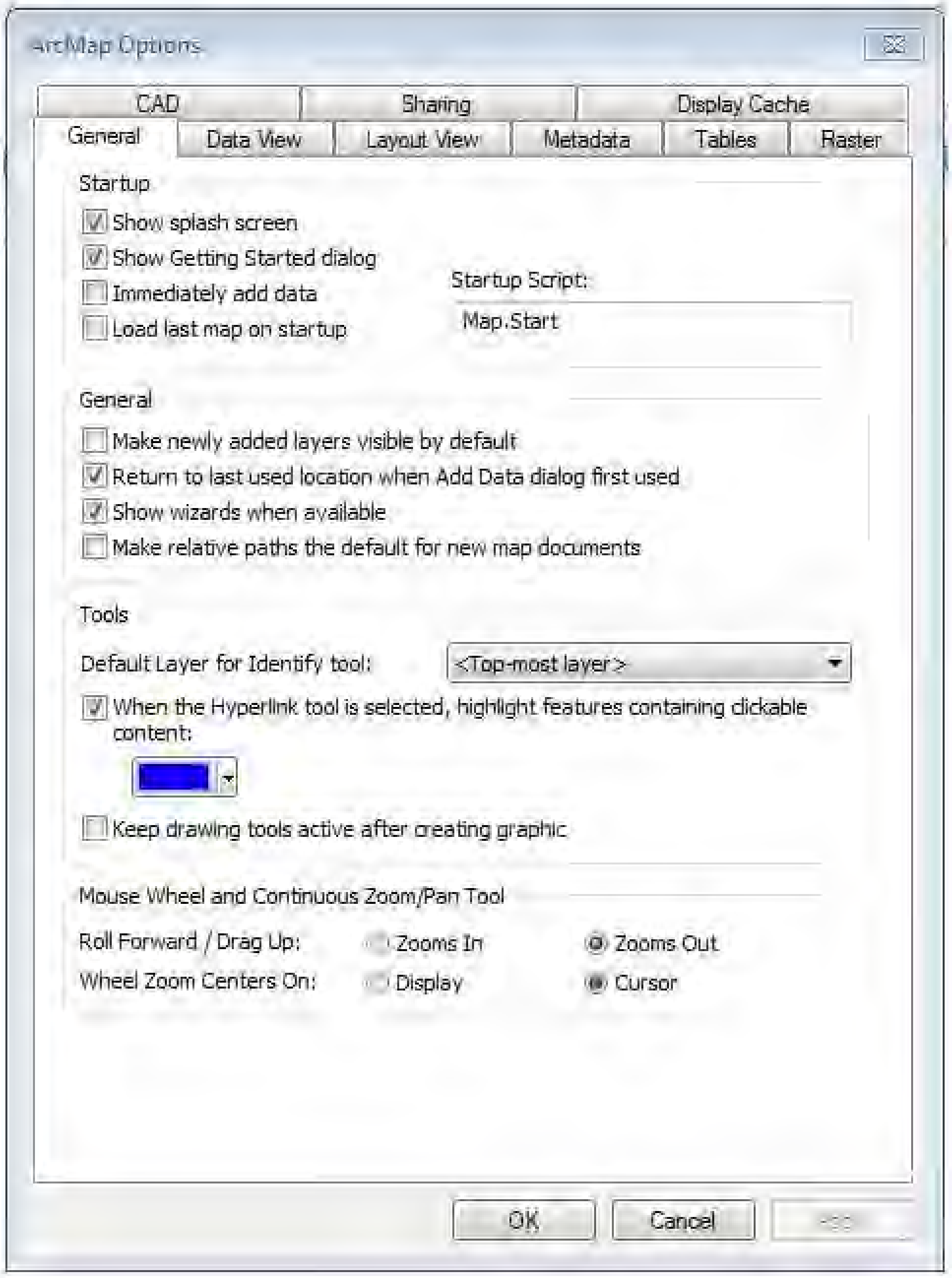
Display / Temporary Data

☑ Add results of geoprocessing operations to the display

☐ Results are temporary by default

Figure 5: ArcMap Geoprocessing settings. These should also be set in ArcCatalog.

Another useful setting, especially on slower computers, is found in the ArcMap Options window (Figure 6) under the Customize menu. If you uncheck the box by “Make newly added layers visible by default”, ArcMap will not try to draw each layer over and over as different layers are added to the map document. This can significantly speed up slower machines.



Startup

☑ Show splash screen
☑ Show Getting Started dialog
☐ Immediately add data
☐ Load last map on startup

Startup Script: Map.Start

General

☐ Make newly added layers visible by default
☑ Return to last used location when Add Data dialog first used
☑ Show wizards when available
☐ Make relative paths the default for new map documents

Tools

Default Layer for Identify tool: <Top-most layer>

☑ When the Hyperlink tool is selected, highlight features containing clickable content:

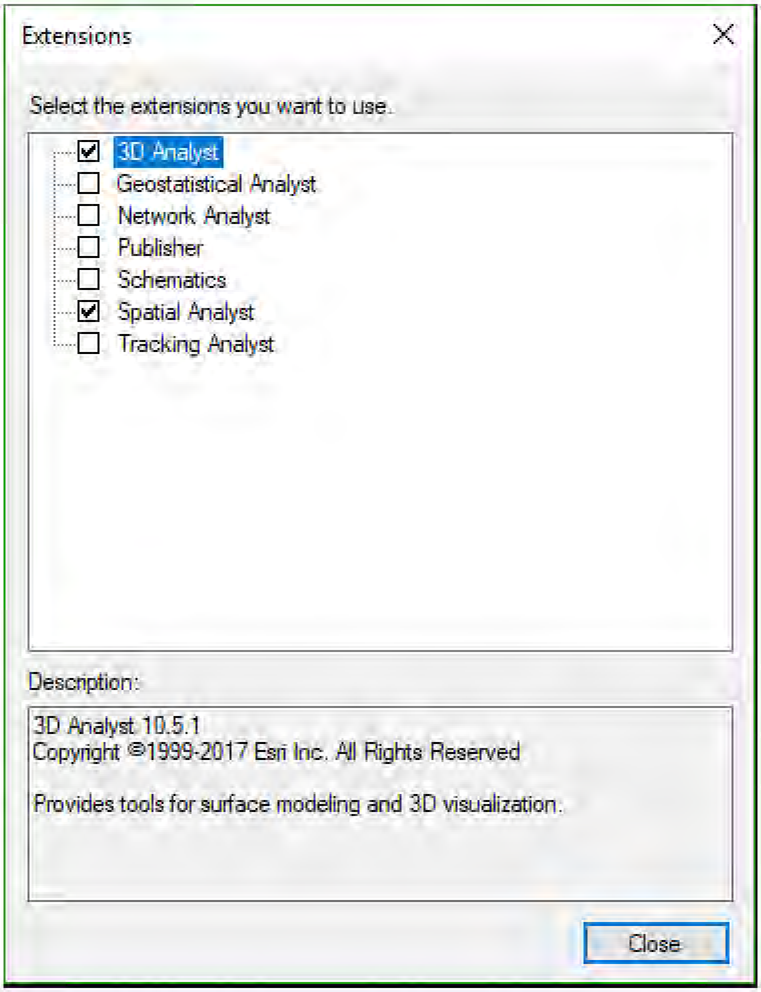
☐ Keep drawing tools active after creating graphic

Mouse Wheel and Continuous Zoom/Pan Tool

Roll Forward / Drag Up: ○ Zooms In ● Zooms Out
Wheel Zoom Centers On: ○ Display ● Cursor

Figure 6: ArcMap Options settings.

ArcHydro and GRAIP_Lite make use of two extensions in ArcGIS: 3D Analyst and Spatial Analyst. Spatial Analyst is also very useful for setting up your GRAIP_Lite projects. You can verify that these are set up and available by going to Customize -> Extensions and making sure the appropriate boxes are checked (Figure 7).



Select the extensions you want to use.

- ☑ 3D Analyst
- ☐ Geostatistical Analyst
- ☐ Network Analyst
- ☐ Publisher
- ☐ Schematics
- ☑ Spatial Analyst
- ☐ Tracking Analyst

Description:

3D Analyst 10.5.1
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Provides tools for surface modeling and 3D visualization.

Figure 7: The Extensions window accessed in the Customize menu.

Input Data Requirements

GRAIP_Lite requires that the input data meet certain requirements. While in some cases GRAIP_Lite may still run if these requirements are not met, the model results may not be accurate. GRAIP_Lite requires a rectangular projection with meters as the linear unit. Since input data is often in different projections, or in unprojected geographic coordinate systems, all input data should be checked and projected into a suitable coordinate system. Universal Transverse Mercator (UTM) systems are ideal.

Roads Layer

The roads layer input into GRAIP_Lite also needs to meet specific requirements as to the attributes present in the data set. GRAIP_Lite was designed around the U.S. Forest Service's INFRA road layers, which contain information about road surfacing and maintenance that is used by the model to estimate parameters related to sediment production.

Both the attribute field names and the values contained in those fields needs to fit the specific form that GRAIP_Lite expects. The three required fields for any dataset are the route status (ROUTE_STAT or ROUTE_STATUS), surface type (SUFACE_TY or SURFACE_TYPE), and operational maintenance level (OPER_MAINT or OPER_MAINT_LEVEL) fields; short names are for shapefiles and long names are for geodatabase feature classes.

Where data are missing from these fields, GRAIP_Lite attempts to fill it in by making certain assumptions. If data are missing from the surface type field, the model will assume a native road surface; if data are missing from the maintenance level field, then the model assumes the road is a maintenance level 2 road, meaning that it has minimal design and is intended for slow, high clearance vehicles. Often, INFRA road layers are missing this information from non-Forest Service System roads, which may include private or county roads and state or federal highways. In most such cases, especially with county, state, or federal roads, the surface type may be known and it is just the maintenance level that is missing. Ideally, all missing data will be accurately filled in. Again, the design allows for the manger's discretion with respect to effort versus accuracy. In most cases, the default sets the condition to the highest risk so that analysts may reasonably claim that uncertainty was set to a worst case analysis.

We have seen GRAIP_Lite give an error when the data in Oper_Maint is not in the correct format; for example, if it is set to "D – Decommissioned" it will cause an error because D is not a numeric value and GRAIP_Lite does not know what to do with the value. Such values need to be corrected before the database will initialize by changing the value to one of the expected values; "D – Decommissioned" gets changed to "1 – BASIC CUSTODIAL CARE (CLOSED)" and "NA – NOT APPLICABLE" should be changed to match the road characteristics, if known, or deleted so there is no value for those records.

Digital Elevation Model

Calibration sets included with GRAIP_Lite were developed using DEMs from the 1/3rd arc-second National Elevation Dataset (NED) with a nominal 30m resolution, accessible at https://viewer.nationalmap.gov/basic/. In practice, these DEMs run between about 20m and 28m resolutions when projected into a UTM coordinate space; we usually round the cell size off to the nearest meter for simplicity. When using one of the installed calibrations, including the default calibration, a nominal 30m DEM has been assumed and should be used.

Because Arc Hydro uses a threshold approach to determining stream head locations and that contributing area threshold is determined by the number of contributing cells rather than the contributing area, using a higher resolution DEM without also changing the threshold cell count results in a denser modelled stream network (Figure 8), which in turn results in shorter modelled flow distances to streams and differences in road connectivity and sediment delivery. DEM resolution must match that of the calibration being used, or care must be used to set the *Number of Cells* threshold when running the *DEM Processing* tool to match the contributing area threshold, and therefore modelled drainage density, of the calibration. The contributing area threshold is described by

$$C\,L^2 = A$$

where C is the *Number of Cells* threshold, L is the resolution of the DEM, and A is the contributing area threshold.

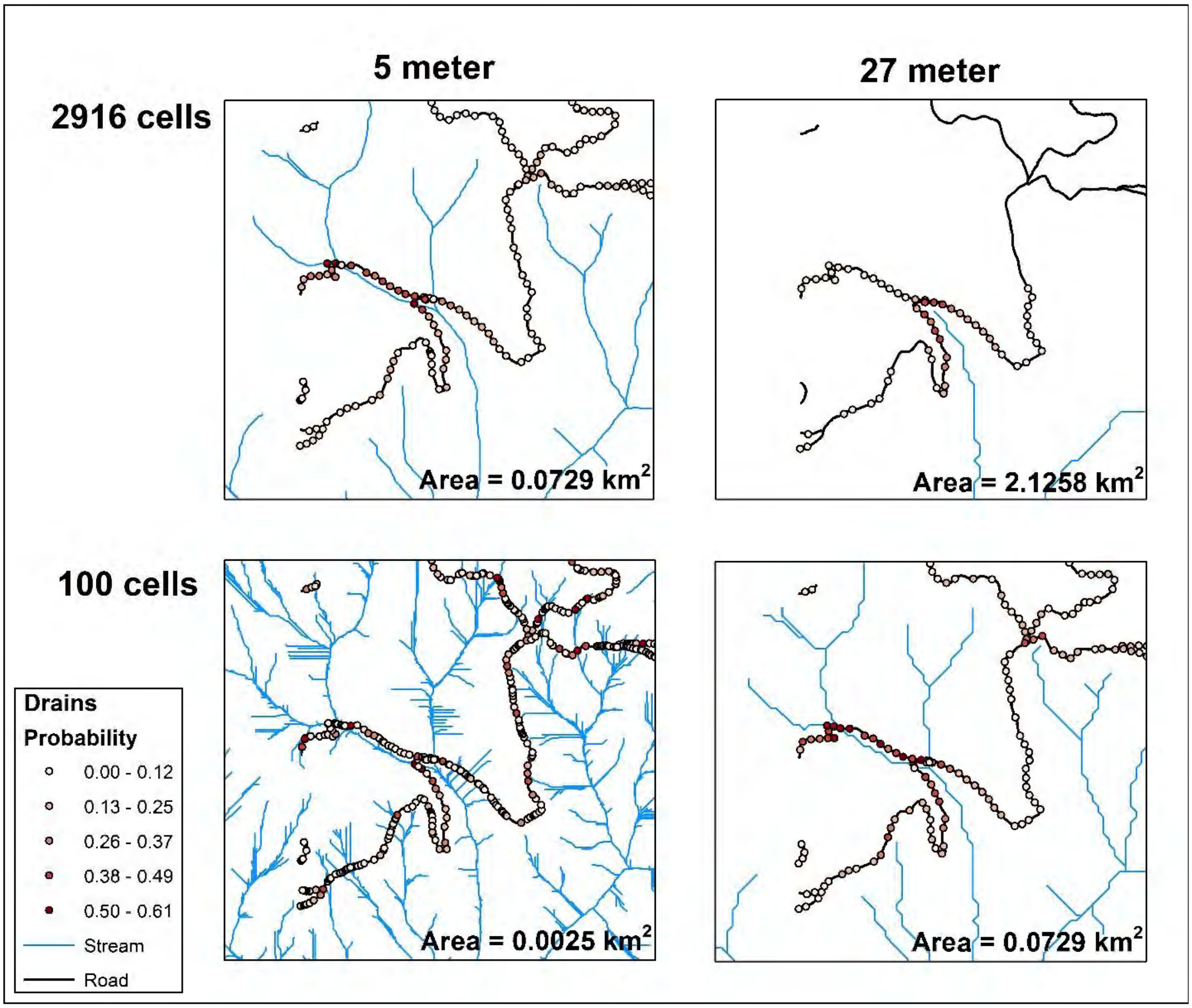


Figure 8: Relationships between DEM resolution, contributing cell threshold, and resulting contributing area thresholds in terms of resulting modelled drainage density and stream connection probabilities.

It is also important to keep in mind that the streams in GRAIP_Lite are modeled streams at all steps beyond the collection of the field calibration data. This means that there will be discrepancies between these modeled streams and the actual streams on the ground when it comes to the location and extent of the stream networks. Local controls on steam head locations may not be apparent when modeling stream networks from a DEM when using a simple threshold cell-count approach.

Using Calibration Zones

Calibration zones are defined by a polygon shapefile or feature class with an extent equal to that of the DEM. These define areas where characteristics are relatively similar (e.g. climate and geology) and the necessary model parameters are known. A given run of GRAIP-Lite can use one or more zones. Each defined zone requires a field called “Name” that contains the name of the calibration for that area. Included calibrations can be used by assigning the names of the desired calibrations (Table 2). Managers seeking to increase the accuracy and precision for their project area can complete surveys to create a custom calibration (effort-accuracy balance). Custom calibrations require that the appropriate parameter tables are included in the same directory as the calibration zone shapefile or feature class.

Table 2: Included GRAIP_Lite calibrations.

Name		**Baserate**	**Mean Annual Precipitation**	**Mean Elevation**	**Connection Rate**	**Number of Years of Data**	**Number of Plots**
Formal	*Used in GRAIP_Lite Tables*	*(kg/yr/m)*	*(mm)*	*(m)*			
Default	Default	79.0			15%		
Andesite - Eldorado NF	Andesite_EldoradoNF	53.0	1287	1718	13%	3	3
Andesite - Plumas NF	Andesite_PlumasNF	77.6	803	1906	15%	4	4
Basalt - Payette NF	Basalt_PayetteNF	27.2	1009	1722	17%	5	5
Basalt - Umatilla NF	Basalt_UmatillaNF	1.5	464	1178	26%		
Basalt/Sandstone - Siuslaw NF	BasaltSandstone_SiuslawNF	79.0	2096	200	4%		
Belt Super Group - Colville NF	BeltSG_ColvilleNF	14.0	625	1151	8%		
Belt Super Group - Lolo Helena Flathead NFs	BeltSG_LlHlnFlthdNFs	14.0	680	1523	6%	7	15
Granite - Boise NF	Granite_BoiseNF	21.3	850	1707	17%	9	6
Granite - Eldorado NF	Granite_EldoradoNF	49.5	1302	1766	17%	3	3
Granite - Plumas NF	Granite_PlumasNF	30.2	751	1701	11%	4	4
North Cascades - Mount Baker Snoqualmie NF	NCascades_MtBkrSnqlmNF	79.0	3147	631	35%		

Known Drainpoints-*optional*

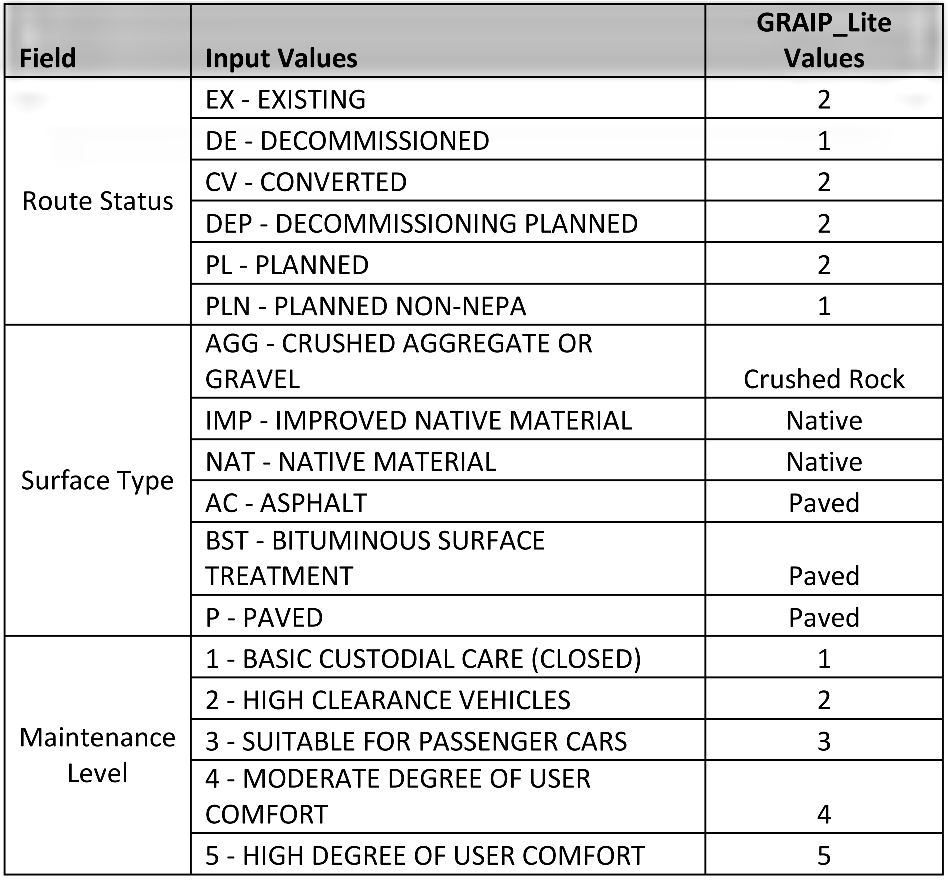
The known drainpoints layer is a point shapefile or feature class containing the locations of known, surveyed drainpoints along the modeled roads. GRAIP_Lite makes use of points within 10m of the roads layer by snapping those points to the road layer and using them as split points when breaking up the road layer into road segments. This allows the user to force GRAIP_Lite to create split points at engineered drainage features in addition to relying on topographic and maintenance level based split point predictions.

Input Data from Other Sources

Road layers from other sources may be used, but some pre-processing will likely be necessary to make such layers compatible. It will likely be necessary to add and populate the required fields, which are the route status (ROUTE_STAT or ROUTE_STATUS), surface type (SUFACE_TY or SURFACE_TYPE), and operational maintenance level (OPER_MAINT or OPER_MAINT_LEVEL) fields; you can use either long or short names depending on the data type. All of these fields are text fields.

To populate the fields with appropriate data, you will need to know something about your roads and know what values to input (Table 3) so GRAIP_Lite understands what your roads are like. The easiest field is the route status field; this field is used primarily to guess the maintenance level if the maintenance level field is blank but should still be filled in. The surface type field should also be fairly easy to assign. Maintenance levels are probably the trickier values to assign. For more information on Forest Service road maintenance levels see Apadoca et. al. 2012.

Table 3: Input values for GRAIP_Lite.



Field	Input Values	GRAIP_Lite Values
Route Status	EX - EXISTING	2
	DE - DECOMMISSIONED	1
	CV - CONVERTED	2
	DEP - DECOMMISSIONING PLANNED	2
	PL - PLANNED	2
	PLN - PLANNED NON-NEPA	1
Surface Type	AGG - CRUSHED AGGREGATE OR GRAVEL	Crushed Rock
	IMP - IMPROVED NATIVE MATERIAL	Native
	NAT - NATIVE MATERIAL	Native
	AC - ASPHALT	Paved
	BST - BITUMINOUS SURFACE TREATMENT	Paved
	P - PAVED	Paved
Maintenance Level	1 - BASIC CUSTODIAL CARE (CLOSED)	1
	2 - HIGH CLEARANCE VEHICLES	2
	3 - SUITABLE FOR PASSENGER CARS	3
	4 - MODERATE DEGREE OF USER COMFORT	4
	5 - HIGH DEGREE OF USER COMFORT	5

Applications and Uses

GRAIP_Lite has several applications and uses for management purposes. These applications extend from forest-wide watershed condition assessments to project scale NEPA work. Different types of analysis have some different assumptions and limitations.

Model validations between GRAIP_Lite and GRAIP reveal typical patterns of potential errors created by the differences between the two models, largely due to GRAIP_Lite using a probabilistic fractional delivery model and GRAIP using binary (yes or no) observations of delivery. When there is a small amount of road being modeled, there is a greater chance that GRAIP_Lite sediment predictions for individual stream reaches may be significantly different from those predicted by GRAIP (Figure 9A). At the same time, the predictions showing the greatest error are also likely to be relatively smaller masses of sediment (Figure 9B). In both cases, the mean errors, and even the standard deviations, are small even with small amounts of road and smaller amounts of modeled sediment. Some of the errors are also due to GRAIP's ability to describe road segments and drainpoints that do not fit average observed conditions, either by being in better shape than average or by being in worse shape than average.

Another important factor is the accuracy of the input information, especially the data in the road layer. GRAIP has an advantage in this case because of the intensive field inventory; all of GRAIP's input data is effectively field verified and can vary at the scale of individual model road segments. GRAIP_Lite is dependent on the accuracy of the road layer input; if the data in the road layer is inaccurate or out of date, the model results will be as well, and where data are missing, for example where surface type or maintenance level attributes are not complete, GRAIP_Lite must assume parameters which may not reflect reality. Any model is, at best, only as good as the data driving it. A range of options are available in GRAIP_Lite for accepting lower quality input data while still using some understanding of road systems to give a reasonable estimate.

GRAIP_Lite is an ideal tool for use in watershed condition assessments that may be done across one or more forests at a time. In this type of analysis, GRAIP_Lite is used to assess road surface-related sedimentation within areas ranging from 6th-code HUCs to about half a 6th-code HUC across the total landscape. At these scales, GRAIP_Lite yields similar sediment accumulation and delivery values to GRAIP, and absolute values may be used with confidence, insofar as the road data in INFRA are accurate. The goal of this kind of assessment is to prioritize 6th-code or half 6th-code sized HUCs in regards to road-related impact so that future work can be focused in areas that address the greater needs where higher road-related impacts exist. This allows more effective use of project dollars. This application is fast and easy enough to implement that it can replace road density as a sort of basic index. GRAIP_Lite essentially adds that steeper roads, roads closer to streams, and roads with more traffic and less surface preparation pose greater risk from the perspective of road surface erosion. While such concepts are generally well understood, their implementation in GIS has previously been burdensome.

On the other end of the scale spectrum, GRAIP_Lite is used to assess how different proposed road treatments may affect road-related sediment risks in support of a NEPA proposal. This type of analysis usually covers a smaller area, being run on a project scale, and is assessing a smaller set of roads. As a result, this becomes an analysis of relative risk rather than of absolute values. Keeping this in mind, GRAIP_Lite uses the Alternatives module to assess how road-related sediment impacts are likely to change depending on the specified current conditions and treatments applied, modeling the treated road network at an initial condition before any work has been done, at a disturbed condition when the work is recently completed, and at a recovered condition when road surface vegetation and traffic levels have recovered to an equilibrium condition after the work has been completed.

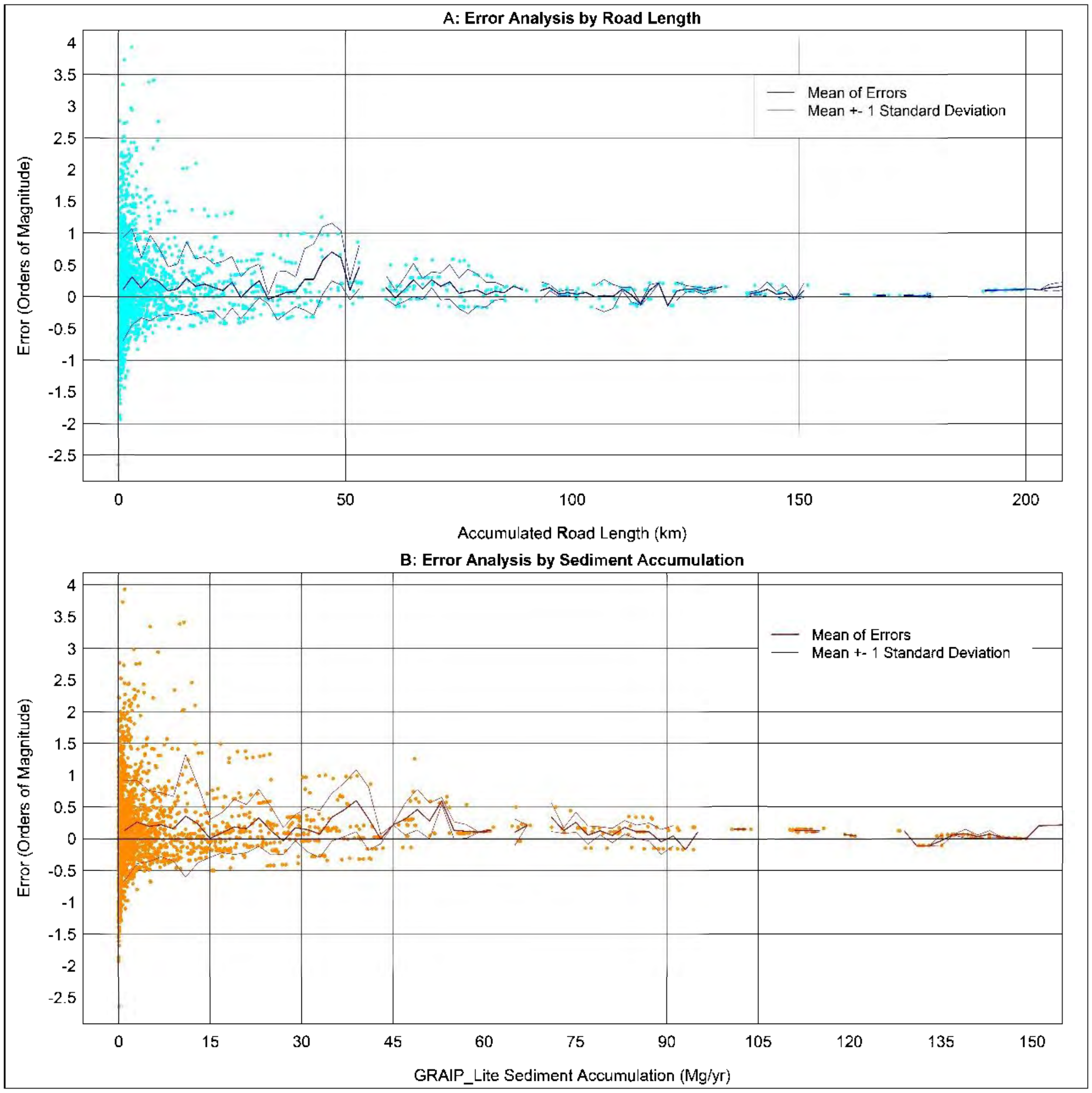


Figure 9: Typical error distributions when validating GRAIP_Lite against the GRAIP model, based on accumulated road length and accumulated sediment.

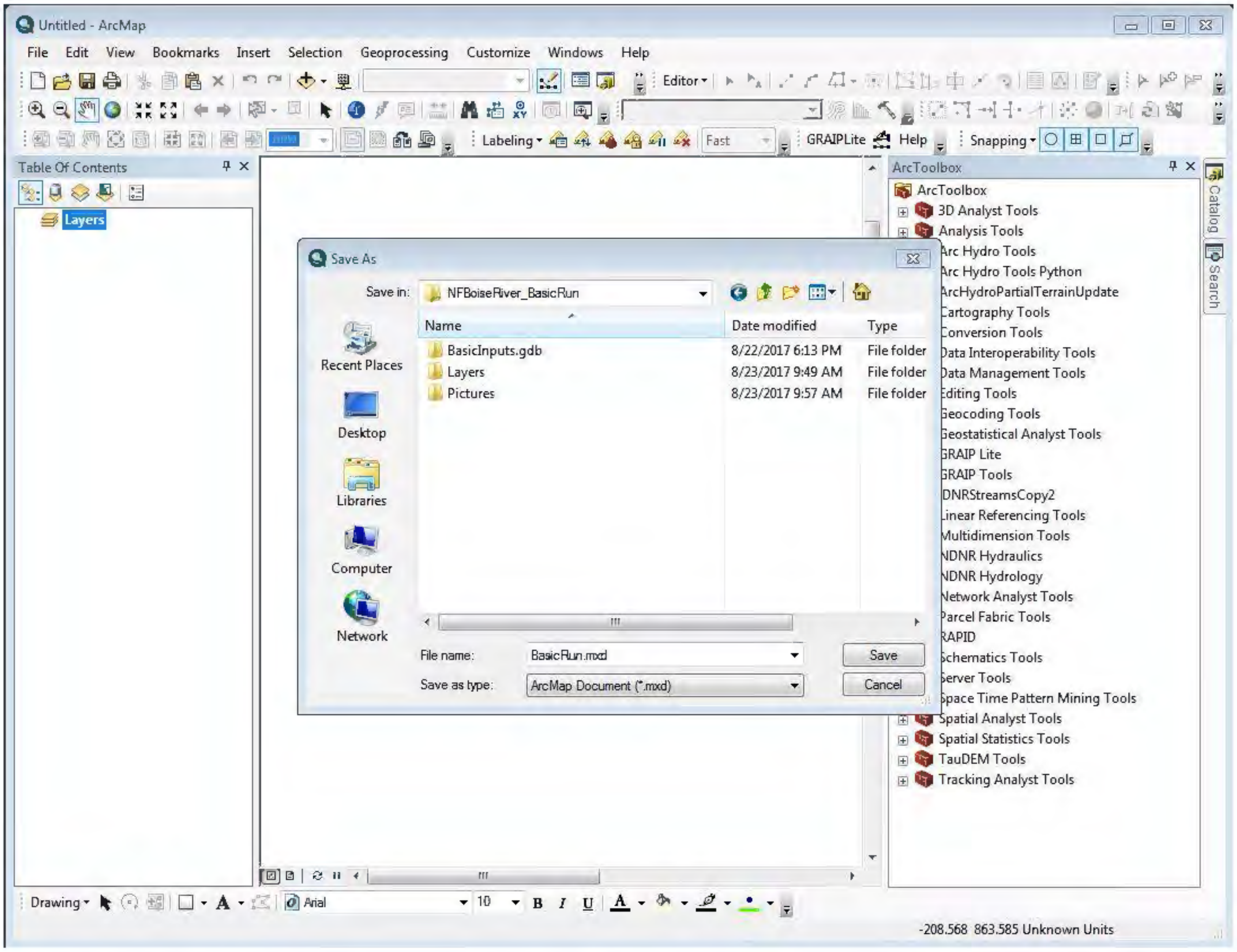
Model Run Tutorials

Several tutorial data sets have been prepared to illustrate potential applications like those outlined above. A "basic" run may be used to assess the relative risk from road surface erosion across sub-watersheds. It is ideal for prioritization of watershed restoration efforts and is a substantial improvement over road density. A "calibration zone" example is included to show how a more heterogeneous area, say with variation in geology, can be modeled. It has similar purposes to the basic run, but accounts for environmental variation in the calculus of determining which basins have greater risk. Finally, an example of how to apply GRAIP_Lite for alternative comparison, as one would do for project planning under NEPA, is included. Here an input system describing most treatments has been set up to make treatment specification easier, and execution of the multiple runs and preparation of output graphics has been automated to speed analyses. The three tutorial examples have been set up as a progression to let users become familiar with easier applications before taking on more advanced tasks.

Basic

This tutorial shows how to use the tools in GRAIP_Lite's Basic Run toolbox. The data set uses INFRA roads sourced from a geodatabase, in this case for the North Fork Boise River drainage on the Boise National Forest, current as of 8 January 2016. The Basic Run is intended to provide the user with a quick view of higher risk areas within the road network and uses the default model calibration. The tool provides a simple analysis and includes a reporting tool to create basic maps for use in reports or presentations.

The first step in any GRAIP_Lite model run, including a basic run, is to save the map document in the project folder. This sets the default locations for files created and accessed by GRAIP_Lite and names the geodatabase in which GRAIP_Lite stores the various feature classes created. With ArcMap open with a blank document, go to *File -> Save As*, navigate to your project folder, and save the document, in this case as *BasicRun.mxd* (Figure 10).



Save in: NFBoiseRiver_BasicRun

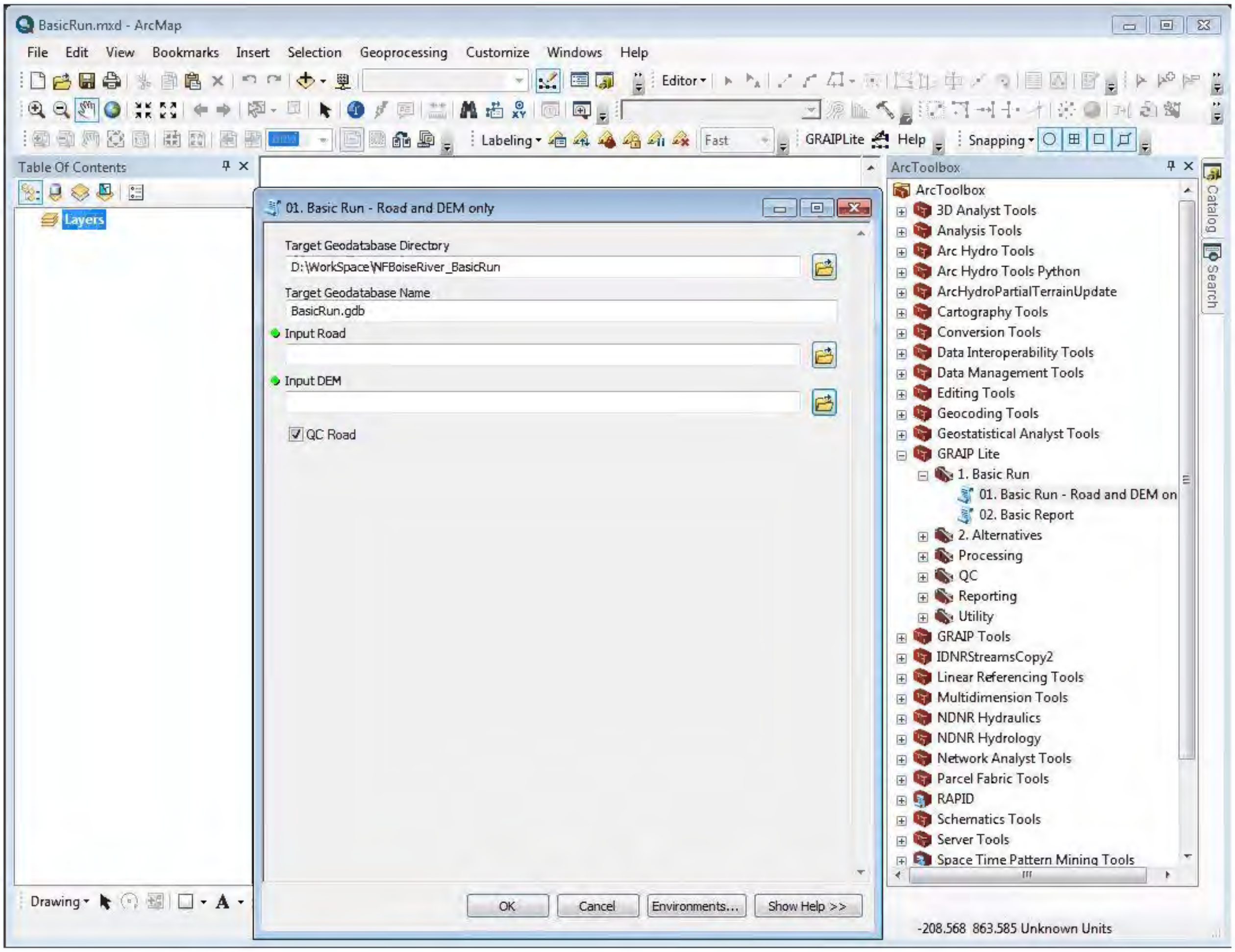
Name	Date modified	Type
BasicInputs.gdb	8/22/2017 6:13 PM	File folder
Layers	8/23/2017 9:49 AM	File folder
Pictures	8/23/2017 9:57 AM	File folder

File name: BasicRun.mxd

Save as type: ArcMap Document (*.mxd)

Figure 10: Saving the map document.

Once the map document is saved, it is time to open the Basic Run tool. Open the ArcToolbox window if it is not yet open. The tool is located in *ArcToolbox->GRAIP Lite->Basic Run-> 01. Basic Run – Road and DEM only*. Double-click to open the tool. Notice that the Target Geodatabase Directory and the Target Geodatabase Name fields are automatically filled in based on the location and name used to save the map document (Figure 11).



01. Basic Run - Road and DEM only

Target Geodatabase Directory
D:\WorkSpace\NFBoiseRiver_BasicRun

Target Geodatabase Name
BasicRun.gdb

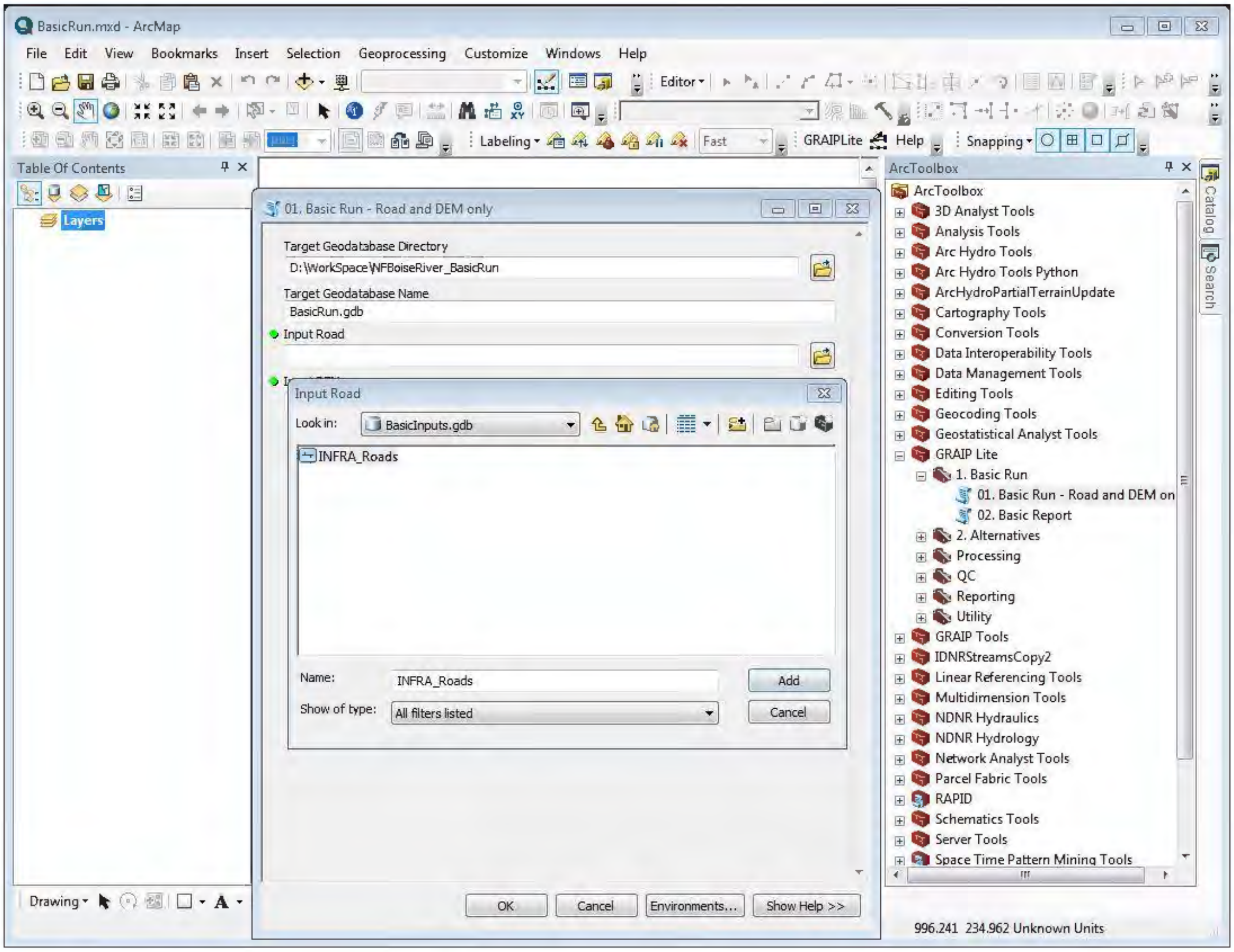
Input Road

Input DEM

☑ QC Road

Figure 11: Basic Run tool opened.

With the tool open, you will need to populate the Input Road and Input DEM fields. The browse buttons allow you to select the appropriate inputs. For this tutorial, the Input Road is the INFRA_Roads feature class in the BasicInputs.gdb geodatabase (Figure 12) and the Input DEM is nfbc in the Layers folder (Figure 13).



Target Geodatabase Directory: D:\WorkSpace\NFBoiseRiver_BasicRun

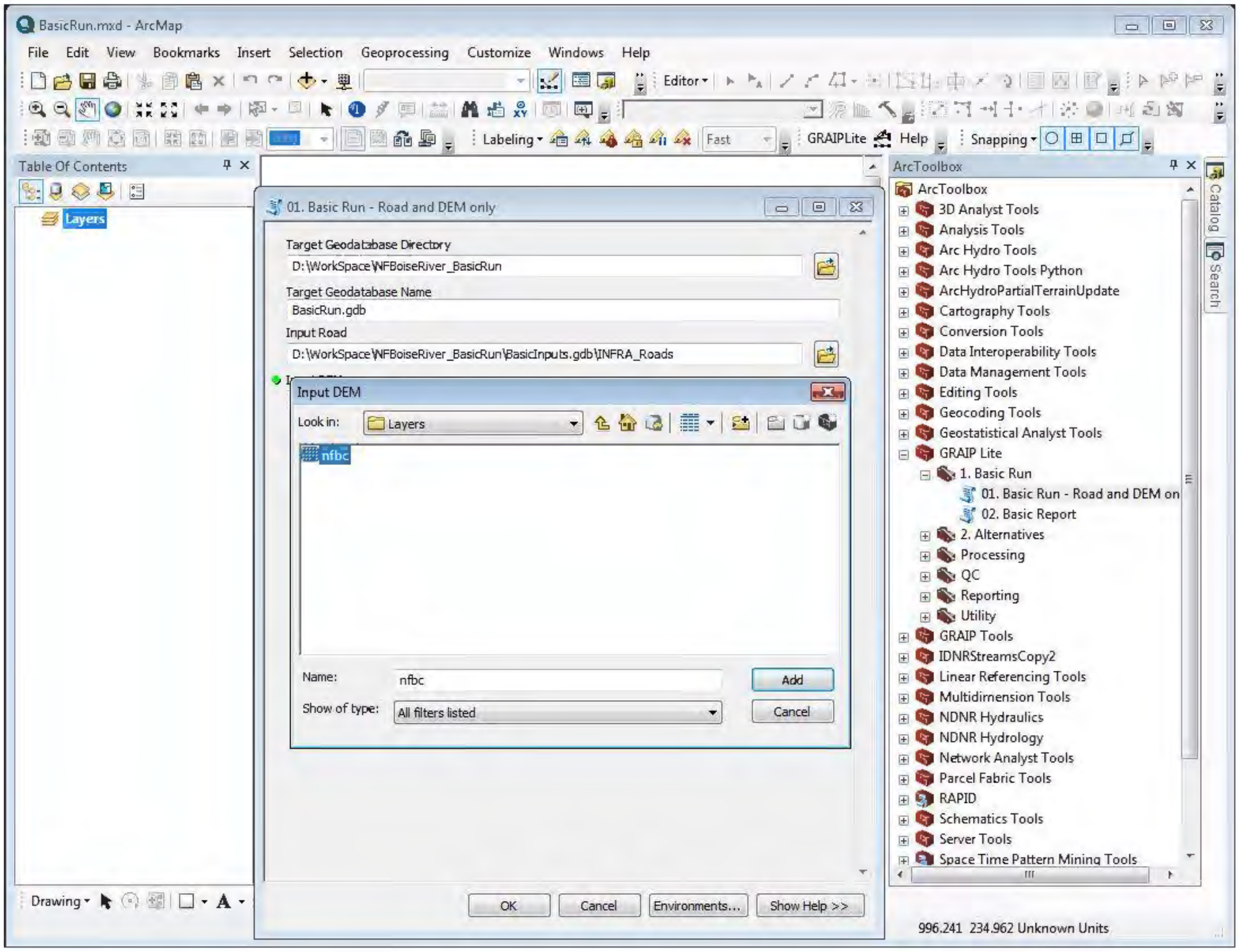
Target Geodatabase Name: BasicRun.gdb

Look in: BasicInputs.gdb

Name: INFRA_Roads

Show of type: All filters listed

Figure 12: Selecting the Input Road feature class.



Target Geodatabase Directory
D:\WorkSpace\NFBoiseRiver_BasicRun

Target Geodatabase Name
BasicRun.gdb

Input Road
D:\WorkSpace\NFBoiseRiver_BasicRun\BasicInputs.gdb\INFRA_Roads

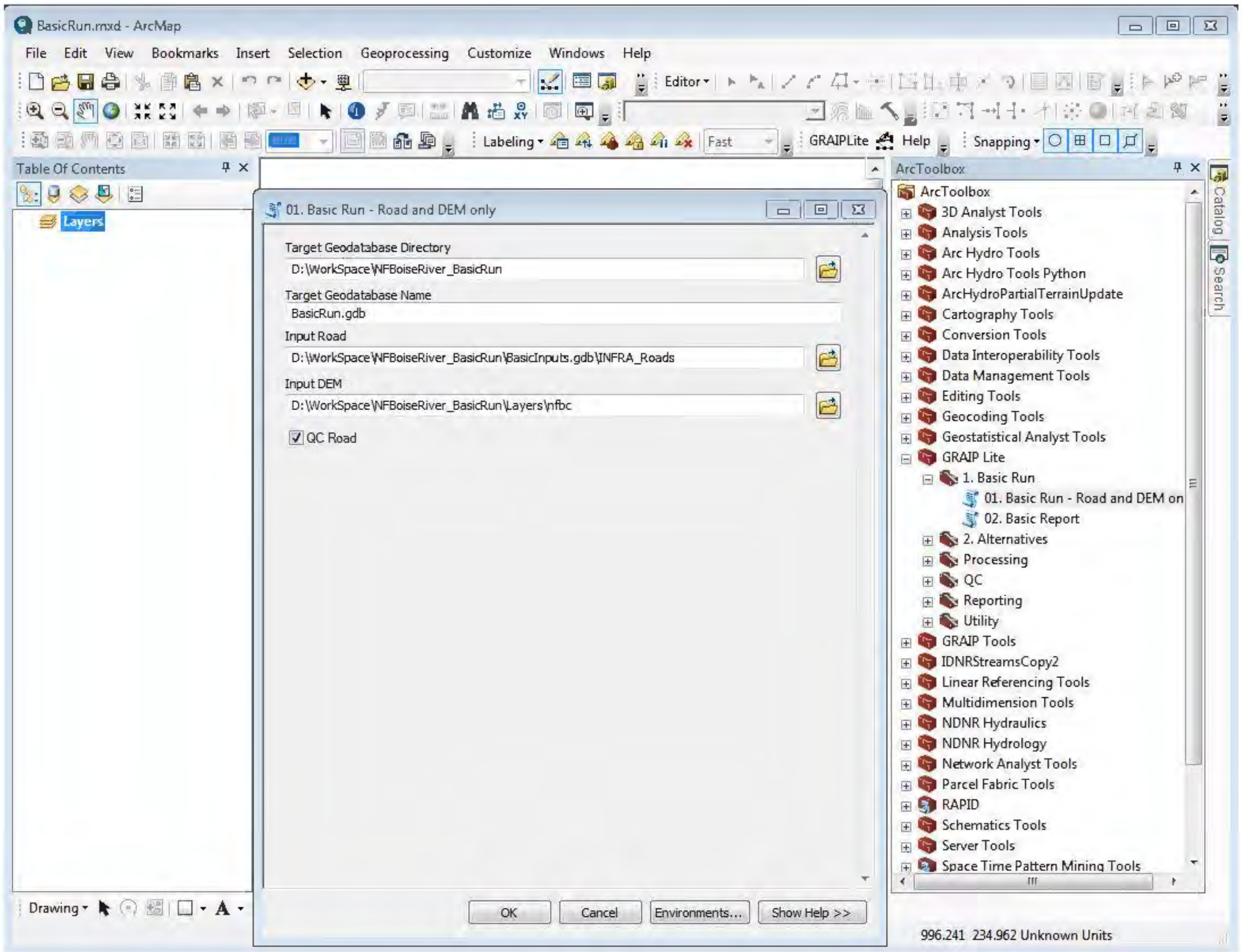
Look in: Layers

Name: nfbc

Show of type: All filters listed

Figure 13: Selecting the Input DEM.

With the road and DEM inputs specified, double check that the box next to QC Road is checked (Figure 14); this ensures that the model will do some basic checks on the input road layer, including looking for loops and geometric duplicates. Click OK and the tool starts running (Figure 15).



Target Geodatabase Directory
D:\WorkSpace\NFBoiseRiver_BasicRun

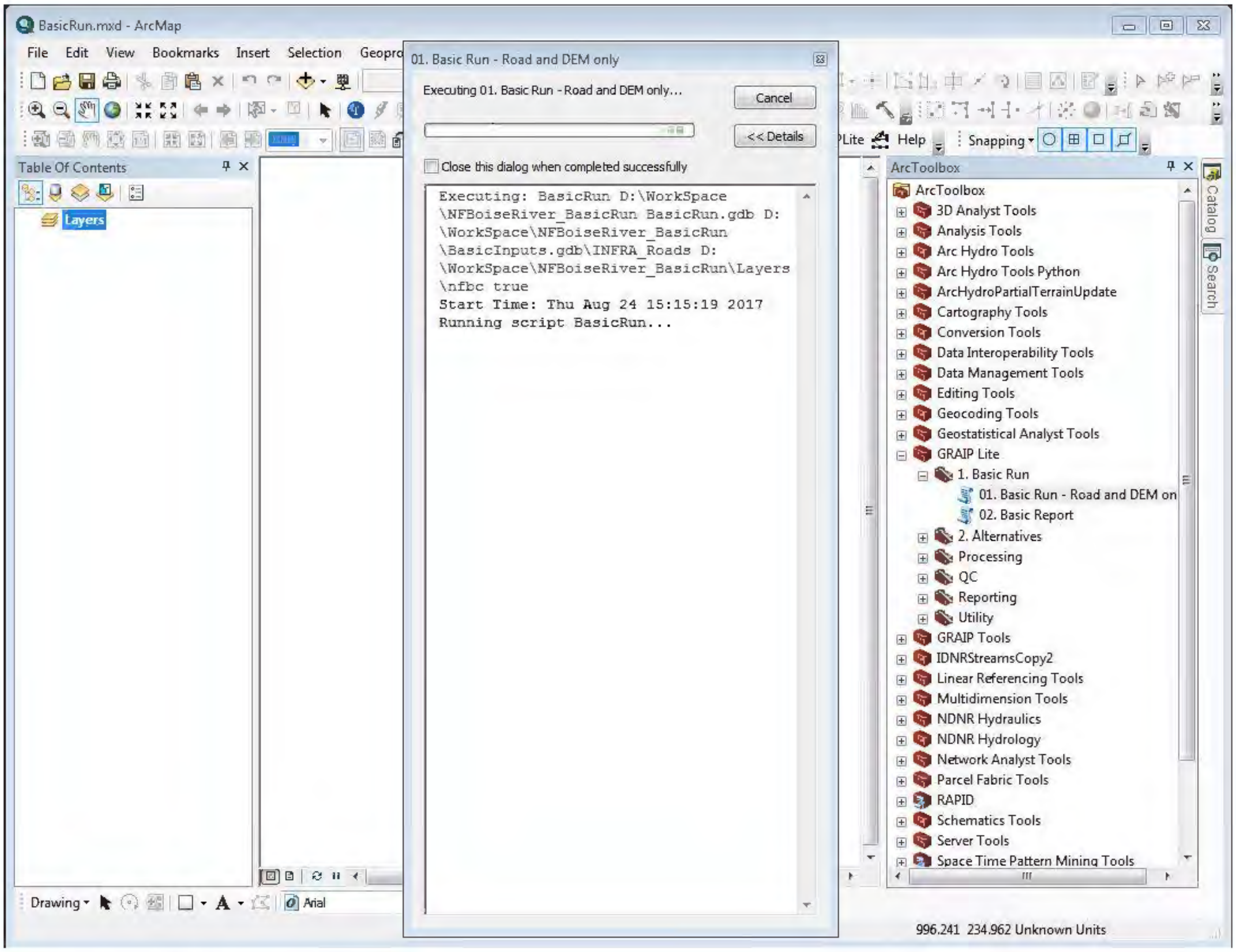
Target Geodatabase Name
BasicRun.gdb

Input Road
D:\WorkSpace\NFBoiseRiver_BasicRun\BasicInputs.gdb\INFRA_Roads

Input DEM
D:\WorkSpace\NFBoiseRiver_BasicRun\Layers\nfbc

☑ QC Road

Figure 14: Basic Run tool ready to run.



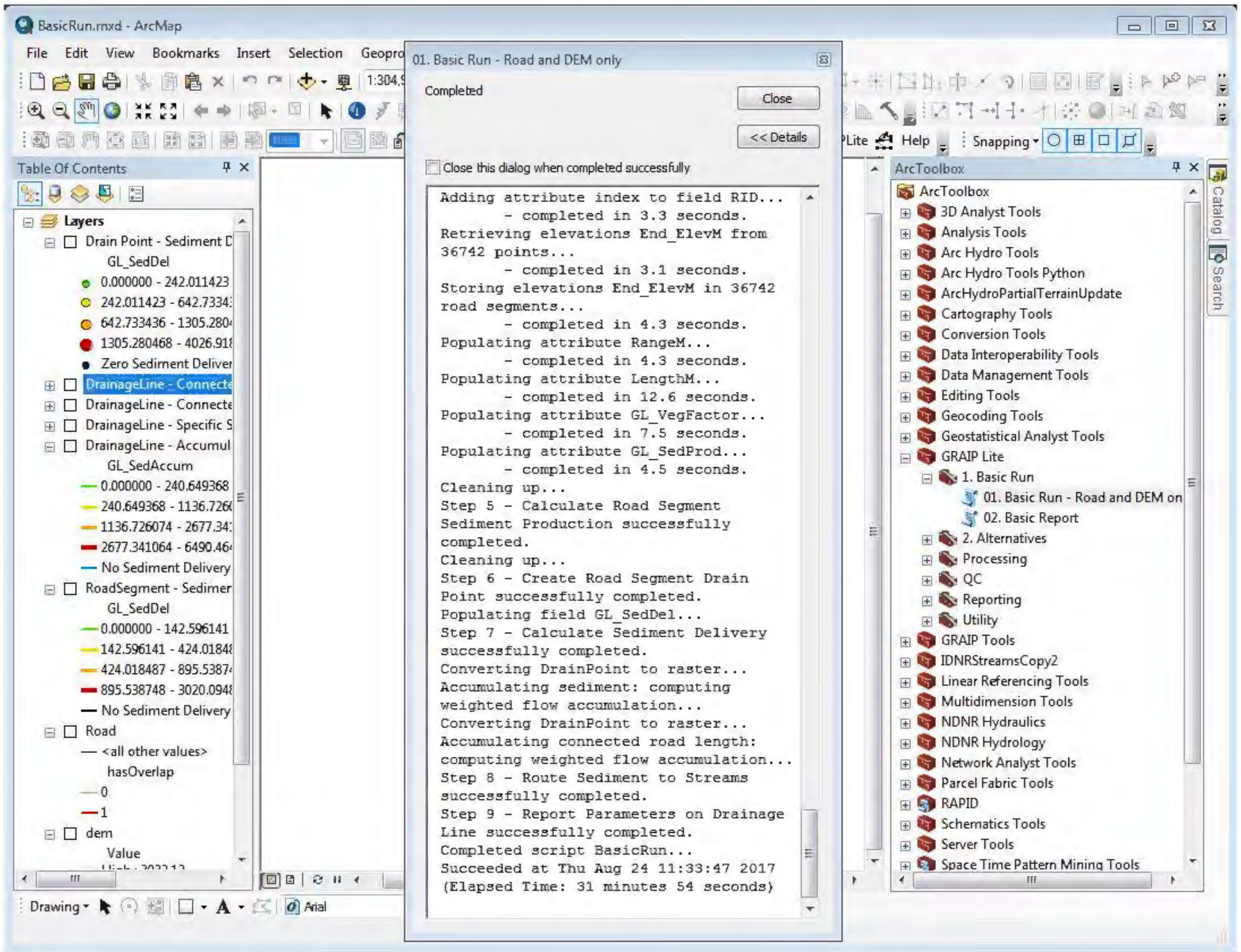
Executing 01. Basic Run - Road and DEM only...

☐ Close this dialog when completed successfully

```
Executing: BasicRun D:\WorkSpace
\NFBoiseRiver_BasicRun BasicRun.gdb D:
\WorkSpace\NFBoiseRiver_BasicRun
\BasicInputs.gdb\INFRA_Roads D:
\WorkSpace\NFBoiseRiver_BasicRun\Layers
\nfbc true
Start Time: Thu Aug 24 15:15:19 2017
Running script BasicRun...
```

Figure 15: Basic Run tool running.

Once the tool has completed (Figure 16), you can close the tool dialog and view the results in the map window (Figure 17). The model has completed its run at this point and the data is now available for use. One of the primary model outputs is Specific Sediment Delivery, which is shown in the DrainageLine feature class. This is the road surface-related sediment load per unit contributing area, and provides a good measure of road-related sediment impact on aquatic habitats. In Figure 17, we can see streams highlighted in red or orange where the local impact is high; yellows and greens are used for moderate to low impacts, and blue is used where no sediment is delivered to streams.



```
Adding attribute index to field RID...
        - completed in 3.3 seconds.
Retrieving elevations End_ElevM from
36742 points...
        - completed in 3.1 seconds.
Storing elevations End_ElevM in 36742
road segments...
        - completed in 4.3 seconds.
Populating attribute RangeM...
        - completed in 4.3 seconds.
Populating attribute LengthM...
        - completed in 12.6 seconds.
Populating attribute GL_VegFactor...
        - completed in 7.5 seconds.
Populating attribute GL_SedProd...
        - completed in 4.5 seconds.
Cleaning up...
Step 5 - Calculate Road Segment
Sediment Production successfully
completed.
Cleaning up...
Step 6 - Create Road Segment Drain
Point successfully completed.
Populating field GL_SedDel...
Step 7 - Calculate Sediment Delivery
successfully completed.
Converting DrainPoint to raster...
Accumulating sediment: computing
weighted flow accumulation...
Converting DrainPoint to raster...
Accumulating connected road length:
computing weighted flow accumulation...
Step 8 - Route Sediment to Streams
successfully completed.
Step 9 - Report Parameters on Drainage
Line successfully completed.
Completed script BasicRun...
Succeeded at Thu Aug 24 11:33:47 2017
(Elapsed Time: 31 minutes 54 seconds)
```

Figure 16: Basic Run tool has completed the model run.

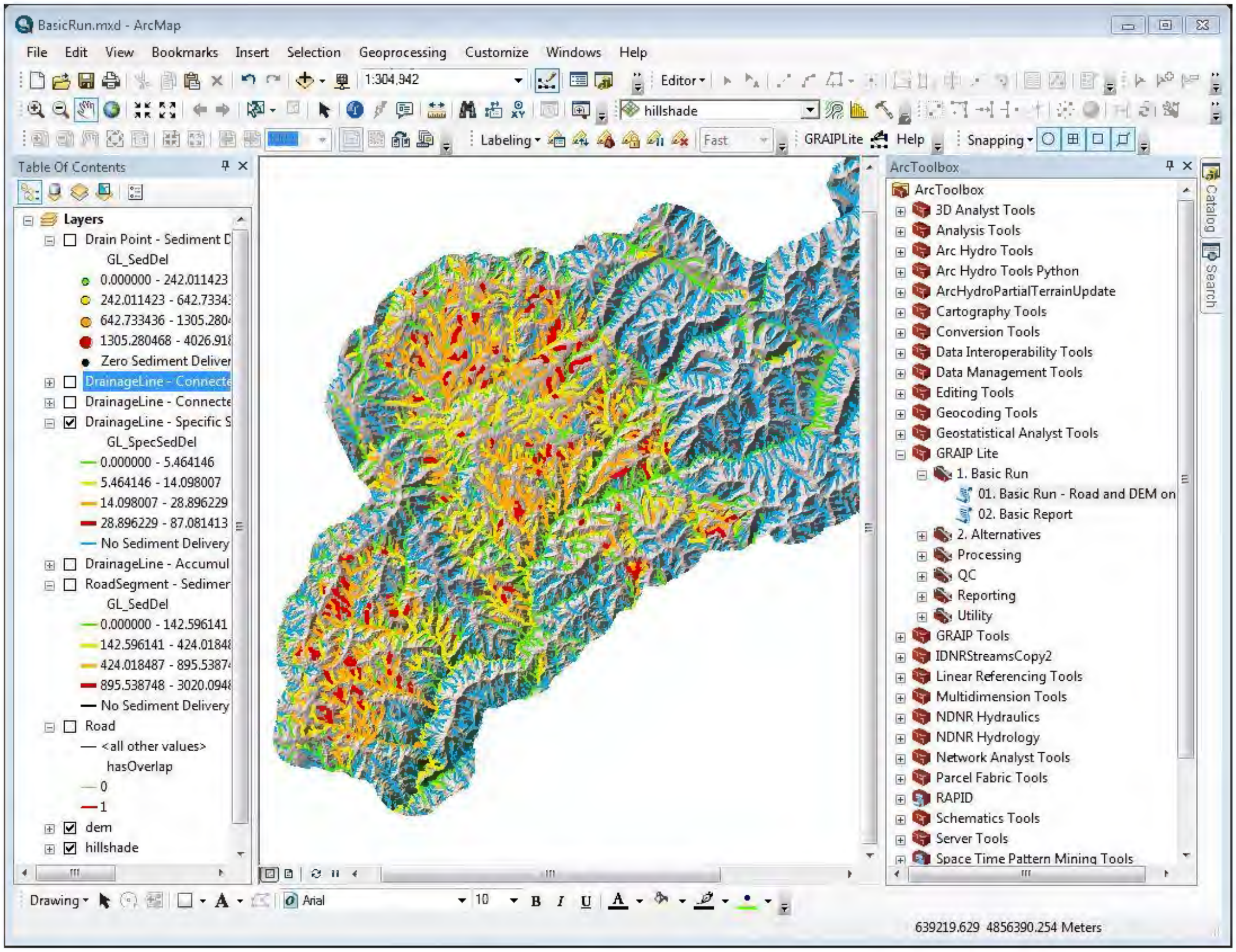
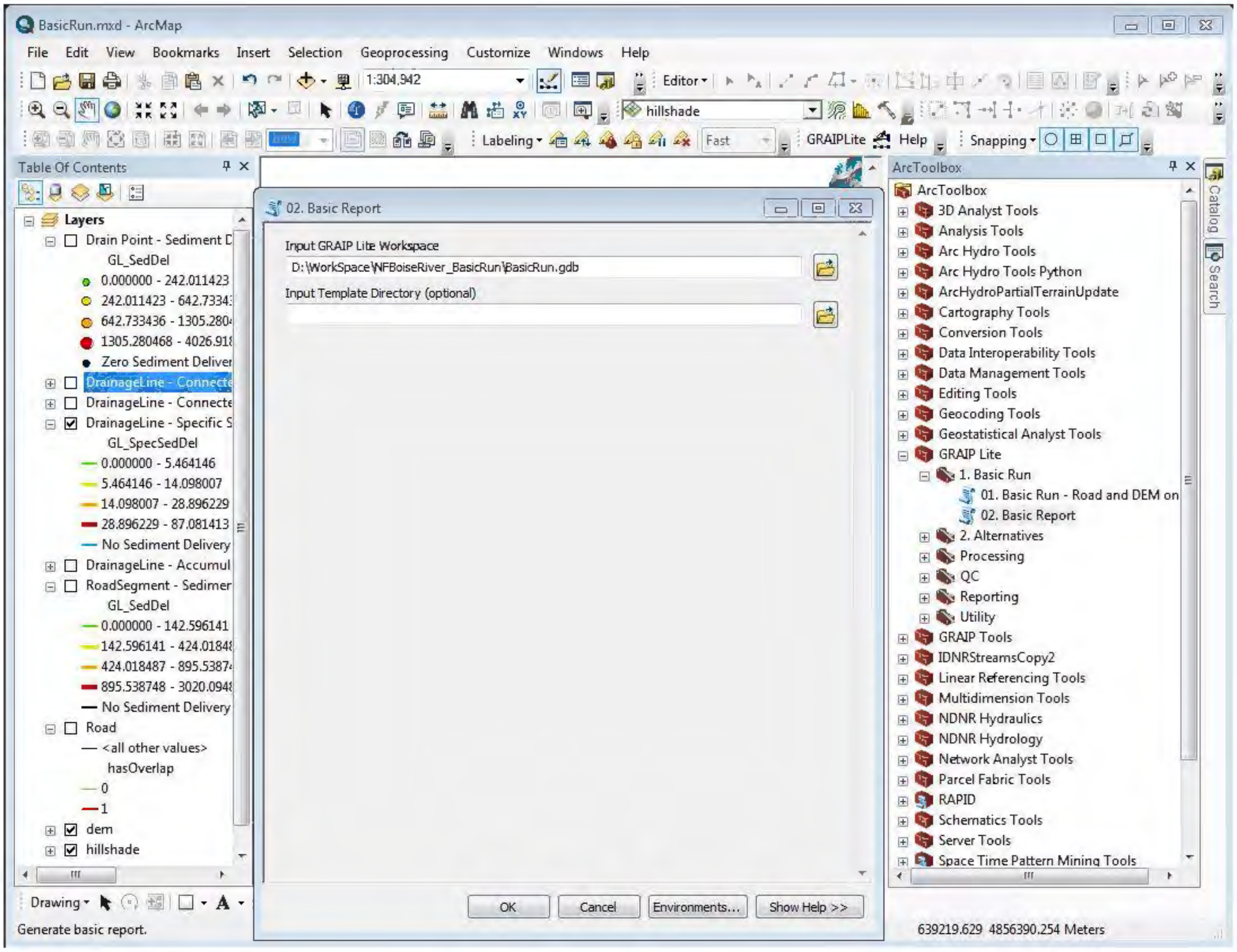


Figure 17: Results from the Basic Run tool Specific Sediment Delivery along Drainage Lines.

The second tool in the Basic Run toolbox is the Basic Report tool. This tool automatically generates a series of maps in both .jpg and .pdf formats; the .jpg files are intended to be used directly in documents and presentations while the .pdf documents provide an easy way of communicating those maps to the public or to various other partners.

Open the tool and note that the Input GRAIP Lite Workspace is already populated (Figure 18). More advanced users may be able to use custom templates, but the defaults are preferred here so there is no need to populate the Input Template Directory field. Hit OK to run the tool.



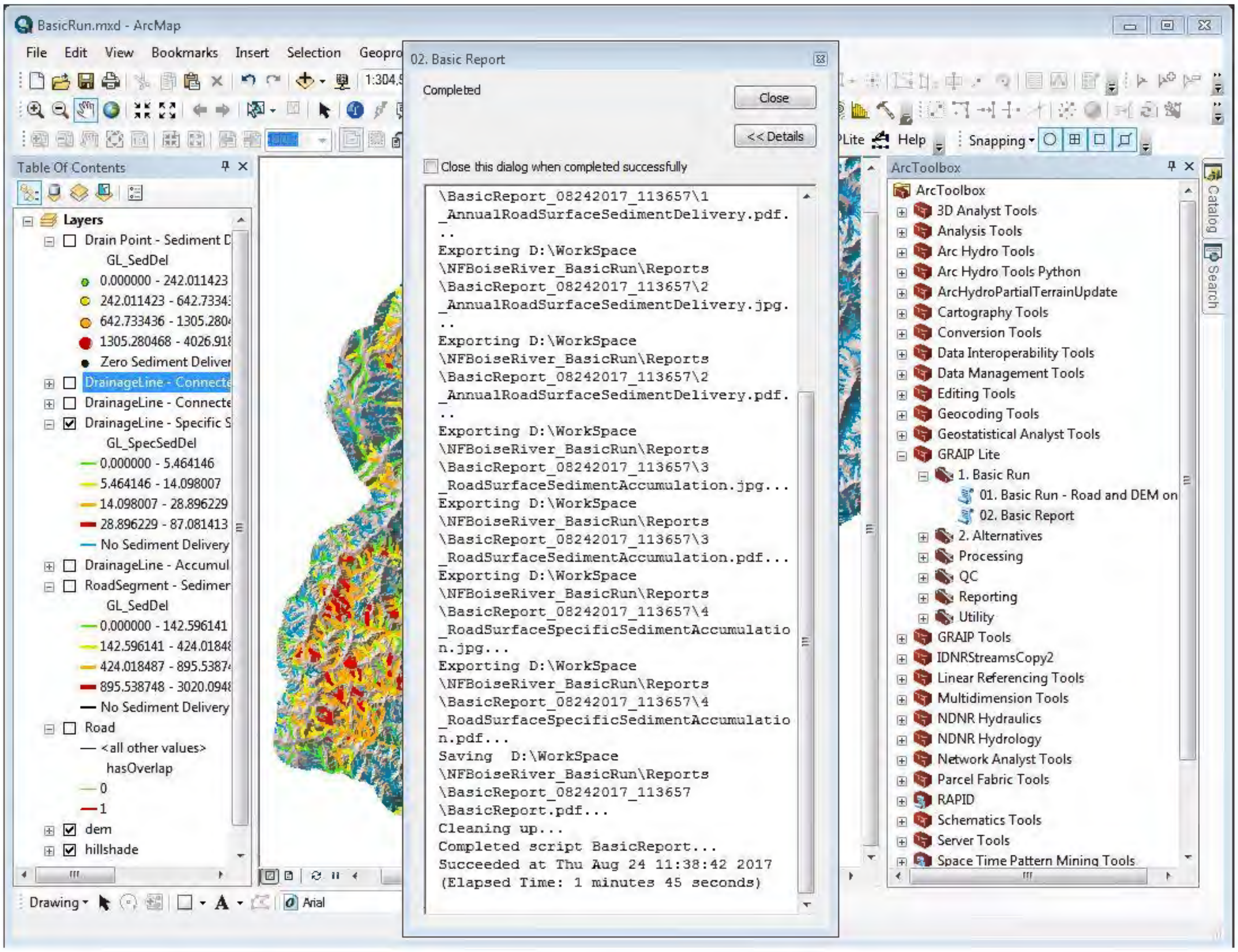
Input GRAIP Lite Workspace

D:\WorkSpace\NFBoiseRiver_BasicRun\BasicRun.gdb

Input Template Directory (optional)

Figure 18: The Basic Report tool ready to run.

As the tool runs, it lists off each map it is exporting and where it is stored. The tool stores these reports in a Reports subfolder within the project folder, and within this creates a unique folder each time the tool is run. Close the tool when it has completed (Figure 19). Example maps from the Basic Report tool will be included in Appendix D.



```
\BasicReport_08242017_113657\1
_AnnualRoadSurfaceSedimentDelivery.pdf.
..
Exporting D:\WorkSpace
\NFBoiseRiver_BasicRun\Reports
\BasicReport_08242017_113657\2
_AnnualRoadSurfaceSedimentDelivery.jpg.
..
Exporting D:\WorkSpace
\NFBoiseRiver_BasicRun\Reports
\BasicReport_08242017_113657\2
_AnnualRoadSurfaceSedimentDelivery.pdf.
..
Exporting D:\WorkSpace
\NFBoiseRiver_BasicRun\Reports
\BasicReport_08242017_113657\3
_RoadSurfaceSedimentAccumulation.jpg...
Exporting D:\WorkSpace
\NFBoiseRiver_BasicRun\Reports
\BasicReport_08242017_113657\3
_RoadSurfaceSedimentAccumulation.pdf...
Exporting D:\WorkSpace
\NFBoiseRiver_BasicRun\Reports
\BasicReport_08242017_113657\4
_RoadSurfaceSpecificSedimentAccumulatio
n.jpg...
Exporting D:\WorkSpace
\NFBoiseRiver_BasicRun\Reports
\BasicReport_08242017_113657\4
_RoadSurfaceSpecificSedimentAccumulatio
n.pdf...
Saving  D:\WorkSpace
\NFBoiseRiver_BasicRun\Reports
\BasicReport_08242017_113657
\BasicReport.pdf...
Cleaning up...
Completed script BasicReport...
Succeeded at Thu Aug 24 11:38:42 2017
(Elapsed Time: 1 minutes 45 seconds)
```

Figure 19: Basic Report tool complete.

Calibrated

The tools in the Processing toolbox can be used to customize the model run and take advantage of additional capabilities. The most important of these is the ability to use different model calibrations to more closely describe the sediment production and delivery characteristics of the project area. As with the Default Run, the first step is saving the map document (Figure 20).

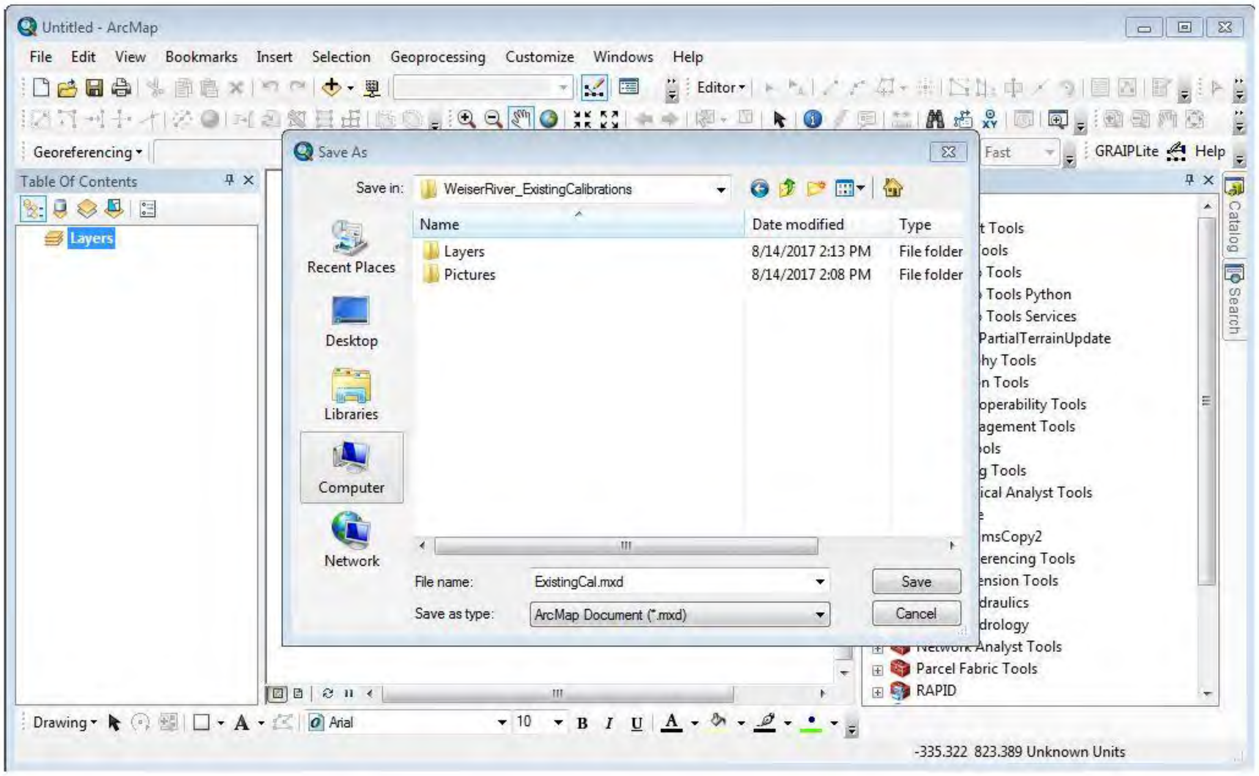
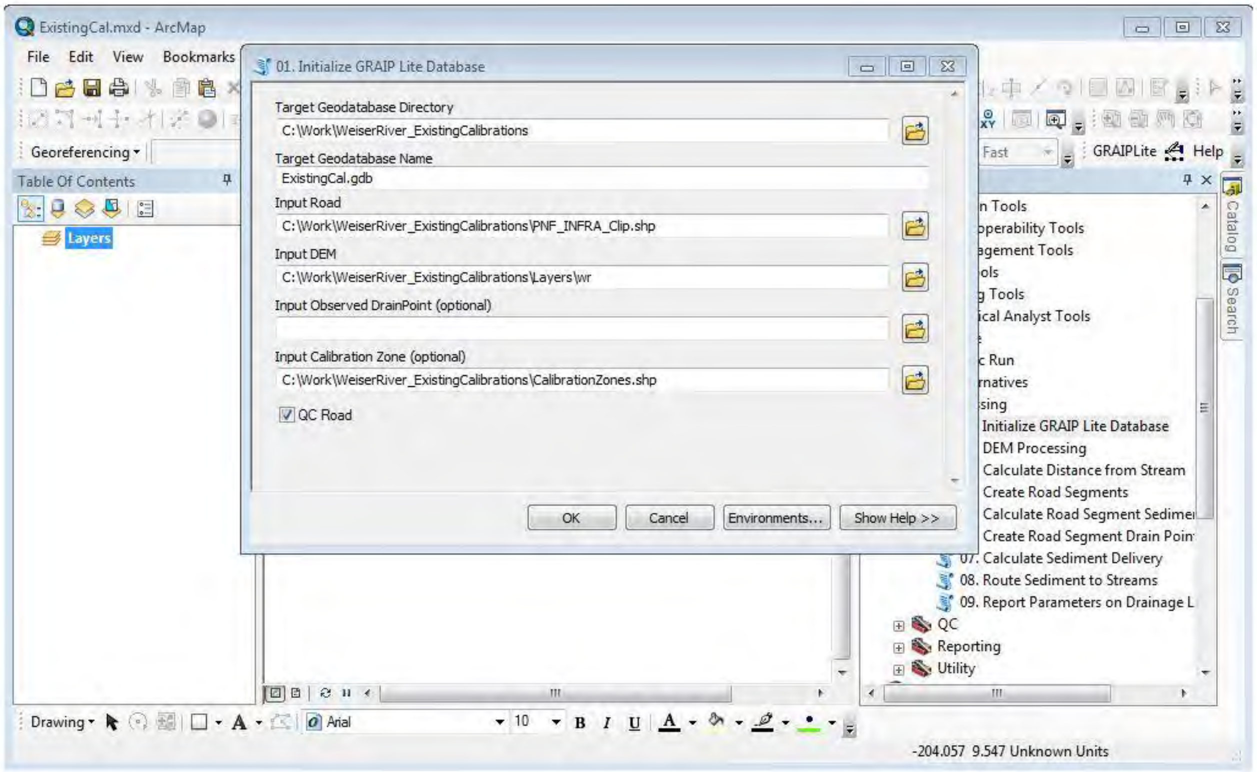


Figure 20: Saving the map document.

The next step is to run the *01. Initialize GRAIP Lite Database* tool (Figure 21). This tool populates the database used to store the inputs for and outputs from the model. The Target Geodatabase Directory and the Target Geodatabase Name fields are automatically filled out based on how you saved the map document; the directory is where you stored it and the name matches the name of the map document.

The Input Road and the Input DEM are required fields and are the same as those for the Basic Run; for this example we want to use PNF_INFRA_Clip.shp for the Input Road and wr as the Input DEM. Using just these two inputs is the same as doing the Basic Run, although it does allow more fine-tuning in some of the steps, namely in the DEM processing steps to come. The two optional fields are the Input Observed DrainPoint field and the Input Calibration Zone field. The Input Observed DrainPoint field, which is not used in this example, is used to provide the model with the locations of known drainage feature from a culvert or other inventory; the model then uses these features as breaks when creating road segments for the model. The Input Calibration Zone field is used to delineate areas that should be modeled using different model calibrations; for this example we are using CalibrationZones.shp as the input. Leave the box for QC Road checked.



01. Initialize GRAIP Lite Database

Target Geodatabase Directory
C:\Work\WeiserRiver_ExistingCalibrations

Target Geodatabase Name
ExistingCal.gdb

Input Road
C:\Work\WeiserRiver_ExistingCalibrations\PNF_INFRA_Clip.shp

Input DEM
C:\Work\WeiserRiver_ExistingCalibrations\Layers\wr

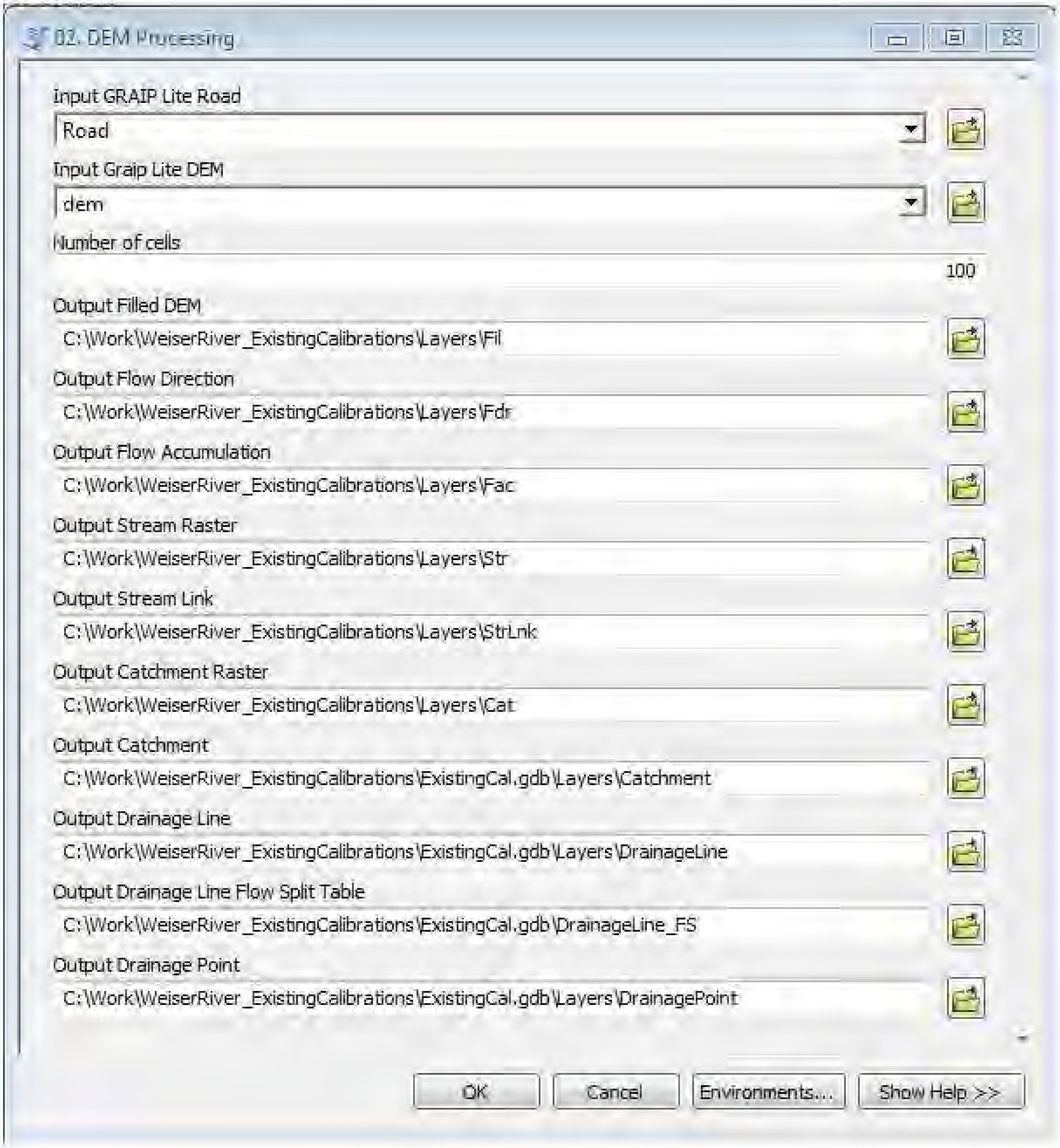
Input Observed DrainPoint (optional)

Input Calibration Zone (optional)
C:\Work\WeiserRiver_ExistingCalibrations\CalibrationZones.shp

☑ QC Road

Figure 21: The Initialize GRAIP Lite Database tool.

Next is the *02. DEM Processing* tool (Figure 22). This is the tool that generates the stream network and the grids necessary for routing sediment within the model. The Number of cells field is used to calibrate the number of accumulated gridcells, or contributing area, necessary for generation of a stream head; however, this needs to match what was used for creating the individual calibrations. All of the included calibrations, which we are using in this example, were created using the default threshold of 100. All of the fields should be automatically populated.



Input GRAIP Lite Road

Road

Input Graip Lite DEM

dem

Number of cells

100

Output Filled DEM

C:\Work\WeiserRiver_ExistingCalibrations\Layers\Fil

Output Flow Direction

C:\Work\WeiserRiver_ExistingCalibrations\Layers\Fdr

Output Flow Accumulation

C:\Work\WeiserRiver_ExistingCalibrations\Layers\Fac

Output Stream Raster

C:\Work\WeiserRiver_ExistingCalibrations\Layers\Str

Output Stream Link

C:\Work\WeiserRiver_ExistingCalibrations\Layers\StrLnk

Output Catchment Raster

C:\Work\WeiserRiver_ExistingCalibrations\Layers\Cat

Output Catchment

C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\Layers\Catchment

Output Drainage Line

C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\Layers\DrainageLine

Output Drainage Line Flow Split Table

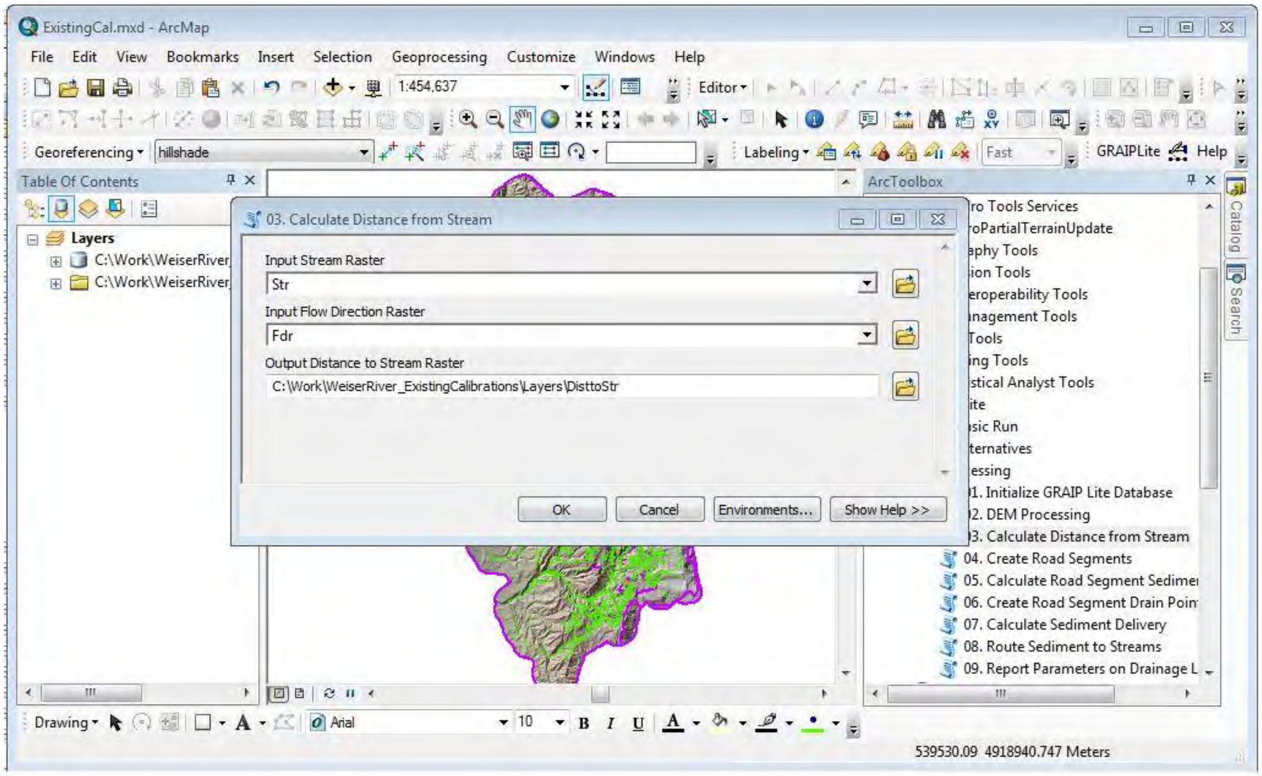
C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\DrainageLine_FS

Output Drainage Point

C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\Layers\DrainagePoint

Figure 22: DEM Processing tool.

The next step is the *03. Calculate Stream Distance* tool (Figure 23). This tool calculates the flow distance to the nearest downhill stream and stores it as a raster; the data gets used later to help calculate sediment delivery. All of the fields should be pre-populated and ready to run.



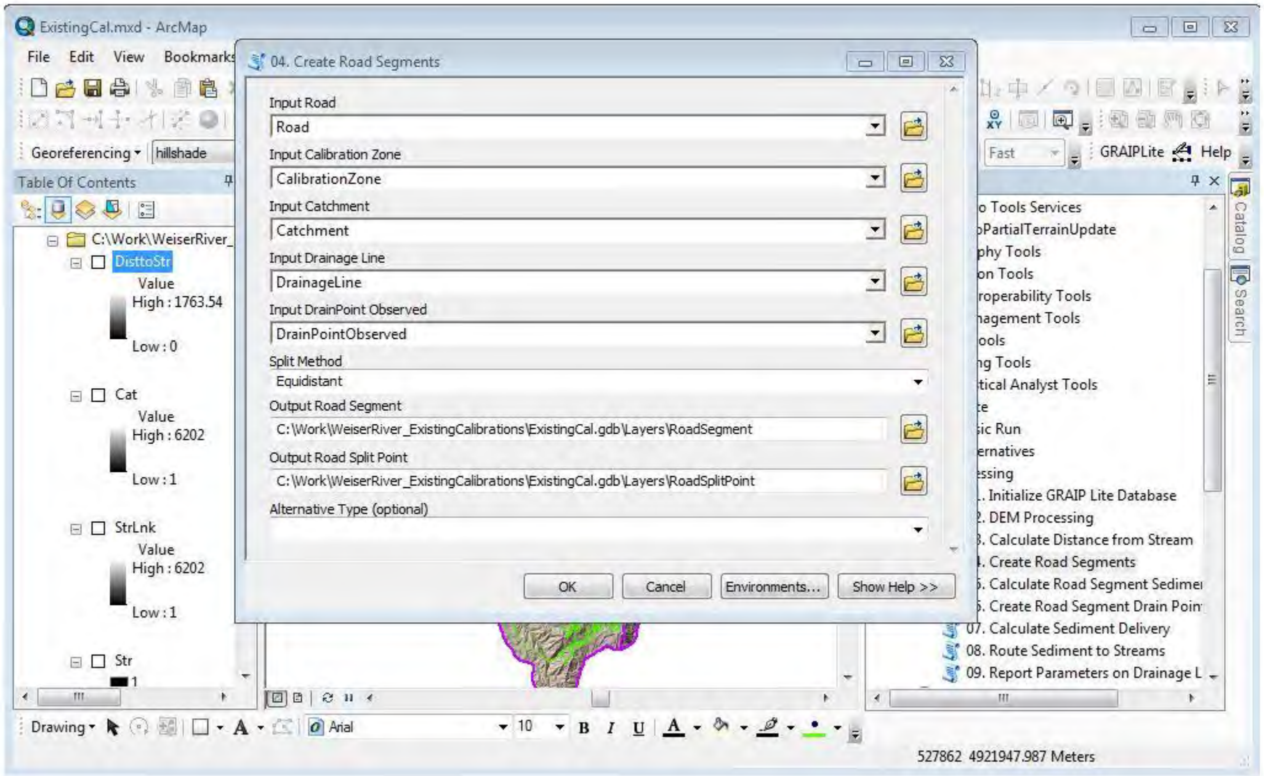
Input Stream Raster: Str

Input Flow Direction Raster: Fdr

Output Distance to Stream Raster: C:\Work\WeiserRiver_ExistingCalibrations\Layers\DisttoStr

Figure 23: Calculate Distance from Stream tool.

Next is the *04. Create Road Segments* tool (Figure 24). This tool takes the input roads features and splits them into GRAIP_Lite road segments using catchment boundaries, stream crossings, calibration zones, known drainpoints, and pre-determined maximum distances. All of the fields should be pre-populated.



Input Road: Road

Input Calibration Zone: CalibrationZone

Input Catchment: Catchment

Input Drainage Line: DrainageLine

Input DrainPoint Observed: DrainPointObserved

Split Method: Equidistant

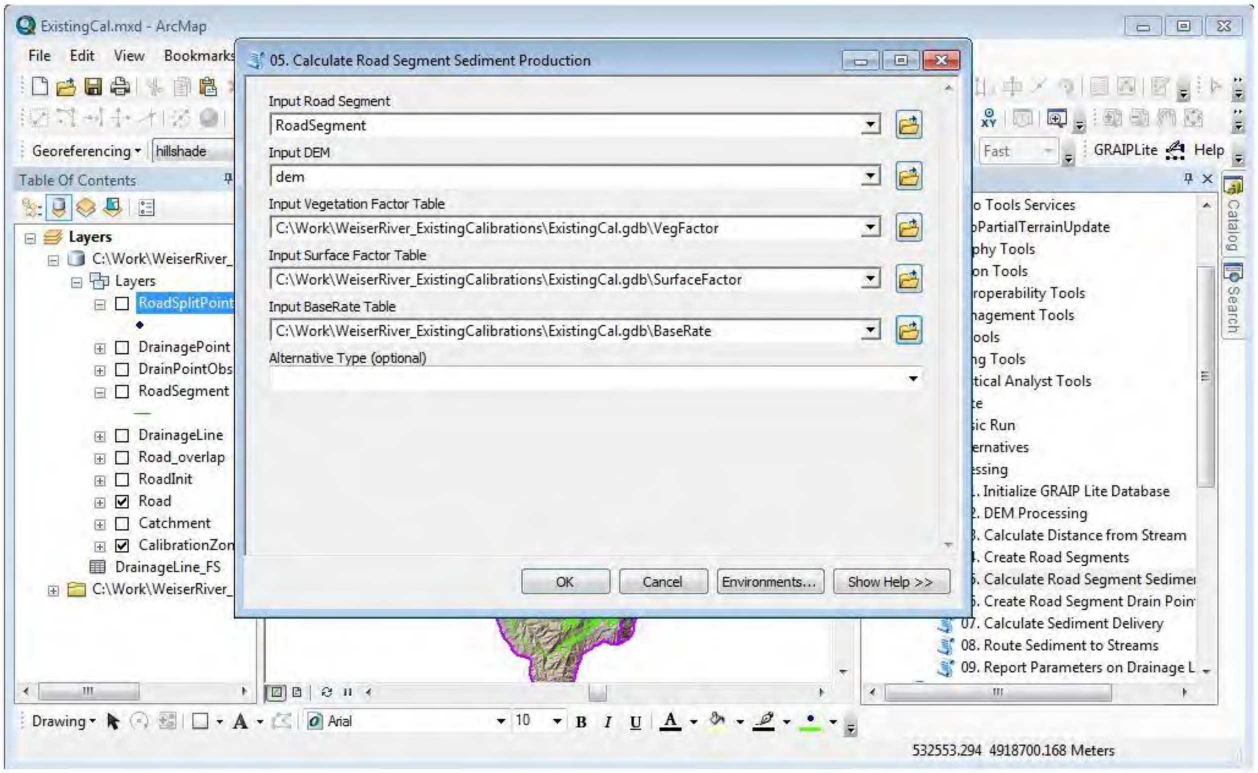
Output Road Segment: C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\Layers\RoadSegment

Output Road Split Point: C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\Layers\RoadSplitPoint

Alternative Type (optional):

Figure 24: Create Road Segments tool.

The next step is to run the *05. Calculate Road Segment Sediment Production* tool (Figure 25). This tool calculates the sediment production expected from each road segment based on the difference in endpoint elevations, the surface type, the expected vegetation, and the expected traffic. Different calibrations provide different baserates and vegetation factors to customize the calculations. Again, all fields should be pre-populated.



05. Calculate Road Segment Sediment Production

Input Road Segment: RoadSegment

Input DEM: dem

Input Vegetation Factor Table: C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\VegFactor

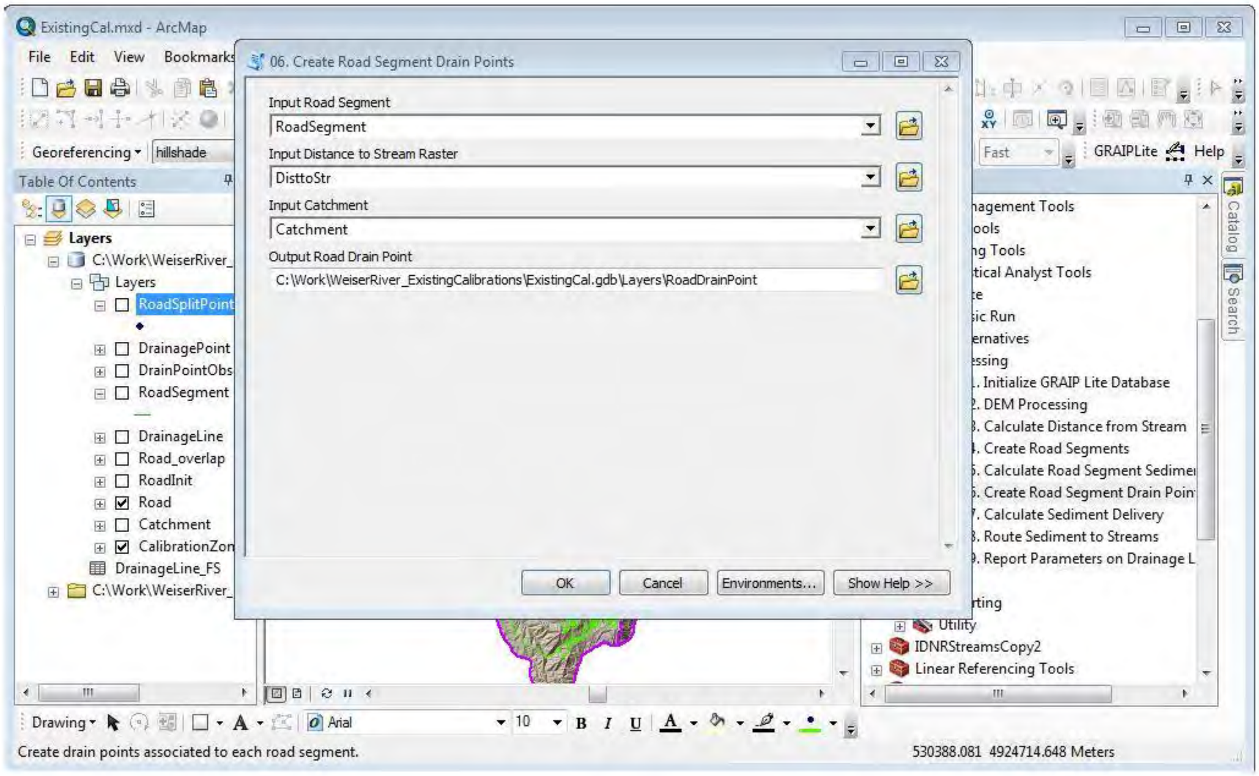
Input Surface Factor Table: C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\SurfaceFactor

Input BaseRate Table: C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\BaseRate

Alternative Type (optional)

Figure 25: Calculate Road Segment Sediment Production tool.

The *06. Create Road Segment Drain Points* tool (Figure 26) is used to select the end of each road segment which is at the lowest elevation and create drain point features at those location. The tool also appends the flow distance to the nearest stream from the DisttoStr raster.



06. Create Road Segment Drain Points

Input Road Segment: RoadSegment

Input Distance to Stream Raster: DisttoStr

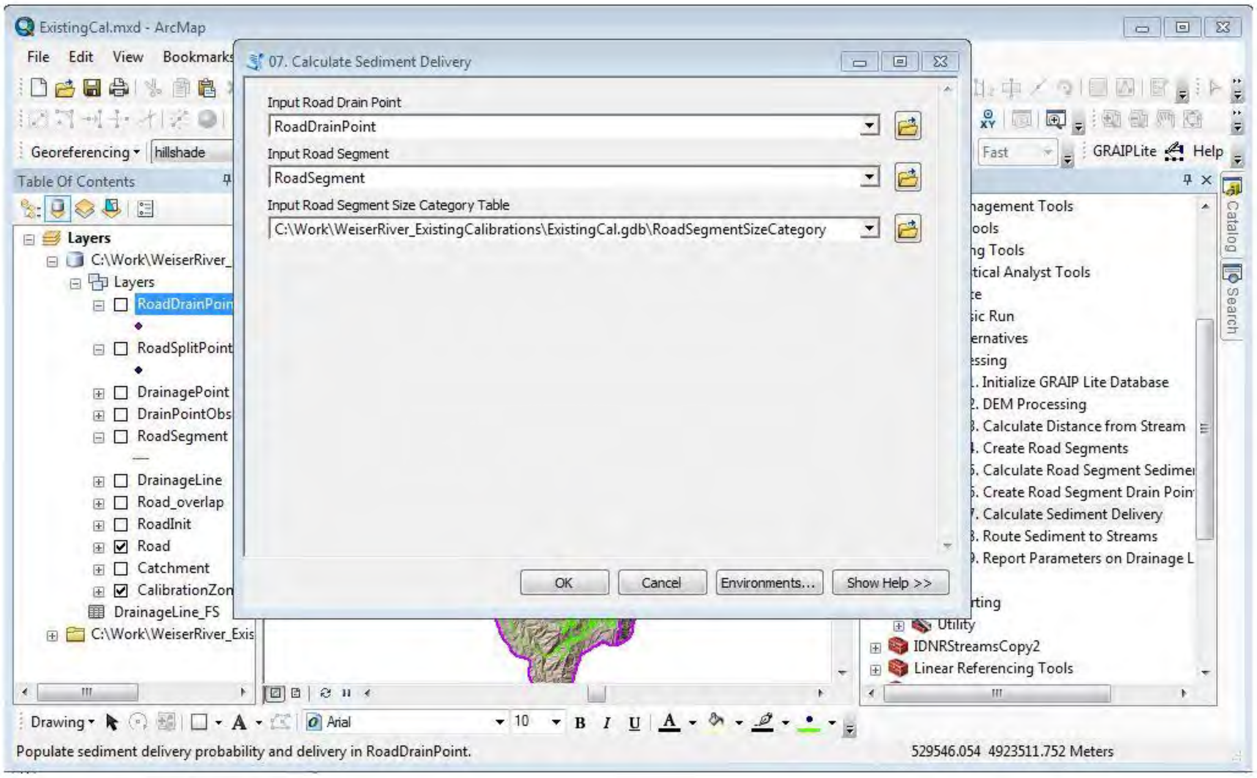
Input Catchment: Catchment

Output Road Drain Point: C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\Layers\RoadDrainPoint

Create drain points associated to each road segment.

Figure 26: Create Road Segment Drain Points tool.

The *07. Calculate Sediment Delivery* tool (Figure 27) uses the flow distance at each drainpoint and the delivery probability table to calculate the amount of sediment expected to be delivered to the stream network at each drainpoint. This step usually has the longest run time. The Delivery Probability table has values describing different curves for each calibration zone allowing the sediment delivery characteristics of an area to be described as part of the calibration.



07. Calculate Sediment Delivery

Input Road Drain Point: RoadDrainPoint

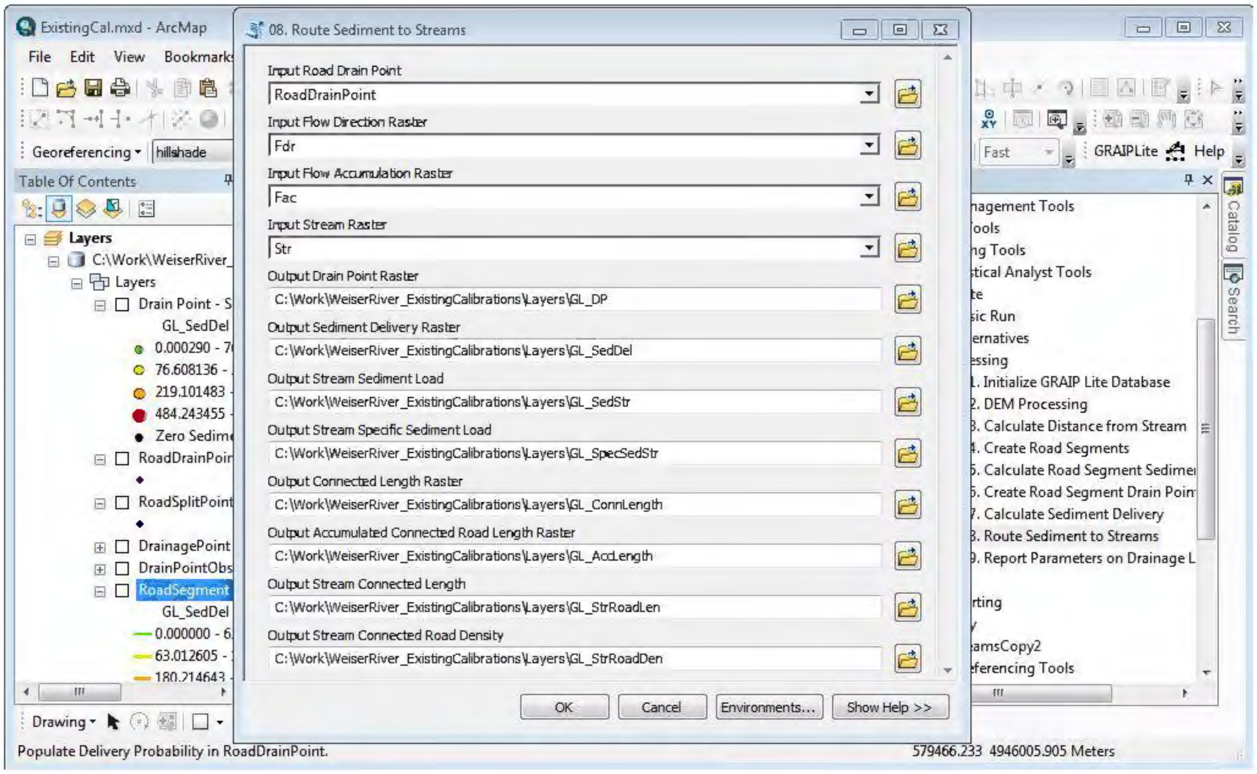
Input Road Segment: RoadSegment

Input Road Segment Size Category Table: C:\Work\WeiserRiver_ExistingCalibrations\ExistingCal.gdb\RoadSegmentSizeCategory

Populate sediment delivery probability and delivery in RoadDrainPoint.

Figure 27: Calculate Sediment Delivery tool.

The *08. Route Sediment to Streams* tool (Figure 28) is next on the list. This tool uses some of the rasters created by the DEM Processing tool to route sediment downhill from the drainpoints to the stream network and then add up the total amount of expected road sediment in the stream network. It also routes and sums the connected road length to create a tally of how much road has affected the stream network. It also normalizes both the accumulated sediment data and the accumulated connected road length data by the contributing area to produce rasters describing specific sediment (accumulated sediment divided by contributing area) and connected road density.



08. Route Sediment to Streams

Input Road Drain Point: RoadDrainPoint

Input Flow Direction Raster: Fdr

Input Flow Accumulation Raster: Fac

Input Stream Raster: Str

Output Drain Point Raster: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_DP

Output Sediment Delivery Raster: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_SedDel

Output Stream Sediment Load: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_SedStr

Output Stream Specific Sediment Load: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_SpecSedStr

Output Connected Length Raster: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_ConnLength

Output Accumulated Connected Road Length Raster: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_AccLength

Output Stream Connected Length: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_StrRoadLen

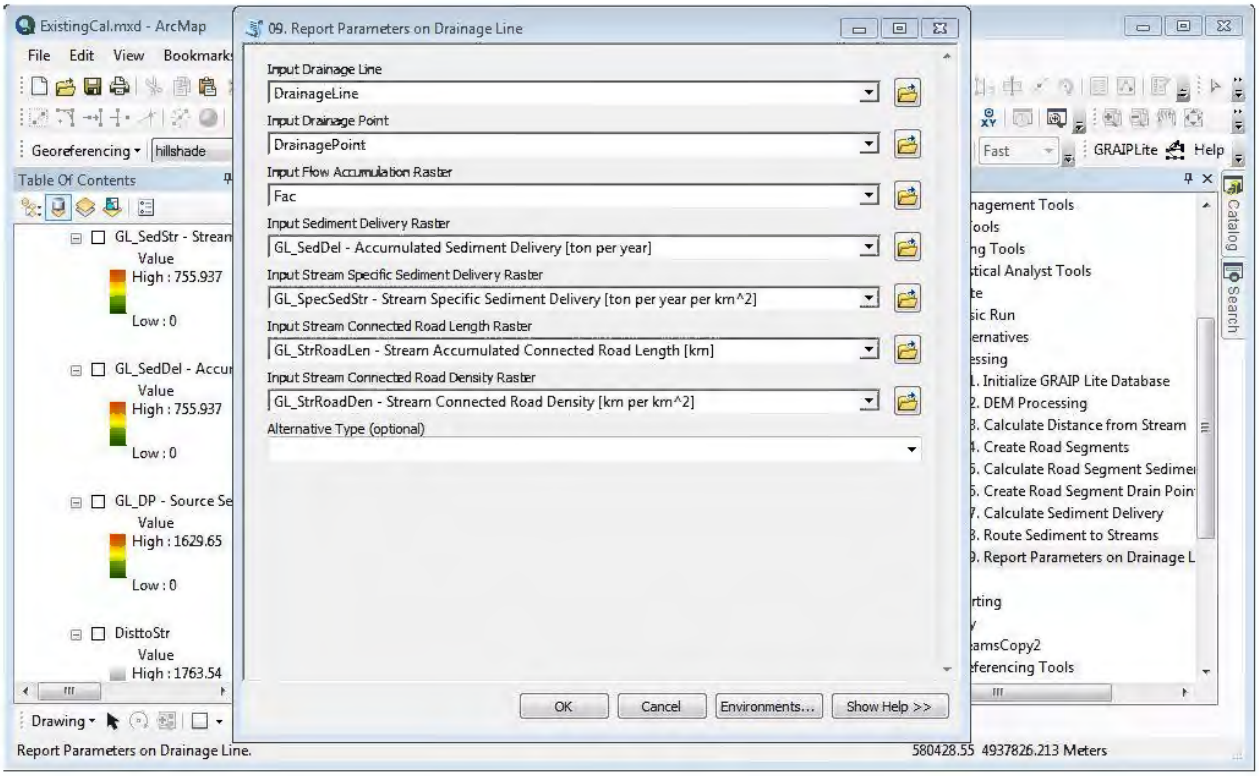
Output Stream Connected Road Density: C:\Work\WeiserRiver_ExistingCalibrations\Layers\GL_StrRoadDen

Populate Delivery Probability in RoadDrainPoint.

579466.233 4946005.905 Meters

Figure 28: Route Sediment to Streams tool.

The *09. Report Parameters of Drainage Line* tool (Figure 29) takes the data recorded in the rasters created in the previous step and appends that data to the features in the Drainage Line feature class, which stores the stream network data. This makes it much easier to present the data in map form, and allows the data to more easily be summarized.


09. Report Parameters on Drainage Line

Input Drainage Line: DrainageLine

Input Drainage Point: DrainagePoint

Input Flow Accumulation Raster: Fac

Input Sediment Delivery Raster: GL_SedDel - Accumulated Sediment Delivery [ton per year]

Input Stream Specific Sediment Delivery Raster: GL_SpecSedStr - Stream Specific Sediment Delivery [ton per year per km^2]

Input Stream Connected Road Length Raster: GL_StrRoadLen - Stream Accumulated Connected Road Length [km]

Input Stream Connected Road Density Raster: GL_StrRoadDen - Stream Connected Road Density [km per km^2]

Alternative Type (optional)

Figure 29: Report Parameters on Drainage Line tool.

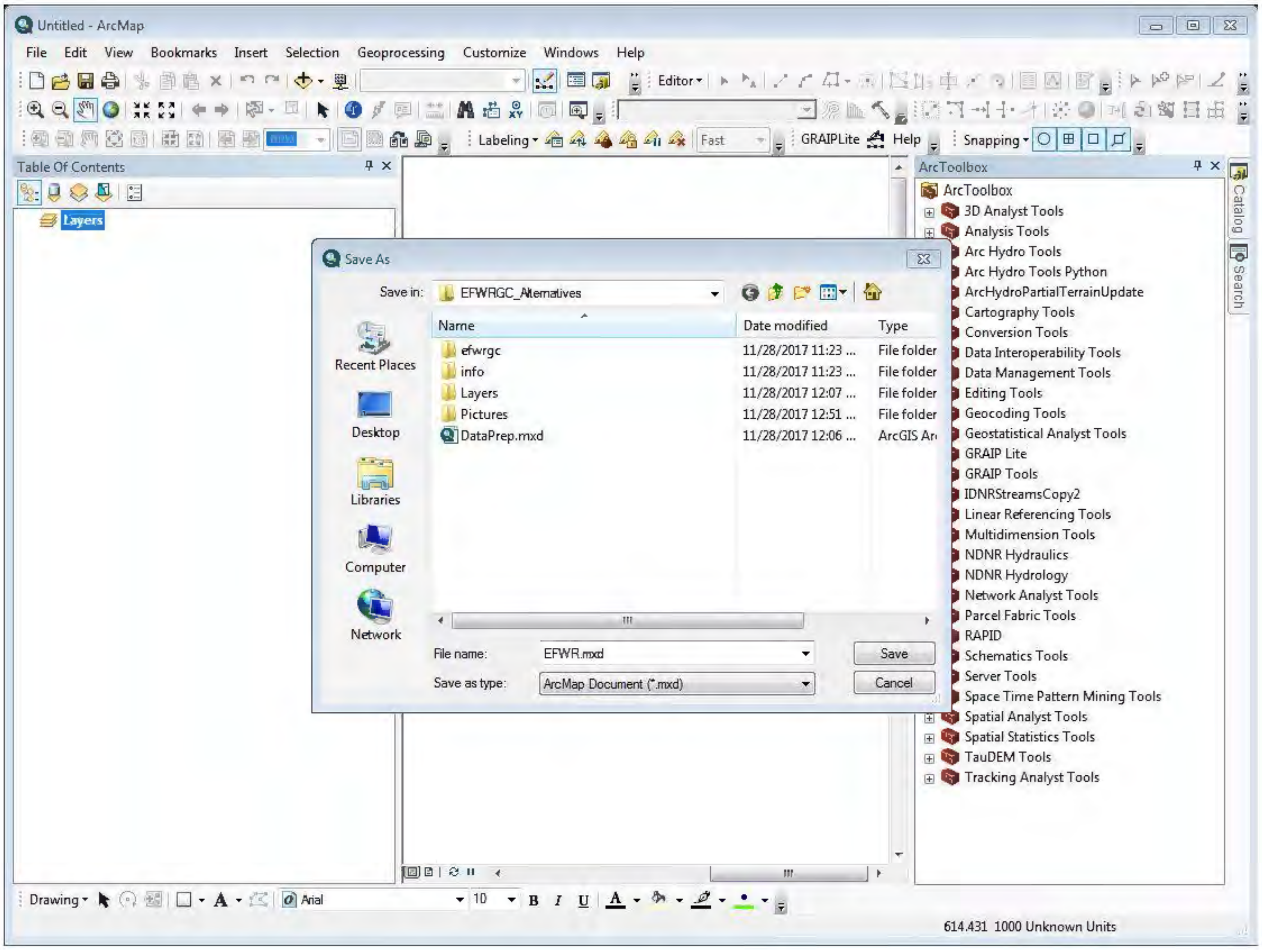
At this point, the Basic Report can be run, which will provide the same set of maps as those produced for the Basic Run.

Alternatives

GRAIP_Lite is also designed as a tool for analyzing different potential treatment options. In order to do this, it provides a way of analyzing different alternative at three time steps. Each alternative is modeled at the initial condition time step, a disturbed time step, and a recovered time step. GRAIP_Lite has a dialog box that is used to create each alternative and set the treatments applied with that alternative; multiple alternatives can be created and run as part of a GRAIP_Lite model. This tutorial is intended to highlight the main ways in which treatments are specified for the GRAIP_Lite model.

There are also a few additional data considerations when modeling alternatives that are not as big a deal when just modeling current conditions. Since road treatments may only be applied to portions of certain roads, those portions need to be separate from the untreated portions of the road network. Since in many cases these treatment portions are defined based on intersections with other roads, one easy way to deal with this is to planarize the road network prior to beginning the model run; this method is demonstrated in this tutorial. If a treatment boundary does not correspond to an intersection, the road section must be split at the appropriate point in order to correctly model the differing sections.

As always, the first step is to save the map document in the project folder, in this case as EFWR.mxd (Figure 30). It is also a good idea to save the map document frequently.



Save in: EFWRGC_Alternatives

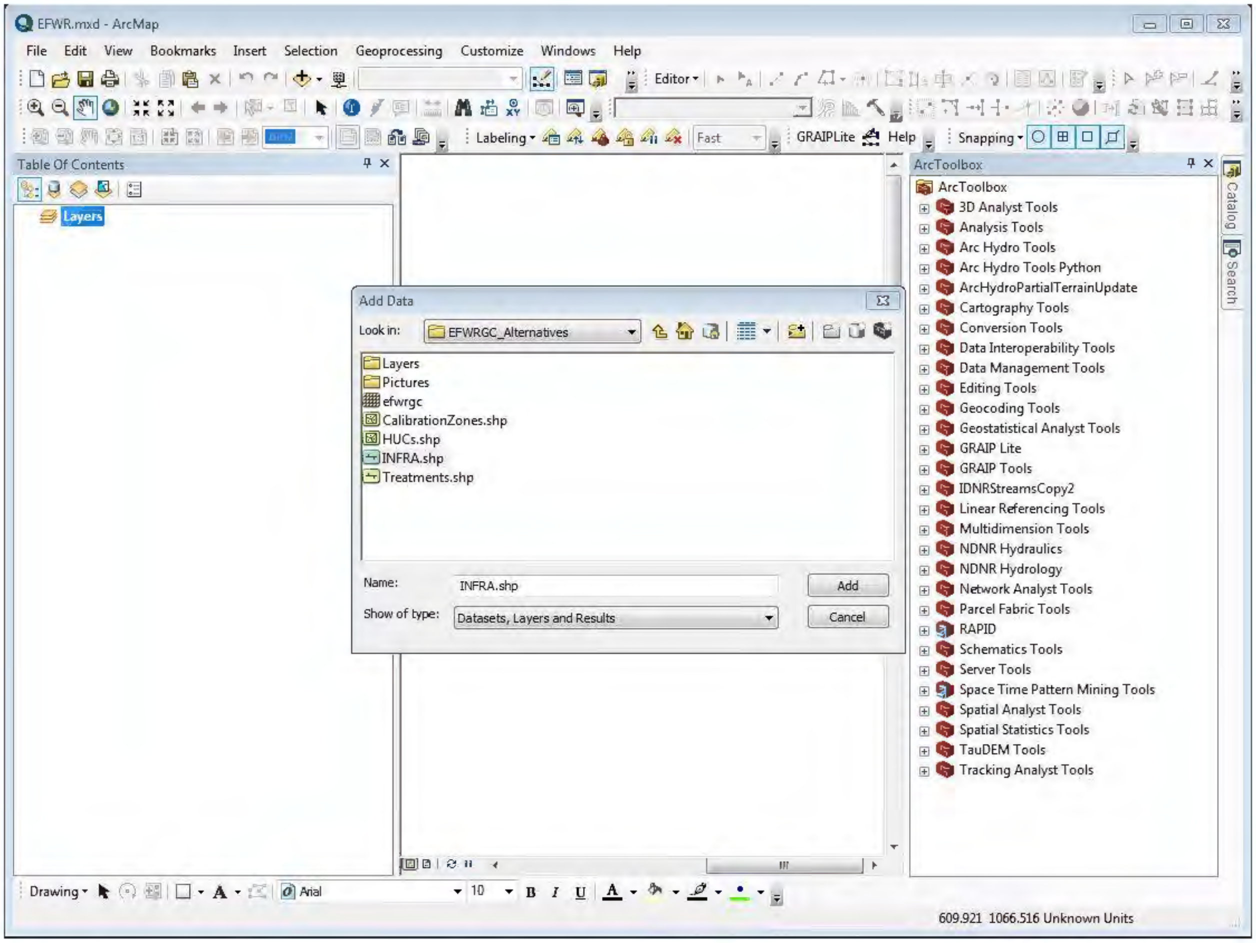
Name	Date modified	Type
efwrgc	11/28/2017 11:23 ...	File folder
info	11/28/2017 11:23 ...	File folder
Layers	11/28/2017 12:07 ...	File folder
Pictures	11/28/2017 12:51 ...	File folder
DataPrep.mxd	11/28/2017 12:06 ...	ArcGIS Ar

File name: EFWR.mxd

Save as type: ArcMap Document (*.mxd)

Figure 30: Saving the map document.

The next step is to add the INFRA.shp file to the map document (Figure 31). This file is the shapefile containing the road information for the project. Click on the Add Data button to access the dialogue box and add the shapefile.



Look in: EFWRGC_Alternatives

Name: INFRA.shp

Show of type: Datasets, Layers and Results

Figure 31: Add INFRA shapefile.

Next, make sure the Editor toolbar is visible, click on Editor to open the menu, and then click on Start Editing. This will activate all of the tools in the Editor and Advanced Editing toolbars (Figure 32).

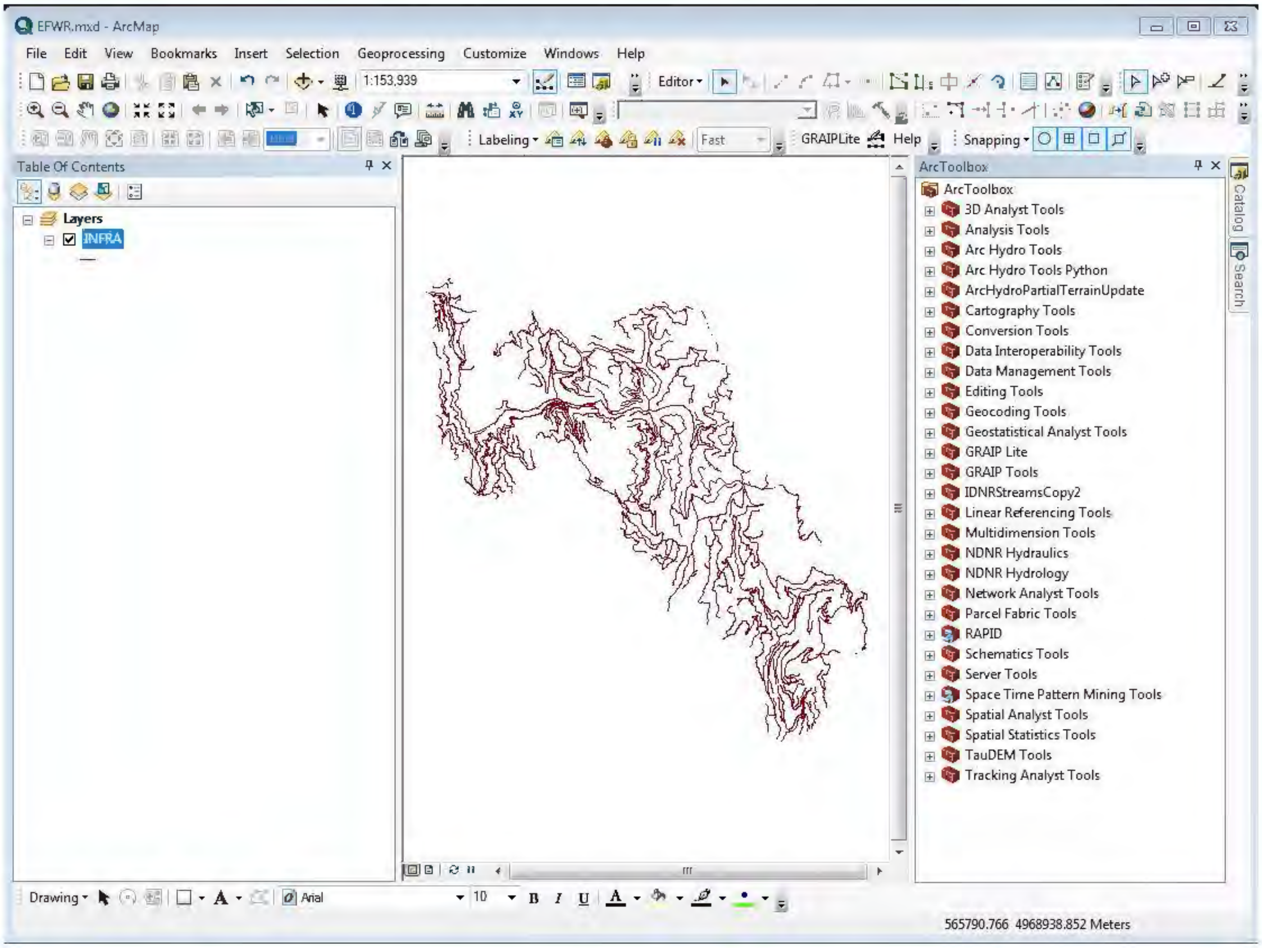


Figure 32: Start Editing.

Next, use the Selection tool to select all roads in the INFRA shapefile (Figure 33). The easiest way to do this is to click and drag a box around all of the roads shown in the map window.

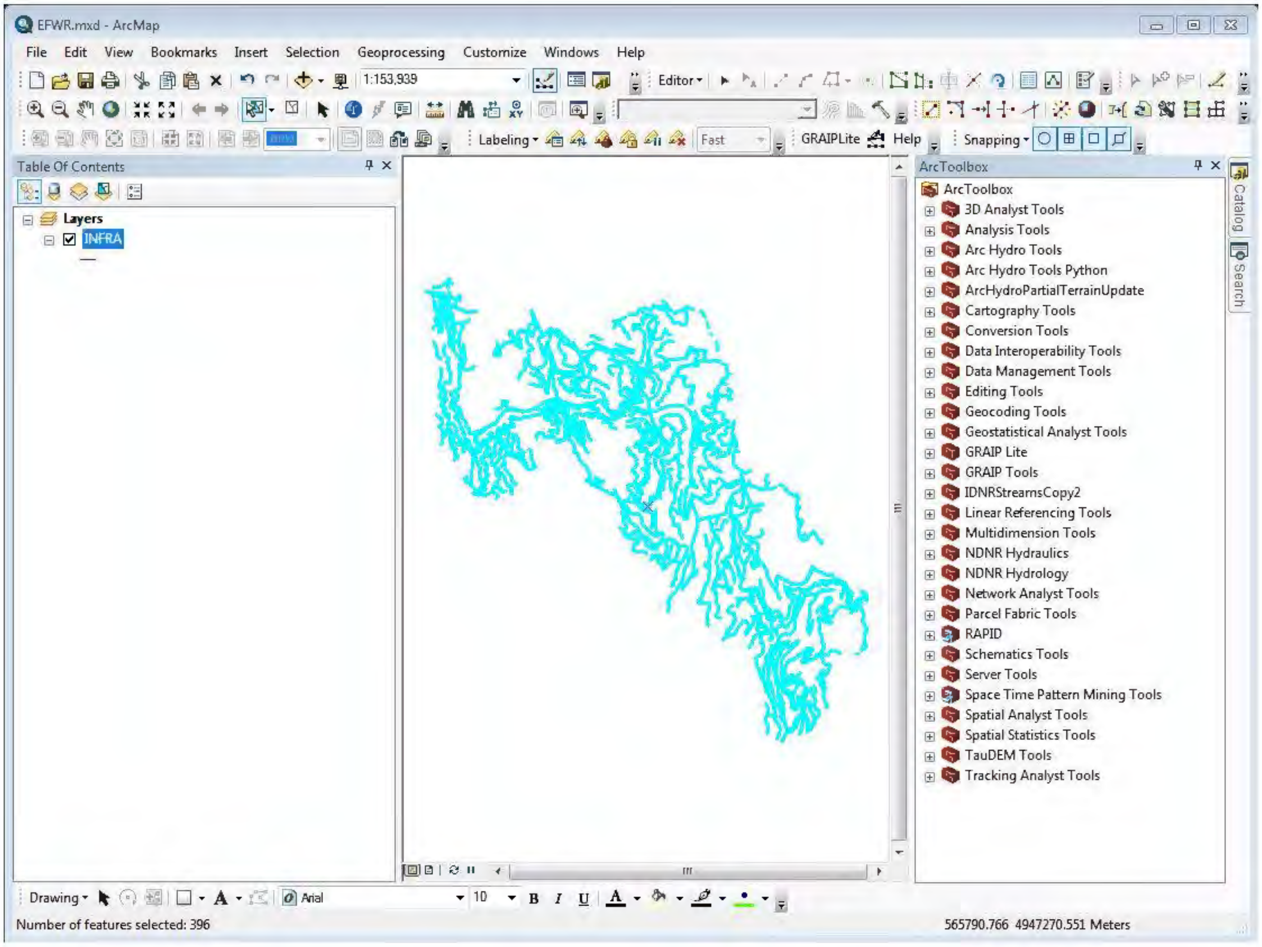
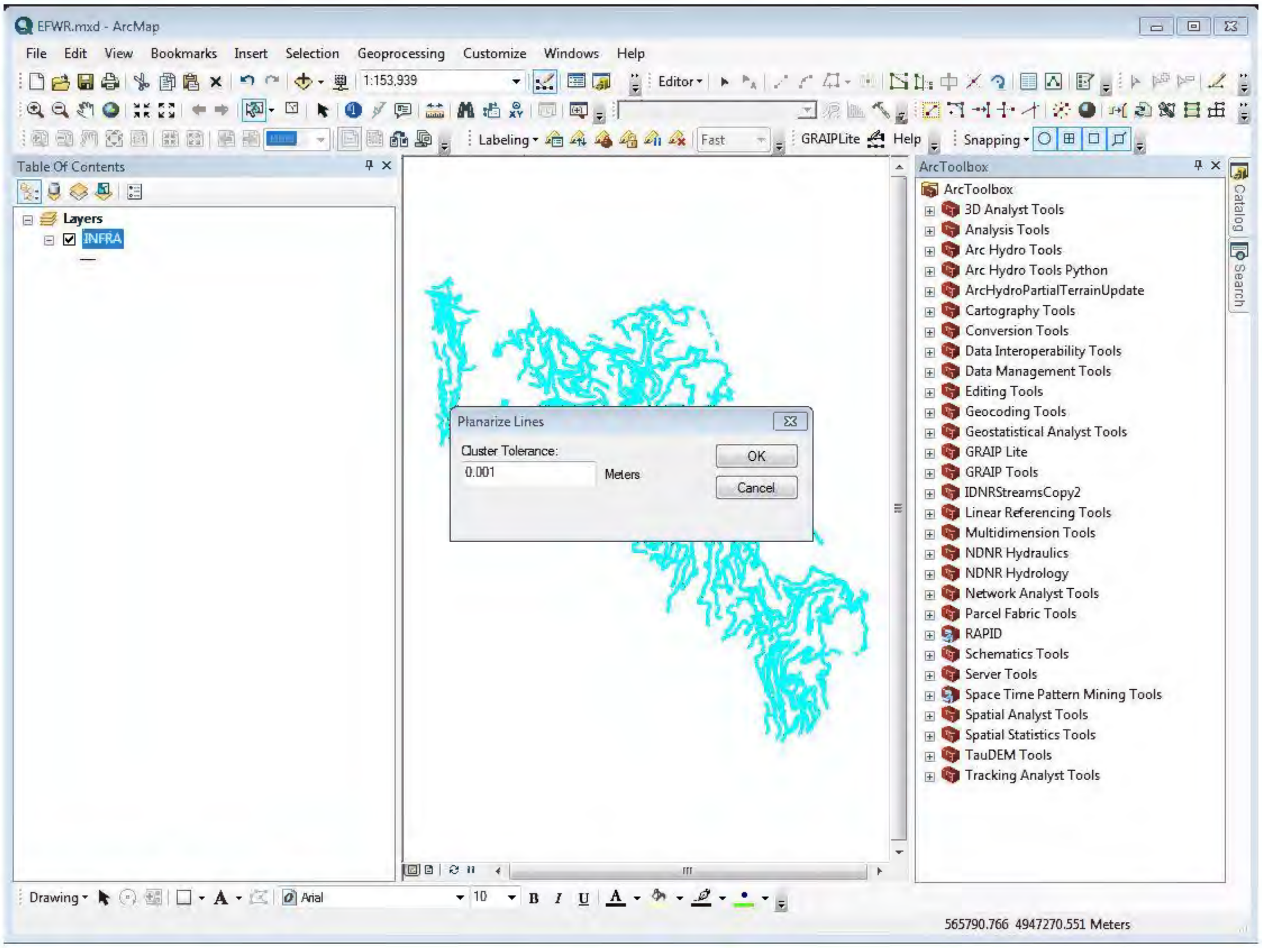


Figure 33: Select all road features.

Once all of the roads are selected, click on the Planarize Lines tool in the Advanced Editing toolbar (Figure 34). Specify a Cluster Tolerance of 0.001 meters, or 1 mm, and click OK. This tool splits all of the lines at each intersection point, resulting in separate features on either side of the intersection. All attributes are preserved during the process.



Planarize Lines

Cluster Tolerance: 0.001 Meters

Figure 34: Planarize Lines tool.

Once the tool has finished, click on Save Edits and then Stop Editing, both located in the Editor menu (Figure 35). At this point, all road sections should be deselected. If there are places where the road needs to be split between intersections, use the Split tool, located in the main Editor toolbar, to do so while in editing mode, making sure to save your edits; in this tutorial this is not necessary.

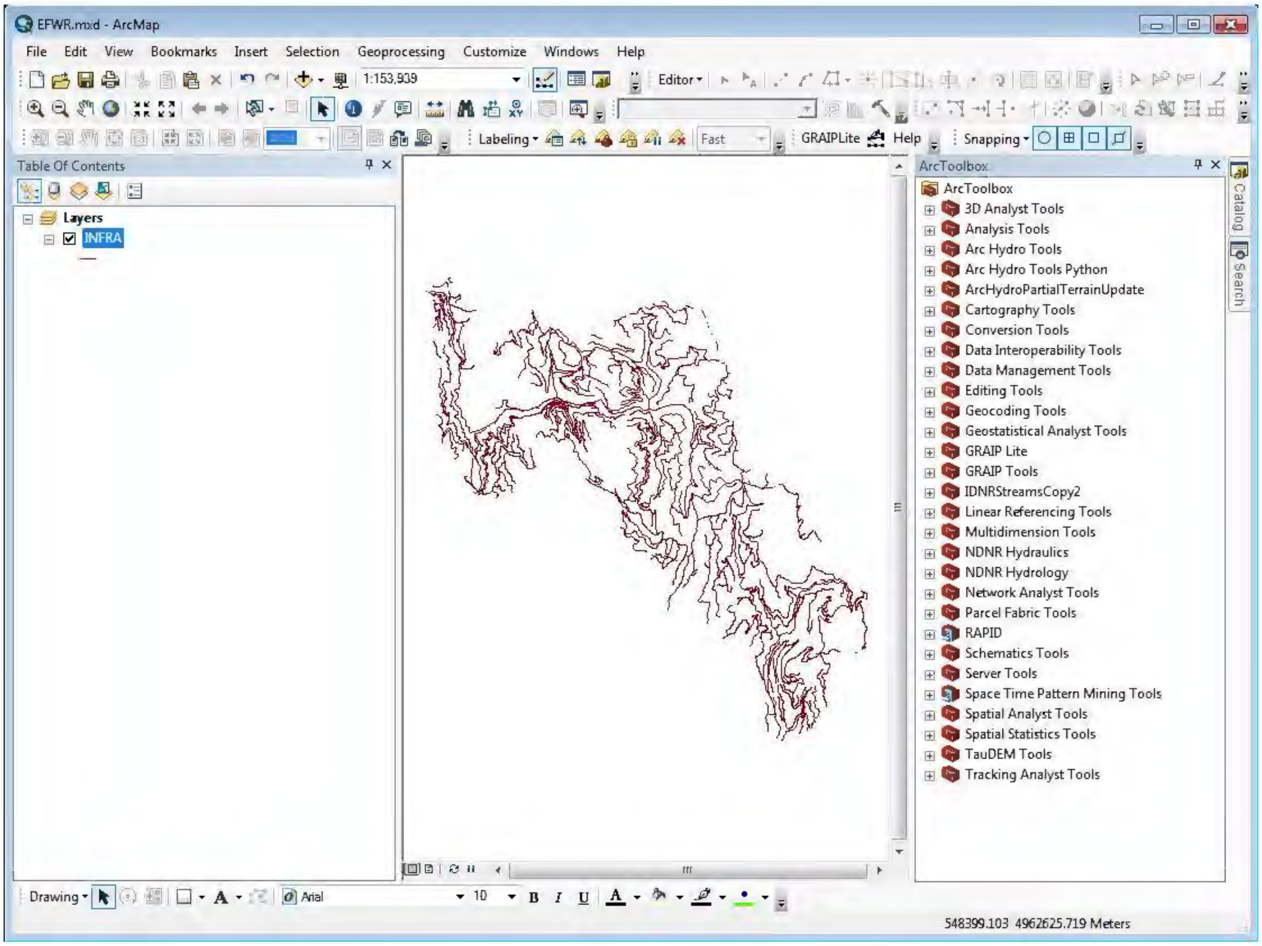
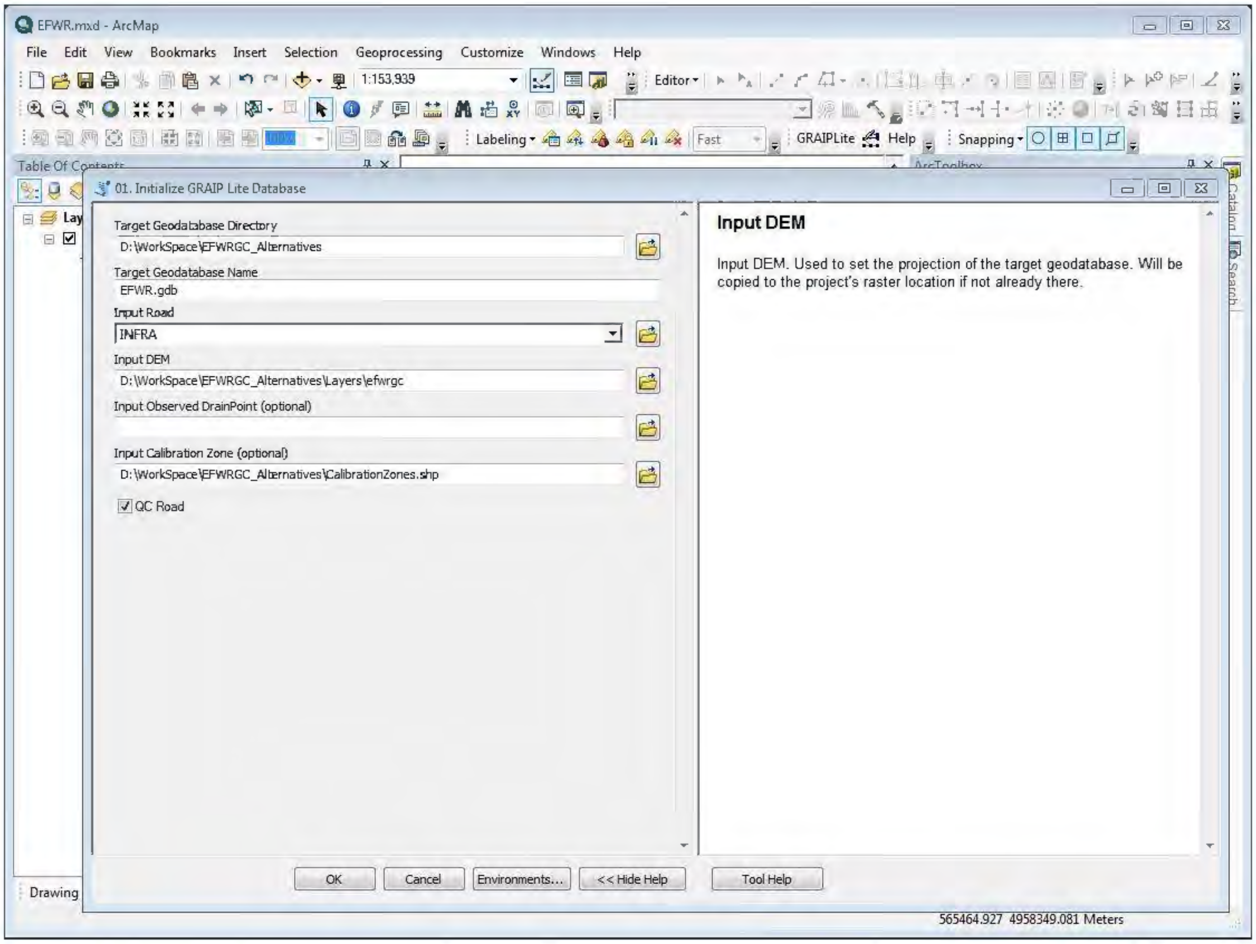


Figure 35: Save edits and stop editing.

Now that the data is in the format we need so that we can properly designate which portions of the road network will be treated, it is time to start the GRAIP_Lite model run. Before we can model the alternatives, we need to give GRAIP_Lite the underlying structure. This can be done with the Basic Run tool if there is no calibration or known drainpoints to be included, but if either or both of these are available it is best to do a full run using the Processing tools. The first step is the *01. Initialize GRAIP Lite Database* tool (Figure 36). This tool tells GRAIP_Lite where our data is and creates the geodatabase to keep track of the results.



01. Initialize GRAIP Lite Database

Target Geodatabase Directory
D:\WorkSpace\EFWRGC_Alternatives

Target Geodatabase Name
EFWR.gdb

Input Road
INFRA

Input DEM
D:\WorkSpace\EFWRGC_Alternatives\Layers\efwrgc

Input Observed DrainPoint (optional)

Input Calibration Zone (optional)
D:\WorkSpace\EFWRGC_Alternatives\CalibrationZones.shp

☑ QC Road

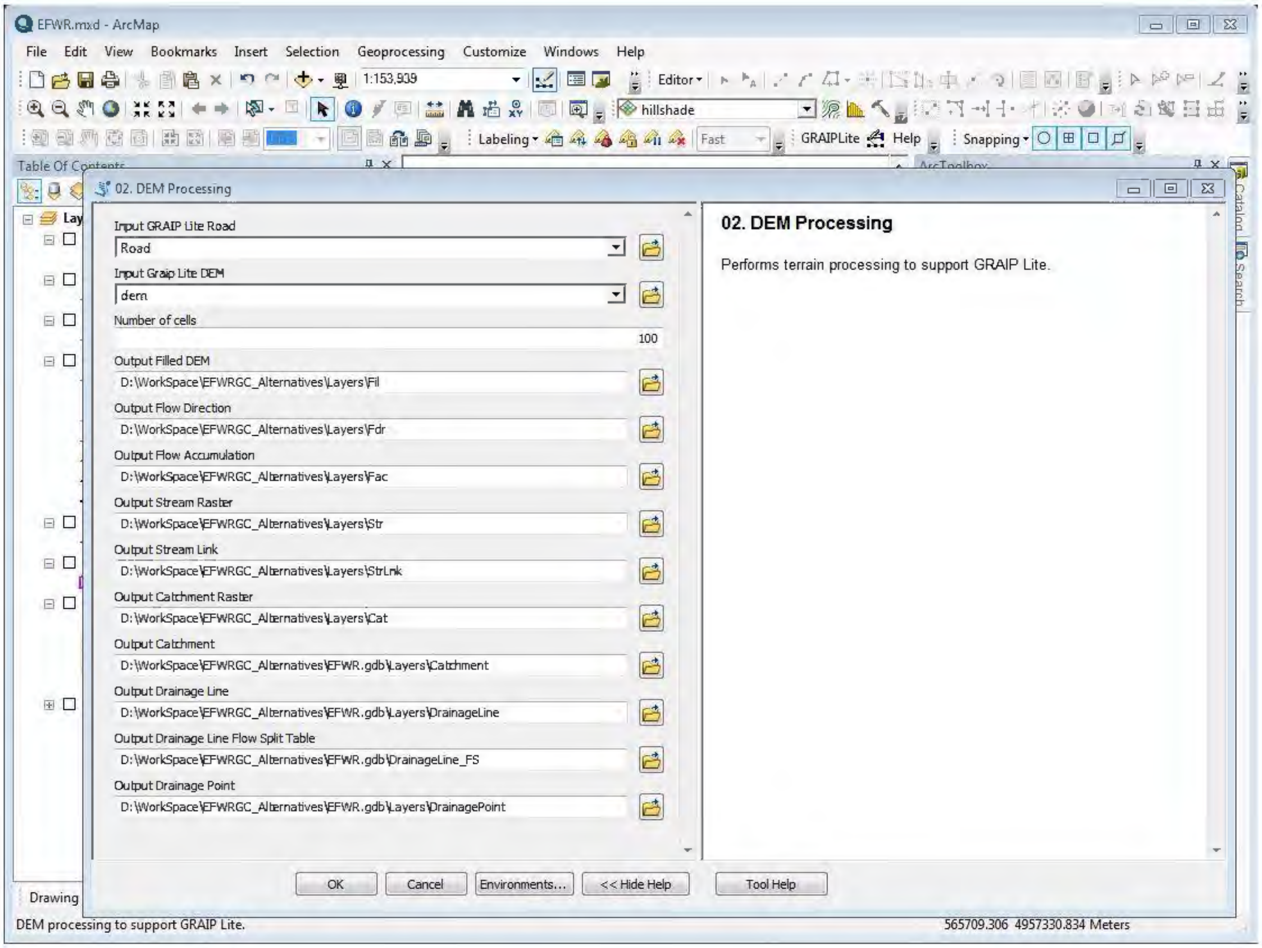
Input DEM

Input DEM. Used to set the projection of the target geodatabase. Will be copied to the project's raster location if not already there.

565464.927 4958349.081 Meters

Figure 36: Initialize GRAIP Lite Database tool.

The next tool, *02. DEM Processing*, generates the stream network and the raster datasets needed for routing sediment in the GRAIP_Lite model (Figure 37).



02. DEM Processing

Input GRAIP Lite Road: Road

Input Graip Lite DEM: dem

Number of cells: 100

Output Filled DEM: D:\WorkSpace\EFWRGC_Alternatives\Layers\Fil

Output Flow Direction: D:\WorkSpace\EFWRGC_Alternatives\Layers\Fdr

Output Flow Accumulation: D:\WorkSpace\EFWRGC_Alternatives\Layers\Fac

Output Stream Raster: D:\WorkSpace\EFWRGC_Alternatives\Layers\Str

Output Stream Link: D:\WorkSpace\EFWRGC_Alternatives\Layers\StrLnk

Output Catchment Raster: D:\WorkSpace\EFWRGC_Alternatives\Layers\Cat

Output Catchment: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\Layers\Catchment

Output Drainage Line: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\Layers\DrainageLine

Output Drainage Line Flow Split Table: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\DrainageLine_FS

Output Drainage Point: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\Layers\DrainagePoint

02. DEM Processing

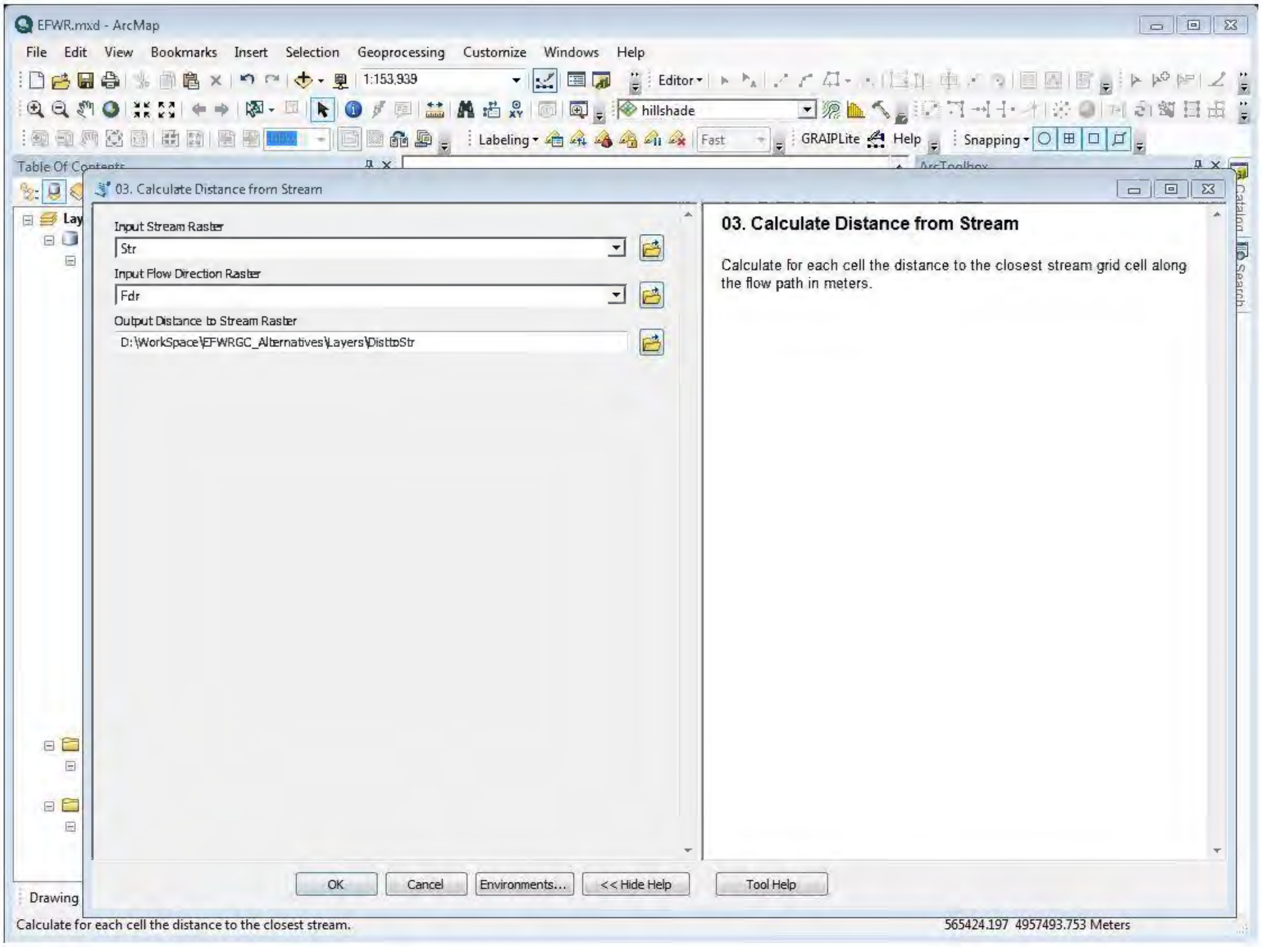
Performs terrain processing to support GRAIP Lite.

DEM processing to support GRAIP Lite.

565709.306 4957330.834 Meters

Figure 37: DEM Processing tool.

Next is the *03. Calculate Distance from Stream* tool (Figure 38), which calculates the distance along the flowpath to the nearest downhill stream.



03. Calculate Distance from Stream

Input Stream Raster: Str

Input Flow Direction Raster: Fdr

Output Distance to Stream Raster: D:\WorkSpace\EFWRGC_Alternatives\Layers\DisttoStr

03. Calculate Distance from Stream

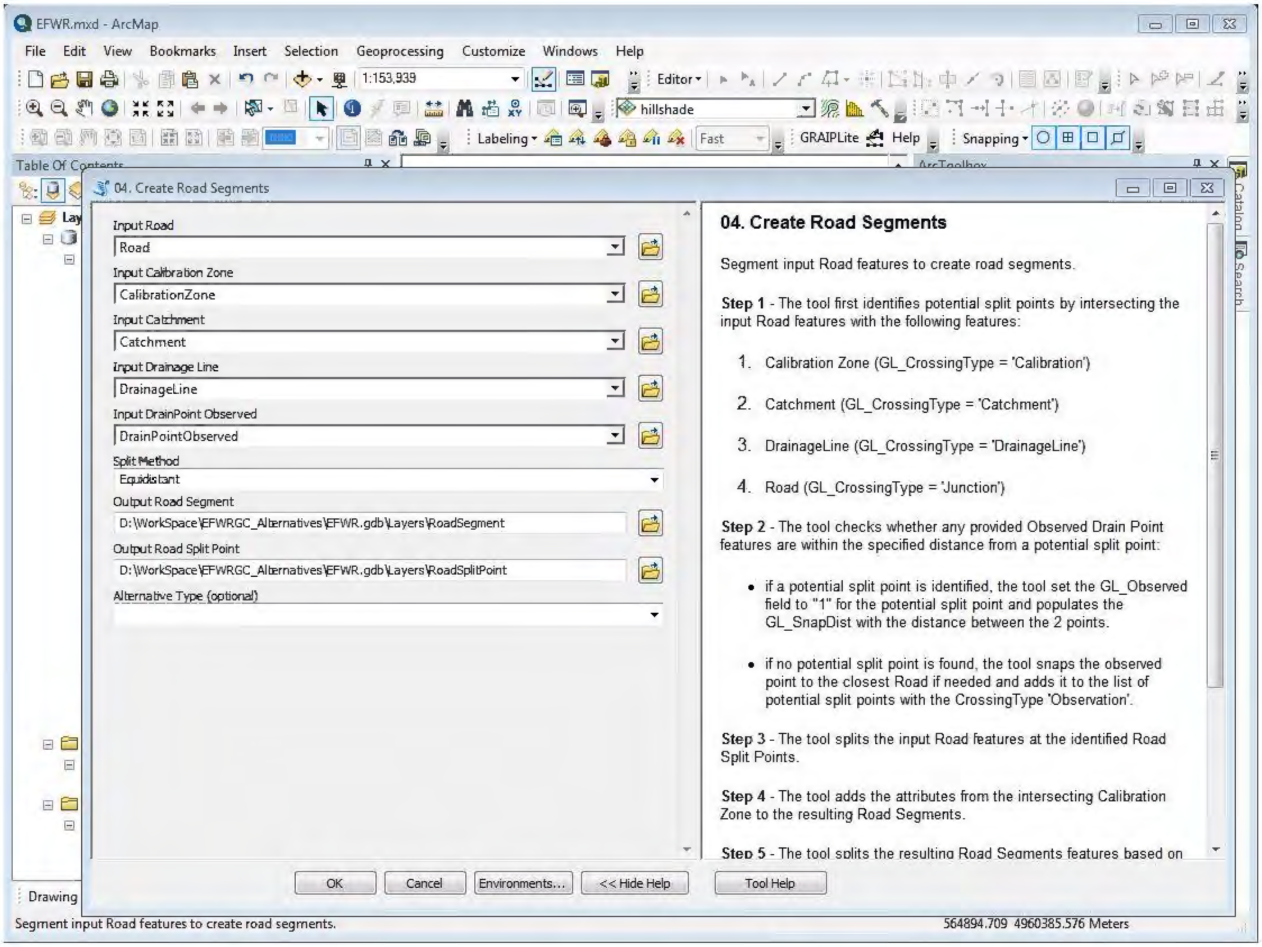
Calculate for each cell the distance to the closest stream grid cell along the flow path in meters.

Calculate for each cell the distance to the closest stream.

565424.197 4957493.753 Meters

Figure 38: Calculate Distance from Stream tool.

The next tool is the *04. Create Road Segments* tool (Figure 39). This tool takes the input road layer and splits it up into GRAIP_Lite road segments based on intersections with calibration zone and catchment boundaries, streams (drainage lines), observed drainpoints, and a maximum road segment length determined by the road segment maintenance level.



04. Create Road Segments

Input Road: Road

Input Calibration Zone: CalibrationZone

Input Catchment: Catchment

Input Drainage Line: DrainageLine

Input DrainPoint Observed: DrainPointObserved

Split Method: Equidistant

Output Road Segment: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\Layers\RoadSegment

Output Road Split Point: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\Layers\RoadSplitPoint

Alternative Type (optional):

04. Create Road Segments

Segment input Road features to create road segments.

Step 1 - The tool first identifies potential split points by intersecting the input Road features with the following features:

1. Calibration Zone (GL_CrossingType = 'Calibration')
2. Catchment (GL_CrossingType = 'Catchment')
3. DrainageLine (GL_CrossingType = 'DrainageLine')
4. Road (GL_CrossingType = 'Junction')

Step 2 - The tool checks whether any provided Observed Drain Point features are within the specified distance from a potential split point:

- if a potential split point is identified, the tool set the GL_Observed field to "1" for the potential split point and populates the GL_SnapDist with the distance between the 2 points.
- if no potential split point is found, the tool snaps the observed point to the closest Road if needed and adds it to the list of potential split points with the CrossingType 'Observation'.

Step 3 - The tool splits the input Road features at the identified Road Split Points.

Step 4 - The tool adds the attributes from the intersecting Calibration Zone to the resulting Road Segments.

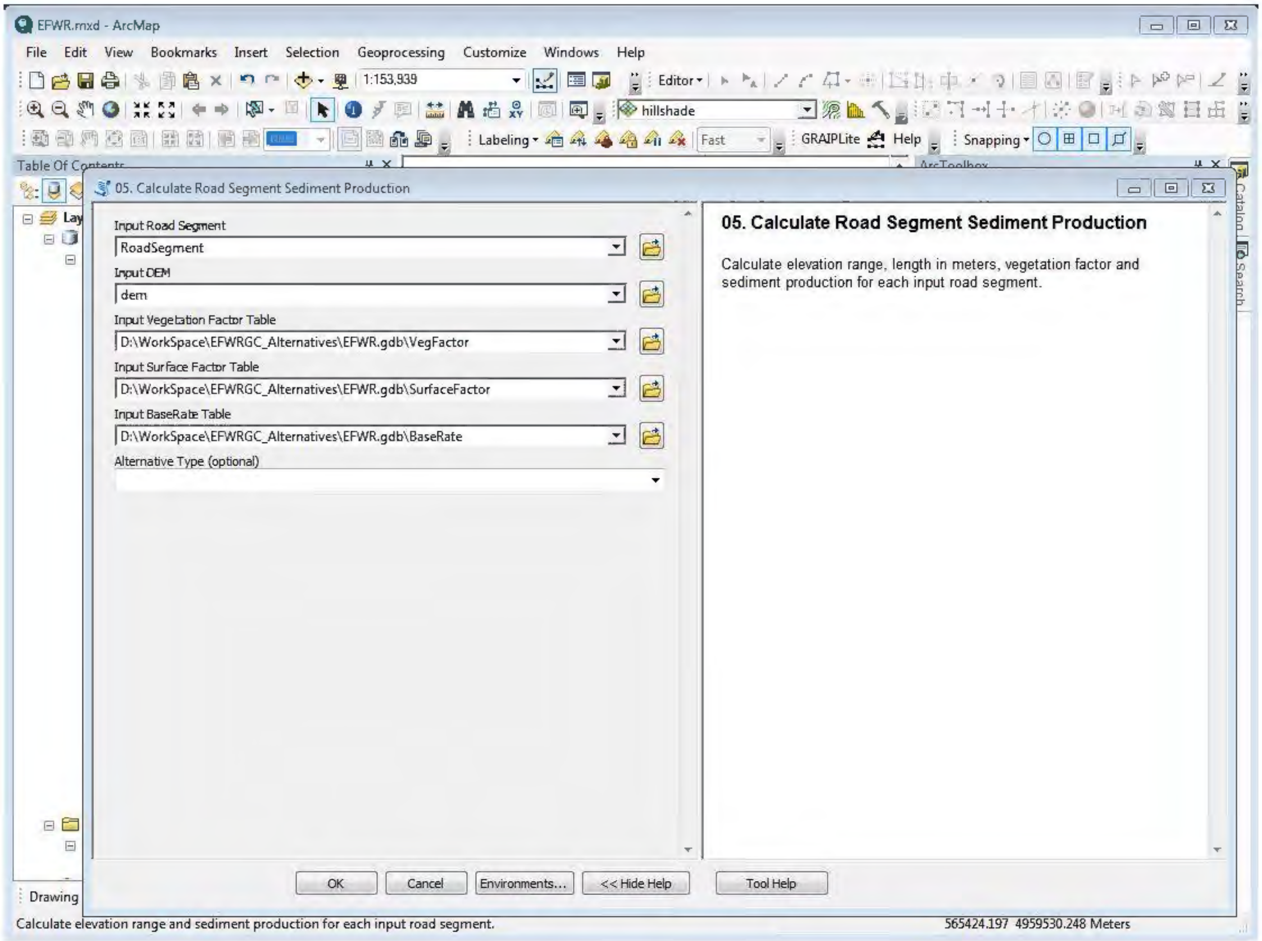
Step 5 - The tool splits the resulting Road Segments features based on

Segment input Road features to create road segments.

564894.709 4960385.576 Meters

Figure 39: Create Road Segments tool.

Road-surface sediment production is then calculated using the *05. Calculate Road Segment Sediment Production* tool (Figure 40).



05. Calculate Road Segment Sediment Production

Input Road Segment: RoadSegment

Input DEM: dem

Input Vegetation Factor Table: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\VegFactor

Input Surface Factor Table: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\SurfaceFactor

Input BaseRate Table: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\BaseRate

Alternative Type (optional):

05. Calculate Road Segment Sediment Production

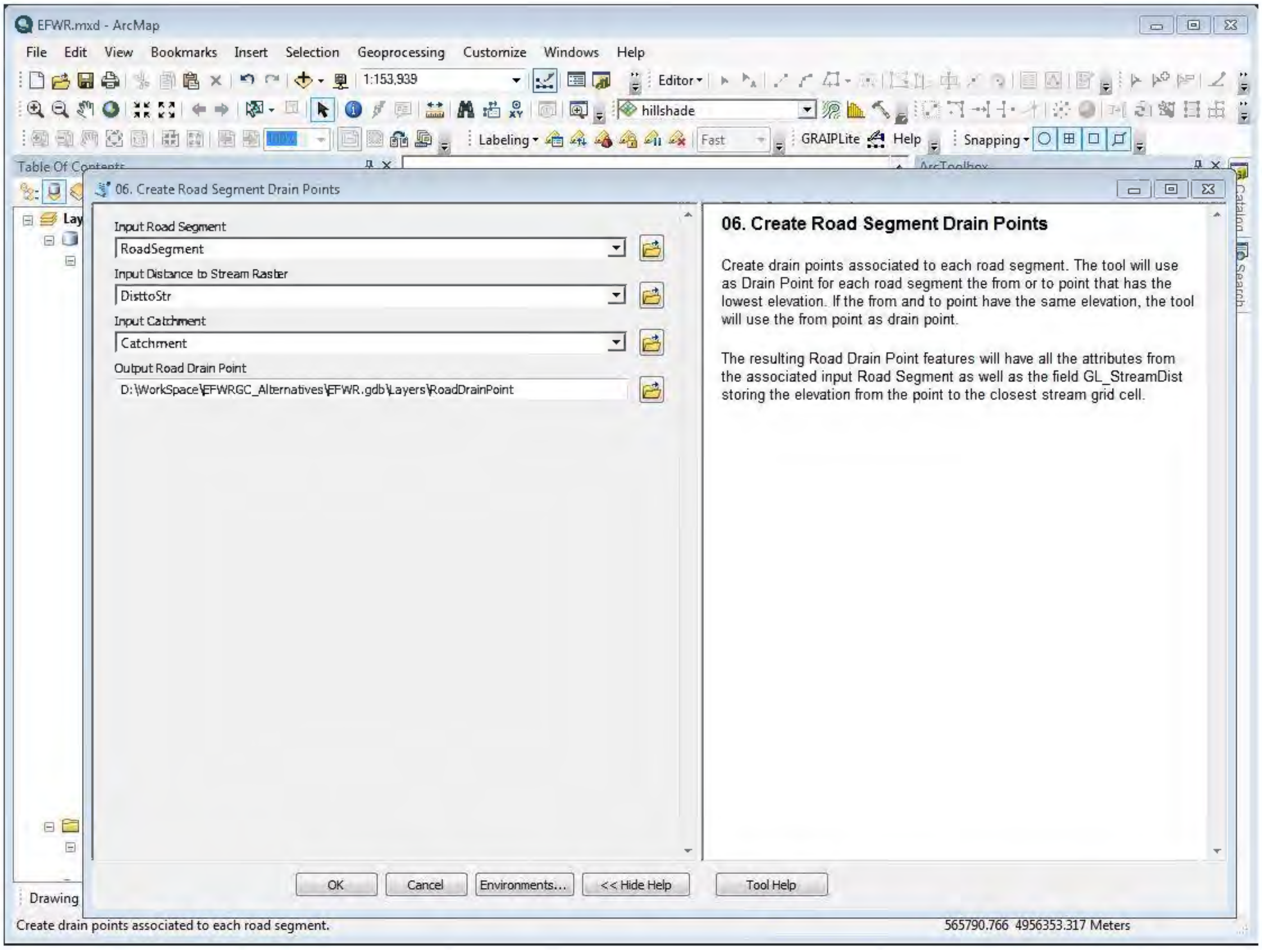
Calculate elevation range, length in meters, vegetation factor and sediment production for each input road segment.

Calculate elevation range and sediment production for each input road segment.

565424.197 4959530.248 Meters

Figure 40: Calculate Road Segment Sediment Production tool.

The next tool, the *06. Create Road Segment Drain Points* tool, creates drain points at the low end of each road segment and appends the flow distance to the stream (Figure 41).



06. Create Road Segment Drain Points

Input Road Segment: RoadSegment

Input Distance to Stream Raster: DisttoStr

Input Catchment: Catchment

Output Road Drain Point: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\Layers\RoadDrainPoint

06. Create Road Segment Drain Points

Create drain points associated to each road segment. The tool will use as Drain Point for each road segment the from or to point that has the lowest elevation. If the from and to point have the same elevation, the tool will use the from point as drain point.

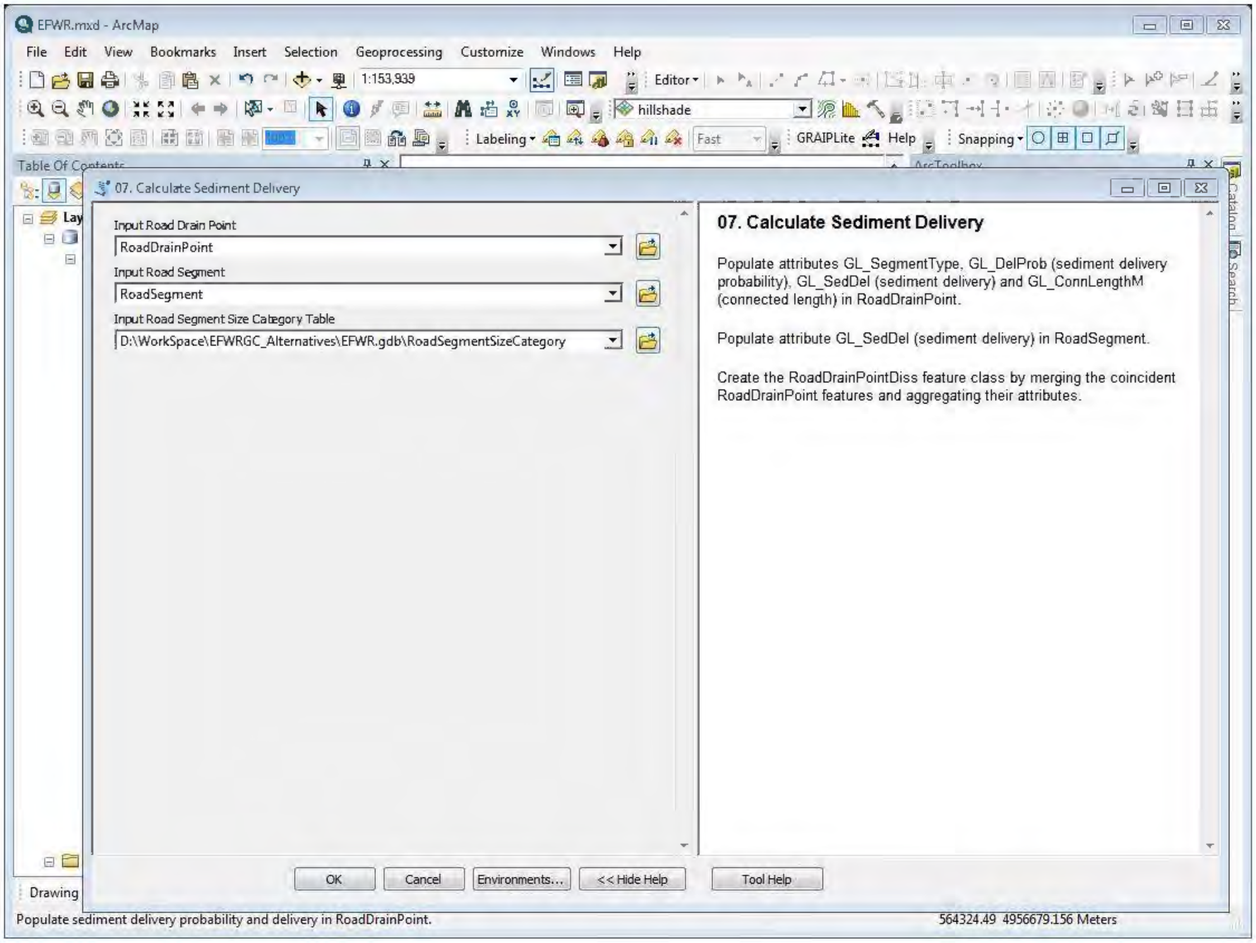
The resulting Road Drain Point features will have all the attributes from the associated input Road Segment as well as the field GL_StreamDist storing the elevation from the point to the closest stream grid cell.

Create drain points associated to each road segment.

565790.766 4956353.317 Meters

Figure 41: Create Road Segment Drain Points tool.

Next is the *07. Calculate Sediment Delivery* tool (Figure 42) that calculates how much of the produced sediment from each road segment will be delivered to the stream network.



07. Calculate Sediment Delivery

Input Road Drain Point: RoadDrainPoint

Input Road Segment: RoadSegment

Input Road Segment Size Category Table: D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb\RoadSegmentSizeCategory

07. Calculate Sediment Delivery

Populate attributes GL_SegmentType, GL_DelProb (sediment delivery probability), GL_SedDel (sediment delivery) and GL_ConnLengthM (connected length) in RoadDrainPoint.

Populate attribute GL_SedDel (sediment delivery) in RoadSegment.

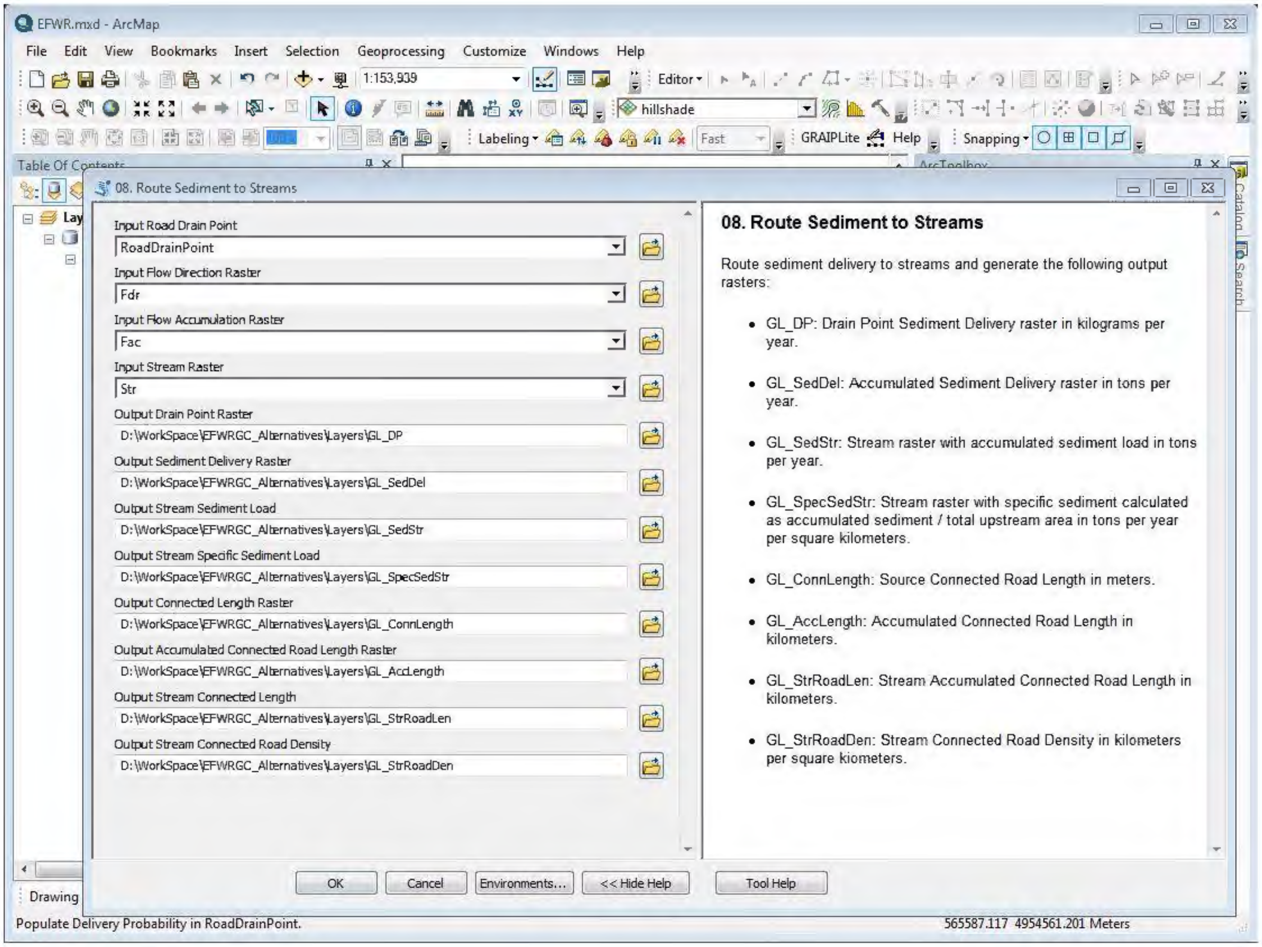
Create the RoadDrainPointDiss feature class by merging the coincident RoadDrainPoint features and aggregating their attributes.

Populate sediment delivery probability and delivery in RoadDrainPoint.

564324.49 4956679.156 Meters

Figure 42: Calculate Sediment Delivery tool.

The next step is to route the delivered sediment into the stream network using the *08. Route Sediment to Streams* tool (Figure 43).



08. Route Sediment to Streams

Input Road Drain Point: RoadDrainPoint
Input Flow Direction Raster: Fdr
Input Flow Accumulation Raster: Fac
Input Stream Raster: Str
Output Drain Point Raster: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_DP
Output Sediment Delivery Raster: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_SedDel
Output Stream Sediment Load: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_SedStr
Output Stream Specific Sediment Load: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_SpecSedStr
Output Connected Length Raster: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_ConnLength
Output Accumulated Connected Road Length Raster: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_AccLength
Output Stream Connected Length: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_StrRoadLen
Output Stream Connected Road Density: D:\WorkSpace\EFWRGC_Alternatives\Layers\GL_StrRoadDen

08. Route Sediment to Streams

Route sediment delivery to streams and generate the following output rasters:

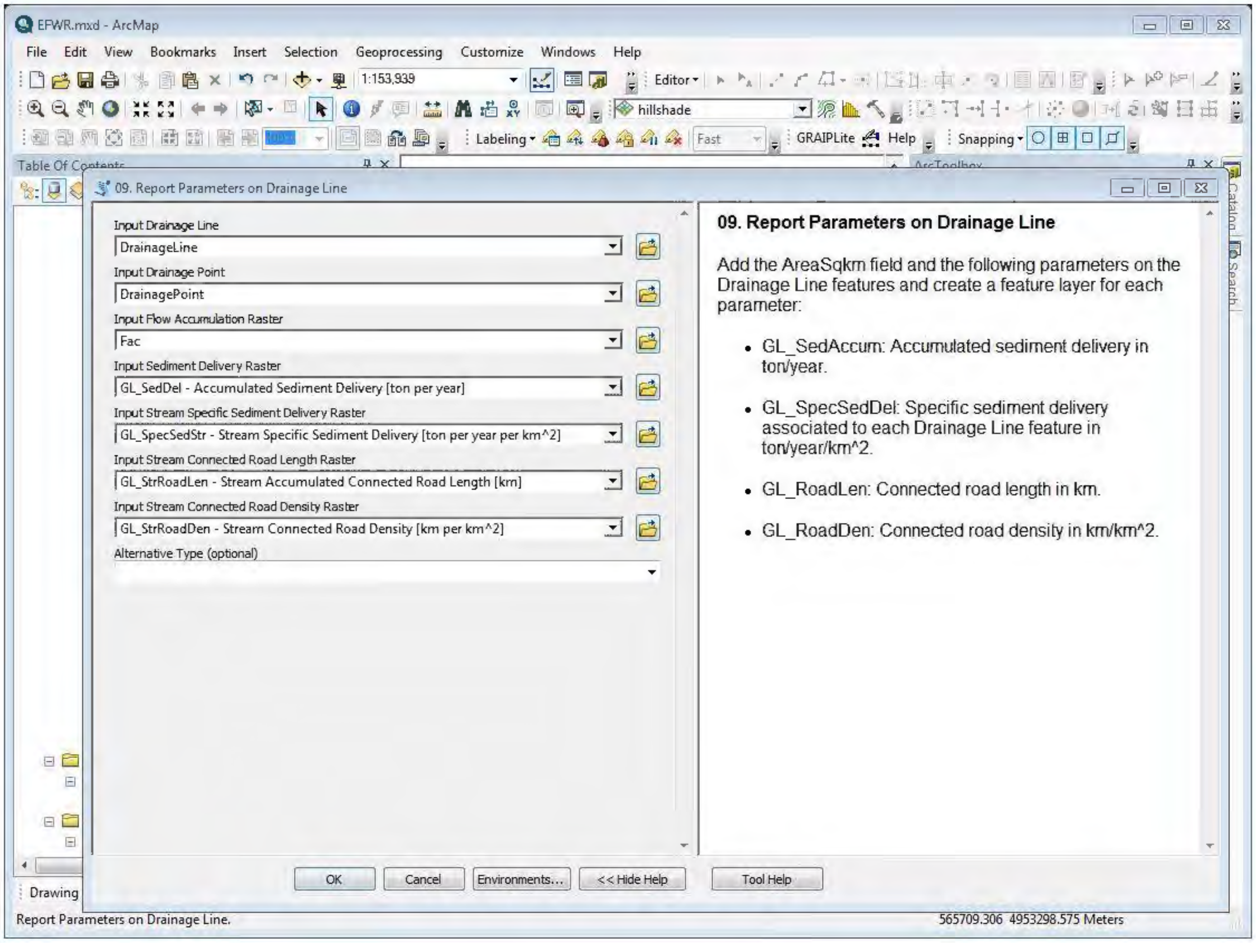
- GL_DP: Drain Point Sediment Delivery raster in kilograms per year.
- GL_SedDel: Accumulated Sediment Delivery raster in tons per year.
- GL_SedStr: Stream raster with accumulated sediment load in tons per year.
- GL_SpecSedStr: Stream raster with specific sediment calculated as accumulated sediment / total upstream area in tons per year per square kilometers.
- GL_ConnLength: Source Connected Road Length in meters.
- GL_AccLength: Accumulated Connected Road Length in kilometers.
- GL_StrRoadLen: Stream Accumulated Connected Road Length in kilometers.
- GL_StrRoadDen: Stream Connected Road Density in kilometers per square kiometers.

Populate Delivery Probability in RoadDrainPoint.

565587.117 4954561.201 Meters

Figure 43: Route Sediment to Streams tool.

Finally, run the *09. Report Parameters on Drainage Line* tool to add the accumulated sediment metrics to the drainage line feature class (Figure 44). This completes the initial part of the model run and establishes the model parameters that will be used to model the alternatives.



09. Report Parameters on Drainage Line

Input Drainage Line: DrainageLine

Input Drainage Point: DrainagePoint

Input Flow Accumulation Raster: Fac

Input Sediment Delivery Raster: GL_SedDel - Accumulated Sediment Delivery [ton per year]

Input Stream Specific Sediment Delivery Raster: GL_SpecSedStr - Stream Specific Sediment Delivery [ton per year per km^2]

Input Stream Connected Road Length Raster: GL_StrRoadLen - Stream Accumulated Connected Road Length [km]

Input Stream Connected Road Density Raster: GL_StrRoadDen - Stream Connected Road Density [km per km^2]

Alternative Type (optional)

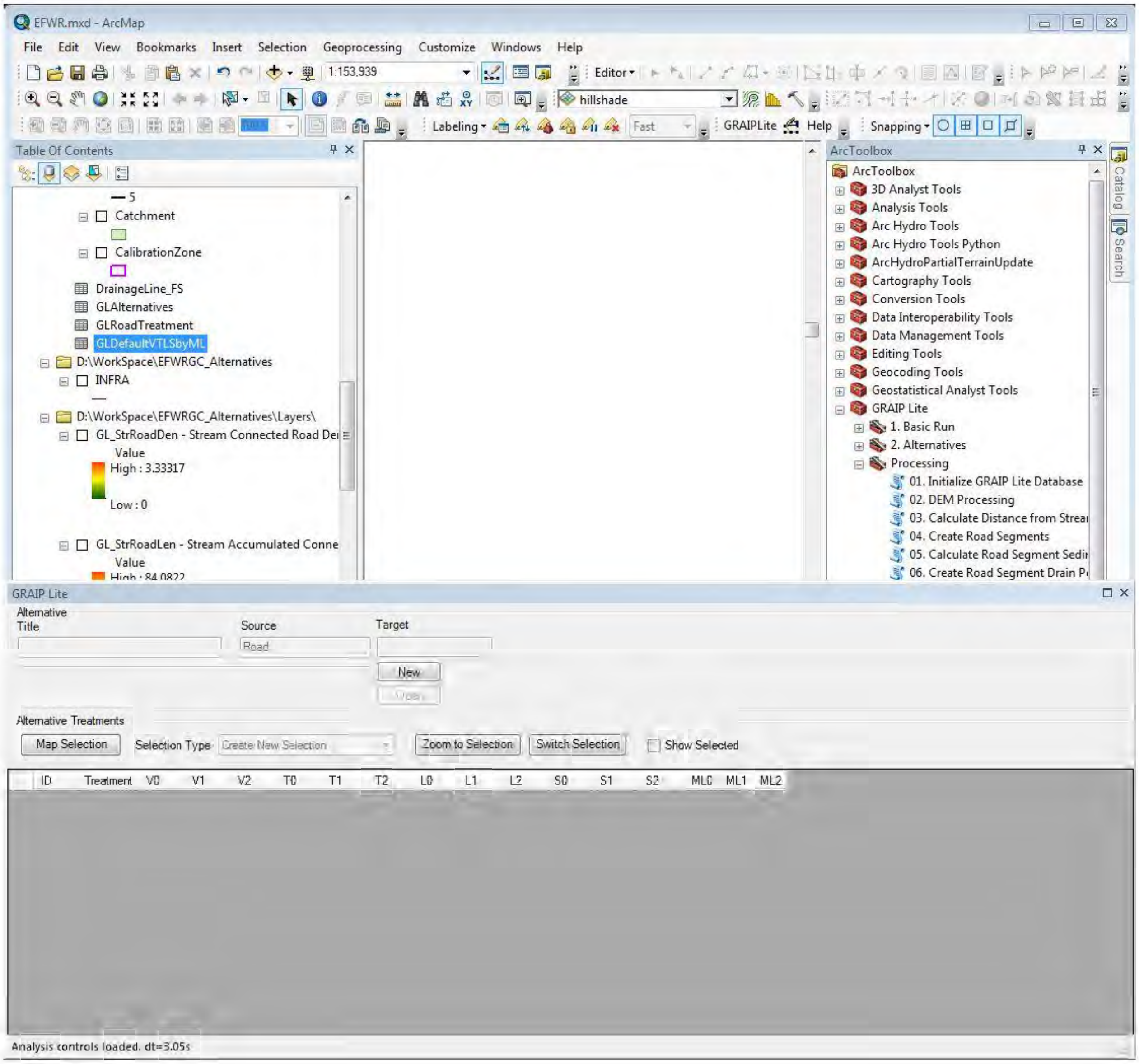
09. Report Parameters on Drainage Line

Add the AreaSqkm field and the following parameters on the Drainage Line features and create a feature layer for each parameter:

- GL_SedAccum: Accumulated sediment delivery in ton/year.
- GL_SpecSedDel: Specific sediment delivery associated to each Drainage Line feature in ton/year/km^2.
- GL_RoadLen: Connected road length in km.
- GL_RoadDen: Connected road density in km/km^2.

Figure 44: Report Parameters on Drainage Line tool.

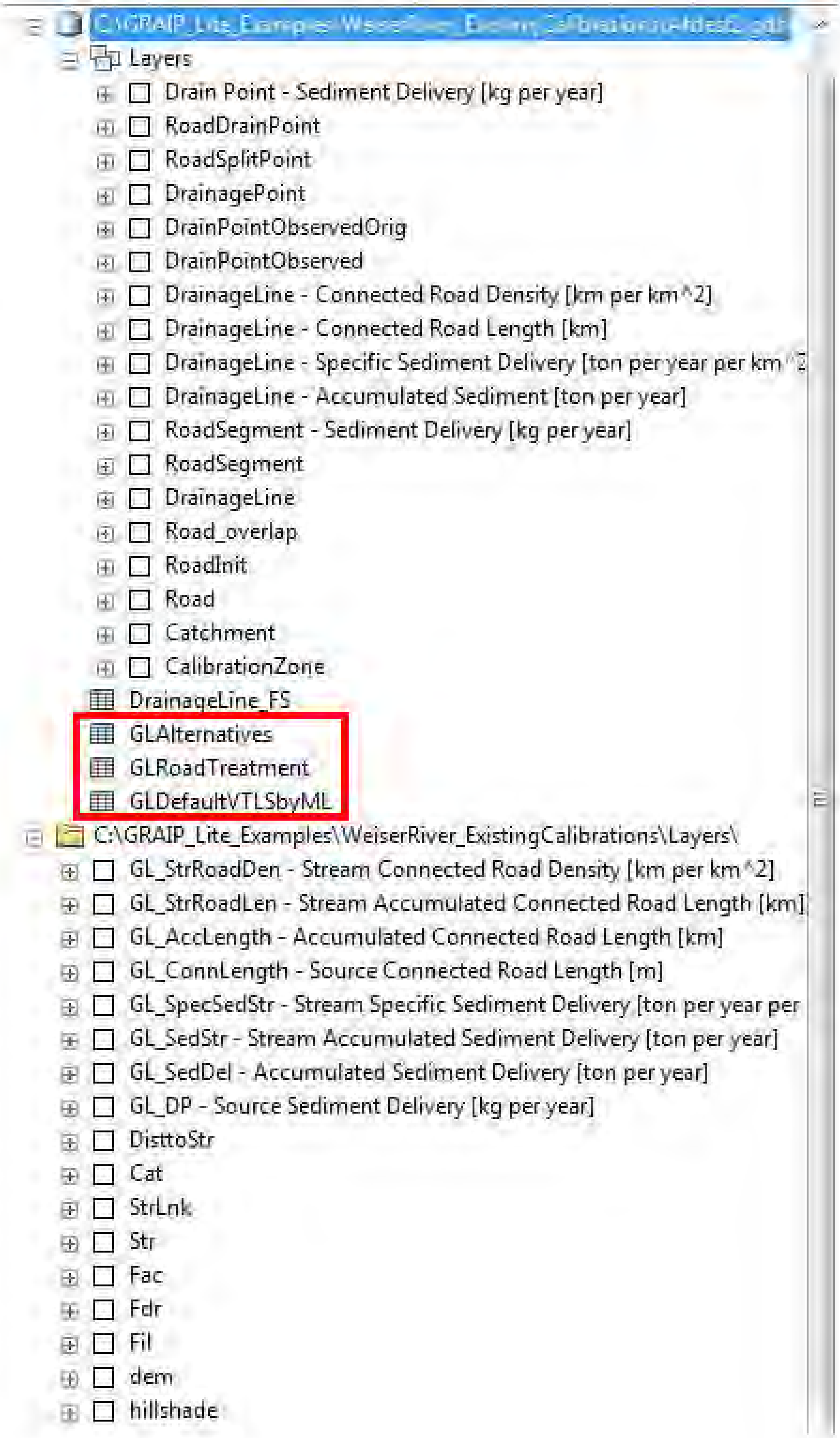
Before the treatments can be modeled, GRAIP_Lite needs to know what the treatments are and what road segments are being treated. This is done using the GRAIP_Lite window, which is opened from the GRAIP_Lite toolbar by clicking on *GRAIP Lite* (Figure 45). The window can be docked or moved to a convenient location on your screen.



Analysis controls loaded. dt=3.05s

Figure 45: Open GRAIP Lite window.

Another common, and annoying, error we have been seeing involves the ApUtilities setting the target locations incorrectly, usually to one of the previously opened map documents. This results in errors when starting the GRAIP_Lite window in preparation for defining treatments to be modeled as alternatives. When the GRAIP_Lite window is opened from the GRAIP_Lite toolbar, three tables are supposed to be copied into the GRAIP_Lite project database. The red box in the Figure 46 shows the three tables; the picture shows them in the correct location, as noted by the path highlighted in blue (pointing to the project geodatabase).



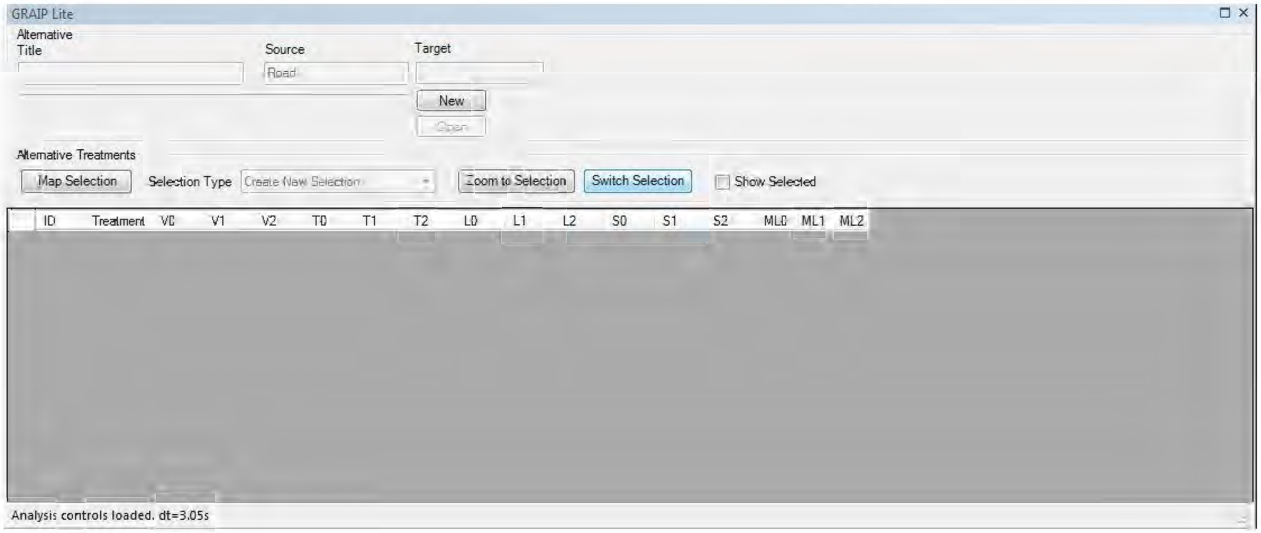
- C:\GRAIP_Lite_Examples\WeiserRiver_ExistingCalibrations\AddedC.gdb
  - Layers
    - ☐ Drain Point - Sediment Delivery [kg per year]
    - ☐ RoadDrainPoint
    - ☐ RoadSplitPoint
    - ☐ DrainagePoint
    - ☐ DrainPointObservedOrig
    - ☐ DrainPointObserved
    - ☐ DrainageLine - Connected Road Density [km per km^2]
    - ☐ DrainageLine - Connected Road Length [km]
    - ☐ DrainageLine - Specific Sediment Delivery [ton per year per km^2
    - ☐ DrainageLine - Accumulated Sediment [ton per year]
    - ☐ RoadSegment - Sediment Delivery [kg per year]
    - ☐ RoadSegment
    - ☐ DrainageLine
    - ☐ Road_overlap
    - ☐ RoadInit
    - ☐ Road
    - ☐ Catchment
    - ☐ CalibrationZone
  - DrainageLine_FS
  - GLAlternatives
  - GLRoadTreatment
  - GLDefaultVTLSbyML
- C:\GRAIP_Lite_Examples\WeiserRiver_ExistingCalibrations\Layers\
  - ☐ GL_StrRoadDen - Stream Connected Road Density [km per km^2]
  - ☐ GL_StrRoadLen - Stream Accumulated Connected Road Length [km]
  - ☐ GL_AccLength - Accumulated Connected Road Length [km]
  - ☐ GL_ConnLength - Source Connected Road Length [m]
  - ☐ GL_SpecSedStr - Stream Specific Sediment Delivery [ton per year per
  - ☐ GL_SedStr - Stream Accumulated Sediment Delivery [ton per year]
  - ☐ GL_SedDel - Accumulated Sediment Delivery [ton per year]
  - ☐ GL_DP - Source Sediment Delivery [kg per year]
  - ☐ DisttoStr
  - ☐ Cat
  - ☐ StrLnk
  - ☐ Str
  - ☐ Fac
  - ☐ Fdr
  - ☐ Fil
  - ☐ dem
  - ☐ hillshade

Figure 46: The tables created when opening the GRAIP_Lite window should appear in this location in your project geodatabase.

If the tables show up where they are supposed to, then all is good. If the tables show up in any other path, close ArcMap **WITHOUT** saving the document. Re-open ArcMap, then re-open the map document, and try again. In our testing, it should work at this point, but double check that the tables are being copied to the correct location before saving the map document.

One way we have found to avoid this is to save, close, and then re-open the map document after running the *Initialize GRAIP Lite Geodatabase* tool. This seems to prevent the issue, which appears to be related to ArcMap not letting go of settings for a previous map document and work space.

Once the GRAIP_Lite window is open, and the tables are in the correct location, click on New to open the options for a new alternative (Figure 47). If you have already created an alternative, you would also have the option to click on Open to access an existing alternative.

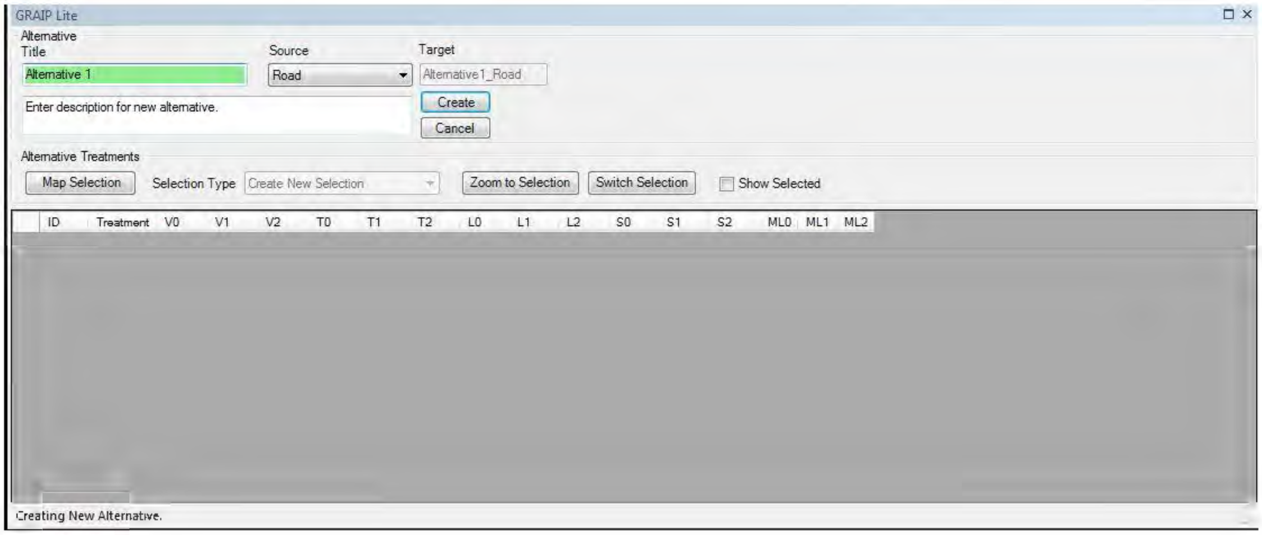


Analysis controls loaded. dt=3.05s

Figure 47: GRAIP Lite window; click on New to start.

After clicking *New*, the window will provide you options for setting up the alternative (Figure 48). You can use the *Title* field to name the alternative, as well as select the *Source* road layer for the alternative. For this tutorial, the defaults will be used. The road layer in this case is the *Road* feature class from the initial model run; this is the copy of the road layer created when the *01. Initialize GRAIP Lite Database* tool was run. There is also a space to enter a description of the alternative. Click *Create* and wait while the tool creates the feature classes for the alternative.

Note that you can choose a different *Source* road layer; this is most commonly used if creating multiple alternatives where there are only a few differences between them. In such a case, one alternative can be set up, and then that layer (*Alternative1_Road*) may be used as the *Source* for the other alternative with only minor changes being made to subsequent alternatives.



Title: Alternative 1

Source: Road

Target: Alternative1_Road

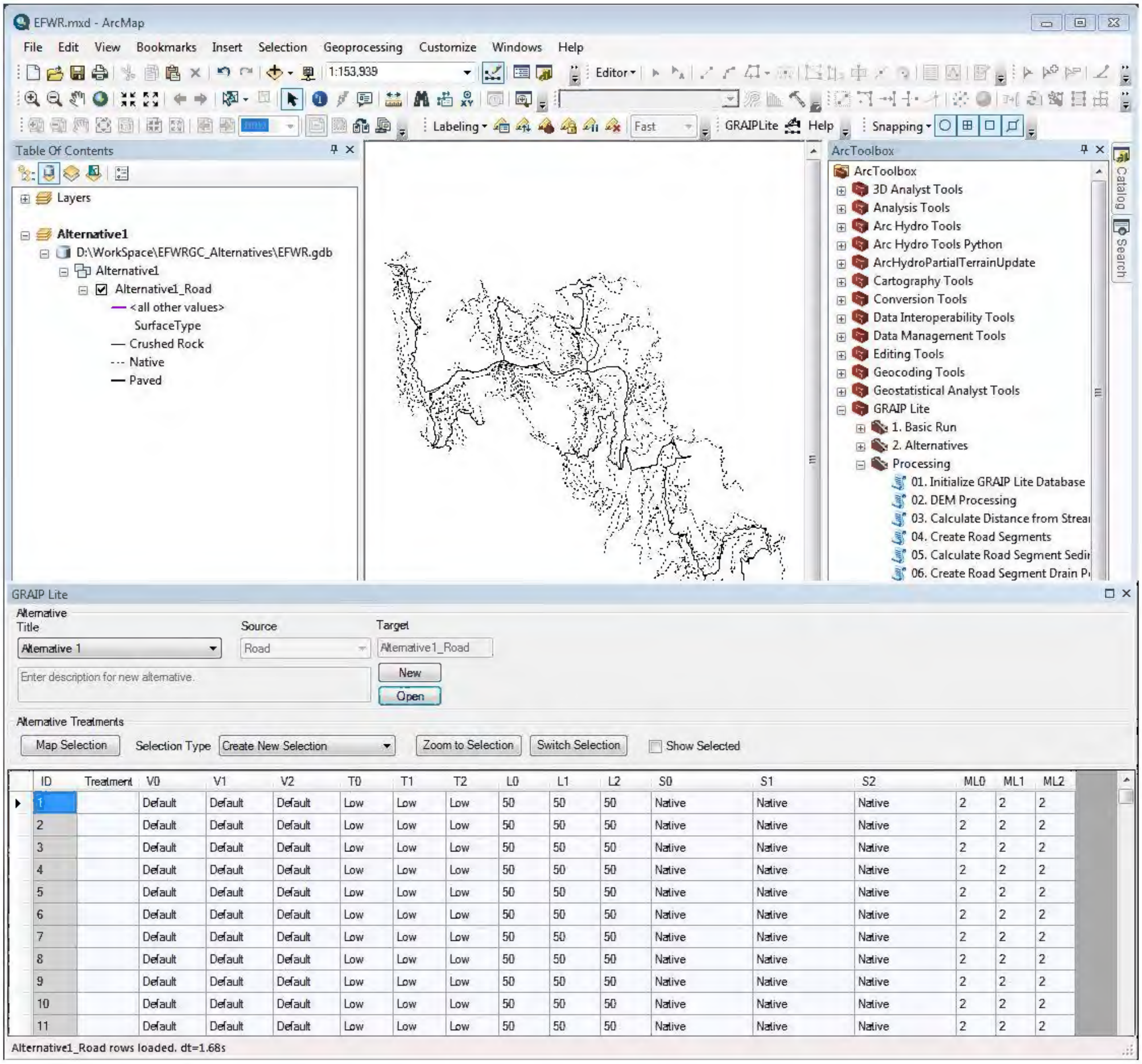
Enter description for new alternative.

Selection Type: Create New Selection

Creating New Alternative.

Figure 48: Create new alternative.

Once the tool has created the alternative, you will be able to see a table where you will be able to set treatment values (Figure 49). Click on *Open* to begin editing the treatments for the alternative. Notice that when the new alternative was created, a new map is added to ArcMap's Table of Contents. Save the map document.



Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

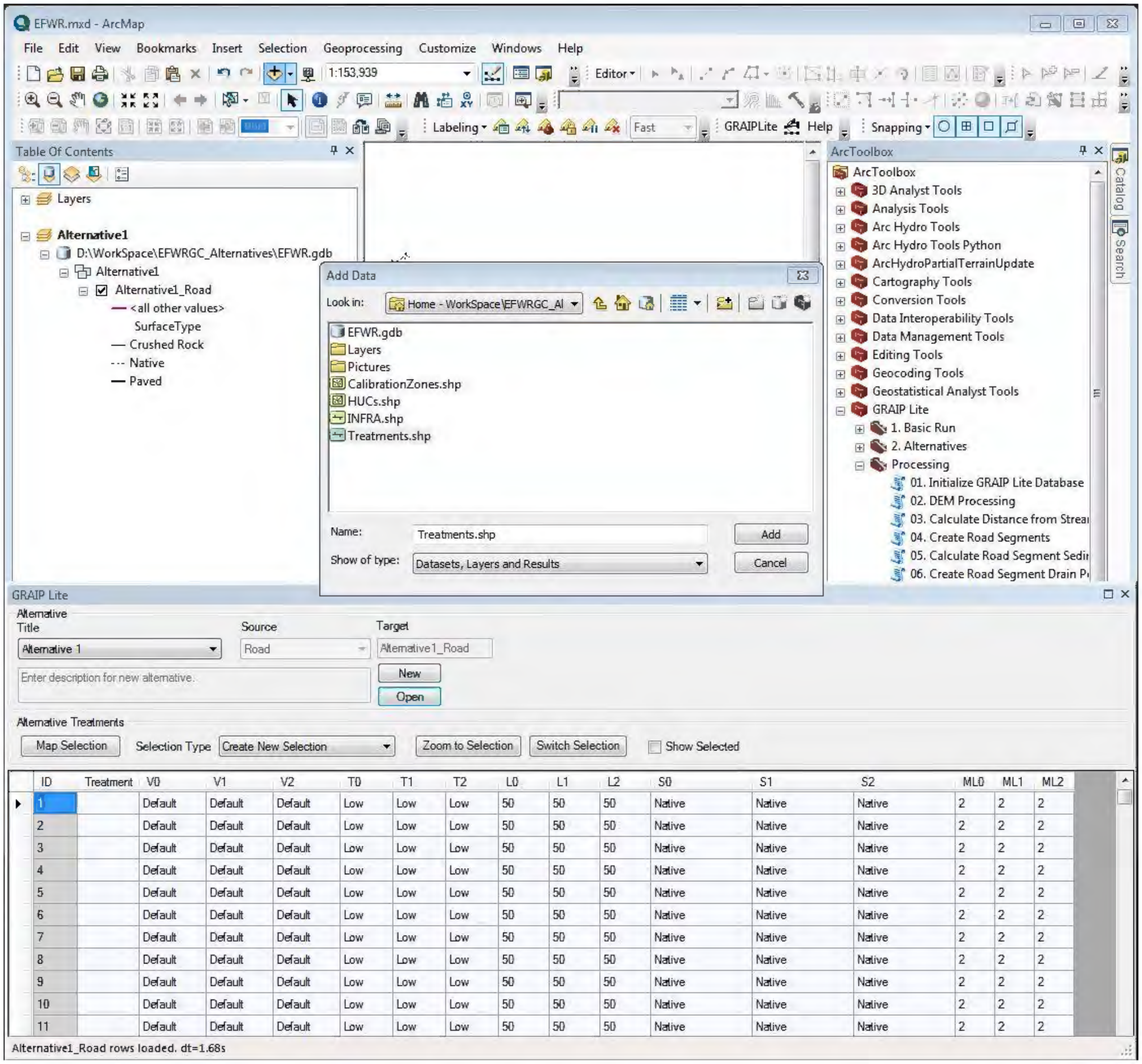
Selection Type: Create New Selection

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	ML2
1		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
2		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
3		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
4		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
5		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
6		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
7		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
8		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
9		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
10		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
11		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2

Alternative1_Road rows loaded. dt=1.68s

Figure 49: Newly created alternative ready to open for editing.

One way to plan treatments is using a shapefile or feature class dataset to keep track of those planned treatments. For the purposes of the tutorial, the *Treatments.shp* shapefile contains just the planned treatments. It was created from a planarized version of the *INFRA.shp* shapefile used for the tutorial. Add the Treatments.shp shapefile using the Add Data dialogue (Figure 50). A separate shapefile or feature class is not necessary; if the treatments are already recorded in columns in the road layer, that information will carry over into GRAIP_Lite which means that features can be directly selected in the *Alternative1_Road* layer using the *Select by Attributes* tool. If the treatment descriptions are already in the *Alternative1_Road* layer, the *Select by Location* tool is not necessary.



Look in: Home - WorkSpace\EFWRGC_Al

Name: Treatments.shp

Show of type: Datasets, Layers and Results

Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

Selection Type: Create New Selection

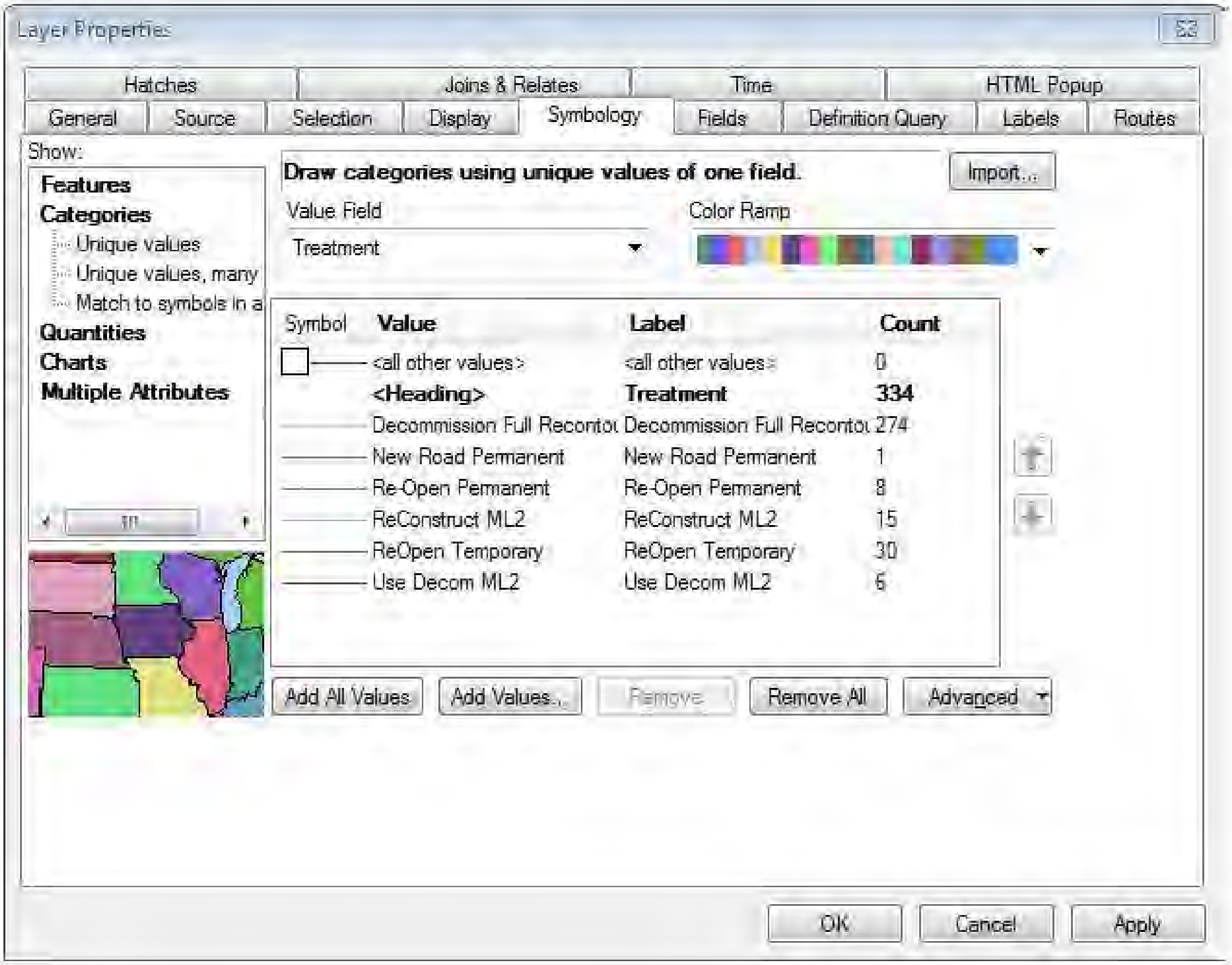
☐ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	ML2
1		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
2		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
3		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
4		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
5		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
6		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
7		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
8		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
9		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
10		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
11		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2

Alternative1_Road rows loaded. dt=1.68s

Figure 50: Add Treatments layer.

Once the treatments layer has been added, double click on it to open the Layer Properties and click on the Symbology tab (Figure 51). Select the Unique values option under the Categories menu, then select Treatment in the Value Field menu. Finally, click Add All Values. The choice for color ramp isn't important; the idea is just to be able to distinguish each treatment category. Click OK when satisfied with the symbology and turn the layer on if it is not already on.



Draw categories using unique values of one field.

Value Field: Treatment

Symbol	Value	Label	Count
☐	<all other values>	<all other values>	0
	<Heading>	**Treatment**	**334**
	Decommission Full Reconto	Decommission Full Reconto	274
	New Road Permanent	New Road Permanent	1
	Re-Open Permanent	Re-Open Permanent	8
	ReConstruct ML2	ReConstruct ML2	15
	ReOpen Temporary	ReOpen Temporary	30
	Use Decom ML2	Use Decom ML2	6

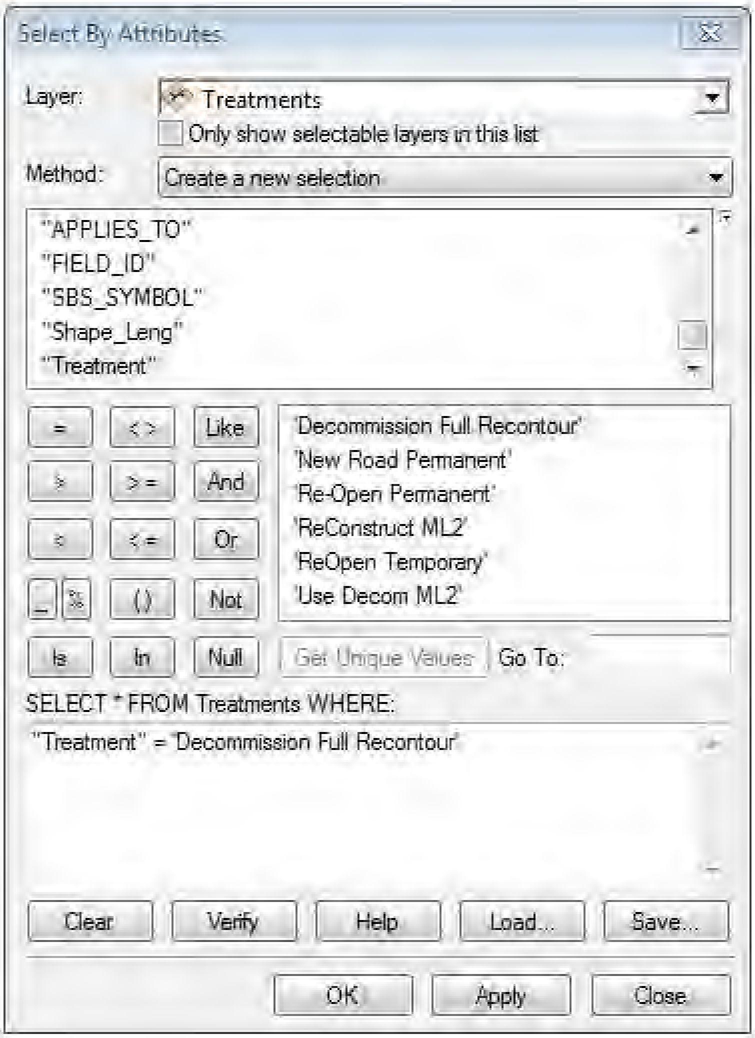
Figure 51: Treatments symbology.

It is now time to start selecting road segments and setting treatment values. In order to set the treatments, the appropriate road segments must be selected from the *Alternative1_Road* layer. There are a couple ways to do this, depending on the way the data is set up and how many road segments will receive the same treatment.

Since the *Treatments* layer in this example is derived from the *INFRA* data set used for the model, and both layers were planarized, individual road sections are geometrically identical. This means that we can select features in the *Treatments* layer using the *Select By Attributes* tool and then use the *Select By Location* tool to select the corresponding features in the *Alternative1_Road* layer. If your project has the treatments specified in your road layer, just use the *Select By Attributes* tool to directly select the features in the *Alternative1_Road* layer.

Open the *Select By Attributes* tool by clicking on *Selection* and then *Select By Attributes* in the main ArcMap menu. Make sure *Treatments* is the target *Layer*, and in the list of attribute fields, scroll to the bottom to find *"Treatment"* (Figure 52). Double click on *"Treatment"* to add it to the logic statement in the lower part of the dialogue box, then click on *Get Unique Values* to see a list of the possible values for the field *"Treatment".* Now click on the = button and then double click on *'Decommission Full*

Recontour'. You should now have a statement in the lower part of the dialogue box: *"Treatment" = 'Decommission Full Recontour'*. Click *Apply* to select all features in the *Treatments* layer where the treatment is specified to be decommissioning by fully recontouring the road.


Select By Attributes

Layer: Treatments

☐ Only show selectable layers in this list

Method: Create a new selection

"APPLIES_TO"
"FIELD_ID"
"SBS_SYMBOL"
"Shape_Leng"
"Treatment"

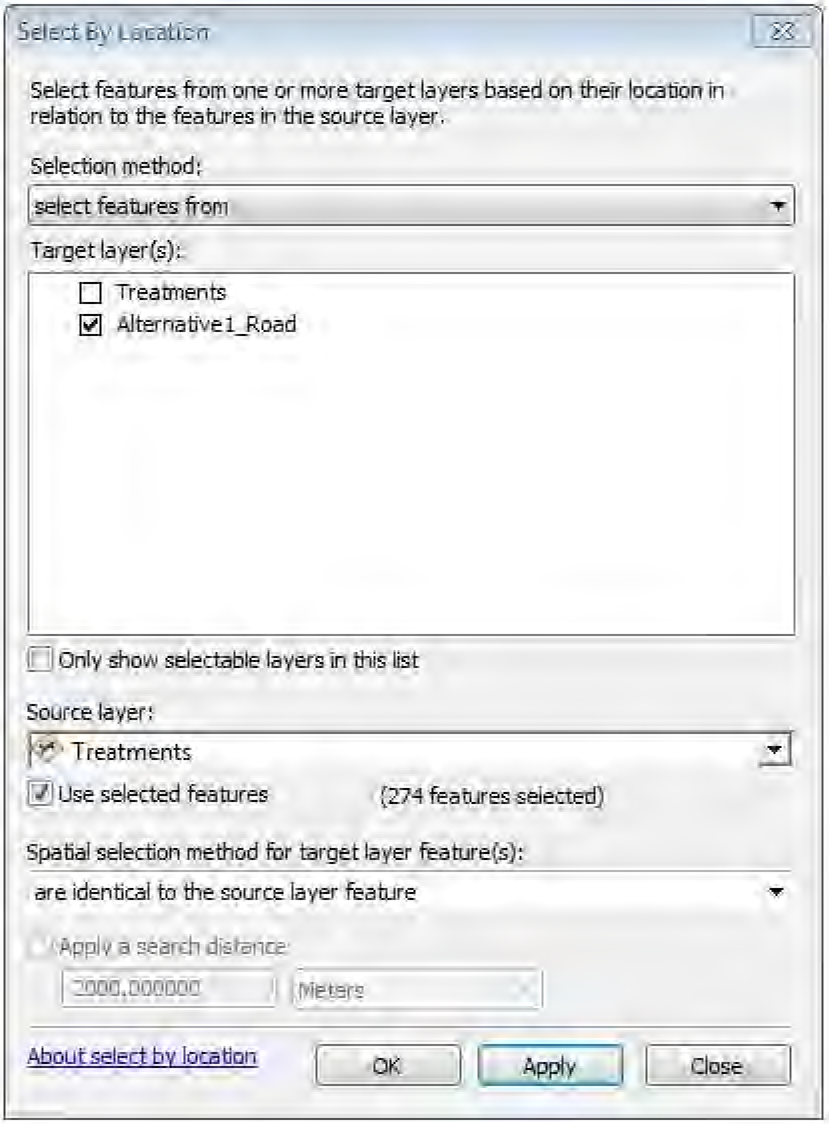
'Decommission Full Recontour'
'New Road Permanent'
'Re-Open Permanent'
'ReConstruct ML2'
'ReOpen Temporary'
'Use Decom ML2'

SELECT * FROM Treatments WHERE:

"Treatment" = 'Decommission Full Recontour'

Figure 52: Select by Attributes tool.

Open the *Select By Location* tool by clicking on *Selection* and then *Select By Location* in the main ArcMap menu. This tool will be used to select the corresponding features in the *Alternative1_Road* layer. The *Select By Location* tool (Figure 53) is used to select features from the *Target layer* or layers based on their location relative to features in the *Source layer*. In the *Target layer(s):* list, make sure *Alternative1_Road* is selected. Make sure *Treatments* is the *Source layer* and click the box to *Use selected features*. There is a list of different options for *Spatial selection method for target layer feature(s):*; use the option *are identical to the source layer feature*. This selects the features in the *Alternative1_Road* layer that are geometrically identical to the features selected from the *Treatments* layer during the previous step.


Select By Location

Select features from one or more target layers based on their location in relation to the features in the source layer.

Selection method: select features from

Target layer(s):

☐ Treatments

☑ Alternative1_Road

☐ Only show selectable layers in this list

Source layer: Treatments

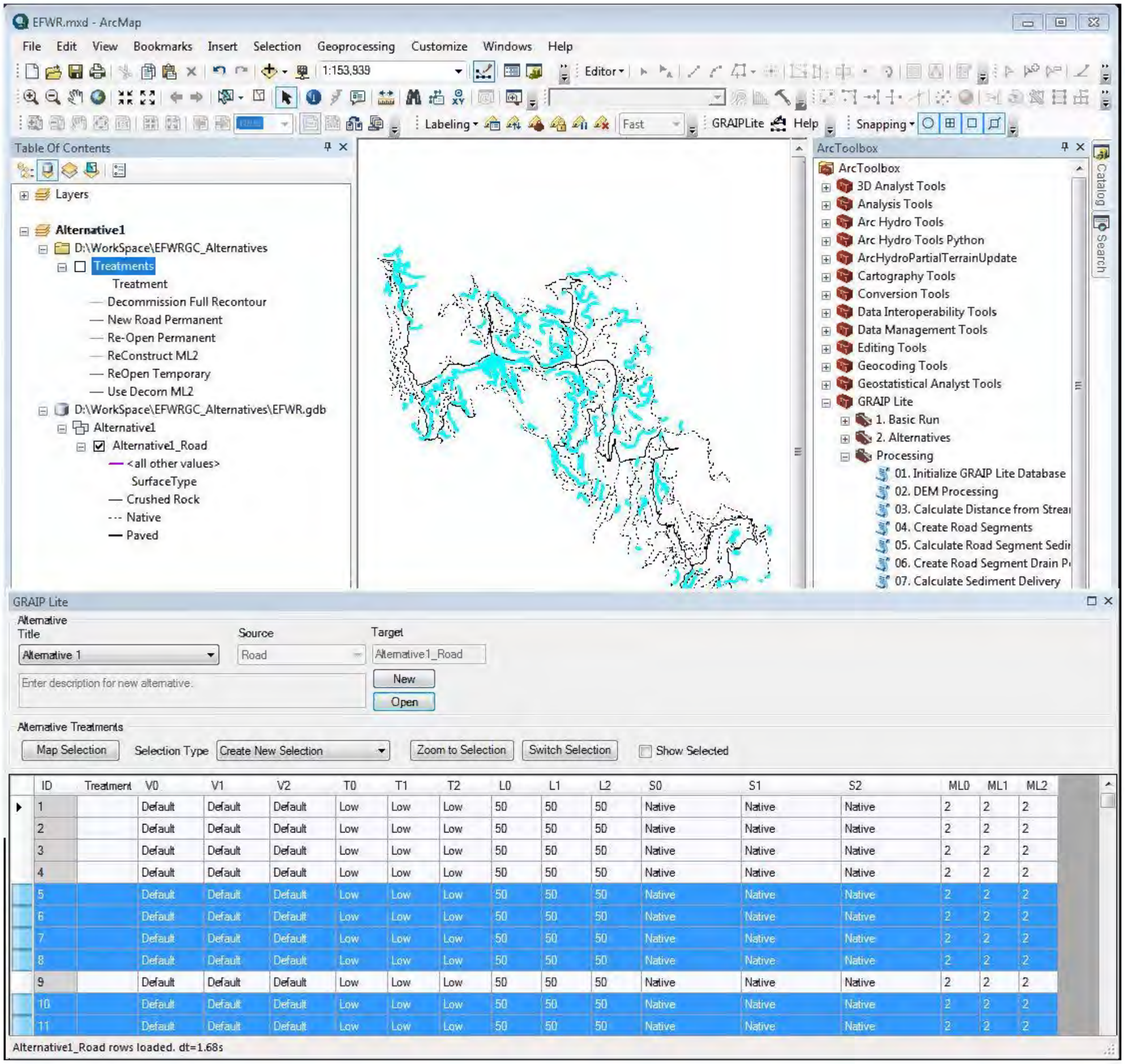
☑ Use selected features (274 features selected)

Spatial selection method for target layer feature(s): are identical to the source layer feature

☐ Apply a search distance 2000.000000 Meters

Figure 53: Select by Location tool.

The selected features will appear highlighted in both the map window and the GRAIP Lite dialogue box (Figure 54). You can check that the correct features were selected by turning on and off the *Treatments* layer and comparing the selected features on the map.



Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

Selection Type: Create New Selection

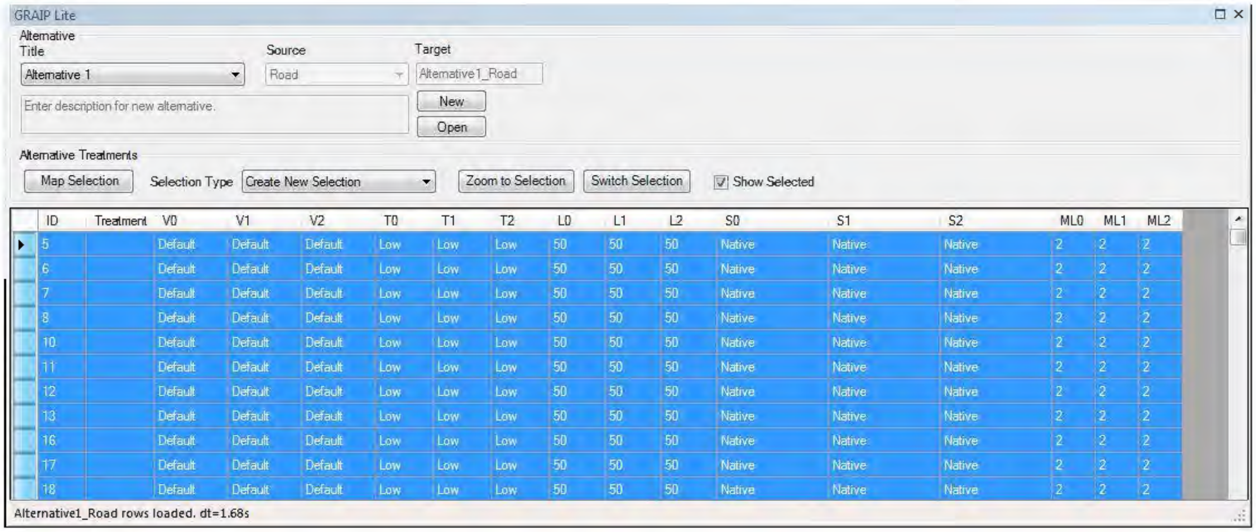
☐ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	ML2
1		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
2		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
3		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
4		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
5		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
6		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
7		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
8		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
9		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
10		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
11		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2

Alternative1_Road rows loaded. dt=1.68s

Figure 54: Selected features.

In the GRAIP Lite window, click on the box for Show Selected to show only the selected road sections (Figure 55).



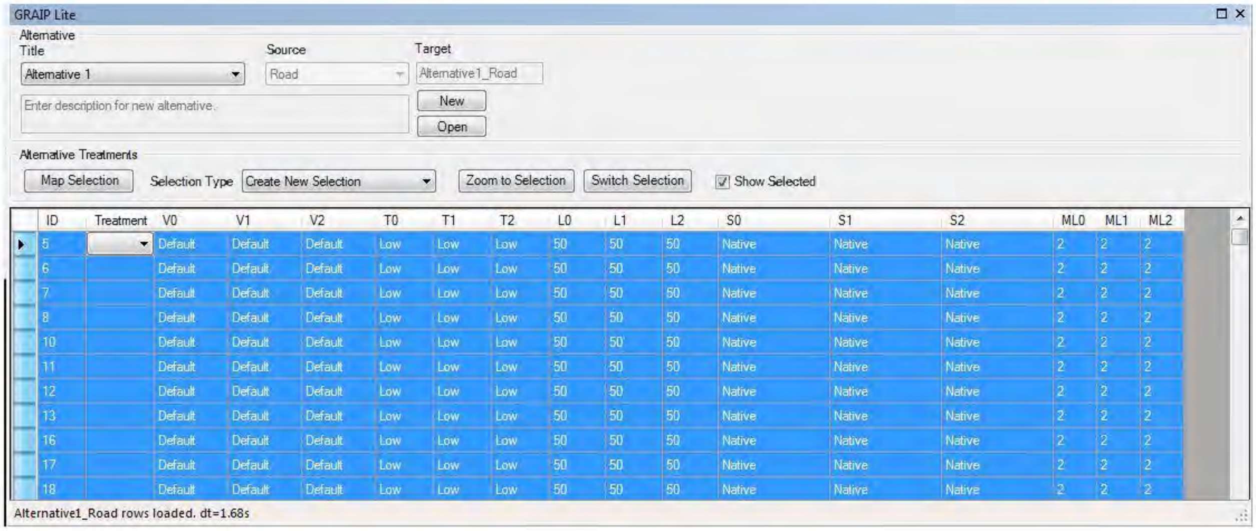
Title: Alternative 1
Source: Road
Target: Alternative1_Road
Enter description for new alternative.
Selection Type: Create New Selection
☑ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	ML2
5		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
6		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
7		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
8		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
10		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
11		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
12		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
13		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
16		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
17		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
18		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2

Alternative1_Road rows loaded. dt=1.68s

Figure 55: Showing only selected features.

Click on the top row of the table in the Treatment column. It will probably take a couple clicks before the treatment menu appears, but since the tool is doing things each time you click, wait for it to be done between clicks. You will see a drop-down menu when it is ready (Figure 56). If you click too fast, it will end up selecting only the top row as a subselection to apply the chosen treatment to; if you let the program catch up between clicks, you will be able to apply the treatment to all selected features at once.



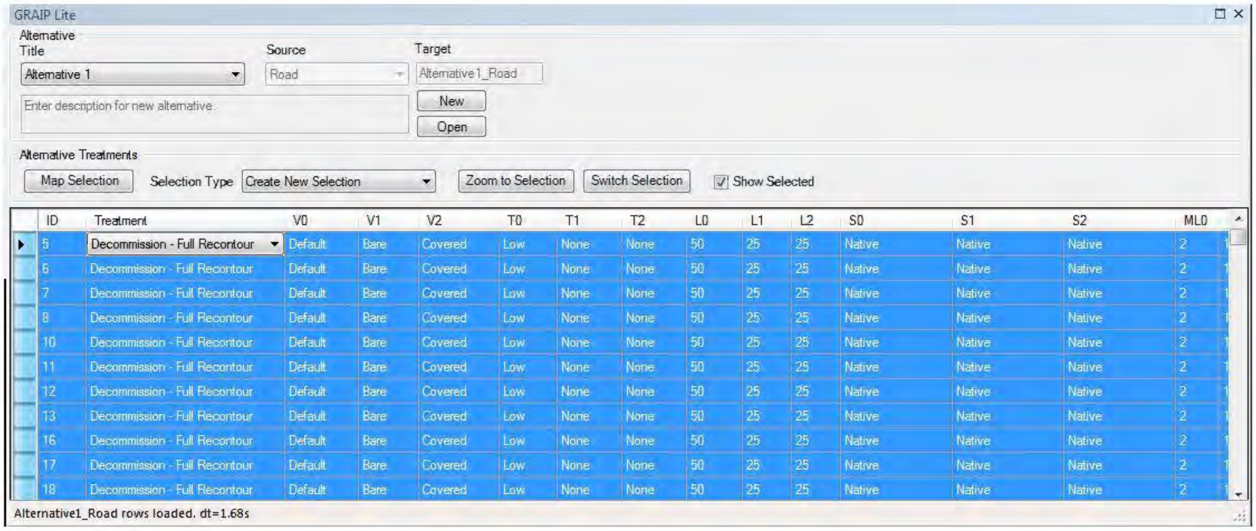
Title: Alternative 1
Source: Road
Target: Alternative1_Road
Enter description for new alternative.
Selection Type: Create New Selection
☑ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	ML2
5		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
6		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
7		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
8		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
10		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
11		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
12		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
13		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
16		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
17		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2
18		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2

Alternative1_Road rows loaded. dt=1.68s

Figure 56: Treatment column showing dropdown menu ready to be accessed.

When the menu opens, select “Decommission – Full Recontour” and wait while GRAIP_Lite sets the treatment values in the table. When it is done, it should look like Figure 57. Notice that the many of the values in the table have now changed to reflect conditions at the disturbed and recovered conditions based on the treatment specified.



Title: Alternative 1
Source: Road
Target: Alternative1_Road
Enter description for new alternative
Selection Type: Create New Selection
☑ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0
5	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
6	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
7	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
8	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
10	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
11	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
12	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
13	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
16	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
17	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2
18	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native	2

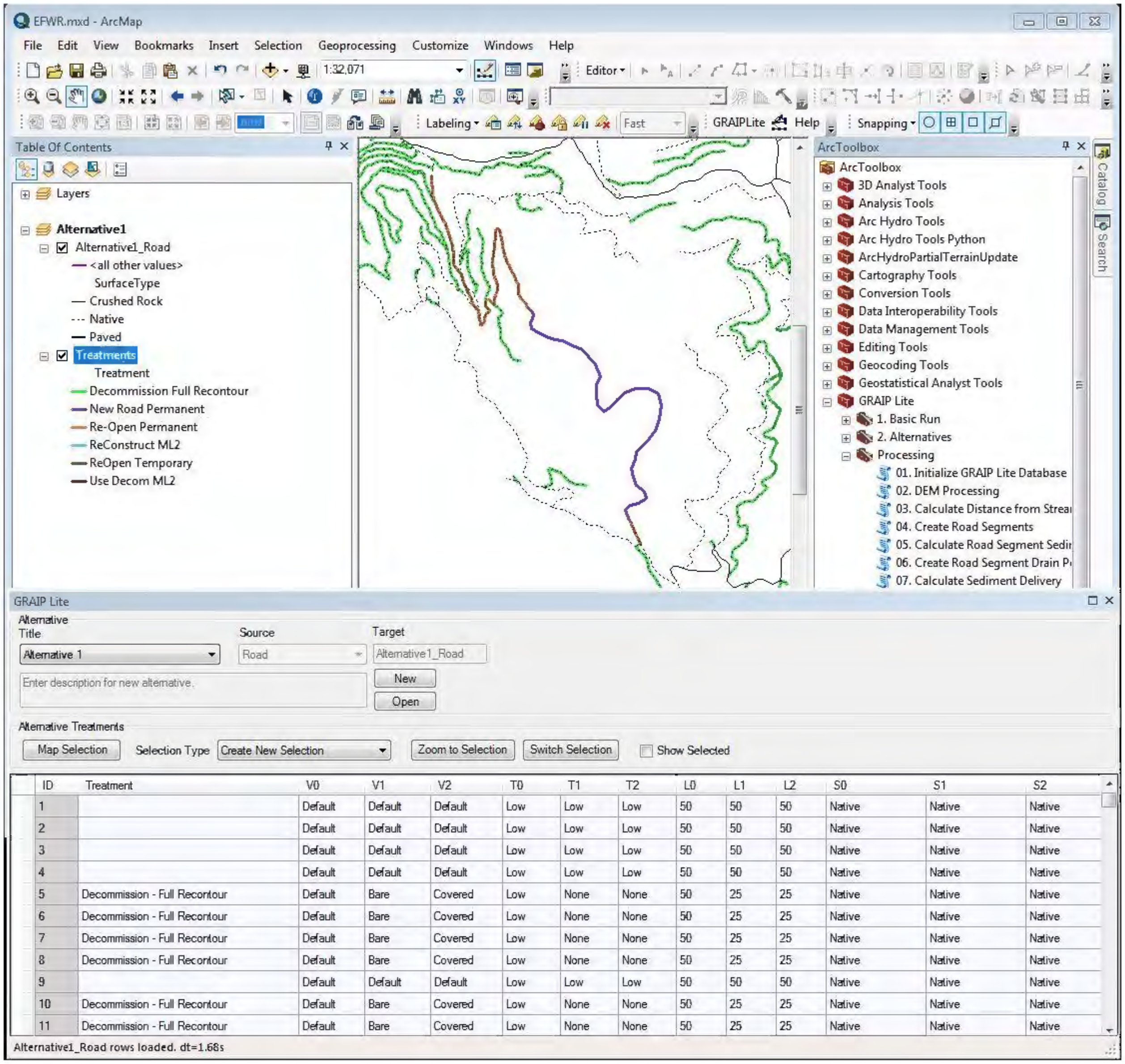
Alternative1_Road rows loaded. dt=1.68s

Figure 57: Treatment selected and applied to features.

When the tool has finished, uncheck the box by *Show Selected* and then *Clear Selected Features* (in the *Tools* toolbar) before making a new selection.

Repeat this process to select and set treatments for those road sections with the specified treatments of “Reconstruct ML2”, “ReOpen Temporary”, and “Use Decom ML2” before moving on to the next part of the tutorial.

Another tool used to select roads is the *Select Features* tool (also in the *Tools* toolbar), which allows you to select visible features by clicking on them. This tool is more useful when there are only a few road sections receiving a given treatment. Use the *Zoom In* tool to zoom in on the area of the roads listed for “Re-Open Permanent” and “New Road Permanent” so that they roughly fill the map window (Figure 58); this tool is also in the *Tools* toolbar. This will make it easier to select the road sections that will be re-opened.



Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

Alternative Treatments

Selection Type: Create New Selection

☐ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2
1		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
2		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
3		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
4		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
5	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native
6	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native
7	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native
8	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native
9		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
10	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native
11	Decommission - Full Recontour	Default	Bare	Covered	Low	None	None	50	25	25	Native	Native	Native

Alternative1_Road rows loaded. dt=1.68s

Figure 58: Map window zoomed in to show "Re-Open Permanent" and "New Road Permanent" features.

Making sure both the *Treatments* and *Alternative1_Road* layers are visible, use the *Select Features* tool to select the features marked “Re-Open Permanent” (Figure 59); the features will be selected in both layers.

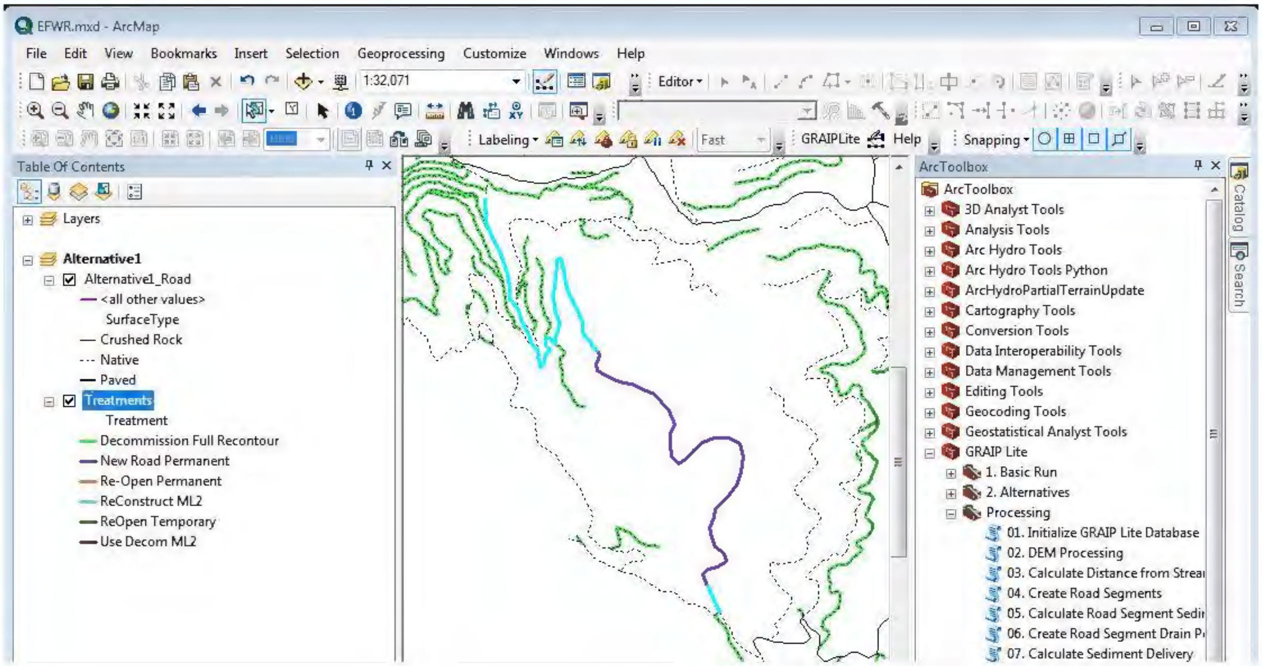
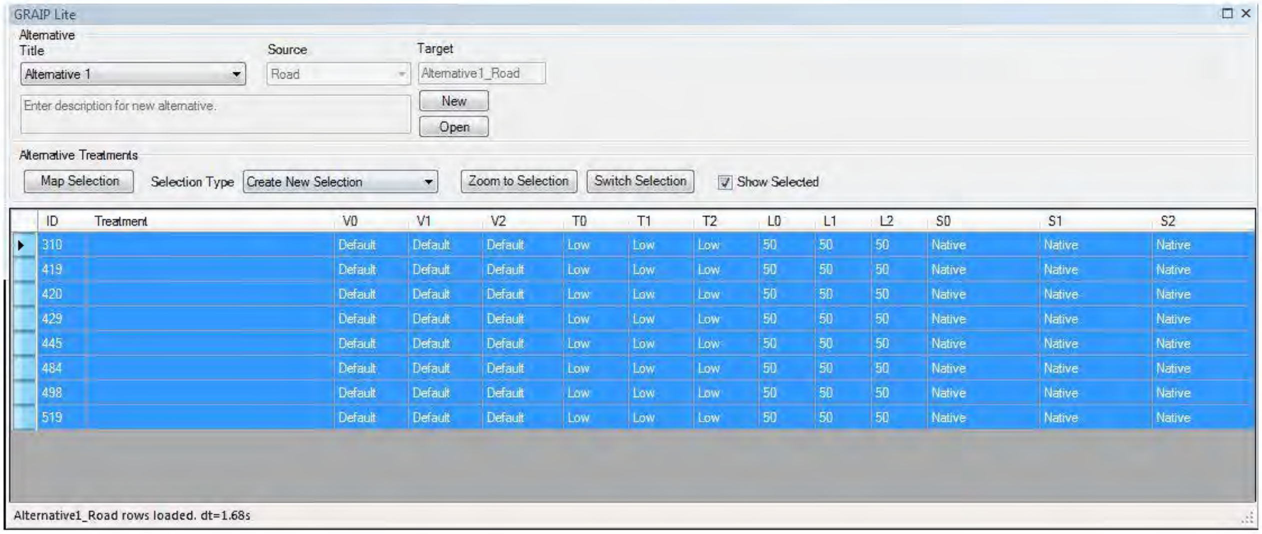


Figure 59: Select Features tool used to select the "Re-Open Permanent" features.

In the GRAIP Lite window, click on *Show Selected* so that only the eight selected features are displayed (Figure 60).



Alternative Title: Alternative 1
Source: Road
Target: Alternative1_Road
Enter description for new alternative.

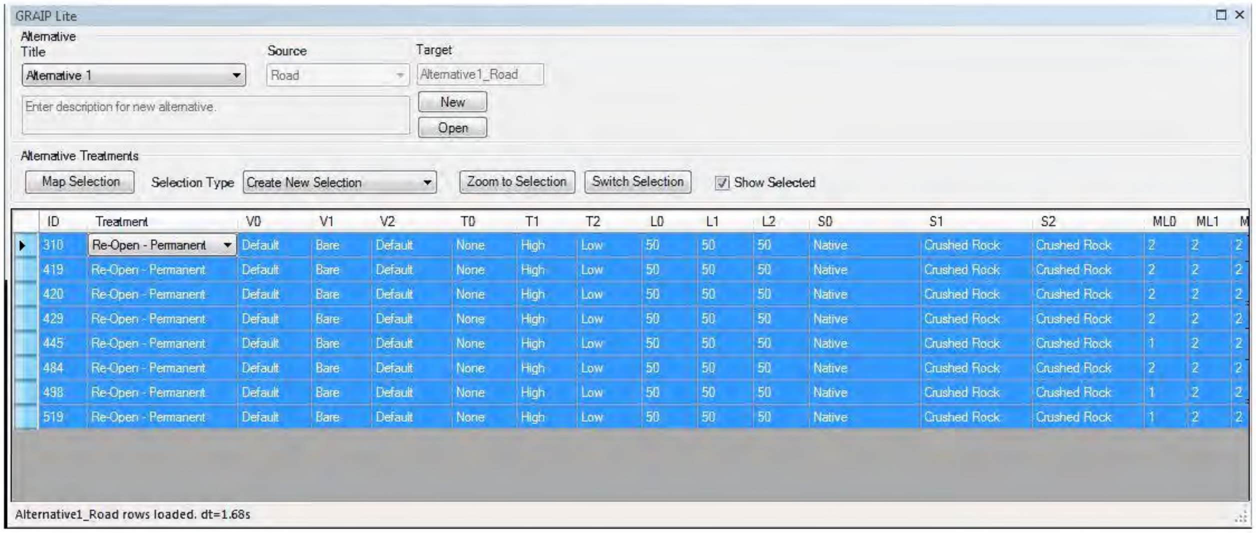
Alternative Treatments
Selection Type: Create New Selection
☑ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2
310		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
419		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
420		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
429		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
445		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
484		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
498		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
519		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native

Alternative1_Road rows loaded. dt=1.68s

Figure 60: Showing only selected features.

Next select the treatment to be applied to these road segments (Figure 61).



Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

Selection Type: Create New Selection

☑ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	M
310	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	2	2	2
419	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	2	2	2
420	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	2	2	2
429	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	2	2	2
445	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	1	2	2
484	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	2	2	2
498	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	1	2	2
519	Re-Open - Permanent	Default	Bare	Default	None	High	Low	50	50	50	Native	Crushed Rock	Crushed Rock	1	2	2

Alternative1_Road rows loaded. dt=1.68s

Figure 61: Treatment selected and applied.

Once the treatments are set, uncheck the box by *Show Selected* and then *Clear Selected Features*.

There is one road section listed in the *Treatments* layer that does not yet exist in the *Alternatives1_Road* layer. This is the new road with the specified treatment "New Road Permanent". Use the *Create New Road* tool from the GRAIP Lite toolbar to draw in the new road following the one shown in the *Treatments* layer (Figure 62).

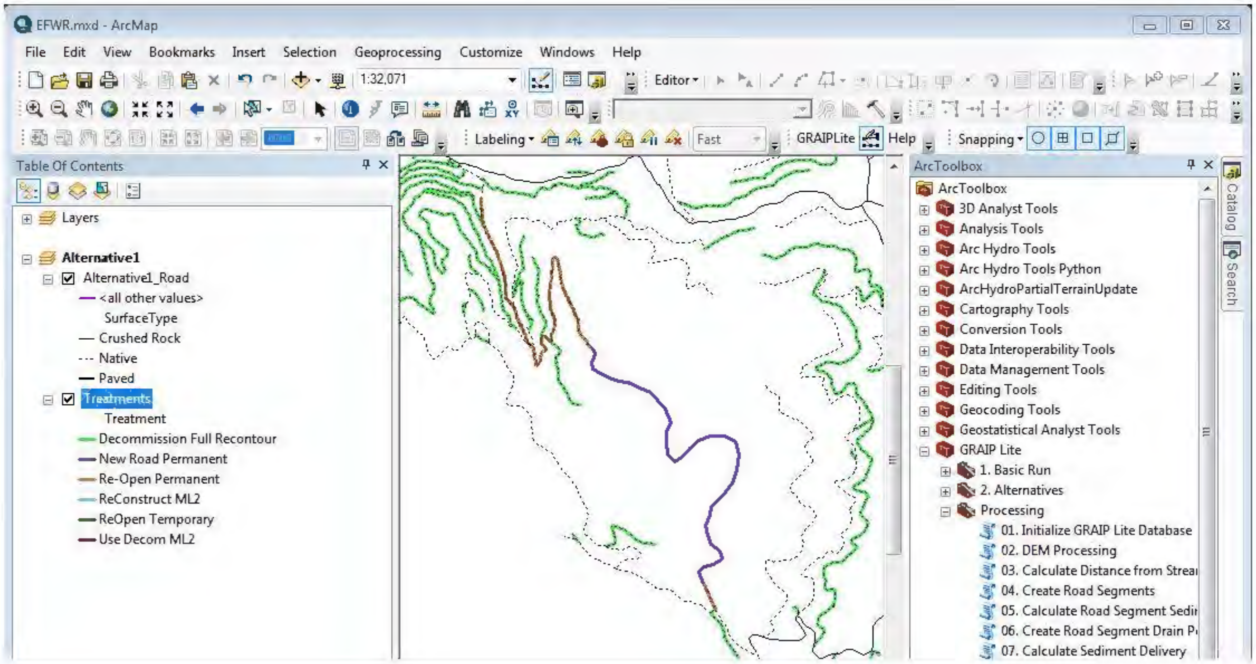
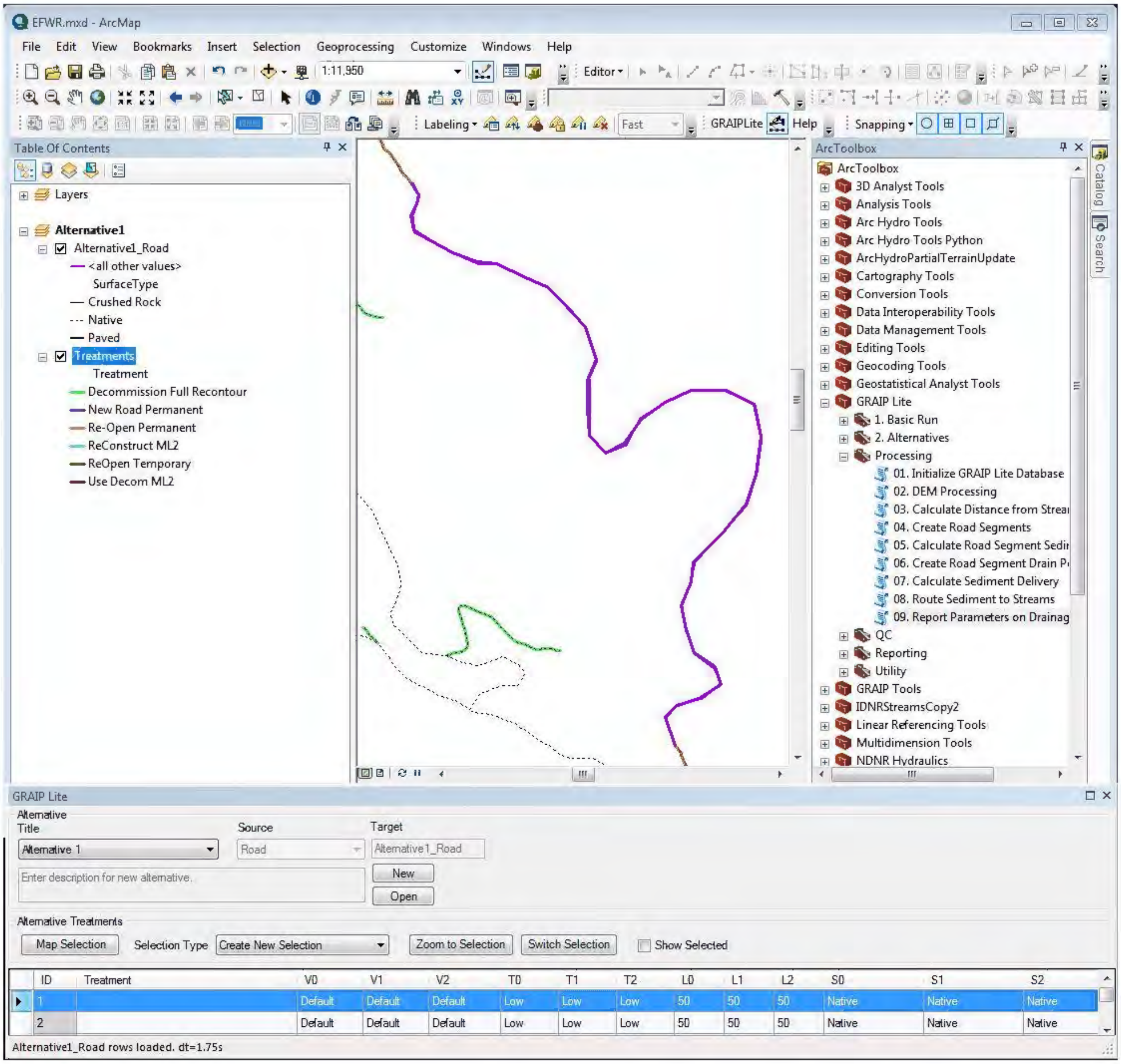


Figure 62: The GRAIP Lite Create New Road tool.

The tool appears in the map as a crosshair, and places vertices for the new road line at the center of the crosshair with each click. Start at one end and double click to end the feature when you get to the other end (Figure 63). Notice that the newly created feature is selected in the GRAIP Lite window.



Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

Alternative Treatments

Selection Type: Create New Selection

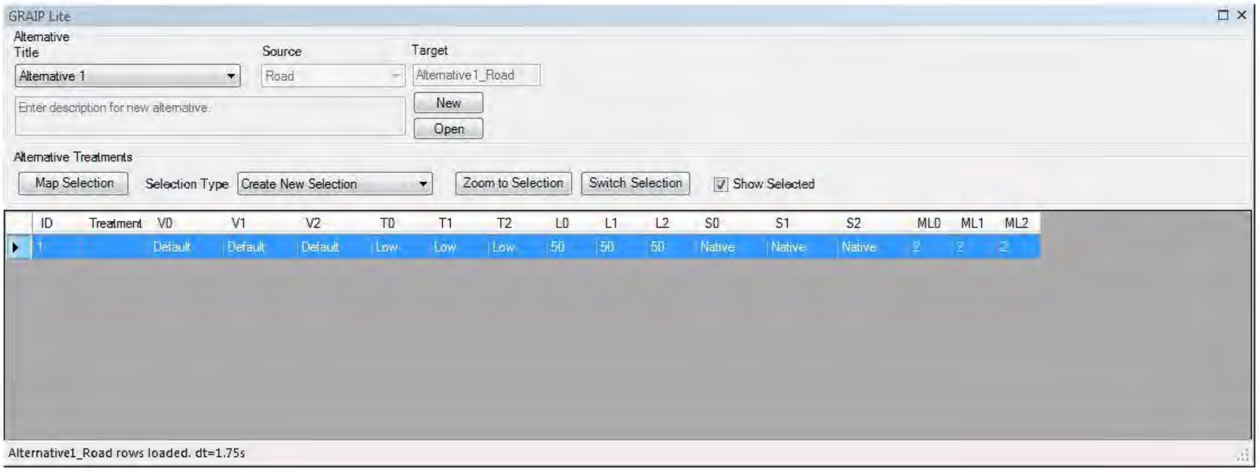
☐ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2
1		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native
2		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native

Alternative1_Road rows loaded. dt=1.75s

Figure 63: Draw new road following feature in Treatments layer.

Click on *Show Selected* (Figure 64). Notice that the new road has all default values including a native surface type and maintenance level 2. These are the defaults for any time the surface type and maintenance level are not defined.



Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

Alternative Treatments

Selection Type: Create New Selection

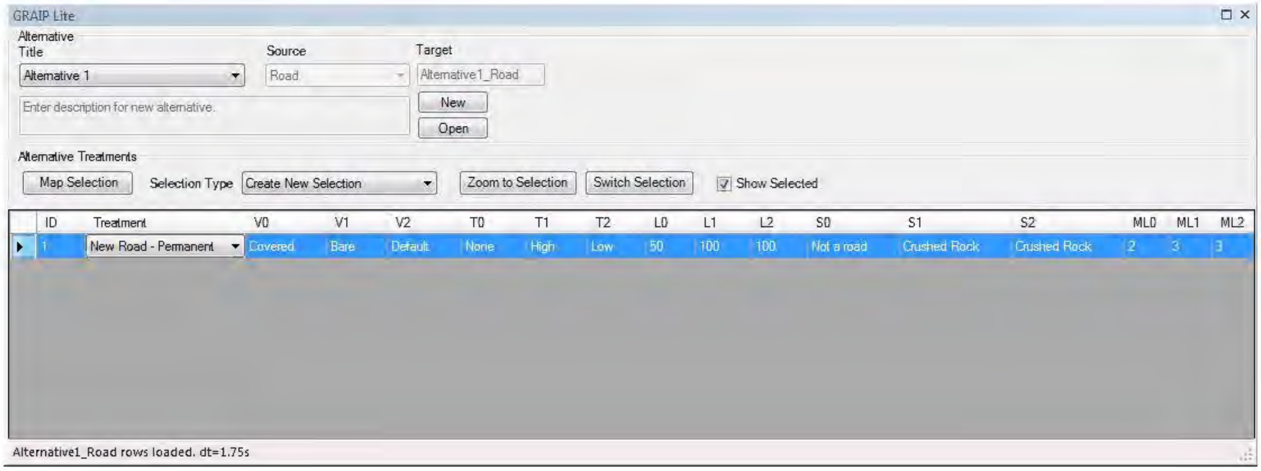
☑ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	ML2
1		Default	Default	Default	Low	Low	Low	50	50	50	Native	Native	Native	2	2	2

Alternative1_Road rows loaded. dt=1.75s

Figure 64: Show Selected.

Set the *Treatment* to "New Road – Permanent" and notice the change in values, specifically for *S0*, which is set to "Not a road" (Figure 65). This means the road will not produce sediment during the initial condition run because it does not yet exist.



Alternative Title: Alternative 1

Source: Road

Target: Alternative1_Road

Enter description for new alternative.

Alternative Treatments

Selection Type: Create New Selection

☑ Show Selected

ID	Treatment	V0	V1	V2	T0	T1	T2	L0	L1	L2	S0	S1	S2	ML0	ML1	ML2
1	New Road - Permanent	Covered	Bare	Default	None	High	Low	50	100	100	Not a road	Crushed Rock	Crushed Rock	2	3	3

Alternative1_Road rows loaded. dt=1.75s

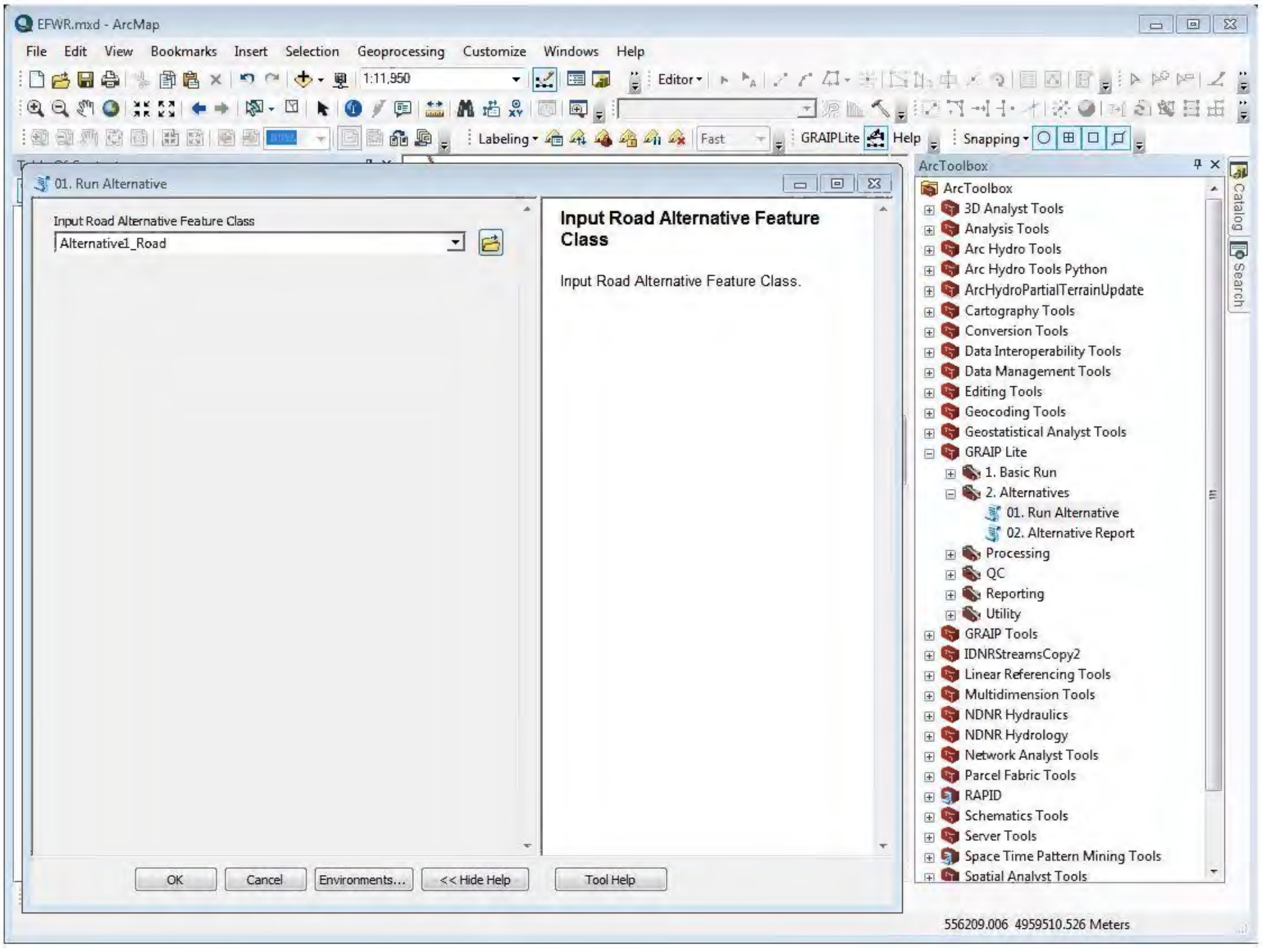
Figure 65: Assign treatment; note that S0, the surface factor for the initial condition, is set to "Not a road".

At this point, GRAIP_Lite now knows what treatments to model and where they will be applied. Save changes to the map document, close the GRAIP Lite window, and clear all selected features.

Often, more than one alternative needs to be analyzed in order to determine which alternative represents the best course of action. In such cases, the above process of creating an alternative and specifying treatments would be repeated for each alternative to be analyzed.

The next step runs the model for each time step in the alternative. Open the *01. Run Alternative* tool in the *Alternatives* toolbox (Figure 66). The *Input Road Alternative Feature Class* should be set to

Alternative1_Road; click *OK* to run the tool. This tool may take a while to run, especially with larger data sets and increasing amounts of road treated.



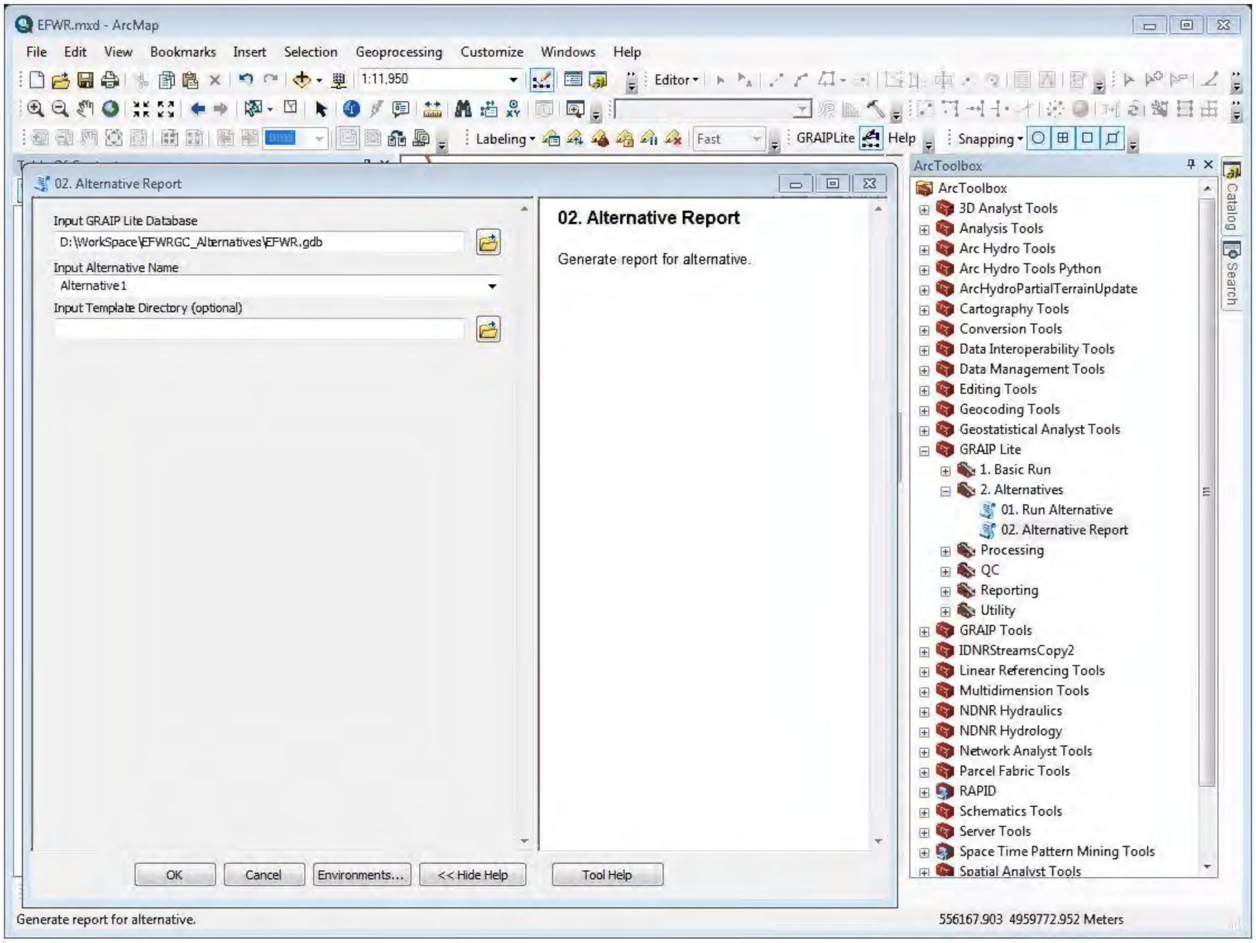
Input Road Alternative Feature Class
Alternative1_Road

Input Road Alternative Feature Class

Input Road Alternative Feature Class.

Figure 66: The Run Alternative tool.

The last tool to run is the *02. Alternative Report* tool (Figure 67), also in the *Alternatives* toolbox. This tool creates the same set of reports as the Basic Report tool, but it does so for each time step for the alternative. It also produces two maps showing the change in specific sediment at the disturbed and recovered conditions relative to the initial condition; these are helpful for highlighting where road related sediment impacts are expected to change, and in which direction and at what time frame, during the course of the alternative. Make sure the location of the *Input GRAIP Lite Database* is correct, and set the *Input Alternative Name* to *Alternative1*. Click *OK* to run the tool.



Input GRAIP Lite Database
D:\WorkSpace\EFWRGC_Alternatives\EFWR.gdb

Input Alternative Name
Alternative1

Input Template Directory (optional)

02. Alternative Report

Generate report for alternative.

Generate report for alternative.

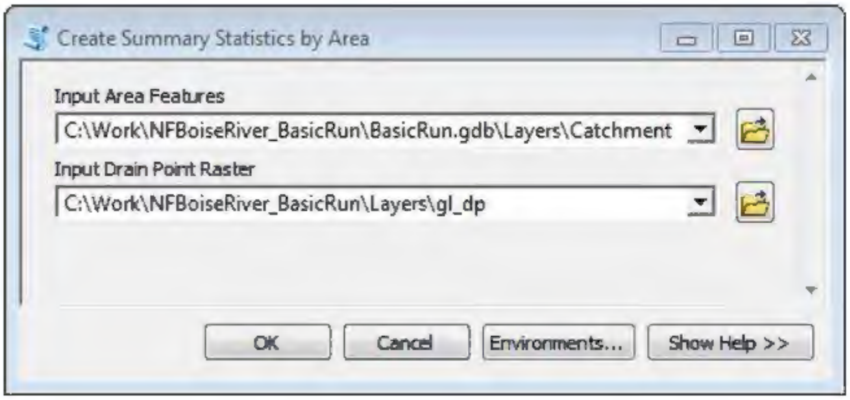
556167.903 4959772.952 Meters

Figure 67: The Alternative Report tool.

If you are analyzing multiple alternatives, the *01. Run Alternative* and *02. Alternative Report* tools will need to be run separately for each alternative.

Post Processing

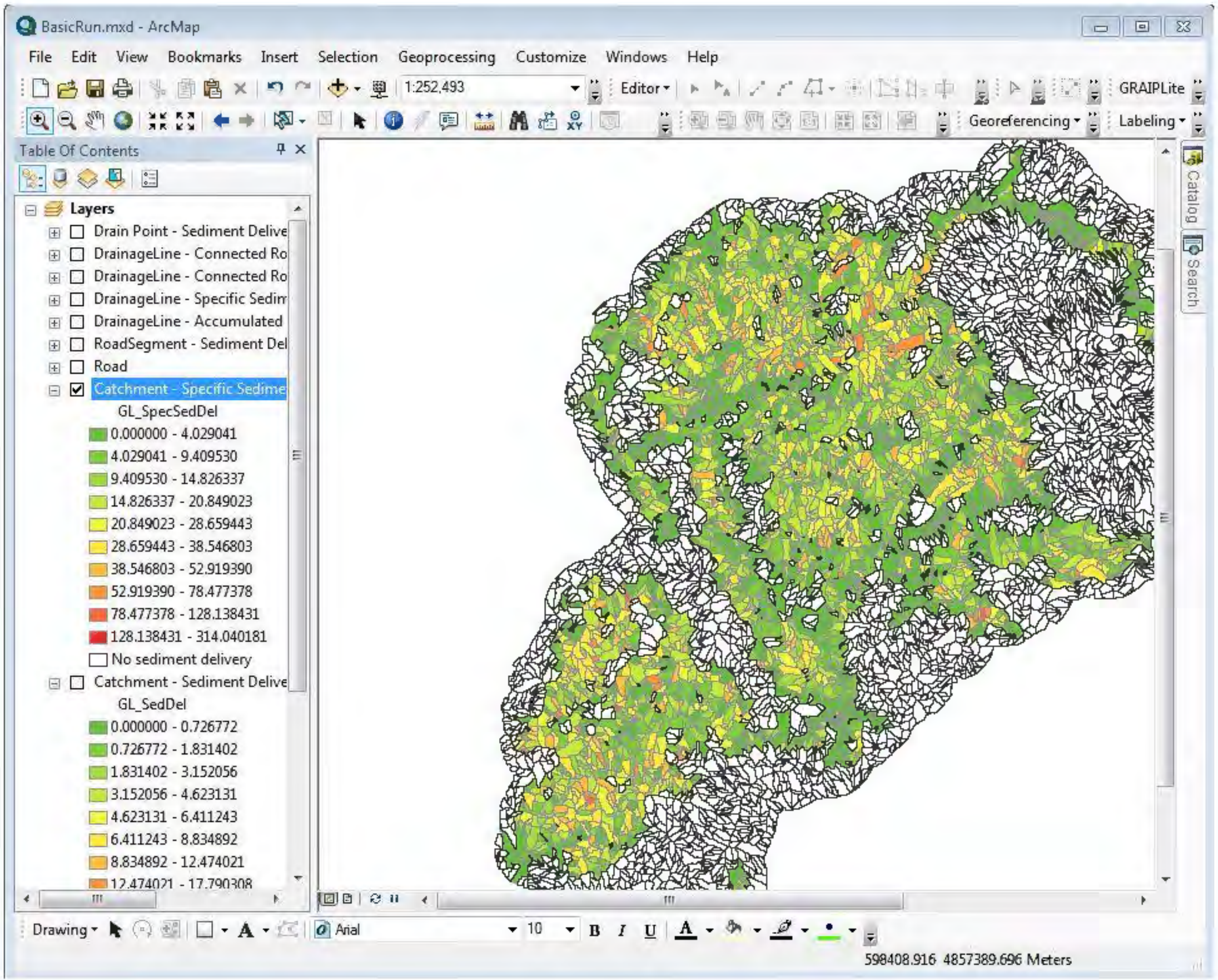
One additional tool is the Create Summary Statistics by Area tool (Figure 68) that aggregates several metrics by catchment area. This is especially useful because it calculates the specific sediment delivery to the catchment areas (Figure 69), which is effectively a measure of road-related sediment impact in each catchment. This highlights both the stream segments and the direct contributing area where the roads are having the greatest impacts on the stream network.



Input Area Features
C:\Work\NFBoiseRiver_BasicRun\BasicRun.gdb\Layers\Catchment

Input Drain Point Raster
C:\Work\NFBoiseRiver_BasicRun\Layers\gl_dp

Figure 68: The Create Summary Statistics by Area tool, ready to be run on the Basic Run tutorial dataset.



Layers
- ☐ Drain Point - Sediment Delive
- ☐ DrainageLine - Connected Ro
- ☐ DrainageLine - Connected Ro
- ☐ DrainageLine - Specific Sedim
- ☐ DrainageLine - Accumulated
- ☐ RoadSegment - Sediment Del
- ☐ Road
- ☑ Catchment - Specific Sedime
  - GL_SpecSedDel
  - 🟩 0.000000 - 4.029041
  - 🟩 4.029041 - 9.409530
  - 🟩 9.409530 - 14.826337
  - 🟩 14.826337 - 20.849023
  - 🟨 20.849023 - 28.659443
  - 🟨 28.659443 - 38.546803
  - 🟧 38.546803 - 52.919390
  - 🟧 52.919390 - 78.477378
  - 🟥 78.477378 - 128.138431
  - 🟥 128.138431 - 314.040181
  - ☐ No sediment delivery
- ☐ Catchment - Sediment Delive
  - GL_SedDel
  - 🟩 0.000000 - 0.726772
  - 🟩 0.726772 - 1.831402
  - 🟩 1.831402 - 3.152056
  - 🟩 3.152056 - 4.623131
  - 🟨 4.623131 - 6.411243
  - 🟨 6.411243 - 8.834892
  - 🟧 8.834892 - 12.474021
  - 🟧 12.474021 - 17.790308

598408.916 4857389.696 Meters

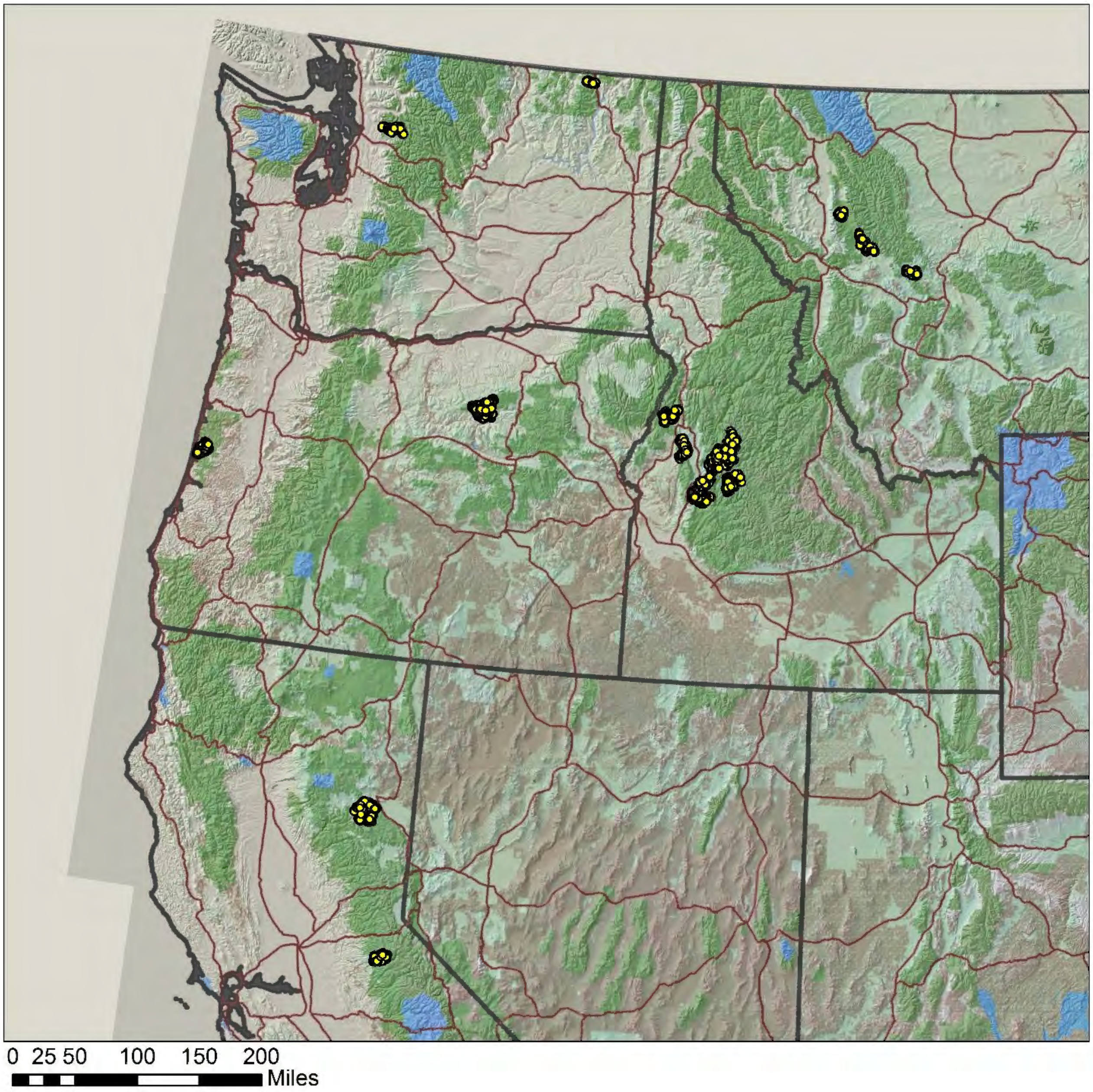
Figure 69: Specific Sediment Delivery (Mg/yr/km^2) aggregated to hydrologic catchments.

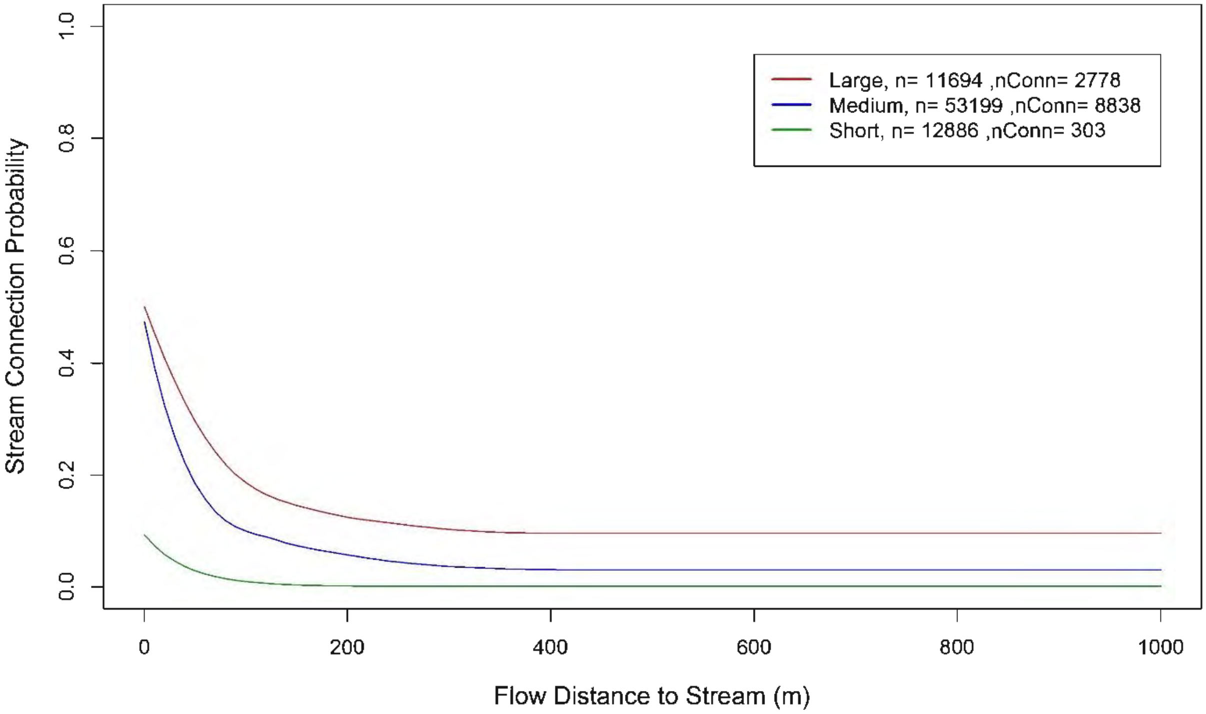
In some cases, it may be necessary to manually aggregate the data. One way to do this is to use the Intersect tool and then summarize the data based on a column in the resulting data; start by intersecting the RoadDrainPoint layer with the layer that has the features you wish to aggregate the data to. Next, summarize the table based on a unique identifier for the features you are aggregating the data. Finally, join the summary table back to the aggregate features. Summary tables can also be created using columns in the original data, for instance, road number/name/ID or jurisdiction. Most often, the data to be aggregated will be the sums of road lengths and the sediment production and delivery values.

Appendix A: Description of Existing Calibration Data Sets

Default: This calibration set consists of the other calibration sets merged into a single calibration set. It totals 77,779 observations from 5,374 km of roads and has an observed stream connection rate of 15 percent. The mean flow distance from the observed calibration points to the stream network modelled by ArcHydro for GRAIP_Lite (stream distance) was 166 m and the standard deviation was 164 m.

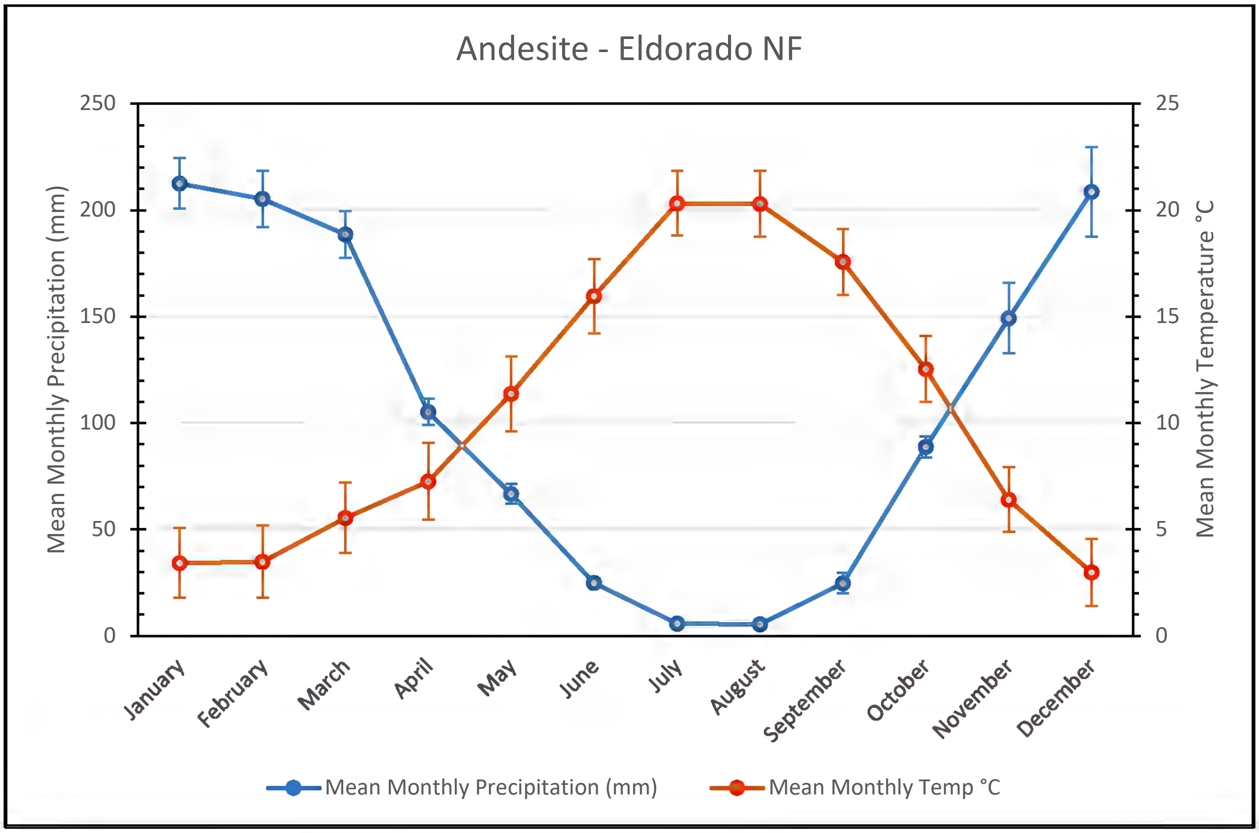
The baserate used with the default calibration set is 79 kg/yr/m vertical drop along the road, and comes from the data in Luce and Black, 1999. This default baserate is also the default for the more detailed, inventory-based GRAIP model.

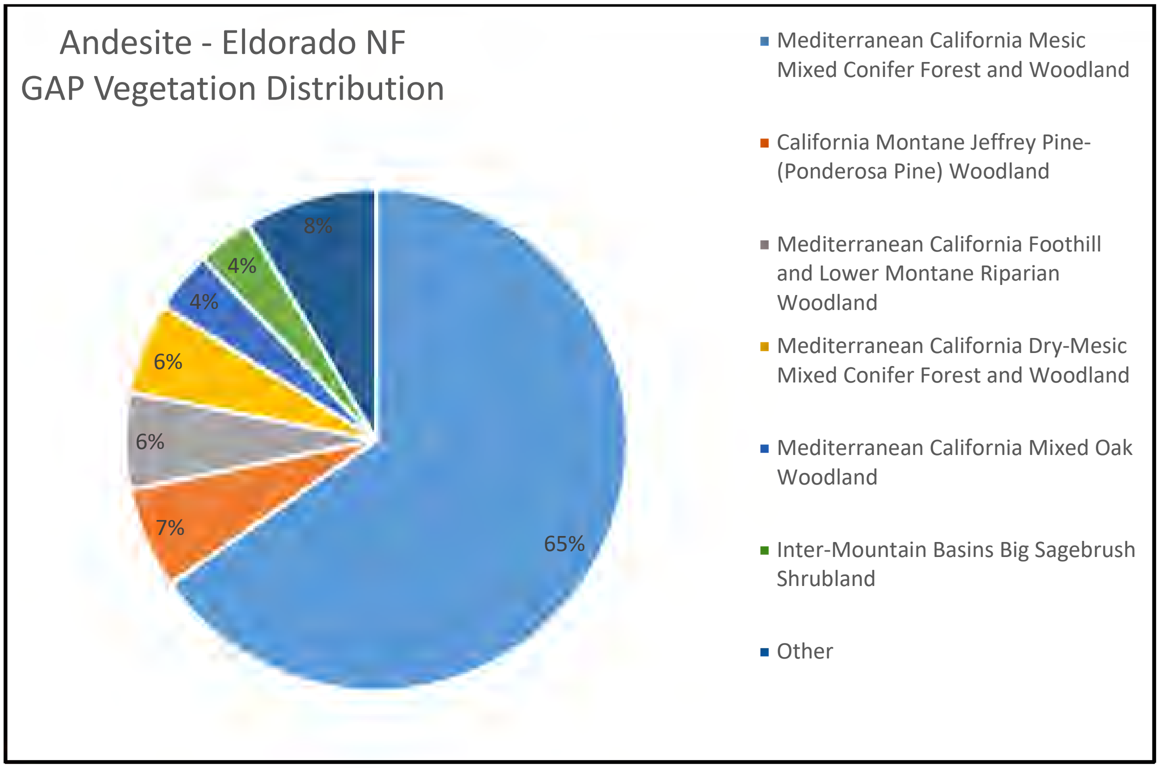


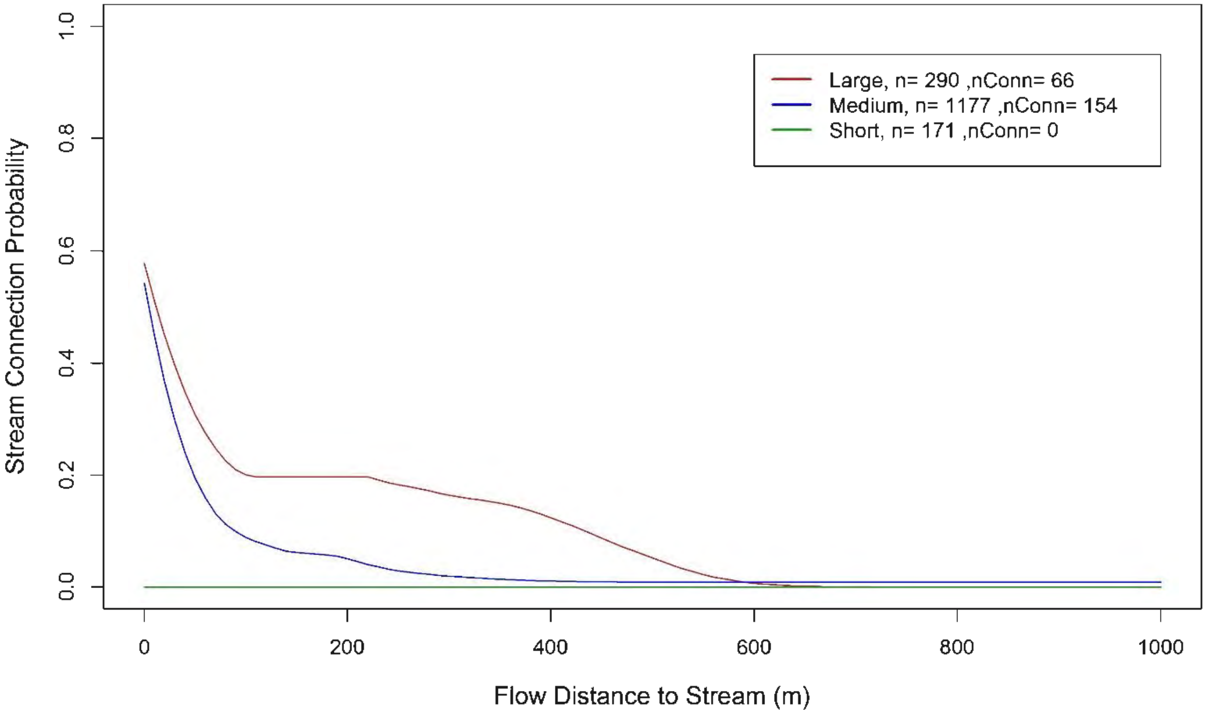

Large, n= 11694 ,nConn= 2778
Medium, n= 53199 ,nConn= 8838
Short, n= 12886 ,nConn= 303
Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)

Andesite – Eldorado NF: This calibration set was collected as part of a GRAIP inventory conducted as part of restoration work associated with the Power Fire on the Eldorado National Forest. It consists of 1,638 calibration points collected from 124 km of road. The observed stream connection rate was 13 percent. The mean stream distance was 210 m with a standard deviation of 162 m. Elevations range from 1,117 m to 2,431 m, with a mean of 1,718 m and standard deviation of 273 m. Mean annual precipitation is 1,287 mm with a standard deviation across the calibration set of 83 mm.

The baserate used with this calibration set is 53 kg/yr/m vertical drop along the road, and comes from three sediment monitoring plots utilizing a main settling tank, tipping bucket flow gage, and a flow splitter leading to a fines collection tank. These plots were installed in 2015.

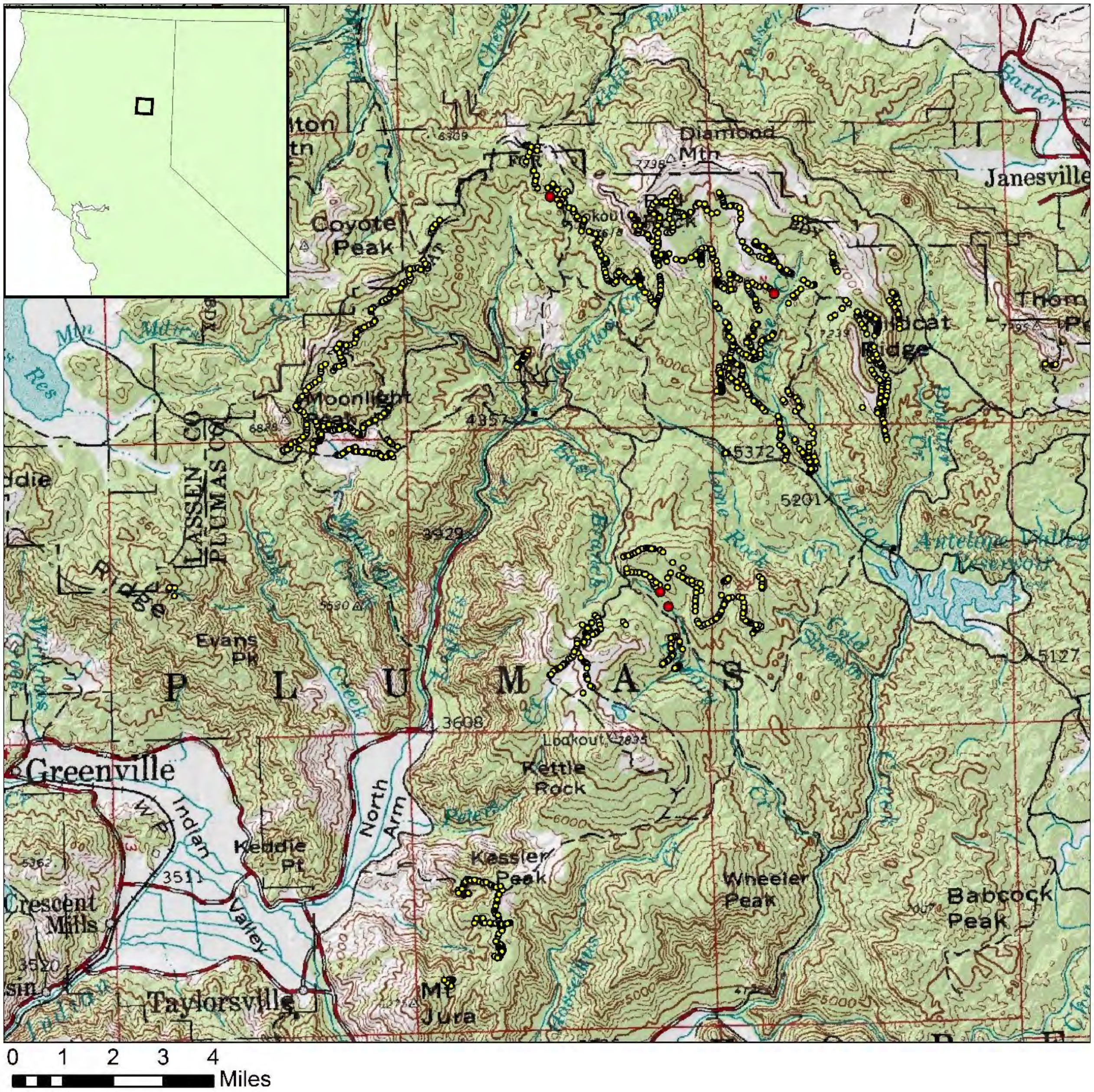

Andesite - Eldorado NF
Mean Monthly Precipitation (mm)
Mean Monthly Temperature °C
250
200
150
100
50
0
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

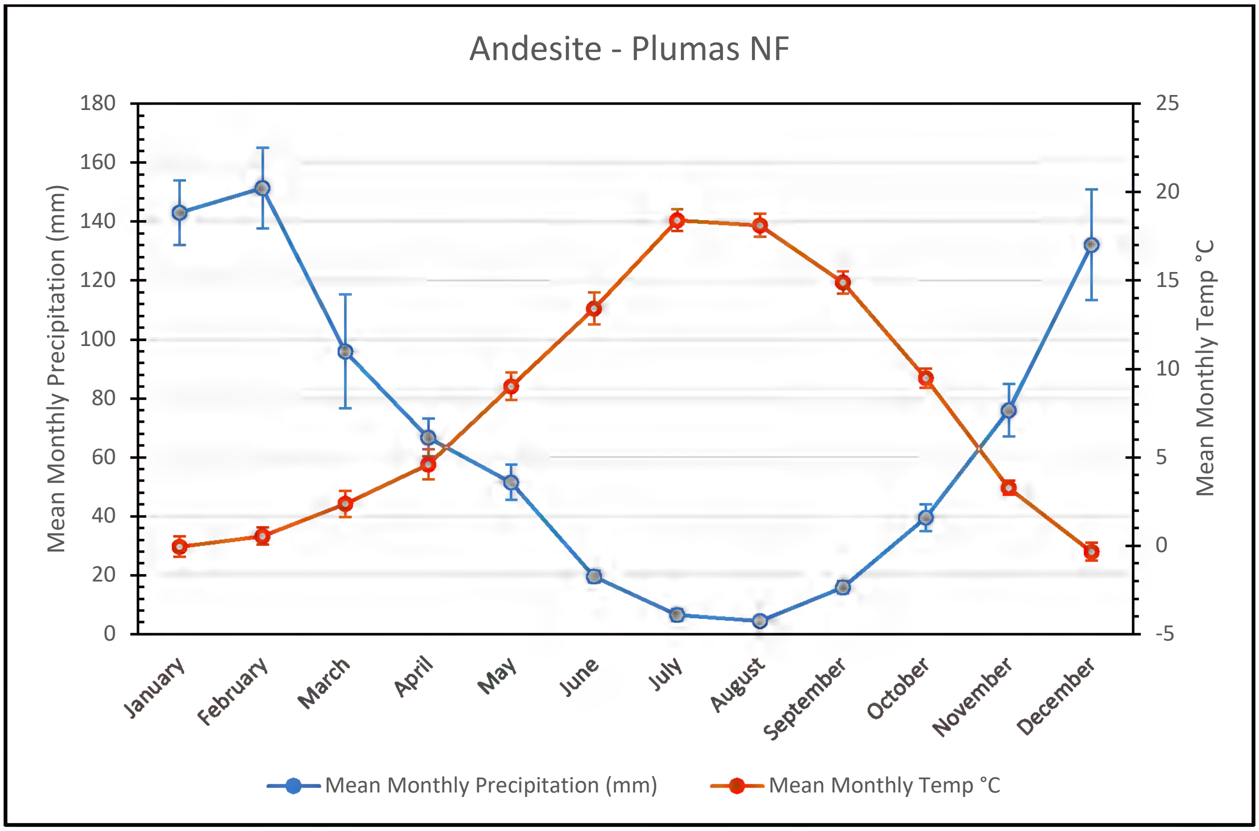

Andesite - Eldorado NF
GAP Vegetation Distribution
8%
4%
4%
6%
6%
7%
65%
■ Mediterranean California Mesic Mixed Conifer Forest and Woodland
■ California Montane Jeffrey Pine-(Ponderosa Pine) Woodland
■ Mediterranean California Foothill and Lower Montane Riparian Woodland
■ Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland
■ Mediterranean California Mixed Oak Woodland
■ Inter-Mountain Basins Big Sagebrush Shrubland
■ Other

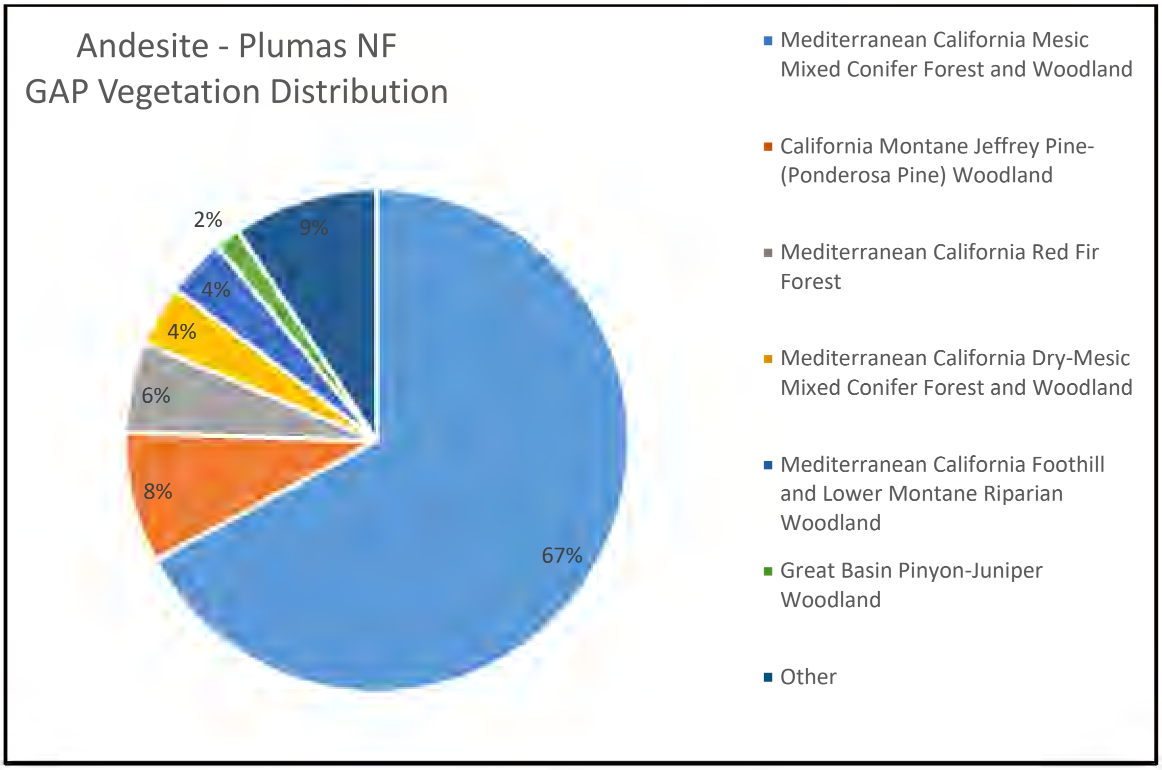

Large, n= 290 ,nConn= 66
Medium, n= 1177 ,nConn= 154
Short, n= 171 ,nConn= 0
Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)

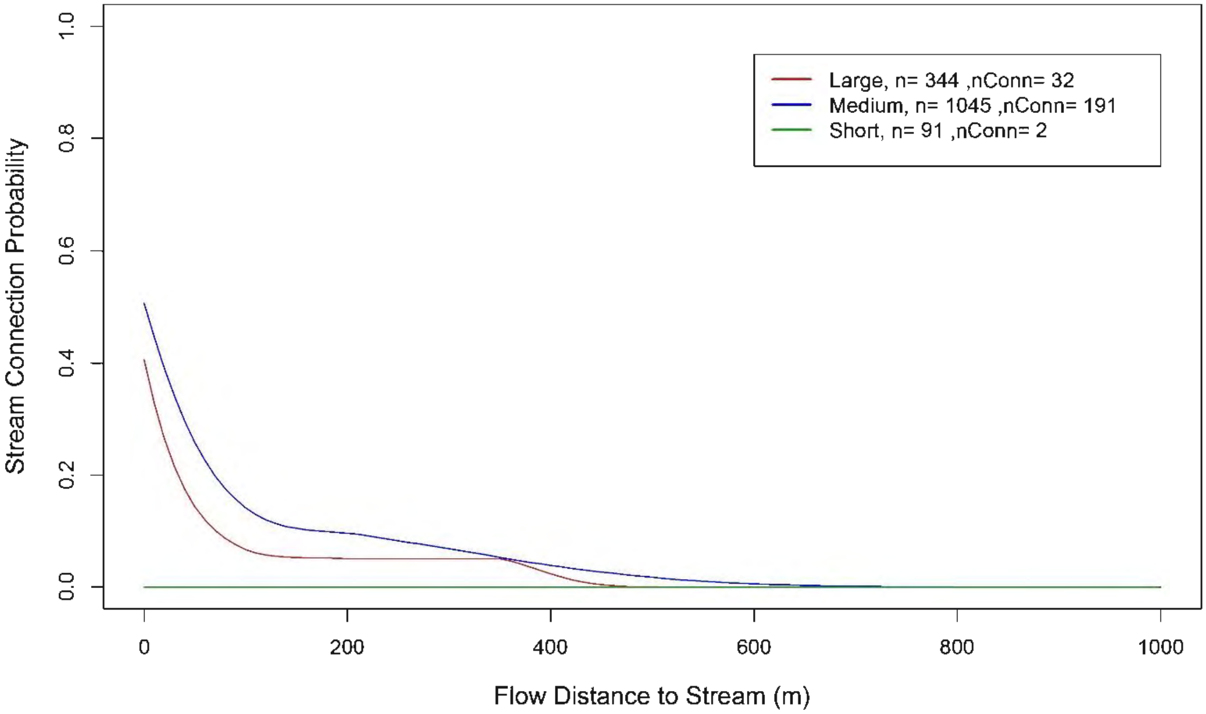
Andesite – Plumas NF: This calibration set was collected as part of a GRAIP inventory conducted as part of restoration work associated with the Moonlight Fire on the Plumas National Forest. It consists of 1,480 calibration points collected from 111 km of road. The observed stream connection rate was 15 percent. The mean stream distance was 189 m with a standard deviation of 158 m. Elevations range from 1,483 m to 2,182 m, with a mean of 1,906 m and standard deviation of 164 m. Mean annual precipitation is 803 mm with a standard deviation across the calibration set of 56 mm.

The baserate used with this calibration set is 77.6 kg/yr/m vertical drop along the road, and comes from four sediment monitoring plots utilizing a main settling tank, a flow splitter, and a second tank to collect fines. These plots were installed in 2014.



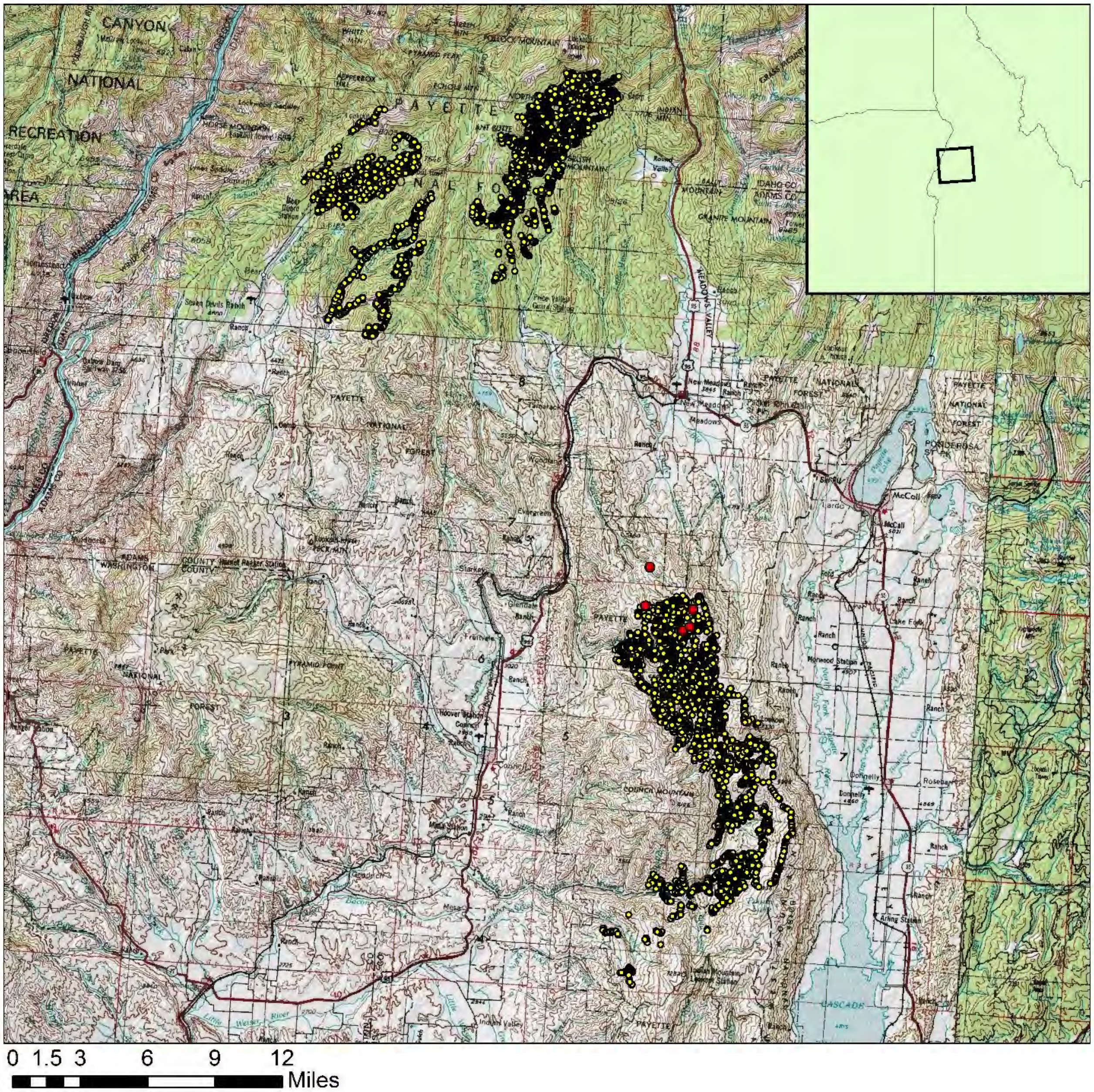

Andesite - Plumas NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
180
160
140
120
100
80
60
40
20
0
25
20
15
10
5
0
-5
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

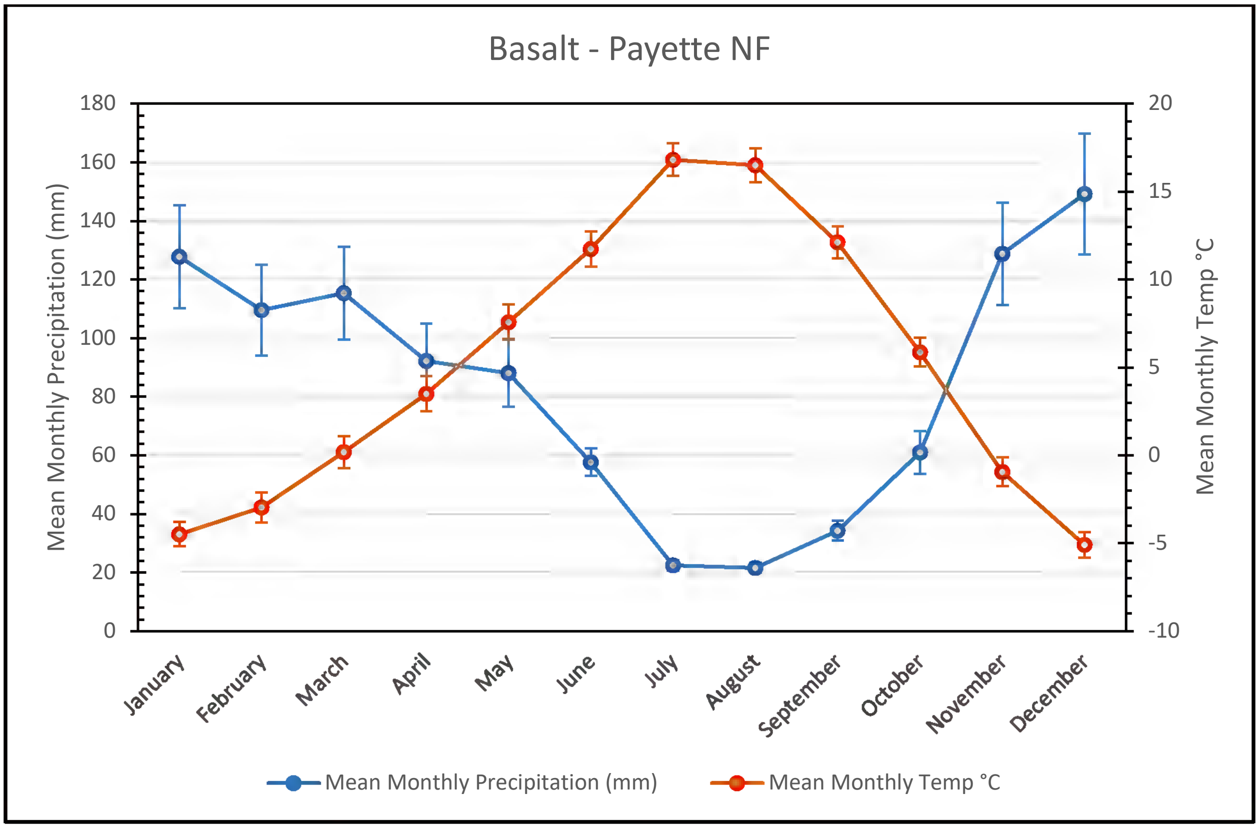

Andesite - Plumas NF
GAP Vegetation Distribution
2%
9%
4%
4%
6%
8%
67%
Mediterranean California Mesic Mixed Conifer Forest and Woodland
California Montane Jeffrey Pine-(Ponderosa Pine) Woodland
Mediterranean California Red Fir Forest
Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland
Mediterranean California Foothill and Lower Montane Riparian Woodland
Great Basin Pinyon-Juniper Woodland
Other

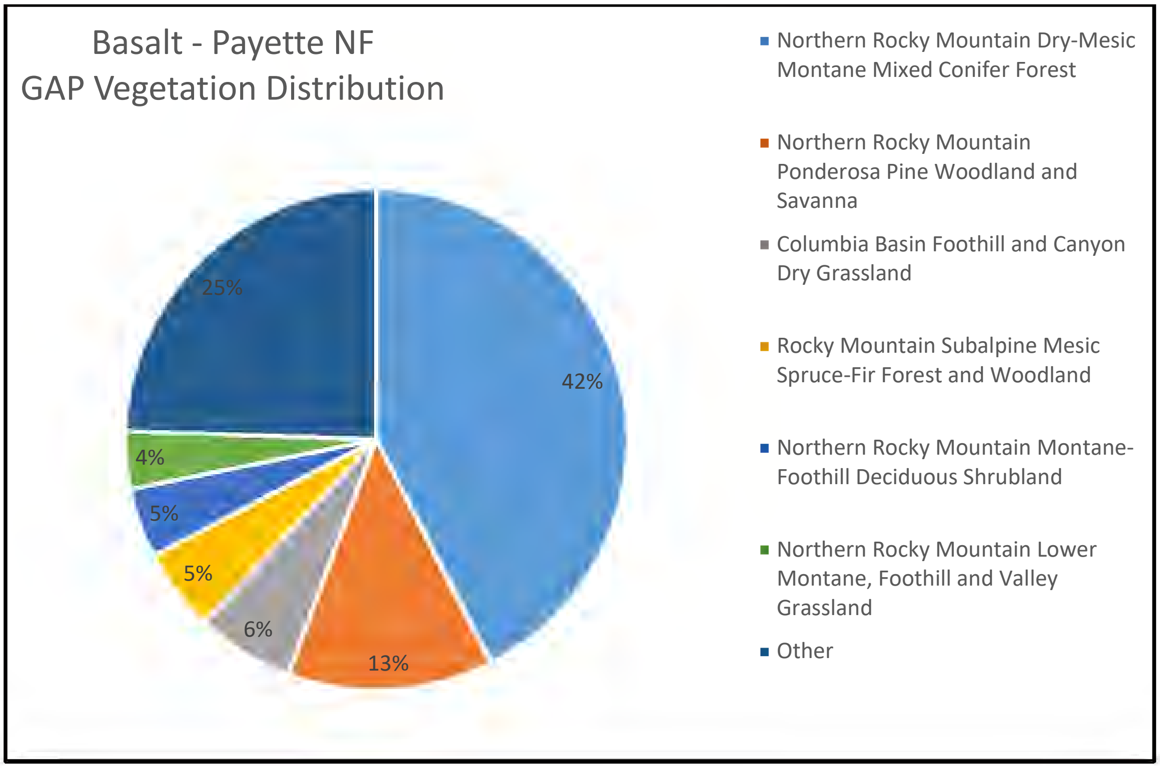

Large, n= 344 ,nConn= 32
Medium, n= 1045 ,nConn= 191
Short, n= 91 ,nConn= 2
Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)

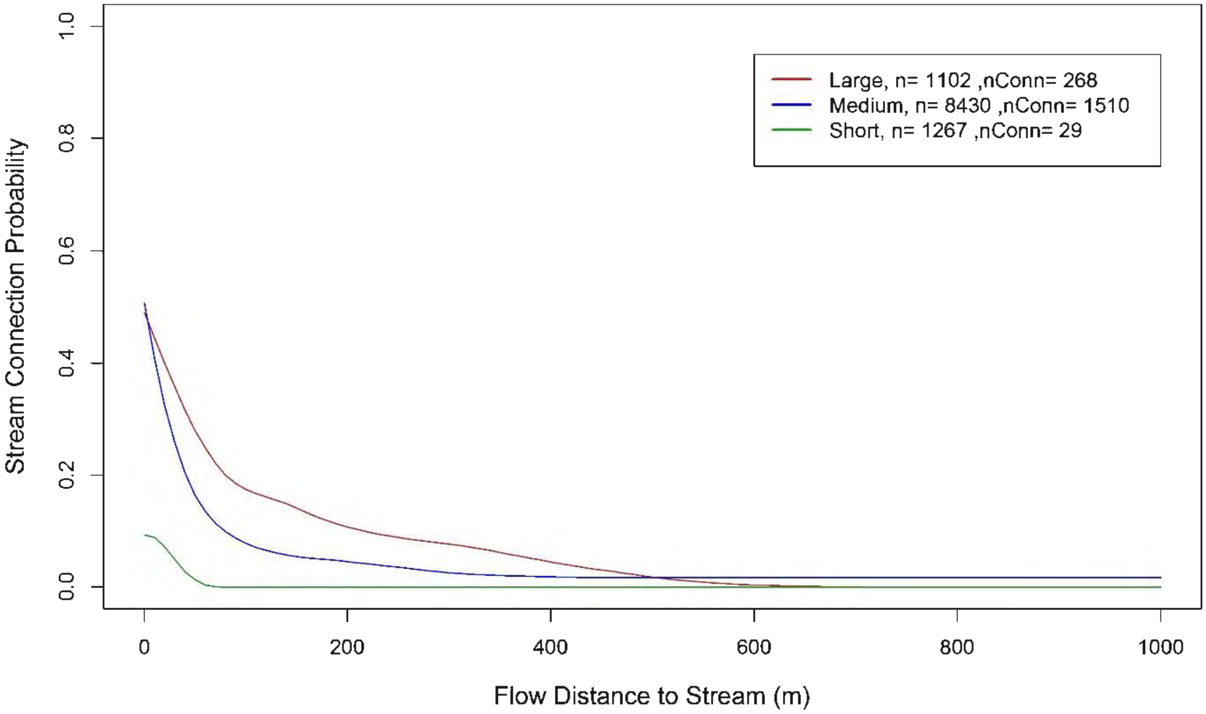
Basalt – Payette NF: This calibration set consists of GRAIP inventories collected between 2013 and 2015 as part of watershed assessment and project planning operations on the Payette National Forest. It consists of 10,799 calibration points collected from 806 km of road. The observed stream connection rate was 17 percent. The mean stream distance was 135 m with a standard deviation of 139 m. Elevations range from 1,279 m to 2,295 m, with a mean of 1,722 m and standard deviation of 158 m. Mean annual precipitation in 1,009 mm with a standard deviation across the calibration set of 118 mm.

The base rate is 27.2 kg/yr/m and was derived from 5 sediment plots measured twice a year starting in 2013. These five sediment plots all include tipping buckets and splitters feeding into fine sediment recovery tanks.



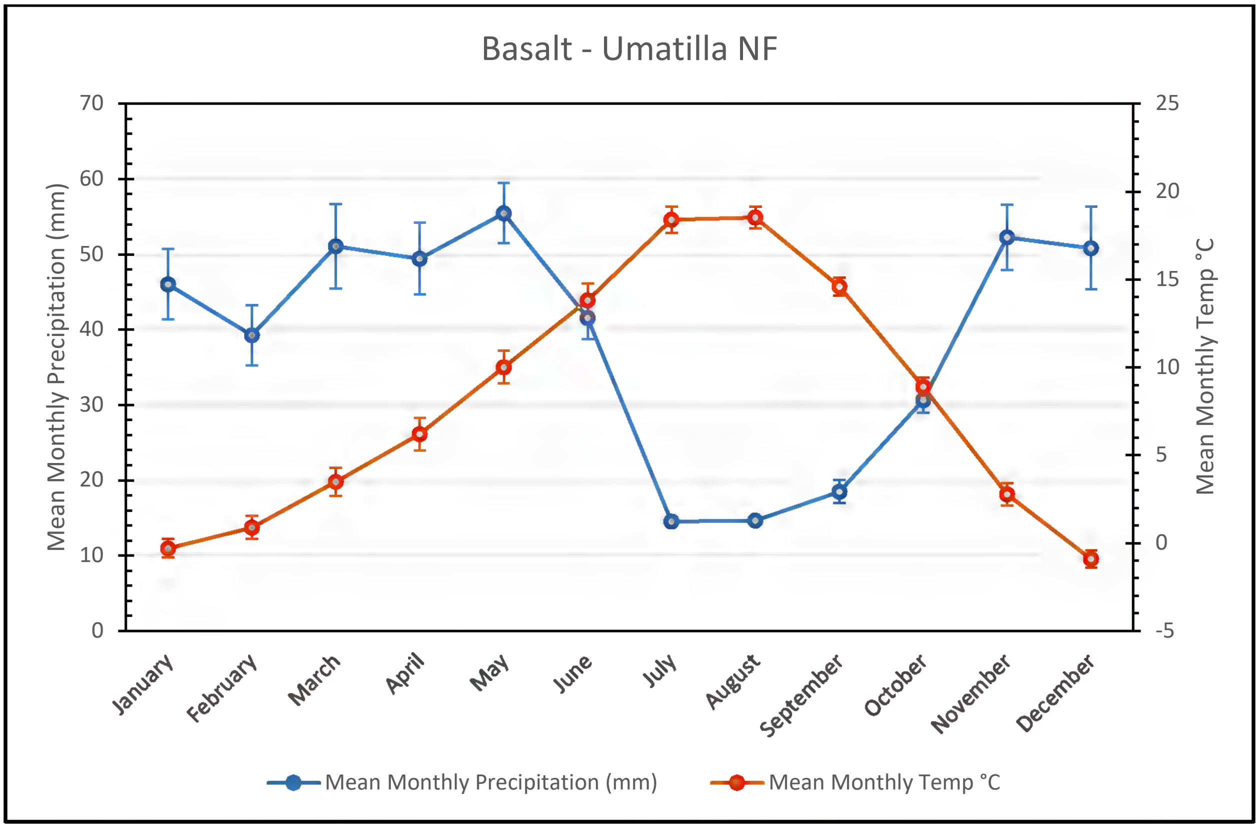

Basalt - Payette NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
180
160
140
120
100
80
60
40
20
0
20
15
10
5
0
-5
-10
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

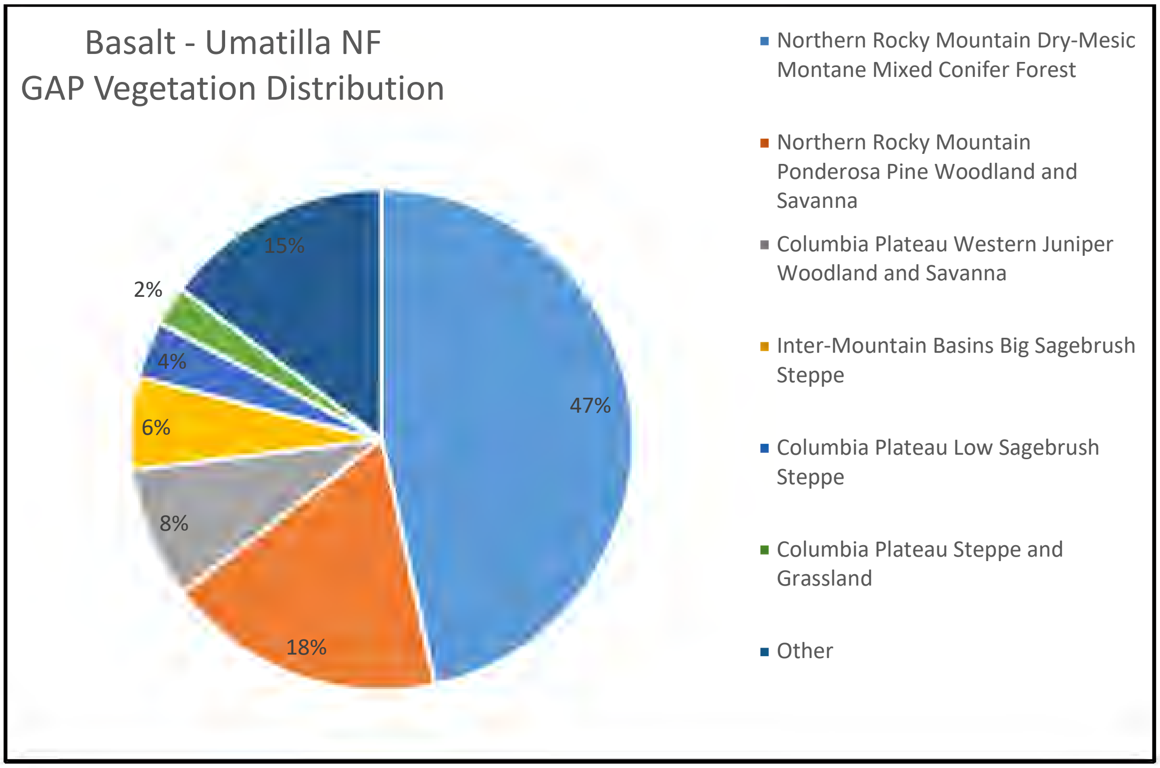

Basalt - Payette NF
GAP Vegetation Distribution
42%
13%
6%
5%
5%
4%
25%
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
Columbia Basin Foothill and Canyon Dry Grassland
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland
Other

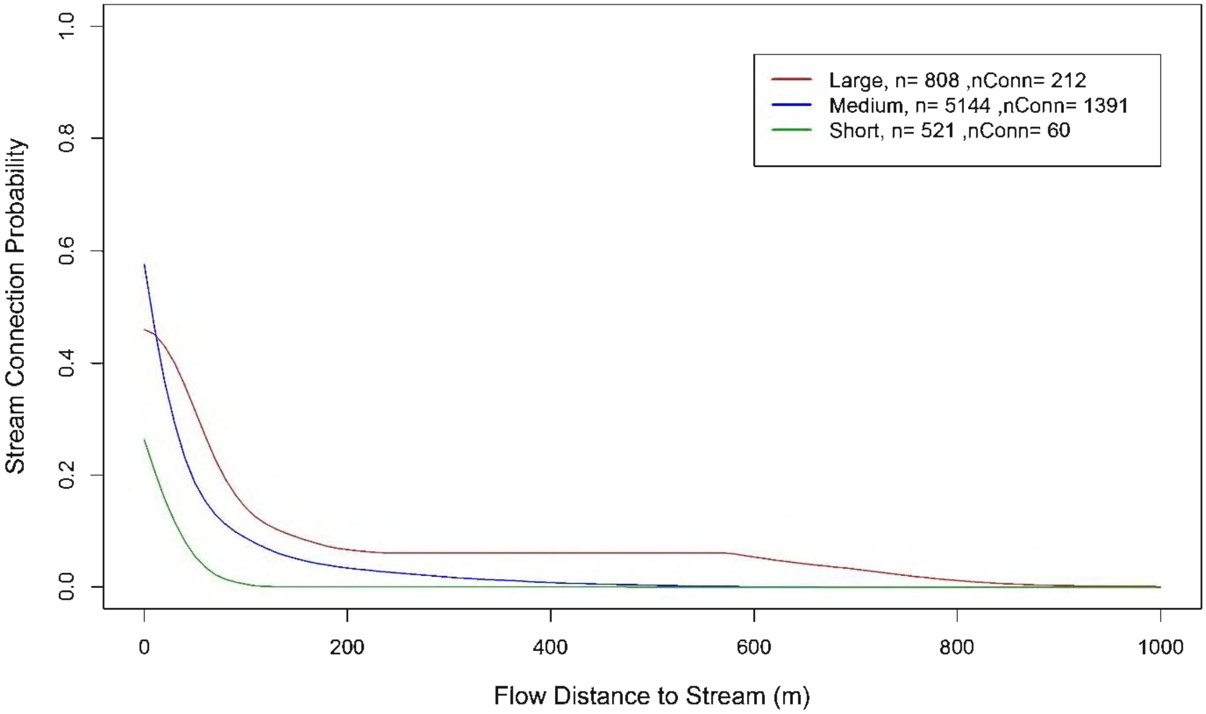

Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)
Large, n= 1102 ,nConn= 268
Medium, n= 8430 ,nConn= 1510
Short, n= 1267 ,nConn= 29

Basalt – Umatilla NF: This calibration set consists of a GRAIP inventory collected in support of TMDL analysis in the Wall Creek watershed on the Umatilla National Forest. It consists of 6,473 calibration points collected from 725 km of road. The observed stream connection rate was 26 percent. The mean stream distance was 104 m with a standard deviation of 128 m. Elevations range from 684 m to 1,530 m, with a mean of 1,178 m and standard deviation of 142 m. Mean annual precipitation in 464 mm with a standard deviation across the calibration set of 38 mm.

The base rate is 1.5 kg/yr/m and was assumed for the Wall Creek watershed inventory based on three years of data from nine native and aggregate surfaced roads near Klamath Falls, Oregon. For more information, see the Wall Creek Watershed GRAIP Roads Assessment.

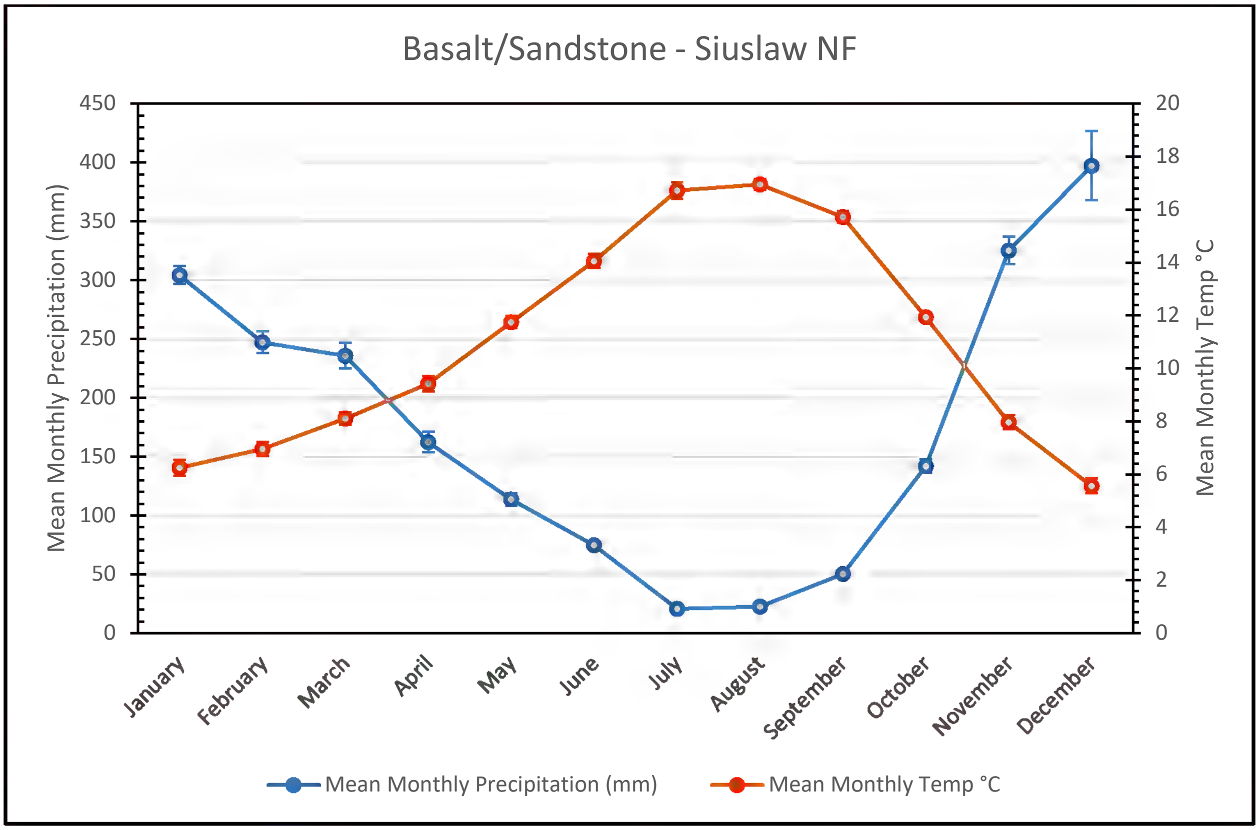

Basalt - Umatilla NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
70
60
50
40
30
20
10
0
25
20
15
10
5
0
-5
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

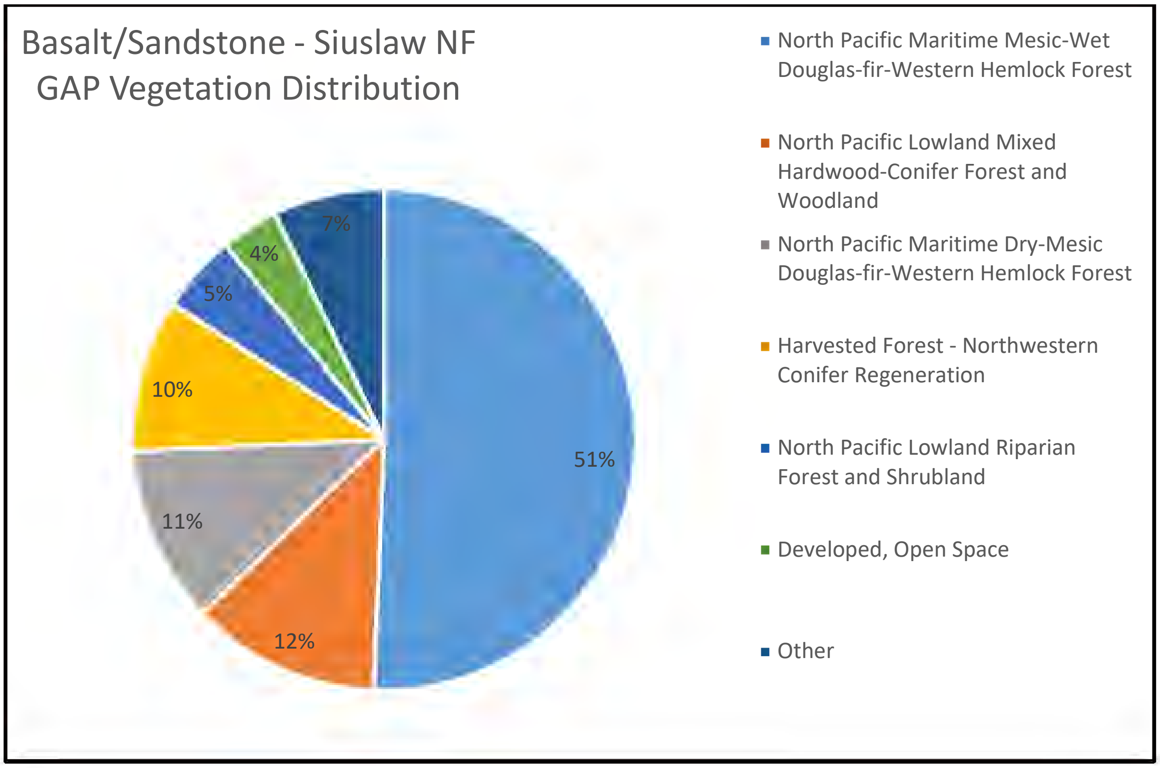

Basalt - Umatilla NF
GAP Vegetation Distribution
15%
2%
4%
6%
8%
18%
47%
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
Columbia Plateau Western Juniper Woodland and Savanna
Inter-Mountain Basins Big Sagebrush Steppe
Columbia Plateau Low Sagebrush Steppe
Columbia Plateau Steppe and Grassland
Other

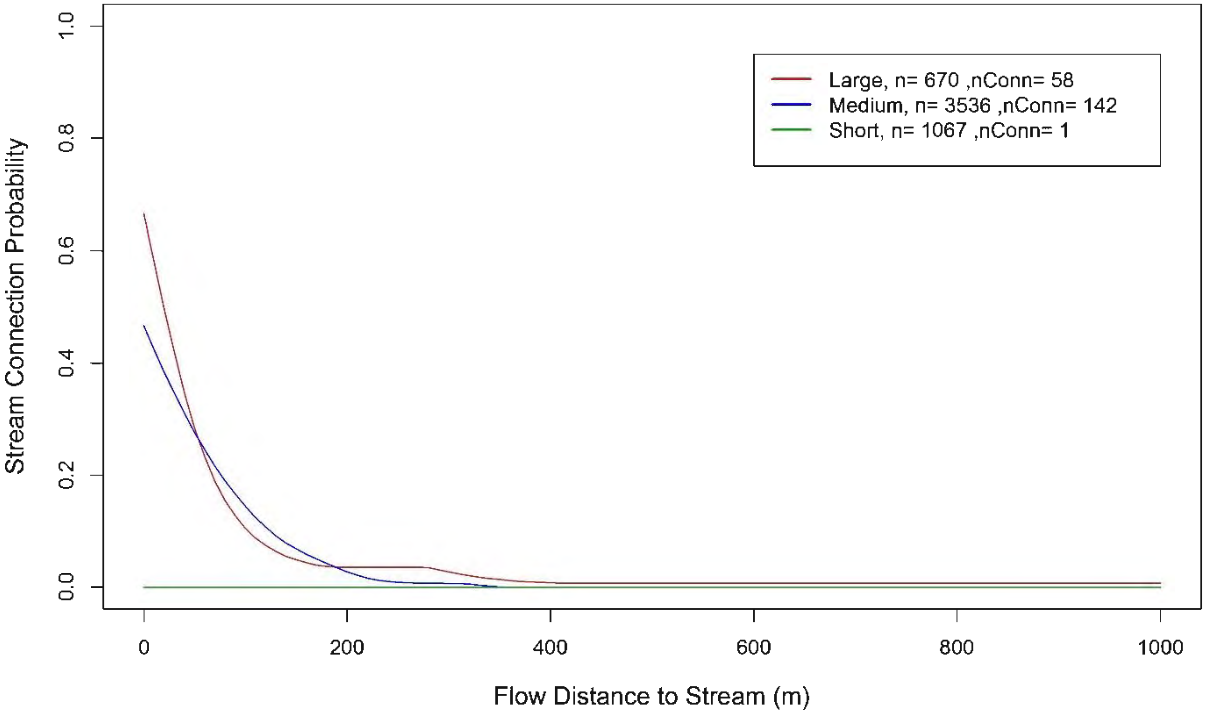

Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)
Large, n= 808 ,nConn= 212
Medium, n= 5144 ,nConn= 1391
Short, n= 521 ,nConn= 60

Basalt/Sandstone – Siuslaw NF: This calibration set consists of a GRAIP inventory collected during 2010 and 2011 in the North Fork Siuslaw River watershed on the Siuslaw National Forest. It consists of 5,273 calibration points collected from 261 km of road. The observed stream connection rate was 4 percent. The mean stream distance was 271 m with a standard deviation of 124 m. Elevations range from 41 m to 583 m, with a mean of 200 m and standard deviation of 74 m. Mean annual precipitation in 2,096 mm with a standard deviation across the calibration set of 79 mm.

This calibration set uses the default baserate, which was developed nearby.

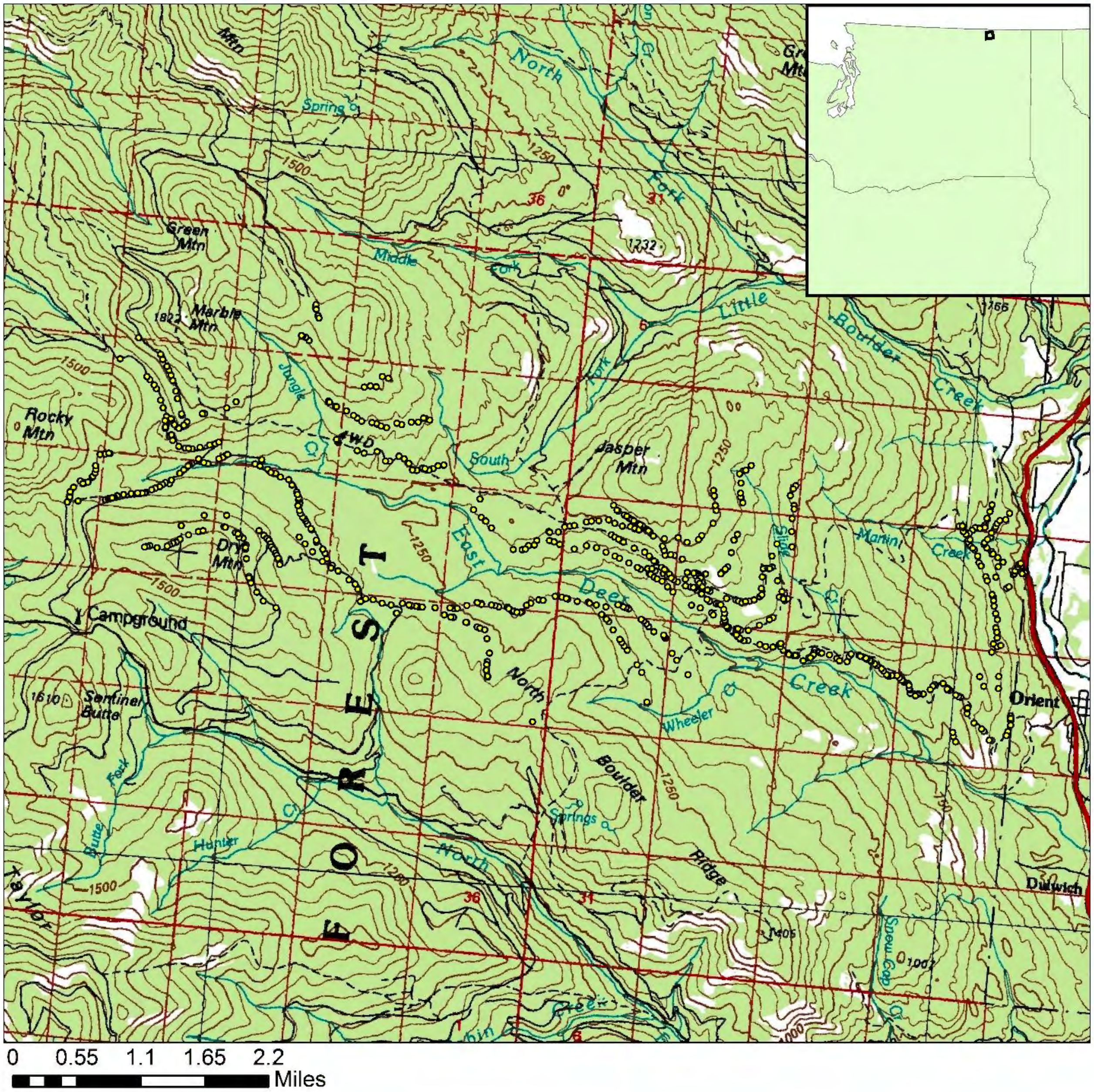

Basalt/Sandstone - Siuslaw NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
450
400
350
300
250
200
150
100
50
0
20
18
16
14
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

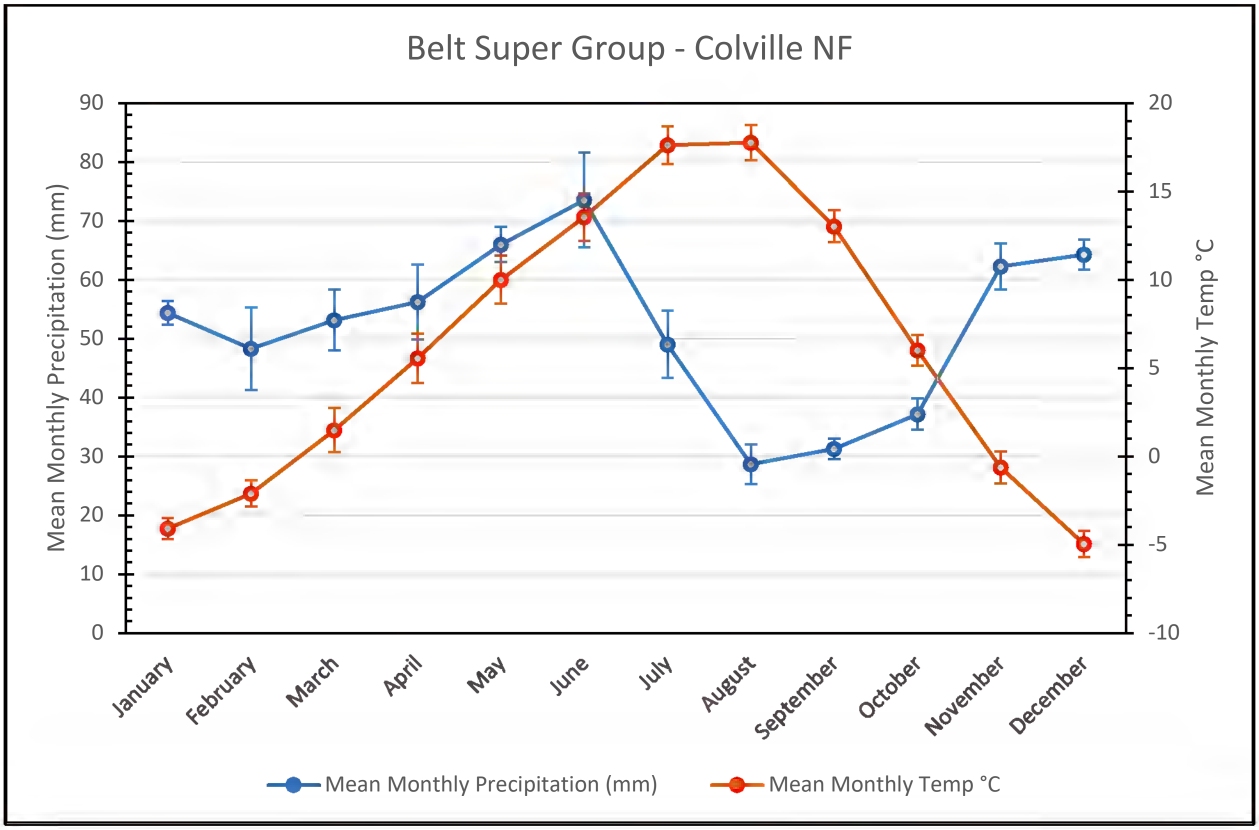

Basalt/Sandstone - Siuslaw NF
GAP Vegetation Distribution
51%
12%
11%
10%
5%
4%
7%
North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest
North Pacific Lowland Mixed Hardwood-Conifer Forest and Woodland
North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest
Harvested Forest - Northwestern Conifer Regeneration
North Pacific Lowland Riparian Forest and Shrubland
Developed, Open Space
Other

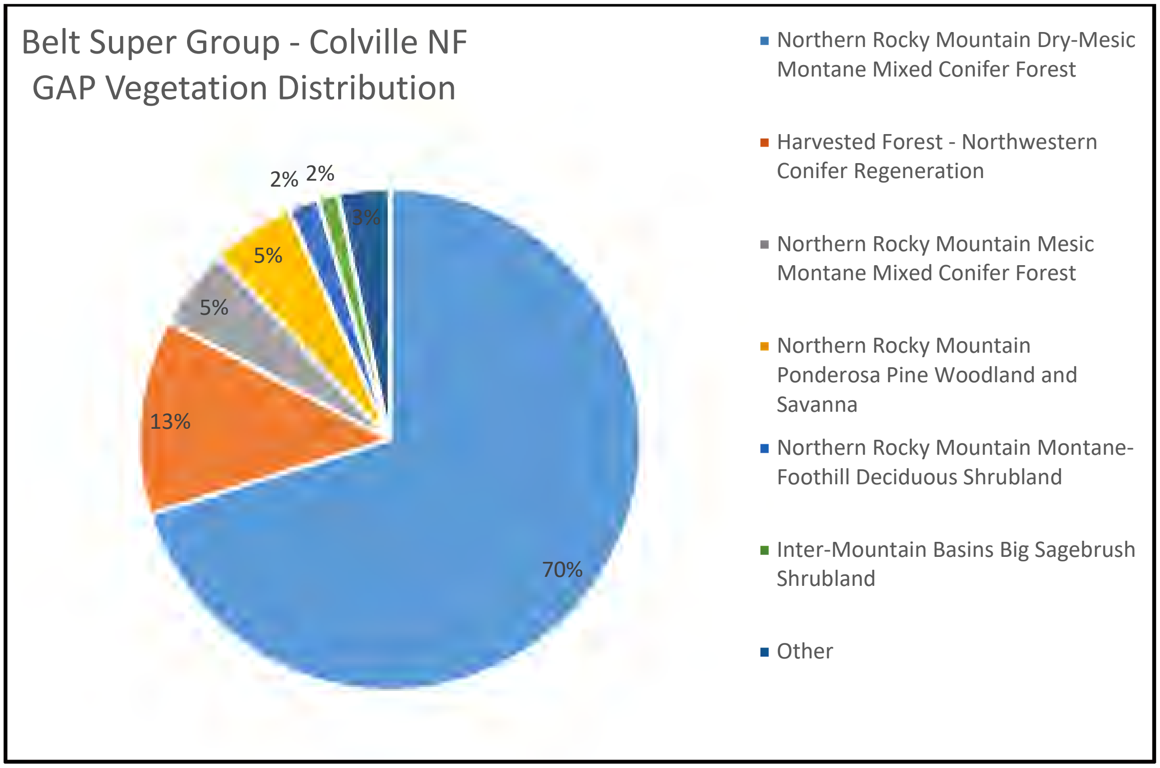

Stream Connection Probability
1.0
0.8
0.6
0.4
0.2
0.0
0
200
400
600
800
1000
Flow Distance to Stream (m)
Large, n= 670 ,nConn= 58
Medium, n= 3536 ,nConn= 142
Short, n= 1067 ,nConn= 1

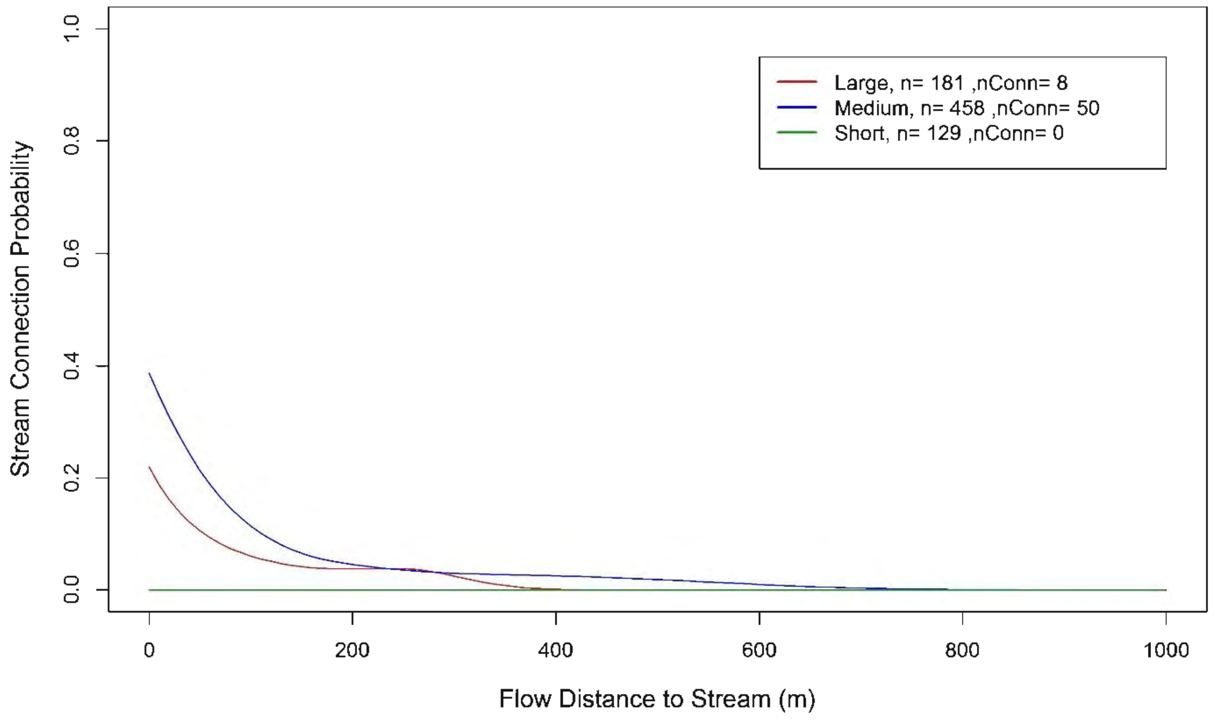
Belt Super Group – Coleville NF: This calibration set consists of a small GRAIP inventory collected as a baseline for planned fuels remediation treatments in the Deer Creek watershed on the Colville National Forest. Because this watershed functions as a municipal water supply for the town of Orient, WA, all roads in the watershed are closed to motorized vehicles. It consists of 768 calibration points collected from 70 km of road. The observed stream connection rate was 8 percent. The mean stream distance was 324 m with a standard deviation of 330 m. Elevations range from 464 m to 1,625 m, with a mean of 1,151 m and standard deviation of 276 m. Mean annual precipitation in 625 mm with a standard deviation across the calibration set of 39 mm.

This calibration uses a baserate of 14 kg/yr/m derived from the plots on the Lolo National Forest for the Belt Super Group – Lolo Helena Flathead NFs calibration set.



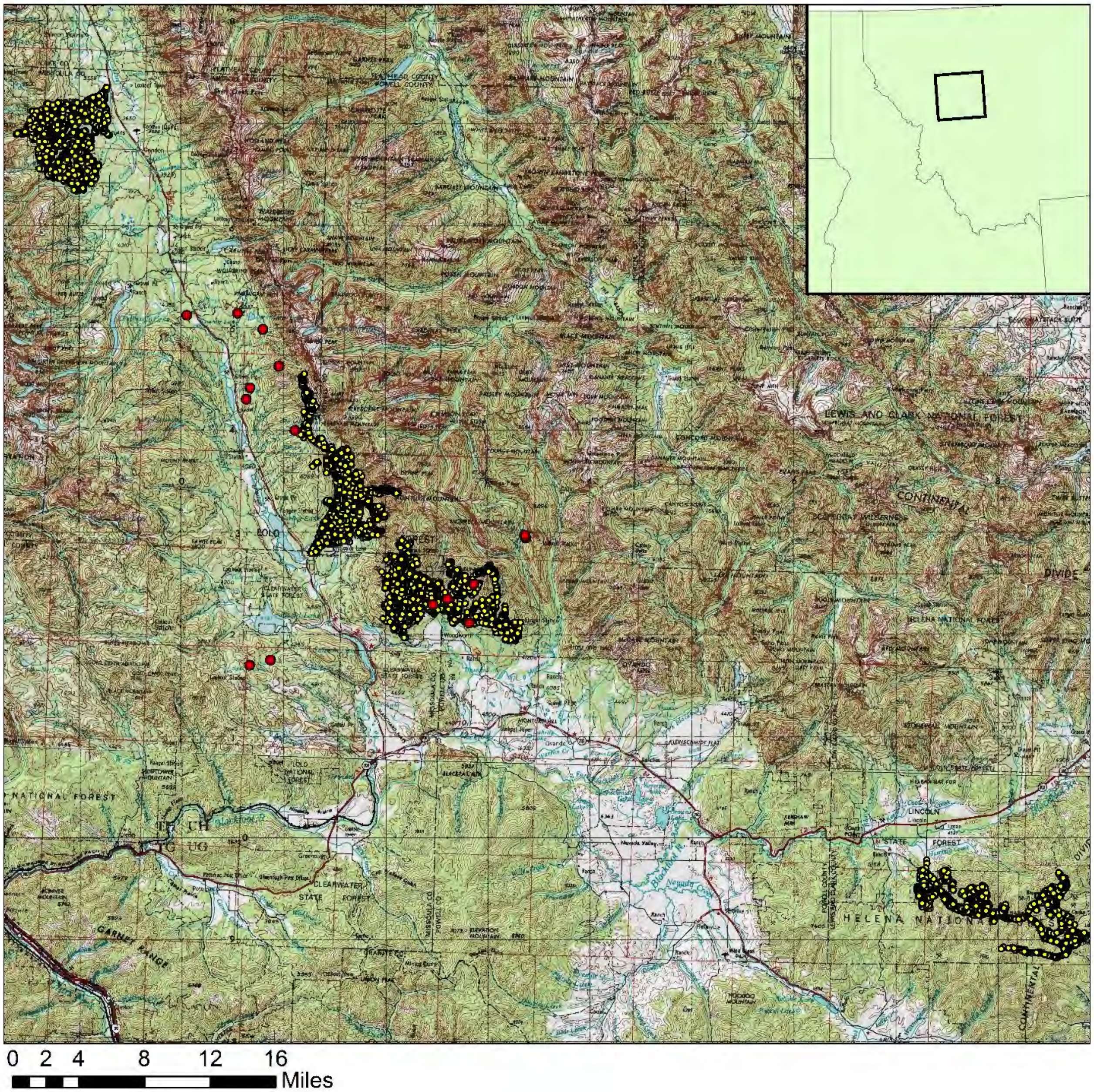

Belt Super Group - Colville NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
90
80
70
60
50
40
30
20
10
0
20
15
10
5
0
-5
-10
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

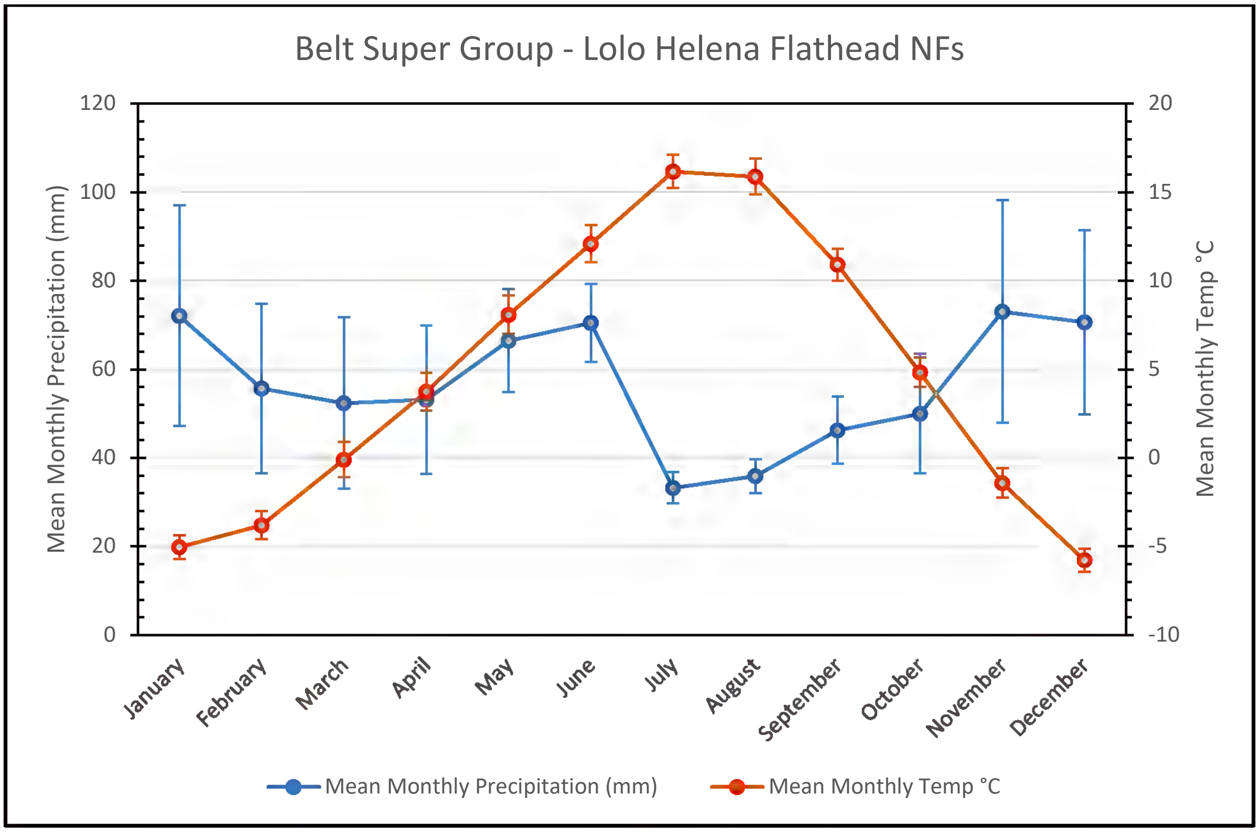

Belt Super Group - Colville NF
GAP Vegetation Distribution
70%
13%
5%
5%
2%
2%
3%
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Harvested Forest - Northwestern Conifer Regeneration
Northern Rocky Mountain Mesic Montane Mixed Conifer Forest
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
Inter-Mountain Basins Big Sagebrush Shrubland
Other

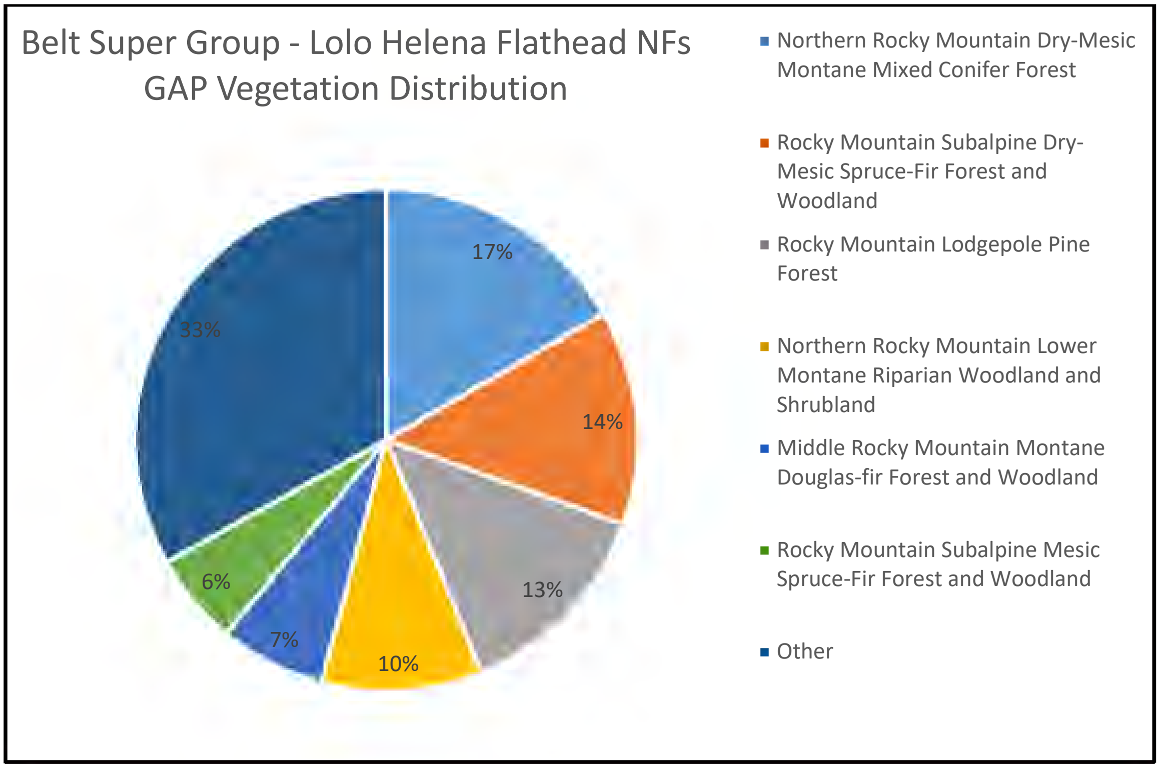

Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
Large, n= 181 ,nConn= 8
Medium, n= 458 ,nConn= 50
Short, n= 129 ,nConn= 0
0
200
400
600
800
1000
Flow Distance to Stream (m)

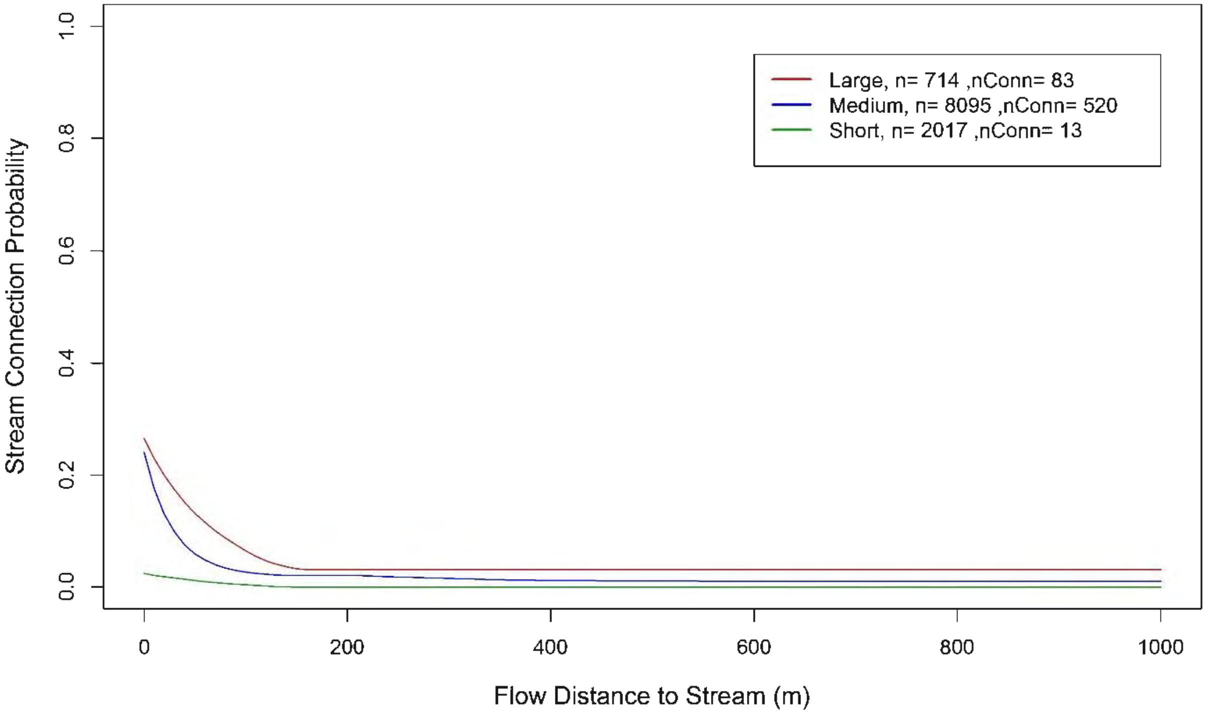
Belt Super Group – Lolo Helena Flathead NFs: This calibration set consists of several GRAIP watershed inventories collected from 2012 through 2013 on the Lolo, Helena, and Flathead National Forests as part of work being done by the South West Crown of the Continent Collaborative Forest Landscape Restoration Program. It consists of 10,826 calibration points collected from 616 km of road. The observed stream connection rate was 6 percent. The mean stream distance was 189 m with a standard deviation of 187 m. Elevations range from 1,081 m to 2,260 m, with a mean of 1,523 m and standard deviation of 246 m. Mean annual precipitation is 680 mm with a standard deviation across the calibration set of 165 mm.

This calibration uses a baserate of 14 kg/yr/m derived from 15 separate sediment monitoring plots. Eight of these plots use a large settling tank combined with a flow splitter and sediment blanket supported by a basket for fines collection; the other seven plots use a main settling tank, tipping bucket flow gage, and a flow splitter leading to a fines collection tank. The original eight plots, with filter fabric, were installed in 2011. Four plots were then installed in 2015, and the last three plots were installed in 2016.


LEWIS AND CLARK NATIONAL FOREST
CONTINENTAL
DIVIDE
HELENA NATIONAL FOREST
CLEARWATER STATE FOREST
GARNET RANGE
LINCOLN
HELENA NATIONAL
CONTINENTAL
0 2 4 8 12 16
Miles

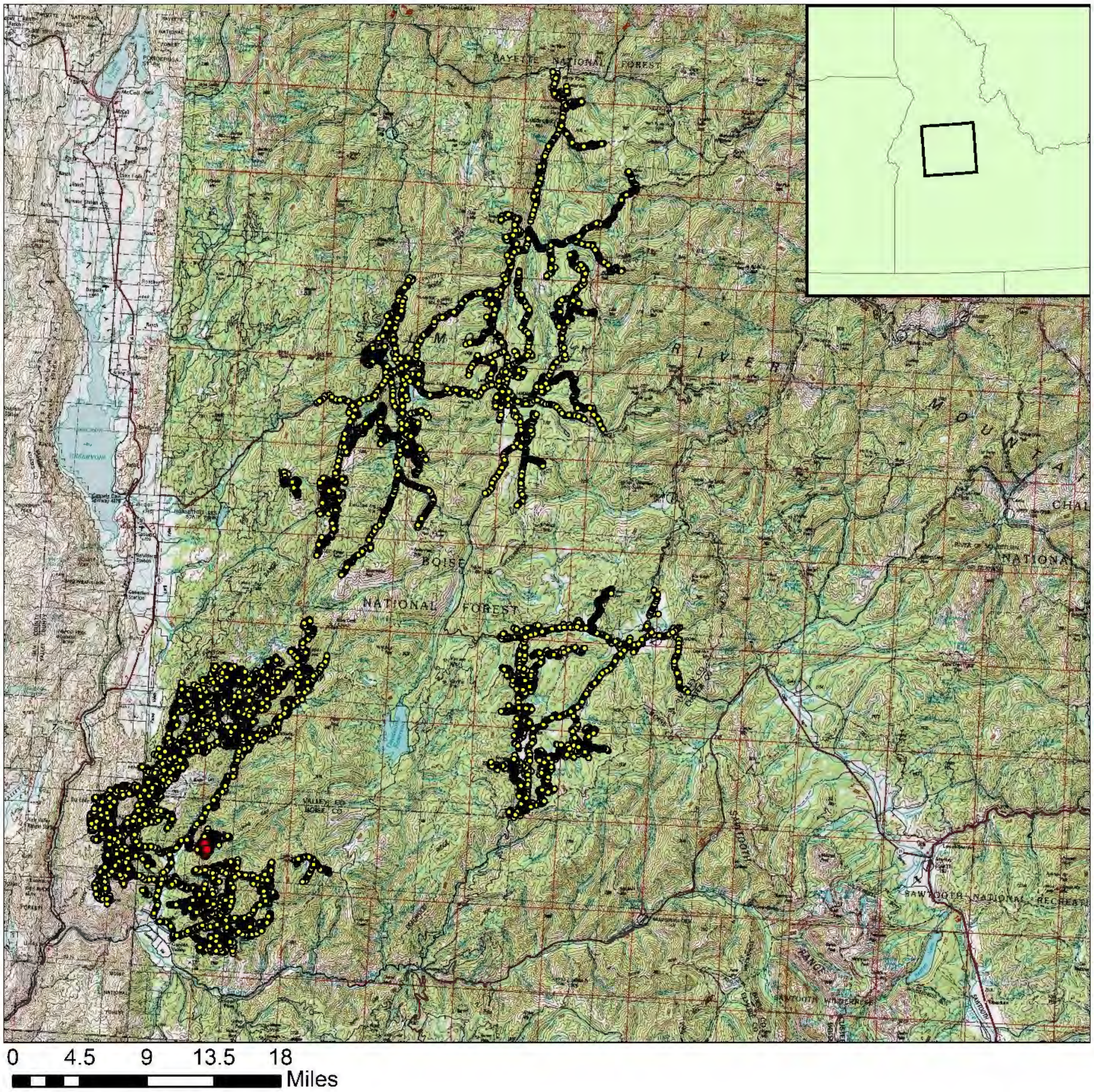

Belt Super Group - Lolo Helena Flathead NFs
Mean Monthly Precipitation (mm)
120
100
80
60
40
20
0
Mean Monthly Temp °C
20
15
10
5
0
-5
-10
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

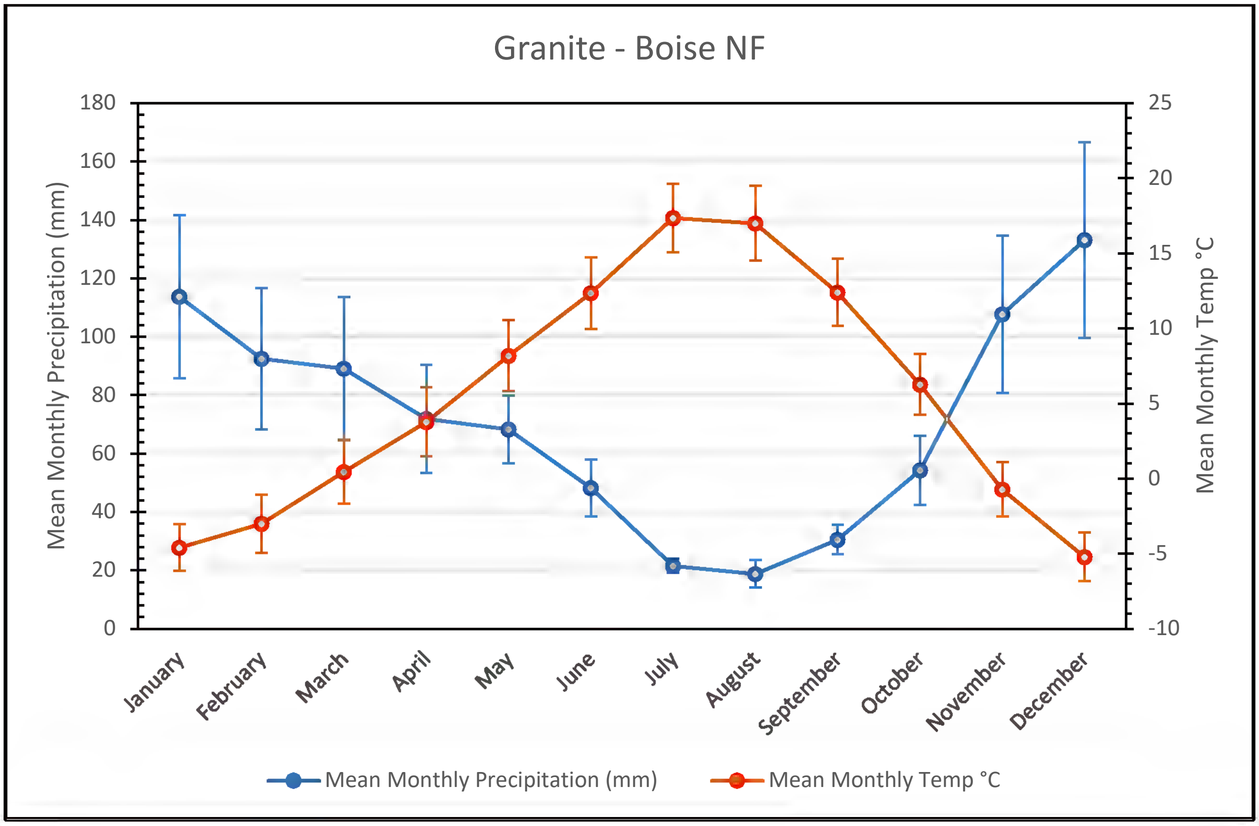

Belt Super Group - Lolo Helena Flathead NFs
GAP Vegetation Distribution
17%
14%
13%
10%
7%
6%
33%
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
Rocky Mountain Lodgepole Pine Forest
Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
Other

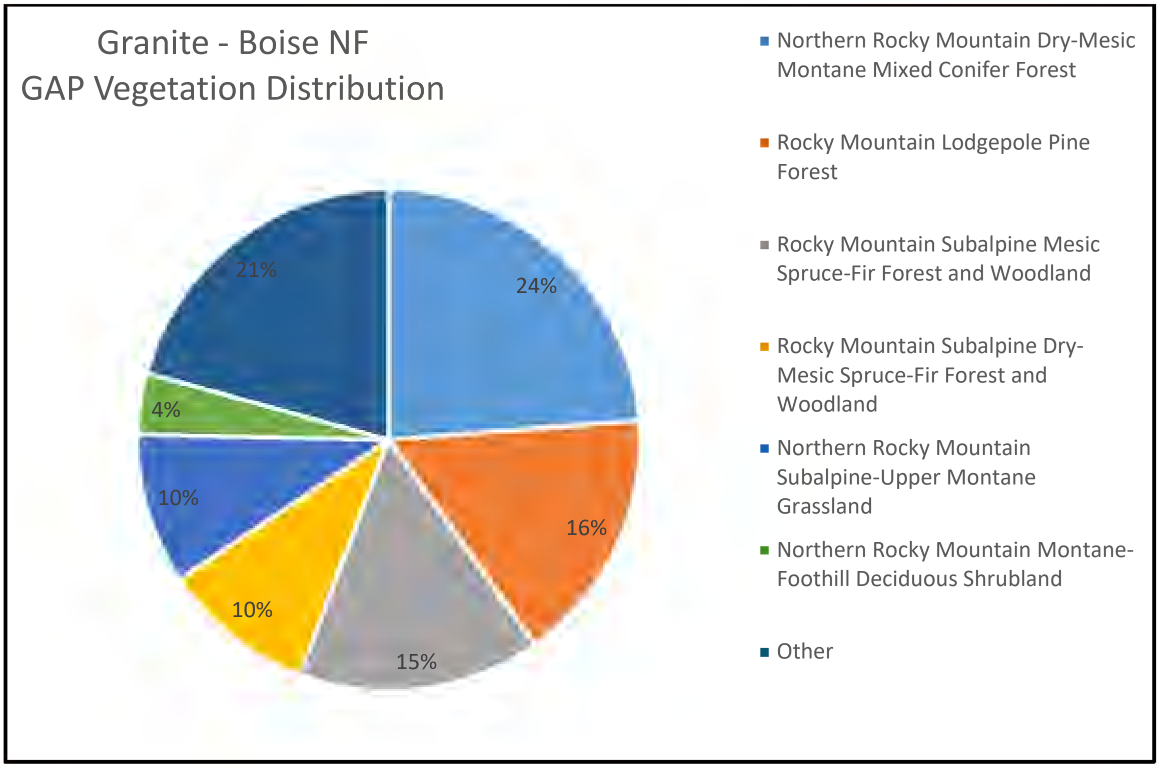

Large, n= 714 ,nConn= 83
Medium, n= 8095 ,nConn= 520
Short, n= 2017 ,nConn= 13
Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)

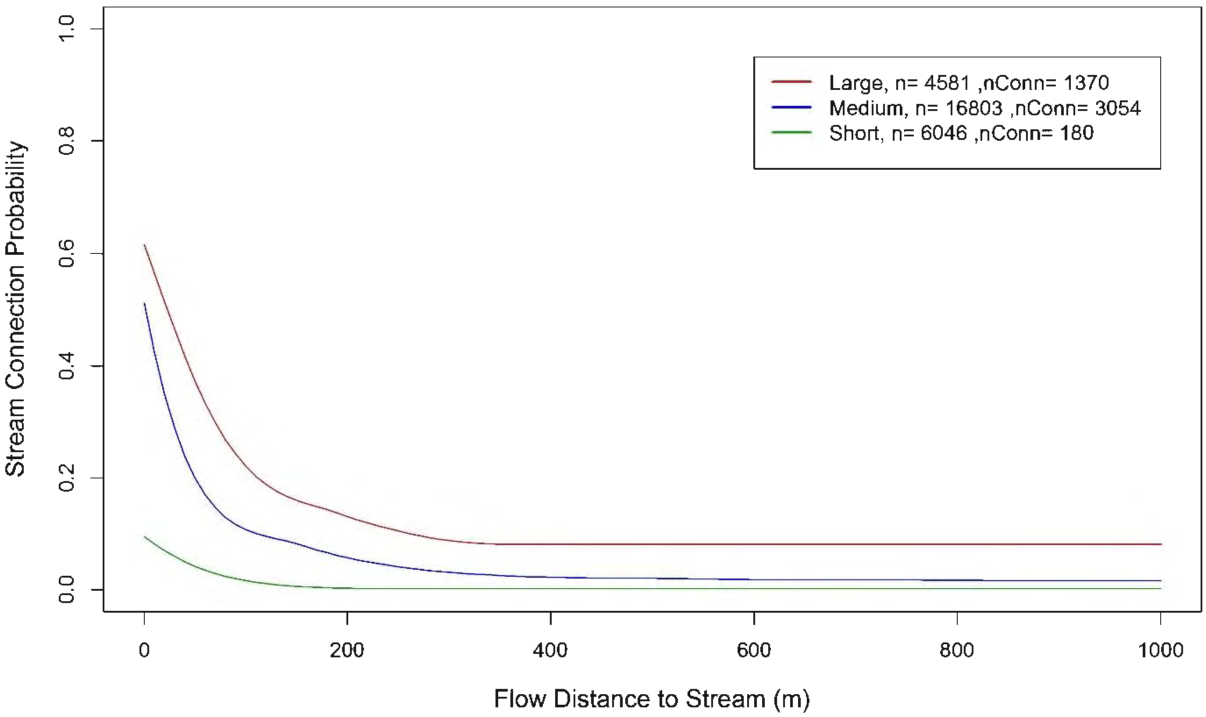
Granite – Boise NF: This calibration set consists of several GRAIP watershed inventories collected on the Boise National Forest between 2009 and 2011 in support of TMDL, 4b, and other restoration projects. It consists of 27,430 calibration points collected from 1,655 km of road. The observed stream connection rate was 17 percent. The mean stream distance was 149 m with a standard deviation of 146 m. Elevations range from 932 m to 2,581 m, with a mean of 1,707 m and standard deviation of 336 m. Mean annual precipitation is 850 mm with a standard deviation across the calibration set of 195 mm.

This calibration uses a baserate of 21.3 kg/yr/m derived from 6 separate sediment monitoring plots installed on the Lightning Creek road. Five of these plots were installed in 2009 and the sixth plot was installed in 2010 using a prototype tipping bucket. Later, a second tipping bucket was added on one additional plot. Currently, four plots consist of just a main sediment tank and two plots have a main sediment tank, tipping bucket with splitter, and fines collection tank.



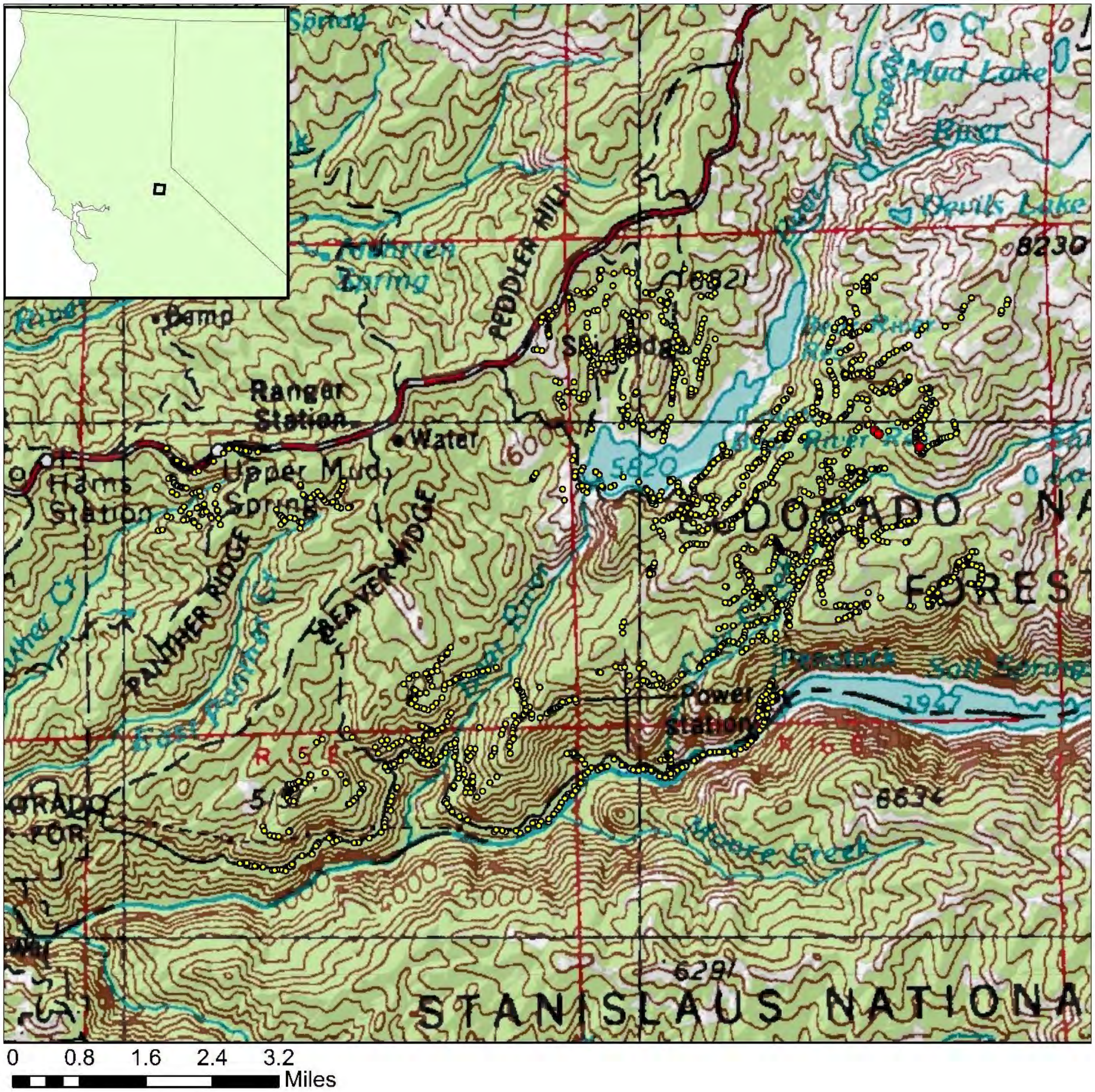

Granite - Boise NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
180
160
140
120
100
80
60
40
20
0
25
20
15
10
5
0
-5
-10
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

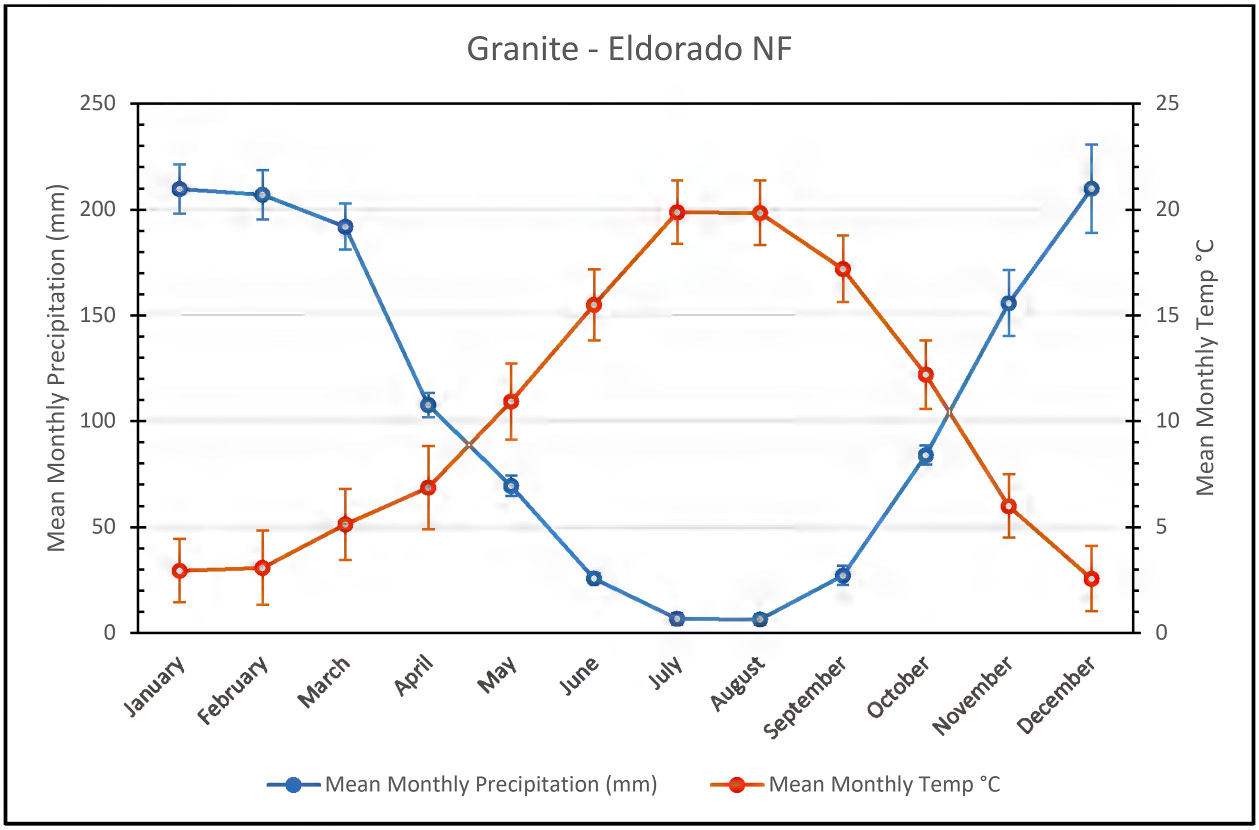

Granite - Boise NF
GAP Vegetation Distribution
24%
16%
15%
10%
10%
4%
21%
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Rocky Mountain Lodgepole Pine Forest
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
Northern Rocky Mountain Subalpine-Upper Montane Grassland
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
Other

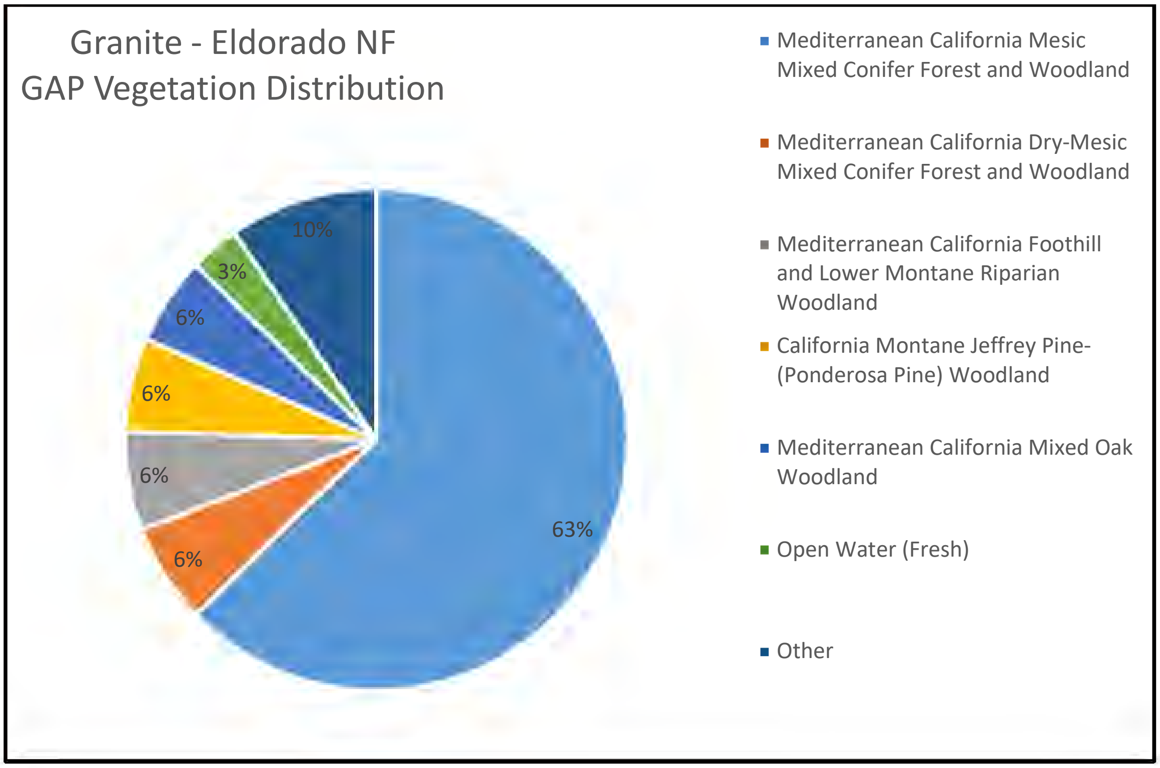

Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)
Large, n= 4581 ,nConn= 1370
Medium, n= 16803 ,nConn= 3054
Short, n= 6046 ,nConn= 180

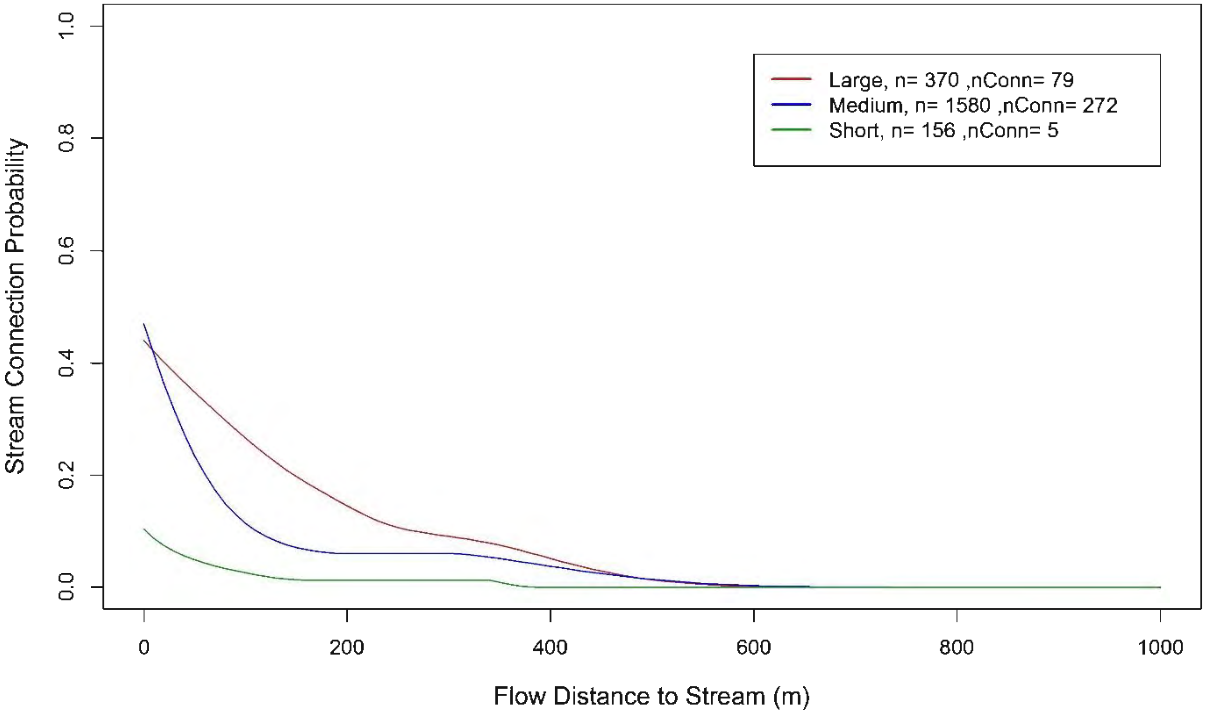
Granite – Eldorado NF: This calibration set was collected as part of a GRAIP inventory conducted as part of restoration work associated with the Power Fire on the Eldorado National Forest. It consists of 2,106 calibration points collected from 145 km of road. The observed stream connection rate was 17 percent. The mean stream distance was 192 m with a standard deviation of 199 m. Elevations range from 1,070 m to 2,394 m, with a mean of 1,766 m and standard deviation of 311 m. Mean annual precipitation is 1,302 mm with a standard deviation across the calibration set of 86 mm.

The baserate used with this calibration set is 49.5 kg/yr/m vertical drop along the road, and comes from three sediment monitoring plots utilizing a main settling tank, tipping bucket flow gage, and a flow splitter leading to a fines collection tank. These plots were installed in 2015.



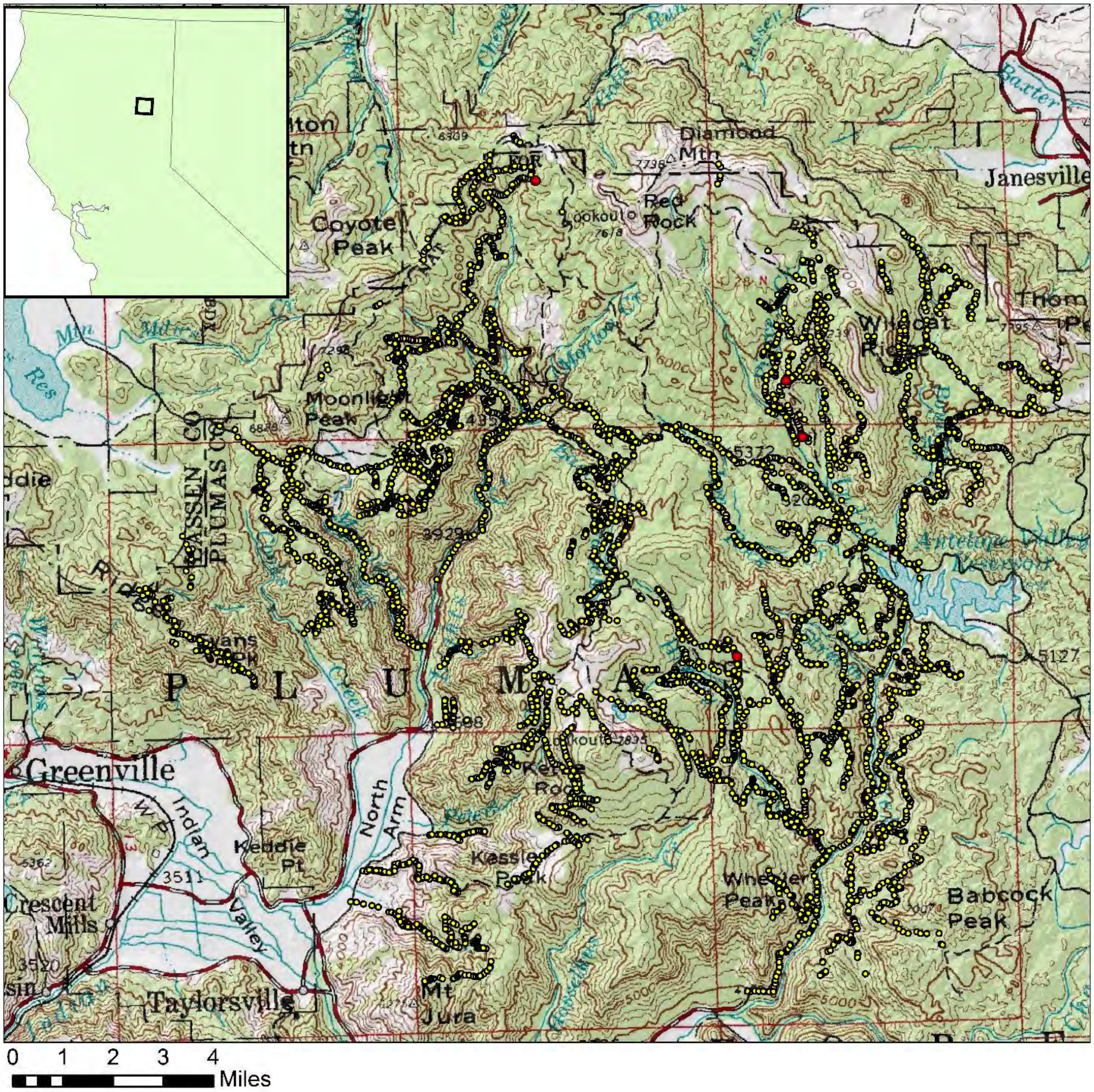

Granite - Eldorado NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
250
200
150
100
50
0
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

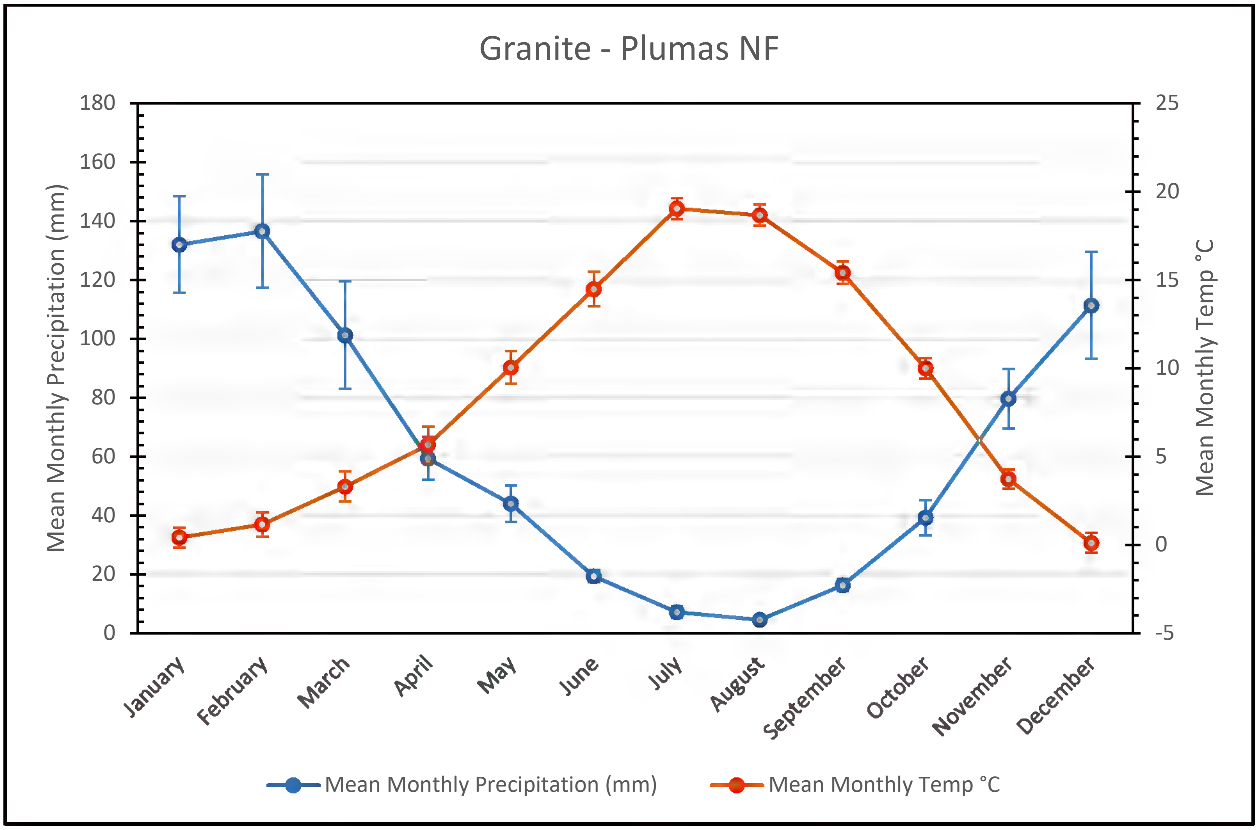

Granite - Eldorado NF
GAP Vegetation Distribution
10%
3%
6%
6%
6%
6%
63%
Mediterranean California Mesic Mixed Conifer Forest and Woodland
Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland
Mediterranean California Foothill and Lower Montane Riparian Woodland
California Montane Jeffrey Pine-(Ponderosa Pine) Woodland
Mediterranean California Mixed Oak Woodland
Open Water (Fresh)
Other

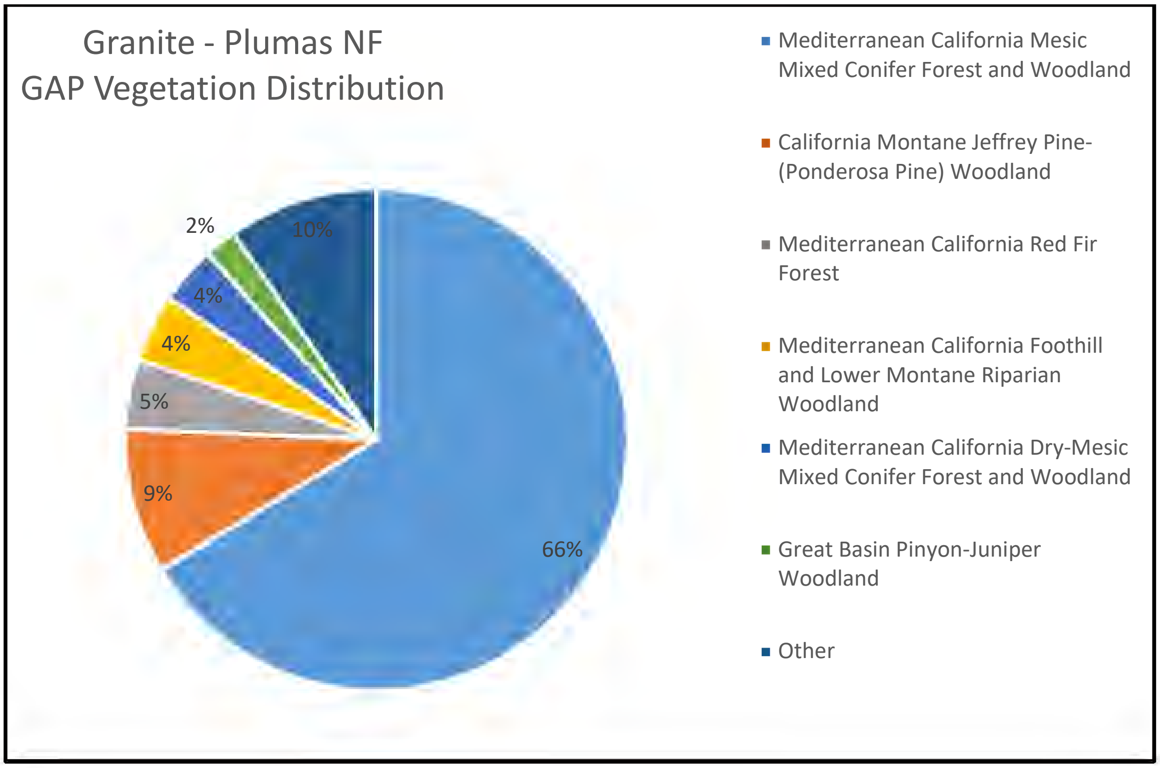

Large, n= 370 ,nConn= 79
Medium, n= 1580 ,nConn= 272
Short, n= 156 ,nConn= 5
Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)

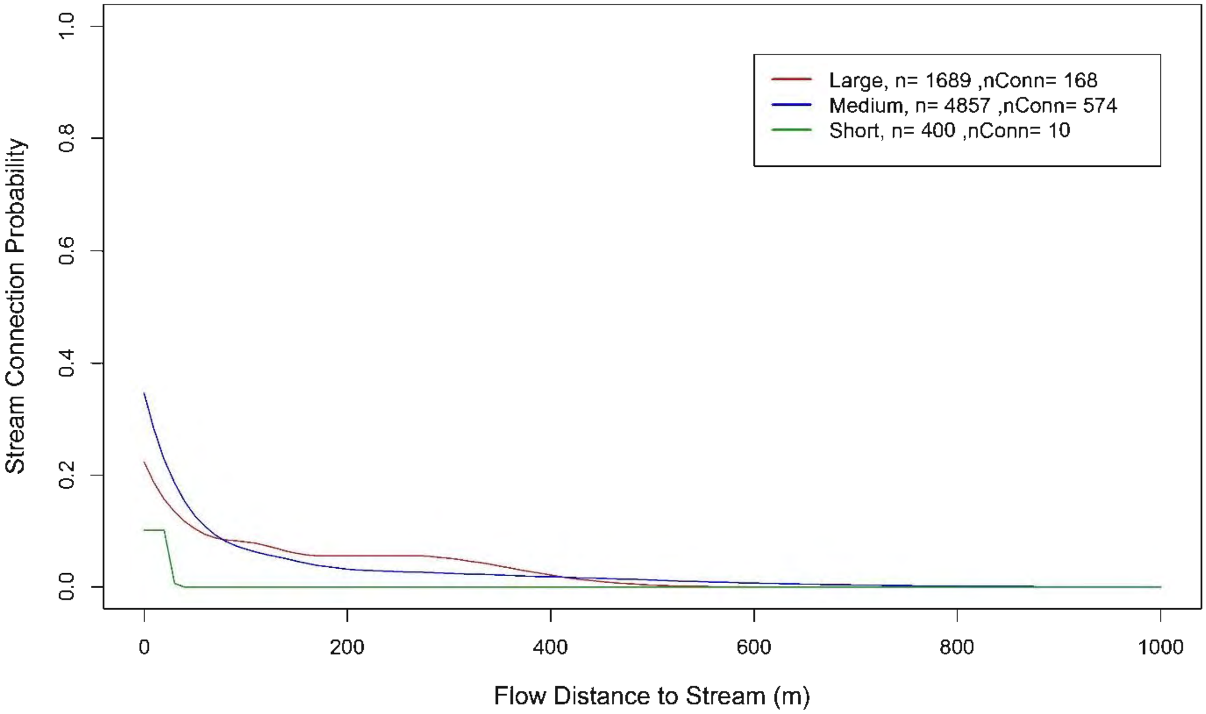
Granite – Plumas NF: This calibration set was collected as part of a GRAIP inventory conducted as part of restoration work associated with the Moonlight Fire on the Plumas National Forest. It consists of 6,946 calibration points collected from 495 km of road. The observed stream connection rate was 11 percent. The mean stream distance was 149 m with a standard deviation of 149 m. Elevations range from 1,089 m to 2,260 m, with a mean of 1,701 m and standard deviation of 189 m. Mean annual precipitation is 751 mm with a standard deviation across the calibration set of 92 mm.

The baserate used with this calibration set is 30.2 kg/yr/m vertical drop along the road, and comes from four sediment monitoring plots utilizing a main settling tank, a flow splitter, and a second tank to collect fines. These plots were installed in 2014.



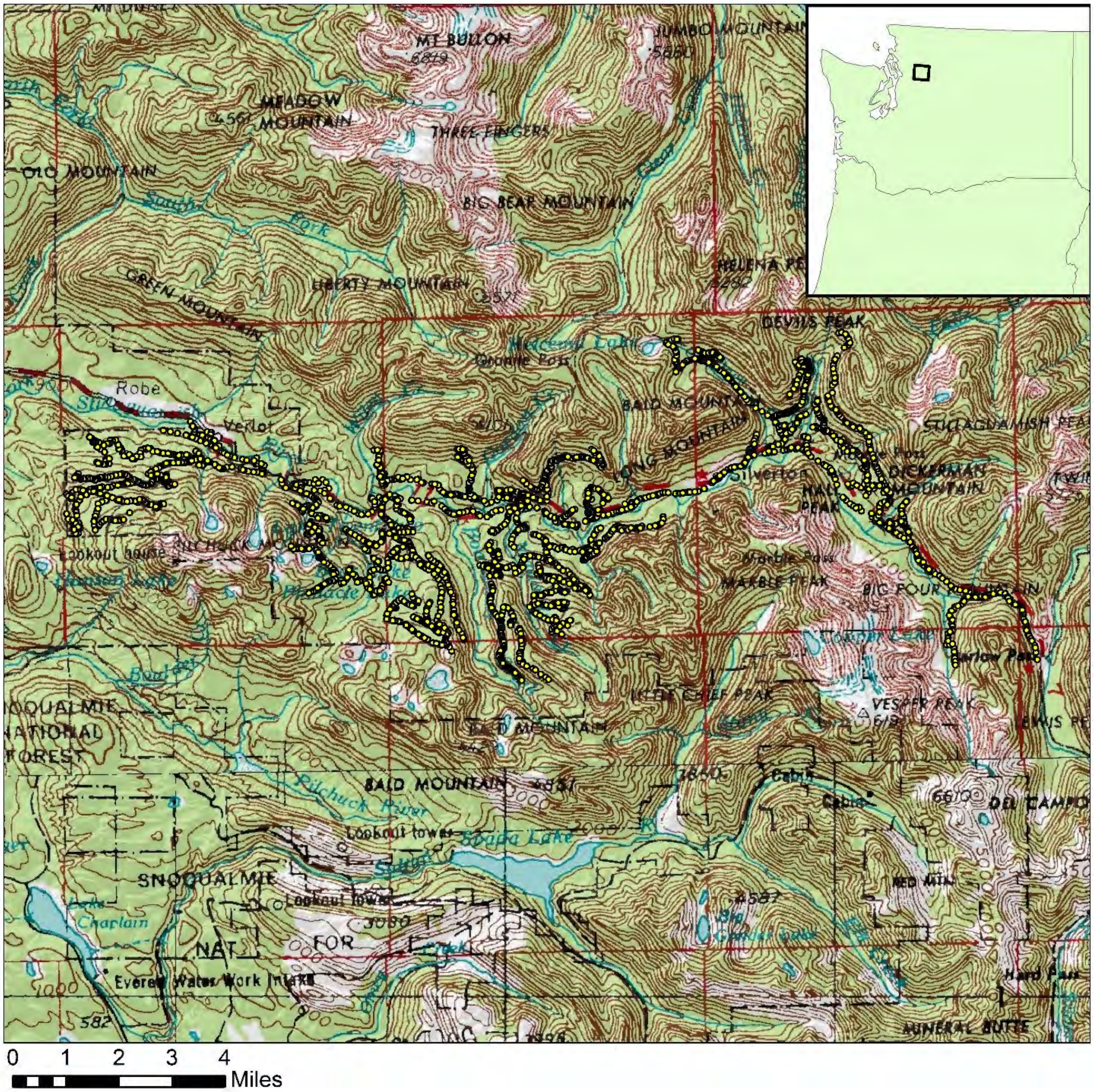

Granite - Plumas NF
Mean Monthly Precipitation (mm)
180
160
140
120
100
80
60
40
20
0
Mean Monthly Temp °C
25
20
15
10
5
0
-5
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C

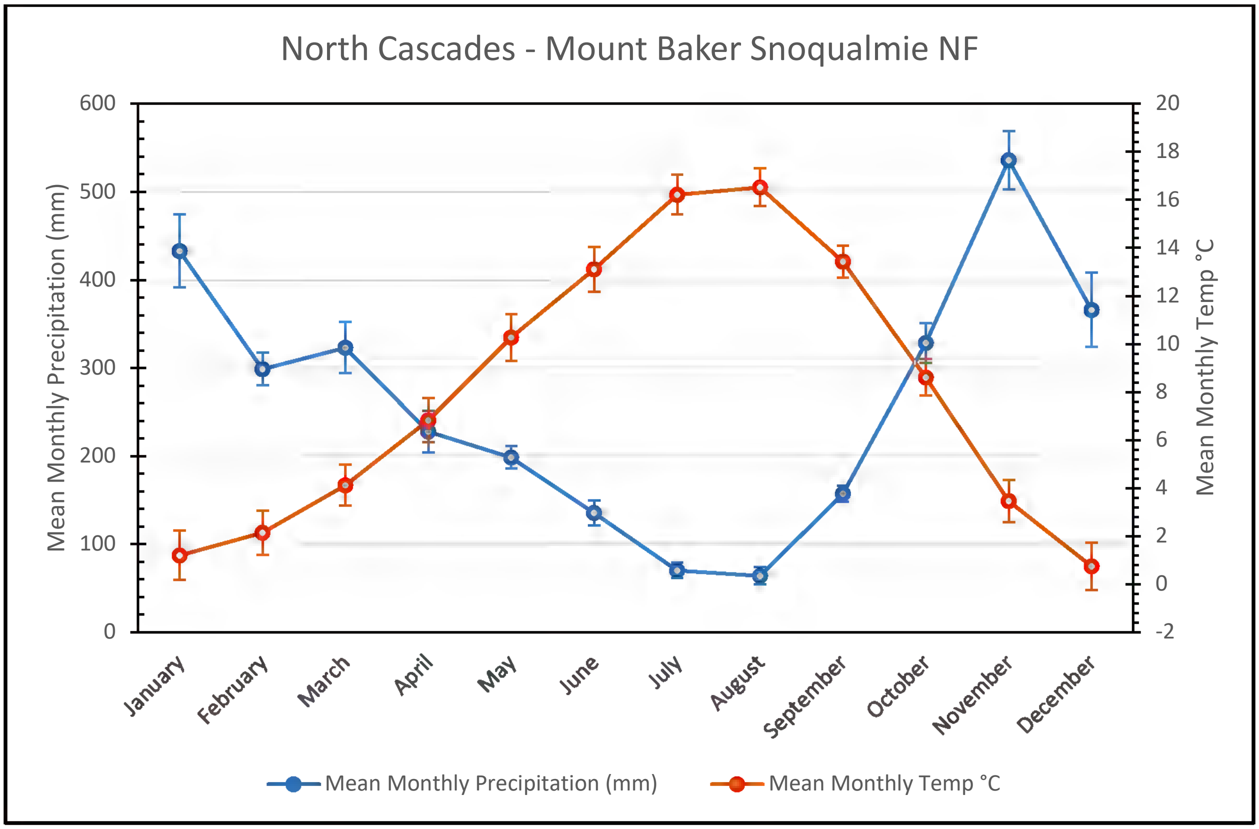

Granite - Plumas NF
GAP Vegetation Distribution
2%
10%
4%
4%
5%
9%
66%
Mediterranean California Mesic Mixed Conifer Forest and Woodland
California Montane Jeffrey Pine-(Ponderosa Pine) Woodland
Mediterranean California Red Fir Forest
Mediterranean California Foothill and Lower Montane Riparian Woodland
Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland
Great Basin Pinyon-Juniper Woodland
Other

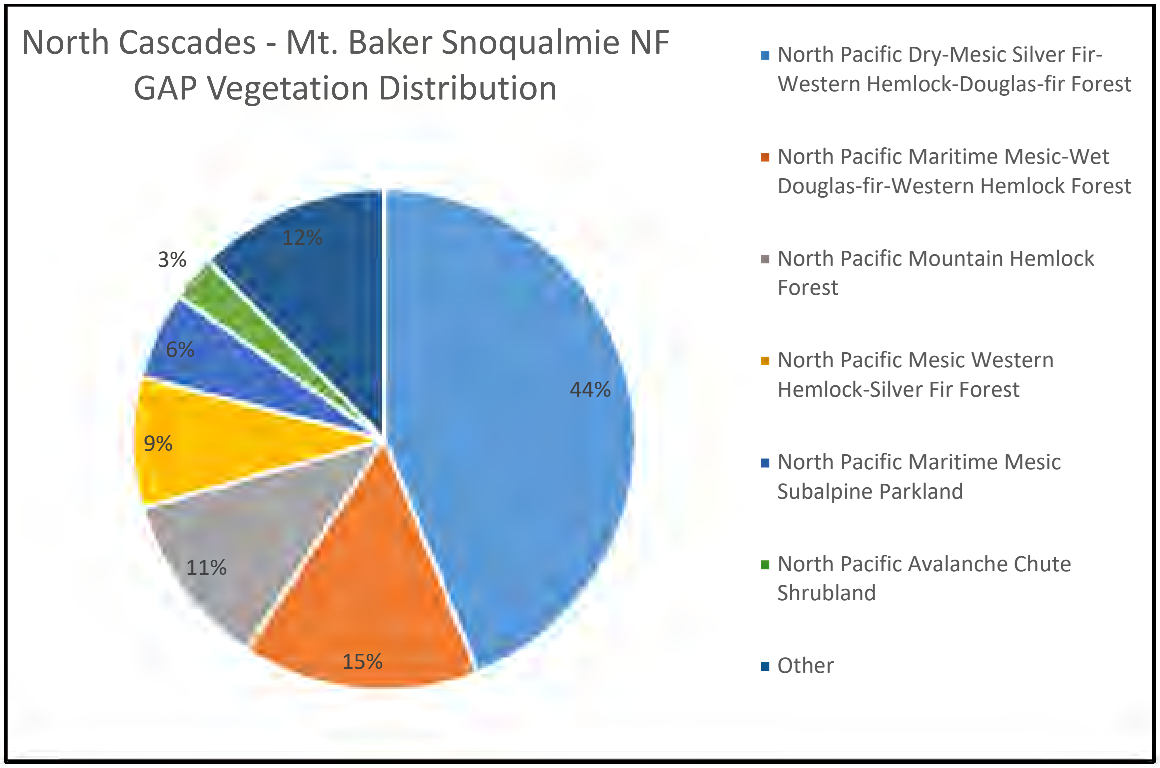

Large, n= 1689 ,nConn= 168
Medium, n= 4857 ,nConn= 574
Short, n= 400 ,nConn= 10
Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)

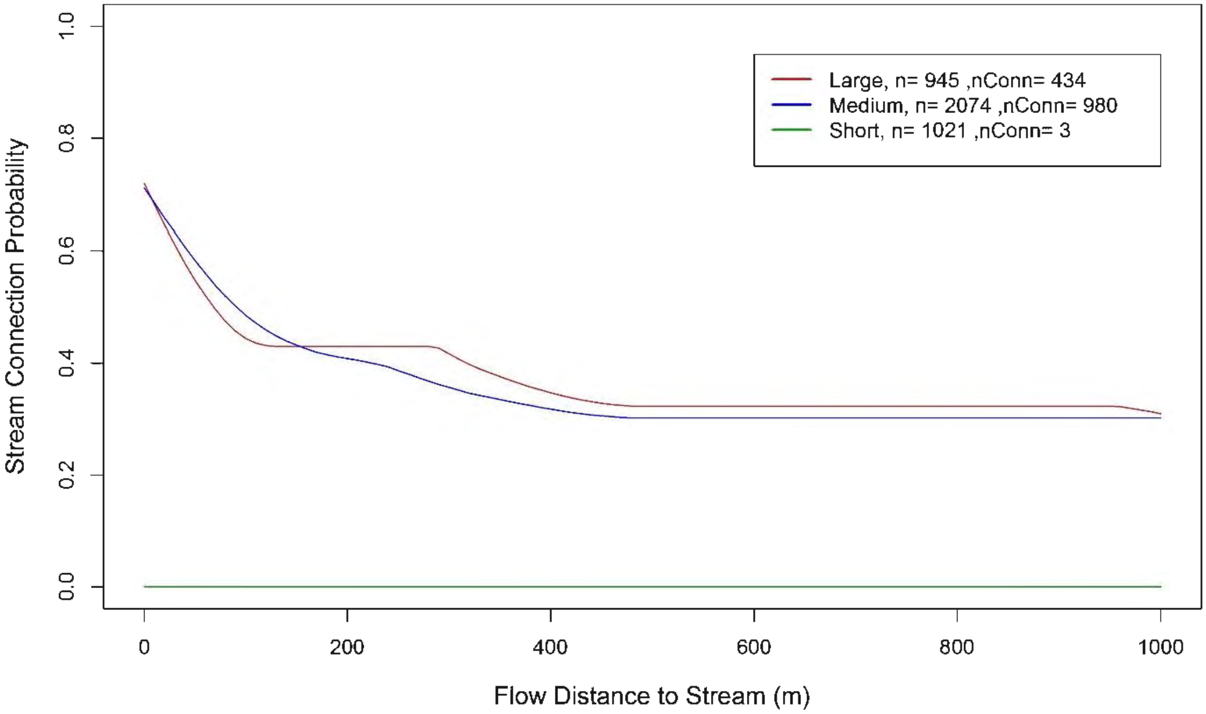
North Cascades – Mount Baker Snoqualmie NF: This calibration set consists of a GRAIP inventory collected during 2013 and 2014 in the Stilliguamish River watershed on the Mount Baker – Snoqualmie National Forest. It consists of 4,040 calibration points collected from 203 km of road. The observed stream connection rate was 35 percent. The mean stream distance was 227 m with a standard deviation of 211 m. Elevations range from 308 m to 1,132 m, with a mean of 631 m and standard deviation of 165 m. Mean annual precipitation is 3,147 mm with a standard deviation across the calibration set of 232 mm.

This calibration set uses the default baserate.




North Cascades - Mount Baker Snoqualmie NF
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C
0
100
200
300
400
500
600
-2
0
2
4
6
8
10
12
14
16
18
20
January
February
March
April
May
June
July
August
September
October
November
December
Mean Monthly Precipitation (mm)
Mean Monthly Temp °C


North Cascades - Mt. Baker Snoqualmie NF
GAP Vegetation Distribution
44%
15%
11%
9%
6%
3%
12%
North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest
North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest
North Pacific Mountain Hemlock Forest
North Pacific Mesic Western Hemlock-Silver Fir Forest
North Pacific Maritime Mesic Subalpine Parkland
North Pacific Avalanche Chute Shrubland
Other


Stream Connection Probability
0.0
0.2
0.4
0.6
0.8
1.0
0
200
400
600
800
1000
Flow Distance to Stream (m)
Large, n= 945 ,nConn= 434
Medium, n= 2074 ,nConn= 980
Short, n= 1021 ,nConn= 3

Appendix B: Description of Treatments

New Road – Temporary: This treatment is used when a road will be added for use during the project and then fully recontoured at the end of the project. For the initial condition, it assumes the road does not exist. For the disturbed condition, it assumes a bare, native surfaced, ML2 or equivalent road with high traffic and drainage at 100m distances. For the recovered condition, it assumes the road has been recontoured yielding a native surfaced ML1 with no traffic covered in vegetation and having drainage every 25m.

New Road – Permanent: This treatment is used when a road will be added for long-term access. For the initial condition, it assumes the road does not exist. For the disturbed condition, it assumes a bare, crushed rock surfaced, ML3 or equivalent road with high traffic and drainage at 100m distances. For the recovered condition, it assumes the road has come to vegetative equilibrium similar to other like roads and that traffic is low.

New Road – Reroute: This treatment is used when a road will be added to make a connection during a reroute project. For the initial condition, it assumes the road does not exist. For the disturbed condition, it assumes a bare, crushed rock surfaced, ML3 or equivalent road with high traffic and drainage at 100m distances. For the recovered condition, it assumes the road has come to vegetative equilibrium similar to other like roads and that traffic is low. The maintenance level and drainage distance should be set to match the road being replaced.

Re-Open – Temporary: This treatment is used when a closed road will be temporarily opened for use during a project and then recontoured. For the initial condition, it assumes the road is closed (ML1) with normal vegetation, drainage every 50m, and a native surface. For the disturbed condition, it assumes a bare, native surfaced, ML2 or equivalent road with high traffic and drainage at 100m distances. For the recovered condition, it assumes the road has been recontoured yielding a native surfaced ML1 with no traffic covered in vegetation and having drainage every 25m.

Re-Open – Permanent: This treatment is used when a closed road will be reopened, often as part of a reroute project. For the initial condition, it assumes the road is closed (ML1) with normal vegetation, drainage every 50m, and a native surface. For the disturbed condition, it assumes a bare, crushed rock surfaced, ML2 or equivalent road with high traffic and drainage at 50m distances. For the recovered condition, it assumes the road has come to vegetative equilibrium similar to other like roads and that traffic is low. If this is part of a reroute, the maintenance level and drainage distance should be set to match the road being replaced.

Traffic Increase – ML2 with gravel: This treatment is used when gravel will be applied to a ML2 road to support temporary increased traffic loads such as during haul operations. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare, crushed rock surface with high traffic and a drainage distance of 100m. For the recovered condition, it assumes that the surface has degraded back to a native surface, the vegetation has recovered to an average state, the traffic level has dropped to low, and the drainage distance has returned to 50m.

Traffic Increase – ML3 with gravel: This treatment is used when gravel will be applied to a ML3 road to support temporary increased traffic loads such as during haul operations. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare, crushed rock surface with high traffic and a drainage distance of 100m. For the recovered condition, it assumes that the surface is crushed rock, the vegetation has recovered to an average state, the traffic level has dropped to medium, and the drainage distance is 100m.

Traffic Increase – ML4 with gravel: This treatment is used when gravel will be applied to a ML4 road to support temporary increased traffic loads such as during haul operations. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare, crushed rock surface with high traffic and a drainage distance of 100m. For the recovered condition, it assumes that the surface is crushed rock, the vegetation has recovered to an average state, the traffic level has dropped to medium, and the drainage distance is 100m.

Traffic Increase – ML5 Paved: This treatment is used when gravel will be applied to a ML5 road to support temporary increased traffic loads such as during haul operations. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare ditch, paved surface with high traffic and a drainage distance of 200m. For the recovered condition, it assumes that the vegetation in the ditch has returned to the average condition.

SDRR Improvement – Nat-Gravel ML2: This treatment is used to simulate the effect of converting a native surfaced ML2 road to a crushed rock surface. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare crushed rock surface with high traffic and a 50m drainage spacing. For the recovered condition, it assumes that the traffic has decreased to low and that the vegetation has returned to average conditions.

SDRR Improvement – Nat-Gravel ML3: This treatment is used to simulate the effect of converting a native surfaced ML3 road to a crushed rock surface. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare crushed rock surface with high traffic and a 100m drainage spacing. For the recovered condition, it assumes that the traffic has decreased to medium and that the vegetation has returned to average conditions.

SDRR Improvement – Drainage ML3: This treatment is used to simulate the effect of increasing the drainage density of a ML3 road with a gravel surface. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare crushed rock surface with high traffic and a 50m drainage spacing. For the recovered condition, it assumes that the traffic has decreased to medium and that the vegetation has returned to average conditions.

Reconstruct – ML2: This treatment is used to simulate the effect of reconstructing a native surfaced ML2 road to a using a crushed rock surface. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare crushed rock surface with high traffic and a 100m drainage spacing. For the recovered condition, it assumes that the traffic has decreased to low and that the vegetation has returned to average conditions.

Reconstruct – ML3: This treatment is used to simulate the effect of reconstructing an ML3 road using a crushed rock surface. It is functionally the same as Traffic Increase – ML3 with gravel.

Upgrade – Pave: This treatment is used to model paving a road and establishing a 200m drainage spacing. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a paved road surface with a bare ditch, high traffic, and a 200m drainage spacing. For the recovered condition, vegetation in the ditch is returned to an average condition and traffic remains high.

Storage – Close ML2: This treatment is used to model long-term closure (storage) of an ML2 road. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a native surface with no traffic and a 50m drainage spacing; vegetation is modeled as the average condition for the ML2 road. For the recovered condition, vegetation is modeled as the average condition on ML1 roads.

Storage – Drainage Removal ML2: This treatment is used to model long-term closure (storage) of an ML2 road and specifies the removal of existing drainage culverts; it is modeled the same as the Storage – Close ML2 treatment. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a native surface with no traffic and a 50m drainage spacing; vegetation is modeled as the average condition for the ML2 road. For the recovered condition, vegetation is modeled as the average condition on ML1 roads.

Decommission – Rip/Till: This treatment is used to model decommissioning a road by ripping or tilling, rather than recontouring, and then seeding or planting vegetation. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare native surface with no traffic and a 50m drainage spacing. For the recovered condition, vegetation is modeled as covered. If treatment will not involve seeding or planting, V2 should be set to Default rather than Covered.

Decommission – Partial Recontour: This treatment is used to model decommissioning a road by partially recontouring the road surface, and then seeding or planting vegetation. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare native surface with no traffic and a 50m drainage spacing. For the recovered condition, vegetation is modeled as covered. If treatment will not involve seeding or planting, V2 should be set to Default rather than Covered.

Decommission – Full Recontour: This treatment is used to model decommissioning a road by fully recontouring the road surface, and then seeding or planting vegetation. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare native surface with no traffic and a 25m drainage spacing. For the recovered condition, vegetation is modeled as covered. If treatment will not involve seeding or planting, V2 should be set to Default rather than Covered.

Use and Decommission – ML2 Recontour: This treatment is used to model using a road for a project and then recontouring that road after project completion. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare native surface with high traffic and a 100m drainage spacing. For the recovered condition, it assumes a covered native surface with no traffic and a 25m drainage spacing. If treatment will not involve seeding or planting, V2 should be set to Default rather than Covered.

Use and Decommission – ML3 Recontour: This treatment is used to model using a road for a project and then recontouring that road after project completion. For the initial condition, it uses the road attributes from the initial GRAIP_Lite run based on the INFRA road layer. For the disturbed condition, it assumes a bare crushed rock surface with high traffic and a 100m drainage spacing. For the recovered condition, it assumes a covered native surface with no traffic and a 25m drainage spacing. If treatment will not involve seeding or planting, V2 should be set to Default rather than Covered.

Appendix C: Data Structure and Requirements

Name in Structure	Explanation
Project Folder	**Main folder containing project**
Alternative1	**Folder containing rasters for Alternative 1**
gl_acclength0	Accumulated connected road length, Initial condition
gl_acclength1	Accumulated connected road length, Disturbed condition
gl_acclength2	Accumulated connected road length, Recovered condition
gl_connlen0	Drainpoints, connected road length, Initial condition
gl_connlen1	Drainpoints, connected road length, Disturbed condition
gl_connlen2	Drainpoints, connected road length, Recovered condition
gl_dp0	Drainpoints, delivered sediment, Initial condition
gl_dp1	Drainpoints, delivered sediment, Disturbed condition
gl_dp2	Drainpoints, delivered sediment, Recovered condition
gl_seddel0	Accumulated sediment, Initial condition
gl_seddel1	Accumulated sediment, Disturbed condition
gl_seddel2	Accumulated sediment, Recovered condition
gl_sedstr0	
gl_sedstr1	
gl_sedstr2	
gl_specsedstr0	Specific sediment, Initial condition
gl_specsedstr1	Specific sediment, Disturbed condition
gl_specsedstr2	Specific sediment, Recovered condition

gl_strrdden0	Connected road density, Initial condition
gl_strrdden1	Connected road density, Disturbed condition
gl_strrdden2	Connected road density, recovered condition
gl_strrdlen0	
gl_strrdlen1	
gl_strrdlen2	
Layers	**Folders for rasters created by initial model**
cat	Catchments
dem	DEM, copy if Input DEM
disttostrm	Flow distance to stream
fac	Flow accumulation
fdr	Flow direction
fil	Pit-filled DEM
gl_acclength	Accumulated road length
gl_connlength	Drainpoints connected road length
gl_dp	Drainpoints sediment delivery
gl_seddel	Accumulated sediment
gl_sedstr	
gl_specsedstr	Specific sediment
gl_strroadden	Road density
gl_strroadlen	
Input DEM	The DEM used as model input
hillshade	Hillshade of the DEM
str	Stream network raster
strlnk	
project.gdb	**Project geodatabase**
Alternative1	**Geodatabase folder for feature classes related to Alternative 1**
Alternative1_DrainageLine	Stream network feature class for Alternative 1
Alternative1_Road	Initial road layer for Alternative 1
Alternative1_RoadDrainPoint0	Drainpoints for Initial condition

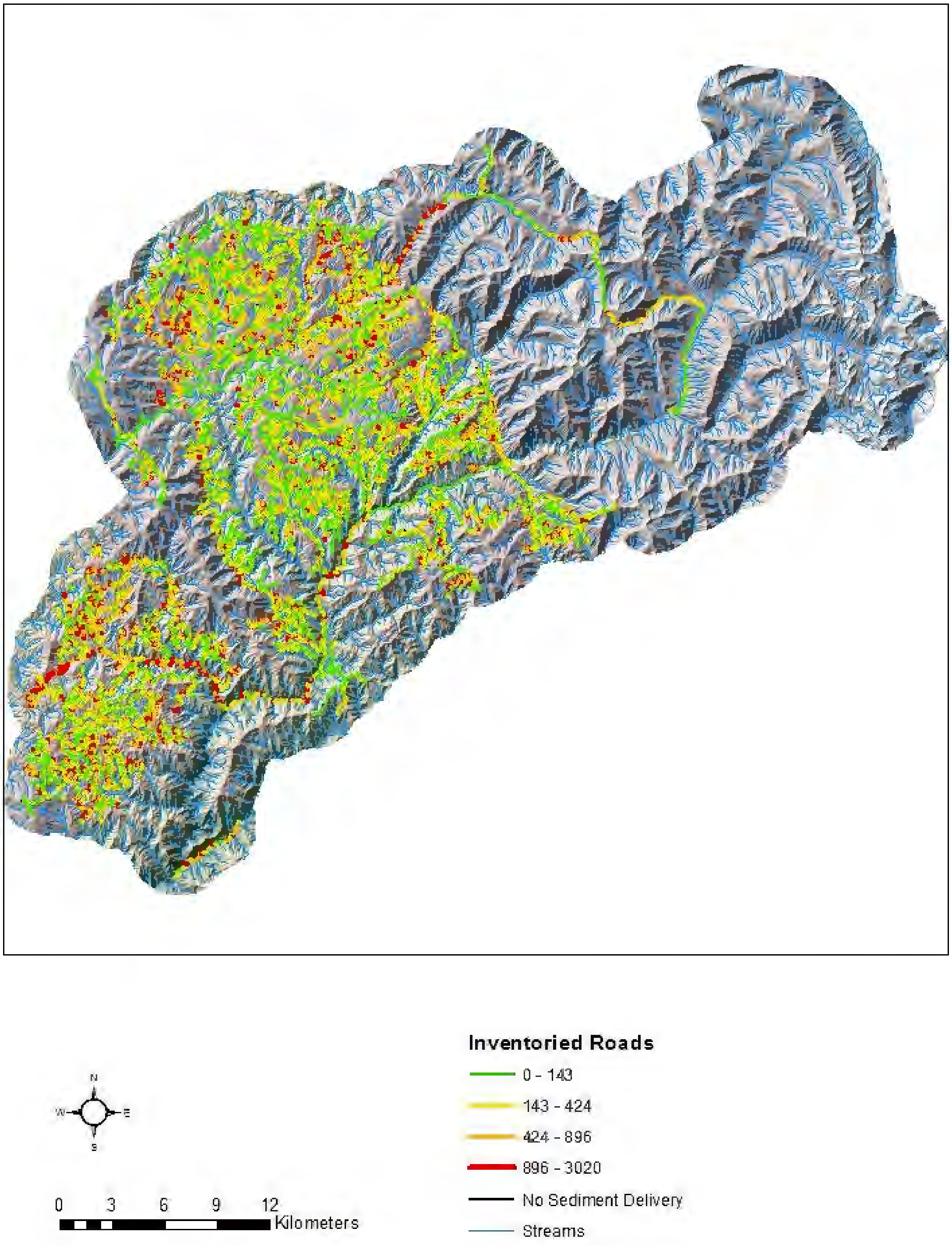
Alternative1_RoadDrainPoint0Diss	Dissolved drainpoints for Initial condition
Alternative1_RoadDrainPoint1	Drainpoints for Disturbed condition
Alternative1_RoadDrainPoint1Diss	Dissolved drainpoints for Disturbed condition
Alternative1_RoadDrainPoint2	Drainpoints for Recovered condition
Alternative1_RoadDrainPoint2Diss	Dissolved drainpoints for Recovered condition
Alternative1_RoadSegment0	Road segments for Initial condition
Alternative1_RoadSegment1	Road segments for Disturbed condition
Alternative1_RoadSegment2	Road segments for Recovered condition
Alternative1_RoadSplitPoint0	Road split points for Initial condition
Alternative1_RoadSplitPoint1	Road split points for Disturbed condition
Alternative1_RoadSplitPoint2	Road split points for Recovered condition
Layers	**Geodatabase folder for feature classes related to initial model**
CalibrationZone	Calibration zone feature class
Catchment	Catchments feature class
DrainageLine	Drainage lines (streams) feature class
DrainagePoint	Stream network intersection points
DrainPointObserved	Observed drainpoints; copy of Input Known Drains
Road	Road feature class with GRAIP_Lite attributes, including QC
Road_overlap	Overlapping road segments, part of QC
RoadDrainPoint	Drainpoints
RoadDrainPointDiss	Dissolved drainpoints
RoadInit	Road feature class with GRAIP_Lite attributes
RoadSegment	GRAIP_Lite road segments
RoadSplitPoint	GRAIP_Lite road split points

APUNIQUEID	
Baserate	Table with baserates by calibration
DeliveryProbability	Table with delivery probability curves by calibration
DrainageLine_FS	
GLAlternatives	Descriptions of alternatives analyzed
GLDefaultVTLSbyML	Default vegetation, traffic, split lengths, and surfacing by maintenance level
GLRoadTreatment	VTLS by treatment type
MaintenanceLevelLookup	Lookup table to fill in missing maintenance levels base on ROUTE_STAT field
RoadSegmentSizeCategory	Maximum road segment length definitions for delivery curves
SplitDistancebyMaintenanceLevel	Maximum road segment lengths by maintenance level
SurfaceFactor	Surface factors by surface type and traffic level
SurfaceTypeLookup	Lookup table to condense INFRA surface type values
TrafficbyMaintenanceLevel	Default traffic levels based on maintenance level
VegFactor	Vegetation factors by calibration, surface type, and maintenance level
VegFactorbyVegCover	Vegetation factors for Bare and Covered values for treatment options
project.mxd	Map document in which GRAIP_Lite is done.
Input Roads	Input road layer, line shapefile or feature class, must have route status, maintenance level, and surface type fields with appropriate values
Input Calibration Zones	Input calibration zones, polygon shapefile or feature class, must have name field with appropriate values

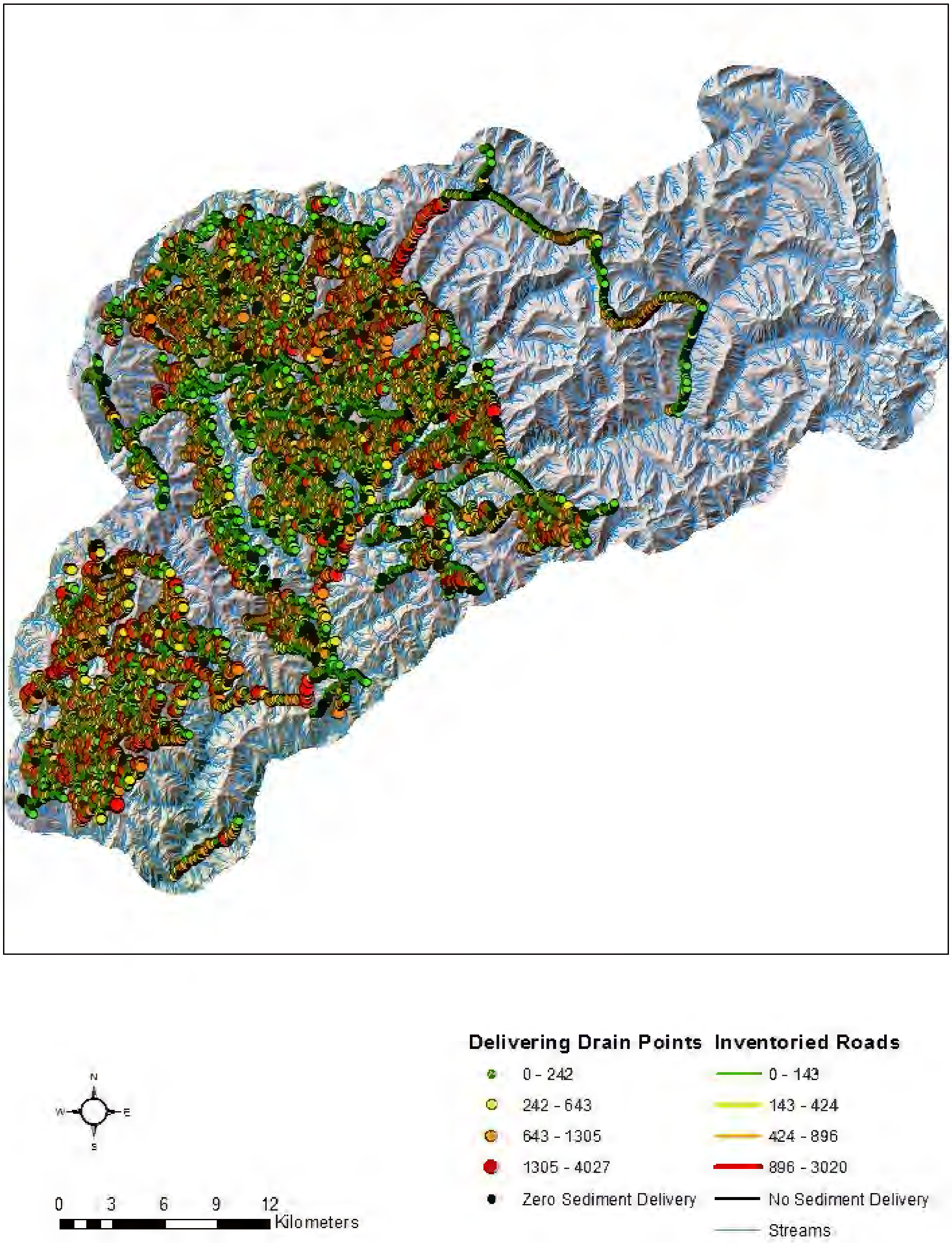
Input Known Drains	Input known drains, point shapefile or feature class

Appendix D: Basic Report Example

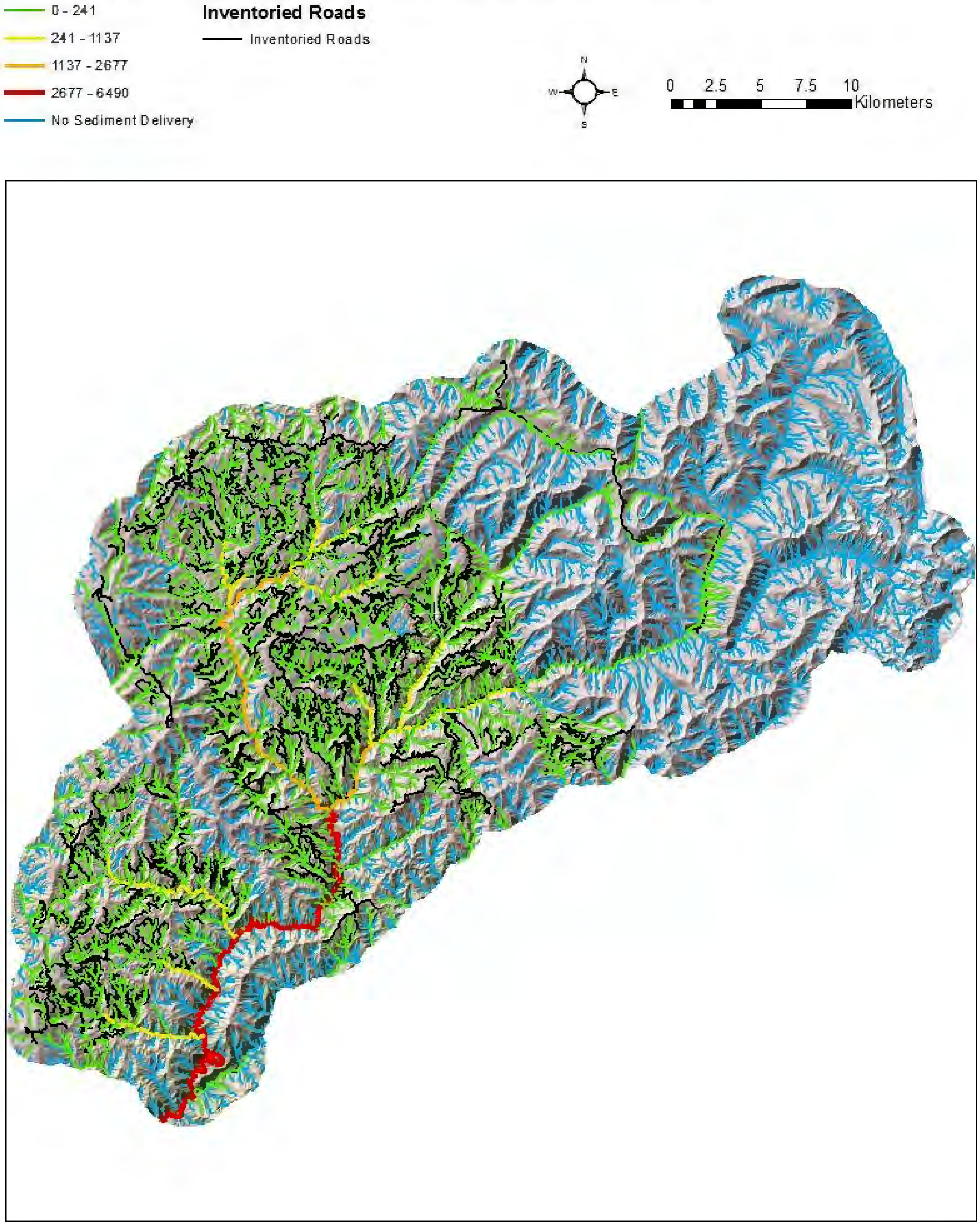
Annual Road Surface Sediment Delivery (kg/yr)



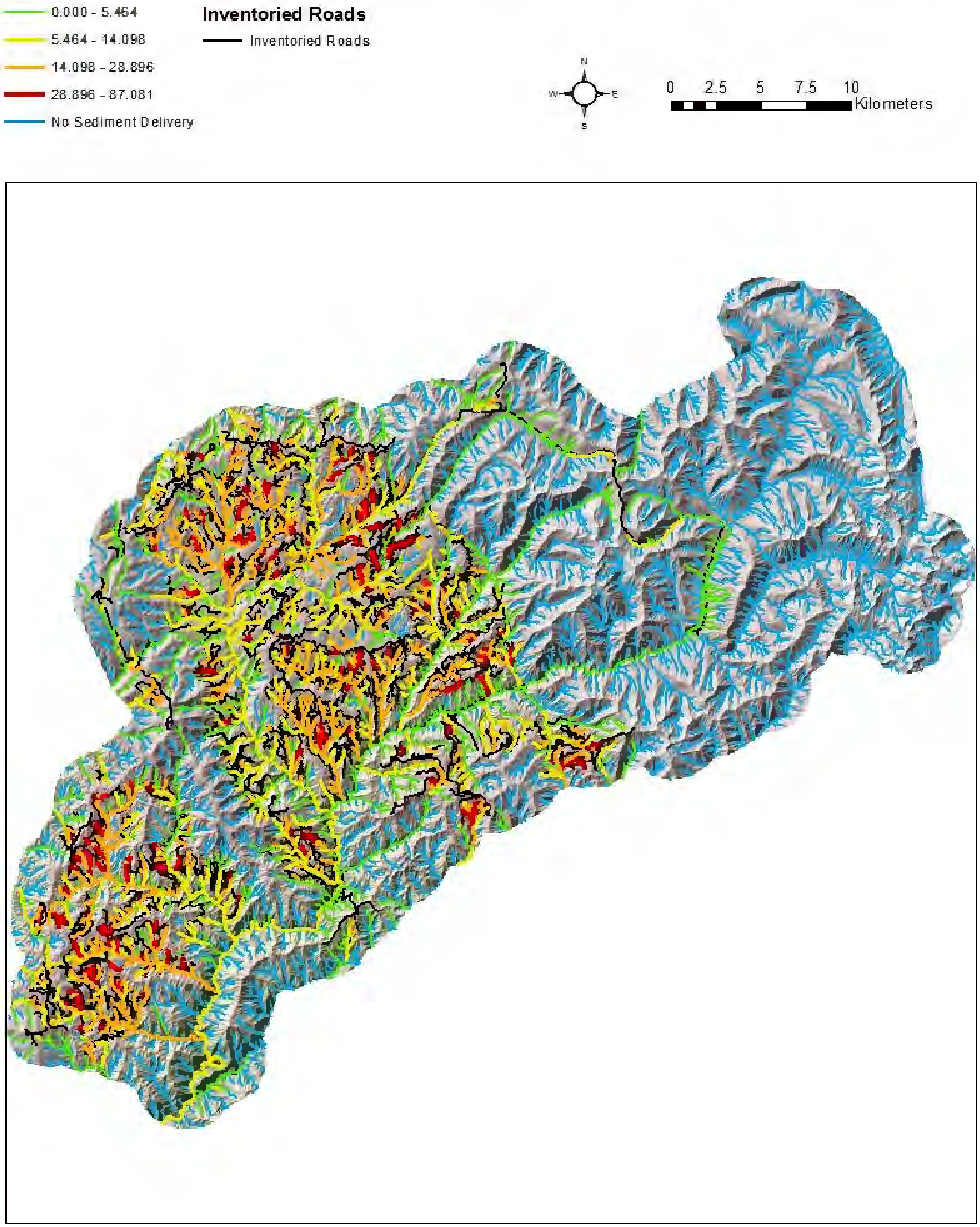
Annual Road Surface Sediment Delivery (kg/yr)



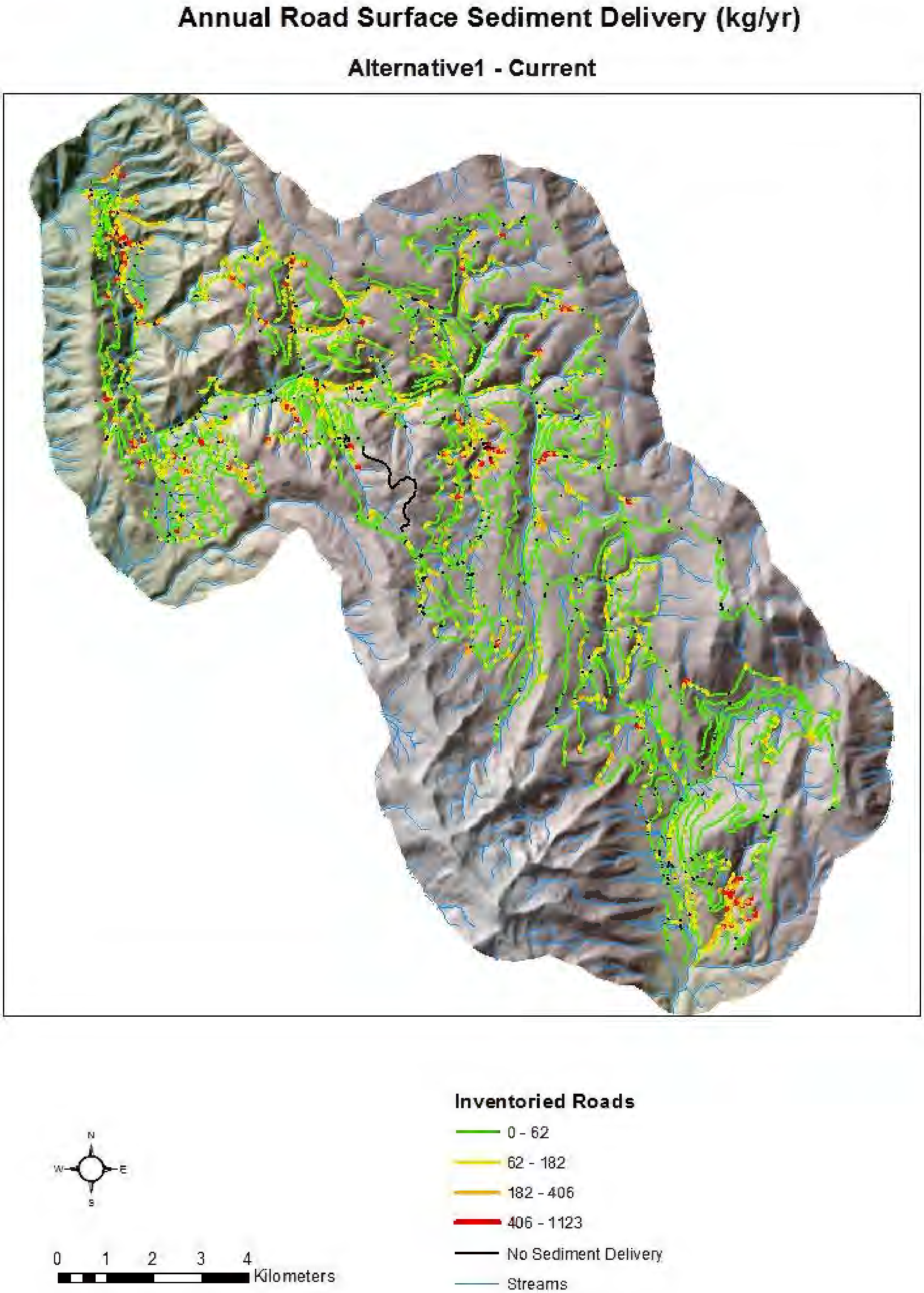
Road Surface Sediment Accumulation in Streams (ton/yr)



Road Surface Specific Sediment Accumulation in Streams (ton/yr/sqkm)



Appendix E: Alternative Report Example



Annual Road Surface Sediment Delivery (kg/yr)

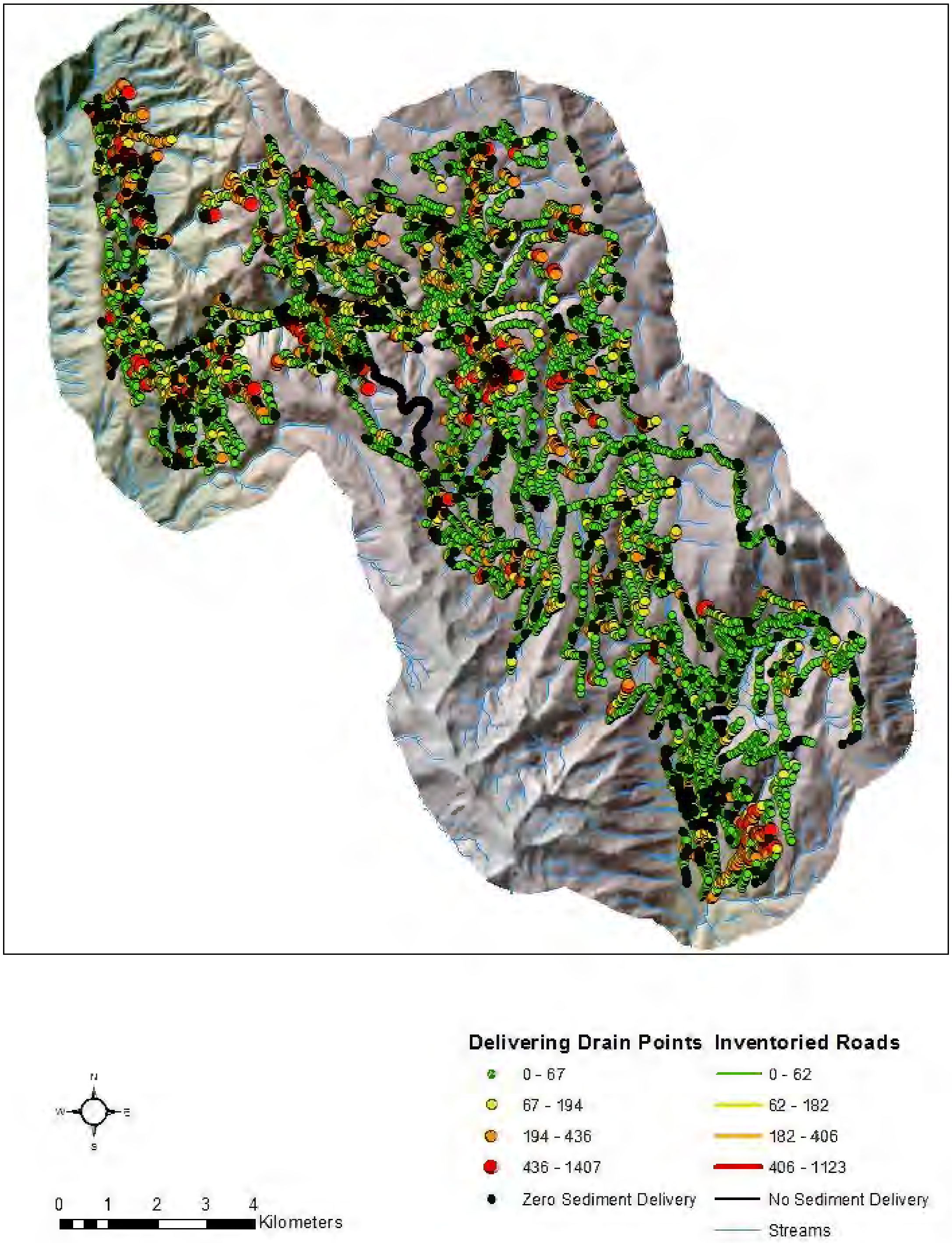
Alternative1 - Disturbed

Annual Road Surface Sediment Delivery (kg/yr)

Alternative1 - Long Term

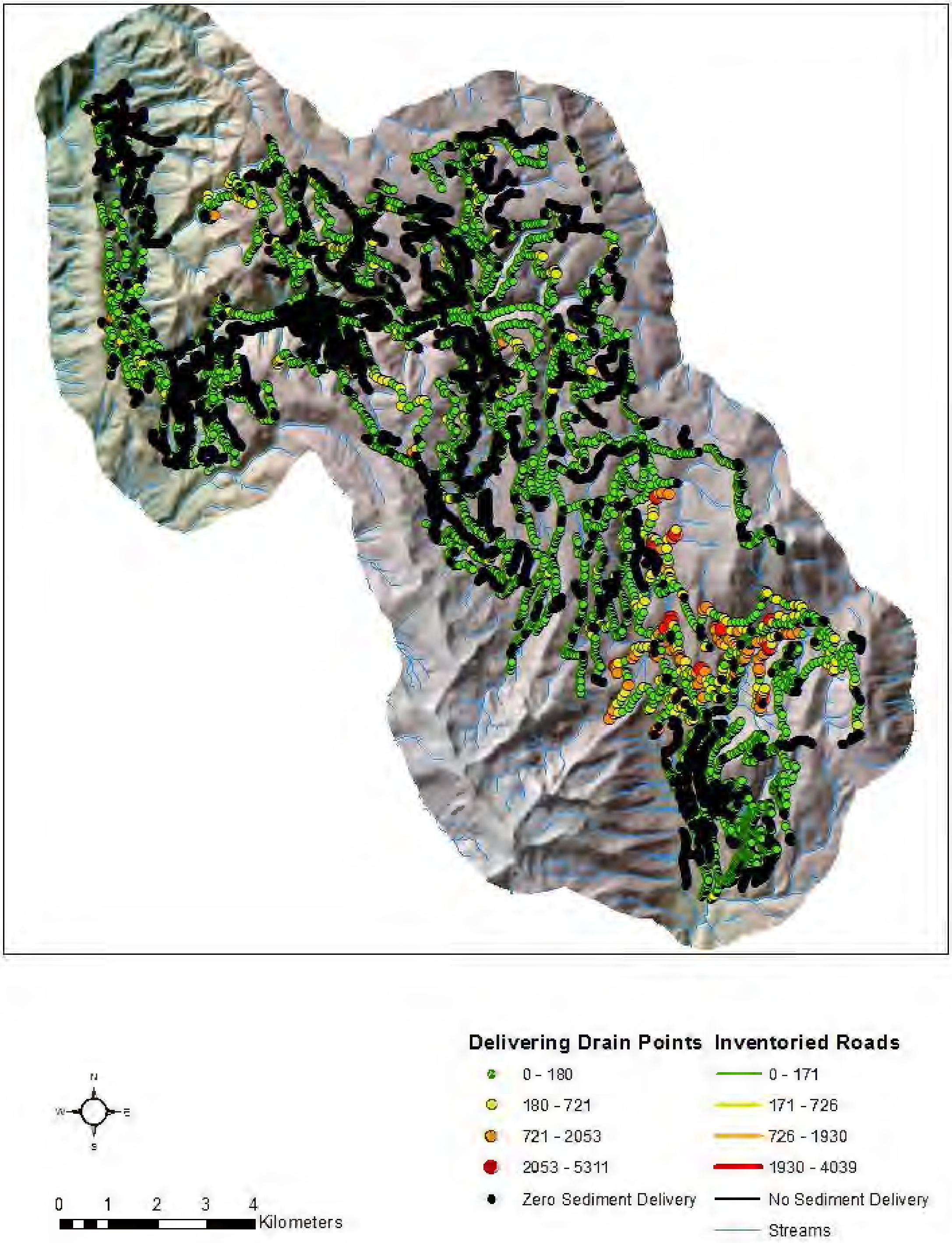
Annual Road Surface Sediment Delivery (kg/yr)

Alternative1 - Current



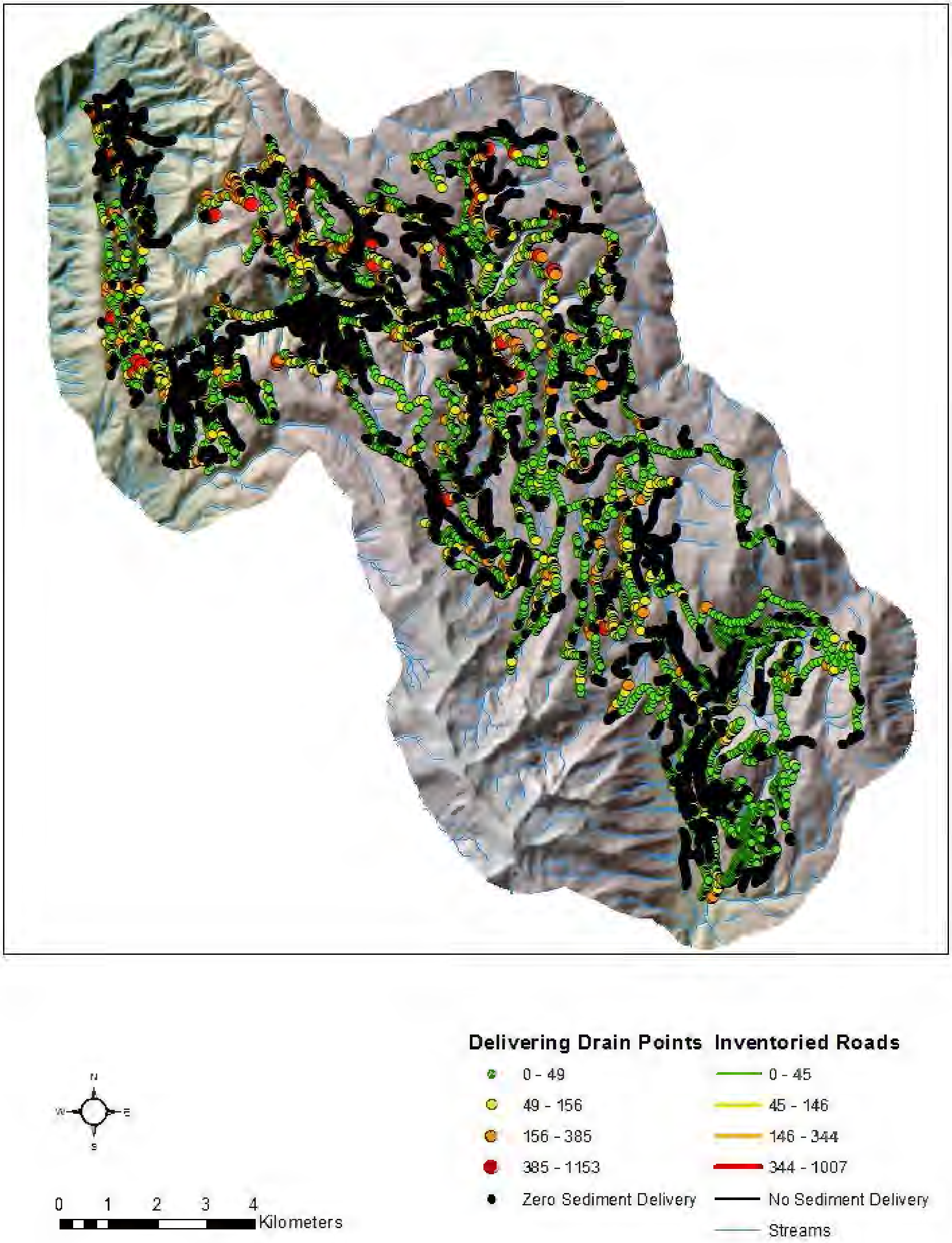
Annual Road Surface Sediment Delivery (kg/yr)

Alternative1 - Disturbed



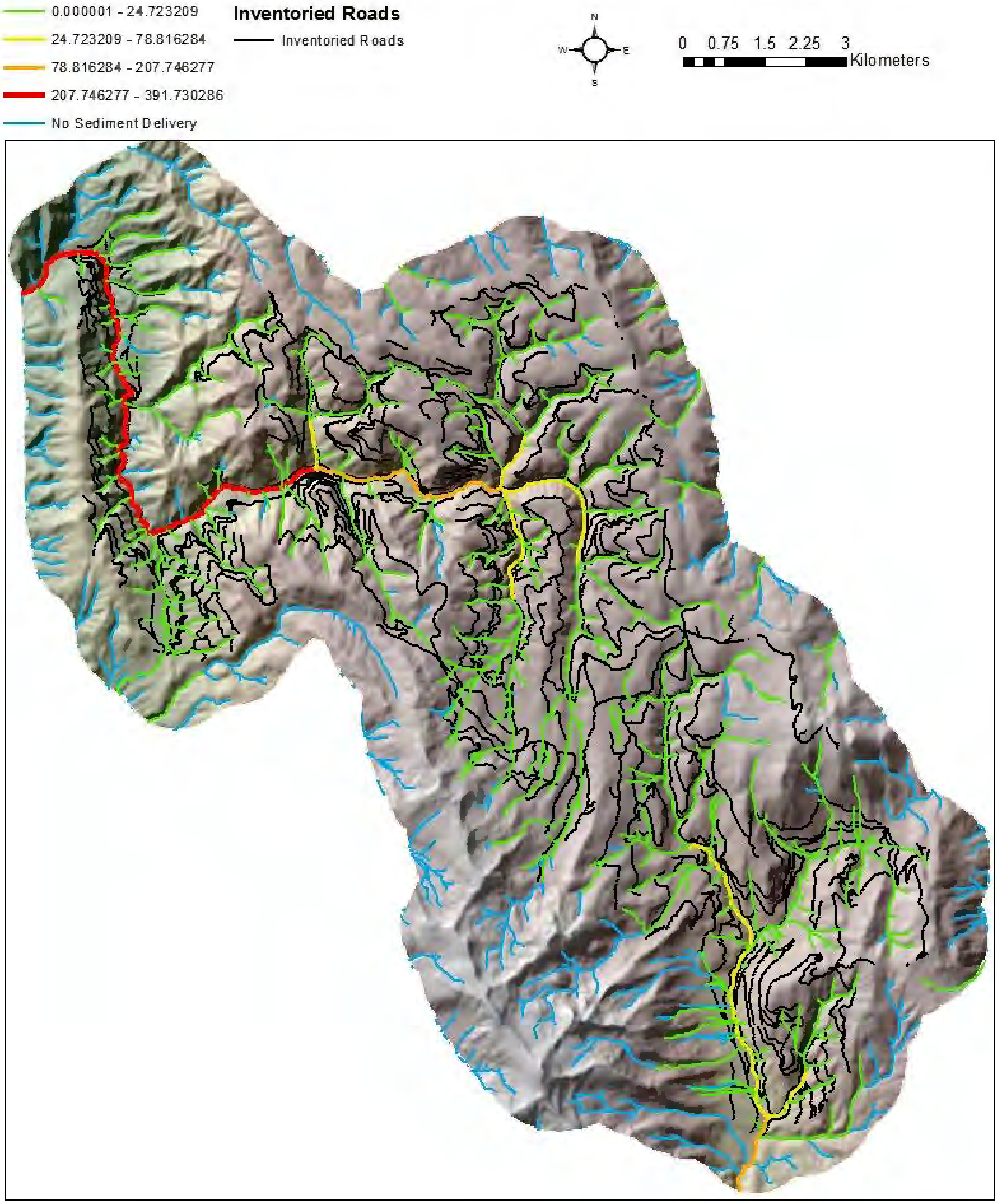
Annual Road Surface Sediment Delivery (kg/yr)

Alternative1 - Long Term



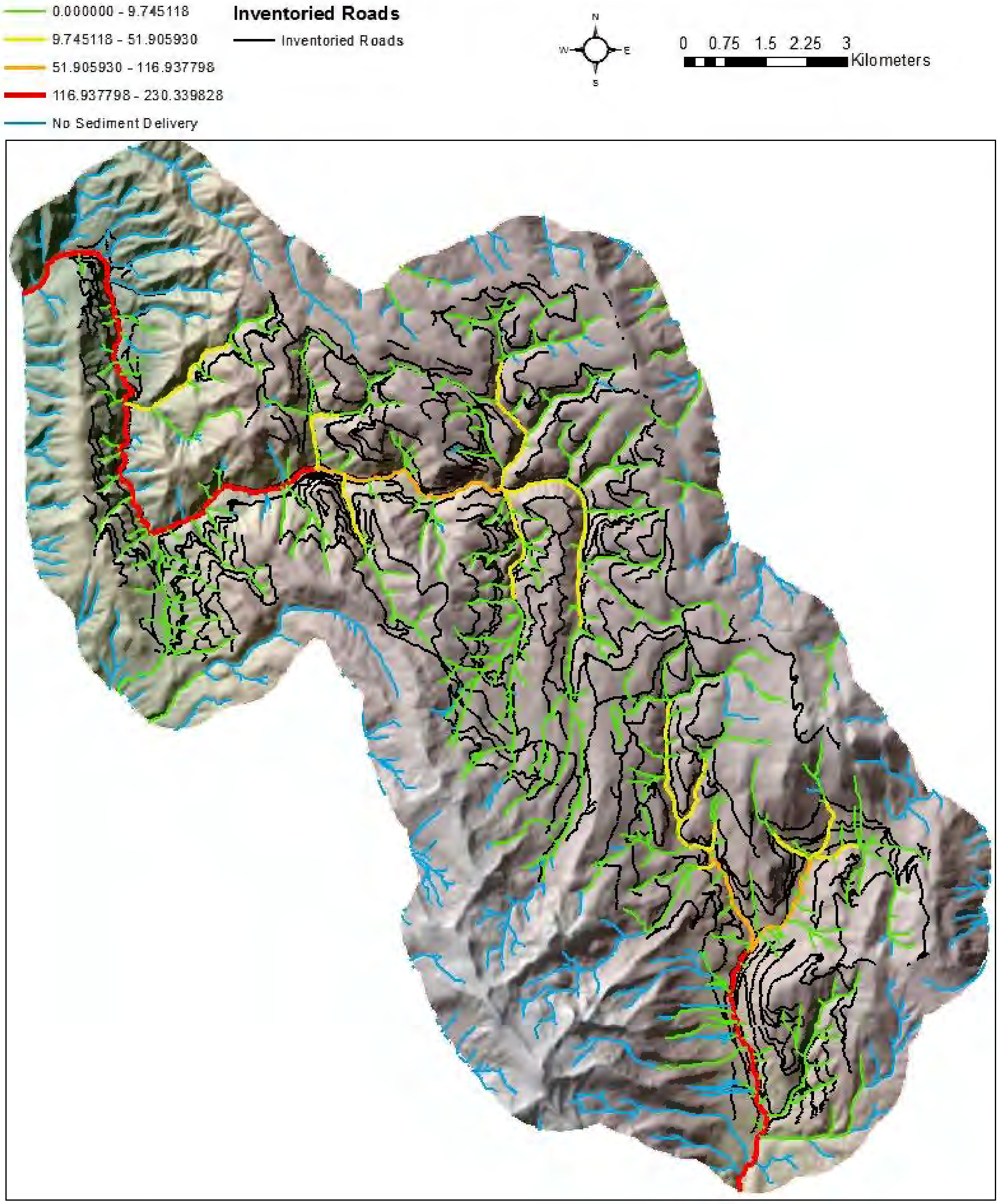
Road Surface Sediment Accumulation in Streams (ton/yr)

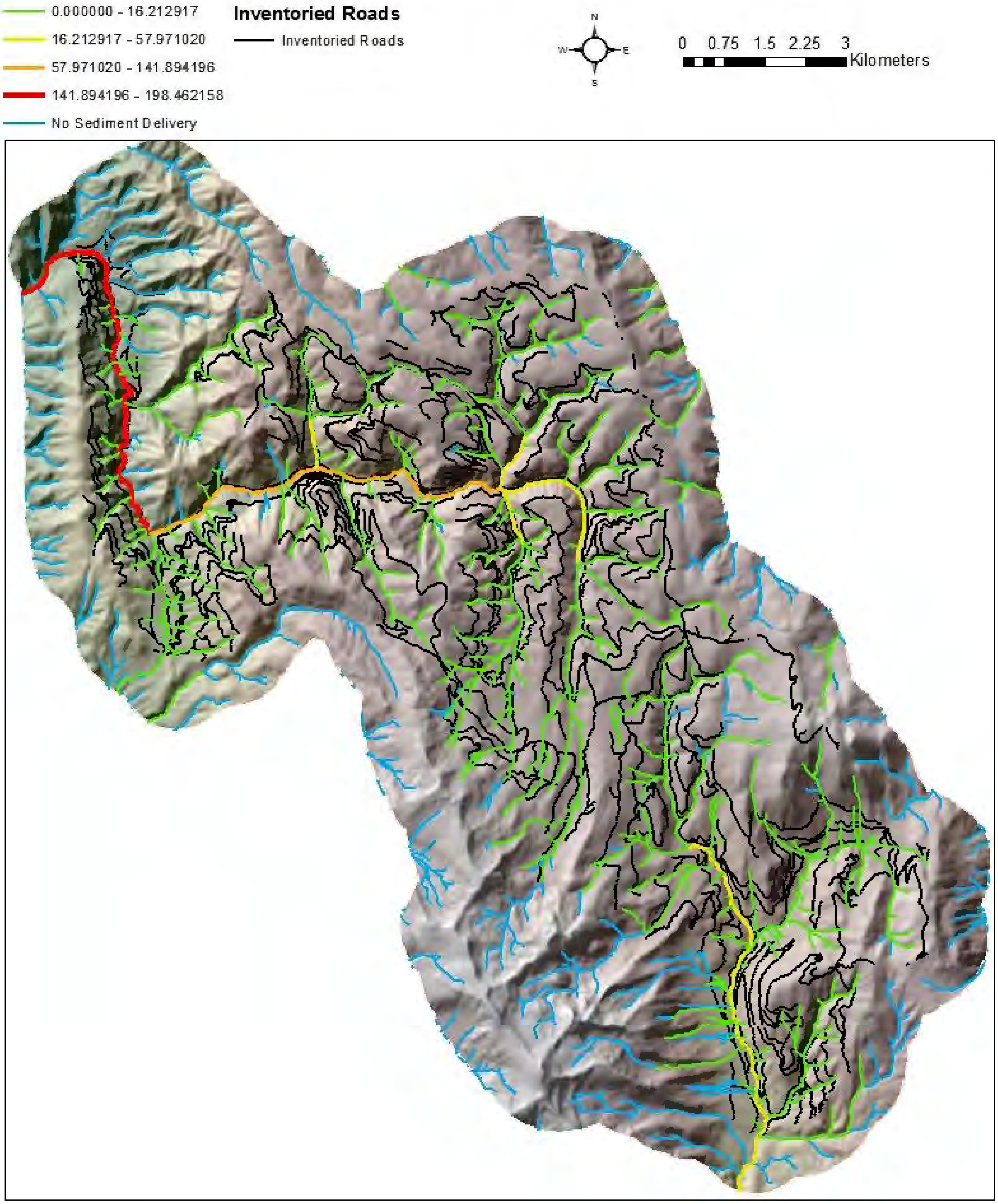
Alternative1 - Current



Road Surface Sediment Accumulation in Streams (ton/yr)

Alternative1 - Disturbed



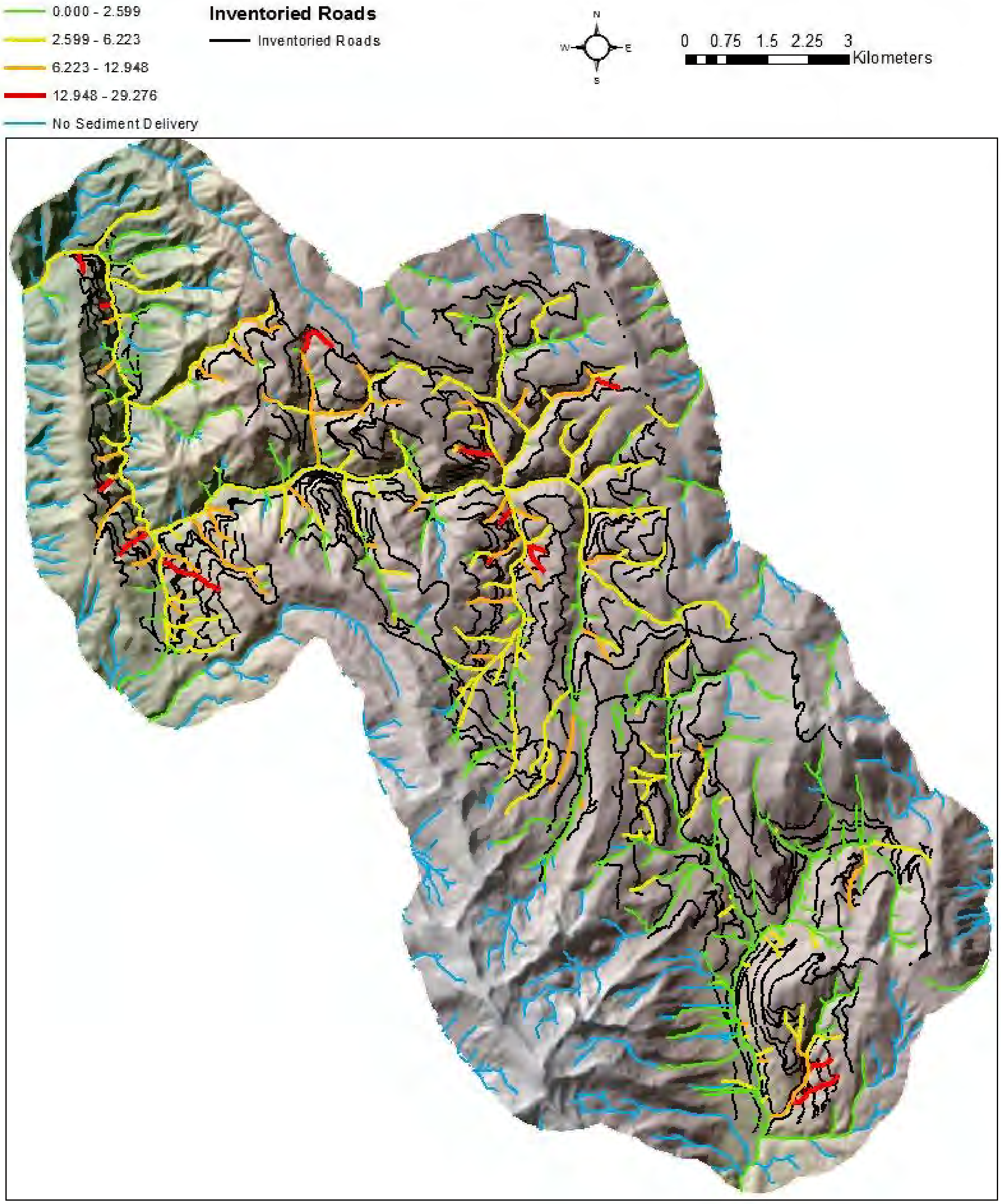


Road Surface Sediment Accumulation in Streams (ton/yr)

Alternative1 - Long Term

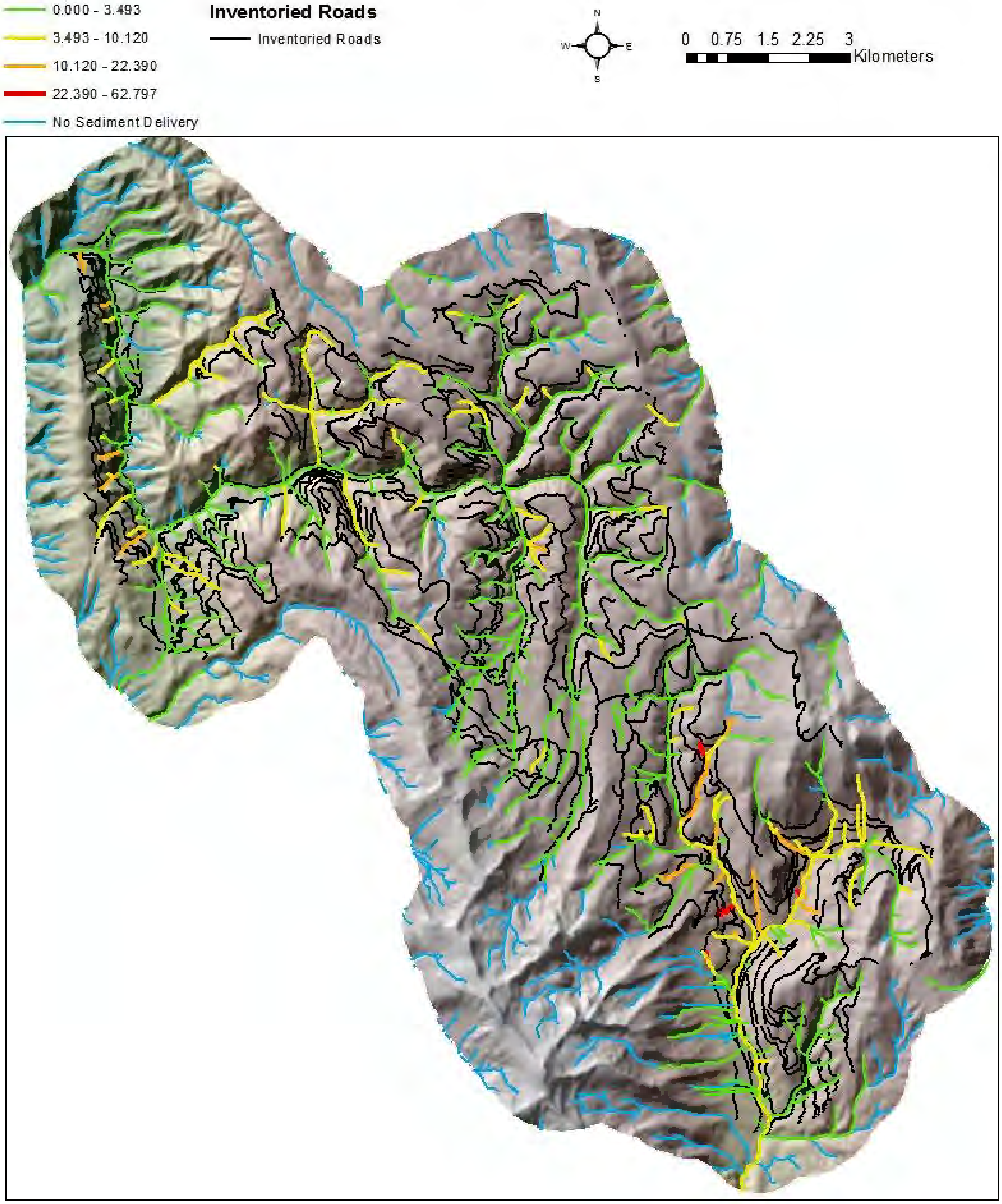
Road Surface Specific Sediment Accumulation in Streams (ton/yr/sqkm)

Alternative1 - Current



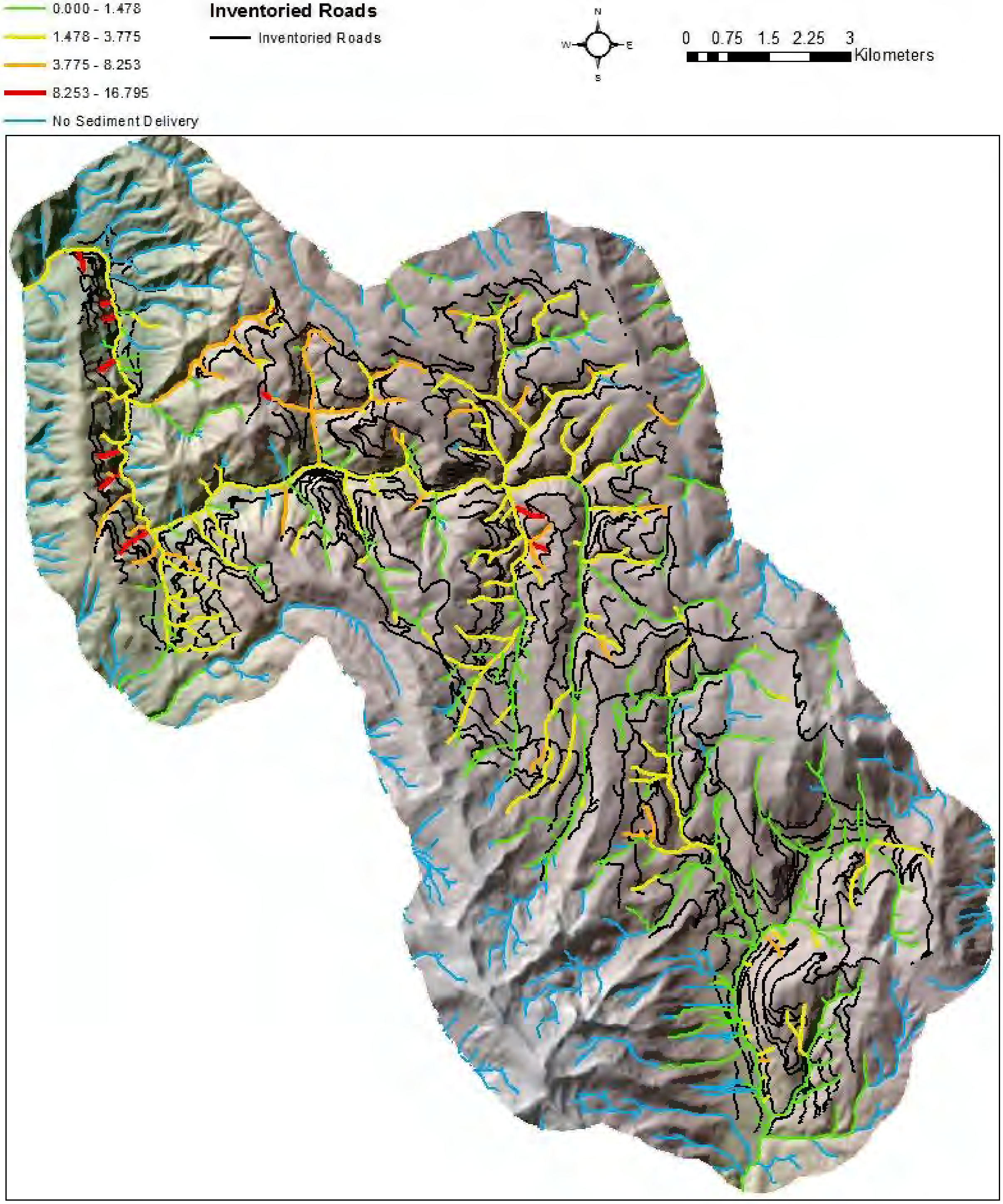
Road Surface Specific Sediment Accumulation in Streams (ton/yr/sqkm)

Alternative1 - Disturbed



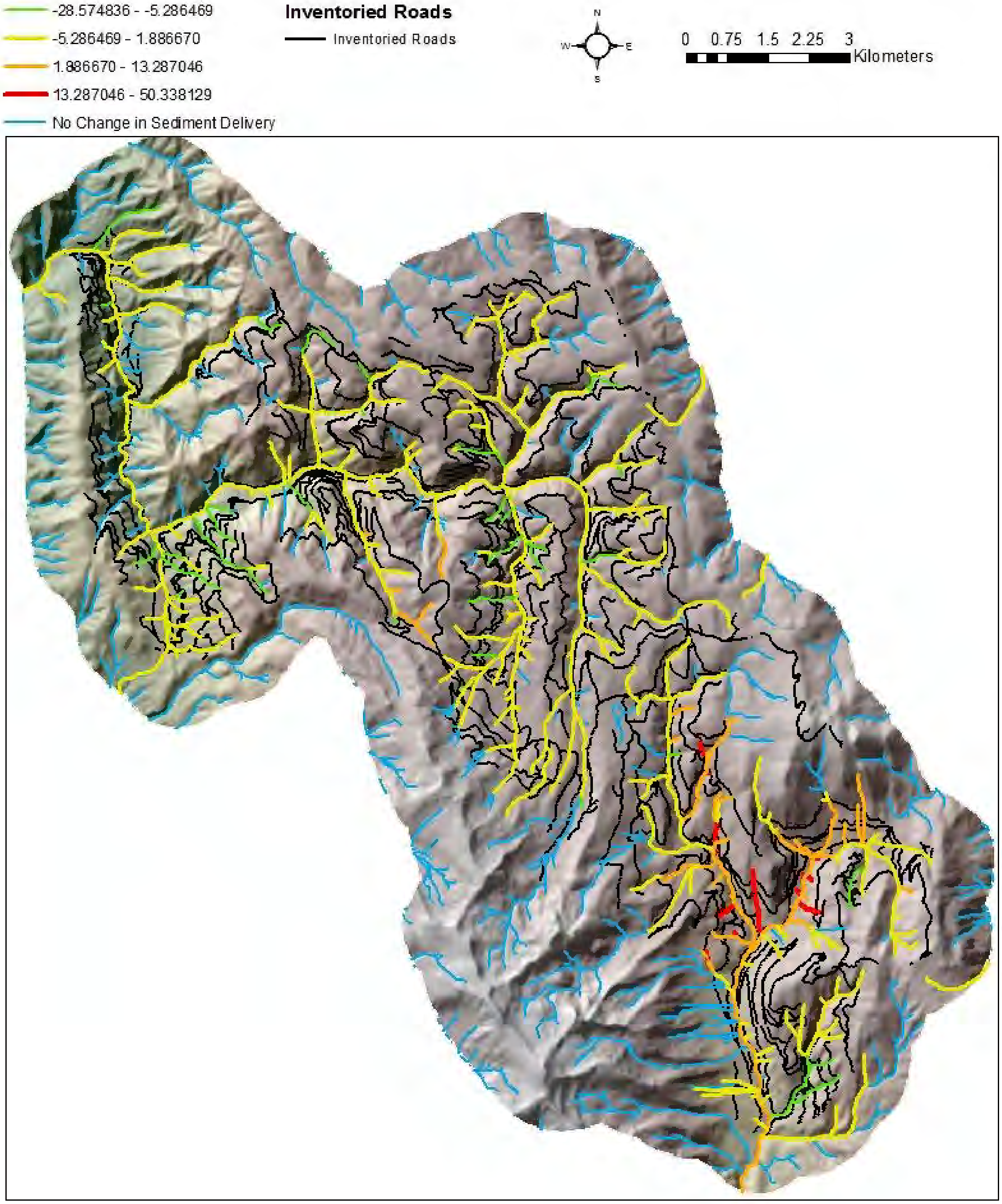
Road Surface Specific Sediment Accumulation in Streams (ton/yr/sqkm)

Alternative1 - Long Term



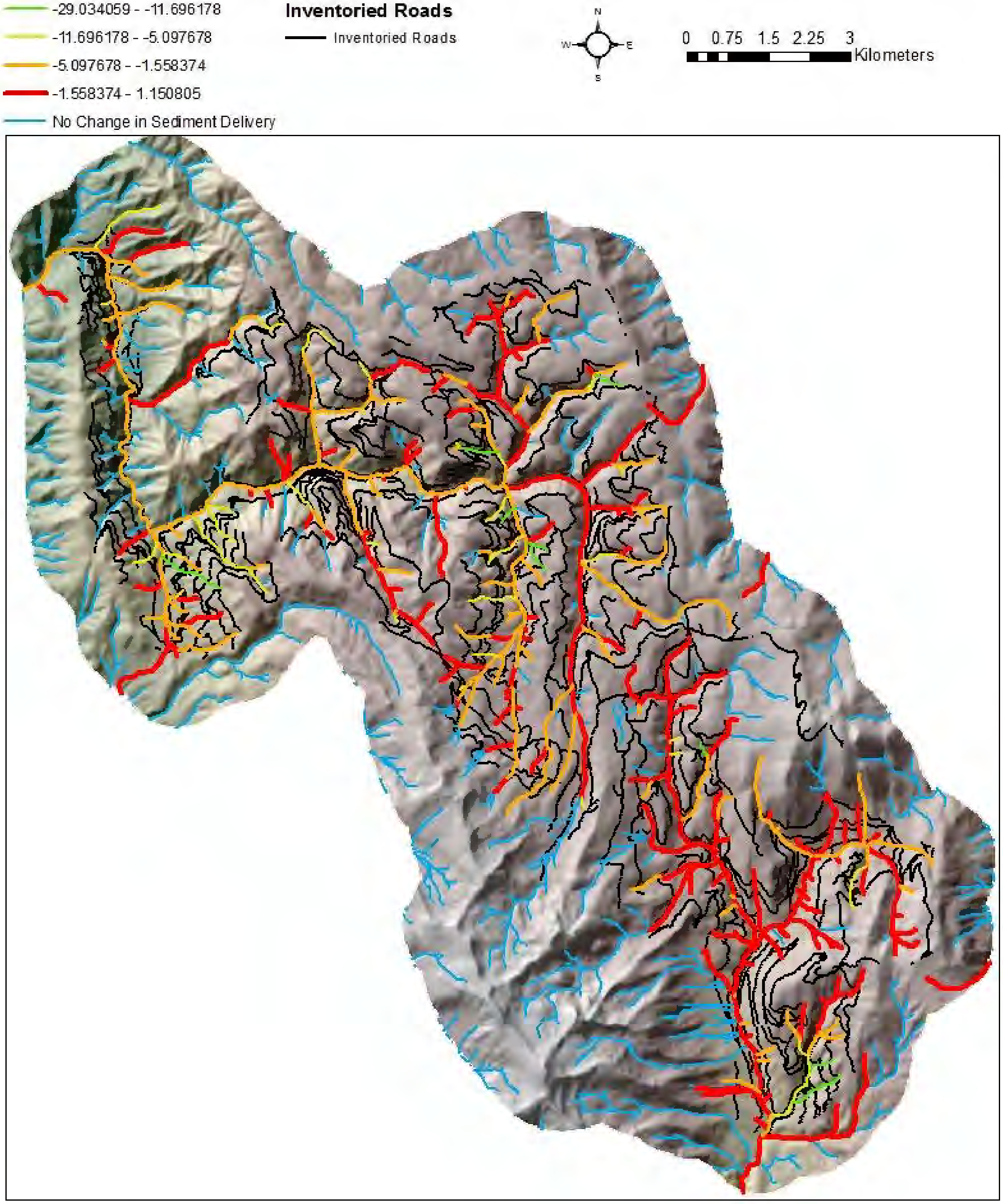
Change in Road Surface Specific Sediment Load in Streams (ton/yr/sqkm)

Alternative1 - Disturbed



Change in Road Surface Specific Sediment Load in Streams (ton/yr/sqkm)

Alternative1 - Long Term



Appendix F: Tips and Tricks

How to change traffic levels, surface types, maintenance levels, and split distances when using the Processing tools in GRAIP_Lite.

Run the Initialize GRAIP Lite Database tool. This imports the roads and creates the GL_Traffic field in the Road feature class. The process to change the traffic could also be used to update surface type or maintenance level fields as well to correct inaccuracies in the INFRA layer used as input.

1. Start an editing session and select the Road feature class as your editing target.
2. Select the roads on which you need to make the changes.
3. Open the attribute table for the Road feature class and scroll to the right until you find GL_Traffic.
4. For your selected roads, click in the GL_Traffic field, which should open a drop-down menu of the available options.
5. Select the option you want, which won't be <null> unless you are trying to crash GRAIP_Lite.
6. Save edits and exit the editing session.
7. Continue with the GRAIP_Lite run.

For numeric fields like GL_MaintenanceLevel or GL_SplitDistance, you don't get a drop-down menu so you need to be a little more careful about what numbers you put in there, especially for maintenance level.

How to reset the calibration zone from Default.

Run the Initialize GRAIP Lite Database tool. One of the things this does is create a CalibrationZone feature class in the geodatabase if you haven't provided one. The CalibrationZone will be the same extent as the DEM you supplied, and stores the name of the calibration data set to be used in the GL_CalibrationZone field. If you change this name to match a different existing calibration data set, it will make the model use the corresponding calibration data for baserate, vegetation factors, and delivery curves. If you change it to something that does not match the names used for existing calibration data sets, you need to provide the data for the calibration or the model will crash.

Glossary

Calibration zone: A polygon that defines which calibration, with its attendant baserate, vegetation factors, and delivery curves, is used for modelling roads within that polygon.

Connected road density: The density of stream-connected road within the contributing watershed area for a given stream reach, reported as GL_RoadDen in the DrainageLine feature class. Connected road length is determined for each road segment as the road length multiplied by the delivery probability; this is then accumulated through the stream network and normalized by contributing area. The units are km/km^2.

Connected road length: The length of stream-connected road within the contributing watershed area for a given stream reach, reported as GL_RoadLen in the DrainageLine feature class. Connected road length is determined for each road segment as the road length multiplied by the delivery probability; this is then accumulated through the stream network. The units are km.

Drainpoint: A point on the road network where water and sediment leave the road. In GRAIP_Lite, these are arbitrarily defined based on topography and other factors except where known drainpoints are present in the known drainpoints layer.

Sediment accumulation: The sum of all delivered sediment that is routed to a given stream reach, reported as GL_SedAccum in the DrainageLine feature class. The units are Mg/yr.

Sediment delivery: That portion of sediment produced on the road surface that makes it into the stream network, reported as GL_SedDel in the RoadSegment, RoadDrainPoint, and RoadDrainPointDiss feature classes. The units are kg/yr.

Sediment production: Surface erosion generated on the road tread and ditch, reported as GL_SedProd in the RoadSegment and RoadDrainPoint feature classes. The units are kg/yr.

Specific sediment delivery: Sediment accumulation normalized by contributing area, reported as GL_SpecSedDel in the DrainageLine feature class. The units are Mg/yr/km^2.

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The Panel on Health Risks and Toxicological Effects of Methylmercury:
Donna Mergler, Henry A. Anderson, Laurie Hing Man Chan, Kathryn R. Mahaffey, Michael Murray, Mineshi Sakamoto and Alan H. Stern

Methylmercury Exposure and Health Effects in Humans: A Worldwide Concern

The paper builds on existing literature, highlighting current understanding and identifying unresolved issues about MeHg exposure, health effects, and risk assessment, and concludes with a consensus statement. Methylmercury is a potent toxin, bioaccumulated and concentrated through the aquatic food chain, placing at risk people, throughout the globe and across the socioeconomic spectrum, who consume predatory fish or for whom fish is a dietary mainstay. Methylmercury developmental neurotoxicity has constituted the basis for risk assessments and public health policies. Despite gaps in our knowledge on new bioindicators of exposure, factors that influence MeHg uptake and toxicity, toxicokinetics, neurologic and cardiovascular effects in adult populations, and the nutritional benefits and risks from the large number of marine and freshwater fish and fish-eating species, the panel concluded that to preserve human health, all efforts need to be made to reduce and eliminate sources of exposure.

INTRODUCTION

The Panel on Health Risks and Toxicological Effects of Methylmercury received the mandate to describe and synthesize current scientific knowledge on methylmercury (MeHg) exposure and its effects in humans and to identify research gaps. The present paper is not intended to be a comprehensive review and presentation of all the literature on MeHg exposure and effects in humans but builds on earlier literature, other reviews, and more recent literature in highlighting the current understanding in the field and what we consider to be remaining unresolved issues. Humans are exposed to different forms of mercury (Hg), and potential health risks from forms other than MeHg can occur, including mercury vapor from dental amalgams, as well as from occupational exposures (e.g., dental offices, chloralkali plants, fluorescent lamp factories, mercury mining) and from artesanal and small-scale gold and silver mining operations (1–5), the present document does not cover these exposures, because the pathways of exposure and effects differ from those for MeHg. Here, we examine issues of MeHg exposure, studies on its health effects and major risk assessments, and conclude with our consensus statement.

MeHg Exposure

Sources of exposure. Methylmercury contamination poses a particular challenge to public health because this toxicant is mainly contained in fish, a highly nutritious food, with known benefits for human health. Moreover, fish are culturally vital for many communities and constitute an important global commodity. Although we often refer to "fish" in a generic way, all fish do not have similar amounts of mercury. As a result of bioaccumulation of MeHg through multiple levels of the aquatic food web, higher tropic-level pelagic fish can be contaminated with MeHg at concentrations in excess of 1 part per million (ppm). The concentrations of total Hg vary widely across fish and shellfish species, with the mean values differing by as much as 100-fold (6). Methylmercury is bound to proteins, as well as to free amino acids, that are components of muscle tissues, and are not removed by any cooking or cleaning processes that do not destroy muscle tissues.

Although in general, MeHg accumulates in fish through the food chain, consumption of farmed fish can also lead to MeHg exposures, in part, because of the presence of MeHg in feed (7). Some studies have shown no significant difference in MeHg levels in farmed *vs.* wild salmon, although concentrations in both cases are relatively low (8, 9). Although fish and shellfish are the predominant sources of MeHg in the diets of humans and wildlife, a few reports of other sources exist. Rice cultivated in areas contaminated with mercury can contain relatively high levels of MeHg (10). Methylmercury has also been reported in organ meats of terrestrial animals (11), as well as in chicken and pork, probably as a result of the use of fish meal as livestock feed (12). Some communities also have higher MeHg exposure because of the consumption of fish-eating marine mammals (13, 14).

Profiles of exposure. Although most reports on MeHg exposure focused on specific populations generally assumed to have high levels of fish consumption, estimates of general populations exposure exist for the United States (15, 16), Germany (17), and Japan (18) [summarized in Pirrone and Mahaffey (19)]. For populations that are not selected on the basis of high fish consumption, mean hair Hg levels generally range from >0.1 $\mu g\ g^{-1}$ to <1.0 $\mu g\ g^{-1}$ (20–25). The mean blood Hg for such populations is generally in the range of <1.0 $\mu g\ L^{-1}$ to <5.0 $\mu g\ L^{-1}$, although, worldwide there are fewer data on MeHg exposure based on blood than on hair. In the United States nationally, about 5–10% of the population of women of childbearing age have hair levels exceeding 1.0 $\mu g\ g^{-1}$ (16) and blood levels exceeding 5 $\mu g\ L^{-1}$ (26). In Japan, where more fish is consumed, 73.7% of women of this age have hair levels above 1.0 $\mu g\ g^{-1}$ and 1.7% above 5 $\mu g\ g^{-1}$ (18). In Germany, the 1998 geometric mean blood level was 0.58 $\mu g\ L^{-1}$ (17).

High levels of Hg exposure were identified in numerous fish-eating populations throughout the world [for reviews see: Pirrone and Mahaffey (19)]. Many of these live near oceans, major lakes and rivers, or hydroelectric dams, and are often dependent on local catch, with fish an integral part of their cultural traditions. In the sea islands of the Faroes and Seychelles, median mothers' hair Hg concentrations were 4.5 $\mu g\ g^{-1}$ [with 27% above 10 $\mu g\ g^{-1}$ (27)] and 5.8 $\mu g\ g^{-1}$ (28), respectively. In the river basins of the Amazon, where a large number of studies was carried out on populations for whom freshwater fish is a dietary mainstay, median hair Hg levels typically range between 5 $\mu g\ g^{-1}$ and 15 $\mu g\ g^{-1}$ (29–34).

Despite the importance of local catch, fish is also a global commodity and market fish, such as shark, tuna, and swordfish, or canned white tuna (35), consumed by persons living far away from the source can likewise have high levels of MeHg. In the United States, individuals with high blood Hg concentrations were reported among affluent urbanites who ate large quantities of marine fish, high in the food web (36, 37). Thus, elevated MeHg exposure is present around the globe, with no geographic, social, economic, or cultural boundaries.

Biomarkers of MeHg exposure. Hair and blood Hg concentrations are both accepted as valid biomarkers of MeHg exposure, although each provides a somewhat different reflection of exposure (38). Blood gives an estimate of exposure over the most recent one to two half-lives, with the half-life of MeHg in blood being 50–70 days, whereas hair reflects the average exposure over the growth period of the segment (28). Hair Hg is predominantly MeHg, with MeHg constituting from 80% to 98% of hair total Hg (33, 39). For populations with regular and frequent fish consumption, hair total Hg and blood MeHg are consistently correlated (40). Generally, hair is 250 to 300 times more concentrated in mercury than is blood (39). However, in populations and individuals with infrequent fish consumption or where bolus doses of MeHg occur, there can be considerable inter- and intraindividual variability in the relation between hair and blood Hg levels resulting from temporal differences in the retention of Hg by each biomarker (33, 40, 41). Segmental analyses of hair Hg can provide a chronology of exposure over time (24, 28, 29, 33). However, information on short-term peaks in exposure is not well represented by such analyses (38). Another consideration is that the growth rate of hair, generally estimated at 1 cm mo^{-1}, can have both inter-and intraindividual variability (38). Recent advances in a single hair-strand analysis (42), including measurement of Hg at micron resolution by using laser ablation (43) should yield more information on the relation between Hg uptake and Hg deposition in hair.

The Hg levels in toenails and fingernails also were used as biomarkers of Hg exposure, mostly in major studies of the cardiovascular effect of MeHg (see below) (44, 45), but to what extent these reflect organic or inorganic Hg exposures remains to be clarified (46). A recent study of women, with no history of occupational exposure to Hg, showed similar correlations between Hg intake through fish consumption and both toenail and hair Hg concentrations; however, only total Hg was assessed (47). In this study, hair, toenail, and urinary total Hg were highly correlated. Urinary Hg levels largely reflect exposure to inorganic Hg (40) and are not considered useful bioindicators of MeHg exposure. There are, however, several recent reports of positive correlations between fish consumption and urinary Hg (48–50), and investigators of these studies propose that demethylation may account, at least partially, for this observation. The relation of fish consumption and inorganic Hg in different biological tissues, and its consequence for human health still need to be elucidated.

Health effects from low to moderate levels of MeHg exposure were reported in a variety of systems and domains. Each of these effects may depend on different aspects of exposure [e.g., fish-eating patterns, time of exposure (first, second, or third trimester, childhood, adulthood)]. Therefore, the different reflections of exposure provided by hair and blood Hg concentrations may provide different information about dose-response for different exposure populations and different exposure scenarios. Few studies investigated side-by-side dose-response relations for both biomarkers. In the study in the Faroe Islands, maternal hair and fetal-cord blood predicted similar but not identical patterns of effect across various measures of neurologic performance (38).

Fish Consumption as a Predictor of MeHg Exposure

Exposure dose. Although most studies identified a clear association between the quantity and the frequency of fish consumption and Hg exposure, there is considerable interindividual and intergroup variability in the relation between the amount or the frequency of fish consumption and the levels of biomarker of MeHg exposure. Several factors mediate this relation. The MeHg concentration within and across species of dietary fish is an obvious source of variability. For example, those who eat mainly carnivorous fish and/or fish-eating mammals have relatively higher levels of Hg compared with those who eat mainly noncarnivorous fish (14, 29, 33, 51–54). Independent of the MeHg concentration, the frequency of fish consumption is also an important factor in this variability. Because biomarkers reflect the weighted average of exposure over time, short-term reporting of fish consumption may not correspond with a longer-term average of MeHg exposure. Under some circumstances, episodic exposures can result in large bolus doses of MeHg. Bolus doses can arise, for example, from the infrequent consumption of fish or fish-eating mammals with high concentrations of MeHg. Given practical limitations in sampling frequency, as well as the nature of some of the biomarkers themselves, bolus doses during putative discrete windows of sensitivity in fetal development may not be fully revealed by biomarkers of exposure.

Toxicokinetics. Although most experimental studies on the gastrointestinal absorption of MeHg indicated that nearly 100% of MeHg in fish is absorbed, recently reported animal and human data suggest that there may be substantial variability (55, 56). In animal studies, variation in absorption kinetics was related to factors such as sex and age (57). A further gap exists because human absorption studies were primarily conducted in adult male subjects.

Toxicokinetic (pharmacokinetic) models and physiologically based pharmacokinetic (PBPK) models are applied to estimate internal dose, given a known intake dose, as well as the intake dose, given a measured internal dose (38). The basic one-compartment model (39, 58, 59) is a steady-state model that is intended to predict concentration in a single compartment only (generally, blood). As such, it is less flexible than the PBPK models in predicting nonsteady state conditions and concentrations in other compartments. However, its relative simplicity has allowed it to be used with probabilistic input parameters to obtain estimates of population variability in predictions of blood concentration and intake dose (60). Estimates of concentrations in other compartments (e.g., cord blood) can be made based on empirical ratios relating mercury concentration in blood to mercury concentrations in those compartments (61).

The PBPK models have the potential to predict changes in MeHg concentration in various tissues in response to changes in MeHg intake and in response to physiological changes (e.g., pregnancy, growth). They can be used to predict short-term changes in MeHg concentrations in different compartments during intake and distribution among compartments, if the parameters are correct (62–65).

The validity of these models overall is not thoroughly established under a range of exposures to MeHg by comparison with actual human data. Although they have the theoretical advantage of making predictions under dynamic conditions, the PBPK models are computationally complex and require data on many parameters whose MeHg-specific values have not been defined. This lack of MeHg specific values is a major limitation, particularly for predicting population variability. The extent to which these models rely on coefficients derived from metabolic studies and/or physiological parameters obtained in different populations and subpopulations and studies with other metals/elements, limits their utility. Nonetheless, both simple toxicokinetic models and PBPK models have been used with reasonable consistency for setting public health guidance.

In humans, there is increasing evidence from environmental epidemiology studies of ethnic differences in the relation between Hg intake from fish consumption and bioindicators of exposure (56), suggesting that diet and/or metabolic differences may be influencing mercury uptake and/or excretion. As yet, such differences have not been investigated in metabolic studies. Several studies suggest that selenium (Se) may play a role in MeHg absorption or excretion (66–68), but these data are not consistent. In the Brazilian Amazon, fruit consumption was associated with lower hair Hg concentrations (69). A positive relation was reported between iron and Hg in blood samples collected from Sweden (70). Overall, little is known about the factors that may modulate Hg absorption in humans, and research is needed to better understand this complex issue.

Fetal and infant exposure. One area in which the toxicokinetic data is consistent is the finding that MeHg is actively transferred to the fetus across the placenta via neutral amino acid carriers during gestation (71, 72). Although maternal and cord blood Hg concentration is highly correlated, cord blood MeHg is consistently higher than the corresponding maternal concentration, with an average ratio of about 1.7 (24, 61, 73, 74). Consequently, biomonitoring adult women's blood MeHg as a surrogate for potential fetalexposure, the corresponding fetal level will be, on average, 70% higher than maternal blood and up to three times higher at the 95th percentile. The maternal body burden of MeHg tends to decrease during gestation consistent with hemodilution and a transfer of a portion of the maternal body burden to the fetus (24).

Neonatal and infant exposure to MeHg occurs through intake of mother's milk, which is derived from maternal plasma, has a lower level of MeHg, and is enriched in inorganic Hg relative to the whole blood (75). Thus, lactational exposure to MeHg is reduced compared with what would be expected on the basis of maternal blood MeHg. Human and animal studies showed that, after birth, there is a decline in MeHg levels, reaching 40–50% at 2–3 months of age (76–78). During this period, infant body weight increases about 1.5–2 times. Consequently, the rapid increase in body volume and the limited MeHg transfer appear to explain the dilution of MeHg in infants during breast feeding.

HEALTH EFFECTS

Neurological Endpoints

Clinical manifestations. In 1958, McAlpine and Araki (79) linked the unusual neurological disease that was associated with fish consumption from Minamata Bay to MeHg exposure. This historic recognition of the brain and nervous system as the primary target organ for MeHg poisoning, resulting in marked distal sensory disturbances, constriction of visual fields, ataxia, dysarthria, auditory disturbances, and tremor, remains unchanged (80, 81). Based on analysis of the studies of human poisoning, the World Health Organization (WHO) (39) estimated that 5% of MeHg-exposed adults would experience neurologic effects with a blood Hg level of 200 μg L^{-1} (corresponding to a hair level of approximately 50 μg g^{-1}). This estimate, however, was called into question by a re-analysis of these studies by Kosatsky and Foran (82), who suggested that the lowest observed effect level for clinical effects is likely to be considerably lower. Indeed, anecdotal and case reports of diffuse and subjective neurologic symptoms in adults and older children with moderately elevated MeHg exposures continue to appear (36, 83). In many cases, cessation or significant curtailing of fish consumption results in improvement of symptoms in conjunction with reduction in biomarker concentrations. These suggest the possibility of clinical effects, perhaps in a sensitive subset of the general population, at levels of exposure considerably below those previously associated with clinical effects in poisoning episodes. Currently, there is no formal case description or diagnostic criteria for such effects.

Although exposures throughout the world are lower than those producing the historical epidemics of MeHg poisoning, there is growing evidence that for many populations, exposures are sufficient to alter normal functioning of several systems, constitutes an important public health problem.

Effects in neonates, infants, and children. The poisoning in Minamata brought attention to the risk from fetal exposure. Exposed to MeHg through the placenta of the exposed mother, infants showed severe cerebral palsy–like symptoms, even when their mothers had mild or no manifestation of the poisoning (84). Mental retardation, cerebellar ataxia, primitive reflexes, dysarthria, and hyperkinesias were observed. These symptoms, described over 25 years ago (80, 85), continue as the clinical hallmark of congenital MeHg poisoning. Reconstruction of maternal or fetal doses resulting in these symptoms is difficult because of a lack of concurrent sampling. An estimate of the mean maternal hair concentration, resulting in such symptoms of 41μg g^{-1} ppm was proposed (86); however, a large uncertainty surrounds this estimate. Health effects observed with frank poisonings should not be confused with the more subtle, populational effects observed at lower levels of exposure.

At the subclinical and the population level, several studies in different parts of the world report poorer neurologic status and slower development in newborns, infants, and/or children exposed to MeHg *in utero* and/or during early childhood (87–98), although some studies did not observe effects (99–101). In children, MeHg exposure *in utero* is associated with lower performance on tests of language, attention, memory, and/or visuospatial and/or motor functions. Although most child studies focused on fish-eating populations with relatively high levels of MeHg exposure, in a recent study, Oken et al (90) observed an inverse relation between mercury concentration in maternal hair and infants' performance on a visual recognition memory task at levels of mercury exposure consistent with background exposure in the US population (maternal hair levels varied between 0.02–2.38 μg g^{-1}). Interestingly, in this study, fish consumption *per se* was associated with better performance, suggesting that some positive aspects of fish consumption, perhaps n-3 (omega-3) fatty acids, are reduced or antagonized by the MeHg contained in the same fish. A similar picture is emerging among adults for the some of the cardiovascular effects of MeHg (see below).

The two major ongoing longitudinal cohort studies on children from the Faroe Islands and the Seychelles are worthy of particular mention because they have both been following children through teenage years, assessing neuropsychological performance as a function of current, childhood, and *in utero* exposure. The Faroes study consistently observed neurobehavioral deficits associated with *in utero* exposure, even when children whose mother's hair Hg levels above 10 μg g^{-1} were excluded (91). In the initial studies of the Seychelles cohort, no effects were observed (100–103). However, recent reports of the Seychelles 9-year-old cohort shows decreases in fine motor function associated with higher fetal exposure levels ($\geq$10 μg g^{-1} maternal hair); the investigators suggest that adverse effects may become apparent on higher-order cognitive functions that develop with maturity (104, 105). There has been much discussion about the differences between these two well-performed studies. Factors such as type of exposure (one of the main exposure pathways in the Faroes study is through pilot whale, while in the Seychelles, it is entirely marine fish), biomarkers of exposure (cord blood *vs.* maternal hair), differences in test batteries and age of testing; cohort size and power were considered as possible explanations for the differences in observed outcomes. However, none of these explanations proved entirely satisfactory or clearly decisive (38, 106). Other hypotheses, such as dietary intake of nutrients that may modify Hg metabolism or toxicity, were also proposed (69). Despite whatever significant differences do, in fact, exist between the Seychelles and Faroes studies that may explain differences in results that were observed to this time, the most recent results from the Seychelles appear to indicate a convergence in findings. More work needs to be done on factors that may affect the patterns of manifestation of Hg toxicity.

Neurophysiologic studies offer strong support for nervous-system alterations associated with MeHg exposure. These studies showed mercury-related delayed latencies for auditory and visual evoked potentials (107–110). In the Faroes longitudinal study, latency delays were observed at 7 and 14 years (107, 109). No significant dose-effect relations for evoked potentials were observed in a study of Japanese children with low mercury exposure (maternal and children hair mercury levels of 1.6 μg g^{-1}) (111).

Nervous system endpoints in adults. Fewer studies addressed the neurotoxic effects of Hg exposure in adults. Mercury-related deficits in motor, psychomotor, visual and/or cognitive functions have been reported for different populations within the Brazilian Amazon (112–115) and for tuna consumers from the Mediterranean (116). A recent study, in the United States, of older adults (50–70 years old) with considerably lower blood Hg levels (mean, 2.1 μg L^{-1}) showed inconsistent evidence of effect across neurobehavioral tests (117). Studies of associations between neurobehavioral outcomes and MeHg exposure in adult populations in which frequent and lifetime fish consumption is a cultural norm, generally cannot distinguish between effects because of adult exposure and permanent developmental effects because of gestational and early childhood exposures.

Cardiovascular Endpoints

A body of evidence was developed that addresses potential associations between MeHg and a range of cardiovascular effects. These include cardiovascular disease [coronary heart disease, acute myocardial infarction (AMI), ischemic heart disease], blood pressure and hypertension effects, and alterations in heart rate variability [see Chan and Egeland (118) and Stern (119) for recent reviews]. The strongest evidence for causal associations is for cardiovascular disease, particularly AMI in adult men (44, 120–122). In general, the relative risk and the odds ratios for AMI from these studies showed a doubling in the upper range of the observed Hg exposures. Comparison of exposures in these studies to exposures in Western populations suggests that the upper percentiles of current levels of exposure in these populations may result in a significantly elevated risk of AMI. Another well-conducted study of US health professionals, however, did not find an association between Hg exposure and coronary heart disease (123). This may be because dentists with possible exposure to elemental mercury accounted for 63% of controls and had a Hg exposure more than twice that of the other groups in the cohort. It is not known whether elemental or inorganic Hg acts similarly to MeHg with respect to cardiovascular effects. In addition, two of these studies used toenail Hg as the biomarker of exposure. Because this biomarker has not been adequately compared with the more common exposure biomarkers of hair or blood Hg, it is difficult to assess the dose-response implications of these studies in relation to current exposures.

The evidence for an association between MeHg and other cardiovascular endpoints is weaker. An association was found between increased systolic and diastolic blood pressure in Faroese children at 7 years old and gestational exposure to MeHg (124). However, the association did not persist when the cohort was re-examined at 14 years old (125). Decreased heart rate variability was also associated with MeHg exposure, and this effect persisted through 14 years of age, but the implications of this effect in children for clinically significant outcomes is not clear. There are few studies that relate adult blood pressure to MeHg exposure. A recent study in the Brazilian Amazon reported that persons with 10 μg g^{-1} hair Hg were three times more likely to have elevated systolic blood pressure ($\geq$130 mm Hg) (126), whereas in a study of women from the United States, no clear association was observed (127).

Reproductive Outcomes

The effect of MeHg on the sex ratio of offspring at birth and stillbirth in Minamata City, Japan, in the 1950s and 1960s, including the period when MeHg pollution was most severe, showed decreases in male birth in offspring in the overall city population, among fishing families (72, 128). An increase in the proportion of male stillborn fetuses raises the possibility that increased susceptibility of male fetuses to death *in utero* could explain the altered sex ratio.

Immune System Effects

Inorganic mercury was shown to suppress immune functions and to induce autoimmunity in multiple species (129). Both MeHg and inorganic Hg were shown to produce an autoimmune response, as well as an immunosuppressive effect in several strains of genetically susceptible mice (130, 131). However, data on the immune effects of MeHg in general are sparse, and research is required in this area.

Co-contaminants

Fish tend to accumulate halogenated organics, including polychlorinated biphenyls (PCB), dioxins, and related compounds. The neurodevelopmental effects of PCBs and, to a lesser extent, dioxins, share some similarities to those observed for MeHg (132). This can potentially present difficulties in determining causality and in constructing MeHg-specific dose-response relations. Because MeHg tends to associate more with proteins than with fats, fish species with elevated levels of MeHg are not necessarily those with elevated levels of the lipophilic halogenated organics. Thus, for fish consumption where both exposures occur, the influence of the individual contaminants can potentially be separated by statistical techniques if a variety of fish species is consumed and sufficiently precise exposure metrics are collected. In the Faroe Islands studies, both MeHg and PCBs appear to jointly affect some developmental endpoints. However, although MeHg appeared to enhance the PCB-attributable effects, the PCBs appeared to make a relatively minor contribution to the MeHg-specific effects (132, 133). Contradictory findings were observed in a study of cognitive development associated with exposures to MeHg and PCBs in the Lake Oswego area of New York State (134). In that study, elevated PCB exposure appeared to potentiate MeHg effects. However, both MeHg and PCB levels were considerably lower than in the Faroes study, and no PCB-MeHg association was observed on follow-up testing of the cohort. More work remains to be done on the joint influence of MeHg and halogenated organics, as well as other metal contaminants that may also be present in fish (135).

Elemental Hg continues to be used in dental amalgam for the treatment of dental carries. In populations with significant amalgam use, elemental Hg may account for a proportion of total Hg exposure comparable with or greater than MeHg (38).

Table 1. Differences in decision choices between the NAS/NRC (2000) and the JECFA (2003) risk assessments for mercury intake.

Variable	NAS/NRC (2000)	JECFA (2003)
Studies	Considered Faroes, New Zealand, Seychelles. Final value based on Faroes	Faroes and Seychelles
Biomarker used as index	Cord blood, μg L^{-1}	Maternal hair [Hg], μg g^{-1} or ppm.
BMDL selected	58 μg L^{-1} cord blood	14 μg g^{-1} maternal hair
Uncertainty factor	Uncertainty factor = 10. 3.2 for toxicokinetics. 3.2 for toxicodynamics	3.2 (100.5) (individual variation) × 2 for overall average interindividual variation = 6.4 No toxicodynamic factor.
Exposure limit	Reference dose of 0.1 μg kgbw^{-1} d^{-1} (equal to 0.7 μg kgbw^{-1} wk^{-1})	1.6 μg kgbw^{-1} wk^{-1} (equal to 0.23 μg kgbw^{-1} d^{-1})

It is known that elemental Hg vapor can cross the placenta and accumulate in fetal tissue (136–138), and animal data suggest that elemental Hg has the potential to cause adverse neurologic developmental effects (139). Both elemental Hg and MeHg are metabolized in the brain to the inorganic mercuric form (38). It is not known whether the ultimate neurodevelopmental toxicant of MeHg is MeHg itself, the inorganic mercuric ion, free radicals generated in the conversion to the inorganic species, or some combination of these. If the inorganic form is the ultimate toxicant of MeHg in the developing brain or if MeHg and inorganic Hg share common neurodevelopmental toxic mechanisms, then current estimates of risk based on MeHg exposure alone could underestimate the population risk. Additional research is clearly needed to address these questions.

Potential Benefits of Fish Consumption

Several investigators have addressed the issues surrounding the risks and benefits associated with fish consumption, in general and for remote communities that depend on fish traditionally and/or as their dietary mainstay (69, 140–142). Indeed, for many populations, fish is the primary source of protein and other nutrients. Moreover, some fish can be an important source of the omega-3 fatty acids, eicosapentaenoic acid and docosahexaenoic acid, that appear to have positive effects on at least some of the same systems adversely affected by MeHg. However, similar to MeHg, there is considerable variability in the occurrence of omega-3 fatty acids across species (143). Fatty fish have higher levels of omega-3s compared with lean fish, and freshwater fish largely have lower levels of omega-3 fatty acids compared with ocean fish (15). There is no association between MeHg concentration of the fish or shellfish species and the omega-3 fatty acid level of the species (15). Several fish and shellfish species that are low in MeHg are high in omega-3 fatty acids (e.g., anchovies, herring, salmon), whereas others that are high in MeHg can be comparatively low in omega-3 fatty acids (e.g., shark, swordfish, pike) (15).

Omega-3 fatty acids are associated with beneficial effects on neurologic development in some studies (15), as has fish consumption in general, possibly as a correlate of omega-3 intake (90). However, not all studies found such a benefit (15, 144). Omega-3 fatty acids also were linked to a reduction in the risk of cardiovascular disease (44), although such an association recently were called into question in a comprehensive review (145). For both endpoints, there is some evidence suggesting that, in addition to its intrinsic toxicity, MeHg also antagonizes the beneficial effects of the omega-3 fatty acids (44, 119, 146). Because intake of both substances arises from the same food source, this suggests that the risk-benefit analysis for either the omega-3s or MeHg will depend on an understanding of this complex interaction.

Some animal studies suggest that micronutrients that are normally found in high levels in seafood, such as Se and vitamin E, may protect against Hg toxicity without specifically modulating MeHg absorption or excretion (55). For Se, differences across studies in the forms of Se and Hg, and the route and duration of exposure make interpretation difficult. Although there is some evidence showing protection against inorganic Hg toxicity by selenite, there is almost no evidence showing protection against MeHg toxicity by the organic Se compounds, such as selenomethione or selenocysteine, that are the forms of Se commonly found in the human diet. There is no human data that support a protective role for Se with respect to Hg neurotoxicity. For vitamin E, there is a suggestion that its antioxidant properties may protect against some of the adverse effects of MeHg (147, 148). However, there are few *in vivo* studies, and no epidemiological studies have addressed vitamin E intake.

RISK ASSESSMENT FOR MeHg

The risk assessment process for chemicals in foods is based on hazard identification, exposure assessment, dose-response evaluation, and risk characterization. The most commonly used paradigms for risk assessment are those reflecting the processes developed by the National Academy of Sciences/National Research Council (NAS/NRC) in the United States (149) and a similar process used internationally by the Joint Expert Committee on Food Additives and Contaminants (JECFA) under the Food and Agriculture Organization and the WHO (150). The NAS/NRC provided recommendations on MeHg in 2000, and JECFA continues to evaluate MeHg after their evaluation published in WHO Food Additives Series Number 52 (151).

In the risk assessment for MeHg, both NAS\NRC and JECFA used a benchmark dose approach based on a predetermined change in response rate of an adverse effect. Both used the benchmark dose lower limit (BMDL), which is the statistical lower confidence limit on the dose. Because these two major risk assessments recommend different intake levels [0.1 μg kg-body-weight (bw)$^{-1}$ d^{-1} and 0.23 μg kgbw^{-1} d^{-1}, respectively], here we examine the choices throughout the process that lead to these differences (Table 1):

i. Choice of study. Currently both rely on neurodevelopment effects of MeHg as the adverse health effect used in their respective risk assessments. The NAS/NRC based their analyses on the Faroes Islands study as the primary source of epidemiological data and relied on the studies from New Zealand (87) and the Seychelles as secondary sources and derived a BMDL, based on cord blood of 58 μg L^{-1}. The JECFA excluded the New Zealand study and, basing their BMDL calculation only on the Faroe Islands and the Seychelles studies, derived a BMDL of 12 μg g^{-1} in maternal hair.
ii. Biomarker of exposure. The NAS/NRC based their analyses on cord blood, and the JECFA used maternal hair. Because some of the critical studies for these risk assessments measured only one of these biomarkers converting between cord blood and maternal hair concentration (or vice versa)

involves uncertainty. Furthermore, as the most critical period(s) of gestation for the neurodevelopmental toxicity of MeHg are not yet known, it is not clear which lengths of maternal hair are most appropriate to measure

iii. Uncertainty factor. This factor accounts for adequacy of the pivotal study, interspecies extrapolation, interindividual variability in humans, adequacy of the overall data base, and the nature of the toxicity. These are not "safety factors" in that they are intended to factor in quantitatively to address areas of uncertainty in the risk assessment rather than provide "safety" *per se*. The magnitude of the uncertainty factors is intended as an estimate of the influence of these uncertainties, rather than the application of an arbitrary layer of safety. In the assessment conducted by the NAS/NRC committee, a composite uncertainty factor of 10 was used to account for variability and uncertainty in toxicokinetics and toxicodynamic, as well as database insufficiency for endpoints possibly more sensitive than neurodevelopmental (e.g., cardiovascular endpoints). The JECFA used an overall uncertainty factor of 6.4 to address variability in both toxicokinetics and toxicodynamics. The toxicokinetic portion accounts for a factor of 3.2 based on a generalized estimate of intraspecies toxicokinetic variability (152). The toxicodynamic portion likewise accounts for a factor of 2.0 based on a generalized estimate of interindividual variability in response.

The starting points for derivation of their respective recommended intakes differ both with respect to the actual values and the approaches taken. The JECFA Committee estimated that a steady-state intake of 1.5 μg kgbw^{-1} d^{-1} would be an exposure that would have no appreciable adverse effects on children, in contrast to the NAS/NRC determination of a BMDL of 1.0 μg kgbw^{-1} d^{-1}, which is an effect level. However, neither of these assessments reflected bioconcentration of MeHg across the placental circulation from the mother to the fetus (61). This bioconcentration and its population variability suggests that the full toxicokinetic variability is significantly larger (60, 153) than previously estimated (38, 151, 154).

The NAS/NRC used cord blood mercury for their BMDL of 58 μg L^{-1}, as did the US Environmental Protection Agency in 2001. However, the subsequent increased recognition that cord blood mercury is, on average, 60% to 70% higher in Hg than maternal blood, coupled to the coefficient of variation around the mid-point of 1.7 described by Stern and Smith (61) as 0.56 with a 95th percentile of 3.4, supports the use of a blood mercury concentration in the mid-30 μg L^{-1} range to recognize this fetal-maternal blood mercury difference (152, 155). By contrast, assessments based on association of maternal hair Hg with adverse neurobehavioral outcomes in the child after *in utero* exposures to MeHg need no such adjustment for MeHg concentration.

PANEL CONSENSUS CONCLUSIONS

Methylmercury is a potent toxicant, bioaccumulated and concentrated through the aquatic food chain, placing at risk humans who consume high-end aquatic predators or for whom fish is a dietary mainstay. Elevated levels of MeHg exposure occur worldwide and are not restricted to isolated populations. Rather, exposure to MeHg at levels above those that can be considered clearly safe and without risk of adverse effect occur throughout the globe and across the socioeconomic spectrum.

Hair and blood Hg concentrations (including cord blood Hg concentrations) are valid biomarkers of MeHg exposure. Each conveys somewhat different information on exposure. The most useful picture of exposure is likely to be obtained by data from both biomarkers, along with specific dietary information on fish consumption and other dietary data. Urinary Hg concentration is a biomarker of inorganic Hg. More research characterizing the relations between toenail Hg, hair Hg, blood Hg, and urinary Hg, and the relations between MeHg and inorganic Hg should be considered a priority. Single-strand and, particularly, continuous single-strand hair analysis of Hg concentration should be pursued as the best method for elucidating dynamic changes in MeHg exposure. This is particularly relevant for studies of the effect of *in utero* exposure to MeHg to assess the significance of bolus doses.

Total fish consumption without differentiating fish species is not necessarily a dependable metric for estimating MeHg exposure. To be useful for such purposes, valid data on the MeHg concentration of each species, as well as the frequency and the amount of consumption for each species must be included.

There is sufficient evidence to state that MeHg is a developmental neurotoxin, and developmental or fetal neurotoxicity has constituted the basis for risk assessments and public health policies. Although uncertainties in the risk assessment for the neurodevelopmental effects of MeHg remain, there is sufficient evidence to warrant a public health response based on prudent selection of fish species in the diet. Development of a formal case description and diagnostic criteria for the clinical effects of MeHg observed in some adults and older children with moderately elevated MeHg exposure should be a priority for clinicians involved with MeHg research.

Current studies suggest that present levels of exposure to MeHg have the potential to result in an elevated risk of cardiovascular disease to a significant fraction of the population. However, additional studies in other populations would clarify this picture. Quantitative dose-response assessment of existing studies should be undertaken. The potential effect of MeHg on the immune system should be investigated with respect to adverse effects on immune response, as well as with respect to individual sensitivities to MeHg, potentially including autoimmune responses.

To date, it has been possible to statistically separate the neurodevelopmental effects of MeHg and PCBs in key studies where both exposures occur in the fish-consuming population. However, knowledge of the mechanisms and interactions of PCBs and other halogenated organics with MeHg is an important missing piece in understanding the overall risk for fish consumption. Research into the potential interactions of inorganic Hg and MeHg should be considered a priority. Although the possible interactions between Se and MeHg are a fruitful area for further research, there is currently no clear evidence that dietary Se can modulate the toxicity of MeHg.

Because the intake of both omega-3 fatty acids and MeHg occurs from fish consumption and because MeHg appears to antagonize the beneficial effects of the omega-3s as well as exerting its own intrinsic toxicity, a proper assessment of risks and benefits for the combination of the two must address their complex interaction. Currently, there are insufficient data on this interaction to describe a coherent picture. Despite the lack of a clear picture of the interaction of the omega-3 fatty acids and MeHg, there are fish with high levels of omega-3s and relatively low levels of MeHg. Consumption of fish with low levels of MeHg and organic contaminants constitute a "win-win" situation and should be encouraged regardless of the underlying nature of the omega-3-MeHg interaction.

To preserve human health, all efforts need to be made to reduce and eliminate sources of exposure, through regulation and dissemination of information. In addition to documenting the multiple health hazards associated with exposure to MeHg throughout the lifespan, research needs to focus on identifying factors that influence the uptake and the toxicity of MeHg and on examining the potential benefits of different fish species. These studies will provide information on maximizing nutritional intake from consumption and minimizing risk from exposure to MeHg.

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Aquatic Resources 2016 Baseline Study

Stibnite Gold Project

Midas Gold Idaho, Inc.

April 2017

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SECTION 1 INTRODUCTION

1.1 Purpose of Study

The aquatic resources baseline study is conducted to characterize existing aquatic habitat and biological conditions prior to the start of proposed mining operations at the Stibnite Gold Project in central Idaho. The study describes the existing aquatic resources in the project study area, and it will be used to support the United States Forest Service (USFS) Environmental Impact Statement (EIS) for the Stibnite Gold Project.

1.2 Background

Figure 1-1 shows the location of the Stibnite Gold Project. The project is in the Stibnite-Yellow Pine Mining District in central Idaho, near the village of Yellow Pine. Located in Valley County, the District is characterized by historic mining activities and unpatented (federal land) and patented (private land) deposits of gold, silver, tungsten, and antimony. The Stibnite-Yellow Pine Mining District is in the Boise National Forest (BOI), but is administered by the Krassel Ranger District of the Payette National Forest (PAF).

Mining began in the District in the late 1800s, and continued on and off through 1997. Beginning in 2009, Midas Gold Idaho, Inc. (Midas Gold), began to acquire mining claims throughout the District from prior owners or by staking claims on its own behalf. With federal and the State of Idaho (State) approval, Midas Gold initiated mineral exploration activities in 2009 to better define the mineral deposit potential for the area. This effort included using the existing road network and the construction of several temporary roads to access drill sites, build drill pads, drill on both National Forest System (NFS) and private lands, and to access disturbed areas for reclamation when exploration work concludes.

The PAF Krassel Ranger District has jurisdictional authority over surface disturbance associated with mining and exploration activities on NFS land in the Stibnite-Yellow Pine Mining District. The Payette Lakes Supervisory Area of the Idaho Department of Lands has jurisdictional authority over exploration and mining-related activities on private lands within its administrative area (Idaho Administrative Procedure Act [IDAPA] 20.03.02).

In addition to the mining activities occurring in the Stibnite-Yellow Pine Mining District, future mine plans may include proposed access roads that provide transportation routes to and from the project. Proposed access roads would be on land located in the BOI, administered by the Cascade Ranger District, as well as PAF land administered by the Krassel Ranger District.

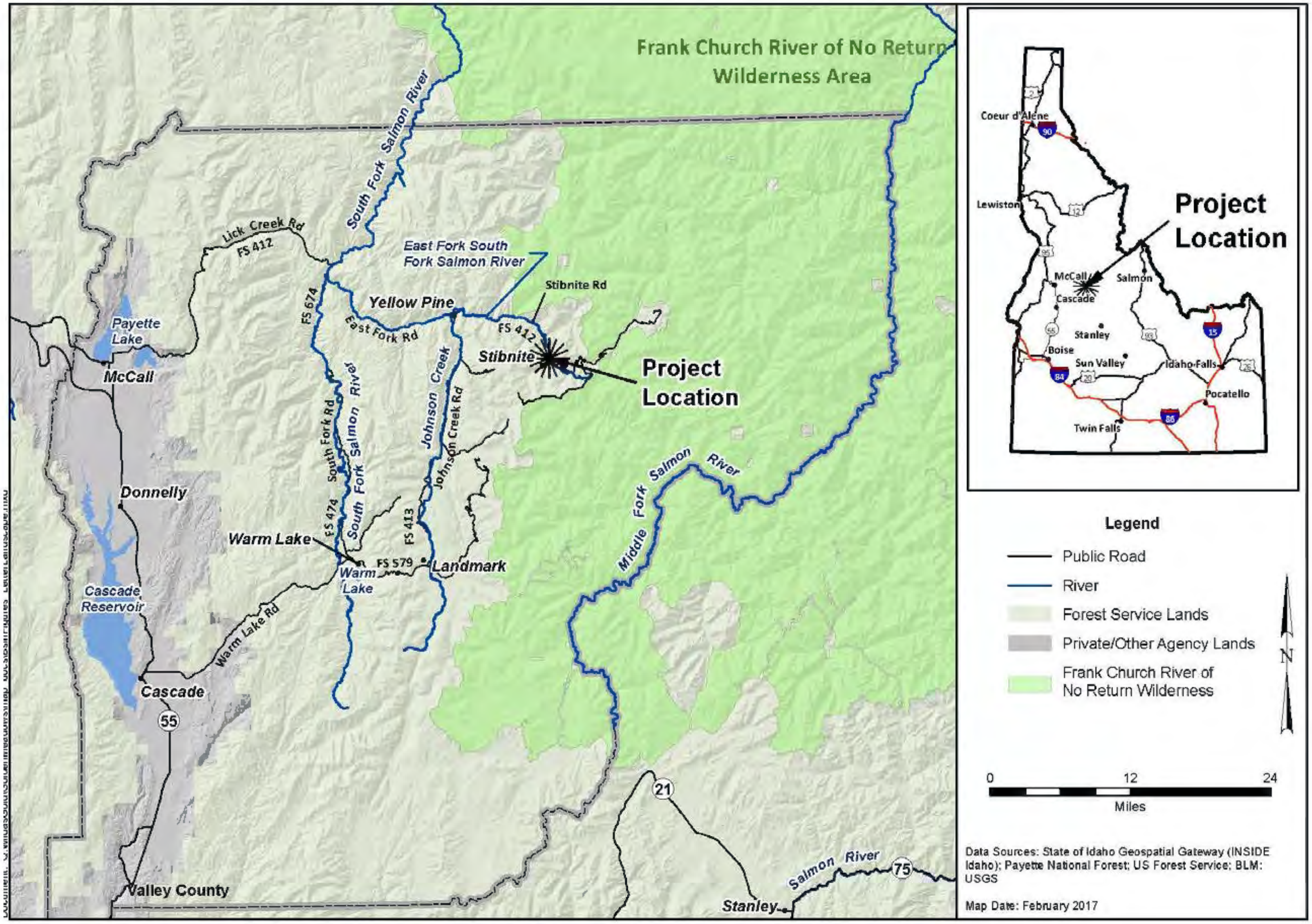
1.2.1 Project Area Description

Figure 1-2 shows the project area. The terrain within the project area consists of narrow valleys surrounded by steep mountains. Elevations along valley floors range from 6,000 to 6,600 feet above mean sea level (msl). The surrounding mountains reach elevations over 8,500 feet above msl. The main drainage basin in the project area is the East Fork of the South Fork of the Salmon River (EFSFSR).

The EFSFSR flows for 16 miles before joining Johnson Creek near the town of Yellow Pine. The project area encompasses the watersheds of tributaries of the EFSFSR, including Sugar Creek, Meadow Creek, Johnson Creek, Riordan Creek, Burntlog Creek, and Trout Creek. The project area includes Cabin Creek and Warm Lake Creek, which are tributary streams to the South Fork Salmon River (SFSR). The primary uses or activities in the area have been mineral exploration, mining, logging, and dispersed recreation.

During non-winter conditions (when roads are clear of snow), the project site can be accessed from the City of Cascade by traveling northeast on Warm Lake Road/Forest Service Road (FS) 579 (FS 579) for about 37 miles to Landmark, then north on Johnson Creek Road (FS 413) for 28 miles to Yellow Pine, and 14 miles east on Stibnite Road (FS 412) (**Figure 1-2**). The site can also be accessed from the City of McCall during non-winter conditions by traveling east on Lick Creek Road (FS 412) for 33 miles to East Fork Road (FS 412), then 16 miles to Yellow Pine, and 14 miles on Stibnite Road (FS 412).

During winter, the site can be accessed only from Cascade by traveling 24 miles northeast on Warm Lake Road (FS 579) to its intersection with South Fork Road (FS 474/674), then north on South Fork Road for 32 miles to East Fork Road (FS 412), then 16 miles east on East Fork Road to Yellow Pine, and 14 miles on Stibnite Road (FS 412).



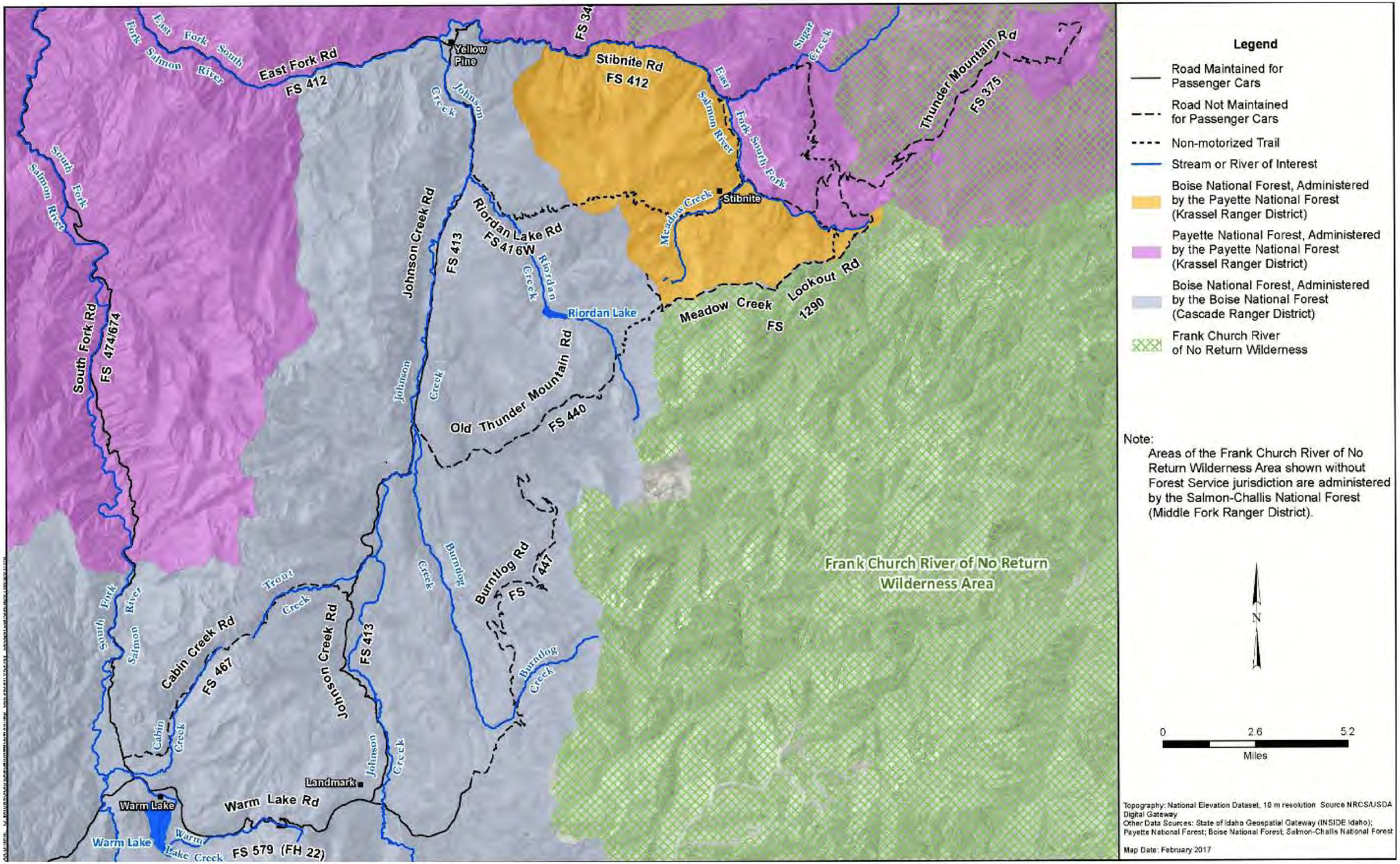
Data Sources: State of Idaho Geospatial Gateway (INSIDE Idaho); Payette National Forest; US Forest Service; BLM; USGS

Map Date: February 2017

Figure 1-1. Vicinity Map

1.3 Organization of Report

- Section 1, the introduction, explains the purpose of the baseline study and provides background information on the aquatic resources study area, the project site, and surrounding areas
- Section 2 provides an overview of the aquatic resources study area
- Section 3 summarizes the methodology used to characterize the existing aquatic resources
- Section 4 details the affected environment as it relates to aquatic resources.
- Section 5 provides the results and summary of the annual monitoring efforts
- Section 6 contains project references, a glossary, and a list of abbreviations and acronyms
- Section 7 includes the list of preparers
- Six Appendices provide the survey results, including the stream habitat survey statistical results; macroinvertebrate survey results; water temperature monitoring results and comparison to the Watershed Condition Indicators; laboratory reports for the metals testing in soils, macroinvertebrates and fish tissues; genetic sample results; and snorkel survey results



Note:
Areas of the Frank Church River of No Return Wilderness Area shown without Forest Service jurisdiction are administered by the Salmon-Challis National Forest (Middle Fork Ranger District).

Topography: National Elevation Dataset, 10 m resolution Source NRCS/USDA Digital Gateway
Other Data Sources: State of Idaho Geospatial Gateway (INSIDE Idaho); Payette National Forest; Boise National Forest; Salmon-Challis National Forest

Map Date: February 2017

Figure 1-2. Project Area

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SECTION 2 AQUATIC RESOURCES STUDY AREA

2.1 Description of Study Area

The aquatic resources study area includes all identified aquatic resources that could potentially be affected by the Stibnite Gold Project, including locations where Project access roads could be modified or constructed. The exact extent of potential impacts on aquatic resources will depend on the selected alternative and associated features.

Figure 2-1 shows the aquatic resources study area, including the EFSFSR and its tributaries, which include Meadow Creek, East Fork Meadow Creek (EFMC), Fern Creek, Garnet Creek, Fiddle Creek, Midnight Creek, Hennessy Creek, Cane Creek, Cinnabar Creek, Sugar Creek, Tamarack Creek, and Profile Creek. It also covers tributaries to Johnson Creek, including Burntlog Creek, Trapper Creek, and Riordan Creek. Two additional control sites, tributaries to the SFSR, include Goat Creek and Fourmile Creek. Control sites are considered stream sites in which there are fewer human impacts, and sites in which the Project activities would not have any effect.

A detailed description of each stream-reach survey is provided in **Section 4**.

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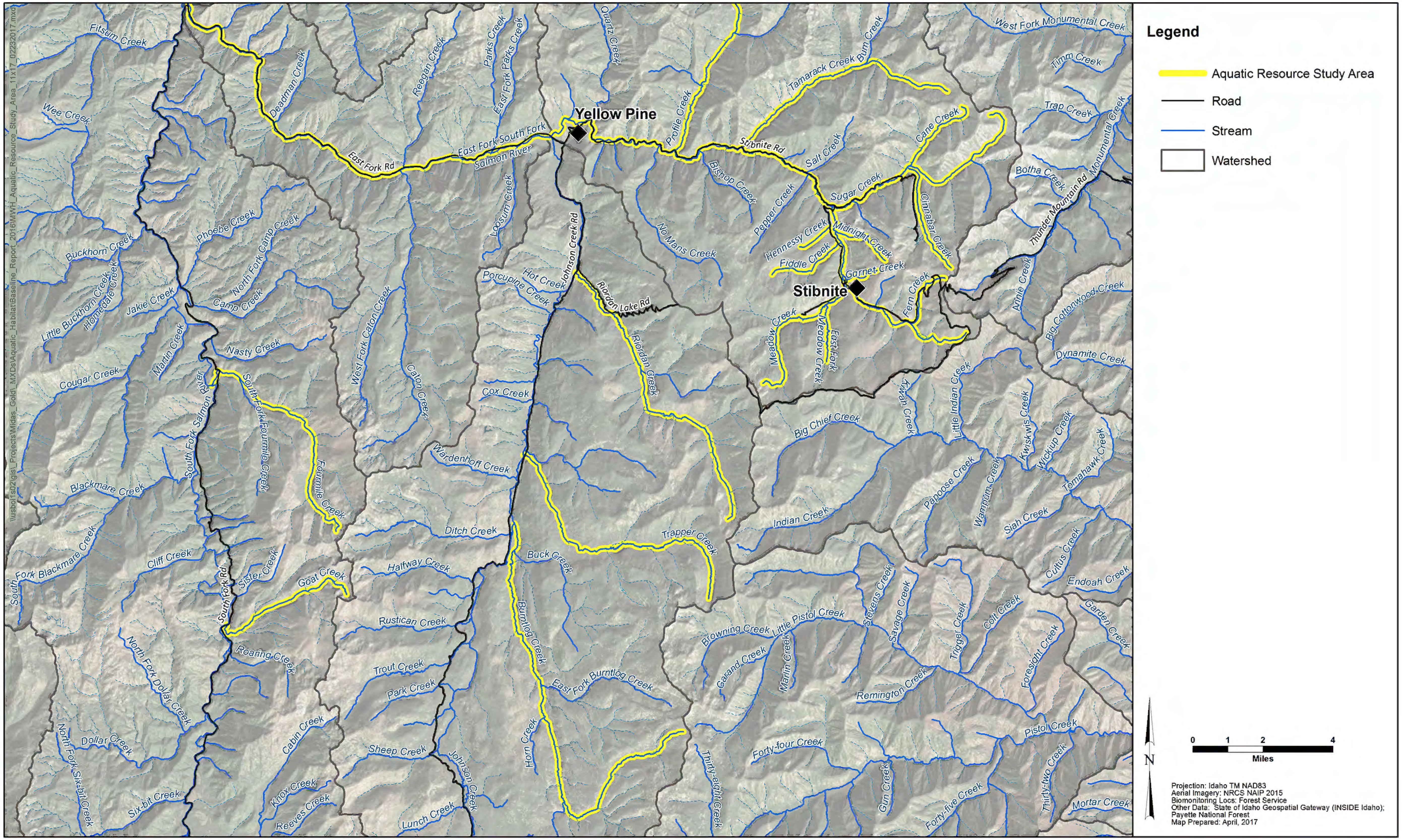

Projection: Idaho TM NAD83
Aerial Imagery: NRCS NAIP 2015
Biomonitoring Locs: Forest Service
Other Data: State of Idaho Geospatial Gateway (INSIDE Idaho);
Payette National Forest
Map Prepared: April, 2017

Figure 2-1. Aquatic Resources Study Area

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SECTION 3 METHODOLOGY

This methodology section details the literature used to develop the aquatic resources baseline study, highlights federal regulations that will be required to advance the Stibnite Gold project, and presents the methods employed to monitor aquatic conditions (stream habitat, macroinvertebrates, metals, and fish) in the aquatic resources study area.

3.1 Literature Review

Over the years, various habitat, fish, and invertebrate studies have been conducted and multiple management, guidance, and methods documents have been prepared, contributing to the understanding of the aquatic resource study area. A bibliography of those studies and documents is provided in the 2016 Aquatic Resources Baseline Study Work Plan (MWH Americas, Inc. [MWH] 2016). The following list identifies the key documents used in the development of baseline report analyses, including field protocols and background information.

- *Streams of Idaho (303(d) Impaired – 1998* (Idaho Division of Environmental Quality [IDEQ] 2002) contains the water-quality constraints on each water body in Idaho.
- *Payette National Forest Land and Resource Management Plan (LRMP)* (PAF 2003) describes management goals and objectives, aquatic resource protection methods and metrics for desired aquatic resource conditions, as well as the availability and suitability of land for resource management.
- *PACFISH/INFISH Biological Opinion (PIBO): Effectiveness Monitoring Program Seven-Year Status Report, 1998 through 2004* (Henderson et al. 2005). This report provides a protocol-level survey to evaluate the effect of land management activities on aquatic and riparian communities at multiple scales, providing consistency and repeatability with field surveys in the PAF. It describes the framework for monitoring aquatic and riparian resources throughout the Upper Columbia River Basin, and was used for the aquatic resources baseline field investigations conducted by MWH.
- *PIBO Field Protocol* (PAF 2013, 2014, 2015) provides the specific protocols for conducting the PIBO surveys in the PAF.
- *Cobble Embeddedness Field Protocol* (PAF 2007a) provides the protocol for conducting the cobble embeddedness surveys.
- *Free Matrix Field Protocol* (PAF 2007b) provides the protocol for conducting the free matrix and surface-fines surveys.
- *Core Sampling Procedure* (PAF 2007c) provides the protocol for conducting the modified McNeil core substrate surveys.
- *Stream Temperature Technical Report* (USFS 2013) provides the protocol for the underwater installation of thermographs and the monitoring of annual temperatures in rivers and streams.
- *Idaho Small Stream Ecological Assessment Framework: An Integrated Approach* (Grafe 2002) describes methods and evaluations for macroinvertebrate sampling.

- *PIBO-EMP Effectiveness monitoring for streams and riparian areas: sampling protocol for stream channel attributes* (Heitke et al 2011) provides field protocols for stream habitat, benthic macroinvertebrates, and fish surveys under the Pacific Anadromous Fish Strategy (PACFISH) Inland Fish Strategy (INFISH) Biological Opinion Effectiveness Monitoring Program (PIBO) protocols.
- *Geography and Timing of Salmonid Spawning in Idaho* (Miller et al. 2014) describes the reproductive timing for Chinook salmon, steelhead, bull trout, westslope cutthroat trout, and brook trout within the State of Idaho.
- *Underwater Methods for Study of Salmonids in the Intermountain West* (Thurow 1994) describes methods for fish counts during snorkel surveys.

3.2 Field Investigations

MWH conducted field investigations from 2012 to 2016, which included stream habitat and biological surveys at multiple sites in the aquatic resources study area, and included at least one control site (the number of control sites depended upon the survey type). Surveys were conducted in the EFSFSR, Profile Creek, Tamarack Creek, Hennessy Creek, Sugar Creek, Cane Creek, Cinnabar Creek, Midnight Creek, Fiddle Creek, Garnet Creek, Meadow Creek, EFMC, Fern Creek, and several unnamed tributaries.

Additional stream habitat surveys were conducted in Riordan Creek, Trapper Creek, and Burntlog Creek, to assess watershed conditions and overall basin health, factors that could potentially be impacted by construction of the proposed Burntlog access route alternative (HDR 2013). The stream habitat assessment also included control sites on Goat Creek and Fourmile Creek. All aquatic resources baseline survey sites were permanently marked with safety-capped rebar to support accurate location for long-term monitoring of the sites.

Methods employed for the field surveys primarily followed the PAF-modified protocol for PIBO (Henderson et al. 2005). PIBO was developed in response to monitoring needs addressed in Biological Opinions from the U.S. Fish and Wildlife Service (USFWS), for bull trout, and National Marine Fisheries Service (NMFS) for steelhead. It provides a consistent framework for monitoring aquatic and riparian resources within the range of the coverage for the Biological Opinion through PIBO. The intent of the PIBO is to help determine whether land management practices are maintaining or improving riparian and aquatic conditions, at both the landscape and watershed scales, on federal land throughout the Upper Columbia River Basin.

The following sections describe the methods and analyses for each of the aquatic surveys.

3.2.1 Stream Habitat Surveys

Stream habitat surveys provide data on the stream bed and bank conditions over time, so that changes in stream conditions can be identified. Surveys for stream habitat characteristics have been conducted annually since 2012, with data collected in early August and mid-September. Stream habitat surveys were conducted in the EFSFSR, Sugar Creek, Meadow Creek, EFMC, Cane Creek, Burntlog Creek, Trapper Creek, and Riordan Creek, with control sites at Tamarack Creek, Goat Creek, Fourmile Creek, and Profile Creek. **Figure 3-1, Table 3-1** and **Table 3-2** show the stream habitat survey locations and survey activity for 2012 through 2016.

The stream habitat survey locations were selected based on recommendations by the PAF, including several survey sites previously established by the PAF. Survey sites were added in 2014 to include streams in watersheds that may be affected by the proposed Burntlog access route alternative, and to provide additional control sites for the baseline study. One site, on Fiddle Creek, was added in 2015 to encompass more of the project area that may be directly affected by project activities.

Stream habitat surveys are subject to specific seasonal time constraints. Core sediment samples (first collected in 2013) must be completed before August 15, to avoid spawning Chinook salmon. Free matrix and cobble embeddedness surveys occur during low-flow conditions (in September or October) with an exception for surveys on lower Meadow Creek. In 2015, following the release of Chinook salmon into Meadow Creek, these surveys were cancelled because of the presence of Chinook salmon redds. Therefore, free matrix and cobble embeddedness surveys in lower Meadow Creek must occur prior to any Chinook salmon release (typically in late August). This modification was implemented in 2016.

Protocols for the stream habitat surveys have been relatively consistent each year; however, modifications were made to the protocols based on revisions by the PAF. For example: bank-angle measurements and modifications to bank-stability criteria were added to the 2014 protocol; stream shade was measured per the protocol in 2012, but the PAF removed this measurement from the protocols in 2013; and large woody debris (LWD) sampling protocols changed in 2014, and then again in 2015.

The following list is a summary of specific protocols and parameters used to sample stream channel conditions, the form of organisms, and relationships between their structures (morphology) and streambed materials (substrate) at the survey sites.

- Cobble embeddedness surveys (methods based on PAF 2007a): Surveys were conducted at five sites in the historic mining area; two control sites on Tamarack and Profile Creeks, and three sites for the Burntlog access route (**Figure 3-1**). Embeddedness measures the degree to which finer particles cover the larger particles.

  Parameters measured:

  - Substrate size (diameter)
  - Depth of embeddedness in the streambed

- Free matrix surveys (methods based on PAF 2007b): Surveys were conducted at 17 existing sites in the Stibnite Gold project area: two control sites on Tamarack and Profile Creeks, and eight sites for the proposed Burntlog access route, including two control sites on Goat and Fourmile Creeks (**Figure 3-1**).

  Parameters measured:

  - Fine sediment particles (surface fines) which measures the amount of fine sediment, less than 6.33 millimeters (mm) on the substrate surface
  - Free cobbles (non-embedded material) and embedded cobbles, which measures substrate size and count of loose cobbles compared with substrate size and count of embedded cobbles

- Modified McNeil core and suspended sediment sampling (methods based on PAF 2007c): McNeil core sampling was conducted at one location in the EFSFSR (**Figure 3-1**).

Parameters measured:

- Spawning sediment depth fines (proportion of the subsurface sediments made up of fine materials) and overall sample particle size distribution based on the water displacement method
- Suspended sediment concentration

- Channel morphology and condition evaluation assessed via PIBO surveys (PAF 2013, 2014, 2015): a total of 22 PIBO locations have been established, 15 of which are located within the historic mining area (excluding sites for the Burntlog access route) (**Figure 3-1**). Because there were extensive avalanches in 2014, PIBO surveys were conducted at two sites in the EFSFSR to determine whether these avalanches changed channel morphology. PIBO surveys were also conducted at two control sites on Tamarack and Profile Creeks, and five sites for the Burntlog access route (including two control sites on Goat and Fourmile Creeks) (**Figure 3-1**).

  Parameters measured:

  - Bankfull width
  - Wetted width
  - Wetted depth
  - Bankfull depth
  - Bank stability
  - Bank angle
  - Bed sediment size
  - Reach gradient
  - Pool dimensions
  - Large woody debris
  - Detailed survey site drawing (or verification of the previous year’s drawing for accuracy)

- Water temperature monitoring (via Tidbit v2 Water Temperature Data Loggers, model UTBI-001, with methods based on USFS 2013): a total of nine data loggers have been installed in the historically mined Stibnite area, and in creeks that may be affected by the Burntlog access route (**Figure 3-1**). Seven sites were originally installed in 2013, eight additional installations occurred in 2014, and one additional site was added in 2015.

  Parameters measured:

  - Thermographs were installed and the temperature was monitored at 15-minute intervals, in accordance with the USFS Rocky Mountain Research Station (RMRS) protocol for continuous stream water temperature monitoring (USFS 2013).[1] Several data losses or gaps have occurred over the years due to malfunctioning field download equipment or high spring-water runoff flows. Specific download events resulting in loss of data include:
    - MWH-001 (EFSFSR) – Installed in 2013, but could not download site due to frozen stream during the 2014 download event. Data loss spans from install date to September 2014.
    - MWH-005 (EFSFSR) – No data has been successfully downloaded due to multiple high spring flows, resulting in the loss of the data logger and a field data shuttle download malfunction. The last reinstallation was completed in August 2016, and planned download is set for the first quarter of 2017, prior to peak spring runoff.
    - MWH-008 (Sugar Creek) – Installed in September 2013, and lost in the spring of 2016 due to high runoff flows. Data gap spans from November 2015 to August 2016, and it was reinstalled in September 2016.
    - MWH-051 (Burntlog Creek) – Installed in September 2014 and lost in the spring of 2016 due to high runoff flows. Data gap spans from November 2015 to August 2016, and it was reinstalled in September 2016.
    - MWH-055 (Riordan Creek) – Installed in September 2015, but no data has been successfully collected to date. This site is only downloaded on an annual basis due to its remoteness. The sampling reach is characterized predominately by a silt / sand, and contains no sizable boulders for permanent epoxy installation. The data logger was attached to one of the few trees located on the bank, using parachute cord and weighted down by fishing weights. The data logger did not remain attached and it was lost. Reinstallation of the temperature data logger will be completed in 2017, and will include stainless steel cabling.
    - MWH-057 (Goat Creek) – Installed in September 2014 and lost in the spring of 2016 due to high runoff flows. Data gap spans from November 2015 to August 2016, and it was reinstalled in September 2016.

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[1] Water temperature data were originally downloaded annually, but the download schedule is now adjusted to two to three times a year to minimize the potential for data losses. Several data losses or gaps occurred over the years, due to malfunctioning downloads from the field data shuttle or loss of the data logger from high spring runoff flows.

Because the water temperature monitoring will continue for multiple years, the previous loss of data will not affect the ability to acquire an ample period of record to develop a stream temperature baseline. To supplement temperature data from the project installed thermographs, stream temperature data was downloaded and summarized from five U.S. Geological Survey (USGS) gauge sites within the aquatic resource study area (**Figure 3-1**).

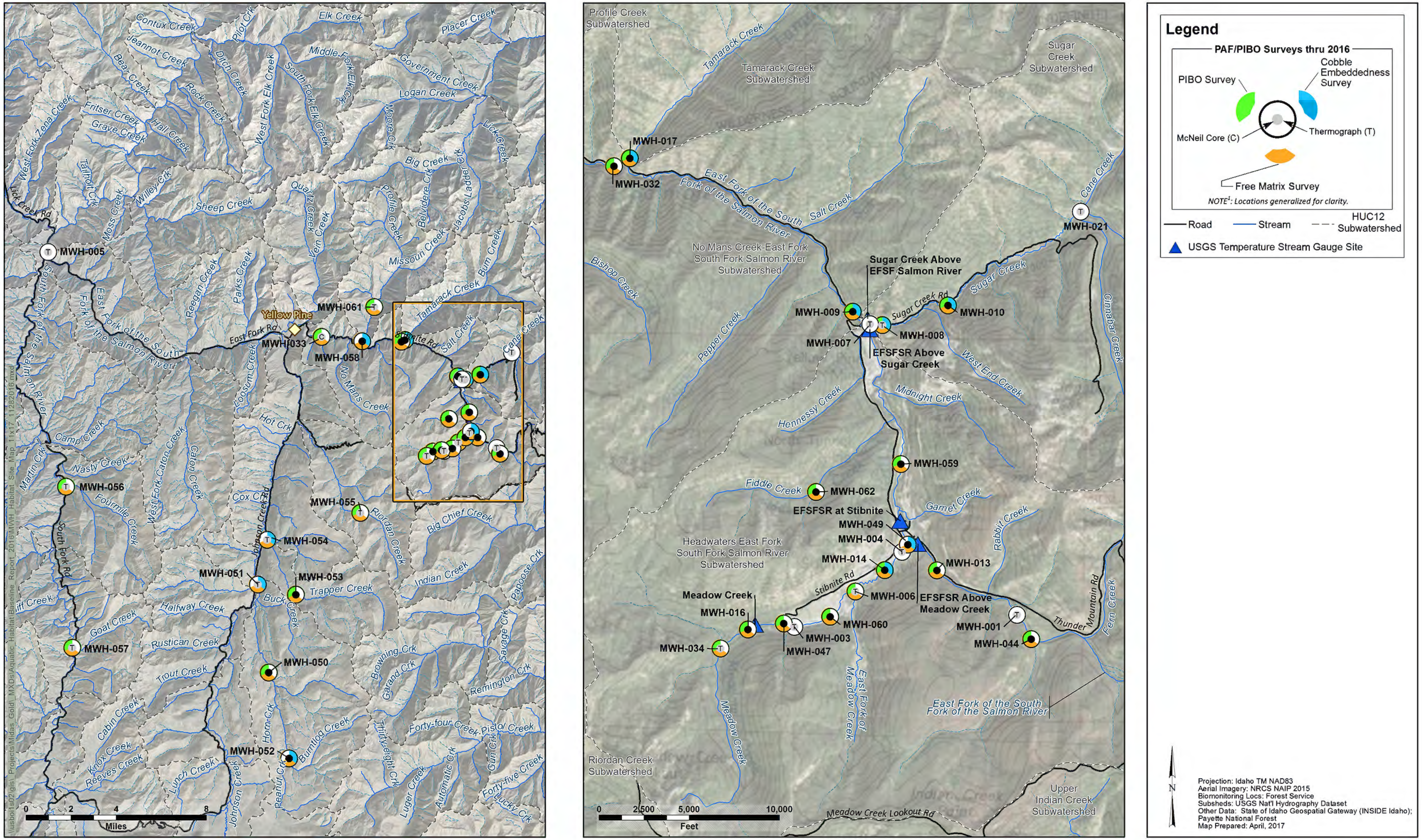

Figure 3-1. Habitat Survey Locations and Survey Activity, 2012 – 2016

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Table 3-1. Cobble Embeddedness, Free Matrix, and PIBO Surveys Conducted from 2012-2016

			Cobble Embeddedness				Free Matrix				PIBO Habitat				
Stream	**Sub-watershed**	**Site ID**	**2013**	**2014**	**2015**	**2016**	**2013**	**2014**	**2015**	**2016**	**2012**	**2013**	**2014**	**2015**	**2016**
EFMC	Headwaters EFSFSR	MWH 006					X		X	X		X		X	
Sugar Creek	Sugar Creek	MWH 008	X	X	X	X	X	X	X	X	X	X			
EFSFSR	No Mans Creek - EFSFSR	MWH 009	X	X	X	X	X	X	X	X	X	X			
Sugar Creek	Sugar Creek	MWH 010	X	X	X	X	X	X	X	X	X	X			
EFSFSR	Headwaters EFSFSR	MWH 013					X			X	X	X			
Meadow Creek	Headwaters EFSFSR	MWH-014	X	X		X	X	X		X	X	X			
Meadow Creek	Headwaters EFSFSR	MWH 016						X	X	X	X			X	
Tamarack Creek	Tamarack Creek	MWH 017	X	X	X	X	X	X	X	X	X	X			
EFSFSR	No Mans Creek - EFSFSR	MWH 032					X	X				X	X		
EFSFSR	No Mans Creek - EFSFSR	MWH 033					X	X		X		X	X		
Meadow Creek	Headwaters EFSFSR	MWH 034					X			X		X			
EFSFSR	Headwaters EFSFSR	MWH 044					X		X	X		X		X	
Meadow Creek	Headwaters EFSFSR	MWH 047					X		X	X		X		X	
Meadow Creek	Headwaters EFSFSR	MWH 049	X	X		X		X		X					
Lower Burntlog Creek	Burntlog Creek	MWH 050						X	X				X	X	
Lower Burntlog Creek	Burntlog Creek	MWH 051		X	X	X		X	X	X					
Upper Burntlog Creek	Burntlog Creek	MWH 052		X	X	X		X	X	X					
Trapper Creek	Trapper Creek – Johnson Creek	MWH 053						X	X	X			X	X	
Trapper Creek	Trapper Creek – Johnson Creek	MWH 054		X	X	X		X	X	X					

Table 3-1. Cobble Embeddedness, Free Matrix, and PIBO Surveys Conducted from 2012-2016 *(continued)*

			Cobble Embeddedness				Free Matrix				PIBO Habitat				
Stream	**Sub-watershed**	**Site ID**	**2013**	**2014**	**2015**	**2016**	**2013**	**2014**	**2015**	**2016**	**2012**	**2013**	**2014**	**2015**	**2016**
Riordan Creek	Riordan Creek	MWH 055						X	X	X			X	X	
Fourmile Creek	Fourmile Creek - SFSR	MWH 056						X	X	X			X	X	
Goat Creek	Goat Creek- SFSR	MWH 057						X	X	X			X	X	
Profile Creek	Profile Creek	MWH 058		X	X	X		X	X	X					
EFSFSR	Headwaters EFSFSR	MWH 059						X	X	X			X		
Meadow Creek	Headwaters EFSFSR	MWH 060						X	X				X		
Profile Creek	Profile Creek	MWH 061						X	X				X		
Fiddle Creek	Headwaters EFSFSR	MWH 062							X	X				X	

Note: Cobble Embeddedness and Free Matrix surveys were conducted by PAF in 2012.

Key:
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River
PIBO = Pacific Anadromous Fish Strategy/Inland Fish Strategy Biological Opinion
SFSR = South Fork of the Salmon River

Table 3-2. McNeil Core Sediment and Water Temperature Surveys Conducted from 2013-2016

			McNeil Core Sediment				Water Temperature			
Stream	**Sub-watershed**	**Site ID**	**2013**	**2014**	**2015**	**2016**	**2013**	**2014**	**2015**	**2016**
EFSFSR	Headwaters EFSFSR	MWH-001					X	X	X	X
Meadow Creek	Headwaters EFSFSR	MWH-003					X	X	X	X
Meadow Creek	Headwaters EFSFSR	MWH-004						X	X	X
EFSFSR	Deadman Creek - EFSFSR	MWH-005					X	X	X	X
EFMC	Headwaters EFSFSR	MWH-006					X	X	X	X
EFSFSR	Headwaters EFSFSR	MWH-007					X	X	X	X
Sugar Creek	Sugar Creek	MWH-008					X	X	X	X
Cane Creek	Sugar Creek	MWH-021						X	X	X
EFSFSR	No Mans Creek - EFSFSR	MWH-033	X	X	X	X				
Meadow Creek	Headwaters EFSFSR	MWH-034					X	X	X	X
Lower Burntlog Creek	Burntlog Creek	MWH-051						X	X	X
Trapper Creek	Trapper Creek – Johnson Creek	MWH-054						X	X	X
Riordan Creek	Riordan Creek	MWH-055								X
Fourmile Creek	Fourmile Creek - SFSR	MWH-056						X	X	X
Goat Creek	Goat Creek - SFSR	MWH-057						X	X	X
Profile Creek	Profile Creek	MWH-061						X	X	X

Key:
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River
SFSR = South Fork of the Salmon River

3.2.1.1 Stream Substrate Quality Analysis

Three distinct sampling techniques were used for sediment monitoring. McNeil core sampling is the oldest of the three sampling methods used for evaluating streambed sediments. Core sampling also provides the most comprehensive assessment of substrate composition, but is also the most labor-intensive and is difficult to implement in smaller streams. Cobble embeddedness measurements provide a method to assess interstitial space in streambed cobbles available to small fish and macrointervertebrates. Free matrix is the most recently developed of the three methodologies and is considered a surrogate for cobble embeddedness. Free matrix protocols also provide measurements of surface fines whereas cobble embeddedness does not. Both cobble embeddedness and free matrix are better suited for small streams and are less labor-intensive compared to core sampling making them easier to establish across the study area (Nelson and Burns 2005).

MWH measured several parameters, including cobble embeddedness, surface fines, free matrix, and depth fines (core sampling) to evaluate substrate quality. The following statistical calculations were performed using Microsoft Excel:

- **Mean (μ)**: The sum of a collection of numbers divided by the total amount of numbers in the collection. While the arithmetic mean is often used to report central tendencies, it is not a robust statistic, meaning that it is greatly influenced by outliers (values that are much larger or smaller than most of the values).
- **Standard Deviation (σ)**: Standard deviation quantifies scatter within a dataset; how much the values vary from one another. It is expressed in the same units as the data.
- **Standard Error of the Mean (SEM)**: The standard error of the mean (SEM) quantifies precision of the mean. It is a measure of how far along a distribution the sample mean is likely to be from the true population mean. It is expressed in the same units as the data. A smaller value of SEM indicates that the sample mean is close to the population mean. A smaller SEM indicates more accurate data.
- **Confidence Interval (CI)**: Confidence intervals consist of a range of values (interval) that act as good estimates of the unknown population parameter. Confidence intervals are typically stated at the 95 percent confidence level and are shown as a value range (i.e., ±5 percent of the mean).
- **Coefficient of Variation (CV)**: Coefficient of variation (CV) is a measure of the dispersion of data points in a data series around the mean. CV is the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one monitoring site to another or between different years, even if the means are drastically different from each other.
- **Analysis of Variance (ANOVA)**: Comparison of means among sites and years, for appropriate variables.

For all habitat data box and whisker plots were developed by year for each site and subwatershed (see **Appendix 1**). Box and whisker plots display variation in samples of a statistical population without making any assumptions of the underlying statistical distribution, and they are used for quality control. A box and whisker plot is a quick way of graphically examining one or more sets of data, and is useful for comparing distributions among multiple datasets.

3.2.1.2 Cobble Embeddedness Evaluation

Cobble embeddedness provides an indication of the amount of interstitial space in streambed cobbles that is available to small fish and macroinvertebrates. Studies have shown that embedded substrate material affects both fish and the aquatic invertebrates that are commonly eaten by fish. For example, *Epeorus albertae,* a species of mayfly, is intolerant to the addition of fine sediment in streambeds. Juvenile steelhead have been shown to have impaired growth as embeddedness increased because of decreased prey availability and increased energy-wasting activity (Bjornn et al. 1977, Suttle et al. 2004).

Cobble embeddedness surveys are conducted annually at 10 sites within the aquatic resources study area, including sites historically monitored by the PAF. Several new sites within the Burntlog and SFSR watersheds were included, to provide data relevant to possible future access road alternatives (**Table 3-3**). Cobble embeddedness is the specific measurement of both the depth of embeddedness and total diameter for substrate for which the greatest diameter is between 45 mm and 300 mm. This measurement provides an estimate of overall percent embeddedness of the sampled reach.

Climatic and hydrologic variability occurs in natural systems, so collecting a robust dataset is not always practical to assess baseline conditions. Since year-to-year substrate conditions can be highly variable, tiered WCIs have been developed by the PAF to support management decisions regarding substrate information for granitic and non-granitic basins (Nelson and Burns 2005, Nelson and Burns 2007, Zurstadt et al. 2016a). The tiered WCI system allows for a single mean assessment to be applied when less than five years of data are available. Currently, no more than four data points exist for a single monitoring site, so WCIs based on a single year are currently being applied in this assessment. WCIs are included in tables and figures in this baseline report and are discussed for reference (Nelson and Burns 2005, Nelson and Burns 2007, Zurstadt et al. 2016a).

The PAF uses different WCIs to assess habitat health in granitic versus non-granitic watersheds (Nelson et al. 2006, Zurstadt et al. 2016a). Each sample site was identified as either a granitic or a non-granitic geologic type based on the spatial analysis of a PAF geology Geographic Information System (GIS) file. Areas designated with intrusive lithology were considered granitic, and areas with extrusive or metamorphic lithology were considered non-granitic. Non-granitic thresholds were adopted from the Big Creek Restoration and Access Management Plan Environmental Assessment (USFS 2016) and applied to this study (**Figure 3-2**).

Table 3-3 shows the substrate watershed condition indicators for granitic and non-granitic watersheds of the SFSR subbasin, for assessing cobble embeddedness.

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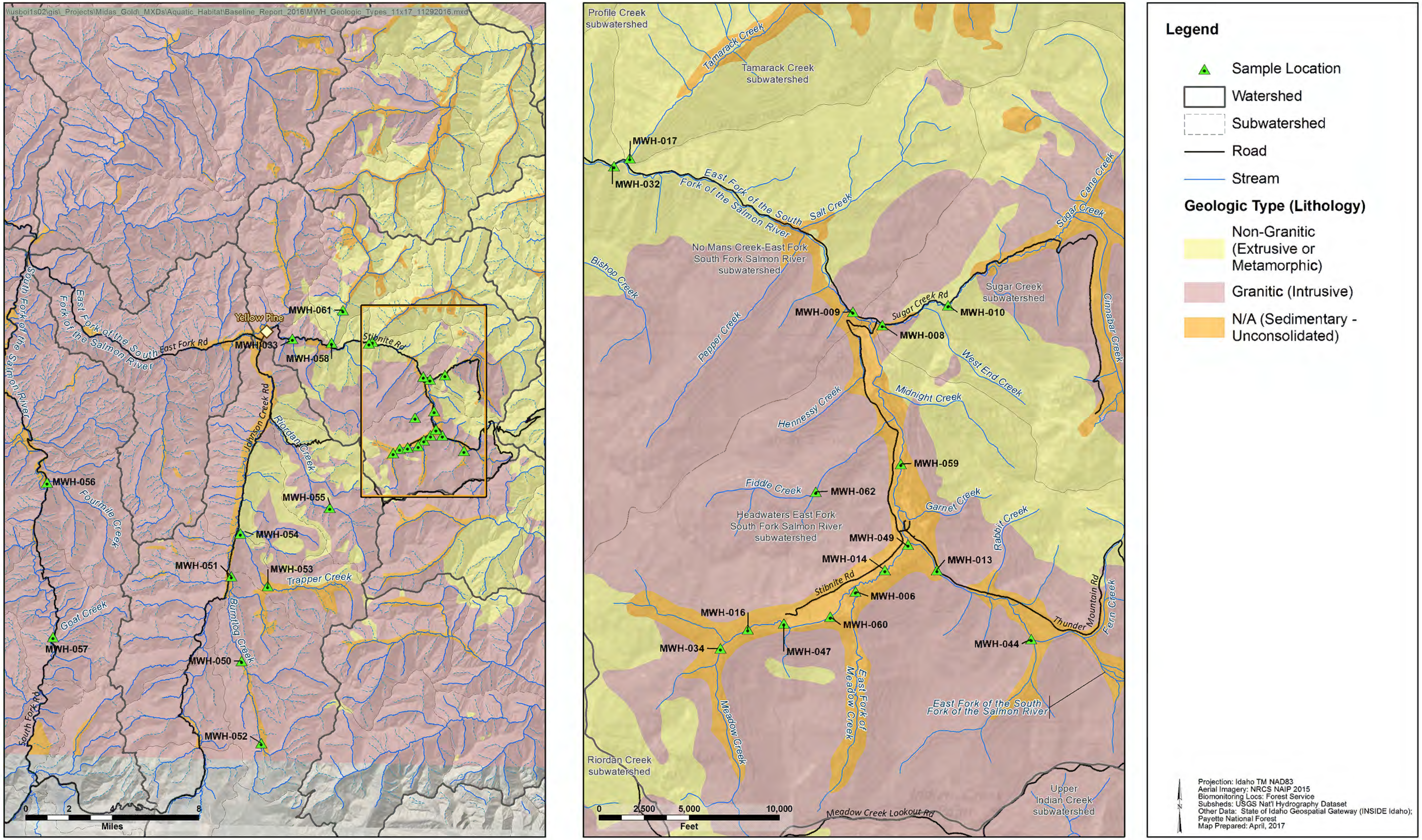

Figure 3-2. Geologic Types in the Project Area

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Table 3-3. Substrate Watershed Condition Indicators for Cobble Embeddedness in Granitic and Non-Granitic Watersheds of the South Fork Salmon River Subbasin

Geologic Type	Time Frame	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk
Granitic	Single Year 5-Year Mean	≤ 24% ≤ 32%	24-32% 32-42%	> 32% > 42%
Non-granitic	Single Year 5-Year Mean	≤ 14% ≤ 19%	14-19% 19-25%	> 19% > 25%

Source: Nelson and Burns, 2005, Nelson et al. 2006, Zurstadt et al. 2016a

Key:
> = greater than
≤ = less than or equal to
% = percent

3.2.1.3 Free Matrix and Surface Fines Evaluation

Free matrix measurements monitor streambed interstitial conditions and can be used as a surrogate for cobble embeddedness. Contrary to cobble embeddedness, free matrix samples at the reach-level follows a simpler sampling protocol, likely resulting in less chance of measurement error by the field observer (Nelson and Burns 2005). Additionally, the free matrix protocol includes an estimate of surface fines. Free matrix and surface fines data have been collected annually at 27 sites within the aquatic resources study area, from 2013 through 2016 (**Table 3-1**).

When measured correctly, free matrix measurements are correlated to, but different than the cobble embeddedness measurements. Free matrix measurements are simply counts of the free and embedded substrate material for which the greatest diameter is between 45 mm and 300 mm. Surface fines are defined as substrate material less than 6.33 mm in greatest dimension (described as diameter by the PAF). Pebble and gravel-size material—which are greater than or equal to 6.33 mm, and less than 45 mm in greatest diameter—are not measured within the free matrix protocol. Nelson and Burns (2007), state that surface fines represent a poor indicator of salmonid habitat condition, and they “caution that visually determining the frequency of fine particles is problematic.”

Cobble embeddedness sample events are limited to very specific habitat strata, they require detailed measurements, and are subject to higher probability of sampling error (Nelson and Burns 2005). By contrast, free matrix measurements cover the stream reach at a variable length, and is a simpler sampling protocol. Free matrix and cobble embeddedness data are collected in a double sampling protocol, to be able to estimate cobble embeddedness for reaches where it is not measured. In addition, free matrix data can serve as a quality-control mechanism for cobble embeddedness measurements, since measurement error is less likely when using free matrix. Cobble embeddedness and free matrix data should correlate for the same site; however, there is no correlation expected with surface fines.

Since year-to-year substrate conditions can be highly variable, tiered WCIs have been developed by the PAF to support management decisions regarding substrate information in both granitic and non-granitic basins (Nelson and Burns 2005, Nelson and Burns 2007, Zurstadt et al. 2016a). Therefore, WCIs are shown for both single sampling events and 5-year mean values for each basin type. **Table 3-4** lists substrate WCIs for granitic and non-granitic areas of the SFSR sub-basin (free matrix and surface fines). These WCIs address the proportion of substrate samples with particles featuring the greatest diameters between 45 mm and 300 mm that are free (i.e., not embedded) in the streambed (free matrix), and the proportion of sampled areas covered by sediment less than 6.33 mm in greatest diameter (surface fines).

Table 3-4. Substrate Watershed Condition Indicators for Free Matrix and Surface Fines in Granitic and Non-Granitic Areas of the South Fork Salmon River Subbasin

Geologic Type	Measurement	Time Frame	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk
Granitic	Free Matrix	Single Year 5-Year Mean	> 27% ≥ 17%	17-27% 11-17%	< 17% < 11%
	Surface Fines	N/A	≤ 12%	12-18%	> 18%
Non-granitic	Free Matrix	Single Year 5-Year Mean	>54% ≥ 43%	43-54% 33-43%	< 43% < 33%
	Surface Fines	N/A	≤ 3%	3-6%	> 6%

Source: Nelson and Burns 2005, Nelson et al. 2006, Zurstadt et al. 2016a

Key:
> = greater than
≥ = greater than or equal to
< = less than
≤ = less than or equal to
% = percent

3.2.1.4 Modified McNeil Core Sampling (Depth Fines) Evaluation

The modified McNeil core substrate sampling (core sampling) measures the proportion of the subsurface stream sediment consisting of fine materials, and is also referred to as depth fines. Percentage of depth fines is an indicator of spawning substrate quality. The core sampling provides an established method for evaluating sediment conditions and trends in streambed sediments, and offers a complete assessment of substrate composition.

Core samples from the EFSFSR at site MWH-033 have been collected annually since 2013 (**Table 3-2**). The core sampling site is approximately one-third of the way from the bottom of PIBO survey delineated reach. It is also upstream from the free matrix/surface fine survey location for MWH-033, since free matrix/surface fines are conducted starting at the downstream end of PIBO surveys. Core sampling occurs in five, 8-by-8 foot grid subsites following the PAF protocol (PAF 2007c).

Core sampling will continue until an adequate sample size is attained. As described above, since year-to-year substrate conditions can be highly variable, tiered WCIs have been developed by the PAF to support management decisions regarding substrate information in granitic and non-granitic basins (Nelson and Burns 2005, Nelson and Burns 2007, Zurstadt et al. 2016a). At this point in the baseline study, data has been collected for four years at the core sample site. All WCI indicators are included in tables, charts, and in discussion for reference.

Core sampling provides the percentage of depth fines of less than 6.33 mm, and the percentage of depth fines less than 0.85 mm. Core samples are only taken in the EFSFSR at site MWH-033, therefore a comparison of means of depth fines is not applicable. Different WCIs are used to assess habitat condition in granitic and non-granitic watersheds (**Table 3-5**) for depth fines less than 6.33 mm, but the WCIs are based on a 5-year mean, with no values provided for single-year samples. For depth fines less than 0.85 mm, Jensen et al. (2009) recommends a 10 percent threshold regardless of geologic substrate. In general, a lower proportion of depth fines indicates higher-quality spawning substrate (Jensen et al. 2009).

Table 3-5. Substrate Watershed Condition Indicators and Thresholds for Depth Fines (Core Sampling) in Granitic and Non-Granitic Areas of the South Fork of the Salmon River Subbasin

Sediment Size Class	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk
< 6.33 mm	5-year mean concentrations at depth of ≤28% with no more than 2 years between 28% and 36%	5-year mean concentrations at depth of 28% to 36% with no more than 2 years >36%	5-year mean concentrations at depth of ≥36%
		5-year mean concentrations at depth between 28% and 36% with an increasing trend over at least 10 years	5-year mean concentrations at depth ≥36% with an **increasing** trend over at least 10 years
	5-year mean concentrations at depth of between 28% and 36% with a **decreasing** trend over at least 10 years	5-year mean concentrations at depth of 36% or more with a **decreasing** trend over at least 10 years	
< 0.85 mm	<10%*	≥10%*	≥10%*

Source: Nelson and Burns 2005, Zurstadt et al. 2016a
Note: WCIs for Depth Fines are based on a 5-year mean only.
*10% thresholds are not part of WCI, rather they are a threshold suggested for long-term trend data for fines <0.85 mm at core sites, based on Jensen et al. 2009 research.
Key:

Key:
> = greater than
< = less than
≤ = less than or equal to
% = percent
mm = millimeters

3.2.1.5 Channel Morphology and Condition Evaluation (PIBO Surveys)

Stream habitat parameters are directly related to fish habitat quality. As shown in **Table 3-1**, PIBO habitat data have been collected at multiple sites since 2012, most of which have been surveyed twice to date. The PIBO surveys are being conducted on a rolling 5-year monitoring schedule (each site is surveyed once every five years), unless a major event such as a landslide, avalanche, or flood occurs. Currently, each PIBO site has data for two years, except for MWH-059 (EFSFSR), MWH-060 (Meadow Creek), MWH-061 (Profile Creek), and MWH-062 (Fiddle Creek). MWH-059, 060 and 061 were established in 2014, and MWH-062 was established in 2015. The PAF advised not using WCI indicators yet for PIBO data comparisons (Zurstadt 2014).

Several parameters are directly influenced by flows or by sampling methodology. Therefore, differences in the data between years does not necessarily indicate that habitat has changed at a site. Parameters for which protocols have changed since 2012, or parameters that are directly affected by field measurements being recorded at different flows include:

- Reach Average Wetted Width-to-Wetted Depth (WW:WD) Ratio and Pool Wetted Width-to-Wetted Max Depth Ratio: These parameters are directly related to the stage (water level) of the stream at the time of sampling. Observed stream stage is dependent on flow, and thus on annual and daily precipitation, surface/groundwater interactions, and the time of year a stream is sampled (i.e., baseflow vs. early summer/spring runoff conditions). As stream stage increases, stream depth as well as wetted width increases; however, depth and wetted width may not change at the same rate with increasing flow, leading to variability in their ratio
- Bank angle measurements were included in the PIBO protocol in 2014
- Bank stability criteria were altered in the 2014 surveys, but the data are comparable
- LWD protocols were modified by the PAF in 2014 and 2015 (PAF 2014 and 2015). **Table 3-6** details the modifications to the LWD protocol between survey years, and Zurstadt et al. (2016b) provides the justification for these changes. While there is an established WCI for LWD, there is flexibility based on local conditions, such as riparian vegetation type/community type, stream channel width and type (PAF 2003). WCI thresholds and descriptions are detailed in **Table 3-7**
- Pools criteria in the PIBO protocol is dependent on flows and water level during the sampling season, so the same unit may not be counted as a pool each year. For example, wetted channel width is directly related to the stream stage at the time of sampling. Therefore, during lower flows, the same "pool" may not meet the wetted width criteria described above. Pools are defined based on the following criteria:
    - Depressions in the streambed that are concave in profile, both laterally and longitudinally
    - Bounded by a head crest (upstream break in streambed slope) and a tail crest (downstream break in streambed slope)
    - Only consider main channel pools where the thalweg (i.e., middle of the deepest part of the channel of a river or other stream) runs through the pool, and not backwater pools
    - Span at least half of the wetted channel width at any location within the pool
    - Maximum depth is at least 1.5 times the pool tail crest depth

Table 3-6. Changes to the Large Woody Debris Protocol between Survey Years

Large Woody Debris Type	2012-2013 Protocol	2013-2014 Protocol	2015 Protocol[1]
Single LWD Pieces	Single pieces must be at least 3 m long or two-thirds the wetted width of the stream (whichever is smaller) and 0.1 m in diameter one-third of the way up from the base	Same as the 2012-2013 protocol	Single pieces must be greater than 1 m in length and 0.1 m in diameter one-third of the way up from the base.
Rootwads	Attached to logs less than 3 m long	Not included in 2014 revised protocol, and may not have been counted as a single LWD, unless attached to log meeting single LWD criteria (see above).	Not included in 2015 revised protocol, and may not have been counted as a single LWD, unless attached to log meeting single LWD criteria (see above).
Forest Plan LWD	Not included in protocol, would have been counted as single LWD	Single piece is 0.3 m in diameter one-third of the way up from the base and is a minimum of 10.7 m in length. Pieces in aggregates are not counted as individual pieces	Single piece is 0.3 m in diameter one-third of the way up from the base and is a minimum of 10.7 m in length. Pieces in aggregates are counted as individual pieces.
Aggregates	Aggregates are a group of two or more pieces, each of which qualifies as a single piece (as above); each aggregate is counted and recorded as an LWD aggregate. Count or estimate the number of individual pieces in the aggregate.	Aggregates are a group of two or more pieces, each of which qualifies as a single piece (as above).	Not included in 2015 revised protocol and individual pieces may not have been counted as single LWD or Forest Plan LWD unless criteria was met (see above).

Note:

[1] The stem of all large woody pieces must extend below bankfull elevation to be counted.

Key:
LWD = large woody debris
m = meter

Table 3-7. Watershed Condition Indicators for Large Woody Debris (LWD)

Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk
> 20 pieces per mile; > 12 inches in diameter, > 35 feet in length, and adequate sources of large woody debris for both long and short-term recruitment	Currently meets standards for functioning appropriately, but lacks potential sources of short or long-term large woody debris recruitment to maintain the desired condition.	Does not meet standards for functioning appropriately and lacks potential large woody debris for short and/or long-term recruitment.

Source: PAF 2003

3.2.1.6 Water Temperature Analysis

Thermograph installation sites were chosen by the USFS to record water temperatures (**Table 3-2**). Some locations coincide with past PAF water temperature monitoring sites which provides a longer-term record for comparison and analyses. Stream temperatures are recorded at 15-minute intervals by the data loggers, which were attached to instream boulders using epoxy and PVC canisters, as detailed in the USFS Rocky Mountain Research Station protocol (USFS 2013). One exception to this installation method is MWH-055 which was attached to a submerged log due to the lack of boulders or large rocks in the streambed.

Data from the thermograph data loggers were originally downloaded on an annual basis, but more frequent (two to three times per year) downloads were completed to limit data loss due to data shuttle download malfunctions or high spring runoff events which has resulted in the loss of data loggers.

To supplement the aquatic resources study area thermograph data, data from five USGS stream gauges have been incorporated into the baseline study analysis.

3.2.2 Macroinvertebrate Surveys

As described in detail in **Appendix 2**, macroinvertebrate samples were collected at 11 sites (located in the EFSFSR, Meadow Creek, Sugar Creek and Tamarack Creek) during the summers of 2012 through 2014, and in 2016, following the PIBO protocol (Heitke et al. 2011). The macroinvertebrate survey sites are shown in **Figure 3-3**.

3.2.2.1 Field Methods

Macroinvertebrates were collected with D-nets using a targeted composite method. As detailed in the PIBO protocols, two individual samples were taken at random locations in four consecutive riffle/run habitat units at each sampling site, for a total of eight individual samples per site. These eight samples were then composited in the field into a single benthic macroinvertebrate sample per site and preserved in 95 percent ethanol.

3.2.2.2 Laboratory Methods

Composite macroinvertebrate samples were transported to the EcoAnalysts, Inc. laboratory in Moscow, Idaho for sorting, subsampling, and taxonomic (e.g., family, genus, species) identifications. A subsample of 500 organisms was randomly sorted out of each composite sample. All organisms in the subsample were then identified to the lowest practical level, generally genus or species, and enumerated. If, for some reason, an individual could not be identified to the lowest practical target resolution (e.g., due to poor condition or damage, being immature, or for some other reason being indeterminate), then it was identified to the lowest taxonomic resolution possible for that individual specimen.

All individuals not identified to target resolution were noted as being unique or non-unique taxa, relative to the other taxa in the sample, so that non-unique taxa could be excluded from taxa richness (total number of identifiably distinct organisms in a sample) calculations. Excluding non-unique taxa from richness metrics avoids erroneously inflating taxa richness values.

The Idaho Stream Macroinvertebrate Index (SMI) was calculated for all sites and sampling years (Grafe 2002). The SMI was developed by the IDEQ and is extensively used to evaluate stream conditions throughout Idaho. The SMI metrics were selected from a larger list of candidate metrics based on how well they predicted macroinvertebrate and habitat/water quality relationships. Candidate metrics fall into one of several categories that include:

- Richness
- Evenness/diversity
- Relative abundances
- Functional feeding groups
- Habit/behavior
- Pollution tolerance

Because taxa composition and natural habitat conditions vary among ecoregion types, the Idaho SMI has been calibrated for different Idaho regions based on the reference conditions used to develop the regional metric scoring formulas. The Stibnite Gold Project is located within the Idaho SMI Central and Southern Mountains region and the scoring formulas for that region were used in this study. It should also be noted that non-unique taxa, as previously defined, were excluded from all taxa richness metric calculations.

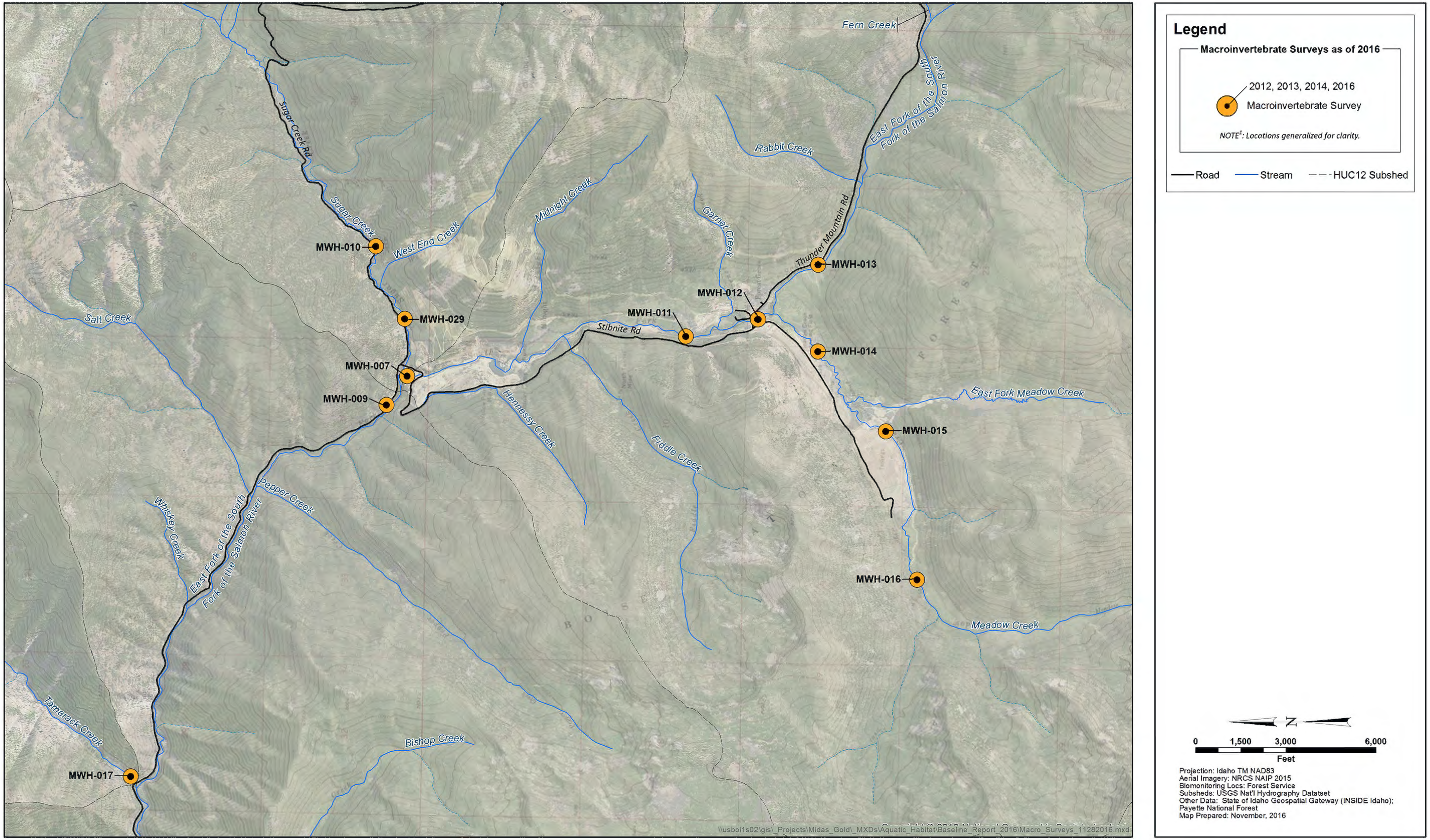
The following SMI metrics were evaluated in this study and are further described in **Appendix 2**:

- Total Taxa Richness – Total number of identifiably distinct taxa in a sample
- Ephemeroptera Taxa Richness – Total number of identifiably distinct taxa in the insect order Ephemeroptera (mayflies)
- Plecoptera Taxa Richness – Total number of identifiably distinct taxa in the insect order Plecoptera (stoneflies)
- Percent Plecoptera – Relative abundance of stoneflies, expressed as a percent of the total number of individuals in the sample
- Trichoptera Taxa Richness – Total number of identifiably distinct taxa in the insect order Trichoptera (caddisflies)
- Hilsenhoff Biotic Index (HBI) – Index of community tolerance to organic pollution
- Percent 5 Dominant Taxa – Percentage of individuals in a sample comprised of the five most abundant taxa
- Scraper Taxa Richness – Total number of distinctly identifiable taxa in a sample whose primary feeding strategy is to scrape attached periphyton (aquatic organisms, such as algae, that live attached to rocks or other surfaces) and other particulates
- Clinger Taxa Richness – Total number of clinger taxa in a sample

The following five additional informative metrics were calculated and presented for all sites and sampling years (and are further described in **Appendix 2)**:

- Long-lived Taxa Richness – The total number of taxa in a sample that require more than one year to complete their life cycle
- Metals Tolerance Index (MTI) – McGuire's Metal Tolerance Index (MTI) is an index of community tolerance to metal contamination that ranks taxa by their sensitivity to metals

- Intolerant Taxa Richness – The number of taxa in a sample with HBI values of 0 to 2
- Percent Tolerant Individuals – The relative abundance of all individuals in a sample having HBI values of 8 to 10, expressed as a percentage of the total number of individuals in the sample
- Shannon-Weaver H' (log e) – A community diversity index



Projection: Idaho TM NAD83
Aerial Imagery: NRCS NAIP 2015
Biomonitoring Locs: Forest Service
Subsheds: USGS Nat'l Hydrography Datatset
Other Data: State of Idaho Geospatial Gateway (INSIDE Idaho); Payette National Forest
Map Prepared: November, 2016

Figure 3-3. Macroinvertebrate Survey Locations for all Survey Years (2012 – 2014 and 2016)

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The functional feeding groups (FFG) represented in the insect community are a direct function of available food and habitat resources, and are often good indicators of habitat quality and stability. The following FFGs were evaluated in this study, and are further described in **Appendix 2**:

- Percent Filterers – The relative abundance of all individuals in a sample whose primary feeding mechanism is to filter suspended fine particulates
- Percent Gatherers – The relative abundance of all individuals in a sample whose primary feeding mechanism is to gather deposited fine particulates
- Percent Predators – The relative abundance of all individuals in a sample whose primary feeding mechanism is to pierce or engulf other invertebrates
- Percent Scrapers – The relative abundance of all individuals in a sample whose primary feeding strategy is to scrape attached periphyton and other particulates
- Percent Shredders – The relative abundance of all individuals in a sample whose primary feeding mechanism is to shred coarse particulate organic matter (CPOM)
- Percent Unclassified – The relative abundance of all individuals in a sample whose primary feeding mechanism is unknown or unclassified
- Filterer Richness – The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to filter suspended fine particulates
- Gatherer Richness – The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to gather deposited fine particulates
- Predator Richness: – The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to pierce or engulf other invertebrates
- Scraper Richness – The total number of distinctly identifiable taxa in a sample in which the primary feeding strategy is to scrape attached periphyton and other particulates
- Shredder Richness – The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to shred CPOM. This is an indicator of terrestrial vegetation input
- Unclassified Richness – The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is unknown or unclassified

3.2.2.3 PIBO Observed/Expected Index

The PIBO observed/expected (O/E) index, derived from the statistical model RIVPACS (River Invertebrate Prediction and Classification System), was also used to assess biological condition of sampled sites in all surveyed years. O/E models compare the macroinvertebrate taxa observed at sites of unknown biological condition (i.e., test sites) to the assemblages expected to be found in the absence of anthropogenic stressors (Hawkins et al. 2000). O/E scores were calculated for taxa having a probability of capture greater than or equal to 0.5, to increase the precision of O/E estimates and subsequent model sensitivity to stressors.

Biological condition was subsequently assessed based on the precision of the reference site data used to develop the PIBO O/E model (mean = 0.95, standard deviation (SD) = 0.16). In general, departures from a ratio of 1.0 indicate that the taxonomic composition in a stream sample differs from that expected under less-disturbed conditions. The biological condition rating for each sampling site is a qualitative rating compared to reference sites ranging from:

- Good (i.e., comparable to reference conditions) – Less than one standard deviation below the mean of reference sites
- Fair – Between 1 and 2 standard deviations below the mean of reference sites
- Poor – More than 2 standard deviations below the mean of reference sites

Additional details are provided in **Appendix 2**.

3.2.3 Metals Surveys

Metals within the watersheds were sampled by collecting stream sediment, macroinvertebrates and fish.

3.2.3.1 Sediment

Sediment samples were collected at 16 survey sites (**Figure 3-4**). The sites selected for testing are at, or near, those established for the Stibnite Area Site Characterization Report (URS 2000), and most overlap with the existing macroinvertebrate sites established for the baseline study. Sediment samples were collected using either a scoop or Ponar grab sampler (depending upon habitat type) and were sifted through a 250-micron sieve until a 500 milliliters (ml) container (provided by SVL Laboratories, Inc.) was approximately two-thirds full, or contained approximately 350 ml. Samples were kept refrigerated until they were shipped to the SVL Laboratory and then analyzed for a full suite of metals and metal-like anions.

The laboratory results provide data that can be used in a limited way to assess the nature and extent of metals in sampled streams' sediment, and their potential exposure to aquatic life. The data were assessed using selected ecological screening-level benchmarks for sediment as compiled by the Environmental Protection Agency (EPA) (EPA 2006). The EPA benchmarks use a synthesis of multiple screening values, which may variously include Threshold Effects Levels (TEL), Probable Effects Levels (PEL), and/or other criteria. When performing a complete risk assessment or full analysis of biological effects due to metals in the environment, it would be essential to consider the nature of these levels. The limited assessment provided in this baseline report is appropriate for the data collected. With limited data on metal content in sediment available, as well as the inherent variability in sediment substrate, it is not prudent or meaningful to provide any conjectures on 2016 temporal trends' results.

Figure 3-4. Sediment and Macroinvertebrate Survey Locations for Metals Testing in 2016

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3.2.3.2 Macroinvertebrates

Macroinvertebrate samples for metals analyses were collected using a D-net at the same survey sites as the sediment metals collections (**Figure 3-4**). The samples were stored in containers provided by ALS Environmental, Inc., the laboratory conducting the analysis. Approximately 10 grams of macroinvertebrates were collected and stored in a freezer until the samples were shipped to the ALS laboratory located in Kelso, Washington.

Many metals can be highly toxic to freshwater invertebrates; however, toxicity varies across taxa, with some taxa more tolerant of metals pollution than others. Therefore, there are no standard benchmarks for metals concentration in invertebrate tissue. The most common effect of metals pollution is a change in macroinvertebrate community composition (i.e., to pollution-tolerant taxa). Due to the limitations described above, the laboratory results are primarily compared spatially between sample locations, as well as temporally with past analyses that were conducted in 1995, 1996, and 1997 (URS 2000). However, tissue concentrations for arsenic, mercury, and selenium are compared to values that are shown to have dietary toxicity for fish (i.e., toxicity to fish from eating invertebrates with high tissue concentrations of these metals). Dietary toxicity data comes from a recent review of toxicological data by NMFS (NMFS 2014). Other metals, including antimony, either did not have enough data to determine dietary toxicity or there was no evidence of dietary toxicity.

3.2.3.3 Fish Tissue

Westslope cutthroat trout and sculpin were collected during the electrofishing fish population study in 2015 from 14 locations, to test for heavy metal bioaccumulation in fish tissue. The fish kept for analyses were collected after fish were marked and after the snorkel surveys were completed. The fish were kept cool while in the field, stored in the freezer at the end of the day, and kept frozen until they were sent to the Jupiter Environmental Laboratories, Inc. for analysis.

3.2.4 Fish Surveys

Multiple fisheries' survey methods have been employed since 2012. These methods include snorkeling, videography, electrofishing, environmental deoxyribonucleic acid (eDNA) collections, and tissue collections for genetic testing. **Table 3-8** identifies all survey sites and the methods employed at these sites except for most the eDNA sites established through the Range-Wide Bull Trout eDNA Project.

Table 3-8. Fisheries Survey Site Locations for All Survey Years

Creek	MWH Site ID	2012	2013	2014	2015	2016
EFSFSR	009	D		D/N		
Sugar Creek	010	D	D	D		
EFSFSR	011	D	D	D/N	D/E	
EFSFSR	013	D	D	D		
Meadow Creek	014	D	D	D	D/E	
Meadow Creek	015	D	D	D/N		
Meadow Creek	016	D		D	D/E	
Tamarack Creek	017	D	D	D/N		
Sugar Creek	018	D	D	D	D/E	
Cinnabar Creek	019	D	D	D	D/E	
Sugar Creek	020	D	D			
Cane Creek	021	D	D			
EFSRSR	022	D	D	D		
Fiddle Creek	023	D	D	D		
Fiddle Creek	024	D				V
EFSFSR	025	D	D		D/E	
EFSFSR	026	D	D	D/N	D/E	
EFMC	027	D	D	D		
EFMC	028	D	D	D/N		
Sugar Creek	029	D	D/N	D		
EFSFSR	030	D	D	D/N		
EFSFSR	032		D	D/N		
EFSFSR	033		D			
Meadow Creek	034		D		D/E	
EFSFSR	044		D			
Meadow Creek	047		D/N	D	D/E	
Midnight Creek	063					D
Midnight Creek	064					V
Hennessy Creek	076					
Hennessy Creek	077					V
Fiddle Creek	425-1					D

Note:
Site MWH-014 includes the 2012 survey at site MWH-031. Site was moved a short distance upstream in 2013 to provide a survey location consistent with the stream habitat and macroinvertebrate surveys.
Site MWH-076 was too shallow to either snorkel or record via a video
Site 425-1 is a designated e-DNA site in the U.S. Forest Service's Range-Wide Bull Trout e-DNA Project, and sites MWH-024, MWH-063, MWH-064, MWH-076, and MWH-077 also include e-DNA samples. Other sites defined in the Range-Wide Bull Trout eDNA Project are not included in this table.

Key:
D = day dive
E = electrofishing
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River
N = night dive
V = videography

3.2.4.1 Genetics Studies

During the electrofishing surveys in 2015, described below, fin clips were taken from fish identified as either a rainbow trout or as a westslope cutthroat trout. The purpose of these fin-clip collections was for genetic sampling, to help determine morphological characteristics separating rainbow trout and cutthroat trout, and to get a better understanding of their potential hybridization and distribution.

Each genetic sample was collected by attaching a portion of a fish fin to chromatograph paper, and then allowing the sample to dry. Fork length was measured and a photograph was taken of each fish from which a genetic sample was collected. Fish collected for the heavy metal bioaccumulation study were kept whole and put into a freezer as quickly as possible. All fish were kept frozen until they reached the lab for processing.

In 2016, eDNA was collected at 22 established Range-Wide Bull Trout eDNA Project survey sites, established by the Rocky Mountain Research Station of the USFS (**Figure 3-5**). Eight additional sites were sampled, covering smaller streams not included in the larger USFS program. Samples were collected under as sterile of conditions as possible. Nitrile gloves were worn while holding the base of the filter cup. The filter cup was faced upstream, into the current, and a peristaltic pump was used to pull five liters of water through the filter. Disposable tweezers were used to remove the filter which was placed in a desiccant, and labeled with the site number, creek name, date, and global positioning system (GPS) location. The sample was then placed on ice until it was stored in a freezer. All samples were provided to the PAF, which was responsible for submitting the samples to the laboratory. Species for which the laboratory tested were Chinook salmon, westslope cutthroat trout, rainbow trout (or more appropriately, *O. mykiss* as eDNA testing cannot distinguish between subspecies at this time), bull trout, brook trout, and Pacific lamprey.

Also in 2016, fin tissues were collected from 11 trout (targeted rainbow and/or golden trout) in Meadow Creek Lake for genetic testing. The tissues were placed on chromatographic tissue sample sheets that provided individual identification labels. Photographs were taken of each fish, and the photograph number was included on the sample sheet. Once the chromatographic sheet was air dry, a single piece of white copy paper was placed on top of the dry chromatographic sheet, and then placed between two pieces of card stock. These were then stored in a single manila envelope and delivered to the PAF, which was responsible for submitting the samples to the laboratory.

3.2.4.2 Population Abundance Study

Fisheries’ surveys in 2015 were conducted using a combination of electroshocking and snorkel surveys to calibrate previous and future snorkel surveys, to provide more accurate population estimates, biomass estimates, and length frequencies. Although a total of 11 sites were selected for sampling, only nine sites were surveyed due to inclement weather. These sites were selected based on the separation of all surveyed units into different strata—as defined by habitat characteristics—that would most likely influence sampling efficiency (Peterson et al. 2004, Meyer and High 2011). Previous PIBO stream habitat survey results, as well as professional judgment, were used to delineate the strata and to categorize existing snorkel sites as most representative of each. Habitat variables used for strata delineation included channel complexity, amount of LWD, stream channel gradient, substrate size, channel width, and stream bank complexity. Based on professional judgment, five strata were considered representative within the aquatic resources study area. To minimize take of Endangered Species Act (ESA)-listed fish, the survey sites selected were those that had a reduced likelihood of encountering adult and juvenile Chinook salmon and large-bodied bull trout.

The following sites by strata, each 100 meters (m) in length, were surveyed and are also shown in **Figure 3-6** and **Table 3-7:**

- Strata 1: Sites MWH-034 (Meadow Creek), MWH-026 (EFSFSR), MWH-016 (Meadow Creek), and MWH-019 (Cinnabar Creek) – complex channel with moderate LWD, moderate gradient, medium sized substrate, and small channel width. PIBO survey completed in strata at MWH-034, and MWH-016.
- Strata 2: Sites MWH-018 (Sugar Creek) and MWH-014 (Meadow Creek) – simple channel, low amounts of LWD, low gradient, small substrate, and medium channel width. PIBO survey completed in strata at MWH-014.
- Strata 3: Site MWH-025 (EFSFSR) – complex channel, high amounts of LWD, moderate gradient, large substrate, and moderate channel size. MWH-013 was intended for inclusion, but time constraints resulted in this site being eliminated from the survey. PIBO surveys were conducted at MWH-013 for comparable habitat information.
- Strata 4: Sites MWH-011 (EFSFSR) – simple channel with low amounts of LWD, large substrate, and large channel width. No PIBO surveys are associated with this strata, although a PIBO site is located approximately 500 m downstream.
- Strata 5: Site MWH-047 (Meadow Creek) – meadow channel, low amounts of LWD, low gradient, small substrate, and small channel width. MWH-027 was intended for inclusion, however time constraints resulted in this site being eliminated from the survey. PIBO survey completed in strata.

Fisheries’ survey methods included mark-recapture, four-pass depletion electrofishing surveys and daytime snorkel surveys within a 100 m stretch of river confined with blocknets. Habitat was characterized for each surveyed site Surveys were conducted by two separate crews, each consisting of two USFS and three MWH biologists and technicians. Additionally, Russ Thurow and John Guzevich, both with the USFS Rocky Mountain Research Station, trained both crews because of their extensive experience in snorkel surveys, electrofishing surveys and calibration studies.

Habitat data were collected at each fish survey site to provide the overall site-specific conditions that could affect the ability to either physically collect the fish through electrofishing, or affect the ability to visually observe the fish underwater via snorkeling. Habitat parameters measured in the 100-m unit included:

- Average stream gradient
- Stream conductivity
- LWD count
- Length of stream with undercut bank
- Length of stream with overhanging vegetation
- Average width of overhanging vegetation
- Percent of unit with submerged vegetation (including tree roots) and turbulent cover

- Dominant pool-forming feature (scour, LWD, boulder)
- At 10 transects roughly equidistant throughout the unit:
  - Wetted width
  - Channel depth at ¼, ½, and ¾ across the channel width
  - Percent of substrate less than 6 mm, between 6 mm and 75 mm, between 75 mm and 150 mm, and greater than 150 mm
- Five to 10 substrate measurements at equal distances across the width

Water temperatures were recorded in 15-minute increments from the time the block nets were first installed to the time they were removed. The intent was to record water temperatures during the snorkel surveys.

Data collected in 2015 provide a calibration for the past and future snorkel surveys in order to estimate fish populations and densities, as well as to determine the best method of collection/fish observation at specific sites. To date, these data have not been fully processed, requiring further calculations to provide snorkel survey efficiencies. Results of the calibration will be presented in an addendum report, which will also include the population estimates and fish densities for the 2012 through 2015 snorkel surveys.

3.2.4.3 Snorkel Surveys

From 2012 through 2014 fish surveys were conducted via snorkeling, following the modified protocol established by the PAF, and techniques described in Thurow (1994) and O’Neil (2007). Since 2012, 31 sites, each approximately 100 m long, have been surveyed at a protocol level (**Figure 3-6** and **Table 3-8**). Both day and night dives were conducted at two sites in 2013, and eight sites in 2014 (**Table 3-8**). Night dives were conducted to observe younger age classes, which often move or use habitat differently at night. Bull trout may also be more observable at night because juveniles, which are bottom oriented, are often found in between cobbles and boulders or among woody complexes, which make them difficult to detect during daylight hours. Additionally, bull trout may increase their nocturnal movements to forage in the water column (Berge and Mavros 2001). Specific night-dive site locations were selected based on access and safety.

Fish species and size class were recorded when feasible, for each survey site, to determine fish distribution. At times, fish moved too quickly to be able to confidently identify the species, thus, notes were recorded indicating fish that were observed but not included in the overall count, which was based on species.

Additional data was recorded, including: water and air temperature, weather conditions, stream gradient, estimated average and maximum depth, and channel widths, which were recorded at 10-m intervals beginning in 2013 (only general estimates of stream widths were made in 2012). Based on protocol recommendations, water temperatures below 9 degrees Celsius (°C) (in 2012) and 10°C (2013 and later) were avoided during day dives, however there was no required temperature minimum for night dives.

The survey team photographed the upstream and downstream end of each survey site at least one time. GPS locations were recorded the first time a site was surveyed, and permanent markers were placed to document site locations.

During these survey years, some bull trout were misidentified as brook trout or as potential brook trout/bull trout hybrids, based on the color and spotting patterns of the fish observed. However, in the 2015 electrofishing survey conducted jointly with the USFS, these fish were identified as bull trout. All brook trout data from 2012 through 2014 were converted to bull trout. Additionally, following the genetics sampling, it appears that rainbow trout do not occur upstream from the Yellow Pine pit. Therefore, fish formerly identified as rainbow trout were changed to westslope cutthroat trout.

At the request of Midas and the USFS, fish observational surveys were conducted via snorkeling or videography at five eDNA survey locations (**Table 3-8**). The original intent was to snorkel six locations; however, four locations were too shallow and/or narrow to snorkel, so underwater videos were recorded, and one site was too shallow to snorkel or record by video. When snorkeling was not feasible, but videography was possible, Panasonic and GoPro digital cameras were used to film as much of the stream channel as possible, filming from downstream and moving upstream. Neither the snorkel surveys nor video surveys were protocol level, as substantial portions of the channels had to be walked around due to shallow depths, LWD aggregates, or cascades. Only the lower Fiddle Creek survey site (425-1) was approximately 100 m long, the remaining units were substantially shorter because of gradient, overgrown vegetation, instream LWD, cascades, or other conditions precluding accessibility.

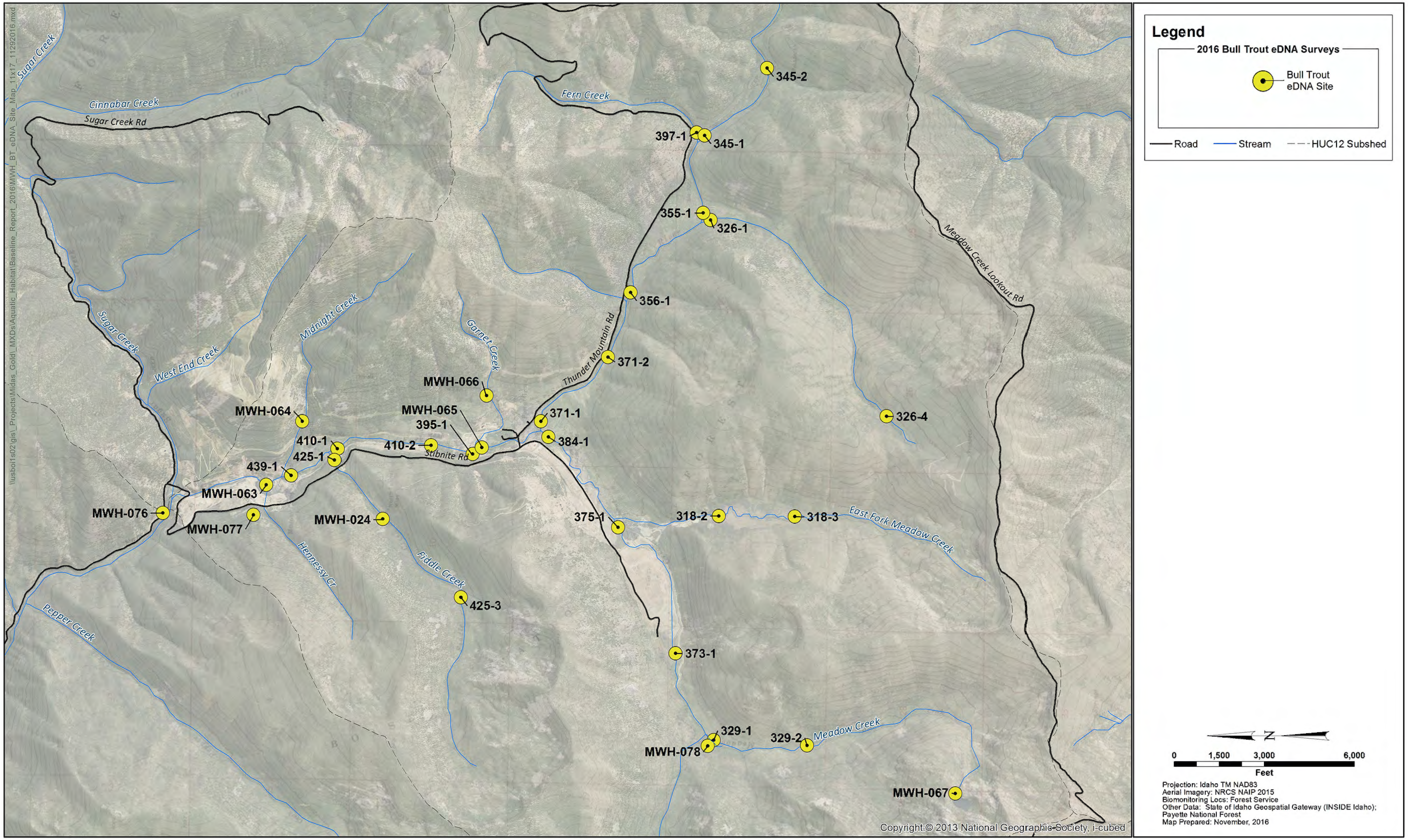

Figure 3-5. Environmental DNA Survey Locations in 2016

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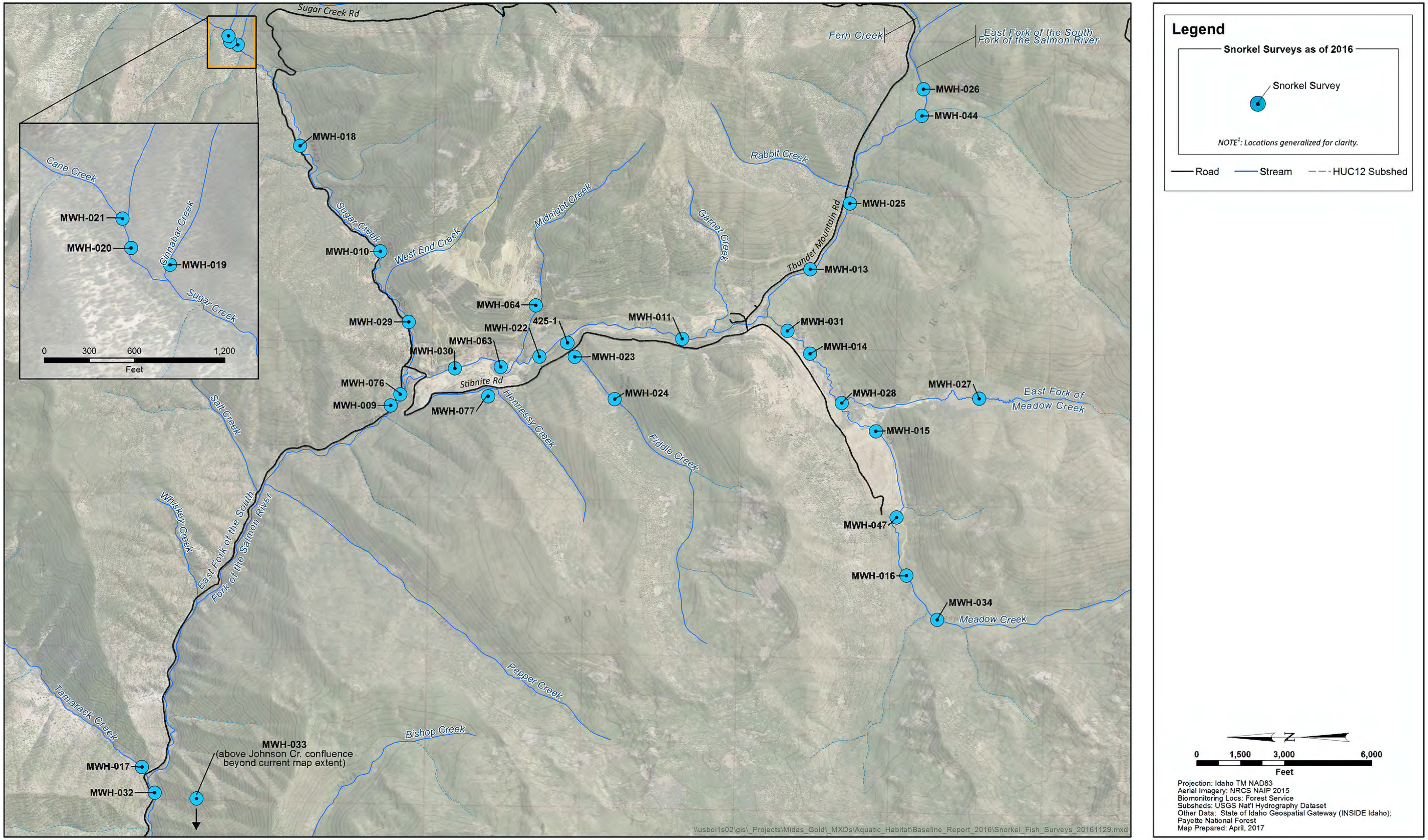

Projection: Idaho TM NAD83
Aerial Imagery: NRCS NAIP 2015
Biomonitoring Locs: Forest Service
Subsheds: USGS Nat'l Hydrography Dataset
Other Data: State of Idaho Geospatial Gateway (INSIDE Idaho); Payette National Forest
Map Prepared: April, 2017

Figure 3-6. Snorkel Survey Sites Established During All Survey Years

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SECTION 4 AFFECTED ENVIRONMENT

This section summarizes the affected environment for the aquatic resources of the Stibnite Gold Project. It includes a description of the surveyed streams and the fish species found in the aquatic resources study area.

4.1 Description of Surveyed Streams

The aquatic resources study area is characterized by cool, dry summers. Most precipitation occurs as winter snow, with peak stream discharge generally occurring in late spring (May through June). The following are descriptions of important aquatic features in the aquatic resources study area:

East Fork of the South Fork of the Salmon River – Habitat type varies in the EFSFSR. In the section upstream from its Meadow Creek confluence, the EFSFSR is characterized by narrower channels with mostly moderate to high gradients (around 2 to over 6 percent), and overall mostly smaller substrate size, with sand, gravel and smaller cobble often dominating the unit with occasional boulders. Between Meadow Creek and the Yellow Pine pit, the EFSFSR widens, has moderate to high gradients (approximately 2 to 8 percent), and has larger streambed material including abundant cobble and boulders. A large cascade (with an approximately 22 percent gradient) immediately upstream from the Yellow Pine pit likely precludes fish passage. Between the Yellow Pine pit and the confluence with Sugar Creek, the EFSFSR is similar in width, gradient and substrate material as immediately upstream, but many of the larger boulders and cobble are sharp and more angular, and pools are frequently deeper. Downstream from the Sugar Creek confluence, the EFSFSR gradients vary, ranging from low gradient pools and runs to large gradient cascades. The substrate is also variable, often dependent on the channel gradient. The lower-gradient sections are often dominated by gravel and cobble, with higher-gradient units dominated by large cobble and boulders. Throughout most of the aquatic resources study area, the EFSFSR has relatively abundant riparian vegetation; the main exception is in the vicinity, both upstream and downstream, of the Yellow Pine pit. Upstream from the Meadow Creek confluence, the stream channels often have very high amounts of LWD. The 2014 avalanches, all downstream from Sugar Creek, resulted in increased LWD downstream in that section of the EFSFSR.

Tamarack Creek – This EFSFSR tributary was surveyed as a control site because, located in the boundary of the wilderness, it is considered to have minimal impacts other than trails and campsites. Only the lower section of the creek was observed and documented. The lower section of Tamarack Creek has moderate gradients with some bank sloughing. Dominant substrate is comprised of gravel and cobble, with some bedrock and boulders. Some LWD is dispersed throughout the creek.

Profile Creek – This EFSFSR tributary was surveyed as a control site, and is a moderate-gradient stream that runs alongside the Warren-Profile Gap Road for several miles. Only the lower section of the stream was observed and documented. Riprap from the Warren-Profile Gap Road embankment forms the western bank of Profile Creek. The stream has very little LWD and has a riparian zone (comprised mostly of willows and berries) that is narrow along the bank formed by Warren-Profile Gap Road. Due to the steep surrounding terrain, the stream is shaded throughout much of the day. The dominant substrates are gravel, cobble and boulder.

Yellow Pine Pit – During mining activities in the 1930s through the 1950s, the nearly 5-acre Yellow Pine pit was created by open pit mining, and the EFSFSR was diverted through the Bradley Tunnel to Sugar Creek (Hogen 2002). After mining ceased in 1952, the EFSFSR was allowed to flow through the abandoned mine pit. The pit currently has a maximum depth of approximately 35 feet. Diverting the EFSFSR back into the stream channel and pit created a long riffle with a high gradient that precluded fish passage into the upper watershed. This lake-like water body is inhabited at times by both fish and mammals, including large Chinook salmon, bull trout and river otters.

Sugar Creek – This EFSFSR tributary, downstream from the Yellow Pine pit, is a relatively low-gradient stream. A closed, but still locally used Forest Service road closely parallels Sugar Creek for nearly 2 miles before crossing the creek. This road may confine the movement of Sugar Creek, specifically in areas where it bounds the banks with riprap rock material. Much of Sugar Creek has large aggregates of LWD. The dominant substrates are sand, gravel and cobble.

Cane Creek – This tributary to Sugar Creek has its headwaters in the village of Yellow Pine. No roads access this small creek, and only its confluence with Sugar Creek was observed and documented. The stream is characterized by a dominant substrate of cobble and gravel with some boulders, and a low-to-moderate gradient. Cane Creek was surveyed in 2012 and 2013, but not in 2014.

Cinnabar Creek – This small tributary flows into Sugar Creek just downstream from Cane Creek. It is relatively high gradient, with abundant boulders often creating small cascades, but the dominant substrate is made up of gravel, sand and cobble.

Fiddle Creek – This is a small tributary of the EFSFSR just upstream from the Yellow Pine pit. The lower section has a very steep gradient where it flows into the EFSFSR, making it unsuitable for fish passage. Upstream of this barrier, Fiddle Creek retains a relatively high gradient in a relatively narrow channel, with an increasing number of side channels. The creek itself can be difficult to access due to thick tall-shrub overstory dominated by alder. The upper-most section of Fiddle Creek flattens in gradient, becoming a slower meandering stream where a reservoir formerly existed. Large amounts of LWD occur throughout the creek, and the dominant streambed substrate consists of boulders, large cobble and gravel.

Meadow Creek – This EFSFSR tributary is in a flat-bottomed valley surrounded by steep mountains. Elevations range from 6,300 feet above sea level to over 7,500 feet. The downstream end of the valley shows remnant effects from early mining activities, along with a large outwash feature created by a dam failure in the EFMC drainage south of Meadow Creek Mine. Meadow Creek has been modified over the years to accommodate and overcome conditions created by past mining operations, including regrading and revegetating the lower section of the creek in 2004 and 2005.

East Fork Meadow Creek – The stream characteristics of this tributary to Meadow Creek was, and is still, substantially affected by a dam that was constructed to supply hydroelectric power for milling operations. The dam was constructed in 1929 and enlarged in 1931. After an inspection by Forest Service engineers, the dam was breached in 1958 to reduce the threat of catastrophic failure. However, the dam failed in 1965 due to record snow melt and runoff rates, depositing large volumes of sediment into Meadow Creek, the EFSFSR, and the Yellow Pine pit (URS 2000). The reach of the EFMC that eroded during the dam failure is still considered unstable, and continues to deposit sediments into Meadow Creek and the EFSFSR during snow melt and storm events. Upstream from this unstable section, the EFMC has reestablished and stabilized into a low-gradient stream flowing through a large meadow. There are few trees, but the banks have abundant grasses. The channel is very narrow, and has a very low gradient (less than 2 percent). The dominant streambed material is sand and gravel.

Garnet Creek – This EFSFSR tributary is a narrow, shallow stream not far downstream from the Meadow Creek confluence. During the summer surveys, the creek near the confluence only several inches deep. Garnet Creek cuts through a formerly burned hillside. Most of the vegetative cover is grasses, however, shrubs and trees grow alongside the banks, and woody vegetation is found within the channel.

Midnight Creek – This EFSFSR tributary has dense overhanging vegetation in the lower portion of the narrow channel, which completely restricted survey access. Midnight Creek overall is a narrow, shallow, high-gradient system.

Hennessy Creek – This EFSFSR tributary is a narrow, low-flow stream downstream from Fiddle Creek. Hennessy Creek flows in a constructed ditch alongside Stibnite Road, and it flows under the adjacent waste rock dump before dropping down a very high gradient into the EFSFSR. This high-gradient segment is a barrier to fish passage. Hennessy Creek is densely vegetated and shallow.

Riordan Creek – This tributary to Johnson Creek is overall a relatively low-gradient stream. Roughly halfway down the length of the stream is Riordan Lake. Downstream from the lake, Riordan Creek has a slightly higher gradient, particularly just before it enters Johnson Creek. A trail with bridges that are open to small off-road vehicles crosses the creek several times above and to the north side of the lake. The dominant substrates are sand and gravel.

Trapper Creek – This tributary to Johnson Creek has a high gradient near its confluence with Johnson Creek. The downstream portion consist of large boulders and cascades. The upper reaches of Trapper Creek contain abundant LWD pieces. The stream’s dominant substrates are gravel and cobble.

Burntlog Creek – This tributary to Johnson Creek is a moderate-gradient stream that parallels Johnson Creek in the lowest reaches, and it occupies a steep valley floor in the upper reaches of the drainage. The upper reaches have moderate amounts of LWD from extensively burned areas, and minimal overhead canopy. The dominant substrates are sand, gravel and cobble.

Goat Creek – This tributary to the SFSR was surveyed as a control site for the Burntlog access route alternative-study sites because it is considered to have minimal human impacts other than trails and campsites. Only the lower section of the stream was observed and documented. Goat Creek is a moderate-gradient stream that occupies the valley bottom of an extensively burned area, above the South Fork Road crossing. The drainage has high amounts of LWD, both in single pieces and contained within several channel-spanning masses. The stream near the survey site was extensively burned, which affected the riparian area. The dominant substrates are sand, gravel and cobble, with some exposed bedrock and boulders.

Fourmile Creek – This tributary to the SFSR was surveyed as a control site for the Burntlog access route alternative because it is considered to have minimal human impacts other than trails and campsites. Only the lower section of the stream (below the South Fork Road crossing, and Fourmile campground) was observed and documented. Fourmile Creek is a moderate-gradient stream. The drainage has moderate amounts of LWD, both in single pieces and contained within aggregates. A large aggregate complex contributes to a split channel in the upper portions of the survey reach. The stream near the survey site has a dense riparian zone that is shaded during much of the day. The dominant substrates are gravel, cobble and boulders.

4.2 Fish Species

This section describes the status, distribution, and basic life histories for Snake River spring/summer Chinook salmon, Snake River Basin steelhead, Columbia River bull trout, and westslope cutthroat trout.

4.2.1 Snake River Spring/Summer Chinook Salmon

Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha*) were listed as threatened in 1992 (NMFS 1992). The spring/summer Chinook salmon in the aquatic resources study area are part of the EFSFSR population. Chinook salmon occur naturally in the EFSFSR up to the Yellow Pine pit at Stibnite, but are introduced upstream from the Yellow Pine pit by the Idaho Department of Fish and Game (IDFG) with the Nez Perce Tribe. Critical habitat for Chinook salmon was designated in 1993 (58 FR 68543) and specifically defines geographic areas and essential habitat elements. Critical Habitat is designated in the EFSFSR up to approximately 1,200 feet upstream from the confluence with Sugar Creek (NMFS 1993, later revised in 1999).

In 2016, NMFS released a draft Recovery Plan for the Snake River spring/summer Chinook salmon and Snake River steelhead, which identified recovery strategies by major population group (MPG). The EFSFSR is included in the South Fork Salmon River spring/summer Chinook salmon MPG. Recovery strategies for spring/summer Chinook salmon that affect the EFSFSR watershed include the need to:

- Maintain current wilderness protection and protect pristine tributary habitat
- Provide/improve passage to and from areas with high intrinsic potential through barrier removal
- Reduce and prevent sediment delivery to streams by improving road systems and riparian communities, and rehabilitating abandoned mine sites
- Manage risks from tributary fisheries according to an abundance-based schedule

Chinook salmon are an anadromous fish, which means they spawn in fresh water, but will spend a portion of their lives in the ocean. Snake River spring/summer Chinook salmon exhibit a stream-type life history, which means they rear in fresh water for an extended period (NMFS 2016). Adults (mostly 3- and 4-year-old fish) begin their upstream migration in the Columbia River in late February and early March. Spawning begins in August, and continues through September. Eggs incubate through the fall and winter, and the fry emerge in the late winter and early spring. Most juvenile fish mature in fresh water for one year before they migrate to the ocean in the spring of their second year, and they may be present in the aquatic resources study area year-round.

The EFSFSR population is a summer-run, historically large population, with historic spawning areas throughout the EFSFSR mainstem and in Johnson Creek, which is the population’s major tributary (NMFS 2011). Chinook salmon in the upper EFSFSR (upstream from the Yellow Pine pit) were extirpated by the diversion of the EFSFSR into a bypass tunnel for mining operations late in the 1930s, and, after the cessation of mining, the very high-gradient riffle created that precludes fish passage past the Yellow Pine pit into the upper watershed. Most current spawning occurs in Sugar Creek and Johnson Creek. Recently, the IDFG, in cooperation with the Nez Perce Tribe, has planted Chinook salmon above Yellow Pine pit into Meadow Creek, which have spawned successfully (Nez Perce 2009, 2010, 2011). A total of 459 Chinook salmon were released in 2011, 294 in 2012, 130 in 2013, 100 in 2015, and 536 in 2016 (Folsom 2013, McPherson 2013, Felty 2015). No fish were released in 2014.

4.2.2 Snake River Basin Steelhead

Snake River Basin steelhead (*O. mykiss*) are an anadromous form of rainbow trout. These fish were listed as a threatened Evolutionarily Significant Unit (ESU) on August 18, 1997 (NMFS 1997), including all natural-origin populations of steelhead in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. They were subsequently reclassified as a threatened Distinct Population Segment (DPS) (NMFS 2006). The final rule designating Critical Habitat for steelhead was published by NMFS on September 2, 2005 (NMFS 2005), and took effect on January 2, 2006. Critical Habitat for Snake River Basin steelhead is designated in the EFSFSR up to approximately 1,200 feet upstream from the confluence with Sugar Creek, and includes Sugar Creek as well as Burntlog Creek.

The 2016 Recovery Plan included recovery strategies for the Salmon River steelhead MPG. Recovery strategies for steelhead that effect the EFSFSR watershed include the intent to:

- Collect and analyze population-specific data to accurately determine population status
- Maintain wilderness protection and protect pristine tributary habitat
- Eliminate passage barriers and improve connectivity to historical habitat
- Reduce and prevent sediment delivery to streams by rehabilitating roads and mining sites
- Manage risks from tributary fisheries through updated Fisheries Management Evaluation Plans and Tribal Resource Management Plans, and according to an abundance-based schedule

Snake River Basin steelhead have traditionally been assigned to two groups (A-run and B-run) based on the bimodal timing of passage into the Columbia River (as measured at Bonneville Dam), and by certain life-history characteristics (Busby et al. 1996). Steelhead in the aquatic resources study area are considered B-run steelhead, which means they pass Bonneville Dam after August 25, and tend to return after two years in the ocean (Campbell et al. 2012). Snake River Basin steelhead enter fresh water from June to October and spawn during the following spring from March to May. Their eggs incubate in redds for up to four months before hatching as alevins, a larval life stage dependent on food stored in a yolk sac. Snake River Basin steelhead usually smolt when they reach two or three years of age.

Steelhead occur widely in the EFSFSR, downstream from the Yellow Pine pit. Although spawning is not well documented, redds and adults were identified in 2004 downstream from the town of Yellow Pine. Most of the spawning sites were in small pockets of suitable substrate, rather than in well-developed spawning riffles (Nelson 2004). Some steelhead may also spawn upstream from the town of Yellow Pine. Anadromous steelhead spawning is restricted to below the Yellow Pine pit at Stibnite, coincident with the upstream endpoint for designated critical habitat in the EFSFSR.

4.2.3 Resident Rainbow/Redband Trout

Redband trout (*O. mykiss gairdneri*) is a subspecies of rainbow trout. Because it coexists with other subspecies of rainbow trout, it can compete and hybridize with the other forms of rainbow trout. Redband trout are thought to occur in the aquatic resources study area, though genetic studies have not been conducted to confirm their presence.

In the aquatic resources study area, resident redband or rainbow trout likely spawn between mid-March and early June, with incubation and emergence occurring until mid-July (Miller et al. 2014). This timing overlaps with steelhead in the area, which results in the inability to separate juveniles during field identifications. Because juvenile steelhead, and juvenile and adult redband trout, and rainbow trout cannot be easily distinguished, this report will refer to each as *O. mykiss*.

4.2.4 Columbia River Bull Trout

Columbia River bull trout (*Salvelinus confluentus*) occur in the SFSR watershed. Hereinafter, all references to bull trout are to the Columbia River bull trout. The USFWS designated Critical Habitat for bull trout in the EFSFSR, and in Tamarack, Sugar, Cane, Cinnabar, Meadow, Burntlog, Trapper and Riordan Creeks (USFWS 2010). Within the aquatic resources study area, bull trout occur throughout the EFSFSR and Sugar Creek. Bull trout are found in the control site in Tamarack Creek.

In 2015, the USFWS released the *Recovery Plan for Coterminous United States Population of Bull Trout (Salvelineus confluentus)* (USFWS 2015). They developed recovery unit implementation plans for specific recovery units, including the Upper Snake Recovery Unit, which includes bull trout in the aquatic resources study area. Four strategies were defined for the recovery of bull trout:

- Protect, restore, and maintain suitable habitat conditions
- Minimize demographic threats by restoring connectivity or populations, where appropriate, to promote diverse life-history strategies and conserve genetic diversity
- Prevent and reduce negative effects of non-native fishes and other non-native taxa
- Work with partners to conduct research and monitoring to implement and evaluate recovery activities, consistent with an adaptive-management approach using feedback from implemented, site-specific recovery tasks, and considering the effects of climate change

Bull trout are generally assumed to be in decline across their range, but there are few data on population sizes and trends in the SFSR. In general, the USFS considers the EFSFSR as important bull trout habitat. Bull trout have several life-history strategies: fluvial (i.e., stream and river dwelling, spawning in small tributaries), adfluvial (lake dwelling and river spawning), and anadromous forms. An adfluvial life history uses the Yellow Pine pit for overwintering, with downstream migration to tributaries for spawning (Hogen and Scarnecchia 2006). Migrants stage at the mouths of presumptive spawning tributaries from mid-July to mid-August, then move into tributaries and spawn from mid-August to mid-September. Fluvial populations downstream from the Yellow Pine pit quickly outmigrate as far as the main Salmon River (Hogen and Scarnecchia 2006), or move up to the Yellow Pine pit for overwintering. Populations upstream from the Yellow Pine pit use the fluvial life-history strategy.

Bull trout reach sexual maturity between four and seven years of age, and they are known to live as long as 12 years. They spawn in fall after temperatures drop below 48 degrees Fahrenheit (°F) (9°C), in streams with cold, unpolluted water, clean gravel and cobble substrate, and gentle stream slopes (USFWS 2002). Many spawning areas are associated with cold-water springs or areas where stream flow is influenced by groundwater (USFWS 2002).

Bull trout eggs require a long incubation period (four to five months) compared to other salmon and trout, hatching in late winter or early spring (USFWS 2002). Fry remain in the stream bed for up to three weeks before emerging. Juvenile fish are often found at or near the stream bottom, often in between cobbles and boulders, and among woody-debris complexes (Thurow 1994, Berge and Mavros 2001).

4.2.5 Westslope Cutthroat Trout

Westslope cutthroat trout (*O. clarki lewisi*) are designated by the Regional Forester as a “Sensitive” species. There was a petition to list them as federally threatened (63 FR 31691), but the USFWS determined that such a listing was not warranted (65 FR 20120, April 14, 2000). Westslope cutthroat trout occur in the aquatic resources study area, both upstream and downstream from the Yellow Pine pit.

Westslope cutthroat trout in the aquatic resources study area are either resident or fluvial, living in rivers, but then migrating into the tributaries to spawn. They begin to mature at age three, but they usually spawn first at age four or five. They spawn between March and July when water temperatures are near 50°F (10°C). Emerging fry are around 20 mm in length. Westslope cutthroat trout feed primarily on macroinvertebrates—particularly immature and mature forms of aquatic insects, terrestrial insects, and, in lakes, zooplankton (USFWS 1999).

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SECTION 5 AQUATIC SURVEY RESULTS

This section describes the results of the stream habitat surveys (cobble embeddedness, free matrix, modified McNeil core substrate, PIBO habitat, and water temperature), macroinvertebrate surveys, metals surveys, and fish surveys that were conducted between 2012 and 2016.

5.1 Stream Habitat

The PAF WCI standards were used as the base metrics for the minimum criteria to determine desired habitat conditions in the aquatic resources study area. The results of the cobble embeddedness, free matrix, modified McNeil core substrate, PIBO habitat, and water temperature surveys are described in detail below.

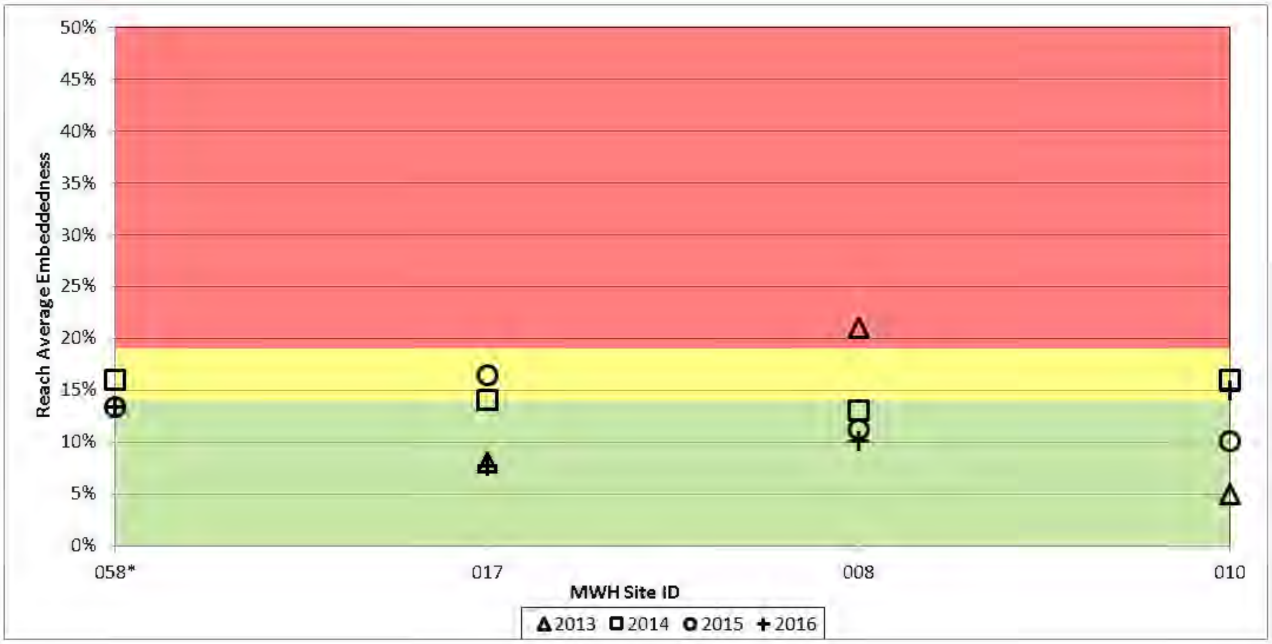
In addition to the surveyed and documented elements in this report, other factors may have contributed to variability within the study area. Observed natural disturbance events (e.g., avalanches, landslides or windfall) and federal management activities (road decommissioning) that occurred within the aquatic resource study area between 2012 and 2016 may also have had an influence on variability between sample years.

5.1.1 Cobble Embeddedness

The average levels of cobble embeddedness for each survey by site are shown in **Figure 5-1** and **Figure 5-2**, along with WCI indicator ranges for reference purposes. In general, cobble embeddedness values for the aquatic resources study area were within the *functioning appropriately* WCI ranges, except for two sites on lower Meadow Creek (MWH-014, MWH-049). The multiple-year averages would currently put these two lower Meadow Creek sites as *functioning as risk*, but they have been steadily decreasing annually.

Summary cobble embeddedness statistics for each site and subwatershed are shown in **Table 5-1** and **Table 5-2.** Because there is climatic and hydrologic variability in natural systems, developing a minimum five-year mean is recommended to create a statistically robust dataset. Five-year means were used to develop WCI indicator values, against which baseline study site data will be compared to indicate future conditions (Nelson and Burns 2005, Zurstadt et al. 2016). A comparison of means, using Tukey’s Honestly Significant Differences test or ANOVA, will not be conducted for the surveyed sites until an adequate sample size of data has been attained.

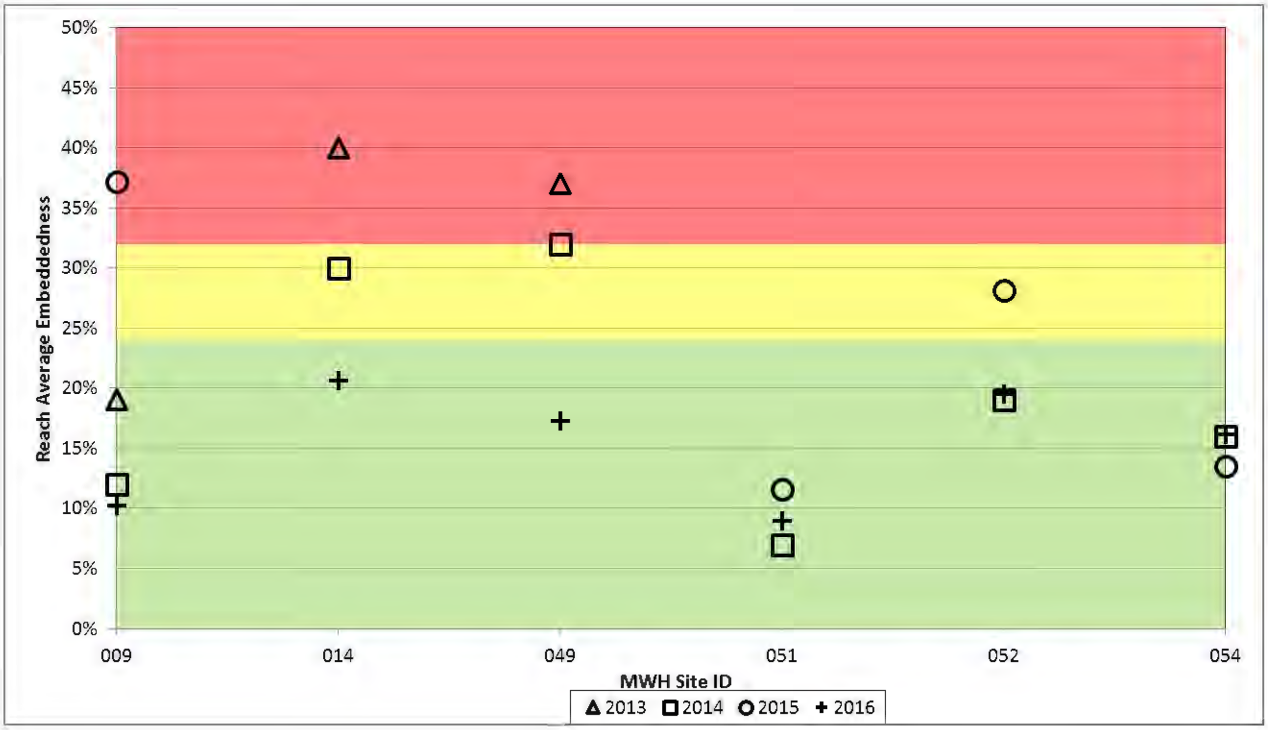
Box and whisker plots were created by year, for each survey site and each subwatershed, and they are shown in **Appendix 1**.



Note: Site locations (ordered downstream to upstream):
MWH-058*: Profile Creek (control site)
MWH-017: Tamarack Creek
MWH-008, MWH-010: Sugar Creek

Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-1. Average Cobble Embeddedness by Site for Non-granitic Watersheds in 2013-2016



Note: Site locations (ordered downstream to upstream):

MWH-009: East Fork of the South Fork of the Salmon River
MWH-014, MWH-049: Meadow Creek
MWH-051 and MWH-052: Burntlog Creek
MWH-054: Trapper Creek

Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-2. Average Cobble Embeddedness by Site for Granitic Watersheds in 2013-2016

Table 5-1. Cobble Embeddedness Analysis Results by Site for 2013-2016

Stream/ Sub-watershed	MWH Site	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95% CI (%)	CV	WCI
Sugar / Sugar Creek	008	Non-Granitic	2013	104	21	29	3	±6	1.4	UR
			2014	117	13	19	2	±4	1.5	A
			2015	125	11	23	2	±4	2.0	A
			2016	135	10	20	2	±3	2.0	A
EFSFSR / No Mans Creek - EFSFSR	009	Granitic	2013	113	19	28	3	±5	1.5	A
			2014	111	12	21	2	±4	1.7	A
			2015	114	37	23	2	±4	0.6	UR
			2016	105	13	24	2	±5	1.8	A
Sugar / Sugar Creek	010	Non-Granitic	2013	116	5	16	1	±3	3.3	A
			2014	102	16	22	2	±4	1.5	R
			2015	110	10	20	2	±4	2.0	A
			2016	135	15	25	2	±4	1.7	R
Meadow / Headwaters EFSFSR	014	Granitic	2013	117	40	27	2	±5	0.7	UR
			2014	127	30	28	2	±5	0.9	R
			2015	Not sampled						
			2016	108	21	22	2	±4	1.1	A
Tamarack / Tamarack Creek	017	Non-Granitic	2013	116	8	20	2	±4	2.5	A
			2014	108	14	25	2	±5	1.8	R
			2015	124	16	27	2	±5	1.6	R
			2016	115	8	19	2	±4	2.5	A
Meadow / Headwaters EFSFSR	049	Granitic	2013	130	37	35	3	±6	1.0	UR
			2014	102	32	36	4	±7	1.1	R
			2015	Not sampled						
			2016	100	17	18	2	±4	1.1	A
Lower Burntlog / Burntlog Creek	051	Granitic	2013	Not sampled						
			2014	115	7	14	1	±3	2.2	A
			2015	113	12	24	2	±4	2.1	A
			2016	121	9	21	2	±4	2.3	A
Upper Burntlog / Burntlog Creek	052	Granitic	2013	Not sampled						
			2014	113	19	26	2	±5	1.3	A
			2015	106	28	25	2	±5	0.9	R
			2016	105	20	27	3	±5	1.4	A
Trapper / Trapper Creek – Johnson Creek	054	Granitic	2013	Not sampled						
			2014	127	16	25	2	±4	1.6	A
			2015	115	14	23	2	±4	1.7	A
			2016	109	16	29	3	±5	1.8	A
Profile / Profile Creek	058	Non-granitic	2013	Not sampled						
			2014	102	16	25	2	±5	1.5	R
			2015	104	13	24	2	±5	1.8	A
			2016	105	13	24	2	±5	1.8	A

Key:
% = percent
A = Functioning Appropriately
CI = confidence interval
CV = coefficient of variation
R = Functioning at Risk
UR = Functioning at Unacceptable Risk
WCI = Watershed Condition Indicator

Table 5-2. Cobble Embeddedness Analysis Results by Subwatershed in 2013-2016

Subwatershed	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95% CI (%)	CV	WCI
Burntlog Creek (Lower)	Granitic	2013	Not Sampled						
		2014	115	7	14	1	±3	2.2	A
		2015	113	12	24	2	±4	2.1	A
		2016	121	9	21	2	±4	2.3	A
Profile Creek	Non-granitic	2013	Not Sampled						
		2014	102	16	25	2	±5	1.5	R
		2015	104	13	24	2	±5	1.8	A
		2016	105	13	24	2	±5	1.8	A
No Mans Creek - EFSFSR	Granitic	2013	113	19	28	3	±5	1.5	A
		2014	111	12	21	2	±4	1.7	A
		2015	114	37	23	2	±4	0.6	UR
		2016	105	10	21	2	±4	2.1	A
Sugar Creek	Non-granitic	2013	220	12	24	2	±3	2.0	A
		2014	219	14	21	1	±3	1.5	A
		2015	235	11	21	1	±3	2.0	A
		2016	270	12	23	1	±3	1.8	A
Tamarack Creek	Non-granitic	2013	116	8	20	2	±4	2.5	A
		2014	108	14	25	2	±5	1.8	A
		2015	124	16	27	2	±5	1.6	R
		2016	115	8	19	2	±4	2.5	A
Trapper Creek – Johnson Creek	Granitic	2013	Not Sampled						
		2014	127	16	25	2	±4	1.6	A
		2015	115	14	23	2	±4	1.7	A
		2016	109	16	29	3	±5	1.8	A
Burntlog Creek (Upper)	Granitic	2013	Not Sampled						
		2014	113	19	26	2	±5	1.3	A
		2015	106	28	25	2	±5	0.9	R
		2016	105	20	27	3	±5	1.4	A
Headwaters EFSFSR	Granitic	2013	247	38	31	2	±4	0.8	UR
		2014	229	31	32	2	±4	1.0	R
		2015	Not Sampled						
		2016	208	19	20	1	±3	1.1	A

Note:
Subwatersheds are defined as 6th field hydrologic unit code
Annual mean is the percent of cobble embeddedness averaged over all subsamples measured

Key:
% = percent
A = Functioning Appropriately
CI = confidence interval
CV = coefficient of variation
R = Functioning at Risk
UR = Functioning at Unacceptable Risk
WCI = Watershed Condition Indicator

5.1.2 Free Matrix and Surface Fines

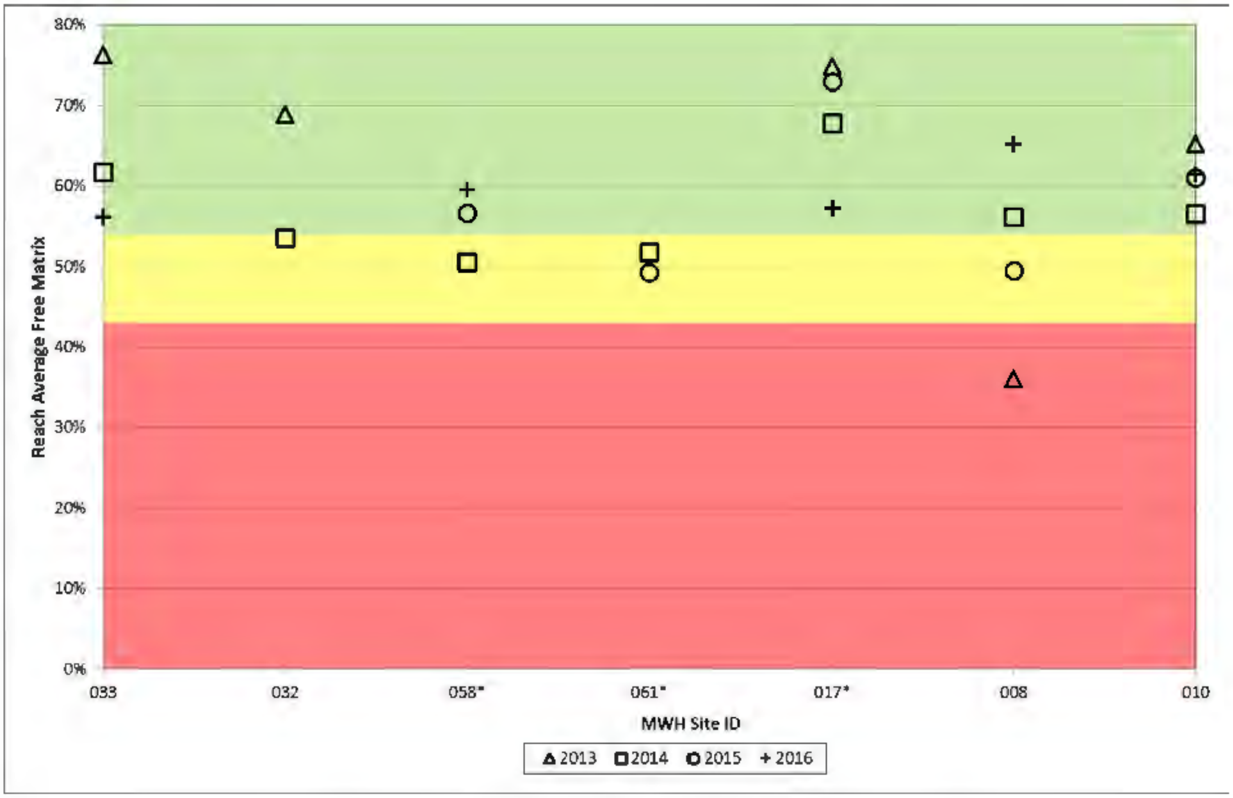
The average levels of free matrix and surface fines for each survey site are shown in **Figure 5-3** through **Figure 5-6**, along with WCI indicator ranges for reference purposes.

Free matrix values for the aquatic resources study area are generally considered functioning appropriately, except for select granitic sites on Meadow Creek (MWH-014, MWH-049, and MWH-060), and the two non-granitic sites on Sugar Creek (MWH-008) and Profile Creek (MWH-061). All five sites have multiple-year means that correspond to the *functioning at risk* free matrix threshold (**Table 5-3**).

In contrast with the free matrix results, most surface fines values for the aquatic resources study area were generally either considered functioning at risk or functioning at unacceptable risk. Only the annual means of granitic sites MWH-009, MWH-050, MWH-051, and MWH 054 are functioning appropriately (**Table 5-3**).

Currently, there are no more than four years of free matrix and surface fines data for any specific sample location. To better account for data variability—due to natural (e.g., climate, hydrology), spatial, and temporal factors, as well as measurer error—a minimum of five years of data is recommended to better evaluate baseline conditions. Five-year means were used to develop WCI indicator values, against which baseline study site data will be compared as an indicator of future conditions (Nelson and Burns 2005, Zurstadt et al. 2016). Tiered WCIs have been developed by the PAF to support management decisions regarding substrate information in granitic and non-granitic watersheds (Nelson and Burns 2005, Nelson and Burns 2007, Zurstadt et al. 2016).

Table 5-3 and **Table 5-4** summarize results of the free matrix and surface fines analyses for each site and subwatershed. A comparison of means, using Tukey's Honestly Significant Differences test or ANOVA, will not be conducted until an adequate sample range of a minimum of 5 years of data has been attained for each survey site. Box and whisker plots that were created by year, for each site and each subwatershed, are presented in **Appendix 1**. The plots display sample variation of a statistical population, without making any assumptions of the underlying statistical distribution, and they assist in data interpretation and quality control.

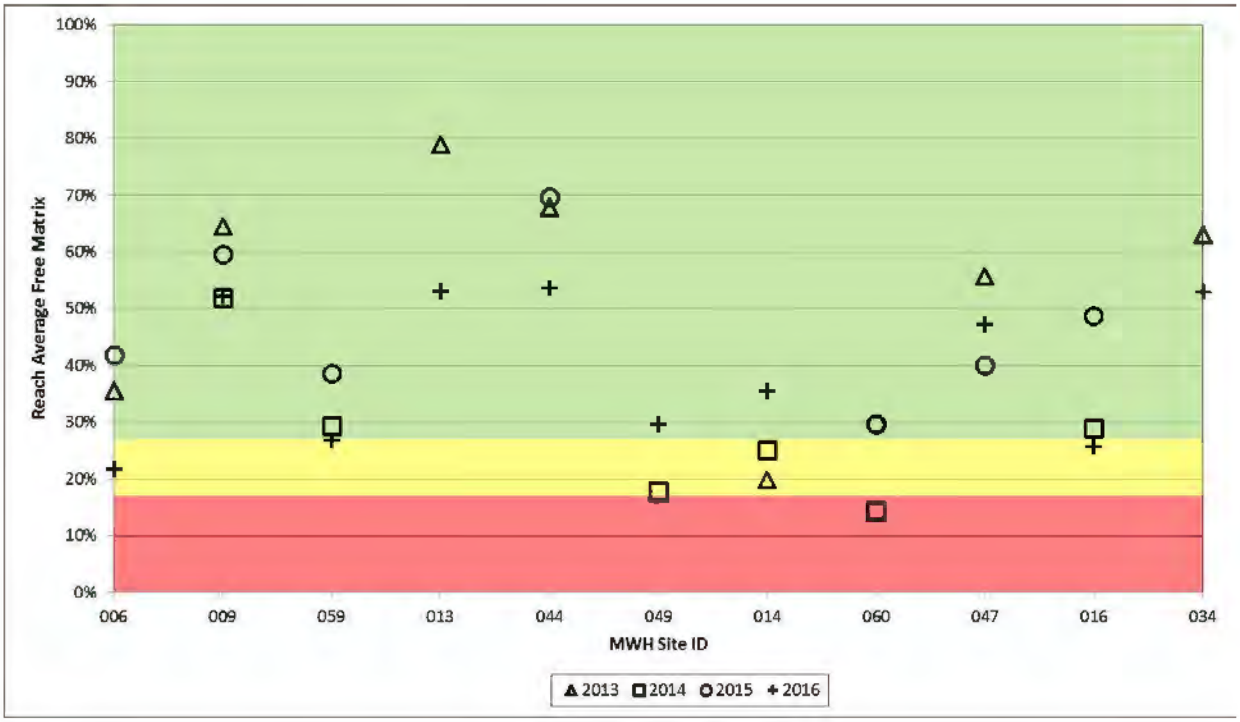


Note: Site locations (ordered downstream to upstream):

MWH-033, MWH-032: East Fork of the South Fork of the Salmon River
MWH-058* and MWH-061*: Profile Creek (control sites)
MWH-017*: Tamarack Creek (control site)
MWH-008 and MWH-010: Sugar Creek

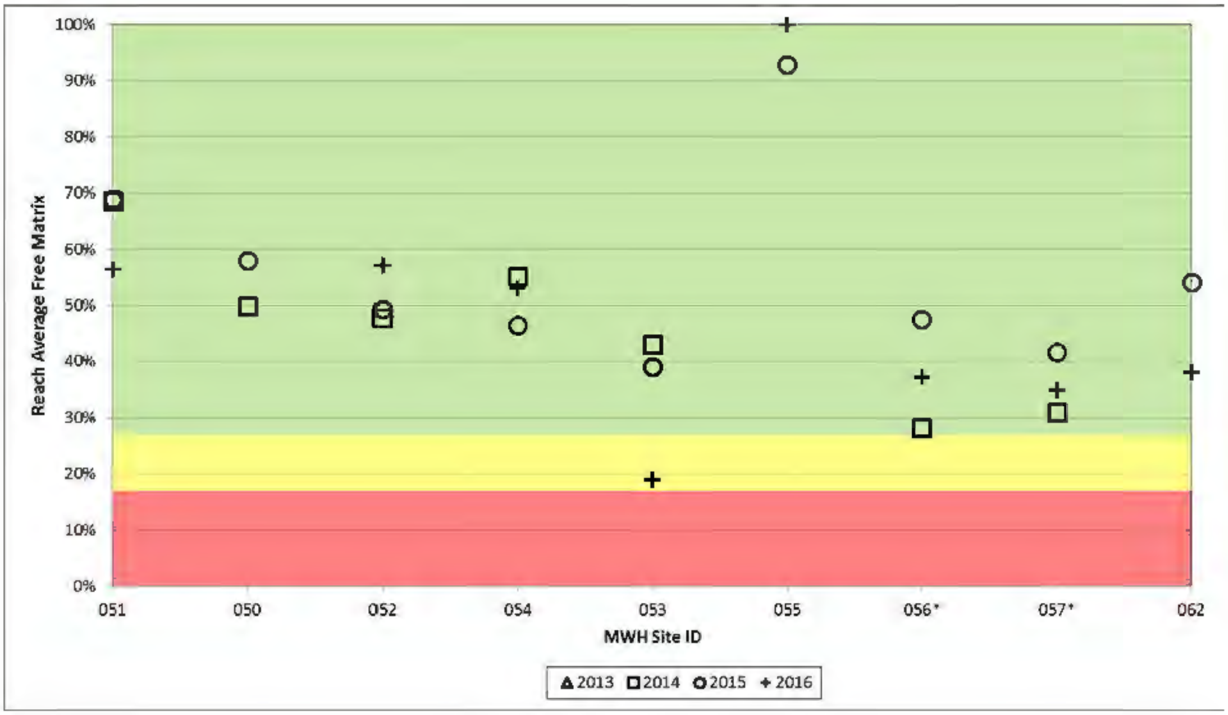
Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-3. Average Free Matrix by Site for Non-Granitic Watersheds in 2013-2016



Note: There were no qualifying substrate material present in the 2014 sampling event for MWH-055, so no annual average is presented.
Site Locations (ordered downstream to upstream):
MWH-006: East Fork Meadow Creek
MWH-009, MWH-059, MWH-013 and MWH-044: East Fork of the South Fork of the Salmon River
MWH-049, MWH-014, MWH-060, MWH-047, MWH-016, and MWH-034: Meadow Creek
Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-4a. Average Free Matrix by Site for Granitic Watersheds in 2013-2016



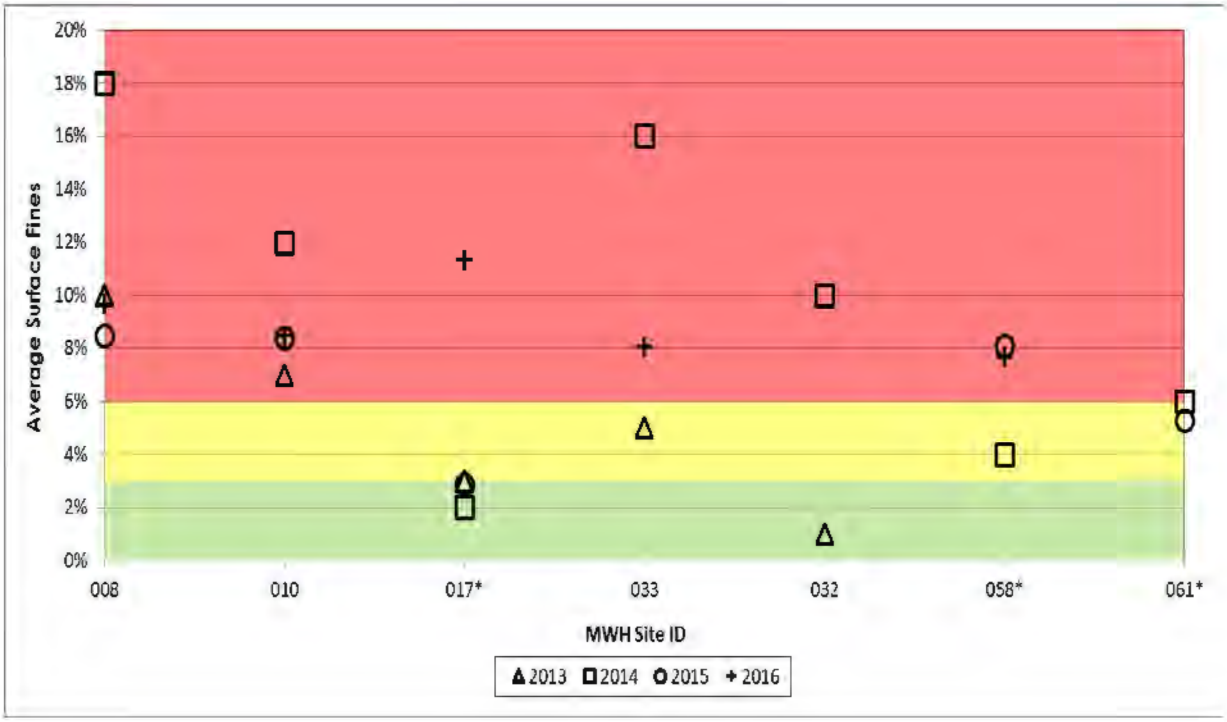
Note: There were no qualifying substrate material present in the 2014 sampling event for MWH-055, so no annual average is presented.

Site Locations (ordered downstream to upstream):

MWH-051, MWH-050 and MWH-052: Burntlog Creek
MWH-054 and MWH-053: Trapper Creek
MWH-055: Riordan Creek
MWH-056* and MWH-057*: Fourmile Creek and Goat Creek, respectively (control sites)
MWH-062: Fiddle Creek

Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-4b. Average Free Matrix by Site for Granitic Watersheds in 2014-2016

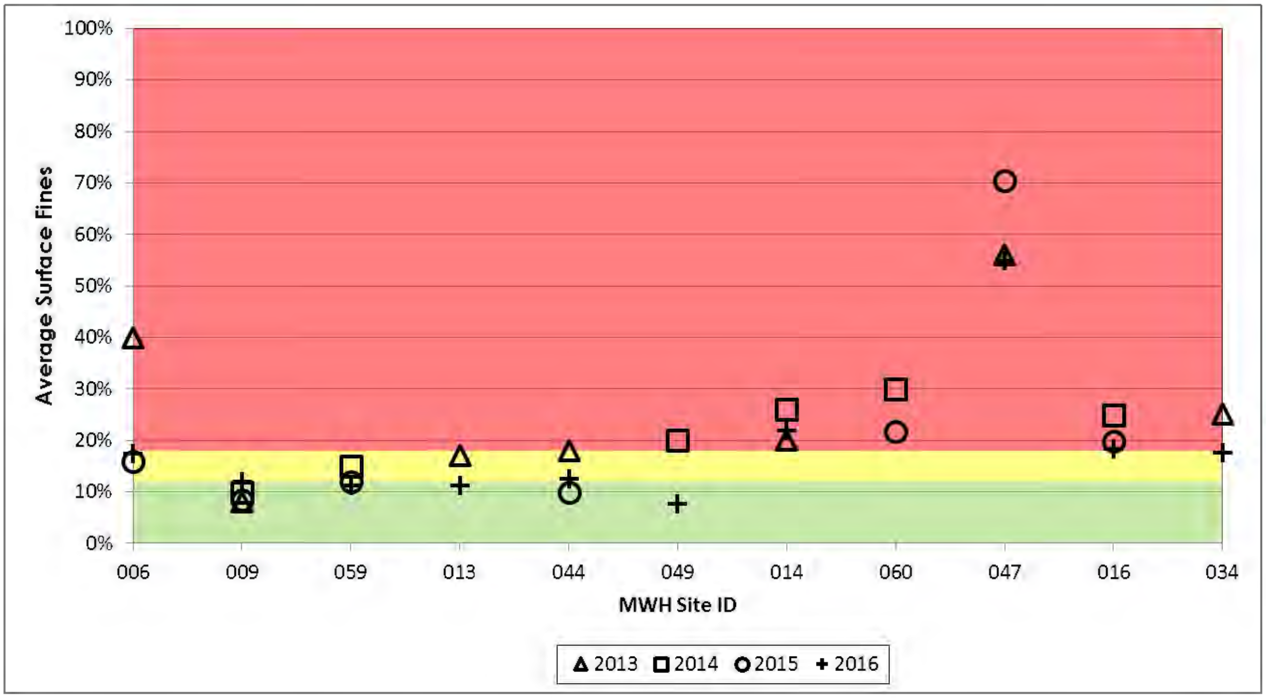


Note: Site locations (ordered downstream to upstream):

MWH-008 and MWH-010: Sugar Creek
MWH-017*: Tamarack Creek (control site)
MWH-033, MWH-032: East Fork of the South Fork of the Salmon River
MWH-058* and MWH-061*: Profile Creek (control sites)

Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-5. Average Surface Fines by Site for Non-Granitic Watersheds in 2013-2016

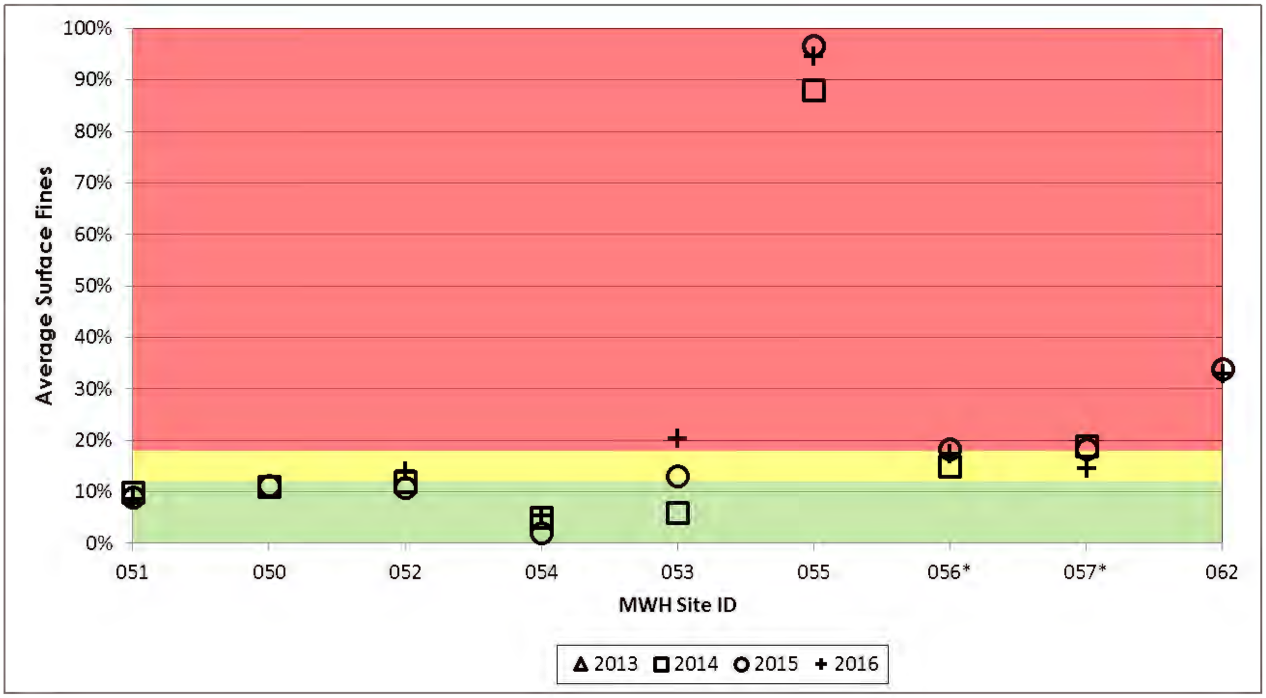


Note: Site Locations (downstream to upstream):

MWH-006: East Fork Meadow Creek
MWH-009, MWH-059, MWH-013 and MWH-044: East Fork of the South Fork of the Salmon River
MWH-049, MWH-014, MWH-060, MWH-047, MWH-016, and MWH-034: Meadow Creek

Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-6a. Average Surface Fines by Site for Granitic Watersheds in 2013-2016



Note: Site Locations (downstream to upstream):

MWH-051, MWH-050 and MWH-052: Burntlog Creek
MWH-054 and MWH-053: Trapper Creek
MWH-055: Riordan Creek
MWH-056* and MWH-057*: Fourmile Creek and Goat Creek, respectively (control sites)
MWH-062: Fiddle Creek

Key:
Green shading = Functioning Appropriately
Yellow shading = Functioning at Risk
Red shading = Functioning at Unacceptable Risk

Figure 5-6b. Average Surface Fines by Site for Granitic Watersheds in 2014-2016

Table 5-3. Free Matrix Analysis Results by Site in 2013-2016

Stream/ Subwatershed	MWH Site ID	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95% CI (%)	CV	WCI
EFMC / Headwaters EFSFSR	006	Granitic	2013	30	35	16	4	±8	0.5	A
			2014	Not Sampled						
			2015	30	42	21	4	±7	0.5	A
			2016	30	22	11	2	±4	0.5	R
Sugar Creek/ Sugar Creek	008	Non-granitic	2013	30	36	18	1	±3	0.5	UR
			2014	30	56	21	4	±8	0.4	A
			2015	30	50	18	3	±7	0.4	R
			2016	30	65	18	3	±6	0.3	A
EFSFSR / No Mans Creek - EFSFSR	009	Granitic	2013	30	65	20	1	±3	0.3	A
			2014	30	52	18	1	±3	0.3	A
			2015	30	60	24	4	±9	0.4	A
			2016	30	52	21	4	±7	0.4	A
Sugar Creek/ Sugar Creek	010	Non-granitic	2013	30	65	19	1	±2	0.3	A
			2014	30	57	22	1	±3	0.4	A
			2015	30	61	17	3	±6	0.3	A
			2016	30	61	9	2	±3	0.2	A
EFSFSR / Headwaters EFSFSR	013	Granitic	2013	30	79	16	2	±4	0.2	A
			2014	Not Sampled						
			2015	Not Sampled						
			2016	30	53	26	5	±9	0.5	A
Meadow Creek/ Headwaters EFSFSR	014	Granitic	2013	30	20	18	3	±6	0.9	R
			2014	30	25	15	2	±4	0.6	R
			2015	Not Sampled						
			2016	30	35	21	4	±8	0.6	A
Meadow Creek/ Headwaters EFSFSR	016	Granitic	2013	Not Sampled						
			2014	30	29	19	3	±6	0.7	A
			2015	30	49	18	3	±7	0.4	A
			2016	30	26	18	3	±7	0.7	R
Tamarack Creek/ Tamarack Creek	017	Non-granitic	2013	30	75	13	1	±1	0.2	A
			2014	30	68	15	1	±1	0.2	A
			2015	30	73	14	3	±5	0.2	A
			2016	30	57	14	3	±5	0.2	A
EFSFSR / No Mans Creek - EFSFSR	032	Non-granitic	2013	30	69	14	0	±1	0.2	A
			2014	30	54	16	2	±3	0.3	R
			2015	Not Sampled						
			2016	Not Sampled						
EFSFSR / No Mans Creek - EFSFSR	033	Non-granitic	2013	30	76	9	1	±2	0.1	A
			2014	30	62	16	1	±3	0.3	A
			2015	Not Sampled						
			2016	30	56	18	3	±7	0.3	A

Table 5-3. Free Matrix Analysis Results by Site in 2013-2016 (*continued*)

Stream/ Subwatershed	MWH Site ID	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Meadow Creek/ Headwaters EFSFSR	034	Granitic	2013	30	63	24	4	±8	0.4	A
			2014	Not Sampled						
			2015	Not Sampled						
			2016	30	53	22	4	±8	0.4	A
EFSFSR / Headwaters EFSFSR	044	Granitic	2013	30	68	14	3	±5	0.2	A
			2014	Not Sampled						
			2015	30	70	19	3	±7	0.3	A
			2016	30	54	21	4	±8	0.4	A
Meadow Creek/ Headwaters EFSFSR	047	Granitic	2013	30	56	37	5	±9	0.6	A
			2014	Not Sampled						
			2015	30	40	29	5	±11	0.7	A
			2016	30	47	29	5	±10	0.6	A
Meadow Creek/ Headwaters EFSFSR	049	Granitic	2013	Not Sampled						
			2014	30	18	13	4	±8	0.7	R
			2015	Not Sampled						
			2016	30	30	20	4	±7	0.7	A
Lower Burntlog Creek/ Burntlog Creek	050	Granitic	2013	Not Sampled						
			2014	30	50	17	2	±3	0.3	A
			2015	30	58	17	3	±6	0.3	A
			2016	Not Sampled						
Upper Burntlog Creek / Burntlog Creek	051	Granitic	2013	Not Sampled						
			2014	30	69	27	2	±3	0.4	A
			2015	30	69	28	5	±10	0.4	A
			2016	30	56	15	3	±5	0.3	A
Upper Burntlog Creek / Burntlog Creek	052	Granitic	2013	Not Sampled						
			2014	30	48	15	2	±3	0.3	A
			2015	30	49	20	4	±7	0.4	A
			2016	30	57	13	2	±5	0.2	A
Trapper Creek/ Trapper Creek – Johnson Creek	053	Granitic	2013	Not Sampled						
			2014	30	43	21	1	±3	0.5	A
			2015	30	39	23	4	±8	0.6	A
			2016	30	19	15	3	±5	0.8	R
Trapper Creek/ Trapper Creek – Johnson Creek	054	Granitic	2013	Not Sampled						
			2014	30	55	28	1	±2	0.5	A
			2015	30	47	23	4	±8	0.5	A
			2016	30	53	18	3	±6	0.3	A
Riordan Creek/ Riordan Creek	055	Granitic	2013	Not Sampled						
			2014	No Qualifying Substrate Present						
			2015	30	93	28	5	±10	0.3	A
			2016	29	100	0	0	N/A	N/A	A

Table 5-3. Free Matrix Analysis Results by Site in 2013-2016 (*continued*)

Stream/ Subwatershed	MWH Site ID	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Fourmile Creek/ Fourmile Creek - SFSR	056	Granitic	2013	Not Sampled						
			2014	30	28	15	2	±4	0.6	A
			2015	30	48	17	3	±6	0.4	A
			2016	30	37	18	3	±7	0.5	A
Goat Creek/ Goat Creek - SFSR	057	Granitic	2013	Not Sampled						
			2014	30	31	22	4	±7	0.7	A
			2015	30	42	23	4	±8	0.6	A
			2016	30	35	19	4	±7	0.6	A
Profile Creek/ Profile Creek	058	Non-granitic	2013	Not Sampled						
			2014	30	51	15	1	±1	1.3	R
			2015	30	57	20	4	±7	0.4	A
			2016	30	60	20	4	±7	0.5	A
EFSFSR / Headwaters EFSFSR	059	Granitic	2013	Not Sampled						
			2014	30	29	15	2	±4	0.5	A
			2015	30	39	15	3	±5	0.4	A
			2016	30	27	13	2	±5	0.5	R
Meadow Creek / Headwaters EFSFSR	060	Granitic	2013	Not Sampled						
			2014	30	14	9	4	±8	0.6	UR
			2015	30	30	19	3	±7	0.6	A
			2016	Not Sampled						
Profile Creek/ Profile Creek	061	Non-granitic	2013	Not Sampled						
			2014	30	52	21	1	±2	0.4	R
			2015	30	49	23	4	±8	0.5	R
			2016	Not Sampled						
Fiddle Creek / Headwaters EFSFSR	062	Granitic	2013	Not Sampled						
			2014	Not Sampled						
			2015	30	54	27	5	±10	0.5	A
			2016	30	38	22	4	±8	0.6	A

Note:
Annual mean is the percent of free matrix (loose cobble) averaged over all subsamples measured
Subwatersheds are defined as 6th field hydrologic unit code

Key:
% = percent
A = Functioning Appropriately
CI = Confidence interval
CV = Coefficient of Variation
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River
R = Functioning at Acceptable Risk
SFSR = South Fork of the Salmon River
UR = Functioning at Unacceptable Risk
WCI = Watershed Condition Indicators

Table 5-4. Surface Fines Analysis Results by Site in 2013-2016

Stream/ Subwatershed	MWH Site ID	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
EFMC / Headwaters EFSFSR	006	Granitic	2013	30	40	23	4	±8	0.6	UR
			2014	Not Sampled						
			2015	30	16	12	2	±4	0.7	R
			2016	30	17	24	4	±8	1.4	R
Sugar Creek/ Sugar Creek	008	Non-granitic	2013	30	10	7	1	±3	0.7	UR
			2014	30	18	23	4	±8	1.3	UR
			2015	30	9	8	1	±3	0.9	UR
			2016	30	10	9	2	±3	1.0	UR
EFSFSR / No Mans Creek - EFSFSR	009	Granitic	2013	30	8	7	1	±3	0.9	A
			2014	30	10	8	1	±3	0.8	A
			2015	30	9	9	2	±3	1.1	A
			2016	30	12	9	2	±3	0.8	A
Sugar Creek/ Sugar Creek	010	Non-granitic	2013	30	7	5	1	±2	0.7	UR
			2014	30	12	8	1	±3	0.7	UR
			2015	30	8	8	1	±3	1.0	UR
			2016	30	9	6	1	±2	0.8	UR
EFSFSR / Headwaters EFSFSR	013	Granitic	2013	30	17	12	2	±4	0.7	R
			2014	Not sampled						
			2015	Not Sampled						
			2016	30	11	17	3	±6	1.5	A
Meadow Creek/ Headwaters EFSFSR	014	Granitic	2013	30	20	16	3	±6	0.8	UR
			2014	30	26	12	2	±4	0.5	UR
			2015	Not Sampled						
			2016	30	22	22	4	±8	1.0	UR
Meadow Creek/ Headwaters EFSFSR	016	Granitic	2013	Not Sampled						
			2014	30	25	17	3	±6	0.7	UR
			2015	30	20	13	2	±5	0.7	UR
			2016	30	18	13	2	±5	0.7	UR
Tamarack Creek / Tamarack Creek	017	Non-granitic	2013	30	3	3	1	±1	1.3	A
			2014	30	2	4	1	±1	1.6	A
			2015	30	3	4	1	±2	1.5	A
			2016	30	11	16	3	±6	1.4	UR
EFSFSR / No Mans Creek - EFSFSR	032	Non-granitic	2013	30	1	3	0	±1	3.3	A
			2014	30	10	9	2	±3	0.9	UR
			2015	Not Sampled						
			2016	Not Sampled						
EFSFSR / No Mans Creek - EFSFSR	033	Non-granitic	2013	30	5	5	1	±2	1.0	R
			2014	30	16	7	1	±3	0.5	UR
			2015	Not Sampled						
			2016	30	8	6	1	±2	0.8	UR

Table 5-4. Surface Fines Analysis Results by Site in 2013-2016 (*continued*)

Stream/ Subwatershed	MWH Site ID	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Meadow Creek/ Headwaters EFSFSR	034	Granitic	2013	30	25	21	4	±7	0.8	UR
			2014	Not Sampled						
			2015	Not Sampled						
			2016	30	18	17	3	±6	1.0	R
EFSFSR / Headwaters EFSFSR	044	Granitic	2013	30	18	15	3	±5	0.9	R
			2014	Not Sampled						
			2015	30	10	9	2	±3	0.9	A
			2016	30	13	14	3	±5	1.1	R
Meadow Creek/ Headwaters EFSFSR	047	Granitic	2013	30	56	26	5	±9	0.5	UR
			2014	Not Sampled						
			2015	30	71	30	5	±11	0.4	UR
			2016	30	55	36	7	±13	0.7	UR
Meadow Creek/ Headwaters EFSFSR	049	Granitic	2013	Not Sampled						
			2014	30	20	21	4	±8	1.1	UR
			2015	Not Sampled						
			2016	30	8	9	2	±3	1.2	A
Lower Burntlog Creek/ Burntlog Creek	050	Granitic	2013	Not Sampled						
			2014	30	11	8	2	±3	0.76	A
			2015	30	11	9	2	±3	0.80	A
			2016	Not Sampled						
Upper Burntlog Creek/ Burntlog Creek	051	Granitic	2013	Not Sampled						
			2014	30	10	9	2	±3	0.8	A
			2015	30	9	11	2	±4	1.3	A
			2016	30	9	10	2	±4	1.2	A
Upper Burntlog Creek / Burntlog Creek	052	Granitic	2013	Not Sampled						
			2014	30	12	9	2	±3	0.8	A
			2015	30	11	10	2	±4	0.9	A
			2016	30	14	15	3	±5	1.0	R
Trapper Creek/ Trapper Creek – Johnson Creek	053	Granitic	2013	Not Sampled						
			2014	30	6	8	1	±3	1.4	A
			2015	30	13	14	3	±5	1.1	R
			2016	30	21	15	3	±5	0.8	UR
Trapper Creek/ Trapper Creek – Johnson Creek	054	Granitic	2013	Not Sampled						
			2014	30	5	6	1	±2	1.2	A
			2015	30	2	3	1	±1	1.5	A
			2016	30	5	11	2	±4	2.0	A
Riordan Creek/ Riordan Creek	055	Granitic	2013	Not Sampled						
			2014	30	88	21	4	±7	0.2	UR
			2015	30	97	5	1	±2	0.1	UR
			2016	29	95	11	2	±4	0.1	UR

Table 5-4. Surface Fines Analysis Results by Site in 2013-2016 (*continued*)

Stream/ Subwatershed	MWH Site ID	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Fourmile Creek / Fourmile Creek - SFSR	056	Granitic	2013	Not Sampled						
			2014	30	15	11	2	±4	0.7	R
			2015	30	18	15	3	±5	0.8	UR
			2016	30	17	14	3	±5	0.8	R
Goat Creek/ Goat Creek - SFSR	057	Granitic	2013	Not Sampled						
			2014	30	19	21	4	±7	1.1	UR
			2015	30	18	14	3	±5	0.8	UR
			2016	30	15	15	3	±5	1.0	R
Profile Creek/ Profile Creek	058	Non-granitic	2013	Not Sampled						
			2014	30	4	4	1	±1	1.2	R
			2015	30	8	8	1	±3	1.0	UR
			2016	30	8	7	1	±3	1.0	UR
EFSFSR / Headwaters EFSFSR	059	Granitic	2013	Not Sampled						
			2014	30	15	10	2	±4	0.7	R
			2015	30	12	9	2	±3	0.8	A
			2016	30	11	12	2	±4	1.1	A
Meadow Creek/ Headwaters EFSFSR	060	Granitic	2013	Not Sampled						
			2014	30	30	22	4	±8	0.7	UR
			2015	30	22	18	3	±6	0.8	UR
			2016	Not Sampled						
Profile Creek/ Profile Creek	061	Non-granitic	2013	Not Sampled						
			2014	30	6	6	1	±2	1.1	R
			2015	30	5	5	1	±2	0.9	R
			2016	Not Sampled						
Fiddle Creek/ Headwaters EFSFSR	062	Granitic	2013	Not Sampled						
			2014	Not Sampled						
			2015	30	34	28	5	±10	0.8	UR
			2016	30	33	27	5	±9	0.8	UR

Note:
Sites are sampled for free matrix only at sites concurrent with a cobble embeddedness survey, or at sites during which a PIBO habitat survey also was conducted. These surveys may not occur every year.
Annual mean is the percent of surface fines averaged over all subsamples measured.
Subwatersheds are defined as 6th field hydrologic unit code.

Key:
% = percent
A = Functioning Appropriately
CI = Confidence interval
CV = Coefficient of Variation
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River
NS = Not sampled
R = Functioning at Acceptable Risk
SFSR = South Fork of the Salmon River
UR = Functioning at Unacceptable Risk
WCI = Watershed Condition Indicators

Table 5-5. Free Matrix Analysis Results by Subwatershed in 2013-2016

Subwatershed	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Headwaters EFSFSR	Granitic	2013	180	51	25	2	±4	0.5	A
		2014	150	21	16	1	±3	0.8	R
		2015	210	43	24	2	±3	0.6	A
		2016	300	33	23	1	±3	0.7	A
Sugar Creek	Non-granitic	2013	60	47	23	1	±2	0.8	R
		2014	60	54	21	2	±4	1.1	R
		2015	60	52	19	2	±5	0.4	R
		2016	60	61	14	2	±4	0.2	A
No Mans Creek - EFSFSR	Granitic	2013	90	68	16	2	±3	1.4	A
		2014	90	53	17	2	±3	0.8	A
		2015	30	53	24	4	±9	0.5	A
		2016	60	48	20	3	±5	0.5	A
Tamarack Creek	Non-granitic	2013	30	73	13	1	±1	1.3	A
		2014	30	66	15	1	±1	1.6	A
		2015	30	71	14	3	±5	0.2	A
		2016	30	58	14	3	±5	0.2	A
Burntlog Creek (Lower)	Granitic	2013	Not Sampled						
		2014	60	54	22	1	±2	0.8	A
		2015	60	57	23	3	±6	0.4	A
		2016	30	52	15	3	±5	0.3	A
Profile Creek	Non-granitic	2013	Not Sampled						
		2014	60	47	18	1	±1	1.1	R
		2015	60	51	22	3	±6	0.4	R
		2016	30	53	20	4	±7	0.4	R
Goat Creek - SFSR	Granitic	2013	Not Sampled						
		2014	30	24	22	4	±7	1.1	R
		2015	30	34	23	4	±8	0.7	A
		2016	30	29	19	4	±7	0.7	A
Fourmile Creek - SFSR	Granitic	2013	Not Sampled						
		2014	30	25	15	2	±4	0.7	R
		2015	30	46	17	3	±6	0.4	A
		2016	30	34	18	3	±7	0.6	A
Riordan Creek	Granitic	2013	Not Sampled						
		2014	30	0	0	4	±7	0.2	--
		2015	30	88	28	5	±10	0.3	A
		2016	29	100	0	0	N/A	N/A	A

Table 5-5. Free Matrix Analysis Results by Subwatershed in 2013-2016 (*continued*)

Subwatershed	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Trapper Creek – Johnson Creek	Granitic	2013	Not Sampled						
		2014	60	42	24	1	±2	1.4	A
		2015	60	35	24	3	±6	0.7	A
		2016	60	32	22	3	±6	0.7	A
Burntlog Creek (Upper)	Granitic	2013	Not Sampled						
		2014	30	46	15	2	±3	0.8	A
		2015	30	46	20	4	±7	0.4	A
		2016	30	56	13	2	±5	0.2	A

Note:
Annual mean is the percent of free matrix (loose cobble) averaged over all subsamples measured
Subwatersheds are defined as 6th field hydrologic unit code

Key:
A = Functioning Appropriately
CI = Confidence interval
CV = Coefficient of Variation
EFSFSR = East Fork of the South Fork of the Salmon River
R = Functioning at Acceptable Risk
SFSR = South Fork of the Salmon River
UR = Functioning at Unacceptable Risk
WCI = Watershed Condition Indicators

Table 5-6. Surface Fines Analysis Results by Subwatershed in 2013-2016

Subwatershed	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Headwaters EFSFSR	Granitic	2013	180	29	24	2	±3	0.8	UR
		2014	150	23	18	1	±3	0.8	UR
		2015	210	26	27	2	±4	1.0	UR
		2016	300	21	24	1	±3	1.2	UR
Sugar Creek	Non-granitic	2013	60	8	6	1	±2	0.8	UR
		2014	60	15	17	2	±4	1.1	UR
		2015	60	8	8	1	±2	0.9	UR
		2016	60	9	8	1	±2	0.9	UR
No Mans Creek - EFSFSR	Granitic	2013	90	5	6	1	±1	1.4	A
		2014	90	12	8	1	±2	0.8	A
		2015	30	9	9	2	±3	1.1	A
		2016	60	10	9	2	±2	0.8	R
Tamarack Creek	Non-granitic	2013	30	3	3	1	±1	1.3	A
		2014	30	2	4	1	±1	1.6	A
		2015	30	3	4	1	±2	1.5	A
		2016	30	11	16	3	±6	1.4	UR
Burntlog Creek (Lower)	Granitic	2013	Not Sampled						
		2014	60	11	8	1	±2	0.8	A
		2015	60	10	10	1	±3	1.0	A
		2016	30	9	10	2	±4	1.2	A
Profile Creek	Non-granitic	2013	Not Sampled						
		2014	60	5	5	1	±1	1.1	R
		2015	60	7	7	1	±2	1.0	UR
		2016	30	8	7	1	±3	1.0	UR
Goat Creek - SFSR	Granitic	2013	Not Sampled						
		2014	30	19	21	4	±7	1.1	UR
		2015	30	18	14	3	±5	0.8	R
		2016	30	15	15	3	±5	1.0	R
Fourmile Creek - SFSR	Granitic	2013	Not Sampled						
		2014	30	15	11	2	±4	0.7	R
		2015	30	18	15	3	±5	0.8	R
		2016	30	17	14	3	±5	0.8	R
Riordan Creek	Granitic	2013	Not Sampled						
		2014	30	88	21	4	±7	0.2	UR
		2015	30	97	5	1	±2	0.1	UR
		2016	29	95	11	2	±4	0.1	UR

Table 5-6. Surface Fines Analysis Results by Subwatershed in 2013-2016 (*continued*)

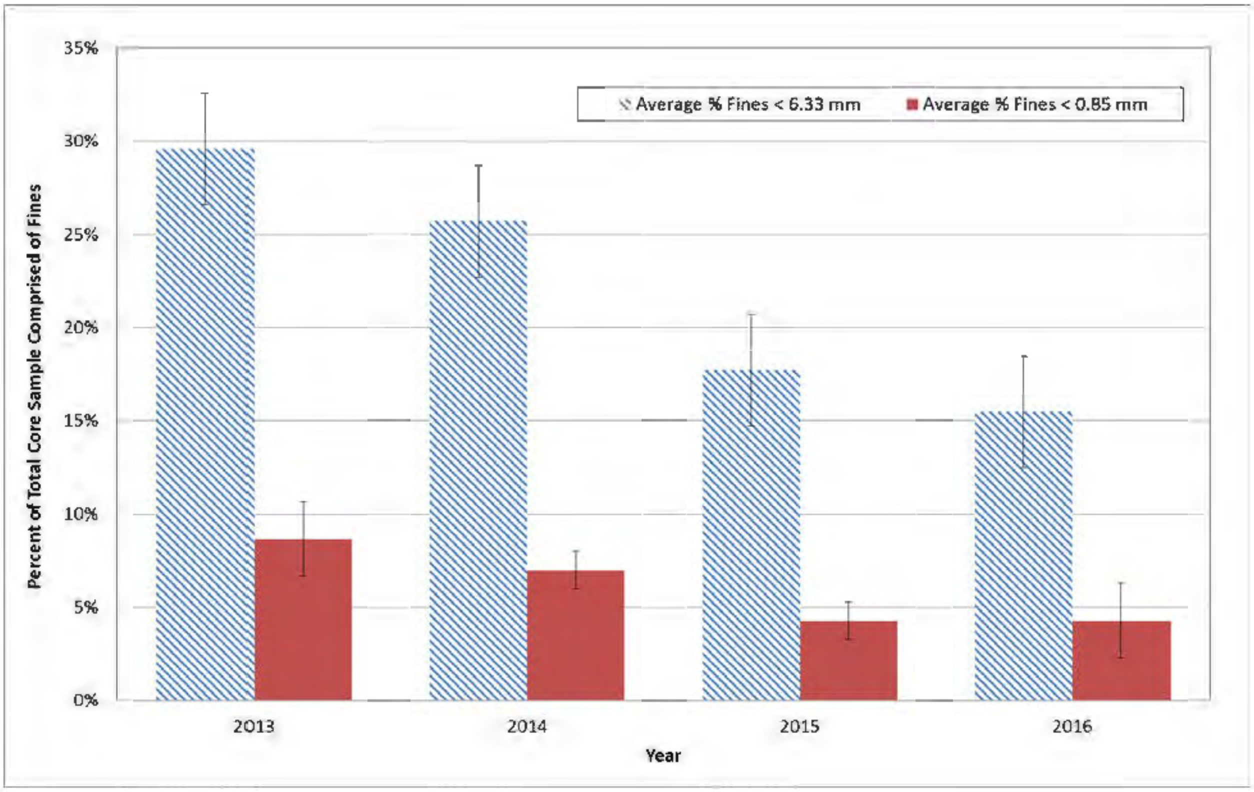
Subwatershed	Geologic Type	Year	Sample Size (n)	Annual Mean (%)	Standard Deviation	Standard Error	95 % CI (%)	CV	WCI
Trapper Creek – Johnson Creek	Granitic	2013	Not Sampled						
		2014	60	5	7	1	±2	1.4	A
		2015	60	8	11	1	±3	1.5	A
		2016	60	13	15	2	±4	1.2	R
Burntlog Creek (Upper)	Granitic	2013	Not Sampled						
		2014	30	12	9	2	±3	0.8	A
		2015	30	11	10	2	±4	0.9	A
		2016	30	14	15	3	±5	1.0	R

Note:
Annual mean is the percent of surface fines averaged over all subsamples measured
Subwatersheds are defined as 6th field hydrologic unit code

Key:
A = Functioning Appropriately
CI = Confidence interval
CV = Coefficient of Variation
EFSFSR = East Fork of the South Fork of the Salmon River
SFSR = South Fork of the Salmon River
R = Functioning at Acceptable Risk
UR = Functioning at Unacceptable Risk
WCI = Watershed Condition Indicators

5.1.3 Modified McNeil Core Sample

The WCI classification for core sampling efforts requires a 5-year mean. To date, only four years of data have been collected, and as a result, no WCI classification can be identified (Nelson and Burns 2005, Nelson and Burns 2006, Zurstadt et al. 2016). A 5-year mean value for sediment that is less than or equal to 28 percent is considered functioning appropriately. For sediment less than 0.85 mm, an established WCI threshold does not exist. A 5-year mean of less than 10 percent is considered functioning appropriately, as a result of Jensen et al. (2009) modeling efforts, and PAF recommendations (Zurstadt et al. 2016). Jensen et al. (2009) reported that at the 10 percent threshold for fines that are less than 0.85 mm, the odds of salmon and steelhead egg-to-fry survival decreased dramatically. **Figure 5-7** compares average depth fines from core samples during the sampling period of 2013 to 2016.



Note:
Bars on columns represent 95 % confidence intervals
Key:
< = Less than
% = percent
mm = millimeter

Figure 5-7. Core Sample Average Depth Fines and 95% Confidence Intervals at MWH-033 in the East Fork of the South Fork of the Salmon River by Survey Year

Table 5-7 summarizes the average percentage of depth fines in the EFSFSR at MWH-033 from 2013 to 2016. A comparison of means, using Tukey's Honestly Significant Differences test or ANOVA, will not be conducted until at least five years of data have been recorded (Zurstadt 2014).

Box and whisker plots, created by year for core sampling results, are presented in **Appendix 1**. The plots display sample variation of a statistical population, without making any assumptions of the underlying statistical distribution, and they assist in data interpretation and quality control.

The percent of depth fines material that was less than 6.33 mm for all four years ranged from 15 to 30 percent (**Table 5-7**). Even though a 5-year mean is required to classify the WCI for the core substrate samples, the current 4-year average is 23 percent, and would be considered functioning appropriately. Annual means for the percent of depth fines less than 0.85 mm ranged from 4 to 9 percent (**Table 5-7**). All years would be considered functioning appropriately at the Jensen et al. (2009) recommended threshold of less than 10 percent (**Table 5-7**).

Table 5-7. Average Percentage of Depth Fine Material at Site MWH-033 in the East Fork of the South Fork of the Salmon River in 2013-2016

	Sample Year	Sample Size (*n*)	Annual Mean (%)	Standard Deviation	Standard Error	95 % Confidence Interval (%)	Coefficient of Variation
Percent Fines <6.33 mm	2013	40	30	10	2	±3	0.3
	2014	40	26	10	2	±3	0.4
	2015	40	18	9	1	±3	0.5
	2016	40	15	11	2	±3	0.7
Percent Fines <0.85 mm	2013	40	9	6	1	±2	0.6
	2014	40	7	3	1	±1	0.5
	2015	40	4	3	0.5	±1	0.7
	2016	40	4	6	1	±2	1.4

Note: Annual mean is the percent of depth fine material averaged over all subsamples measured.
Key:
< = Less than
% = percent
mm = millimeter

5.1.4 Channel Morphology and Condition (PIBO Survey)

Table 5-8 presents the overall average parameter for the morphology and conditions of the stream channel recorded at each PIBO survey site for 2012 through 2015. The PAF advised not using WCI indicators yet for PIBO until a larger dataset is collected (Zurstadt 2014). Complete statistical tables for each site and subwatershed are presented in **Appendix 1**.

Three ANOVA tests were performed, to determine if a statistically significant difference exists between survey sites, by using data for three dependent variables (bank angle, maximum pool depth, and WW:WD ratio). Bank angle can be influenced by many variables including stream gradient, geology, flow, the presence of riparian vegetation, and both natural and human-caused disturbances. These influences may be driving ANOVA results among the samples. Pool depth can also be affected by several factors, the most influential being stream stage at the time of sampling. Pool depths change annually, and some pools may deepen and have sediment deposits that can change pool depth. Additionally, due to PIBO protocol criteria for measuring pools, certain pools may not be counted from year-to-year if they are not at least half the wetted width of the channel. However, the differences shown among pool-depth ANOVA test results may be due to the higher maximum depths of pools at the highlighted sites compared to other sites. The WW:WD ratio is driven mainly by stream stage, which is determined by stream flow, at the time data is collected. As stream stage increases, the depth also increases; therefore, the likelihood of the wetted width also increases. For PIBO variables that are summarized at the plot level and not the individual transect level, ANOVA was not performed since only a maximum of two years of data has been collected at any particular PIBO survey location. PIBO variables where ANOVA was not performed include pool frequency, LWD frequency, percent surface fines, substrate mean size (D_{50}), and bank stability (non-numeric). Summary tables are included in Section 2 of **Appendix 1** for these variables. Additional details and results from the ANOVA testing are discussed in Section 3 of **Appendix 1**.

Table 5-8. PIBO Reach Average Parameter Results for 2012-2015

Stream	MWH Site ID	Year	WW:WD Ratio	Average Gradient (%)	LWD Pieces/ 100 m (LWD Pieces/ mile)[a]	Pool WW:WD Ratio	Pools/100 m (Pools/mile)	D_{50} (mm)	Bank Angle (degree)	Bank Stability
EFMC	006	2013	43.9	4.4	2.3 (37)	6.3	2.3 (37)	61.6	b	UU
		2015	43.3		44.7 (719)	6.4	3.0 (79)	47.9	148	UU
Sugar Creek	008	2012	34.6	2.8	6.7 (107)	c	6.7 (107)	48.9	b	CS
		2013	35.8		6.7 (1074)	7.2	8.6 (138)	79.1	b	CS
EFSFSR	009	2012	50.6	2.1	2.4 (38)	c	2.8 (45)	103.7	b	CS
		2013	51.0		2.0 (32)	8.2	2.4 (38)	88.5	b	CS
Sugar Creek	010	2012	42.0	2.6	6.3 (101)	6.9	3.4 (54)	45.8	b	US
		2013	46.1		9.5 (152)	7.3	7.1 (114)	49.8	b	CS
EFSFSR	013	2012	44.3	4.0	10.1 (162)	7.0	5.4 (86)	37.1	b	CS
		2013	39.1		13.1 (210)	6.4	4.2 (67)	50.1	b	CS
Meadow Creek	014	2012	39.9	1.7	0.0	c	4.4 (70)	43.1	b	CS
		2013	38.6		0.0	7.7	6.0 (36)	44.8	b	CS
Meadow Creek	016	2012	34.7	4.0	8.2 (131)	6.4	6.0 (36)	49.4	b	UU
		2015	43.5		33.7 (542)	6.4	4.3 (70)	33.5	86	CS
Tamarack Creek	017	2012	37.3	2.3	11.4 (182)	c	4.4 (70)	71.7	b	CS
		2013	38.5		8.2 (131)	12.1	8.7 (139)	100.3	b	CS
EFSFSR	032	2013	61.4	2.6	1.8 (29)	8.5	2.4 (38)	155.8	b	CS
		2014	48.5		32.3 (517)	10.8	1.7 (11)	115.5	147	CS
EFSFSR	033	2013	71.6	1.3	0.5 (8)	11.7	1.4 (22)	90.5	b	CS
		2014	67.4		14.8 (237)	14.2	0.6 (10)	104.2	111	CS
EFSFSR	044	2013	18.9	1.8	3.2 (51)	5.5	4.8 (77)	85.7	b	CS
		2015	24.1		16.7 (268)	6.6	5.6 (89)	57.8	87	CS
Meadow	047	2013	15.0	0.4	30.2 (483)	3.4	6.4 (102)	3.9	b	CS
		2015	18.1		48.4 (779)	1.5	4.0 (64)	6.5	83	CS

Table 5-8. PIBO Reach Average Parameter Results for 2012-2015 (*continued*)

Stream	MWH Site ID	Year	WW:WD Ratio	Gradient (%)	LWD Pieces/ 100 m (LWD Pieces/ mile)	Pool WW:WD Ratio	Pools/100 m Pools/mi	D50 (mm)	Bank Angle (degree)	Bank Stability
Burntlog	050	2014	46.4	2.7	16.7 (267)	6.7	2.0 (32)	116.2	124	CS
		2015	49.4		17.3 (279)	7.5	3.1 (49)	95.1	120	CS
Trapper	053	2014	39.7	1.5	34.7 (555)	7.1	3.4 (54)	103.4	108	CS
		2015	33.6		40.9 (658)	10.2	2.3 (37)	112.7	109	CS
Riordan	055	2014	30.1	0.4	16.7 (267)	5.6	4.8 (77)	3.9	91	CS
		2015	29.6		17.3 (278)	4.7	3.6 (57)	3.5	86	CS
Fourmile	056	2014	55.9	1.7	33.9 (542)	9.5	1.7 (11)	92.1	123	CS
		2015	47.4		37.8 (609)	9.5	2.2 (35)	89.0	104	CS
Goat	057	2014	52.4	5.7	31.4 (502)	6.9	4.6 (74)	65.8	109	CS
		2015	56.5		70.5 (1134)	9.2	4.9 (79)	47.4	108	CS
EFSFSR	059	2014	41.1	0.8	19.2 (307)	7.5	0.8 (13)	65.6	141	CS
Meadow	060	2014	21.5	1.9	0.0	No pools	0.5 (8)	121.0	160	CS
Profile	061	2014	30.7	1.4	0.0	4.9	1.5 (24)	162.4	160	CS
Fiddle	062	2015	36.6	8.7	56.5 (910)	5.4	7.1 (115)	24.5	88	CS

Note:
a = LWD protocols were modified by the PAF during the baseline study period. Large differences between sample years may be as a result of natural causes (e.g., avalanches, windfall in burned areas) or as a result of changed protocols (Zurstadt et al. 2016b).
b = Bank angle not added to PIBO protocol until 2014.
c = In 2012, pool lengths were measured instead of widths, so data are not comparable.

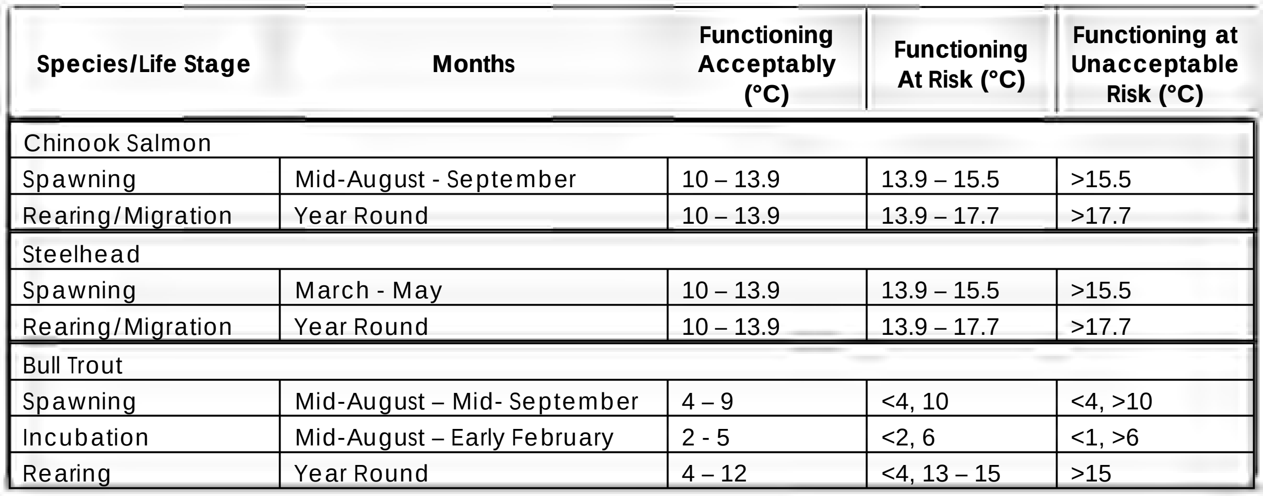
Key:
% = percent
CS = Covered Stable
CU = Covered Unstable
D_{50} = substrate mean size
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River
LWD – large woody debris
mm = millimeter
US = Uncovered Stable
UU = Uncovered Unstable
WW:WD = wetted width-to-wetted depth

Box and whisker plots created by year for PIBO surveys are presented in Section 1 of **Appendix 1**. The box and whisker plots show variation in samples of a statistical population, without making any assumptions of the underlying statistical distribution, and they assist in data interpretation and quality control.

5.1.5 Water Temperature Evaluation

Table 5-9 and **Appendix 3** present 7-day average maximum water temperature WCIs for spawning and rearing Chinook salmon and steelhead; and bull trout spawning, incubation and rearing based on Appendix B of the Land and Resource Management Plan (PAF 2003). Sites where the thermographs were not installed until 2014 were lost, or were inaccessible during late-fall data collection activities, which are shown as data gaps in the figures in **Appendix 3**.

Table 5-9. Water Temperature Watershed Condition Indicators for Chinook Salmon, Steelhead and Bull Trout Based on the 7-Day Average Maximum Temperature



Species/Life Stage	Months	Functioning Acceptably (°C)	Functioning At Risk (°C)	Functioning at Unacceptable Risk (°C)
Chinook Salmon				
Spawning	Mid-August - September	10 – 13.9	13.9 – 15.5	>15.5
Rearing/Migration	Year Round	10 – 13.9	13.9 – 17.7	>17.7
Steelhead				
Spawning	March - May	10 – 13.9	13.9 – 15.5	>15.5
Rearing/Migration	Year Round	10 – 13.9	13.9 – 17.7	>17.7
Bull Trout				
Spawning	Mid-August – Mid- September	4 – 9	<4, 10	<4, >10
Incubation	Mid-August – Early February	2 - 5	<2, 6	<1, >6
Rearing	Year Round	4 – 12	<4, 13 – 15	>15

Source: PAF 2003, page B-13 in Appendix B

5.2 Macroinvertebrates

The final SMI scores were consistently high across sites and years because individual scores for most metrics were high, with several consistently exceeding the highest score of 100 (**Table 5-13** and **Appendix 2**). The overall score was *very good* for seven of the 11 survey sites in all four sampling years, attaining the highest designation in the SMI scoring system. Among the seven consistently “very good” sites, there was relatively little variation in SMI scores between years, except for MWH-010 (upper Sugar Creek), which had a decreased score of 83.2 in 2016 as compared to a range of 92.4 to 95.6 from 2012 to 2014. Even though the overall rating at MWH-010 was still considered *very good*” it’s worth noting that the departure from previous scores appeared to be driven by lower Trichoptera richness, the percentage of Plecoptera, and lower water quality tolerance (i.e., HBI).

SMI metrics with consistently high scores included total taxa richness, Ephemeroptera taxa (mayflies) richness, Trichoptera taxa (caddisflies) richness, percent 5 dominant taxa (i.e., most abundant), HBI (a measure of water-quality tolerances), scraper taxa richness, and clinger taxa richness. However, lower SMI scores for 2016—compared to previous years’ surveys at MWH-007, MWH-010, MWH-015, MWH-016 and MWH-017—were generally the result of lower taxa richness (particularly Plecoptera and Trichoptera), percent Plecoptera, HBI scores, scraper taxa, percent 5 dominant, and clinger taxa. There is some redundancy in these measures, particularly among the richness metrics, so changes in overall diversity may have affected all of these scores.

Plecoptera taxa (stoneflies) richness had somewhat higher variation among sites, but generally it produced high metric scores, except for a sharp decrease over time at site MWH-007 on the EFSFSR, located immediately downstream of the Yellow Pine pit outlet (**Table 5-13** and **Appendix 2**). The cause for this remains unclear considering other metric scores appear healthy.

The lowest metric scores, and widest variation among survey sites, was for percent Plecoptera individuals (**Table 5-13** and **Appendix 2**). Sites MWH-010 (Sugar Creek) and MWH-017 (Tamarack Creek) had the highest average percentage of Plecoptera individuals over the three sampling years, about twice the average metric scores of the other sites, while site MWH-007 had the lowest. In general, most sites exhibited high Plecoptera diversity, but relatively low numbers.

Given the high taxa richness of all the sites, it is difficult to draw firm conclusions regarding relatively low Plecoptera abundance, which could be related to high habitat diversity. Ultimately, relatively low abundance of Plecoptera individuals did not substantially affect the overall SMI scores because of consistently high taxa richness, an abundance of taxa having low water quality tolerance scores, and an abundance of clinger and scraper taxa, which require high-quality stream habitat in the Central and Southern Mountains region, namely clean cobble substrate.

HBI scores were generally lower across all sites in 2016 compared to previous years, indicating that the HBI values were higher. HBI values are the combination of tolerance of organic pollution weighted by the abundance of those taxa in each sample. These higher HBI values (and corresponding lower HBI scores) mean that the types and abundances of taxa collected at those survey sites were skewed towards being more tolerant of organic pollution than in previous years.

Additional metrics results are summarized below, and further described in **Appendix 2**.

Higher MTI values indicate that the taxa composition exhibit greater tolerance to metals. Across all the sites, the MTI values were low, ranging from 1.46 to 3.09, and showed relatively little variation across years with one exception. In 2012, the MTI value was 4.7 at site MWH-015 (a constructed channel on Meadow Creek), but it decreased to 2.42 in 2013, and then to 1.98 by 2014, possibly indicating that metals concentrations within the constructed channel are decreasing, causing a shift towards a greater number of taxa and/or proportion of individuals that are relatively intolerant of metals contamination (**Table 5-13**). In 2016, two sites exhibited MTI values greater than 3.0. These sites were MWH-007 (immediately downstream of the Yellow Pine pit; MTI = 3.49) and at MWH-016 (the furthest upstream Meadow Creek site; MTI = 3.81). The increased MTI score (i.e., lower tolerance to metals) at the upstream Meadow Creek site is a marked departure from earlier years' results. Another site showing a notable departure from previous years was at site MWH-009, the next site downstream from MWH-007. The MTI values at this site from 2012 to 2014 were consistently around 2.0, whereas in 2016 the value was 2.97, indicating possible increased metals contamination at this site.

Intolerant taxa richness was extremely high, for all survey sites and years, at approximately 75 percent of the taxa in individual samples (**Table 5-13**). This metric indicates that all survey sites are supporting many taxa that are intolerant to poor water quality. As with other 2016 richness metrics, MWH observed a notable decrease in intolerant taxa richness at site MWH-016, which was a sharp departure from previous years. This site had the highest and most consistent number of taxa intolerant of organic pollution from 2012 to 2014, but had the lowest number of intolerant taxa in 2016.

The percent of tolerant individuals was low, comprising no more than 4 percent of all individuals at any of the survey sites (**Table 5-13**). This is consistent with other metrics that indicate high water quality among all sites in the project area. In 2016, there was a relatively large increase in percent tolerant individuals at the furthest downstream Meadow Creek site (MWH-014), and at the site immediately downstream (MWH-012), which is located just below the Meadow Creek/EFSFSR confluence. Although the intolerant macroinvertebrates comprised only about 4 to 6 percent of the samples at those sites in 2016, in previous years, intolerant organisms comprised no more than 2 percent of the samples in any given year. This may represent an increase in pollution, particularly when other changes in taxa richness and metals tolerance at Meadow Creek sites are considered.

Shannon-Weaver index values ranged from 2.68 to 3.56, with only a few sites having values of less than 3.0. These values indicate a high diversity among all sites, which is well supported by other measures of richness and evenness for these sites. The lowest values, of all sites and years, were values of 2.68 at MWH-007 (just downstream from the Yellow Pine pit outlet) in 2014, and 2.72 at MWH-014 (Meadow Creek) in 2013 (**Table 5-10**).

The FFG composition of samples across all sites and years was consistent and stable, particularly for FFG richness values across all sites in all survey years, indicating no notable shifts in in habitat conditions. Richness across sites and years was dominated by predators and gatherers, and to a lesser extent shredders and scrapers, along with a low, but stable percentage of filterer taxa.

The data indicates that there is stability and consistency of available habitat and food sources at the study sites, particularly with the apparently rich predator population, which is dependent on diverse and stable food resources in the form of other macroinvertebrates.

Numbers of individuals were dominated by scrapers and gatherers, with a few notable instances of a high proportion of shredders (MWH-013 in 2012, and MWH-015 in 2013). The FFG composition is consistent and evenly distributed among the different FFG designations across sites and sampling years.

The most obvious difference in FFG abundance is the large proportion of filterer individuals at MWH-007, located just downstream of the Yellow Pine pit outlet. Filterers increased steadily from 2012 to 2014 at this site. In 2013 and 2014 this was almost entirely due to a large number of blackflies in the sample. The increase in abundance from 2012 to 2014 may indicate an increase in particulates, including organic/particulate discharge from the Yellow Pine pit. However, the difference may also be due to sampling bias, since blackfly larvae can be found in high densities in such habitat, and therefore, it is possible for a single sampling repetition to inadvertently contribute a disproportionate number of individuals to the combined sample.

The PIBO O/E scores among sampling sites from 2012 through 2016 were consistently rated as being in *good* biological condition, except in three instances where a site was rated as *fair* (**Table 5-11**). A *fair* condition rating was found in 2012 at MWH-007 (Meadow Creek confluence), and in 2013 at MWH-029 (Sugar Creek) and MWH-015 (Meadow Creek). In all three instances, sites with *fair* O/E scores improved to *good* in subsequent sampling years. The O/E condition rating results indicate that the macroinvertebrate assemblages are consistently very comparable to reference conditions in the Western States Ecoregion for which the O/E model was developed (Stoddard et al. 2006).

An overall description of the results, by individual sample locations, is presented in **Appendix 2**.

Table 5-10. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Sampling Sites in 2012-2014 and 2016

Stream Site ID	EFSFSR MWH-007				EFSFSR MWH-009				Sugar Creek MWH-010			
Sampling Year	**2012**	**2013**	**2014**	**2016**	**2012**	**2013**	**2014**	**2016**	**2012**	**2013**	**2014**	**2016**
Metric Values												
Total Taxa	40	37	32	40	44	45	45	47	45	41	45	38
Ephemeroptera Taxa	12	13	12	12	11	13	12	12	11	12	13	12
Plecoptera Taxa	10	5	4	5	9	9	9	8	9	11	10	8
Trichoptera Taxa	11	12	7	13	10	11	11	11	11	8	11	7
Plecoptera	10.2	2.7	2.9	2.3	12.8	12.5	6.0	5.6	31.4	16.8	17.0	6.0
Hilsenhoff Biotic Index	2.17	2.4	3.7	4.3	2.4	2.3	2.5	3.7	2.95	2.9	2.8	4.2
5 Dominant Taxa	57.5	61.5	71.5	64.3	48.3	49.7	43.4	56.5	66.0	64.8	55.4	65.0
Scraper Taxa*	8	12	8	6	9	11	9	9	9	8	12	9
Clinger Taxa	33	32	25	31	35	34	35	35	34	33	37	29
Metric Scores												
Total Taxa	108.1	100.0	86.5	108.1	118.9	121.6	121.6	127.0	121.6	110.8	121.6	102.7
Ephemeroptera Taxa	120.0	130.0	120.0	120.0	110.0	130.0	120.0	120.0	110.0	120.0	130.0	120.0
Plecoptera Taxa	125.0	62.5	50.0	62.5	112.5	112.5	112.5	100.0	112.5	137.5	125.0	100.0
Trichoptera Taxa	122.2	133.3	77.8	144.4	111.1	122.2	122.2	122.2	122.2	88.9	122.2	77.8
Plecoptera	40.9	11.0	11.6	9.2	51.0	50.1	23.9	22.3	125.8	67.1	67.9	23.9
Hilsenhoff Biotic Index	97.9	95.1	79.0	71.3	95.1	96.9	93.7	78.7	88.1	89.2	90.4	72.3
5 Dominant Taxa	90.5	82.0	60.6	75.9	110.0	107.0	120.5	92.5	72.4	74.8	94.9	74.4
Scraper Taxa*	100.0	150.0	100.0	75.0	112.5	137.5	112.5	112.5	112.5	100.0	150.0	112.5
Clinger Taxa	173.7	168.4	131.6	163.2	184.2	179.0	184.2	184.2	179.0	173.7	194.7	152.6
SMI Score	92.2	83.4	73.9	77.1	94.0	94.1	90.9	88.2	95.6	92.4	94.8	83.2
SMI Rating	Very Good	Very Good	Good	Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good

Table 5-10. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Sampling Sites 2012-2014 and 2016 (*continued*)

Stream Site ID	**Sugar Creek MWH-029**				**EFSFSR MWH-011**				**EFSFSR MWH-012**			
Sampling Year	**2012[1]**	**2013**	**2014**	**2016**	**2012**	**2013**	**2014**	**2016**	**2012**	**2013**	**2014**	**2016**
Metric Values												
Total Taxa	39	41	40	47	52	42	43	51	46	45	47	43
Ephemeroptera Taxa	11	10	12	15	14	13	11	14	13	12	10	14
Plecoptera Taxa	8	8	6	9	11	8	7	8	6	7	8	6
Trichoptera Taxa	9	11	11	10	13	10	13	13	13	13	13	14
Plecoptera	22.3	11.0	8.9	6.4	9.8	10.3	5.1	4.8	6.6	7.8	5.6	3.6
Hilsenhoff Biotic Index	2.27	2.01	2.45	3.99	2.36	2.01	2.14	3.53	2.62	3.12	2.20	4.02
5 Dominant Taxa	50.0	64.3	57.2	62.0	55.4	59.5	53.1	52.7	57.0	57.3	47.5	53.0
Scraper Taxa*	8	9	10	10	11	9	10	9	10	9	11	9
Clinger Taxa	31	30	29	38	42	34	35	40	36	34	37	35
Metric Scores												
Total Taxa	105.4	110.8	108.1	127.0	140.5	113.5	116.2	137.8	124.3	121.6	127.0	116.2
Ephemeroptera Taxa	110.0	100.0	120.0	150.0	140.0	130.0	110.0	140.0	130.0	120.0	100.0	140.0
Plecoptera Taxa	100.0	100.0	75.0	112.5	137.5	100.0	87.5	100.0	75.0	87.5	100.0	75.0
Trichoptera Taxa	100.0	122.2	122.2	111.1	144.4	111.1	144.4	144.4	144.4	144.4	144.4	155.6
Plecoptera	89.2	44.0	35.5	25.7	39.2	41.3	20.6	19.2	26.3	31.2	22.4	14.5
Hilsenhoff Biotic Index	96.6	99.9	94.3	75.2	95.5	99.8	98.3	80.9	92.3	86.0	97.5	74.7
5 Dominant Taxa	106.4	76.1	91.1	80.9	95.0	86.1	99.7	100.7	91.6	91.0	111.8	100.1
Scraper Taxa*	100.0	112.5	125.0	125.0	137.5	112.5	125.0	112.5	125.0	112.5	137.5	112.5
Clinger Taxa	163.2	157.9	152.6	200.0	221.1	179.0	184.2	210.5	189.5	179.0	194.7	184.2
SMI Score	98.4	91.1	88.4	86.9	92.2	91.9	89.6	88.9	87.2	88.4	91.1	84.9
SMI Rating	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good

Table 5-10. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Sampling Sites 2012-2014 and 2016 (*continued*)

Stream Site ID	**EFSFSR MWH-013**				**Meadow Creek MWH-014**				**Meadow Creek MWH-015**			
Sampling Year	**2012**	**2013**	**2014**	**2016**	**2012**	**2013**	**2014**	**2016**	**2012**	**2013**	**2014**	**2016**
Metric Values												
Total Taxa	47	44	47	39	40	37	49	42	35	40	37	35
Ephemeroptera Taxa	12	12	11	11	12	13	14	16	10	9	12	15
Plecoptera Taxa	11	9	10	8	7	6	7	6	5	8	7	8
Trichoptera Taxa	11	13	11	8	8	9	8	8	8	11	10	4
Plecoptera	17.7	12.2	8.4	7.5	7.3	9.3	11.3	5.1	4.1	7.3	8.5	7.5
Hilsenhoff Biotic Index	2.93	3.25	4.55	4.38	3.44	3.62	3.33	4.31	4.66	3.81	3.42	4.73
5 Dominant Taxa	51.4	60.7	65.8	68.7	60.8	65.5	52.6	56.6	74.1	65.7	57.6	69.6
Scraper Taxa*	11	9	9	9	9	10	11	12	8	8	9	8
Clinger Taxa	38	33	36	31	30	30	35	32	27	31	32	30
Metric Scores												
Total Taxa	127.0	118.9	127.0	105.4	108.1	100.0	132.4	113.5	94.6	108.1	100.0	94.6
Ephemeroptera Taxa	120.0	120.0	110.0	110.0	120.0	130.0	140.0	160.0	100.0	90.0	120.0	150.0
Plecoptera Taxa	137.5	112.5	125.0	100.0	87.5	75.0	87.5	75.0	62.5	100.0	87.5	100.0
Trichoptera Taxa	122.2	144.4	122.2	88.9	88.9	100.0	88.9	88.9	88.9	122.2	111.1	44.4
Plecoptera	70.9	49.0	33.4	30.1	29.1	37.3	45.3	20.4	16.2	29.0	33.9	30.2
Hilsenhoff Biotic Index	88.4	84.3	68.1	70.2	82.0	79.8	83.3	71.2	66.8	77.4	82.2	65.9
5 Dominant Taxa	103.3	83.6	72.7	66.6	83.4	73.4	100.9	92.3	55.0	73.1	90.2	64.6
Scraper Taxa*	137.5	112.5	112.5	112.5	112.5	125.0	137.5	150.0	100.0	100.0	112.5	100.0
Clinger Taxa	200.0	173.7	189.5	163.2	157.9	157.9	184.2	168.4	142.1	163.2	168.4	157.9
SMI Score	95.5	90.8	86.0	84.0	85.7	85.1	89.5	83.1	76.0	85.5	88.2	77.7
SMI Rating	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Good	Very Good	Very Good	Very Good

Table 5-10. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Sampling Sites 2012-2014 and 2016 (*continued*)

Stream Site ID	**Meadow Creek MWH-016**				**Tamarack Creek MWH-017**			
Sampling Year	**2012**	**2013**	**2014**	**2016**	**2012**	**2013**	**2014**	**2016**
Metric Value								
Total Taxa	50	45	46	29	39	42	48	36
Ephemeroptera Taxa	11	11	13	10	12	10	13	11
Plecoptera Taxa	13	9	9	7	9	10	10	6
Trichoptera Taxa	10	13	9	2	9	11	12	8
Plecoptera	13.6	11.1	5.6	3.2	29.1	12.3	19.6	6.9
Hilsenhoff Biotic Index	3.39	3.17	3.78	5.04	2.29	3.91	3.21	4.79
5 Dominant Taxa	55.1	57.5	58.2	82.4	58.2	58.9	56.7	69.8
Scraper Taxa*	7	12	9	6	7	8	11	7
Clinger Taxa	36	34	34	22	32	34	37	27
Metric Scores								
Total Taxa	135.1	121.6	124.3	78.4	105.4	113.5	129.7	97.3
Ephemeroptera Taxa	110.0	110.0	130.0	100.0	120.0	100.0	130.0	110.0
Plecoptera Taxa	162.5	112.5	112.5	87.5	112.5	125.0	125.0	75.0
Trichoptera Taxa	111.1	144.4	100.0	22.2	100.0	122.2	133.3	88.9
Plecoptera	54.2	44.5	22.6	12.7	116.3	49.1	78.3	27.8
Hilsenhoff Biotic Index	82.6	85.4	77.8	62.1	96.3	76.1	84.8	65.1
5 Dominant Taxa	95.5	90.4	89.0	37.5	89.1	87.4	92.1	64.2
Scraper Taxa*	87.5	150.0	112.5	75.0	87.5	100.0	137.5	87.5
Clinger Taxa	189.5	179.0	179.0	115.8	168.4	179.0	194.7	142.1
SMI Score	91.1	91.1	87.7	63.9	97.0	90.3	95.0	78.4
SMI Rating	Very Good	Very Good	Very Good	Good	Very Good	Very Good	Very Good	Good

Table 5-11. PIBO Observed/Expected Index Scores for MWH Sampling Sites in 2012-2014 and 2016

		2012		2013		2014		2016	
Site ID	**Water Body**	**O/E Score**	**Condition**	**O/E Score**	**Condition**	**O/E Score**	**Condition**	**O/E Score**	**Condition**
MWH-007	EFSFSR	0.71	Fair	0.87	Good	0.95	Good	1.03	Good
MWH-009	EFSFSR	0.88	Good	0.95	Good	0.95	Good	0.95	Good
MWH-010	Sugar Creek	1.22	Good	0.91	Good	1.06	Good	1.22	Good
MWH-029	Sugar Creek	1.19	Good	0.71	Fair	1.11	Good	1.11	Good
MWH-011	EFSFSR	1.11	Good	0.87	Good	0.95	Good	1.27	Good
MWH-012	EFSFSR	1.11	Good	1.11	Good	1.03	Good	1.11	Good
MWH-013	EFSFSR	1.18	Good	0.94	Good	1.10	Good	1.26	Good
MWH-014	Meadow Creek	0.86	Good	0.85	Good	0.93	Good	1.25	Good
MWH-015	Meadow Creek	0.96	Good	0.74	Fair	1.04	Good	1.11	Good
MWH-016	Meadow Creek	0.87	Good	1.01	Good	1.08	Good	0.87	Good
MWH-017	Tamarack Creek	1.11	Good	1.04	Good	1.04	Good	1.11	Good

Note: Observed/Expected Index is based on results from the RIVPACS statistical model.
In 2012, samples were collected slightly downstream from the current MWH-029, however, the collection location is close and has similar habitat, so is considered the same as MWH-029.

Key:
EFSFSR = East Fork of the South Fork of the Salmon River
O/E = Observed/Expected

5.3 Metals

The results of the metals analysis are discussed below for sediment, macroinvertebrates and fish tissue. Full laboratory results for all metals analyses are presented in **Appendix 4**.

5.3.1 Sediment

Table 5-12 presents sample results for only those metals for which EPA provides screening-level benchmarks (2006). Antimony, arsenic and mercury exceeded their respective benchmarks at most survey sites, generally by one or more orders of magnitude. Iron and manganese exceeded benchmarks at five sites. Cadmium exceeded the benchmark at MWH-007 and MWH-030 (both on the EFSFSR); copper exceeded the benchmark at MWH-017 (Tamarack Creek); and silver exceeded benchmarks at MWH-011 and MWH-012 (both located on the EFSFSR). Selenium concentration exceeded the benchmark at one site (MWH-012), but at all other sites, a comparison could not be made. At those non-comparative sites, the selenium values were reported as less than the Practical Quantitation Limit (PQL) of 4 milligrams per kilogram (mg/kg) dry weight which was twice the benchmark quantitation of 2 mg/kg dry weight.

Table 5-12. Sediment Metals Concentrations Compared to Screening Level Benchmarks

Stream	MWH Site ID	Analyte (mg/kg)	Antimony	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Zinc
		PQL	2	2.5	0.2	0.6	0.6	1	10	0.8	0.8	0.033*	1	4	0.5	1
		Freshwater Sediment Screening Benchmarks	2	9.8	0.99	43.4	50	31.6	20,000	35.8	460	0.18	22.7	2	1	121
EFSFSR	007		152	1090	1.1	8.93	5.63	13.7	18,300	6.2	733	1.4	6.08	<4	0.97	41
EFSFSR	009		48	219	0.29	11.7	5.5	8.47	14,700	6.1	337	62.6	8.42	<4	<0.5	38.3
EFSFSR	011		222	246	0.34	6.43	2.88	7.74	11,400	5.7	304	0.305	3.78	<4	1.09	22.7
EFSFSR	012		743	200	0.3	5.03	2.16	6.88	8,640	12.2	205	11.6	2.54	4.3	2	21.9
EFSFSR	013		6.9	44.6	<0.2	7.58	3.79	12.1	13,500	4.8	316	4.45	4.37	<4	<0.5	38.7
Meadow	014		19.8	52.8	<0.2	7.47	2.72	6.31	10,700	2.5	256	0.153	4.46	<4	<0.5	21.1
Meadow	016		2.9	11.1	<0.2	16.6	3.81	6.89	13,900	4.4	234	0.037	8.09	<4	<0.5	34.3
Tamarack	017		3.4	9.5	<0.2	27	7.04	56	17,400	3.6	254	<0.033	15.7	<4	<0.5	34.3
Sugar	029		19	80	<0.2	12.3	6.25	11.1	13,500	5.9	199	61.8	9.83	<4	<0.5	35.1
EFSFSR	030		241	1640	1.71	8.9	5.77	11.1	20,400	7.5	685	0.64	5.81	<4	1	43.2
Sugar	069		19.3	81.2	<0.2	12.2	6.46	10.9	13,500	5.8	195	70.2	9.39	<4	<0.5	35.2
YPP	070		196	206	0.34	12.3	5.58	12.8	21,300	9.1	479	1.31	7.77	<4	0.92	47.7
YPP	071		169	248	0.37	16.3	6.1	13.2	23,500	9.3	513	0.492	8.96	<4	0.86	60.3
YPP	072		114	293	0.41	15.7	6.04	11.9	22,500	7.9	525	0.447	8.73	<4	0.81	55.1
YPP	073		164	611	0.71	14.1	5.42	11.8	20,600	7.7	320	0.46	7.95	<4	0.8	50
YPP	074		138	184	0.27	9	4.07	9.33	14,500	6.2	368	0.962	5.49	<4	0.59	35.3
Meadow	075		186	307	0.39	9.25	2.93	9.81	12,300	16.2	241	0.447	5	<4	0.95	24.7

Note: Benchmarks obtained from Environmental Protection Agency website on November 15, 2017, Freshwater Sediment Screening Benchmarks developed for Region 3, at https://www.epa.gov/risk/freshwater-sediment-screening-benchmarks.
*Several samples had higher mercury PQL due to required dilutions.
Shaded cells are higher than the applicable screening benchmark
Key:
mg/kg = milligrams per kilogram
PQL = Practical Quantitation Limit
YPP = Yellow Pine pit

5.3.2 Macroinvertebrates

Table 5-13 presents the sample results for metals concentration in macroinvertebrate tissue. Concentrations of metals in macroinvertebrate tissue were elevated at many sites on the EFSFSR and Sugar Creek, relative to concentrations at other sites—particularly sites on Meadow Creek and Tamarack Creek. For example, the highest tissue concentrations of arsenic were on the EFSFSR at the sites further downstream (MWH-009, MWH-007 and MHW-030). The maximum tissue concentration of arsenic was at MWH-030, with an arsenic concentration of 572 mg/kg dry weight. By contrast, tissue concentration of arsenic at the reference site on Tamarack Creek was 4.38 mg/kg dry weight. The arsenic concentrations were lower at the most upstream EFSFSR site, the most upstream Meadow Creek site, and the lowest Sugar Creek site. The highest tissue concentrations of antimony were also on the EFSFSR at the more downstream sites (particularly MWH-007 and MWH-030). Maximum tissue concentration was found at MWH-007, with an antimony concentration of 27.2 mg/kg dry weight. Antimony concentrations in tissue were lower at the more upstream sites on the EFSFSR, and much lower at the Meadow Creek, Sugar Creek, and Tamarack Creek sites. The minimum tissue concentration of antimony, 0.07 mg/kg dry weight, was at the reference site on Tamarack Creek (MWH-017). By contrast, the highest mercury tissue concentrations were at the two survey sites on Sugar Creek. Mercury concentrations at these sites were approximately 10 times greater than the mercury concentrations at other survey sites.

Table 5-13 and **Table 5-14** present a comparison of the survey sites sampled in 1995, 1996, 1997, and 2016. Comparisons between these years do not indicate any temporal trends that are consistent for all sampled metals and across all sample locations. Differences in concentrations of arsenic and antimony for these years are noted below. Comparisons for mercury are not possible, due to a lack of sampling at many sites in 1995 and 1996, as well as results that were below detection limits at many sites in 1997. Concentrations of arsenic were higher at most sites in 2016 than they were in 1997. The exceptions were MWH-012 and MWH-029, which had slightly lower arsenic concentrations in 2016 relative to 1997. Maximum arsenic concentrations were noted in either 1995 (four sites) or 1996 (four sites). Similarly, maximum antimony concentrations were noted in either 1995 (two sites) or 1996 (six sites). Relative to 1997, antimony concentrations were higher in 2016 at six of the nine sites (the exceptions were MWH-011, MWH-014, and MWH-075, which were lower in 2016 relative to 1997).

As presented in **Table 5-13**, concentrations of arsenic in macroinvertebrate tissue at all sites—other than MWH-013 (EFSFSR), MWH-029 (Sugar Creek), and MHW-017 (Tamarack Creek)—were greater than the dietary toxicity levels for fish reported in the Biological Opinion for the water quality toxics standards for Idaho (NMFS 2014). In many cases, the concentrations are extremely high. For example, at MWH-074 (EFSFSR) the concentration was over 40 times higher than levels at which effects to fish may occur. By contrast, concentrations of mercury were generally lower than dietary toxicity levels. The exceptions were the sites on Sugar Creek, where mercury concentrations were greater than the dietary toxicity levels reported in NMFS (2014).

NMFS (2014) reports that selenium toxicity has been reported to occur at dietary concentrations (i.e., concentrations in food sources such as macroinvertebrates) of greater than 3 mg/kg dry weight in one study, but at dietary concentrations of greater than 7.6 mg/kg dry weight in another study. This range was used in **Table 5-13**. Concentrations of selenium in macroinvertebrate tissue at four EFSFSR sites, and one Meadow Creek site, were greater than 3 mg/kg dry weight in 2016, but lower than 7.6 mg/kg dry weight at all other sites.

Table 5-13. Macroinvertebrate Tissue Metals Concentrations

Analyte (mg/kg)	Dietary Toxicity to Salmonids (mg/kg dry weight)	EFSFSR MWH Site ID							Meadow Creek MWH Site ID			Sugar Creek MWH Site ID		Tamarack Creek MWH Site ID	Maximum	Minimum
		009	007	030	074	011	012	013	014	075	016	029	069	017		
Aluminum		593	582	810	410	881	689	780	853	517	785	570	835	758	881	410
Antimony		8.06	27.2	21.3	6.67	6.33	13.3	0.58	1.84	1	0.24	0.39	1.11	0.07	27.2	0.07
Arsenic	> 14	100	331	572	29.1	57.8	38.2	9.39	71.9	55.5	6.49	9.35	24	4.38	572	4.38
Barium		16.5	32	54.9	8.42	20.8	34.6	49	20.3	14.7	62.9	7.88	10.5	6.63	62.9	6.63
Beryllium		0.09	0.09	0.1	0.06	0.07	0.06	0.08	0.06	0.04	0.05	0.08	0.10	0.06	0.10	0.04
Cadmium		0.32	0.14	0.12	0.32	0.34	0.30	0.87	0.24	0.25	0.43	0.43	0.52	1.03	1.03	0.12
Calcium		1530	886	1600	1380	1810	1190	1610	1190	1100	1440	1450	1410	3270	3270	886
Chromium		1.52	0.95	1	0.73	1.55	0.93	1.3	1.3	1.39	0.95	1.09	1.29	2.78	2.78	0.73
Cobalt		2.85	1.88	2.19	3.35	2.31	1.8	2.69	2.18	1.22	1.97	2.24	3.29	1.03	3.35	1.03
Copper		21.2	30.9	24.1	18.7	15.3	15.3	13.9	16.1	12.1	11.5	13.5	16.5	21.4	30.9	11.5
Iron		1600	3490	4080	876	2130	1720	1000	2470	1930	887	584	899	923	4080	584
Lead		0.79	1.01	0.85	0.38	0.48	0.55	0.51	0.47	0.42	0.30	0.31	0.48	0.22	1.01	0.22
Magnesium		1360	1100	1270	1360	1510	1240	1470	1190	1040	1200	1310	1450	1720	1720	1040
Manganese		372	707	1050	224	306	335	136	387	354	136	59.4	98.8	51.1	1050	51.1
Mercury		0.43	0.18	0.19	0.23	0.19	0.23	0.25	0.20	0.18	0.212	2.06	2.56	0.03	2.56	0.03
Mercury[1]	> 0.2	0.03	0.03	0.13	0.02	0.03	0.04	0.04	0.03	0.03	0.02	0.34	0.46	0.01	0.46	0.01
Nickel		1.59	1.34	1.16	1.31	1.54	1.04	0.87	1.58	1.18	1.2	2.23	2.79	1.39	2.79	0.87
Potassium		6410	10400	8560	7350	8260	8580	8810	8940	8050	8880	7790	8330	8190	10400	7350
Selenium	> 3-7.6	3.4	3.4	3.2	4.3	3.2	2.6	0.9	3.6	3	2.4	2.6	2.1	2.2	4.3	0.9
Silver		0.12	0.11	0.24	0.09	0.09	0.13	0.10	0.07	0.07	0.08	0.07	0.07	0.26	0.26	0.068
Sodium		3100	3850	4330	3260	4580	4190	4880	4880	4160	4990	3710	3620	4400	4990	3260
Thallium		0.065	0.015	0.035	0.032	0.025	0.023	0.035	0.021	0.019	0.013	0.19	0.22	0.010	0.224	0.010
Zinc		234	157	147	157	157	181	388	133	129	171	150	155	156	388	129

Note: [1] Mercury data in mg/kg wet weight

Key: mg/kg = milligrams per kilogram

Table 5-14. Comparison of Macroinvertebrate Tissue Metal Concentrations

Creek	MWH Site ID	Antimony				Arsenic				Cadmium				Copper				Iron			
		1995	1996	1997	2016	1995	1996	1997	2016	1995	1996	1997	2016	1995	1996	1997	2016	1995	1996	1997	2016
EFSFSR	009	4.58	11.2	2.48	8.06	43.8	1117	17.9	100	0.17	0.33	<0.1	0.32	13.7	17.1	14.4	21.2	1244	3022	490	1600
	007	21	43.7	16.9	27.2	320	333	79.4	331	0.21	0.19	<0.1	0.14	16.8	22.8	15.3	30.9	4048	4211	1211	3490
	011	14.4	27	12	6.33	49.7	74.9	23	57.8	0.14	<0.1	0.19	0.34	16	15.6	18.7	15.3	849	1518	744	2130
	012	57.4	14.9	12.8	13.3	130	75.9	44.5	38.2	0.21	0.41	0.16	0.3	22.8	16.9	23.3	15.3	2086	1599	1137	1720
Meadow Creek	014	36.8	76.8	13.9	1.84	209	147	63.5	71.9	0.12	<0.14	0.11	0.24	18.9	16.3	20	16.1	3236	1565	1111	2470
	075	11	23.3	12	0.99	105	291	45	55.5	0.17	<0.15	0.18	0.25	18.9	20.2	21.3	12.1	2533	14975	1329	1930
Sugar Creek	029	1.59	-	<0.5	0.39	47.1	-	10.9	9.35	0.18	-	<0.1	0.43	14.6	-	12	13.5	569	-	246	584
	069	0.7	9.24	<0.5	1.11	5.97	1.54	5.52	24	0.24	0.33	0.22	0.52	16.3	13	19.6	16.5	407	964	433	899
Minimum		0.7	9.24	<0.5	0.39	5.97	1.54	5.52	9.35	0.12	<0.14	<0.1	0.14	13.7	13	12	12.1	407	964	246	584
Maximum		57.4	76.8	16.9	27.2	320	1117	79.4	331	0.24	0.41	0.22	0.52	22.8	22.8	23.3	30.9	4048	14975	1329	3490

Table 5-14. Comparison of Macroinvertebrate Tissue Metal Concentrations (*continued*)

Stream	MWH Site ID	Lead				Mercury				Selenium				Zinc			
		1995	1996	1997	2016	1995	1996	1997	2016	1995	1996	1997	2016	1995	1996	1997	2016
EFSFSR	009	1.59	2.3	0.5	0.79	0.8	-	0.24	0.43	2.09	<1.64	1.69	3.4	145	245	203	234
	007	4.5	3.7	1.39	1.01	-	-	<0.25	0.18	3	2.29	2.28	3.4	157	187	179	157
	011	1.59	2.3	0.5	0.48	0.4	-	<0.25	0.19	2.29	1.9	2.3	3.2	130	190	206	157
	012	17.5	2.98	3.56	0.55	-	-	<0.25	0.23	2.7	2.03	2.08	2.6	172	203	233	181
Meadow Creek	014	6.47	1.68	3.27	0.47	0.59	-	<0.25	0.20	3.78	1.82	2.88	3.6	132	184	212	133
	075	2.99	1.74	5.5	0.42	0.44	-	<0.33	0.18	3.79	1.89	2.3	3	139	212	210	129
Sugar Creek	029	1.19	-	<0.5	0.31	1.09	-	0.6	2.06	1.88	-	1.29	2.6	157	-	234	150
	069	0.7	<1.1	<0.5	0.48	1.05	-	1.64	2.56	1.1	<1.10	0.69	2.1	165	235	279	155
Minimum		0.7	<1.1	<0.5	0.31	0.4	0	0.24	2.56	1.1	<1.10	0.69	2.1	130	184	179	129
Maximum		17.5	3.74	5.5	1.01	1.09	0	1.64	0.18	3.79	2.29	2.88	3.6	172	245	279	234

Source: URS 2000 for 1995-1997 data
Note: Concentrations are miligrams per kilogram dry weight
Key: '-' = Not sampled or not analyzed

5.3.3 Fish Tissue

Table 5-15 presents the sample results for metals concentrations in fish tissue. Concentrations of cadmium, silver, and thallium were not detected above the method detection limit (MDL) in fish tissue at any of the sites. In addition, concentrations of chromium, lead, and nickel were only detected above the MDL at a few sites, and even then, at very low concentrations. All other metals were detected at concentrations above the MDL at all sites. Except for mercury, maximum metal concentrations were seen in fish collected in the EFMC and the EFSFSR. However, there was no clear correlation among all metals relative to any sample site (i.e., no one site was elevated for all metals). Concentrations of mercury, antimony, and arsenic did trend higher at the Yellow Pine pit, MWH-011 and MWH-026 sites (all on the EFSFSR). However, concentrations of mercury, antimony, and arsenic were below literature-derived effects thresholds at all sites, except MWH-018 (Sugar Creek). The concentration at MWH-018 was 0.202 mg/kg wet weight, which is essentially at the minimal effects threshold considered in NMFS 2014. The concentration of aluminum at MWH-027 (EFMC) was 16.171 in sample 2G, which is above the lowest observed effects concentration (LOEC) reported in EPA 2015. However, the other two fish sampled from the EFMC had concentrations well below the LOEC.

Metals concentrations in fish tissue from a 1997 study are reported in URS 2000. However, it is unclear how comparable the data is due to differences in data collection (i.e., they analyzed fish fillets and body remains separately, and calculated whole-body concentrations) and sample locations. Therefore, the results are not compared in this baseline report, but the reader is referred to URS 2000 for information on the 1997 data.

Table 5-15. Fish Tissue Metals Concentrations

Stream	Site ID	Sample ID	Species	Analyte (mg/kg wet weight)[1]	Mercury	Aluminum	Antimony	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Magnesium	Manganese	Nickel	Selenium	Silver	Thallium	Titanium	Zinc
				Effects Thresholds (mg/kg wet weight), except Selenium which is mg/kg dry weight																	
				EPA 2015	0.5	8.0	9.0	2.0	0.3		1.7		4.0								88.8
				NMFS 2014	0.2 – 0.3			2.0-5.0													
				EPA 2016a													8.5				
EFMC	**MWH-027**	1G	WCT		0.04	0.25	0.05	0.09	[b]	[c]	0.16	4.49	[d]	**89.84**	0.45	[e]	0.47	[f]	[g]	0.12	4.49
	MWH-027	2G	WCT		0.04	**16.17**	0.03	0.14	[b]	0.03	0.14	**40.43**	[d]	76.36	1.39	[e]	0.23 U	[f]	[g]	**3.37**	3.59
	MWH-027	3G	WCT		0.02	1.26	0.04	0.21	[b]	**0.15**	0.12	7.86	[d]	80.86	0.97	[e]	0.38	[f]	[g]	0.19	4.04
EFSFSR	**EFSFSR01**	5G	WCT		0.02	2.25	0.06	0.27	[b]	[c]	0.18	11.46	[d]	85.35	0.92	[e]	**0.68**	[f]	[g]	0.22	4.04
	EFSFSR02	6G	WCT		0.03	1.35	0.06	**0.49**	[b]	[c]	0.19	8.31	[d]	69.63	1.35	[e]	0.48	[f]	[g]	0.16	4.27
	EFSFSR03	1H	WCT		0.02	1.53	0.06	0.36	[b]	[c]	0.20	8.98	[d]	69.63	0.43	[e]	0.50	[f]	[g]	0.13	3.82
	EFSFSR04	2H	WCT		0.02	0.47	0.04	0.14	[b]	[c]	0.18	5.84	[d]	69.62	0.31	[e]	0.23 U	[f]	[g]	0.12	3.37
	EFSFSR05	4G	WCT		0.02	1.55	0.05	0.09	[b]	[c]	0.16	7.41	[d]	67.38	0.29	[e]	0.25	[f]	[g]	0.13	3.37
	Glory Hole	1A	WCT		0.02	0.16	0.12	0.07	[b]	[c]	0.15	9.66	[d]	62.89	0.40	[e]	0.32	[f]	[g]	0.09	3.37
	Glory Hole	2A	WCT		0.06	1.44	0.24	0.31	[b]	0.03	0.21	16.85	[d]	69.63	**1.39**	[e]	0.62	[f]	[g]	0.17	3.82
	Glory Hole	3A	WCT		0.03	1.42	0.15	0.15	[b]	0.03	**0.27**	10.56	[d]	85.35	0.58	[e]	0.63	[f]	[g]	0.18	4.04
	MWH-011	1F	WCT		0.03	2.0	0.16	0.11	[b]	[c]	0.13	6.06	[d]	65.13	0.43	[e]	0.56	[f]	[g]	0.20	2.25
	MWH-011	2F	WCT		0.03	[a]	0.07	0.10	[b]	[c]	0.14	4.49	[d]	62.89	0.18	[e]	0.55	[f]	[g]	0.07	3.14
	MWH-011	3F	WCT		0.03	1.12	0.11	0.18	[b]	[c]	0.20	8.76	[d]	71.87	0.94	[e]	0.52	[f]	[g]	0.14	3.59
	MWH-026	4A	WCT		0.02	2.7	**0.34**	0.09	[b]	[c]	0.16	7.41	[d]	83.10	0.45	**0.17**	1.2 U	[f]	[g]	0.25	6.06
	MWH-026	5A	WCT		0.05	2.25	0.09	0.04	[b]	0.03	0.18	8.76	[d]	74.12	0.45	[e]	0.23 U	[f]	[g]	0.38	5.62
	MWH-026	4B	WCT		0.07	[a]	0.06	0.13	[b]	[c]	0.11	4.72	[d]	76.36	0.31	[e]	0.23 U	[f]	[g]	0.08	4.27
	MWH-026	5B	WCT		0.05	1.46	0.06	0.05	[b]	[c]	0.22	11.01	[d]	76.36	0.58	[e]	0.37	[f]	[g]	0.18	6.29
Fiddle Creek	**MWH-023**	1B	WCT		0.03	1.15	0.13	0.06	[b]	[c]	0.18	5.17	[d]	58.40	0.27	[e]	0.23 U	[f]	[g]	0.14	3.82
	MWH-023	2B	WCT		0.03	0.61	0.09	0.04	[b]	[c]	0.20	6.74	[d]	74.12	0.49	[e]	0.23 U	[f]	[g]	0.11	4.72
	MWH-023	3B	WCT		0.02	1.62	0.07	0.02	[b]	[c]	0.18	9.66	[d]	80.86	0.63	[e]	0.23 U	[f]	[g]	0.18	**6.51**
Meadow Creek	**MWH-014**	3E	WCT		0.05	0.45	0.05	0.19	[b]	[c]	0.18	6.30	[d]	83.10	0.81	[e]	0.30	[f]	[g]	0.16	3.82
	MWH-014	4E	WCT		0.03	0.72	0.05	0.23	[b]	[c]	0.22	6.96	[d]	76.36	0.56	[e]	0.63	[f]	[g]	0.12	3.14
	MWH-014	5E	WCT		0.04	0.27	0.04	0.12	[b]	[c]	0.13	5.17	0.22	69.63	0.36	[e]	0.36	[f]	[g]	0.09	3.82
	MWH-016	1C	WCT		0.02	3.59	0.07	0.01	[b]	[c]	0.10	7.86	[d]	62.89	0.40	[e]	0.23 U	[f]	[g]	0.36	4.04
	MWH-016	2C	WCT		0.02	1.95	0.06	0.03	[b]	[c]	0.15	11.01	[d]	87.59	0.72	[e]	0.38	[f]	[g]	0.23	4.94
	MWH-016	3C	WCT		0.02	1.24	0.05	0.02	[b]	[c]	0.15	10.33	[d]	87.59	0.65	[e]	0.41	[f]	[g]	0.23	5.84
Sugar Creek	**MWH-018**	1D	Sculpin		**0.20**	0.79	0.06	0.05	[b]	[c]	0.11	5.39	[d]	74.12	0.36	[e]	0.23 U	[f]	[g]	0.13	3.14
	MWH-018	1E	WCT		0.07	0.52	0.05	0.06	[b]	[c]	0.16	4.72	[d]	65.13	0.27	[e]	0.26	[f]	[g]	0.08	2.92
	MWH-018	2E	Sculpin		0.09	0.65	0.04	0.05	[b]	[c]	0.22	8.54	[d]	80.86	0.43	[e]	0.35	[f]	[g]	0.13	3.82
Maximum					0.20	16.17	0.34	0.49		0.15	0.27	40.43	0.22	89.84	1.39	0.17	0.68			3.37	6.51
Minimum					0.02	0.16	0.03	0.01		0.03	0.10	4.49	0.22	58.40	0.18	0.17	0.25			0.07	2.25

Note: Effects thresholds obtained from literature derived values in EPA 2015, EPA 2016a, and NMFS 2014.

Shaded cells are higher than the applicable threshold. Bold text cells are the maximum concentrations for each metal.

[1] Laboratory values were in mg/kg dry weight, but were converted to mg/kg wet weight for comparison with the effects thresholds, which are typically in mg/kg wet weight. Values were converted using the equation: wet weigh =dry weight x [1-(percent moisture/100)]. Percent moisture used in the equation was 77.54, which is the value reported for muscle in EPA 2016b. Concentrations below the MDL were not converted to wet weight and the MDLs are as noted below:

[a] Below MDL of 0.7 [b] Below MDL of 0.046 [c] Below MDL of 0.11 [d] Below MDL of 0.039 [e] Below MDL of 0.15 [f] Below MDL of 0.035 [g] Below MDL of 0.055

Key: EFMC = East Fork Meadow Creek EFSFSR = East Fork of the South Fork of the Salmon River mg/kg = milligrams per kilogram WCT = Westslope cutthroat trout

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5.4 Fish

The results of the fisheries' studies are described below.

5.4.1 Genetics Studies

5.4.1.1 2015 – Fish Tissue

The tissues collected in 2015 for genetic testing was for determining the level of hybridization between westslope cutthroat trout and *O. mykiss*, as well as distinguishing between bull trout and brook trout. The 2015 genetics-study results showed that most field identifications of fish species were correct, and most of the genetic samples for westslope cutthroat trout and *O. mykiss* were westslope cutthroat trout. **Table 5-16** and **Appendix 5** includes the results of the genetic survey. The cutthroat x *O. mykiss* hybrids are mostly second- and third-generation backcrosses to cutthroat trout.

All the bull trout samples indicated genetically pure bull trout, based on analyses of six diagnostic microsatellite alleles. A seventh allele—that is typically diagnostic—was variable, but the absence of hybridization evidence in the other alleles suggests that this is natural genetic variation, not the result of hybridization. Results are shown in **Appendix 5**.

Table 5-16. Results of the 2015 Genetic Study

Creek	MWH Site ID	Number of Cutthroat Trout	Number of *O. mykiss*	Number of Hybrids	Number of Misidentifications	Notes
EFSFSR	011	8	0	4	3	Hybrid alleles predominantly westslope cutthroat trout Misidentified fish were hybrids and labeled as *O. mykiss*
Meadow Creek	014	5	0	2	1	Hybrids alleles predominantly westslope cutthroat trout Misidentified fish was a hybrid and labeled as *O. mykiss*
Meadow Creek	016	19	0	1	2	Hybrid alleles predominantly westslope cutthroat trout One misidentified fish was a hybrid and labeled as bull trout One misidentified fish was not a hybrid and mislabeled as *O. mykiss*
Sugar Creek	018	1	10	0	0	
Cinnabar Creek	019	0	1	0	0	
EFSFSR	025	67	0	0	0	
EFSFSR	026	24	0	1	1	Hybrid alleles predominantly *O. mykiss* Hybrid was labeled as bull trout
Meadow Creek	034	14	0	0	3	Misidentified fish were labeled as *O. mykiss*
Meadow Creek	047	4	0	0	0	
EFMC	N/A	3	0	0	0	
EFSFSR	N/A	6	0	2	0	One hybrid had predominantly westslope cutthroat trout alleles One hybrid had predominantly *O. mykiss* alleles

Key:
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River

5.4.1.2 2016 – eDNA

The 2016 eDNA results indicate that Midnight Creek, upper Garnet Creek, and at least the upper section of the unnamed tributary to the EFSFSR likely do not support fish.

O. mykiss likely do not occur in the EFSFSR (upstream from the Yellow Pine pit), Fiddle Creek, lower Garnet Creek, Meadow Creek, Fern Creek, or the unnamed tributaries to the EFSFSR. No DNA for any species was detected in Midnight Creek or upper Garnet Creek. The results showed only one *O. mykiss* detection in the upper Meadow Creek Lake. DNA from all 28 samples were amplified with the golden trout marker. Had *O. mykiss* DNA been detected above the Yellow Pine pit, the positive eDNA detections upstream from the pit could be either rainbow trout, redband trout, steelhead golden trout, or golden trout x cutthroat trout hybrids. Because the eDNA study did not show *O. mykiss* DNA upstream from the Yellow Pine pit (apart from upper Meadow Creek Lake), formerly identified *O. mykiss* in the snorkel surveys were changed to cutthroat trout. eDNA samples collected by the Nez Perce in a separate study showed a positive detection for *O. mykiss* in upper meadow section of the EFMC.

The eDNA results also show that westslope cutthroat trout occur throughout the aquatics baseline study area, in nearly every collection site except for Midnight Creek, upper Garnet Creek, upper Fiddle Creek, and the upper site in the unnamed tributary to the EFSFSR. Bull trout were also detected in most of the creeks sampled, but with a more limited range than the westslope cutthroat trout.

Bull trout were found in all sites of the EFSFSR except for the most upstream locations, in the in the lower section of Fiddle Creek closest to the EFSFSR confluence and throughout Meadow Creek except for upper Meadow Creek Lake. They were not detected in the EFMC nor the unnamed tributary to the EFSFSR or EFMC. They also did not occur in Midnight Creek, nor upper Garnet Creek.

Neither brook trout nor Pacific lamprey were detected at any sampled location. **Figure 5-8** through **Figure 5-13** show the detections/non-detections for each sampled site, for all the species identified. Full eDNA results are provided in **Appendix 5**.

The 11 trout that were collected in Meadow Creek Lake were identified as *O. mykiss*, with no subspecies listed.

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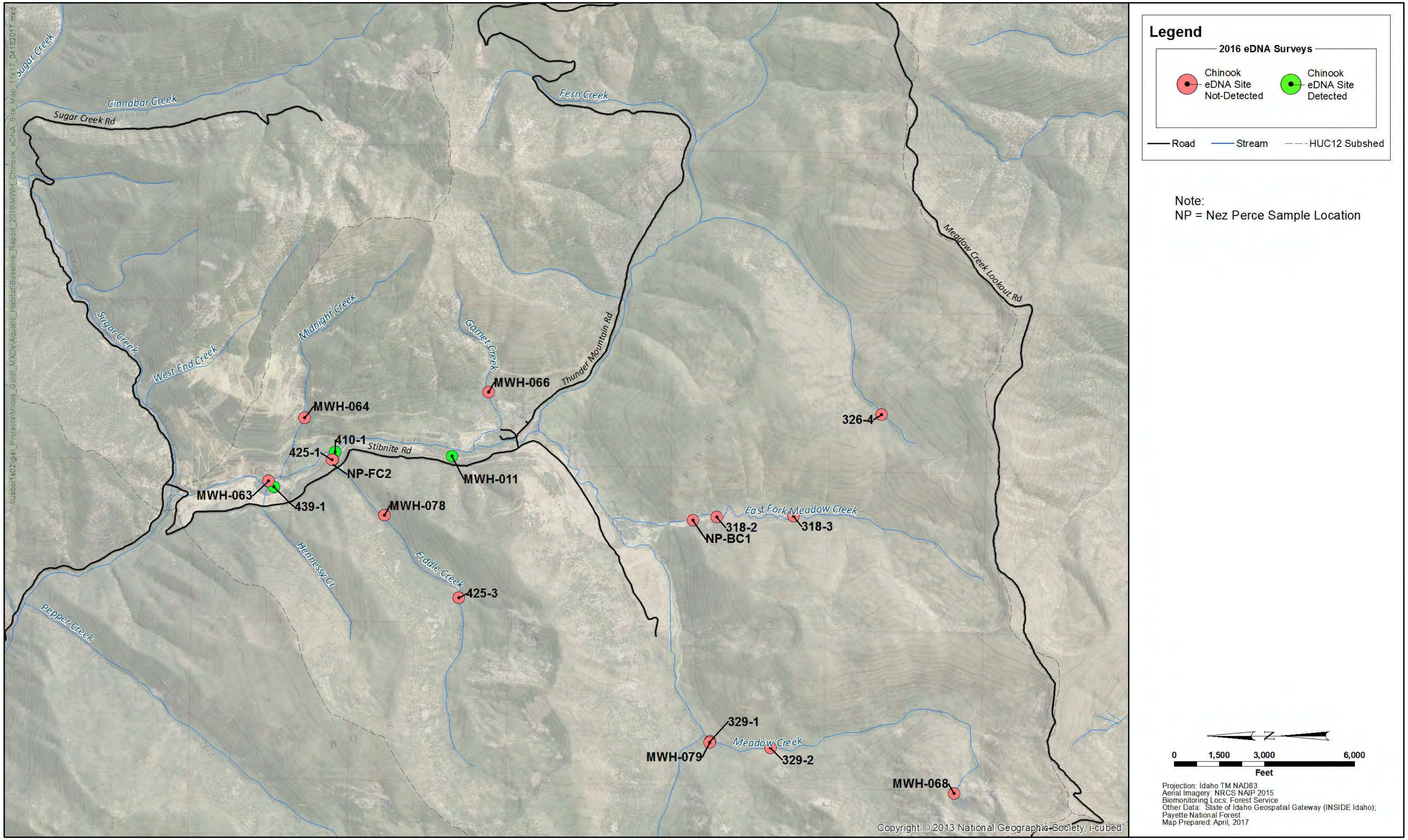

Figure 5-8. Chinook Salmon eDNA Results

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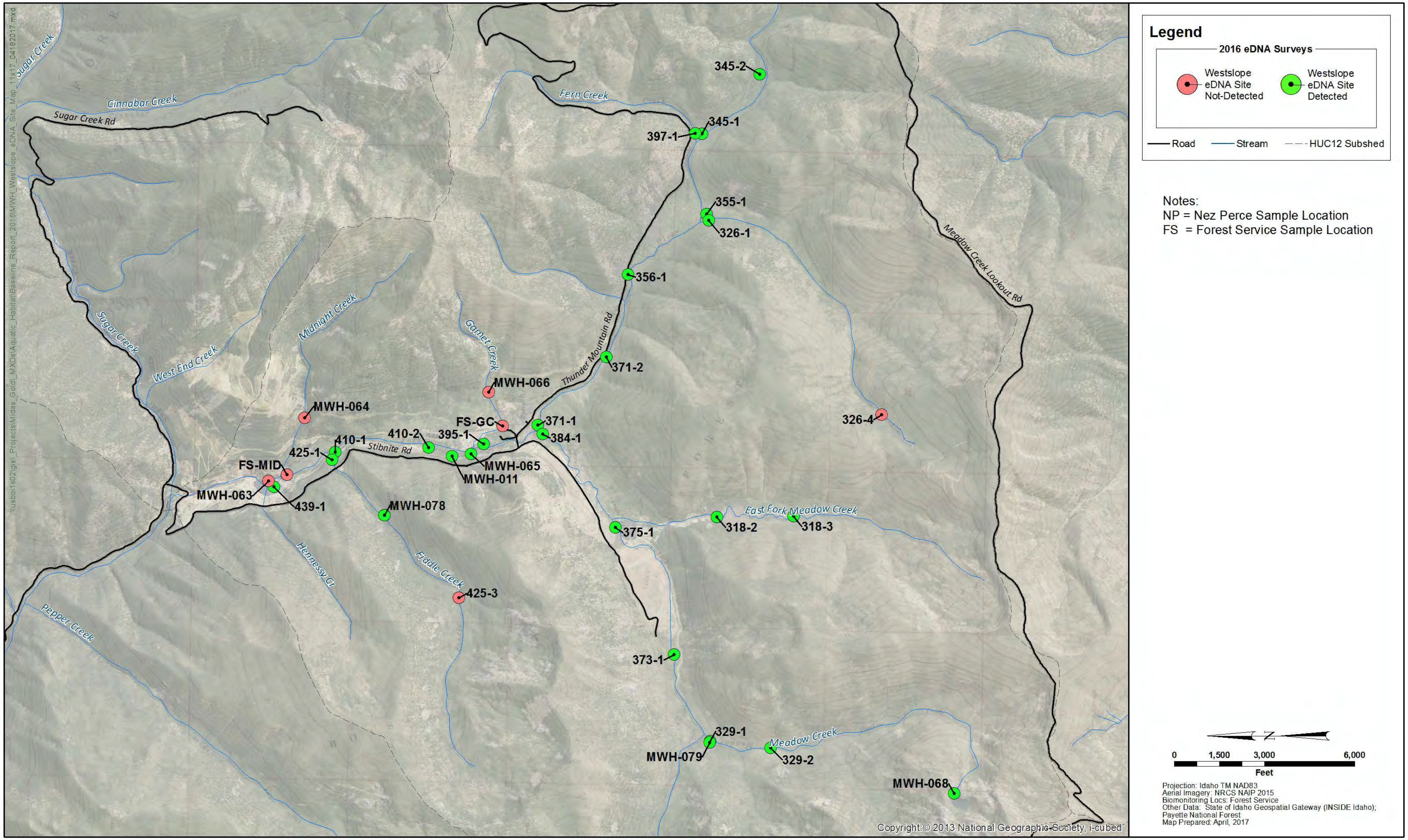

Figure 5-9. Westslope Cutthroat Trout eDNA Results

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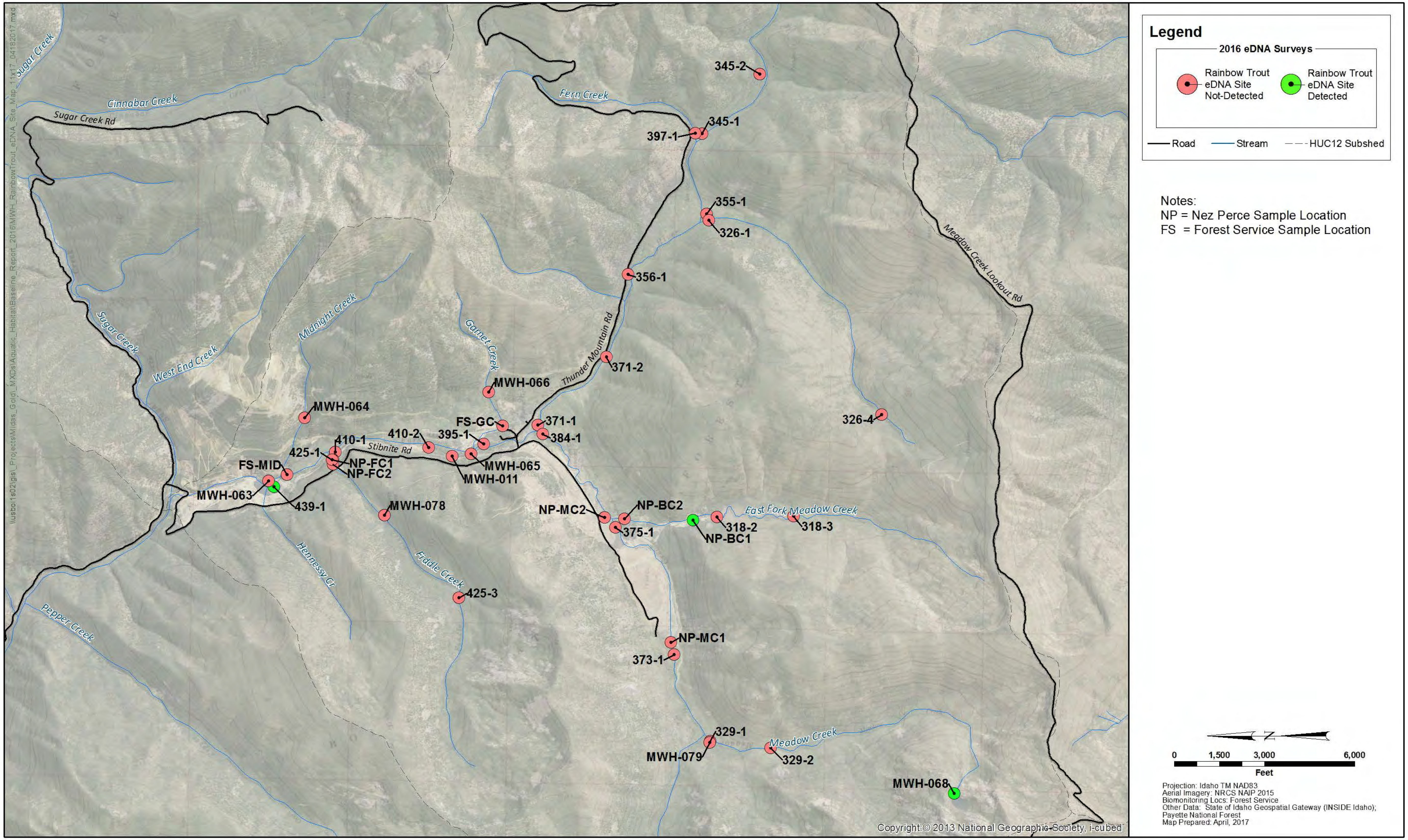

Notes:
NP = Nez Perce Sample Location
FS = Forest Service Sample Location

Projection: Idaho TM NAD83
Aerial Imagery: NRCS NAIP 2015
Biomonitoring Locs: Forest Service
Other Data: State of Idaho Geospatial Gateway (INSIDE Idaho);
Payette National Forest
Map Prepared: April, 2017

Figure 5-10. Oncorhynchus mykiss eDNA Results

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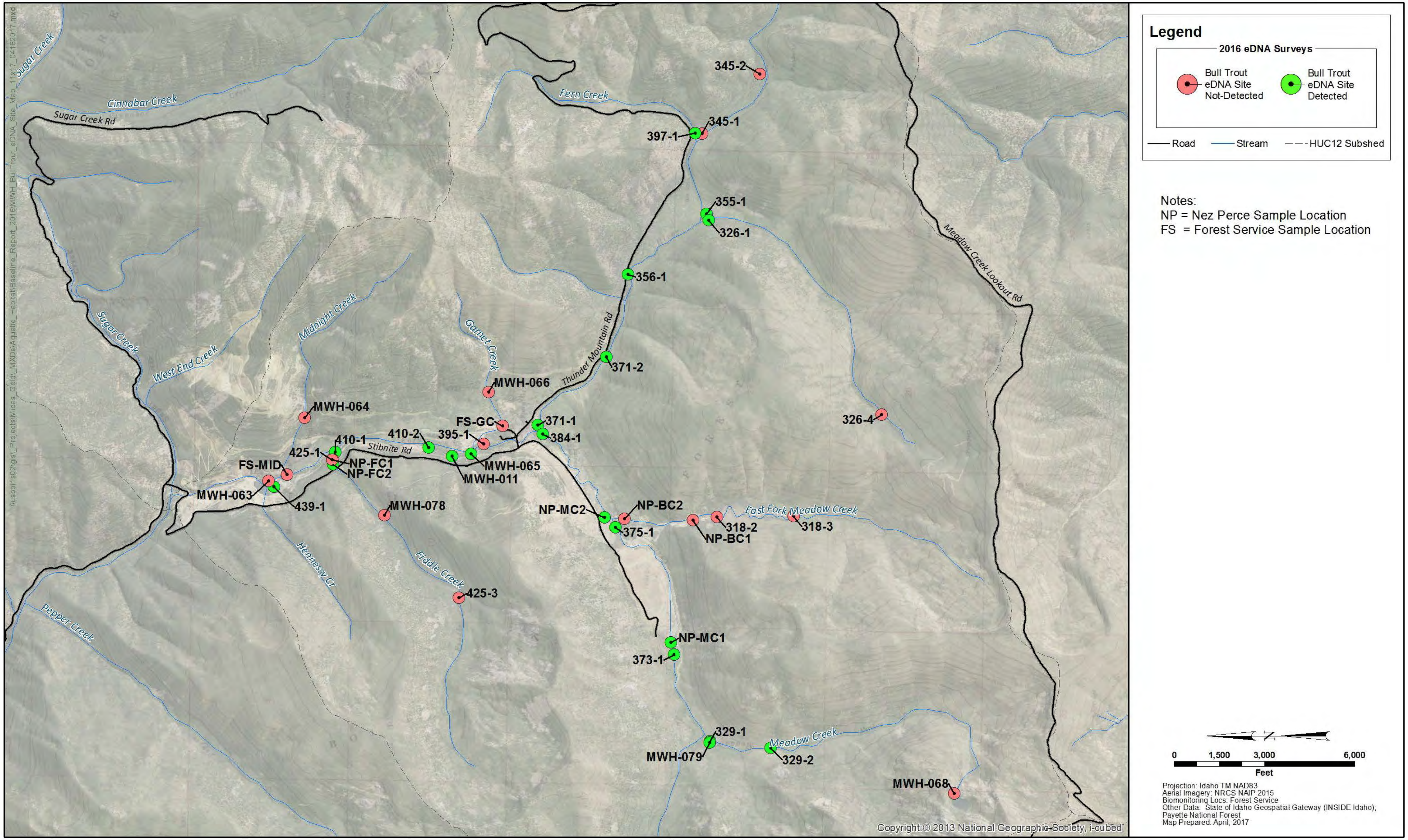

Figure 5-11. Bull Trout eDNA Results

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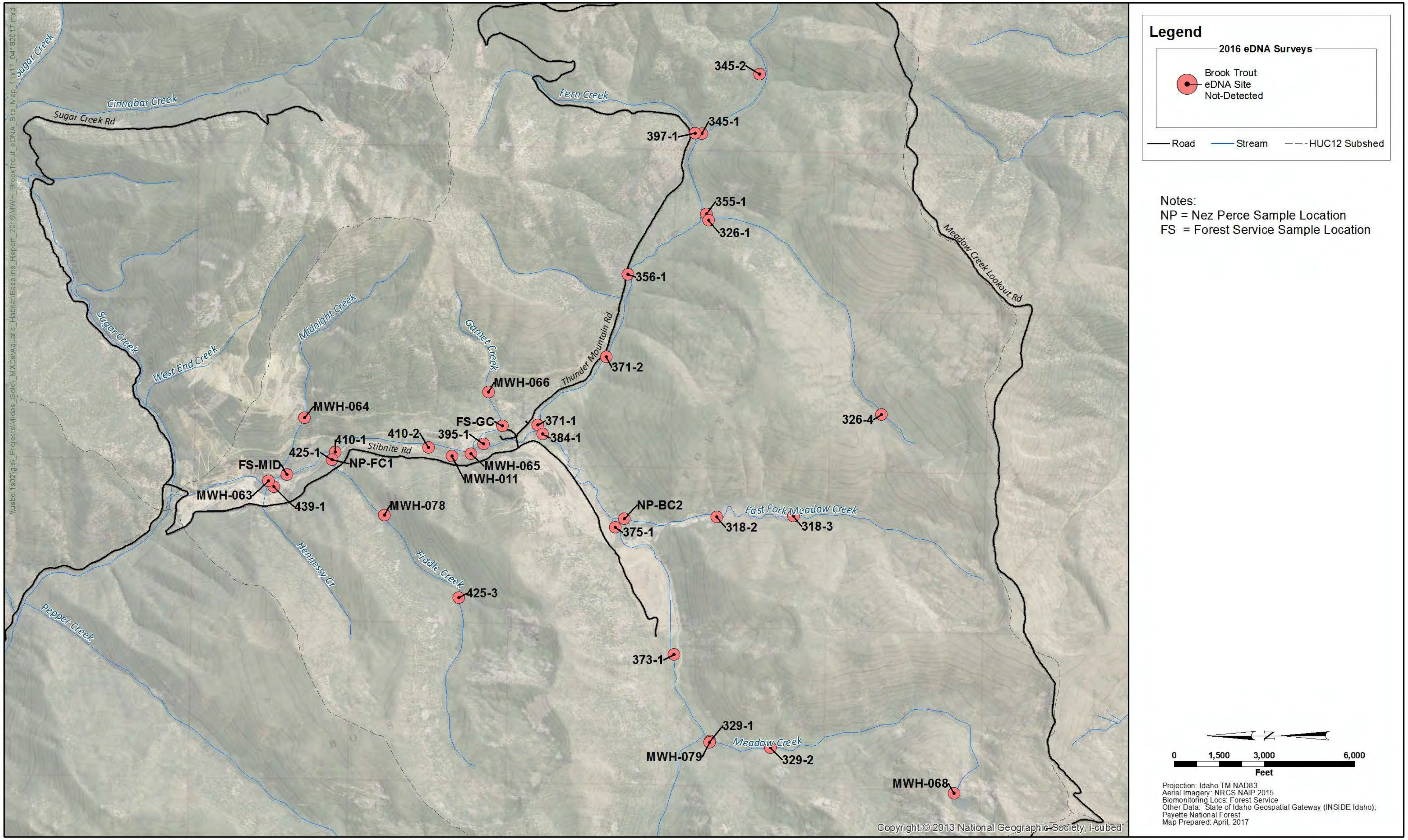

Figure 5-12. Brook Trout eDNA Results

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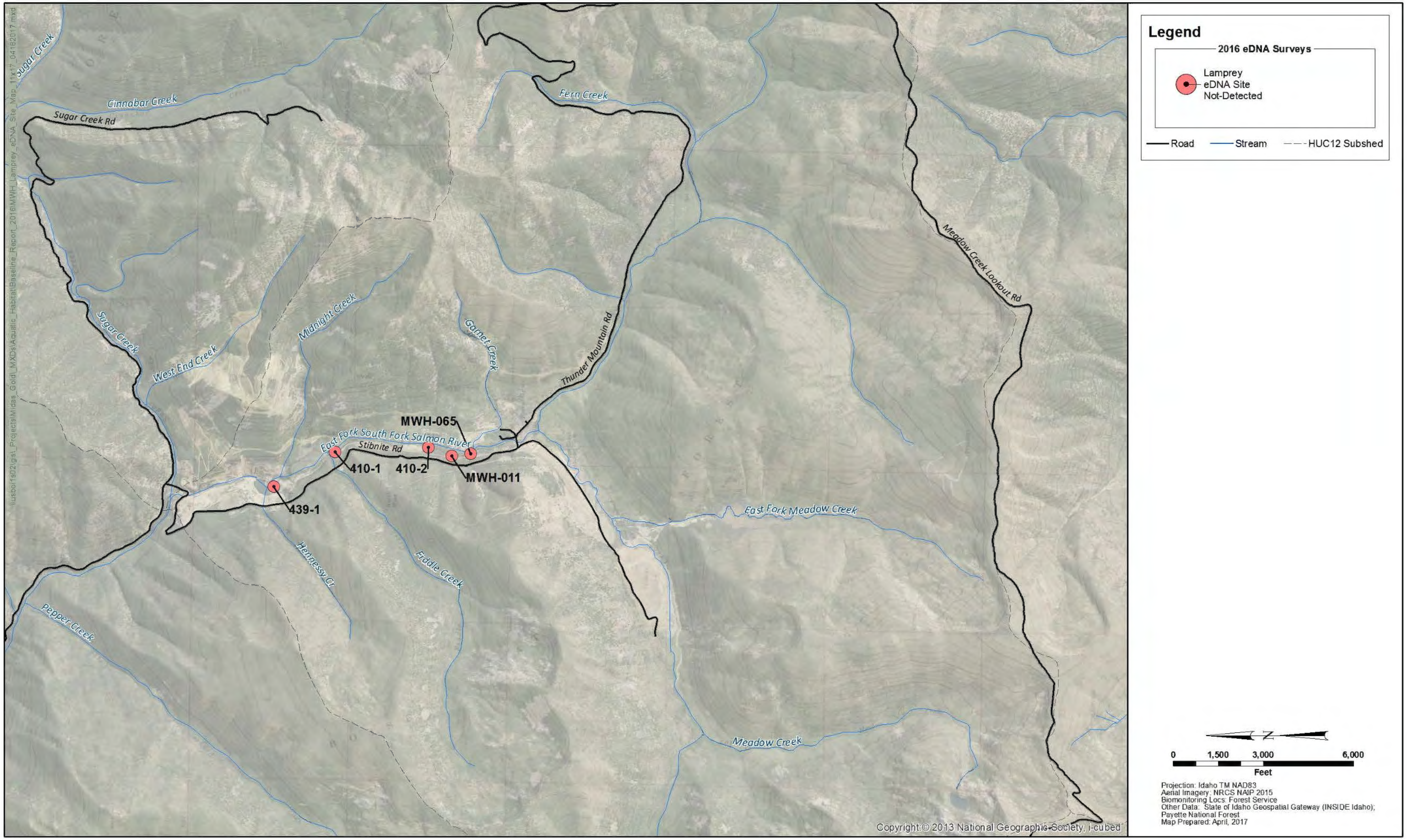

Figure 5-13. Pacific Lamprey eDNA Results

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5.4.2 Population Abundance Study

A population abundance study was conducted in 2015, to obtain a rigorous estimate of fish abundance and size-class structure, characterizing fish populations within the aquatic resources study area. This population abundance study also intended to determine whether efficiency estimates vary substantially by site, and if the measured habitat characteristics were correlated to the efficiency estimates. If efficiency rates vary substantially by site, or with habitat characteristics, then adjusting population estimates based on these variables may be necessary.

The efficiency evaluation, requiring calculations for full comparisons between the counts made in snorkel surveys to those with the combination of the snorkel and electrofishing efforts, has not yet been finalized. These results will be presented in an addendum report.

5.4.3 Snorkel Surveys

5.4.3.1 2016 Visual Survey

Attempts to conduct fish observations were made at two survey sites for each of three locations: Fiddle Creek, Hennessy Creek and Midnight Creek, that are all small tributaries to the EFSFSR (**Table 3-8**). Only two of the six sites were suitable for snorkeling, and three sites were suitable for videography. One site, lower Hennessy Creek, was too shallow, narrow and steep to be able to snorkel or record on video. In Fiddle Creek (site 425-1), one 100-mm cutthroat trout was observed during a snorkel survey. At the second Fiddle Creek site (MWH-024), six fish were observed on video recordings. It is likely that all the fish were cutthroat trout. No fish were observed at any other site. This survey activity was conducted in accordance with a mitigation agreement between Midas and the Nez Perce Tribe.

5.4.3.2 2012 – 2015 Visual Surveys

Results of all snorkel-survey fish counts conducted in 2012 through 2014 are presented in **Appendix 6**.

Tamarack Creek

Tamarack Creek (MWH-017) was selected as the control site because of minimal disturbance to the system. As shown in **Appendix 6**, all key fish species were observed at this site during all survey years (for all day dives and a single night dive), which did not include a survey in 2015. Additionally, whitefish were observed during day dives, and sculpin were observed mostly during the night survey. Water temperatures ranged between 10.1°C to 11.3°C for day dives, and was 11.5°C for the night dive. A full breakdown of the fish counts, and basic habitat information, is presented in **Appendix 6**.

Young-of-the-year (YOY) salmonids are often more active at night, when larger fish, that may feed on the YOY, are less active. Additionally, some observers have claimed that bull trout may also be more active at night (Thurow 1994, Berge and Mavros 2001). The 2013 and 2014 night surveys did not indicate an increase in bull trout activity, except for YOY. Overall, MWH-017 did experience an increase in YOY cutthroat trout and bull trout that were observed in the 2014 night survey.

Both *O. mykiss* and cutthroat trout were the primary species observed during day dives; however, cutthroat trout (primarily YOY) was the species most observed during the night dive (**Table 5-17**).

Table 5-17. Percent of Fish Species Composition Observed in Each Size Class and for Each Species in Tamarack Creek (MWH-017) in 2012-2014

Species/Size Class	2012		2013		2014			Total Percent of Each Species for All Years Combined (Day Dives Only)
					Day	Night		
	Percent Size Class for Each Species	Percent of Each Species	Percent Size Class for Each Species	Percent of Each Species	Percent Size Class for Each Species	Percent Size Class for Each Species	Percent of Each Species: Day/ Night	
Chinook Salmon (50-80)	7.1	26.2	21.1	21.1	4.3	10	4.3/13.3	16.5
Chinook Salmon (81-130)	19							
Chinook Salmon (>130)						3.3		
O. mykiss (51-100)	7.1	38.1		39.5	8.5	6.7	44.7/23.3	40.9
***O. mykiss* (101-150)**	16.7		13.2		12.8	3.3		
***O. mykiss* (151-200)**	7.1		15.8		8.5	3.3		
***O. mykiss* (201-250)**	4.8		5.3		12.8	10		
***O. mykiss* (>250)**	2.4		5.3		2.1			
Bull Trout (<50)	2.4	4.8		5.5	2.1	10	6.3/10	5.5
Bull Trout (151-200)	2.4		2.6		2.1			
Bull Trout (251-300)			2.6		2.1			
Cutthroat Trout (<50)		31	2.6	34.2	10.6	36.7	44.7/53.3	37
Cutthroat Trout (51-100)	2.4		10.5		10.6	10		
Cutthroat Trout (101-150)	23.8		13.2		17.0	6.7		
Cutthroat Trout (151-200)					4.3			
Cutthroat Trout (201-250)			5.3					
Cutthroat Trout (>250)	4.8		2.6		2.1			

Note: blank cells indicate no fish observed

Key:
< = less than
> = greater than

East Fork of the South Fork of the Salmon River

Multiple sites on the EFSFSR were surveyed in late July and early August, between 2012 and 2014, and three sites upstream from the Yellow Pine pit were surveyed in 2015 (**Figure 3-6** and **Table 3-8**). **Appendix 6** presents the total count of salmonids observed in all survey years for all day dives, and night dives at specific locations. Notations were made when observations of whitefish, sculpin and other species were observed. It was noted that sculpin and tadpole observations increased at night. Tadpoles (mostly tailed-frog) were very abundant, particularly at night.

Water temperatures were recorded prior to each snorkel survey, and ranged from 8.3°C to 15.6°C in 2012; 9.3°C to 14°C in 2013; and 11.4°C to 13.9°C for the day dives, and 9°C to 14°C for the night dives in 2014 (**Appendix 6**). Water temperatures in 2015 were recorded every 15 minutes with a data logger attached to the block nets, and temperatures ranged between 9°C to 12°C during these dives.

Fish observations at all EFSFSR sites, both upstream and downstream from the Yellow Pine pit, remained relatively consistent in the first two survey years at each site, with Chinook salmon dominating the species observed. The high counts of Chinook salmon were primarily because of the translocation of spawning adult Chinook salmon in Meadow Creek, with the resulting fish observed being the abundant fry in concentrated locations at two EFSFSR sites. However, in 2014, only a few Chinook salmon fry migrated downstream from Meadow Creek by the time the surveys were conducted, and therefore the numbers of Chinook salmon fry observed were lower in the EFSFSR sites (**Table 5-18)**.

Chinook salmon was the dominant species observed in the EFSFSR from 2012 through 2014 (**Table 5-18**). However, when the sites affected by the translocation of spawning adult Chinook salmon in Meadow Creek were excluded from the overall count (MWH-022 and MWH-011), cutthroat trout numbers were slightly higher than Chinook salmon.

Snorkel surveys have historically identified *O. mykiss* during surveys in the EFSFSR above the Yellow Pine pit. As stated above in Section 5.4.1.2; 2016 eDNA results indicate that *O. mykiss* likely do not occur in the EFSFSR upstream from the Yellow Pine pit, Fiddle Creek, lower Garnet Creek, Meadow Creek, Fern Creek, or the unnamed tributaries to the EFSFSR. The results showed only one *O. mykiss* detection in upper Meadow Creek Lake. DNA from all 28 samples were amplified with the golden trout marker. If *O. mykiss* DNA were detected above the Yellow Pine pit, it would indicate that positive eDNA detections above the pit could potentially be rainbow trout, redband trout, steelhead, golden trout, or golden trout x cutthroat trout hybrids. Because the eDNA study did not show *O. mykiss* DNA upstream from the Yellow Pine pit, apart from the one result in upper Meadow Creek Lake, formerly identified *O. mykiss* in the snorkel surveys have been changed to cutthroat trout in all data tables.

The sites downstream from the Yellow Pine pit had a higher diversity of species and age classes than the upstream sites, including non-target species (whitefish and sculpin). Primarily, the sites upstream from the confluence with Meadow Creek (MWH-013, MWH-025, MWH-044, and MWH-026) only had cutthroat trout and bull trout, except in 2012, when Chinook salmon were observed at MWH-013 and MWH-025.

Table 5-18 summarizes size distribution and percent of species composition for fish observed in the EFSFSR across all survey years.

Table 5-18. Size Distribution and Percent of Species Composition for Fish Observed in East Fork South of the Fork of the Salmon River in 2012-2015, and All Years Combined

2012																
Species (Size in millimeters)	**Percent Species Composition**															**Total Percent Species Composition (Day/Night)**
	Site from Downstream to Upstream by MWH Site Identification Number (Day (D) or Night (N) Dive)															
	033 D	**032 D**	**032 N**	**009 D**	**009 N**	**030 D**	**030 N**	**022 D**	**011 D**	**011 N**	**013 D**	**025 D**	**044 D**	**026 D**	**026 N**	
Chinook Salmon (50-80)	NS	NS	NS	57.5	NS	69.3	NS	96.8	92.9	NS	50	14.6	NS	NS		89.9 (100/0)
Chinook Salmon (>100)				2.5		4.2		2.4	1.8		0	31.7				
***O. mykiss* (51-100)**				10		6										3.5 (100/0)
***O. mykiss* (101-150)**				5		6.6										
***O. mykiss* (151-200)**				5		6.6										
***O. mykiss* (201-250)**						1.8										
***O. mykiss* (>250)**				2.5												
Bull Trout (101-150)				7.5		0.6										0.9 (100/0)
Bull Trout (151-200)						2.4										
Bull Trout (201-250)				2.5												
Bull Trout (251-300)						0.6										
Bull Trout (301-350)						0.6										
Cutthroat Trout (51-100)											7.7	14.6			15.4	5.8 (100/0)
Cutthroat Trout (101-150)				7.3		0.6		0.3	0.7		11.5	19.5			46.2	
Cutthroat Trout (151-200)								0.1	2.5		15.4	12.2			23.1	
Cutthroat Trout (201-250)						0.6			2.1							
Cutthroat Trout (>250)								0.4			15.4	7.3			15.4	

Table 5-18. Size Distribution and Percent of Species Composition for Fish Observed in East Fork South of the Fork of the Salmon River in 2012-2015, and All Years Combined (*continued*)

2013																
Species (Size in millimeters)	**Percent Species Composition**															**Total Percent Species Composition (Day/Night)**
	Site from Downstream to Upstream by MWH Site Identification Number (Day (D) or Night (N) Dive)															
	033 D	**032 D**	**032 N**	**009 D**	**009 N**	**030 D**	**030 N**	**022 D**	**011 D**	**011 N**	**013 D**	**025 D**	**044 D**	**026 D**	**02 6 N**	
Chinook Salmon (50-80)	42.4	36.7	NS	NS	NS	44.8	NS	90.2	93.7	NS					NS	64.1 (100/0)
Chinook Salmon (81-130)	6.1					22.4		7.3	1.9							
***O. mykiss* (<50)**	3.8	3.4				4.9										14.6 (100/0)
***O. mykiss* (51-100)**	11.5	6.8				2.8										
***O. mykiss* (101-150)**	7.6	6.8				2.8										
***O. mykiss* (151-200)**	0.0	4.8														
***O. mykiss* (201-250)**	5.3	7.5				1.4										
***O. mykiss* (>250)**	5.0	3.4				5.6										
Bull Trout (51-100)						0										3.5 (100/0)
Bull Trout (101-150)	1.1	2.0				0.7										
Bull Trout (151-200)	2.7	0.7														
Bull Trout (201-250)	0.4	1.4														
Bull Trout (251-300)																
Bull Trout (301-350)						0.7										
Bull Trout (351-400)						1.4										
Bull Trout (>400)		10.2				0.7										
Cutthroat Trout (<50)		0.7							1.6				8.9			17.8 (100/0)
Cutthroat Trout (51-100)	5.0	7.5							1.6			42.6	35.6	25		
Cutthroat Trout (101-150)	4.2	6.1							0.3		60	29.8	26.7	25		
Cutthroat Trout (151-200)	2.3					3.5						23.4	11.1	50		
Cutthroat Trout (201-250)	0.4	1.4				0.7		0.8	0.6		20	2.1	15.6			
Cutthroat Trout (>250)	2.3					4.2		1.6	0.3		20	2.1	2.2			

Table 5-18. Size Distribution and Percent of Species Composition for Fish Observed in East Fork South of the Fork of the Salmon River in 2012-2015, and All Years Combined (*continued*)

2014																
Species (Size in millimeters)	Percent Species Composition															Total Percent Species Composition (Day/Night)
	Site from Downstream to Upstream by MWH Site Identification Number (Day (D) or Night (N) Dive)															
	033 D	032 D	032 N	009 D	009 N	030 D	030 N	022 D	011 D	011 N	013 D	025 D	044 D	026 D	026 N	
Chinook Salmon (50-80)	NS	41.4	42.9	34.4	35.7	27.3	10.3	46.7	77.1	38.1		NS	NS			38.7 (41/35)
Chinook Salmon (81-130)		3				10.6	10.3	6.7		4.8						
Chinook Salmon (>130)		1		0.8	1.2			20	6.3	9.5						
Chinook Salmon (Adult)		1														
***O. mykiss* (<50)**		1	2.4	8.4	7.1											29.4 (27/34)
***O. mykiss* (51-100)**		4	2.4	3.8	2.4											
***O. mykiss* (101-150)**		11.1	4.8	12.2	9.5	9.1	3.4									
***O. mykiss* (151-200)**		14.1	15.5	4.6	7.1	12.1	3.4									
***O. mykiss* (201-250)**		6.1	15.5	5.3	10.7	10.6	13.8									
***O. mykiss* (>250)**		1	3.6	3.1	3.6	6.1	13.8									
Bull Trout (<50)				9.2	6.0											7.4 (8/7)
Bull Trout (51-100)				1.5	2.4											
Bull Trout (101-150)			1.2	3.1	2.4											
Bull Trout (151-200)		1														
Bull Trout (201-250)				0.8			6.9									
Bull Trout (251-300)						3	3.4									
Bull Trout (301-350)						4.5										
Bull Trout (351-400)							6.9									
Bull Trout (>400)		1		2.3		4.5	3.4									
Cutthroat Trout (<50)							6.9									24.5 (25/25)
Cutthroat Trout (51-100)		2	1.2						4.2	9.5	34.2			26.7	31.8	
Cutthroat Trout (101-150)		7.1	9.5	5.3	7.1	3	10.3		2.1	4.8	18.4			33.3	40.9	
Cutthroat Trout (151-200)		3	1.2	2.3	3.6	3	3.4	6.7		14.3	15.8			26.7	18.2	
Cutthroat Trout (201-250)		1		2.3		4.5	3.4	6.7	6.3	14.3	18.4			13.3	4.5	
Cutthroat Trout (>250)		1		0.8	1.2	1.5		13.3	4.2	4.8	13.2				4.5	

Table 5-18. Size Distribution and Percent of Species Composition for Fish Observed in East Fork South of the Fork of the Salmon River in 2012-2015, and All Years Combined (*continued*)

Species (Size in millimeters)	2015															
	Percent Species Composition															Total Percent Species Composition (Day/Night)
	Site from Downstream to Upstream by MWH Site Identification Number (Day (D) or Night (N) Dive)															
	033 D	032 D	032 N	009 D	009 N	030 D	030 N	022 D	011 D	011 N	013 D	025 D	044 D	026 D	026 N	
Chinook Salmon (50-80)	NS	NS	NS	NS	NS	NS	NS	NS		NS	NS		NS		NS	0
Chinook Salmon (81-130)																
Chinook Salmon (>130)																
Chinook Salmon (Adult)																
O. mykiss (<50)																0
O. mykiss (51-100)																
O. mykiss (101-150)																
O. mykiss (151-200)																
O. mykiss (201-250)																
O. mykiss (>250)																
Bull Trout (<50)																0
Bull Trout (51-100)																
Bull Trout (101-150)																
Bull Trout (151-200)																
Bull Trout (201-250)																
Bull Trout (251-300)																
Bull Trout (301-350)																
Bull Trout (351-400)																
Bull Trout (>400)																
Cutthroat Trout (<50)									50							100 (100/0)
Cutthroat Trout (51-100)												14.3		40		
Cutthroat Trout (101-150)												47.6		60		
Cutthroat Trout (151-200)									25			33.3				
Cutthroat Trout (201-250)									25							
Cutthroat Trout (>250)												4.8				
All Years Combined																

Table 5-18. Size Distribution and Percent of Species Composition for Fish Observed in East Fork South of the Fork of the Salmon River in 2012-2015, and All Years Combined (*continued*)

All Years																
Species (Size in millimeters)	**Percent Species Composition**															**Total Percent Species Composition (Day/Night)**
	Site from Downstream to Upstream by MWH Site Identification Number (Day (D) or Night (N) Dive)															
	033 D	**032 D**	**032 N**	**009 D**	**009 N**	**030 D**	**030 N**	**022 D**	**011 D**	**011 N**	**013 D**	**025 D**	**044 D**	**026 D**	**026 N**	
Chinook Salmon (50-80)	42.4	38.6	42.9	39.8	35.7	52.5	10.3	95.0	91.6	38.1		5.5				68.8 (72/35)
Chinook Salmon (81-130)	6.1	1.2		0.6		12.3	10.3	3.2	1.7	4.8	18.8	11.9				
Chinook Salmon (>130)		0.4		0.6	1.2			0.4	0.5	9.5						
Chinook Salmon (Adult)		0.4														
***O. mykiss* (<50)**	3.8	2.4	2.4	6.4	7.1	1.9										12.9 (11/34)
***O. mykiss* (51-100)**	11.5	5.7	2.4	5.3	2.4	3.7										
***O. mykiss* (101-150)**	7.6	8.5	4.8	10.5	9.5	5.6	3.4									
***O. mykiss* (151-200)**		8.5	15.5	4.7	7.1	5.1	3.4									
***O. mykiss* (201-250)**	5.3	6.9	15.5	4.1	10.7	3.2	13.8									
***O. mykiss* (>250)**	5.0	2.4	3.6	2.9	3.6	3.2	13.8									
Bull Trout (<50)		0.4		7.0	6.0											3.2 (3/7)
Bull Trout (51-100)				1.2	2.4	0.3										
Bull Trout (101-150)	1.1	1.2	1.2	4.1	2.4	0.3										
Bull Trout (151-200)	2.7	0.8				1.1										
Bull Trout (201-250)	0.4	0.8		1.2			6.9									
Bull Trout (251-300)						1.1	3.4									
Bull Trout (301-350)						1.6										
Bull Trout (351-400)						0.3	6.9									
Bull Trout (>400)		6.5		1.8		0.8	3.4									

Table 5-18. Size Distribution and Percent of Species Composition for Fish Observed in East Fork South of the Fork of the Salmon River in 2012-2015, and All Years Combined (*continued*)

All Years

Species (Size in millimeters)	Percent Species Composition															Total Percent Species Composition (Day/Night)
	Site from Downstream to Upstream by MWH Site Identification Number (Day (D) or Night (N) Dive)															
	033 D	**032 D**	**032 N**	**009 D**	**009 N**	**030 D**	**030 N**	**022 D**	**011 D**	**011 N**	**013 D**	**025 D**	**044 D**	**026 D**	**026 N**	
Cutthroat Trout (<50)		0.4					6.9		1.1				8.9			15.1 (14/25)
Cutthroat Trout (51-100)	5.0	5.3	1.2						1.4	9.5	21.7	30.6	35.6	18.9	31.8	
Cutthroat Trout (101-150)	4.2	6.5	9.5	5.8	7.1	2.1	10.3	0.2	1.4	4.8	18.8	28.6	26.7	41.5	40.9	
Cutthroat Trout (151-200)	2.3	1.2	1.2	1.8	3.6	0.8	3.4	0.2	1.1	14.3	14.5	16.3	11.1	30.2	18.2	
Cutthroat Trout (201-250)	0.4	1.2		1.8		2.7	3.4	0.2	0.9	14.3	11.6	1.0	15.6	3.8	4.5	
Cutthroat Trout (>250)	2.3	0.4		0.6	1.2	1.6		0.8	0.5	4.8	14.5	4.1	2.2	5.7	4.5	

Note:
No snorkel surveys were conducted in 2016.
Blank cells indicate no sample was conducted.
Species composition in MWH-022 and MWH-011 were substantially affected by offspring from the introduction of adult hatchery Chinook salmon in the previous year. If Chinook had not been introduced, cutthroat trout are most abundant.

Key:
> = greater than
< = less than
D = Day
N = Night
NS = Not Surveyed

Sugar Creek

Four sites were surveyed in Sugar Creek in 2012 and 2013, three sites in 2014, and one in 2015. One night dive occurred in 2013. All target salmonid species were observed (**Appendix 6**), as were whitefish and sculpin.

The fish snorkel site MWH-010 overlaps with the stream habitat survey site MWH-010, but the fish snorkel site MWH-029 is located just upstream from the stream habitat survey site MWH-008. At all dive sites, stream width, depth, and gradient were recorded (**Appendix 6**). Water temperatures recorded at the beginning of each dive ranged between 9°C to 13.7°C in 2012; between 9.9°C to 14.2°C in the day dives, and was 10.3°C during the night dive in 2013; between 11.4°C to 13.5°C in 2014; and was around 8°C in 2015 (**Appendix 6**).

O. mykiss was the dominant species and Chinook salmon was the least abundant salmonid species observed in Sugar Creek (**Table 5-19**). Most size classes were observed, particularly in MWH-010. Fewer bull trout were observed in the lowest site, and zero or very few Chinook salmon and cutthroat trout were observed in the upstream sites (MWH-018 and MWH-020).

Table 5-19. Size Distribution and Percent of Species Composition for Fish Observed in Sugar Creek from 2012-2015

Species (Size in millimeters)	Total/Percent Species Composition in Sites from Downstream to Upstream (MWH Site Number)																	Total Percent Species Composition (Day Dives Only)
	2012					2013						2014				2015		
	029 D	010 D	018 D	020 D	Total	029 D	029 N	010 D	018 D	020 D	Total	029 D	010 D	018 D	Total	018 D	Total	
Chinook Salmon (50-80)	19.	25.	6.1		20.4	27.7	35.9	14.9			19.2	3.6	2.3		9.5		0	16.5
Chinook Salmon (81-130)	2.8	6.8	9.1	4.2								3.6						
Chinook Salmon (>130)												3.6	9.3					
Chinook Salmon (Adult)													2.3					
***O. mykiss* (<50)**					14.6	6.4	2.6		4.5		16.4	3.6	11.6		32.6		4.8	18.8
***O. mykiss* (51-100)**	2.8	2.3	2.9			2.1		10.6	27.3			7.1	2.3	4.2				
***O. mykiss* (101-150)**	5.6		2.9	4.2				2.1	4.5			10.7	7.0	8.3				
***O. mykiss* (151-200)**	2.8	2.3	2.9				2.6		4.5			7.1	4.7	8.3				
***O. mykiss* (201-250)**	8.3		2.9				2.6			13.6		3.6	2.3	8.3		4.8		
***O. mykiss* (>250)**	8.3	2.3	2.9	4.2			2.6	6.4					2.3	8.3				
Bull Trout (<50)	13.	4.5	3.0	12.5	60.6	12.8	2.6	4.3		4.5	43.5	7.1	2.3		36.8	38.1	76.2	49.1
Bull Trout (51-100)	2.8	13.	24.2	25.0		2.1	25.6	12.8	22.7	18.2		3.6	4.7			9.5		
Bull Trout (101-150)	5.6	18.	30.3	37.5		2.1	10.3	8.5	13.6	9.1		3.6	7.0	16.7		4.8		
Bull Trout (151-200)	8.3	9.1	6.1	12.5		4.3		8.5	9.1	27.3		0.0	7.0	16.7		14.3		
Bull Trout (201-250)	11.	2.3	3.0					8.5	4.5	13.6		14.3	4.7	8.3		9.5		
Bull Trout (251-300)	2.8						2.6		4.5	4.5				4.2				
Bull Trout (301-350)	2.8		3.0							4.5			2.3					
Bull Trout (351-400)										4.5								
Bull Trout (>400)		2.3											4.7	8.3				

Table 5-19. Size Distribution and Percent of Species Composition for Fish Observed in Sugar Creek from 2012-2015 (*continued*)

Species (Size in millimeters)	Total/Percent Species Composition in Sites from Downstream to Upstream (MWH Site Number)																	Total Percent Species Composition (Day Dives Only)
	2012					2013						2014				2015		
	029 D	010 D	018 D	020 D	Total	029 D	029 N	010 D	018 D	020 D	Total	029 D	010 D	018 D	Total	018 D	Total	
Cutthroat Trout (<50)					4.4						20.9		9.3		21.1		19	15.6
Cutthroat Trout (51-100)						17.0	10.3	12.8	4.5				7.0					
Cutthroat Trout (101-150)		6.8				14.9		6.4					4.7	8.3		4.8		
Cutthroat Trout (151-200)						6.4		4.3				7.1	2.3			9.5		
Cutthroat Trout (201-250)		4.5				4.3	2.6					7.1						
Cutthroat Trout (>250)	2.8											14.3				4.8		

Note:
Blank cells indicate no fish observations.
No snorkel surveys were conducted in 2016.

Key:
< = less than
> = greater than
D = Day
N = Night

Cinnabar Creek

Cinnabar Creek, which has a single survey location, was sampled in 2012 through 2015; no night dives were conducted. Pigment anomalies were observed in multiple fish at this site. Several were generally darker than normal over their entire body, while others had darker patterns only on portions of their bodies. For example, in the 2014 survey, one trout (species unidentifiable) had a black head and a black tail, with a golden body that contained no spots or other pigmentation. While these fish had anomalous pigmentation, they appeared otherwise healthy—they swam and acted normally and were observed to be the same size and condition as other fish in the same microhabitat.

Bull trout were the most abundant species observed in all survey years (**Table 5-20** and **Appendix 6**). Water temperatures, recorded at the beginning of each dive, were 10.2°C, 9.1°C, and 11°C in 2012, 2013 and 2014, respectively, and were between 7.5 to 8°C in 2015.

Table 5-20. Size Distribution and Percent of Species Composition for Fish Observed in Cinnabar Creek (MWH-019) in All Survey Years

Species (Size in millimeters)	Percent Species Composition				Total Percent Species Composition (All Years Combined)
	2012	2013	2014	2015	
Bull Trout (<50)	14.3	18.2	11.8	60	94.2
Bull Trout (51-100)	28.6	72.7	29.4	30	
Bull Trout (101-150)	23.8	9.1	29.4	5	
Bull Trout (151-200)	28.6		5.9		
Bull Trout (201-250)	4.8		5.9		
Bull Trout (251-300)					
Bull Trout (301-350)					
Bull Trout (351-400)					
Bull Trout (>400)					
Cutthroat Trout (51-100)			5.9		5.8
Cutthroat Trout (101-150)			5.9	5	
Cutthroat Trout (201-250)			5.9		

Note:
Blank cells indicate no fish observations.
No snorkel surveys were conducted in 2016.

Key:
> = greater than
< = less than

Cane Creek

Cane Creek had a single survey location that was sampled only in 2012 and 2013; no night dives were conducted at this site. Stream habitat parameters recorded included width, depth and gradient. Bull trout were the only species observed (**Table 5-21** and **Appendix 6**). Water temperatures, recorded at the beginning of each dive, were 11.8°C in 2012, and 10.6°C in 2013.

Table 5-21. Size Distribution and Percent of Species Composition for Fish Observed in Cane Creek (MWH-021) in 2012 and 2013

Species (Size in millimeters)	Percent Species Composition	
	2012	2013
Bull Trout (<50)		
Bull Trout (51-100)	25.0	
Bull Trout (101-150)	37.5	
Bull Trout (151-200)	37.5	30
Bull Trout (201-250)		40
Bull Trout (251-300)		
Bull Trout (301-350)		
Bull Trout (351-400)		
Bull Trout (>400)		

Key:
< = less than
> = greater than

Fiddle Creek

Survey site MWH-023 in lower Fiddle Creek was snorkeled each year; no night dives were conducted. Fiddle Creek had two survey locations; however, difficulty accessing the upstream site (MWH-024) due to thick vegetative overgrowth made sampling a challenge, resulting in a reduced sampling effort. MWH-024 was only spot-checked in 2012, and then video recorded in 2016.

Only cutthroat trout were observed in Fiddle Creek (**Table 5-22** and **Appendix 6**). Water temperatures recorded at the beginning of each annual dive, from 2012 to 2014, were 10.2°C, 10.7°C and 11.7°C, respectively.

Table 5-22. Size Distribution and Percent of Species Composition for Fish Observed in Fiddle Creek (MWH-023) in All Survey Years

Species (Size in millimeters)	Percent Species Composition		
	2012	2013	2014
Cutthroat Trout (<50)		35	
Cutthroat Trout (51-100)		55	76.9
Cutthroat Trout (101-150)	66.7	10	23.1
Cutthroat Trout (151-200)	16.7		
Cutthroat Trout (201-250)	16.7		

Key:
< = less than
> = greater than

Meadow Creek

A total of six sites were surveyed in Meadow Creek between 2012 and 2014, with one surveyed at night in 2013, and one in 2014 (**Appendix 6**). MWH-031, sampled in 2012, was intended to coincide with the stream habitat survey site location MWH-014; however, the initial site location received from the PAF placed the site too far downstream. Thus, in 2013, survey site MWH-031 was replaced with MWH-014, to coincide with the stream habitat survey location. Because the sites are close to one another, data collected at MWH-031 was combined with that collected at MWH-014.

Water temperatures recorded at the beginning of each day dive in 2012 ranged from 10.9°C to 14.8°C; in 2013 the range was between 10.3°C to 15.5°C; and in 2014, it ranged from 10.2°C to 16.7°C. Night dives began when water temperatures were 11.1°C (MWH-047) and 9.7°C (MWH-015) (**Appendix 6**). Water temperatures during the 2015 dives ranged between 10°C to 11°C at MWH-047, MWH-016 and MWH-034. Water temperatures at MWH-014 were highly variable during the survey, ranging between 15°C to 16.8°C (**Appendix 3**). It is unclear as to why the temperatures were so variable. One possibility is that the thermograph was placed in an area that was periodically exposed (e.g., it came out of the water when the blocknet moved with the flow, or if the thermograph was placed too high on the net).

In 2012, 559 salmonids were counted during dives conducted during the daytime (**Appendix 6**). The 2013 survey had the highest salmonid observations, totaling 628 salmonids in the day dives, and 38 during the night dive. Of the 628 salmonids recorded, 567 of those were Chinook salmon fry at MWH-014. Tailed-frog tadpoles were common in Meadow Creek, and the observations of them increased during the night dives. Tailed-frog tadpoles were abundant, particularly at MWH-015.

In 2014, a total of 398 salmonids were observed, including nine during the night survey at sites MWH-014 and MWH-015. As with the other sites, tailed-frog tadpoles were common in Meadow Creek, and observations of them increased during the night dives.

During the 2015 population abundance survey, only 26 fish were observed in the Meadow Creek sites combined. Chinook salmon were not translocated to Meadow Creek in 2014, which accounted for the lower fish abundance at MWH-014 and MWH-047 in 2015. The abundance of Chinook salmon in the lower sites (MWH-031 and MWH-014) was strongly affected by the translocation of adult Chinook salmon. Subsequent surveys' counts included the offspring from these released fish. Therefore, the dominant species observed were fry and juvenile Chinook salmon (**Table 5-23** and **Appendix 6**). Yearling Chinook salmon were observed in both 2013 and 2014 in MWH-015 and MWH-047, both of which are located upstream from a long and very high gradient (greater than 5 percent) riffle. These yearlings are the offspring of the released Chinook salmon spawners.

Table 5-23 presents the distribution and percent of species composition for fish observed in Meadow Creek across all survey years.

Table 5-23. Size Distribution and Percent of Species Composition for Fish Observed in All Meadow Creek Sites in 2012-2015, and All Years Combined

2012									
Species (Size in millimeters)	Percent Species Composition								Total Percent Species Composition Total
	031 D	014 D	015 D	015 N	047 D	047 N	016 D	034 D	
Chinook Salmon (50-80)	95.2	NS	21.1	NS	NS	NS		NS	90
Chinook Salmon (81-130)	1.2								
Chinook Salmon (>130)									
Bull Trout (<50)									1.8
Bull Trout (51-100)	0.2								
Bull Trout (101-150)							4.5		
Bull Trout (151-200)			10.5				9.1		
Bull Trout (201-250)			21.1						
Bull Trout (>400)									
Cutthroat Trout (<50)									8.2
Cutthroat Trout (51-100)	0.2		5.3				22.7		
Cutthroat Trout (101-150)	1		10.5				50		
Cutthroat Trout (151-200)	1.2		5.3				13.6		
Cutthroat Trout (201-250)									
Cutthroat Trout (>250)	1.2		26.3						

2013									
Species (Size in millimeters)	Percent Species Composition								Total Percent Species Composition (Day/Night)
	031 D	014 D	015 D	015 N	047 D	047 N	016 D	034 D	
Chinook Salmon (50-80)	NS	98.3		NS		2.6	NS		88.6 (87/2)
Chinook Salmon (81-130)									
Chinook Salmon (>130)					43.8	65.8			
Bull Trout (<50)									0.3
Bull Trout (51-100)									
Bull Trout (101-150)								7.1	
Bull Trout (151-200)									
Bull Trout (201-250)									
Bull Trout (>400)									
Cutthroat Trout (<50)									11.1 (9/5)
Cutthroat Trout (51-100)								25.0	
Cutthroat Trout (101-150)								25.0	
Cutthroat Trout (151-200)			15.8		34.4			21.4	
Cutthroat Trout (201-250)		0.9	47.4			15.8		14.3	
Cutthroat Trout (>250)		0.5	36.8			5.3		7.1	

Table 5-23. Size Distribution and Percent of Species Composition for Fish Observed in All Meadow Creek Sites in 2012-2015, and All Years Combined (*continued*)

2014									
Species (Size in millimeters)	**Percent Species Composition**								**Total Percent Species Composition (Day/Night)**
	031 D	**014 D**	**015 D**	**015 N**	**047 D**	**047 N**	**016 D**	**034 D**	
Chinook Salmon (50-80)	NS	98.8						NS	83.2 (85/11)
Chinook Salmon (81-130)									
Chinook Salmon (>130)			9.1	11.1	8				
Bull Trout (<50)									0.8 (1/0)
Bull Trout (51-100)						4			
Bull Trout (101-150)									
Bull Trout (151-200)									
Bull Trout (201-250)						4			
Bull Trout (>400)									
Cutthroat Trout (<50)									16.1 (4/89)
Cutthroat Trout (51-100)					20.0		22.7		
Cutthroat Trout (101-150)				11.1	16.0		18.2		
Cutthroat Trout (151-200)				33.3	12.0		9.1		
Cutthroat Trout (201-250)		0.6	27.3	22.2	8.0		31.8		
Cutthroat Trout (>250)		0.6	63.6	22.2	28.0		13.6		

2015									
Species (Size in millimeters)	**Percent Species Composition**								**Total Percent Species Composition**
	031 D	**014 D**	**015 D**	**015 N**	**047 D**	**047 N**	**016 D**	**034 D**	
Chinook Salmon (50-80)	NS		NS	NS		NS			0
Chinook Salmon (81-130)									
Chinook Salmon (>130)									
Bull Trout (<50)									3.8
Bull Trout (51-100)									
Bull Trout (101-150)							12.5		
Bull Trout (151-200)									
Bull Trout (201-250)									
Bull Trout (>400)									
Cutthroat Trout (<50)									96.2
Cutthroat Trout (51-100)							12.5	11.1	
Cutthroat Trout (101-150)		16.7			100		50	77.8	
Cutthroat Trout (151-200)							12.5	11.1	
Cutthroat Trout (201-250)		50.0					12.5		
Cutthroat Trout (>250)		33.3							

Table 5-23. Size Distribution and Percent of Species Composition for Fish Observed in All Meadow Creek Sites in 2012-2015, and All Years Combined (*continued*)

All Years Combined									
Species (Size in millimeters)	Percent Species Composition								Total Percent Species Composition (Day/Night)
	031 D	014 D	015 D	015 N	047 D	047 N	016 D	034 D	
Chinook Salmon (50-80)	95.2	97.8	8.2			2.6			85.7 (87/55)
Chinook Salmon (81-130)	1.2								
Chinook Salmon (>130)			2.0	11.1	24.6	65.8			
Bull Trout (<50)									1 (1/0)
Bull Trout (51-100)	0.2				1.5				
Bull Trout (101-150)					1.5		5.8	5.4	
Bull Trout (151-200)			4.1				3.8		
Bull Trout (201-250)			8.2		1.5				
Bull Trout (>400)									
Cutthroat Trout (<50)									13.3 (13/43)
Cutthroat Trout (51-100)	0.2		2.0		9.2		21.2	37.8	
Cutthroat Trout (101-150)	1	0.3	4.1	11.1	15.4	5.3	36.5	18.9	
Cutthroat Trout (151-200)	1.2		8.2	33.3	23.1	5.3	11.5	10.8	
Cutthroat Trout (201-250)		1.1	24.5	22.2	12.3	15.8	15.4	5.4	
Cutthroat Trout (>250)	1.2	0.8	38.8	22.2	10.8	5.3	5.8	37.8	

Note:
Blank cells indicate no fish observations.
No snorkel surveys were conducted in 2016.
Species composition in MWH-031and MWH-014 were substantially affected by offspring from the introduction of adult hatchery Chinook salmon in the previous year. If Chinook had not been introduced, cutthroat are the most abundant.

Key:
> = greater than
< = less than
D = day
N = night
NS = not surveyed

East Fork Meadow Creek

Two EFMC sites were snorkeled between 2012 and 2014, including one night dive in 2014. MWH-027 is in a large meadow, upstream from a high-gradient fish barrier created by a 1965 dam failure. The downstream end of MWH-028 is located just upstream from EFMC's confluence with Meadow Creek.

Water temperatures at the beginning of each day dive were: 10.4°C and 11.1°C in 2012; 13.4°C and 14.9°C in 2013; and 14.2°C and 12.7°C in 2014 for MWH-028 and MWH-027, respectively. The water temperature recorded at the beginning of the 2014 night dive at MWH-027 was 11°C.

Fish abundance was affected by the spawning of released Chinook salmon in lower Meadow Creek because the fry from these spawners rear in the lower section of the EFMC.

Species composition in the lower portion of the EFMC is dominated by the offspring of the translocated Chinook salmon which use this stretch as rearing habitat. Without the translocation of Chinook salmon, cutthroat are the most abundant species. **Table 5-24** lists the size and species composition for fish observed in the EFMC.

Table 5-24. Size Distribution and Percent of Species Composition for Fish Observed in All East Fork Meadow Creek Sites for 2012-2014

Species (Size in millimeters)	Total/Percent Species Composition in Sites from Downstream to Upstream (MWH Site Number)										Total Percent Species Composition (Day/Night)
	2012			2013			2014				
	028 D	027 D	Total by Year	028 D	027 N	Total by Year	028 D	028 N	027 D	Total by Year	
Chinook Salmon (50-80)	96.3		98.3	98.6		98.2	94.9	95.1		95.1	97 (97/97)
Chinook Salmon (81-130)	2.8						2.0	0.7			
Chinook Salmon (>130)							0.6	0.7			
Cutthroat Trout (<50)			1.7	0.2		1.8		0.7		4.9	3 (3/3)
Cutthroat Trout (51-100)							0.3	1.5	53.8		
Cutthroat Trout (101-150)				0.9			1.4	0.7			
Cutthroat Trout (151-200)				0.2	33.3						
Cutthroat Trout (201-250)	0.3										
Cutthroat Trout (>250)					33.3		0.3		7.7		

Note:
Blank cells indicate no fish observations at that site.
No snorkel surveys were conducted after 2014.
Species composition in MWH-027 was substantially affected by offspring from the introduction of adult hatchery Chinook salmon in the previous year. If Chinook had not been introduced, cutthroat are most abundant.

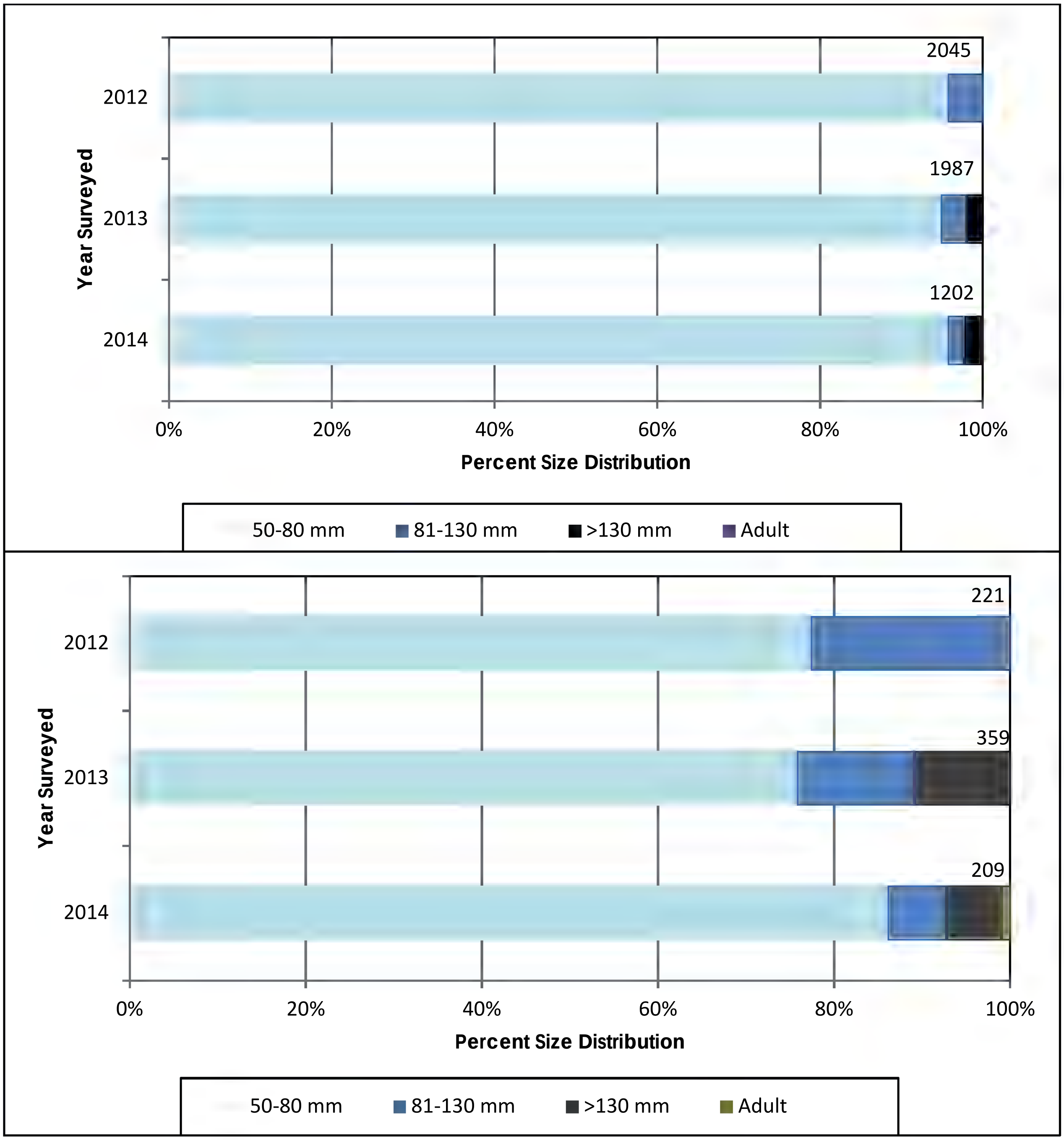
Key:
> = greater than
< = less than
D = day
N = night

5.4.4 Discussion

The translocation of spawning adult Chinook salmon to Meadow Creek by IDFG had a distinct effect on species diversity in the EFSFSR. This played a primary role between Meadow Creek and the Yellow Pine pit (at MWH-022 and MWH-011, but also in 2012 at MWH-013 and MWH-025); at the lower Meadow Creek survey sites (MWH-014, MWH-015 and MWH-047); and in the EFMC downstream site (MWH-028). Species and size diversity are greater in the sites downstream than those found in sites upstream from the Yellow Pine pit.

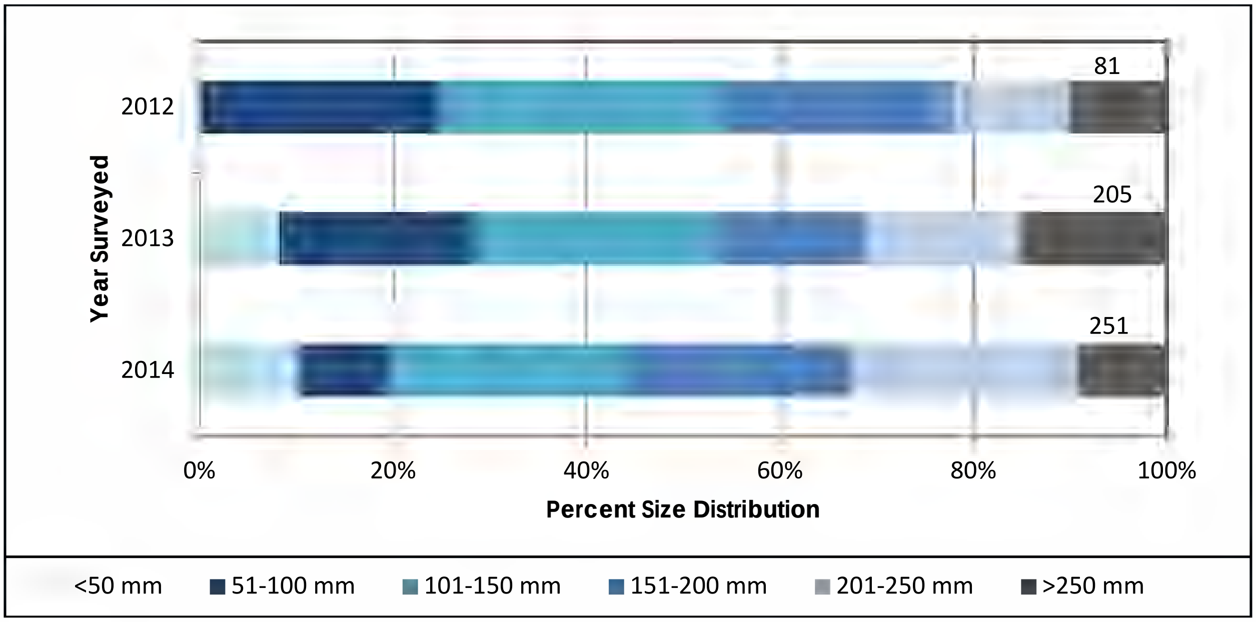
Figure 5-14 through **Figure 5-17** show size distribution for each of the targeted fish species, along with the total number of fish observed. Most of the Chinook salmon were in the smallest size category—less than 80 mm for Chinook salmon. Substantially more large bull trout were observed in 2013 and 2014, possibly due to a larger number of survey sites in the lower EFSFSR for those years. Multiple size classes that are present in a river or stream indicate suitable conditions to support all life stages.

While the surveys did not occur on the same day each year for each site, they all were conducted between late July and mid-August, and were only off by a matter of days to just a few weeks. Because the timing of the surveys is so similar between years, the size classes of each species observed between years is also similar. The different size classes tend to represent different age classes, particularly for resident forms as compared to anadromous forms. Additionally, cooler water temperatures—as occurs in the aquatic resources study area—result in overall slower growth rates. Therefore, the size classes between survey years are comparable.



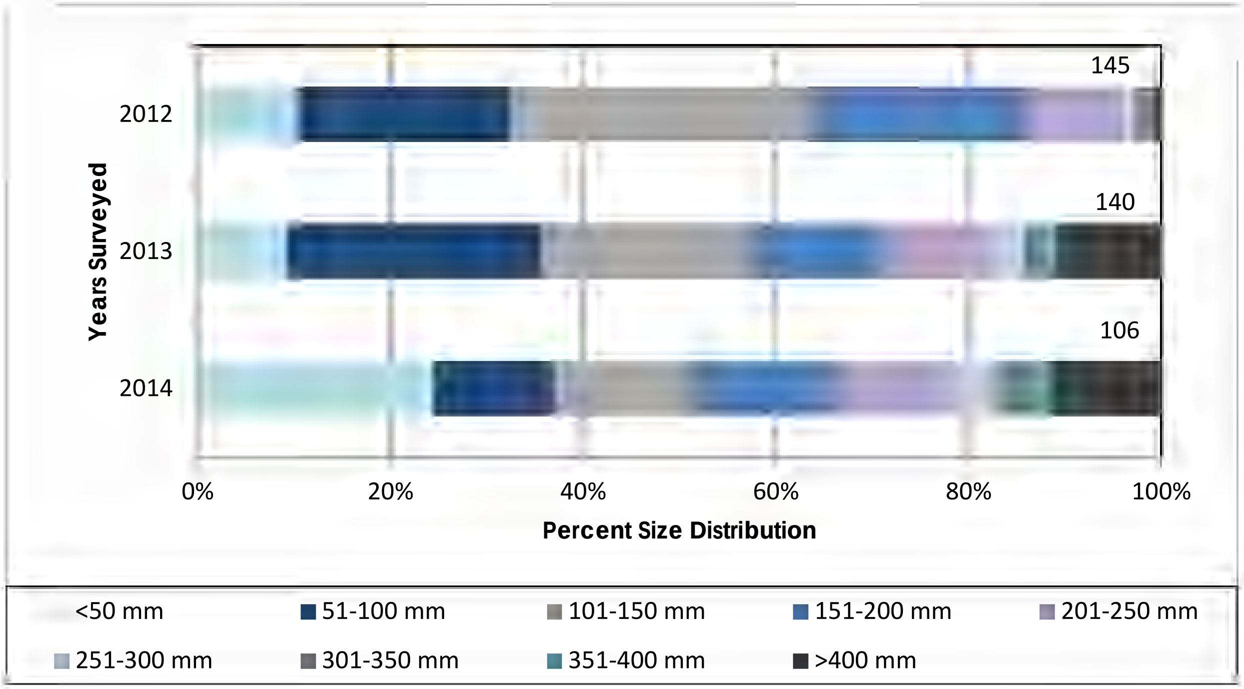
Note: Number above bars represents total number of fish observed
Key:
> = greater than
< = less than
% = percent
mm = millimeters

Figure 5-14. Chinook Salmon Size Distribution for All Survey Sites Combined (Top Graph), and All Sites Combined, Except Those Affected by the Chinook Salmon Translocation (Bottom Graph)



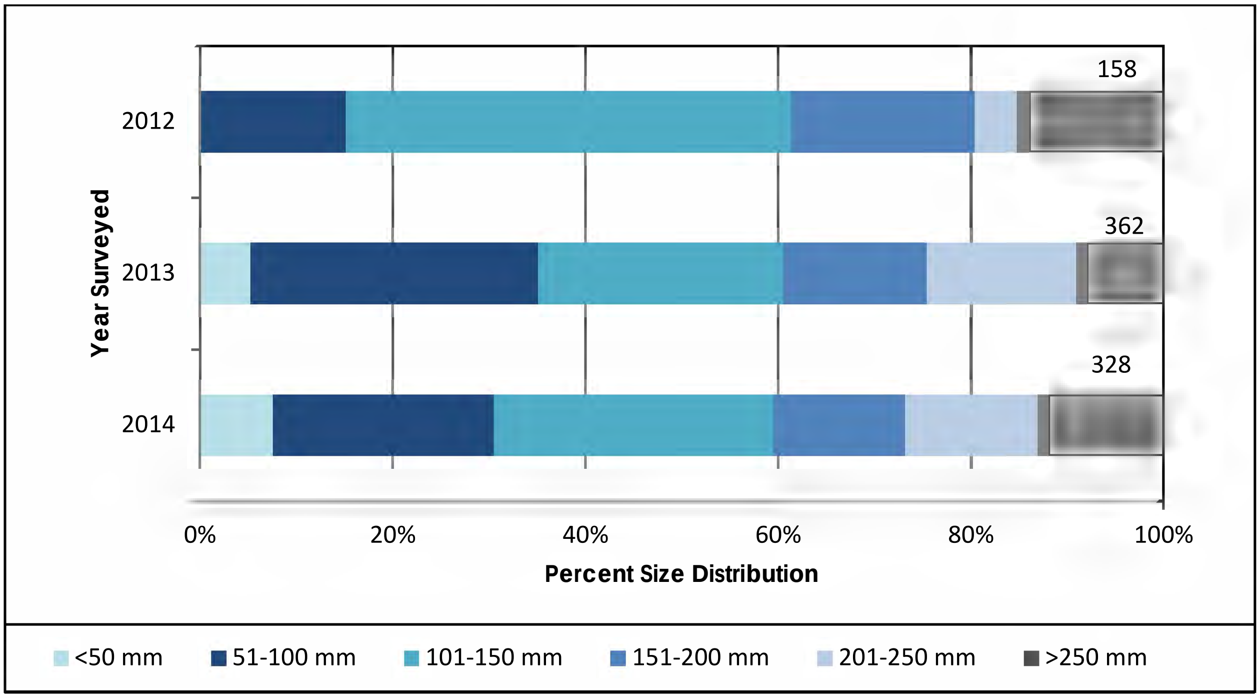
Note: Number above bars represents total number of fish observed
Key:
> = greater than
< = less than
% = percent
mm = millimeters

Figure 5-15. Oncorhynchus mykiss Size Distribution for All Survey Sites Combined



Note: Number above bars represents total number of fish observed
Key:
> = greater than
< = less than
% = percent
mm = millimeters

Figure 5-16. Bull Trout Size Distribution for All Survey Sites Combined



Note: Number above bars represents total number of fish observed
Key:
> = greater than
< = less than
% = percent
mm = millimeters

Figure 5-17. Cutthroat Trout Size Distribution for All Survey Sites Combined

5.5 Aquatics Surveys Summary

This baseline study report characterizes the existing conditions of aquatic resources in the Stibnite Gold project area between 2012 and 2016. The study is based on 4 years of stream habitat survey data, 4 years of macroinvertebrate survey data, 2 years of metals data, 3 years of protocol-level snorkel data, 1 year of 4-pass depletion electrofishing data collected for obtaining unbiased population estimates, 1 year of non-protocol level snorkel survey data or video recordings, and 2 years of genetic data. The combination of these baseline surveys was necessary to characterize the overall condition of the system. Understanding the habitat conditions (e.g., spawning gravel, LWD); water quality conditions (i.e., water temperature, macroinvertebrate taxa diversity and abundance); sediment conditions (i.e., metal content); and biological conditions (i.e., macroinvertebrates and fish distribution and abundance) in combination provides the basis for determining the basin condition.

This report provides an overview of existing stream habitat and biological conditions from data collected on important indicators such as: stream substrate, LWD, water temperature, macroinvertebrate taxa diversity and abundance, sediment and macroinvertebrate metal content, and fish distribution and abundance.

Together, the aquatic resource baseline data permit several general conclusions about the condition of the habitat and biological resources:

- The average streambed interstitial conditions, as measured by both cobble embeddedness and free matrix are considered *functioning appropriately* at nearly all survey sites. Five sites, including in Meadow Creek, Sugar Creek, Profile Creek, and EFMC, however, are considered *functioning at risk* when averaged over all survey years.

- Average surface fines, as measured by free matrix, are generally considered *functioning at risk* or *functioning at unacceptable risk* at most surveyed sites, however, four sites in the EFSFSR, Burntlog Creek, and Trapper Creek, which are all granitic streambeds, are *functioning appropriately* based on annual means.
- The majority of percent depth fines less than 6.33 mm, as measured by core sampling in the EFSFSR, are considered *functioning appropriately* and the percent has decreased each year since 2013. All annual measurements of percent depth fines less than 0.85 mm, as measured by core sampling, are less than the Jensen et al. (2009) suggested threshold of 10 percent. Jensen et al. indicated odds of salmon and steelhead egg-to-fry survival dropping dramatically above the 10 percent threshold.
- Stream habitat conditions may change over time from factors such as seasonal events (e.g., high runoff flows), fire, weather conditions, erosion, and federal management activities (e.g. road decommissioning). For example, in early 2014, the watershed experienced multiple avalanches and landslides, and the subsequent substrate measurements showed changes in embeddedness, fine sediment and free matrix.
- Water temperatures do not appear to exceed the WCIs substantially enough to impair fish production.
- Macroinvertebrate surveys show that the macroinvertebrate assemblages at all 11 survey sites are generally indicative of high water quality and relatively stable habitat. This is supported by high taxa richness, the presence of many predator and long-lived taxa and taxa that require clean cobble substrates, high proportions of taxa that are intolerant of poor water quality, and low numbers of individuals that are tolerant of poor water quality.

  Notable differences in macroinvertebrate composition, as compared between survey sites, included a larger proportion of filterers (in this case blackfly larvae) just downstream of the Yellow Pine pit outlet, somewhat greater numbers of stoneflies at the upstream Sugar Creek and Tamarack Creek sites, and a decrease in metals tolerance index values within the Meadow Creek constructed channel, indicating that metals contamination may be decreasing at that site. PIBO O/E scores among survey sites from 2012 to 2016 were consistently rated as being in *good* biological condition, except in three instances where a site was rated as *fair*. The O/E scores indicated that upper Sugar Creek, the Meadow Creek confluence, and the Meadow Creek constructed channel were initially assessed to be in *fair* condition (2012), but had improved to *good* condition in subsequent sampling years. All other sites were in *good* condition from 2012 to 2014, and in 2016.
- Metals in the sediment—particularly antimony, arsenic, and mercury—frequently exceeded the NMFS and EPA benchmarks at all sampled locations, often by one or more orders of magnitude.
- Concentrations of metals, particularly arsenic in macroinvertebrate tissue, were elevated at sites on the EFSFSR and Sugar Creek, relative to concentrations at other sites—particularly those on Meadow Creek and Tamarack Creek. Mercury concentrations in macroinvertebrates were substantially elevated in Sugar Creek. Arsenic and antimony occurred in lower concentrations in sites farther upstream in the EFSFSR, and in Meadow Creek and Sugar Creek. In comparison to previous studies, arsenic concentrations

decreased in all sites except for one Sugar Creek site; however, no clear temporal trend was indicated.

- Except for mercury, fish collected in the EFMC and EFSFSR had maximum metal concentrations, but no one site was elevated for all metals. Concentrations of mercury, antimony and arsenic did trend higher at the Yellow Pine pit, at MWH-011, and MWH-026 (which are all on the EFSFSR). However, concentrations of mercury, antimony and arsenic were below literature-derived effects thresholds at all sites, except for MWH-018 (Sugar Creek).
- Fish distribution and abundance were relatively similar in each survey year, except for the sites directly affected by IDFG’s translocation or introduction of adult spawning Chinook salmon in Meadow Creek. Most size classes of all target species were represented throughout the aquatic resources study area, which is indicative of relatively stable fisheries for the entire Stibnite Gold project area.
- Genetic studies indicate that *O. mykiss* likely do not occur upstream from the Yellow Pine pit, except for the previously introduced golden trout in the upper Meadow Creek Lake. Westslope cutthroat trout were found in nearly all sites, and Chinook salmon were found only in the samples taken at the Yellow Pine pit, and the EFSFSR downstream from Meadow Creek. Bull trout were detected in the EFSFSR, lower Fiddle Creek Meadow Creek, and the unnamed tributary to Meadow Creek. Brook trout and Pacific lamprey were not detected in any tested sample, and likely do not occur upstream from the Yellow Pine pit.

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6.2 Glossary

Term	**Definition**
Anadromous	Fish that migrate from salt water into freshwater to spawn
Analysis of Variance (ANOVA)	Comparison of means among sites and years, for appropriate variables
Box and Whisker Plots	These plots display variation in samples of a statistical population without making any assumptions of the underlying statistical distribution and assist in data interpretation and quality control
Critical Habitat	Designation under the Endangered Species Act that includes specific geographic areas occupied by the species, that has physical or biological features essential to the survival of the species and which may require special management considerations or protections. It also includes specific areas outside the geographical area occupied by the species the time it is listed that are identified as areas essential for the conservation of the species
Distinct Population Segment (DPS)	Vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species
Coefficient of Variation (CV)	A measure of the dispersion of data points in a data series around the mean. CV represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one monitoring site to another or between different years, even if the means are drastically different from each other
Confidence Interval (CI)	A range of values (interval) that act as good estimates of the unknown population parameter. Confidence intervals are typically stated at the 95 percent confidence level and are shown as a value range (i.e., ±5 percent of the mean)
Evolutionarily Significant Unit (ESU)	Pacific salmon population or group of populations that is substantially reproductively isolated from other conspecific populations and that represents an important component of the evolutionary legacy of the species
Mean (μ)	The sum of a collection of numbers divided by the number of numbers in the collection. While the arithmetic mean is often used to report central tendencies, it is not a robust statistic, meaning that it is greatly influenced by outliers (values that are very much larger or smaller than most of the values)
Periphyton	Aquatic organisms, such as algae, that live attached to rocks or other surfaces
Redd	Nest constructed by salmonid species for spawning

Term	**Definition**
Sensitive Species	Plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by: Significant current or predicted downward trends in population numbers or density. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution."
Species richness	The absolute number of species in an assemblage or community
Standard Deviation (σ)	Quantifies scatter within a dataset; how much the values vary from one another. It is expressed in the same units as the data
Standard Error of the Mean (SEM)	Quantifies precision of the mean. It is a measure of how far along a distribution the sample mean is likely to be from the true population mean. It is expressed in the same units as the data. A smaller value of SEM indicates that the sample mean is close to the population mean. A smaller SEM indicates more precise data
Taxon/Taxa	Any group of organisms or populations considered to be sufficiently distinct from other such groups or populations to be treated as a separate unit
Thalweg	The middle of the deepest part of the channel of a river or other stream
Watershed Condition Indicator (WCI)	Categories describing the level of watershed functionality or integrity. These indices are reflect a range of variability from "functioning appropriately" to "functioning at unacceptable risk"

6.3 Abbreviations and Acronyms

Abbreviation/ Acronym	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
%	percent
ANOVA	Analysis of variance
BOI	Boise National Forest
CI	confidence interval
CPOM	coarse particulate organic matter
CS	covered stable
CU	covered unstable
CV	coefficient of variation
D_{50}	Substrate median size
DPS	distinct population segment
eDNA	environmental deoxyribonucleic acid
EFMC	East Fork Meadow Creek
EFSFSR	East Fork of the South Fork of the Salmon River
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FFG	functional feeding group
FS	Forest Service road
GIS	Geographic Information System
GPS	Global positioning system
HBI	Hilsenhoff Biotic Index
IDAPA	Idaho Administrative Procedure Act
IDEQ	Idaho Division of Environmental Quality
IDFG	Idaho Department of Fish and Game
INFISH	Inland Fish Strategy
LOEC	lowest observed effects concentration
LRMP	Land and Resource Management Plan
LWD	large woody debris
m	meter
MDL	method detection limit

Abbreviation/ Acronym	**Definition**
mg/kg	milligrams per kilogram
mg/kg dw	milligrams per kilogram dry weight
Midas Gold	Midas Gold Idaho Inc.
ml	milliliter
mm	millimeter
MPG	major population group
msl	mean sea level
MTI	Metals Tolerance Index
MWH	MWH Americas, Inc.
NFS	National Forest System
NMFS	National Marine Fisheries Service
O/E	observed/expected
PACFISH	Pacific Anadromous Fish Strategy
PAF	Payette National Forest
PEL	Probably Effects Level
PIBO	PACFISH/INFISH Biological Opinion
PQL	Practical Quantitation Limit
RIVPACS	River Invertebrate Prediction and Classification System
RMRS	Rocky Mountain Research Station
SD	standard deviation
SEM	standard error of the mean
SFSR	South Fork Salmon River
SMI	Stream Macroinvertebrate Index
State	State of Idaho
TEL	Threshold Effects Level
US	uncovered stable
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UU	uncovered unstable
WCI	Watershed Condition Indicators
WW:WD	wetted width-to-wetted depth ratio
YOY	young-of-the-year

SECTION 7 LIST OF PREPARERS

Name	Title	Role
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Gene Bosely	Senior Civil Engineer	Technical Reviewer
MWH Americas		
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Stephanie Theis	Fisheries Biologist	Project technical lead, fisheries sections author, technical review of stream habitat section and macroinvertebrate section and appendix
Cory Bolen	Senior GIS Specialist	Stream habitat section author and GIS Specialist
Matthew Bachman	Engineer and Planner	Statistical analyses and database development
Dave Kikkert	Environmental Scientist	Metals Analysis
EcoAnalysts		
Bill LaVoie	Aquatic Ecologist	Macroinvertebrate technical lead and Appendix author
Gary Lester	Aquatic Ecologist	Macroinvertebrate Appendix QA/QC
Payette National Forest		
Clayton Nalder	Fisheries Biologist	Aquatics survey methodology support
Caleb Zurstadt	Fisheries Biologist	Aquatics survey methodology support
Gina Bonominio	Fisheries Biologist	Aquatics survey methodology support

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Appendix 1:

Stream Habitat Survey Results for 2012 -2016 – Statistical Tables, Box and Whisker Plots and ANOVA Tables for Applicable Variables

Appendix 1: Stream Habitat Survey Results for 2012 to 2016 –Box and Whisker Plots, Statistical Tables, and ANOVA Tables for Applicable Variables

Stibnite Gold Project
Midas Gold Idaho, Inc.

April 2017

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SECTION 1: BOX AND WHISKER PLOTS

A “box and whisker plot” is a way to graphically show where the middle (i.e., median) of the data lies within a dataset. The data is broken into quartiles, each with an equal number of data values. Box and whisker plots display variation in samples of a statistical population without making any assumptions of the underlying statistical distribution. All whiskers are limited to 1.5 times the interquartile range (IQR); this is 1.5 times the distance from quartile to quartile (the distance within the data covered by the boxes). In addition to median, the average or mean is presented for each box and whisker plot with a dashed line. Data that fall outside of the 1.5 IQR appears as a single dot and are considered an outlier. If most of the data is clustered or valued as “0” then no shaded block will appear on the plot. **Figure 1-1** shows the various elements of the box and whisker plots presented in this appendix. Definitions of specific box and whisker components are as followed:

- Median – Represents the mid-point of the dataset and is shown by the line that divides the box into two parts. Fifty percent of the data is greater than or equal to the median and the remaining half are less.
- Mean – Represents the arithmetic average value of the dataset and is shown by a horizontal dotted line.
- Upper Quartile (Q3) - Seventy-five percent of the observed values fall below the upper quartile and twenty-five percent above.
- Lower Quartile (Q1) – Twenty-five percent of the observed values fall below the lower quartile and seventy-five percent above.
- Interquartile Range (IQR) – Represents the middle fifty percent of the dataset and is defined by the range of the upper and lower quartiles.
- Whiskers – The upper and lower whiskers extend to the maximum values within 1.5 times the IQR.
- Outlier – Represents observed values that are either greater than or less than 1.5 times the IQR. These values extend beyond the whiskers on the plot.

The wetted channel width-to-wetted stream depth (WW:WD), maximum pool depth, bank angle, bankfull width, maximum bankfull depth, free matrix, surface fines (as measured from free matrix), cobble embeddedness, and depth fines (as measured from core sampling) were evaluated with the box and whisker plots. The results are presented below.

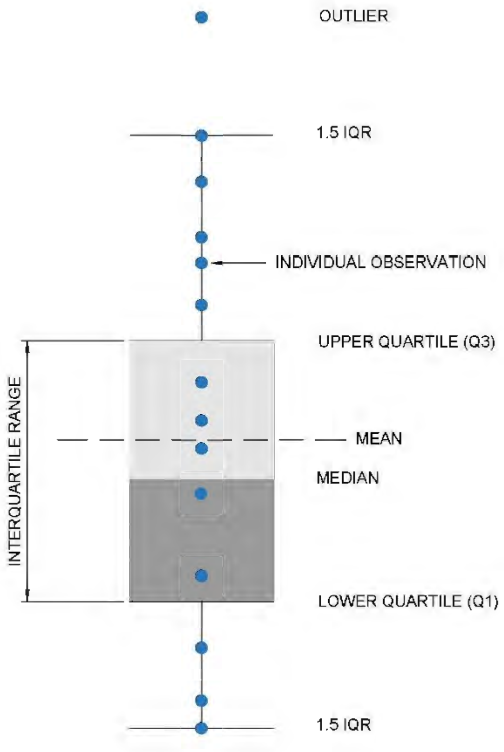
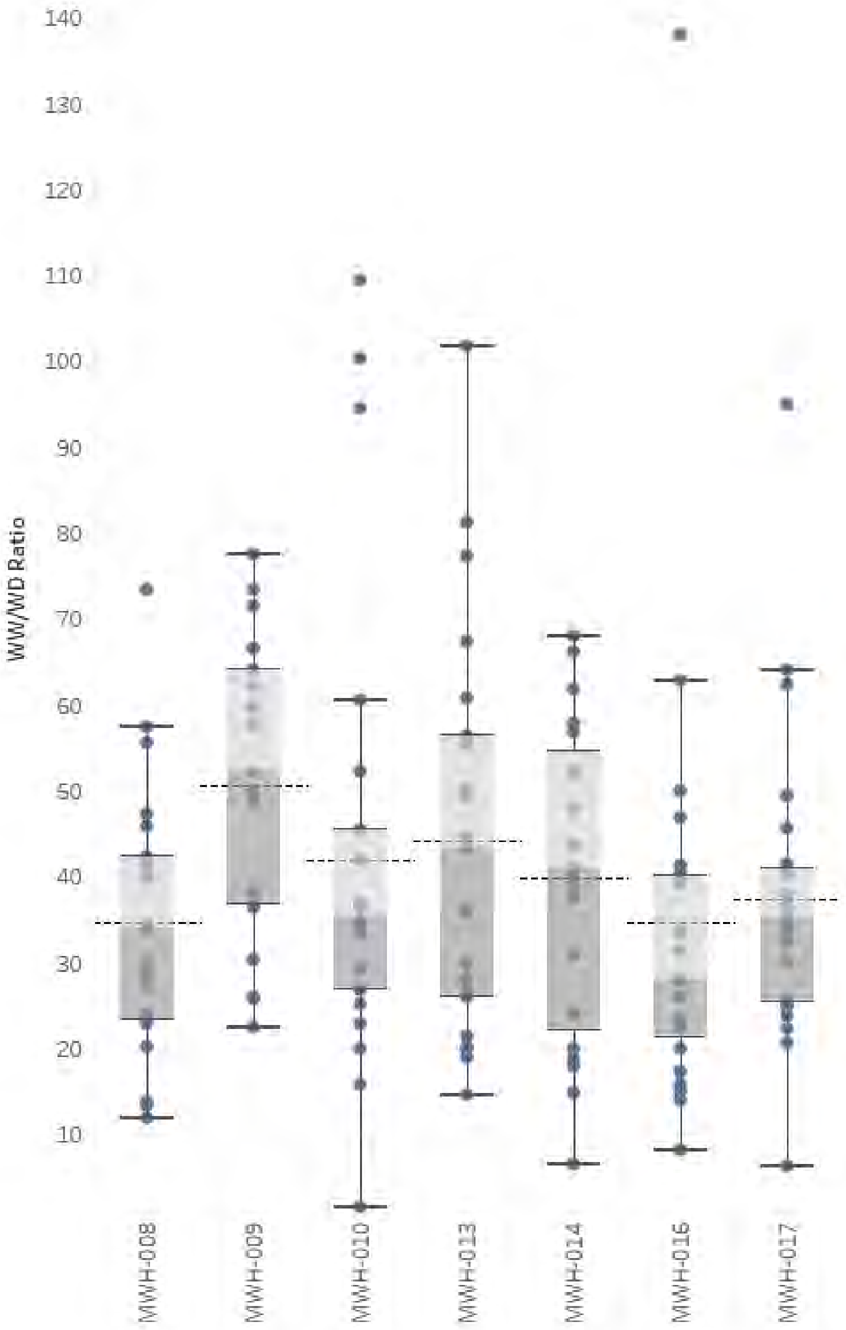


Figure 1-1. Box and Whisker Example Plot

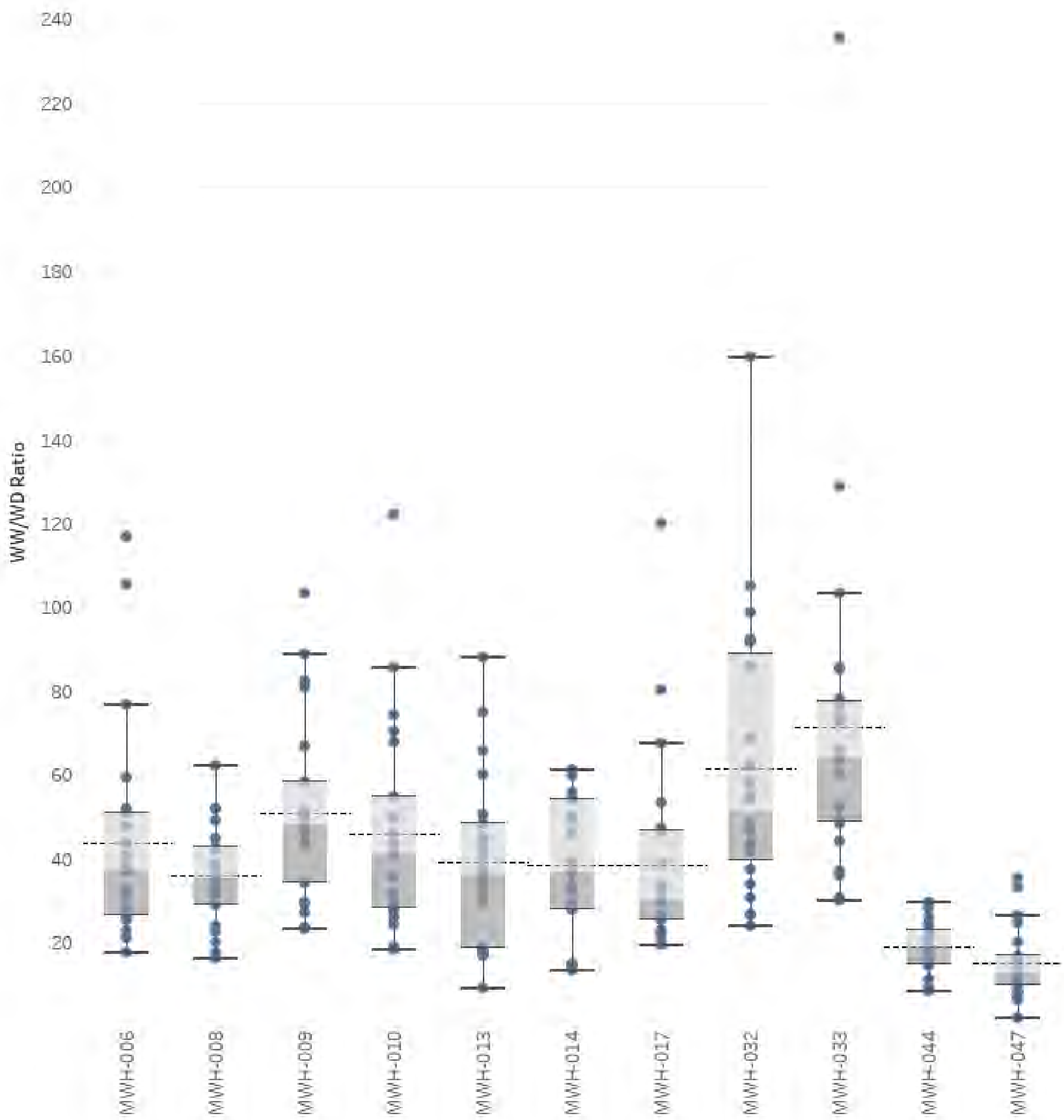
1.1 PIBO Habitat Survey Plots

Methods employed for habitat surveys included habitat sampling following the PAF modified protocol for the Pacific Anadromous Fish Strategy (PACFISH) Inland Fish Strategy (INFISH) Biological Opinion Effectiveness Monitoring Program (PIBO) (USFS 2005, 2013a). PIBO was developed in response to monitoring needs addressed in the Biological Opinions for bull trout (USFWS 1998) and steelhead (NMFS 1998). It provides a consistent framework for monitoring aquatic and riparian resources within the range of the PACFISH/INFISH, to help determine whether land management practices are maintaining or improving riparian and aquatic conditions at both the landscape and watershed scales on federal lands throughout the Upper Columbia River Basin. The results are presented in **Figure 1-2** through **Figure 1-37**.



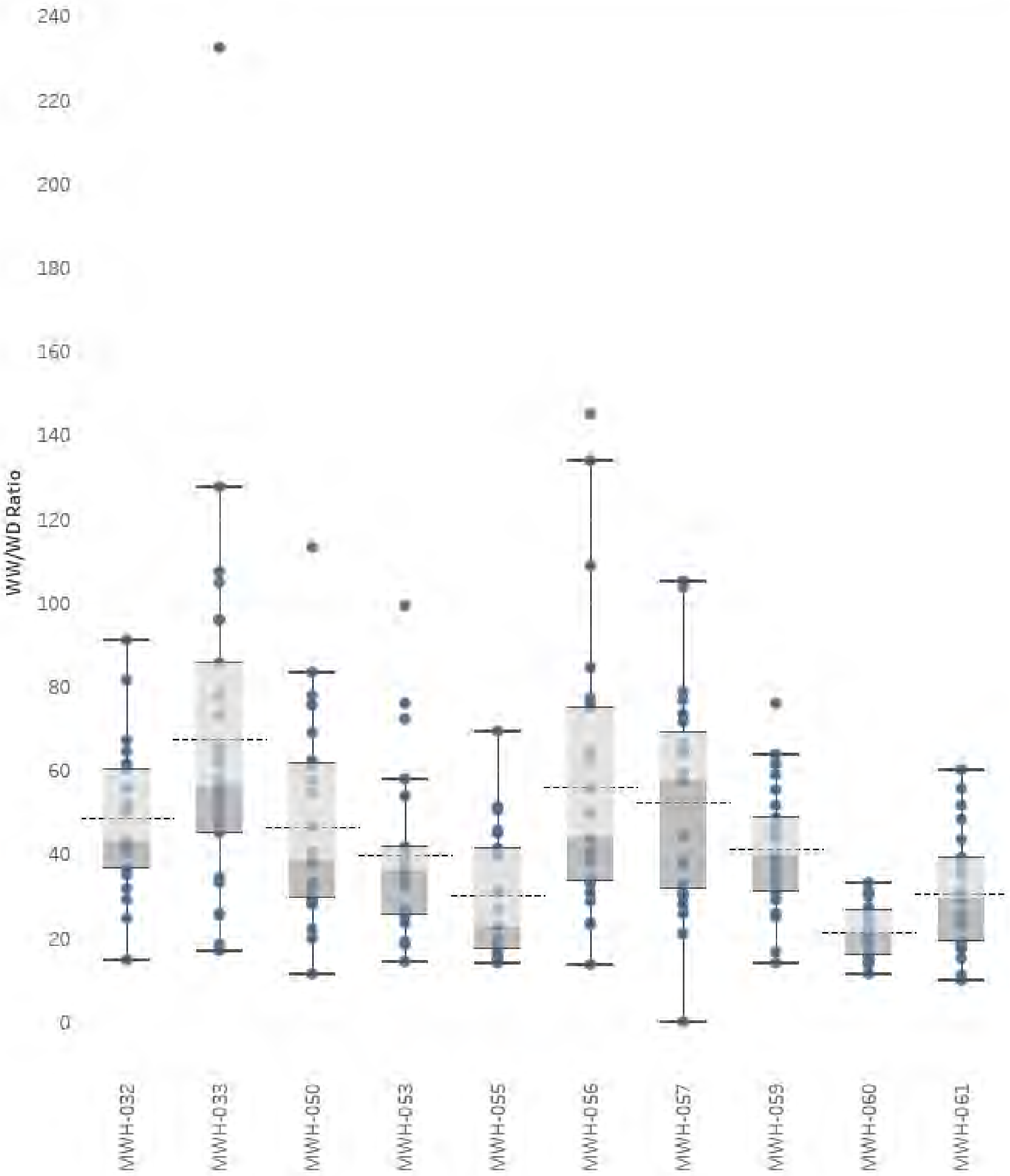
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-2. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Sites in 2012



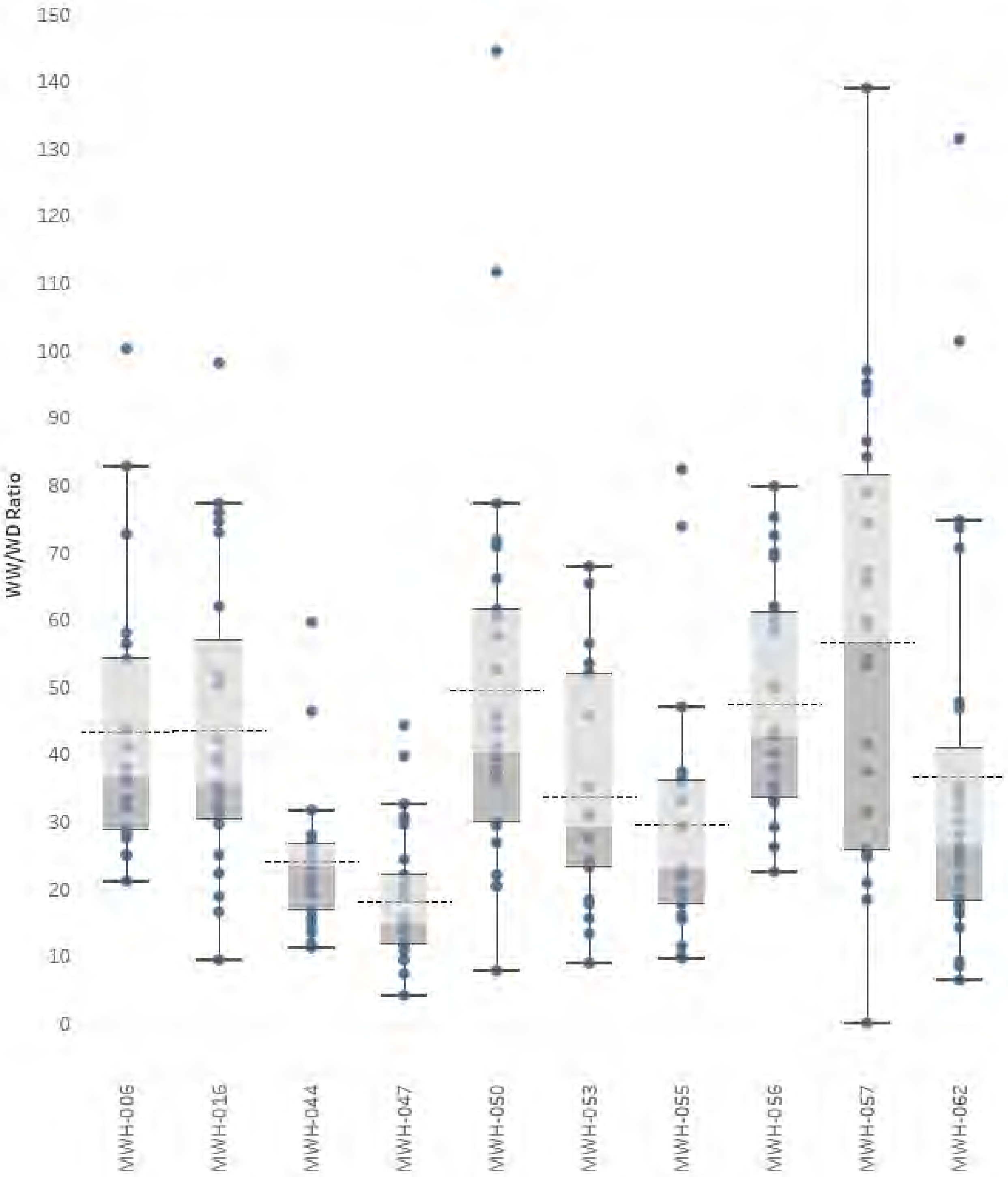
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-3. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Sites in 2013



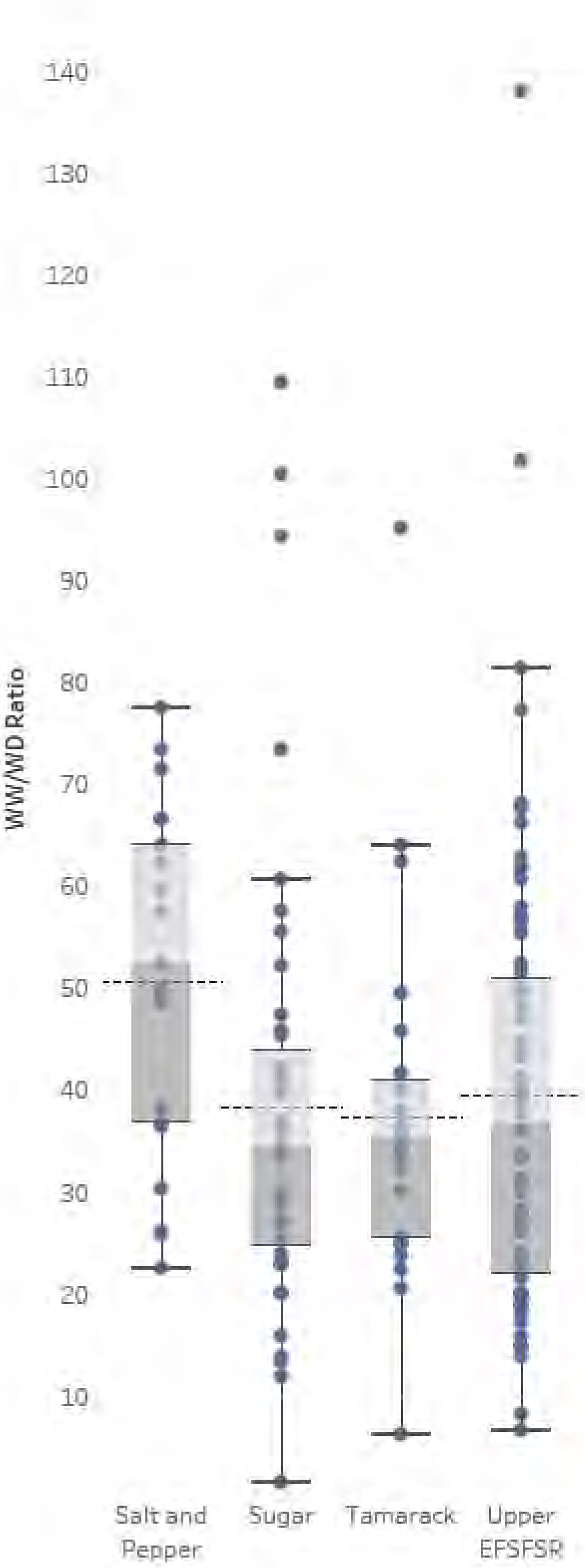
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-4. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Sites in 2014



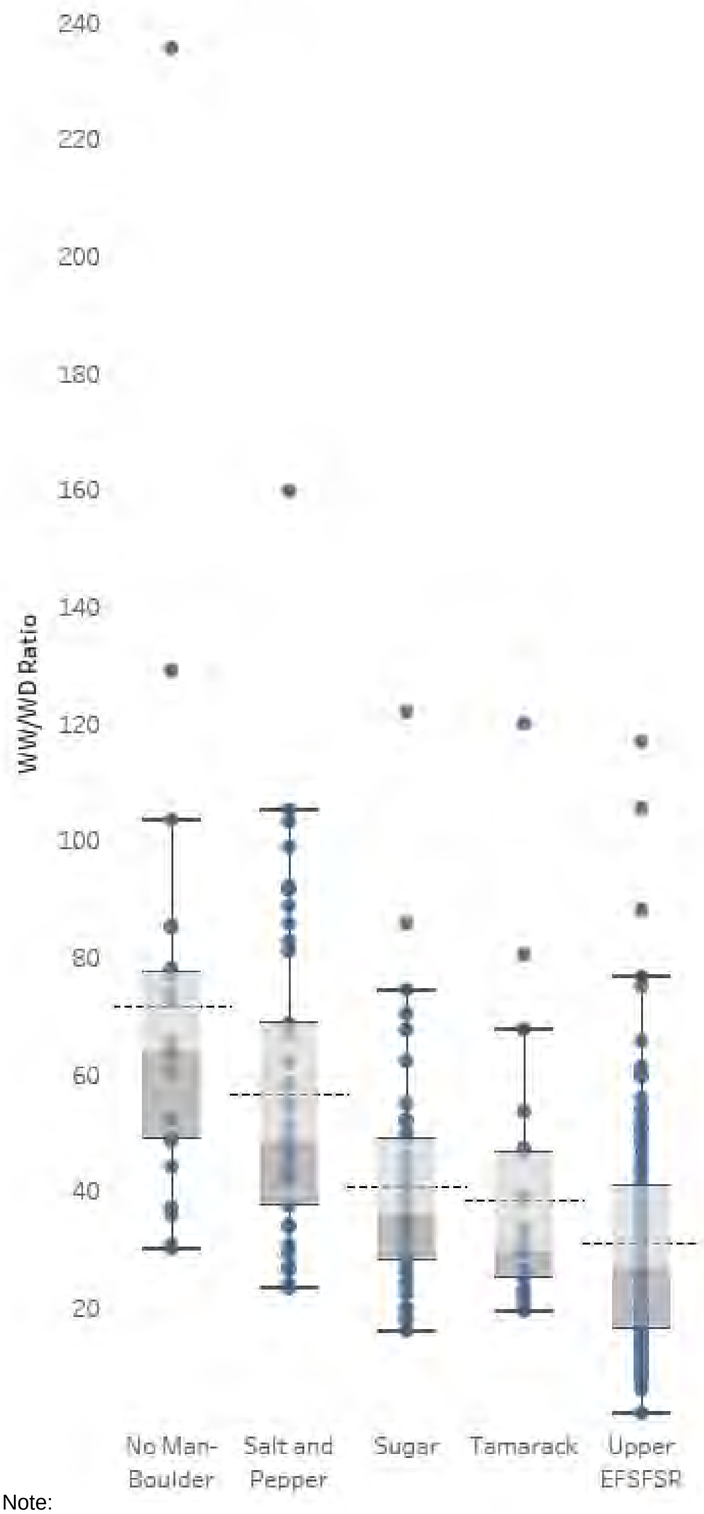
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-5. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Sites in 2015



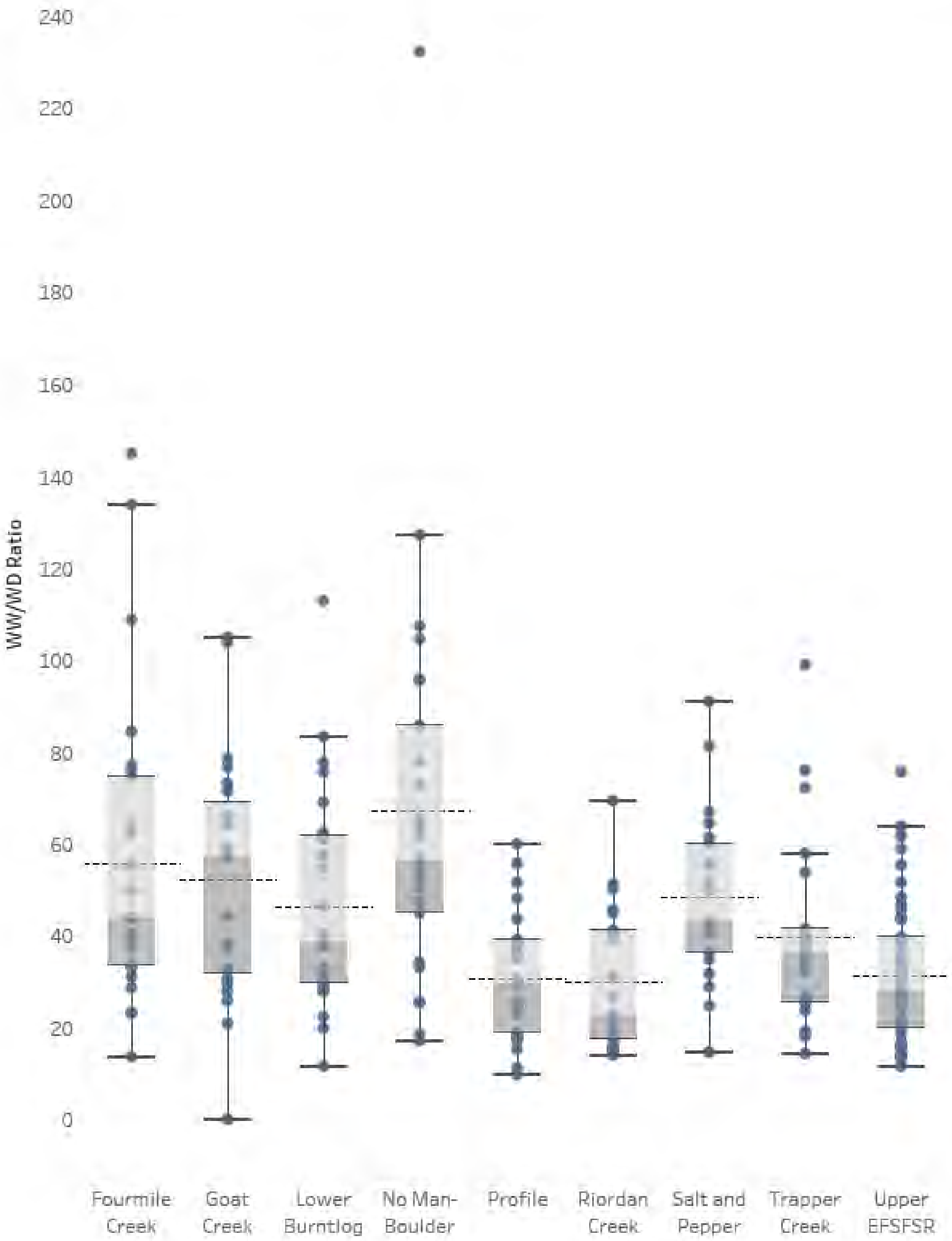
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-6. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Subwatersheds in 2012



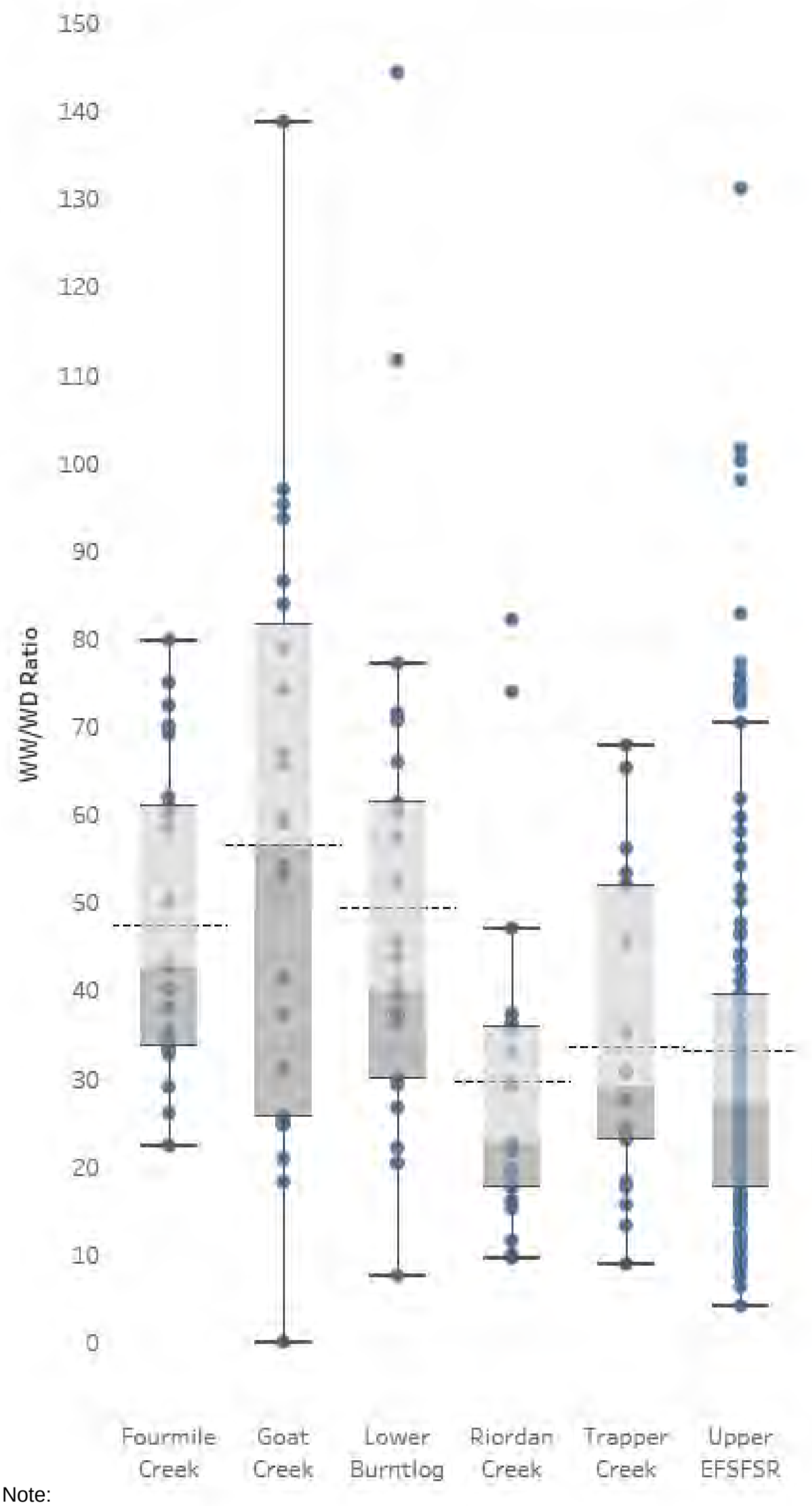
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-7. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Subwatersheds in 2013



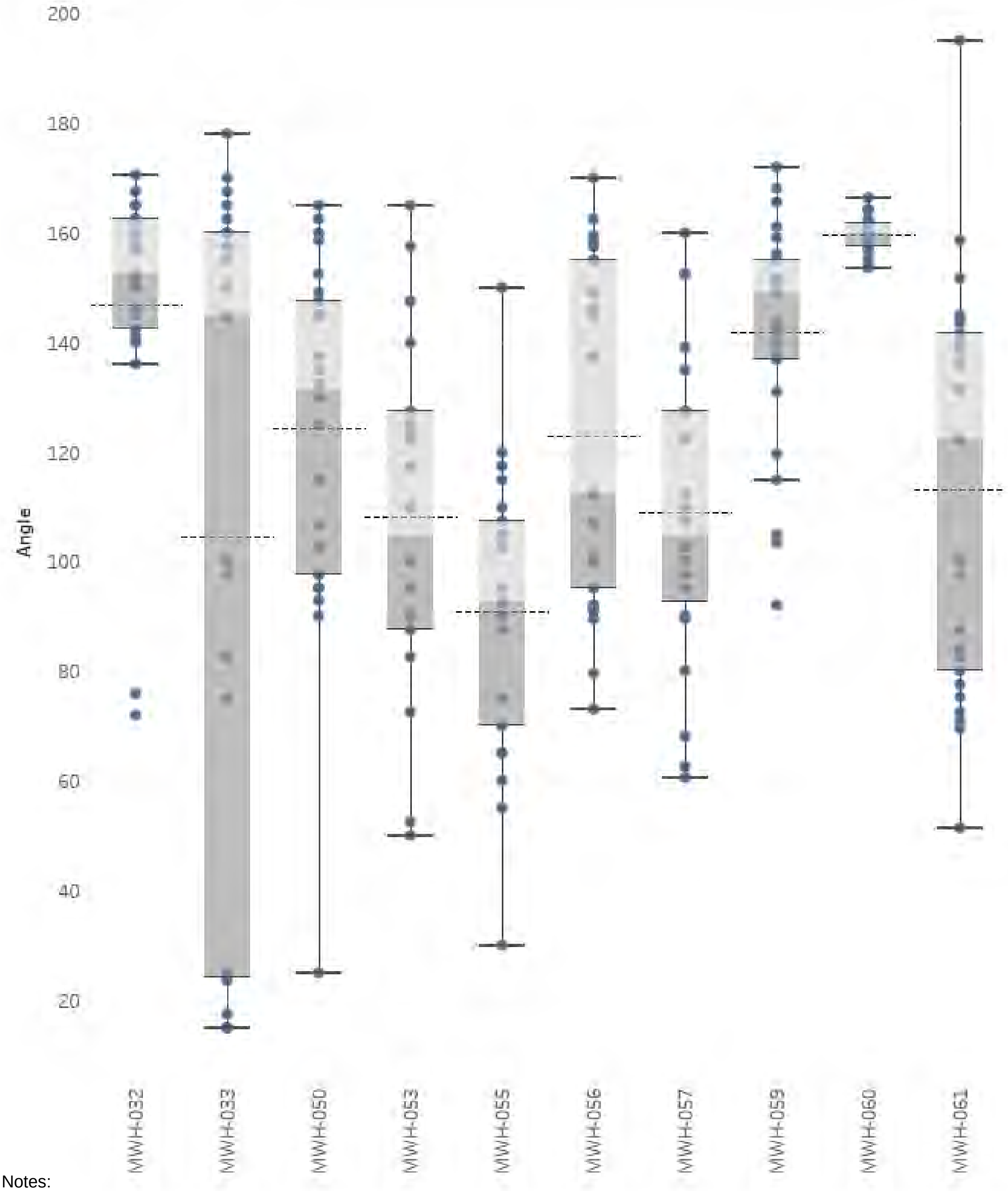
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-8. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Subwatersheds in 2014



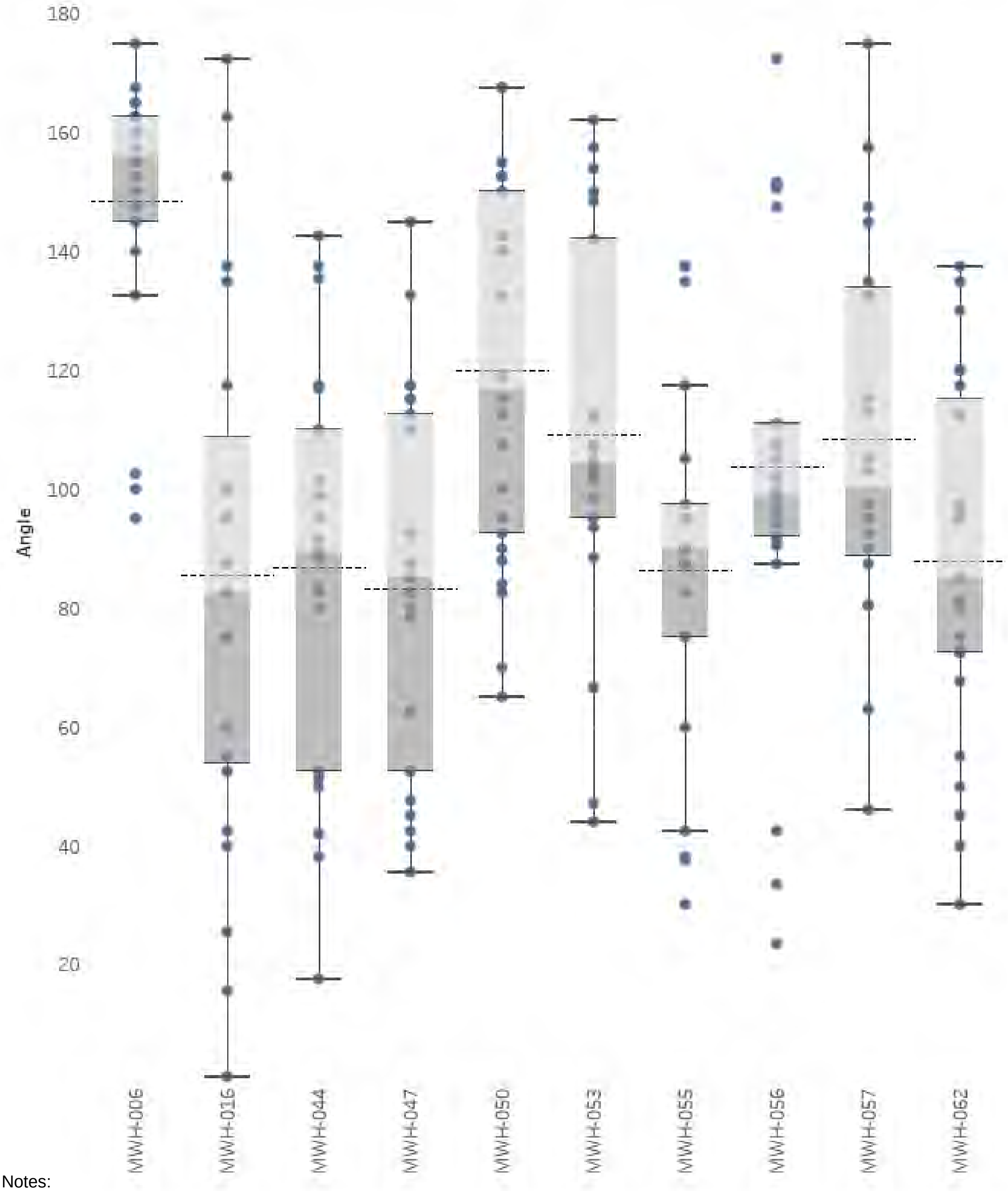
Note:
Dashed lines in each box plot indicate sample mean
Key:
WW: wetted width of channel
WD: wetted depth of channel

Figure 1-9. Box and Whisker Plot for Wetted Width-to-Wetted Depth Ratio for all Subwatersheds in 2015



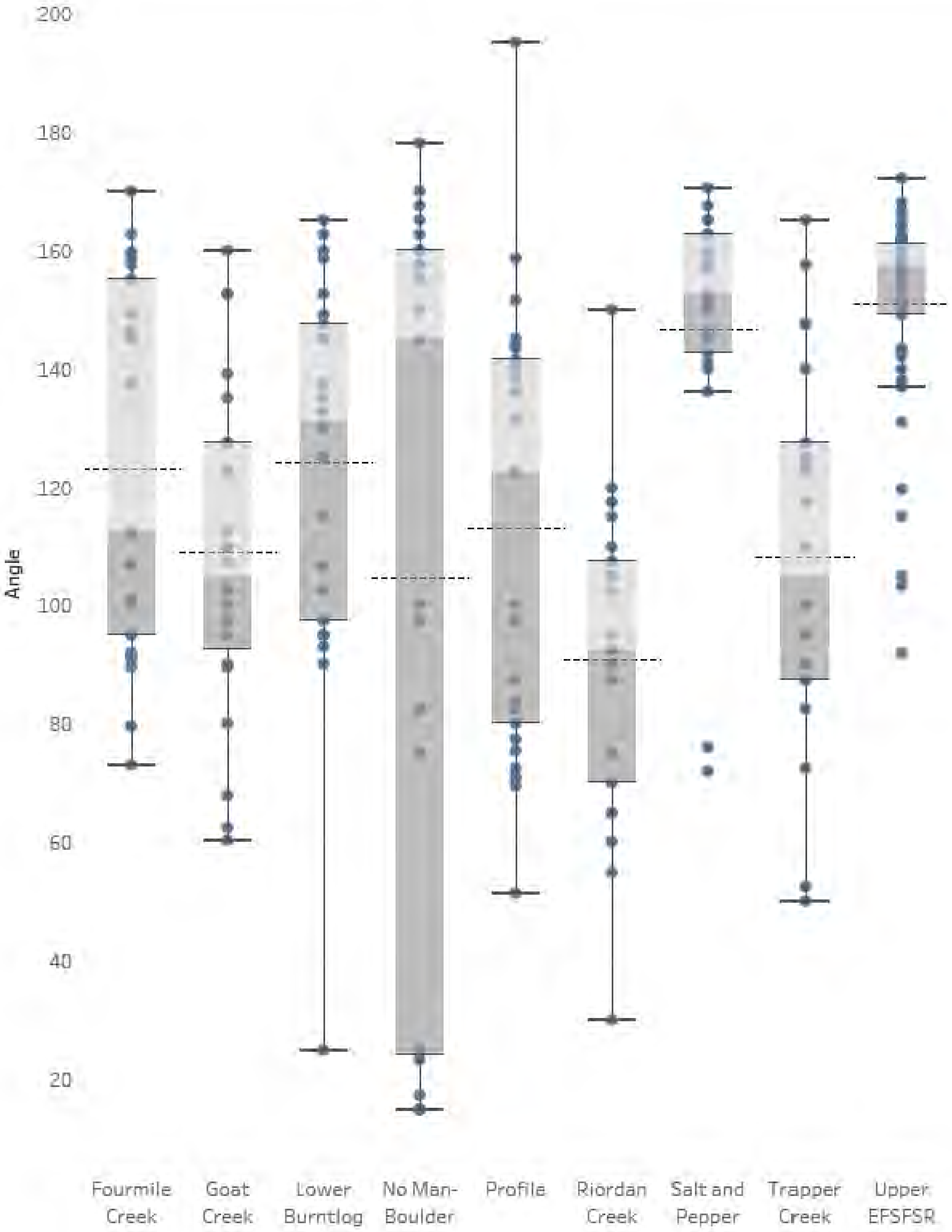
Notes:
Bank angle is measured in degrees
Dashed lines in each box plot indicate sample mean

Figure 1-10. Box and Whisker Plot of the Bank Angles for all Survey Sites in 2014



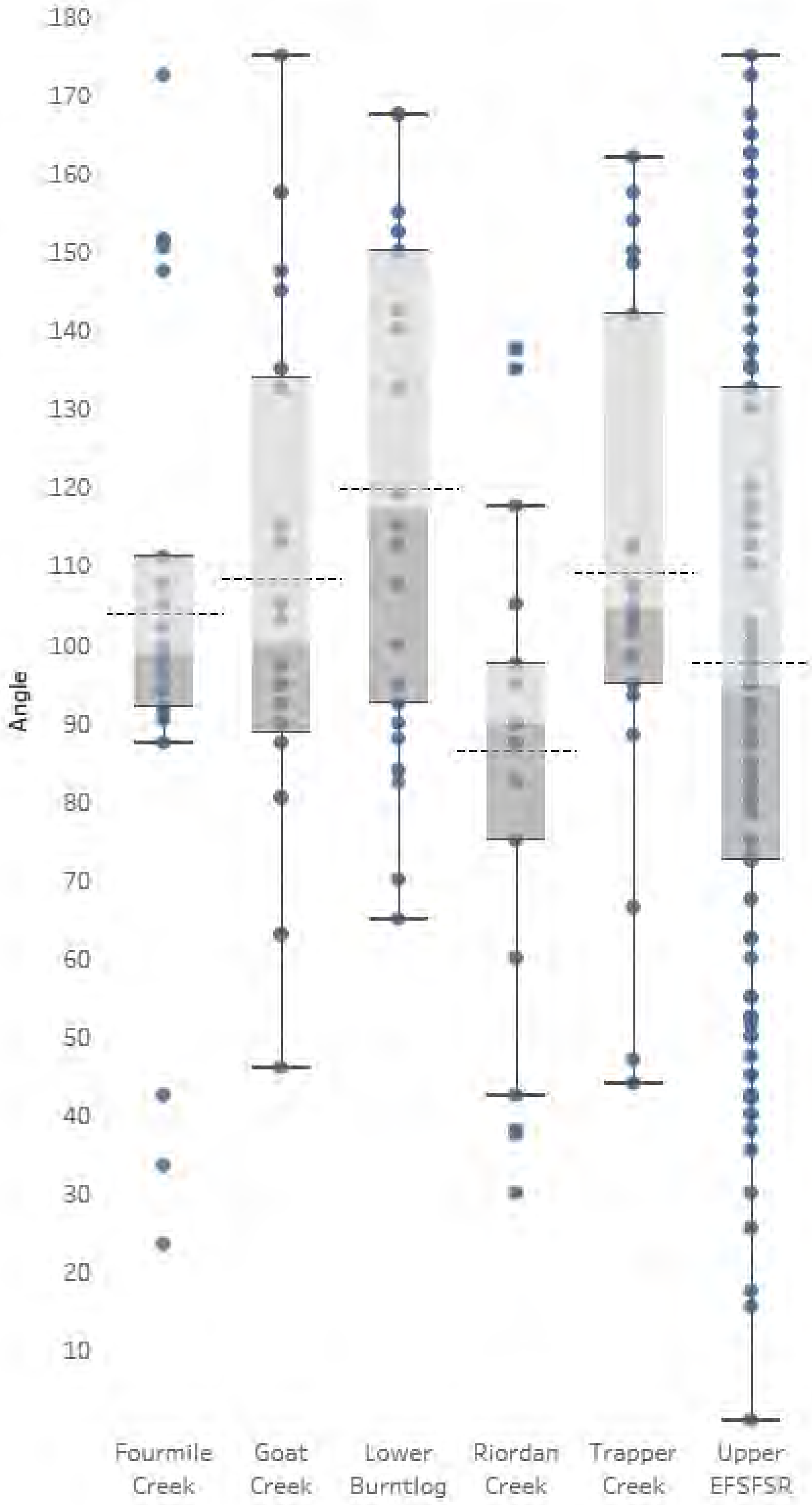
Notes:
Bank angle is measured in degrees
Dashed lines in each box plot indicate sample mean

Figure 1-11. Box and Whisker Plot of the Bank Angles for all Survey Sites in 2015



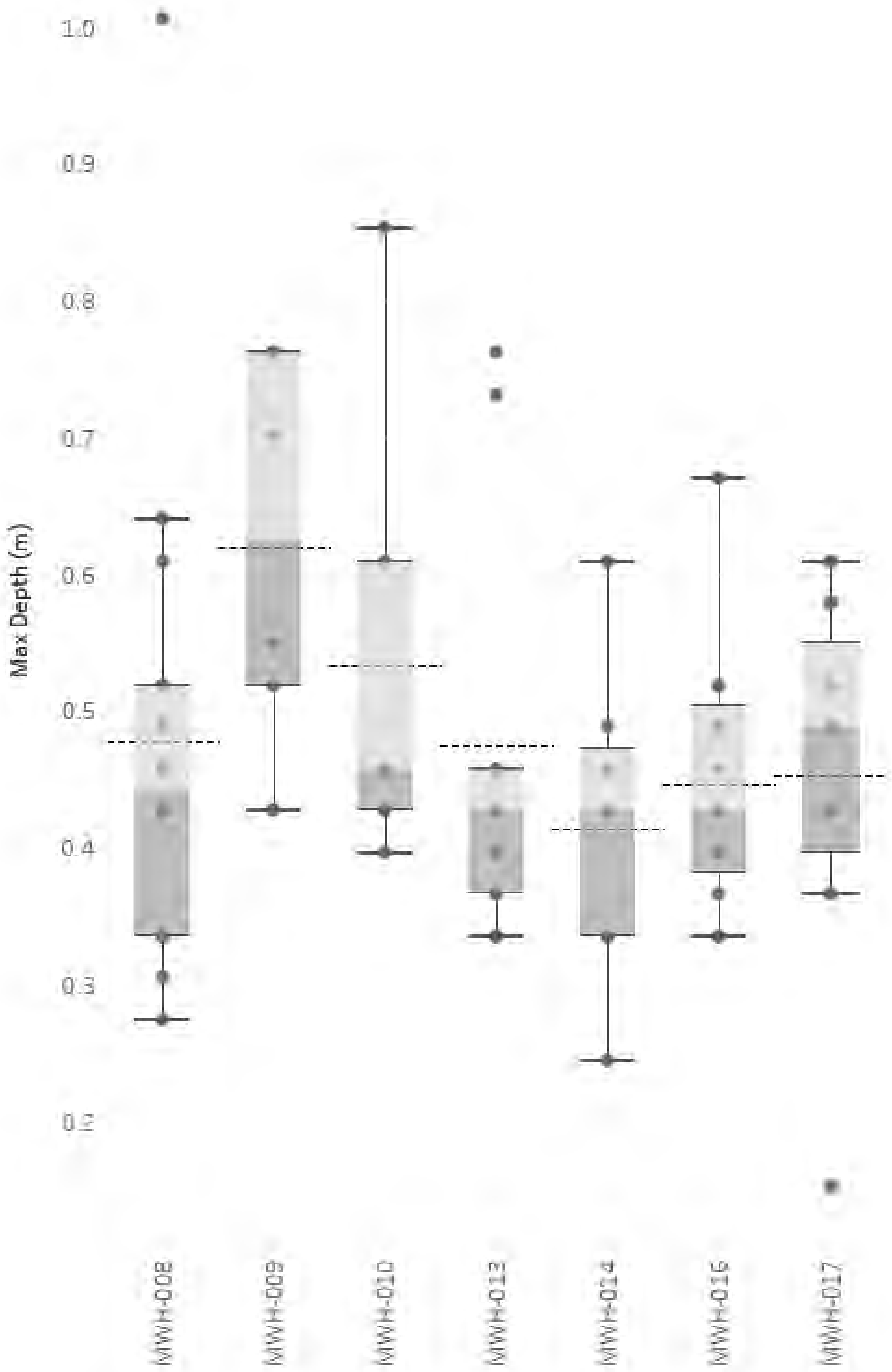
Notes:
Bank angle is measured in degrees
Dashed lines in each box plot indicate sample mean

Figure 1-12. Box and Whisker Plot of the Bank Angles for all Subwatersheds in 2014



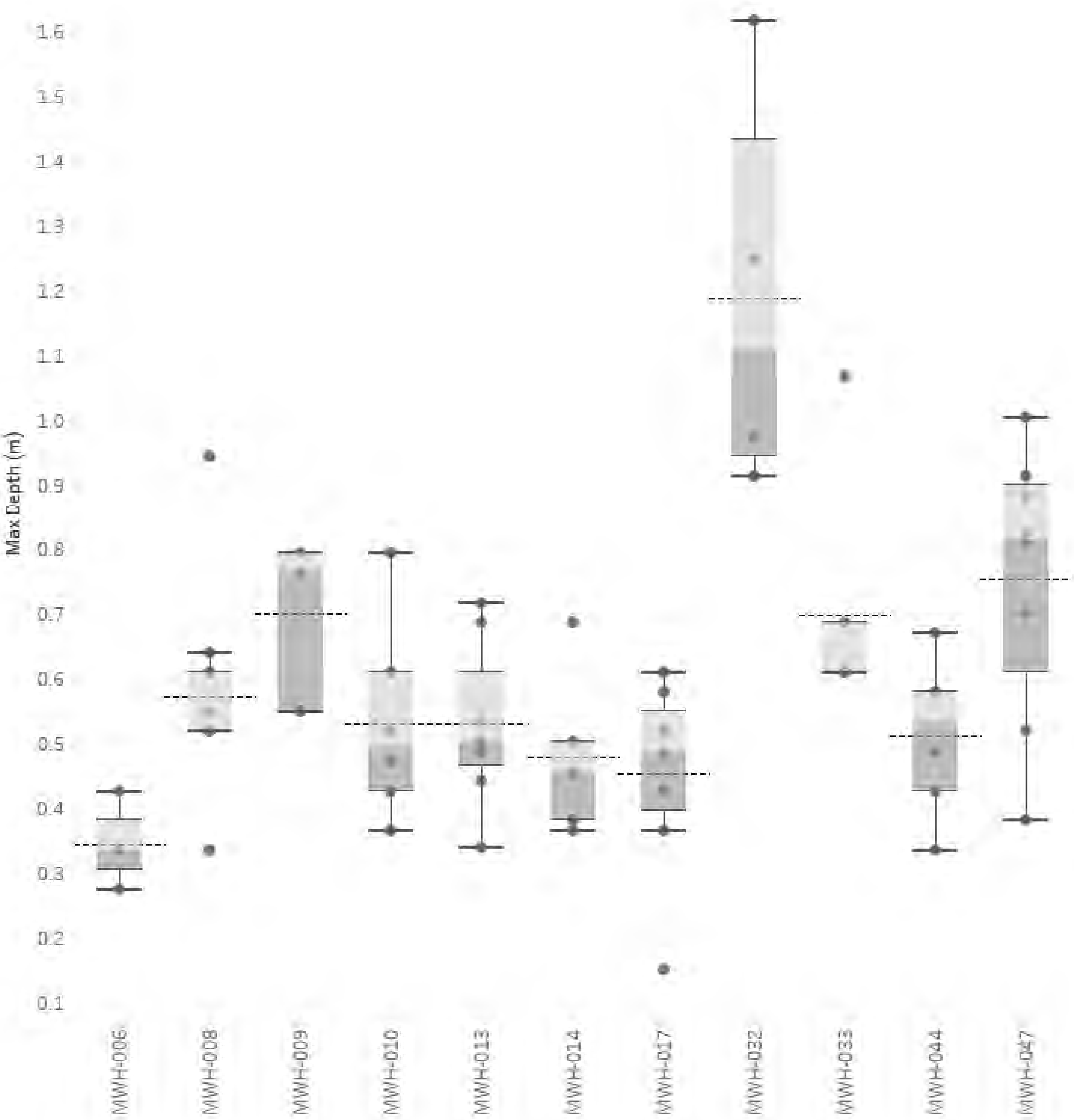
Notes:
Bank angle is measured in degrees
Dashed lines in each box plot indicate sample mean

Figure 1-13. Box and Whisker Plot of the Bank Angles for all Subwatersheds in 2015



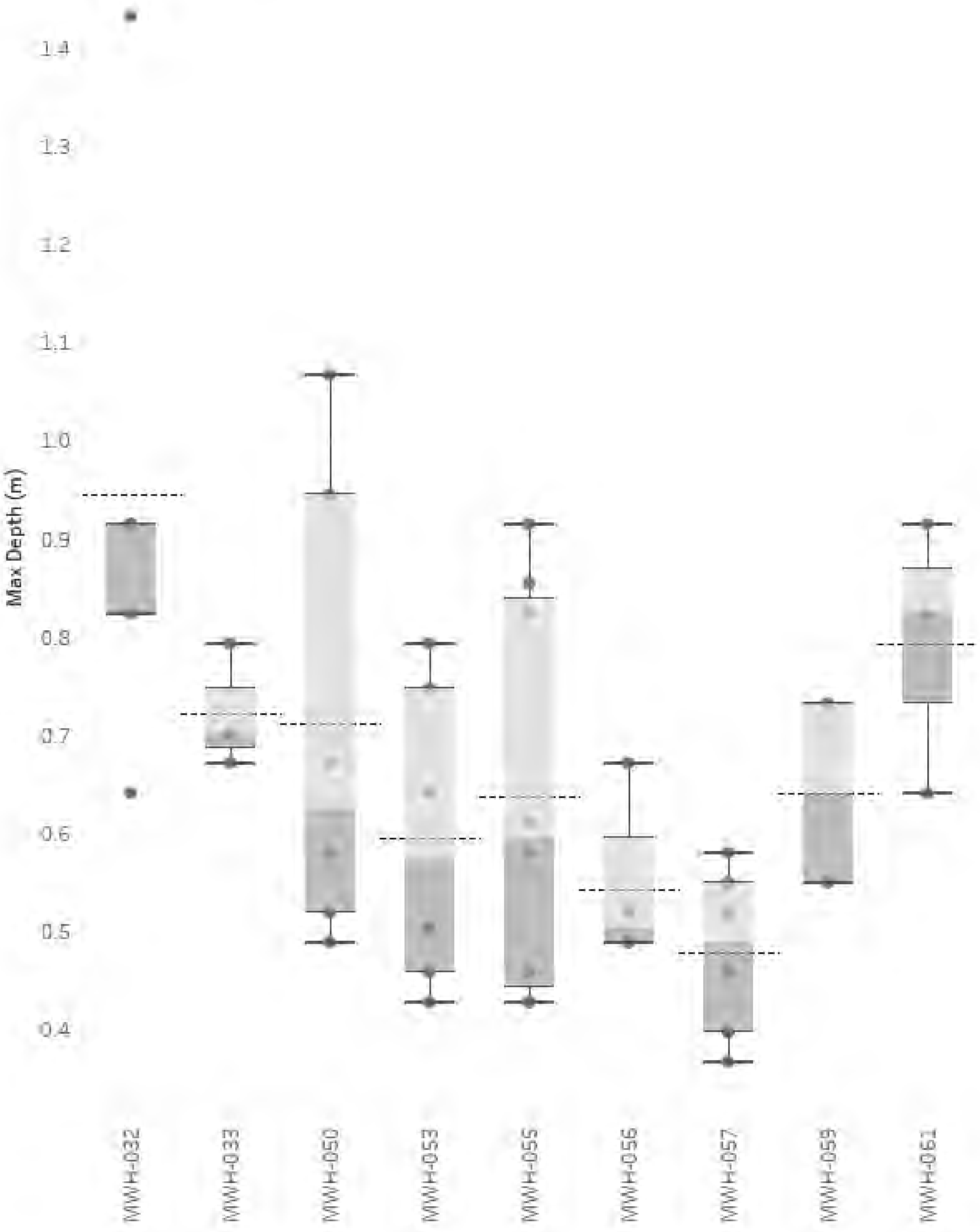
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-14. Box and Whisker Plot of the Maximum Pool Depths for all Survey Sites in 2012



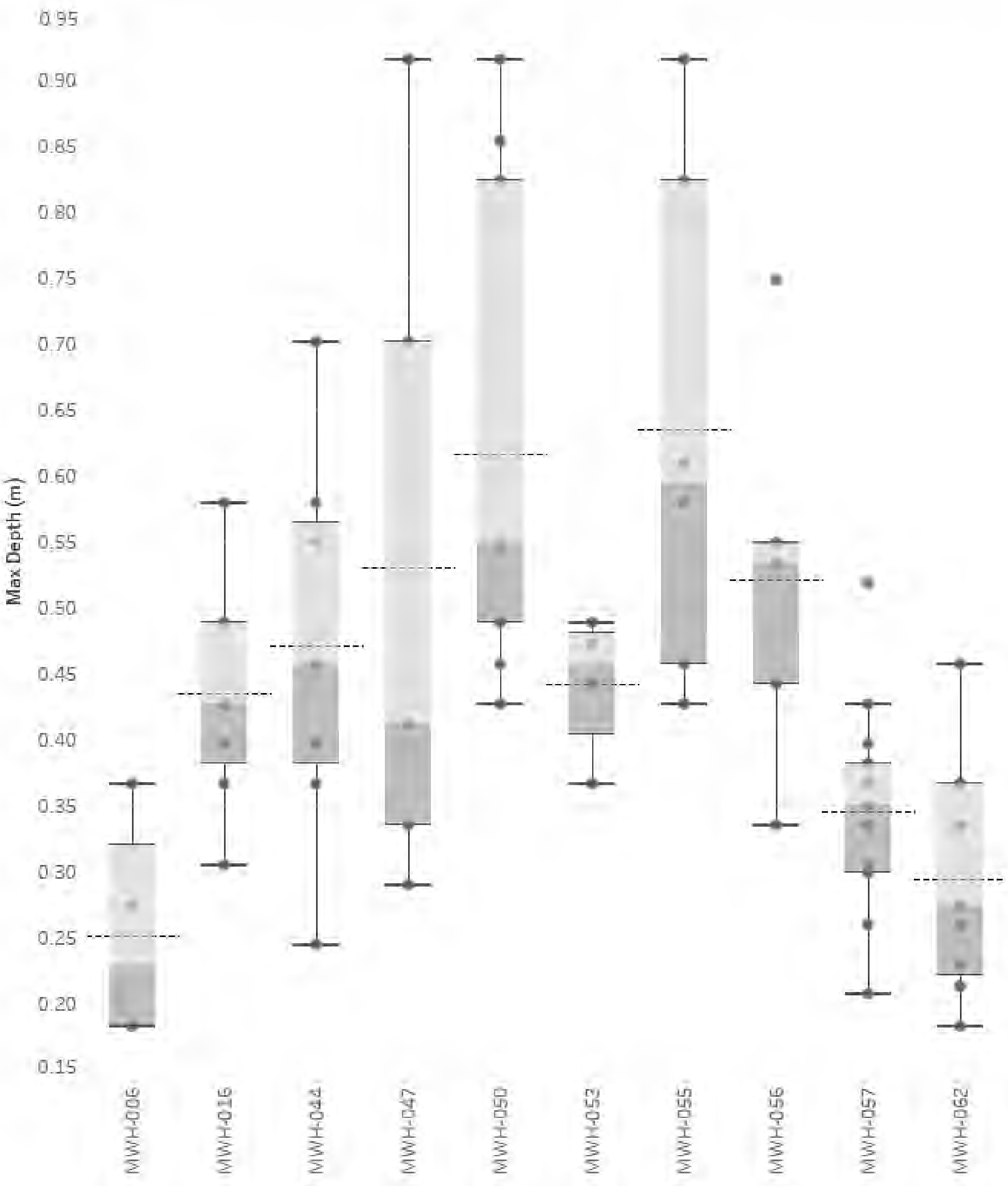
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-15. Box and Whisker Plot of the Maximum Pool Depths for all Survey Sites in 2013



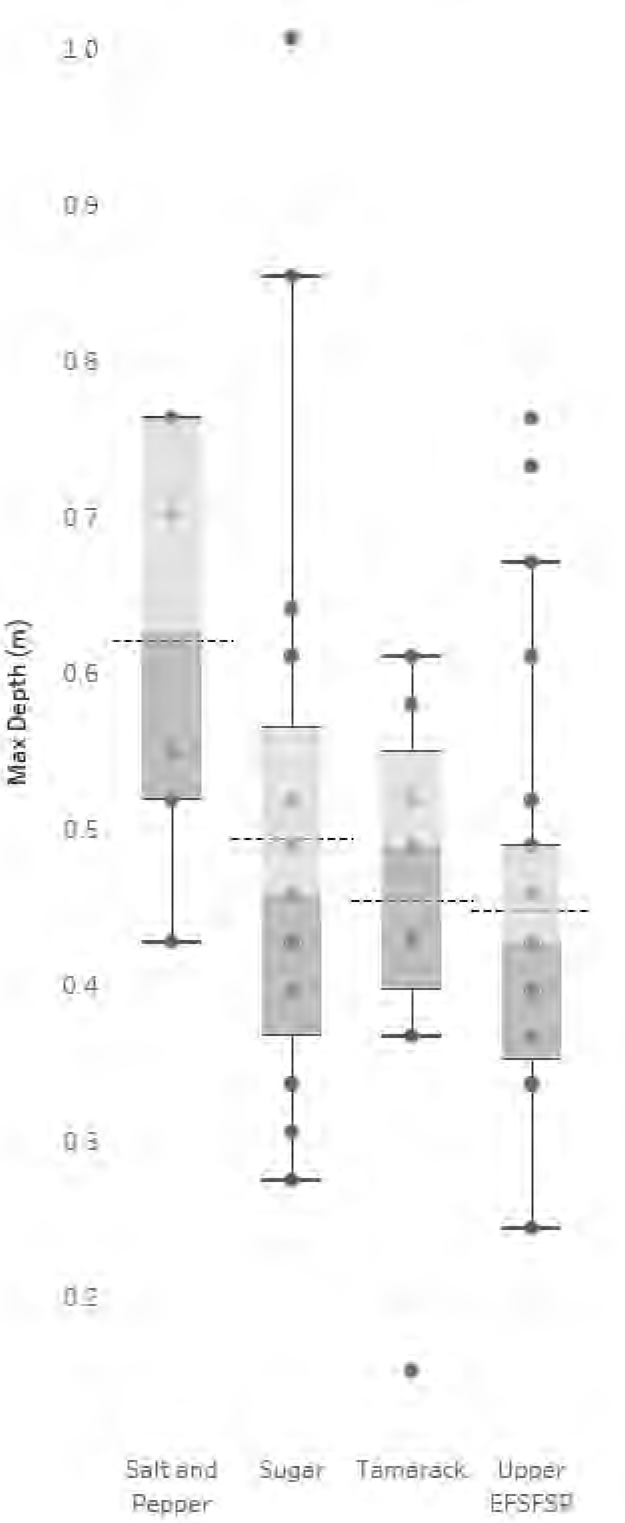
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-16. Box and Whisker Plot of the Maximum Pool Depths for all Survey Sites in 2014



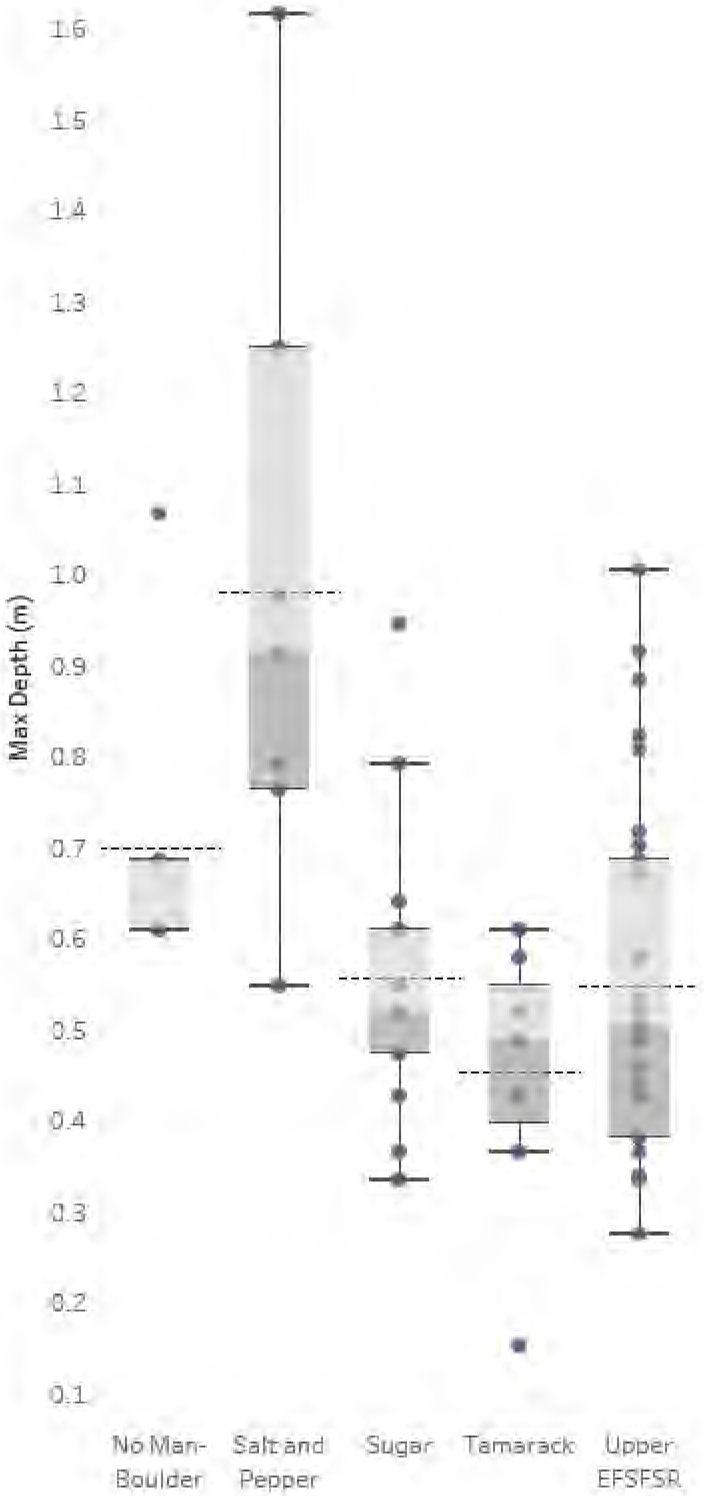
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-17. Box and Whisker Plot of the Maximum Pool Depths for all Survey Sites in 2015



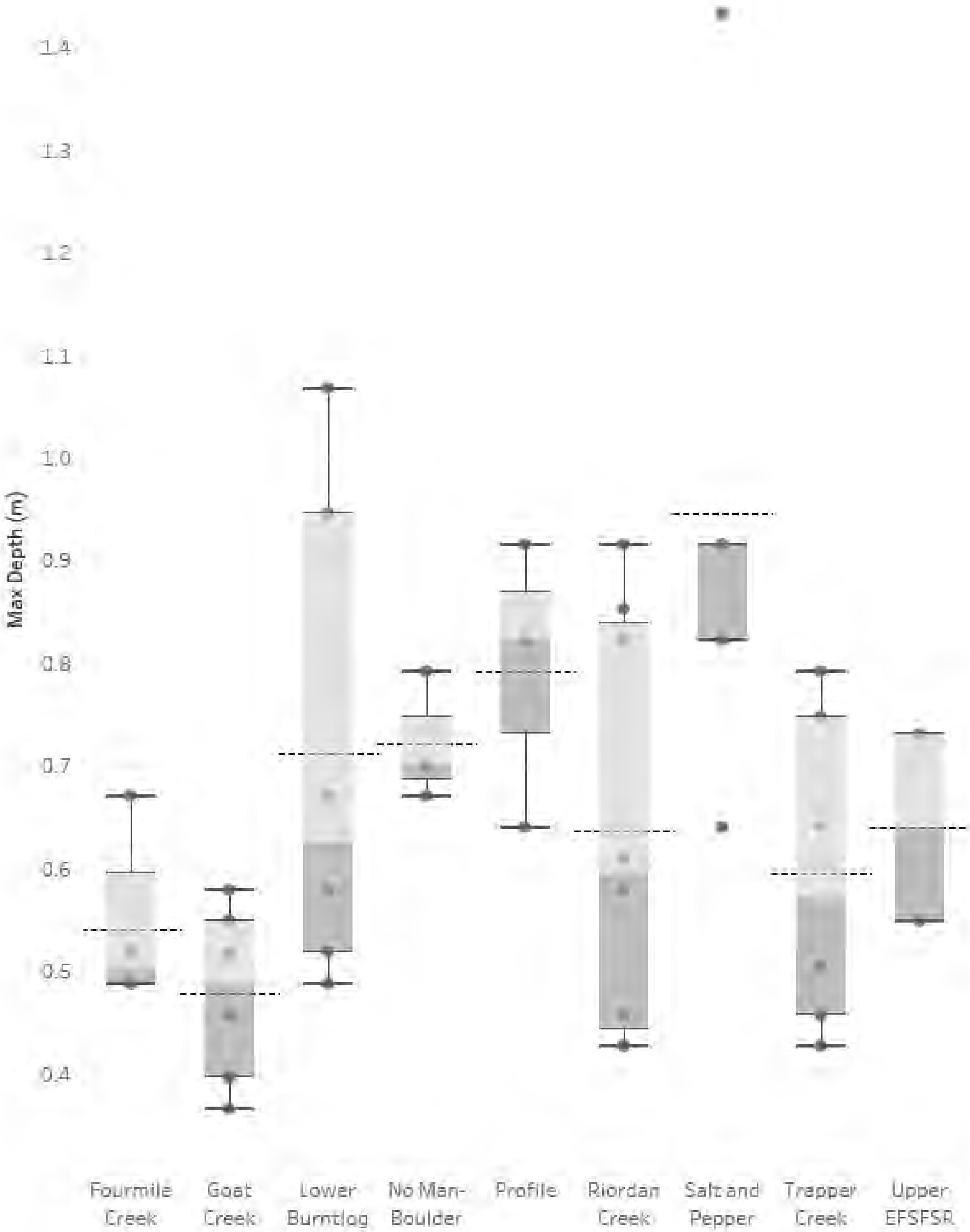
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-18. Box and Whisker Plot of the Maximum Pool Depths for all Subwatersheds in 2012



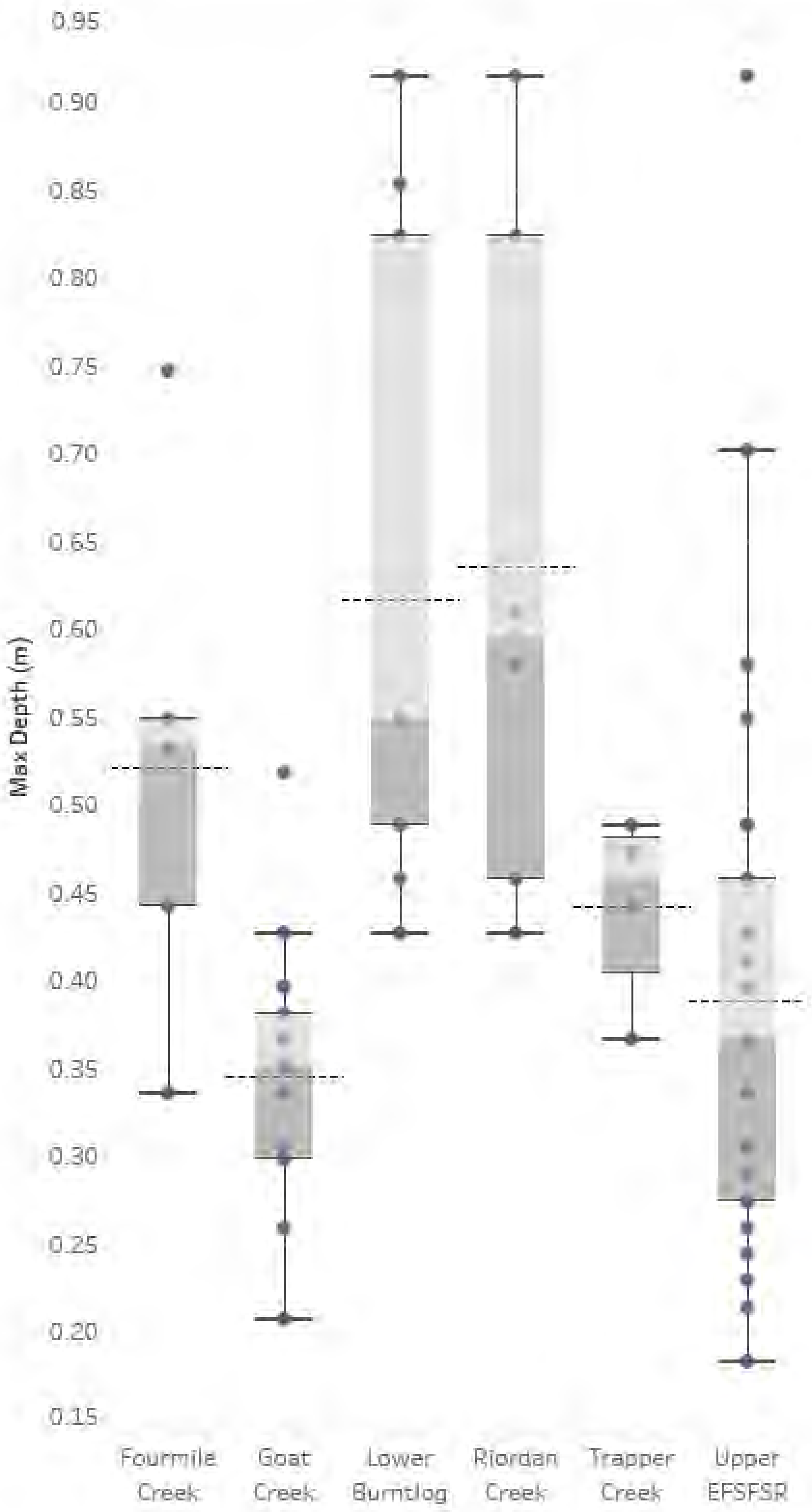
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-19. Box and Whisker Plot of the Maximum Pool Depths for all Subwatersheds in 2013



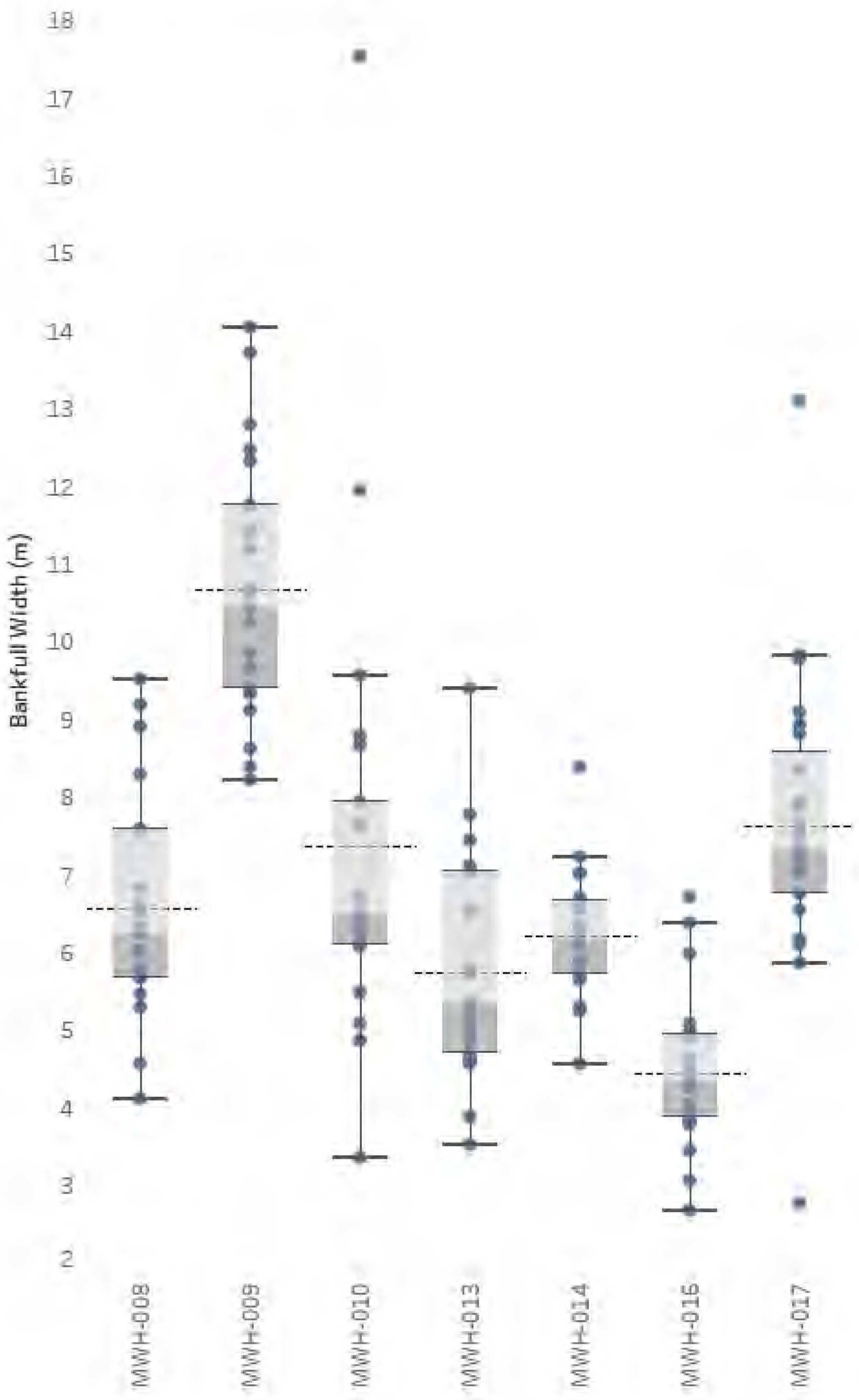
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-20. Box and Whisker Plot of the Maximum Pool Depths for all Subwatersheds in 2014



Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-21. Box and Whisker Plot of the Maximum Pool Depths for all Subwatersheds in 2015



Notes:
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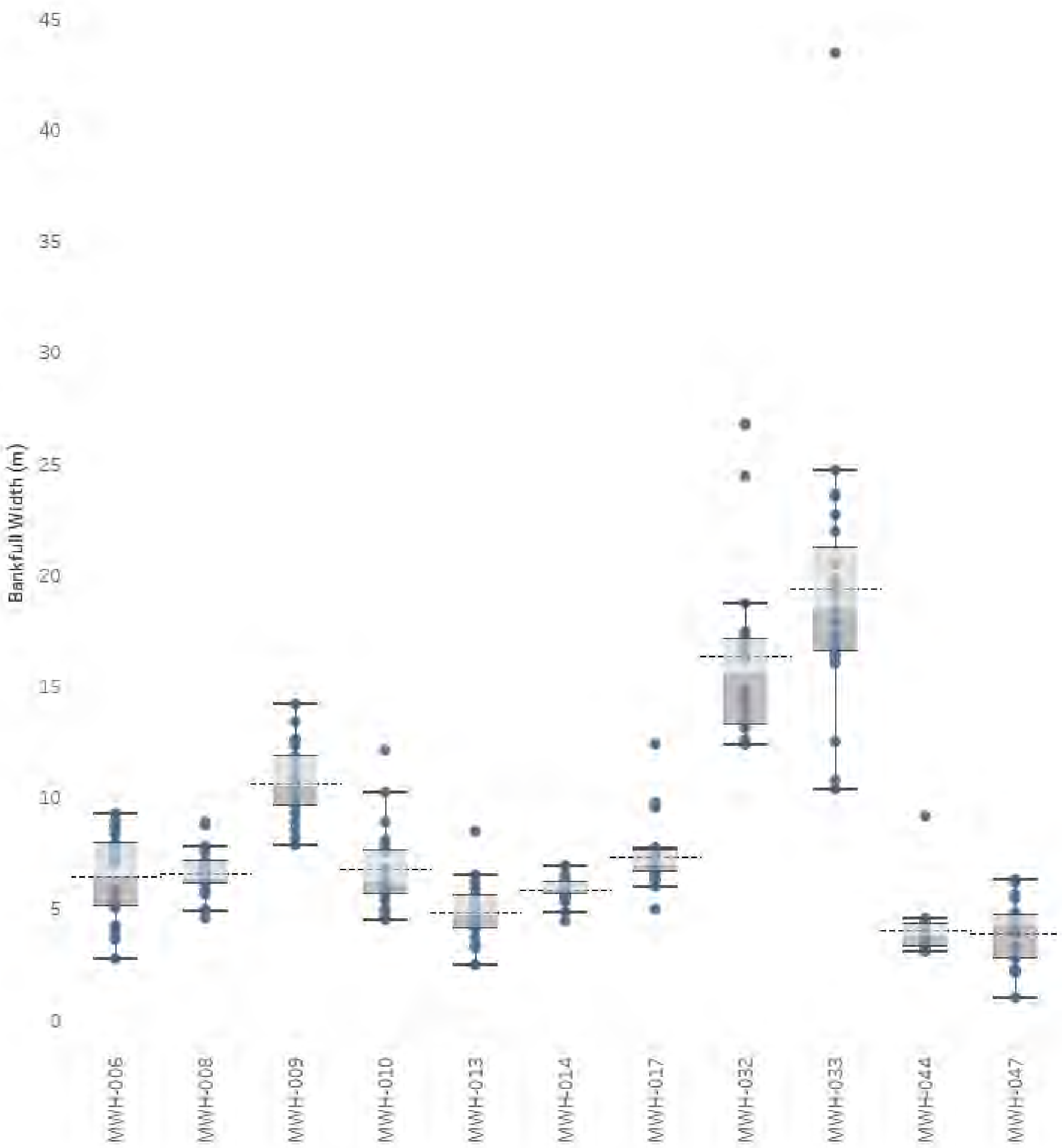
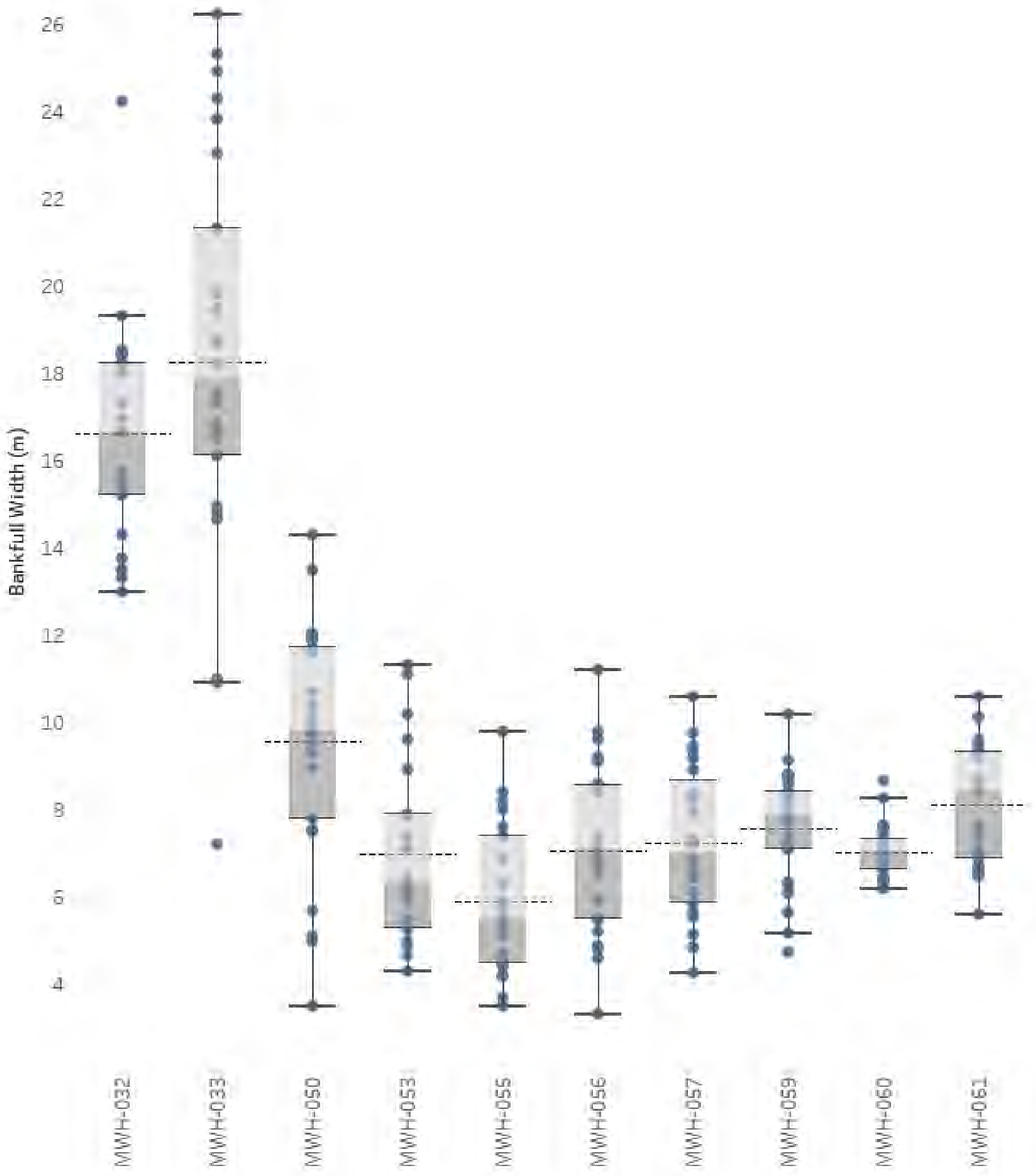
Figure 1-22. Box and Whisker Plot of the Bankfull Widths for all Survey Sites in 2012



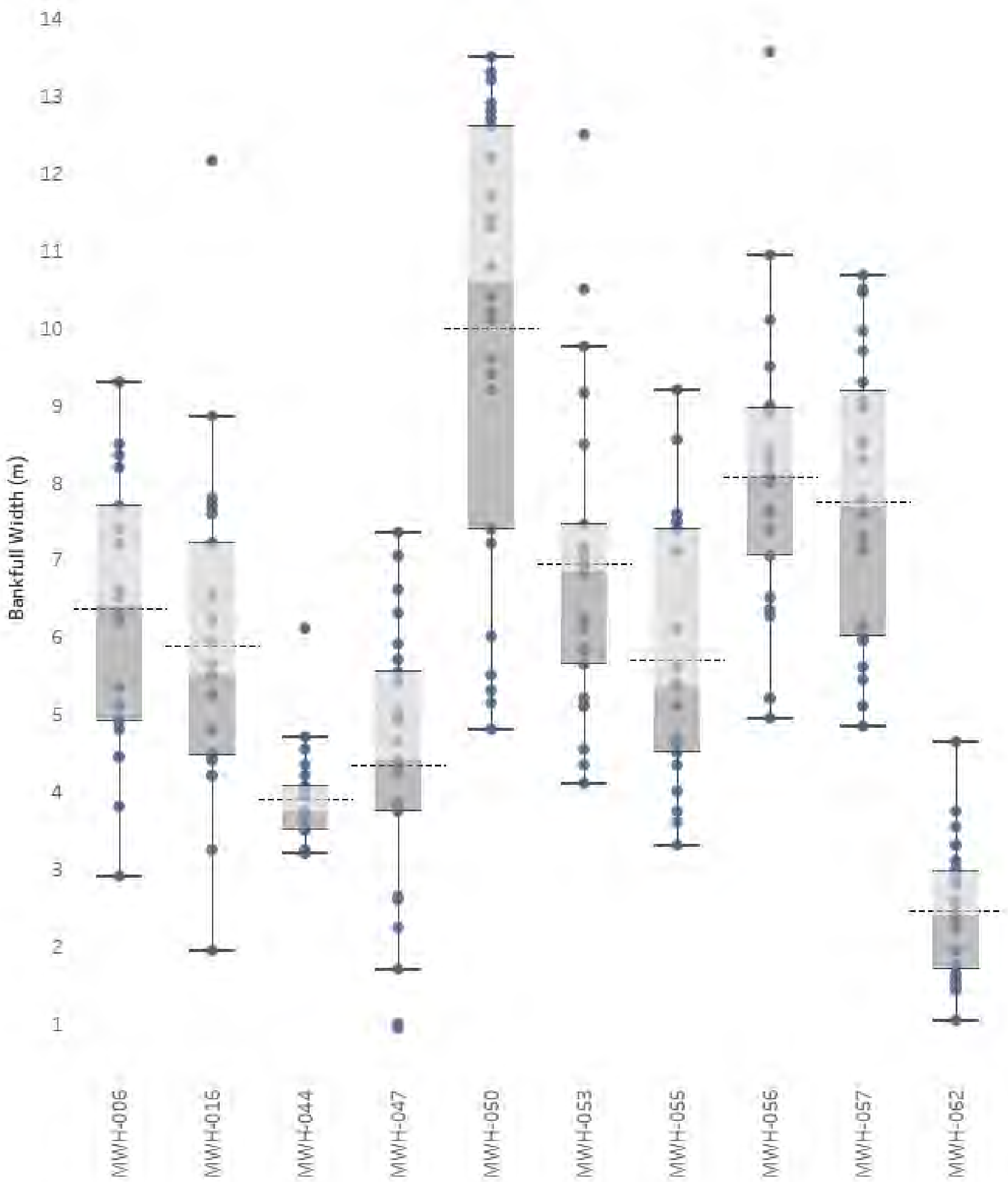
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-23. Box and Whisker Plot of the Bankfull Widths for all Survey Sites in 2013



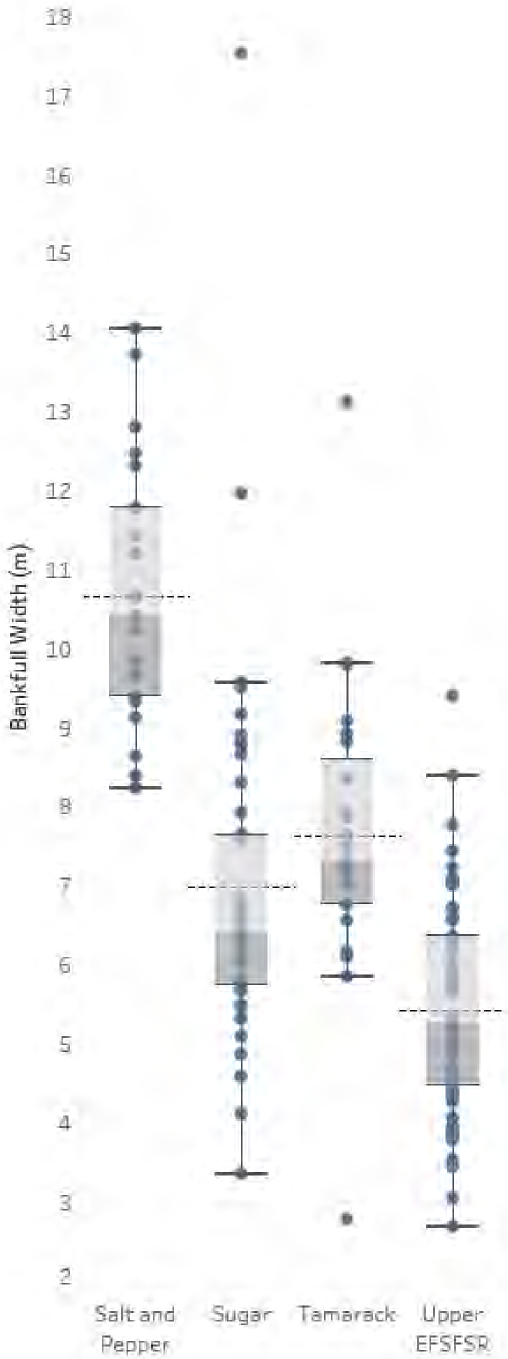
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-24. Box and Whisker Plot of the Bankfull Widths for all Survey Sites in 2014



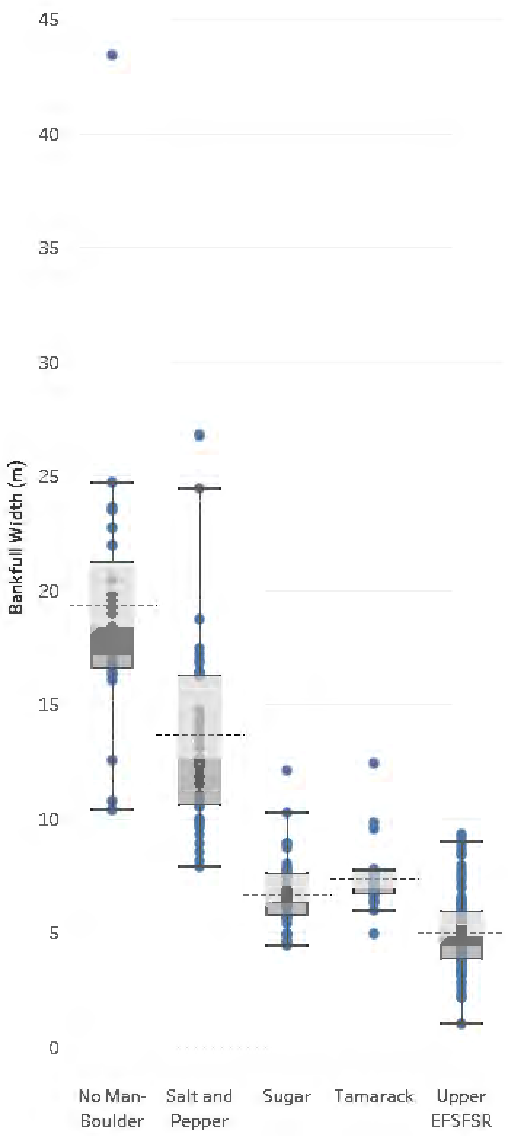
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-25. Box and Whisker Plot of the Bankfull Widths for all Survey Sites in 2015



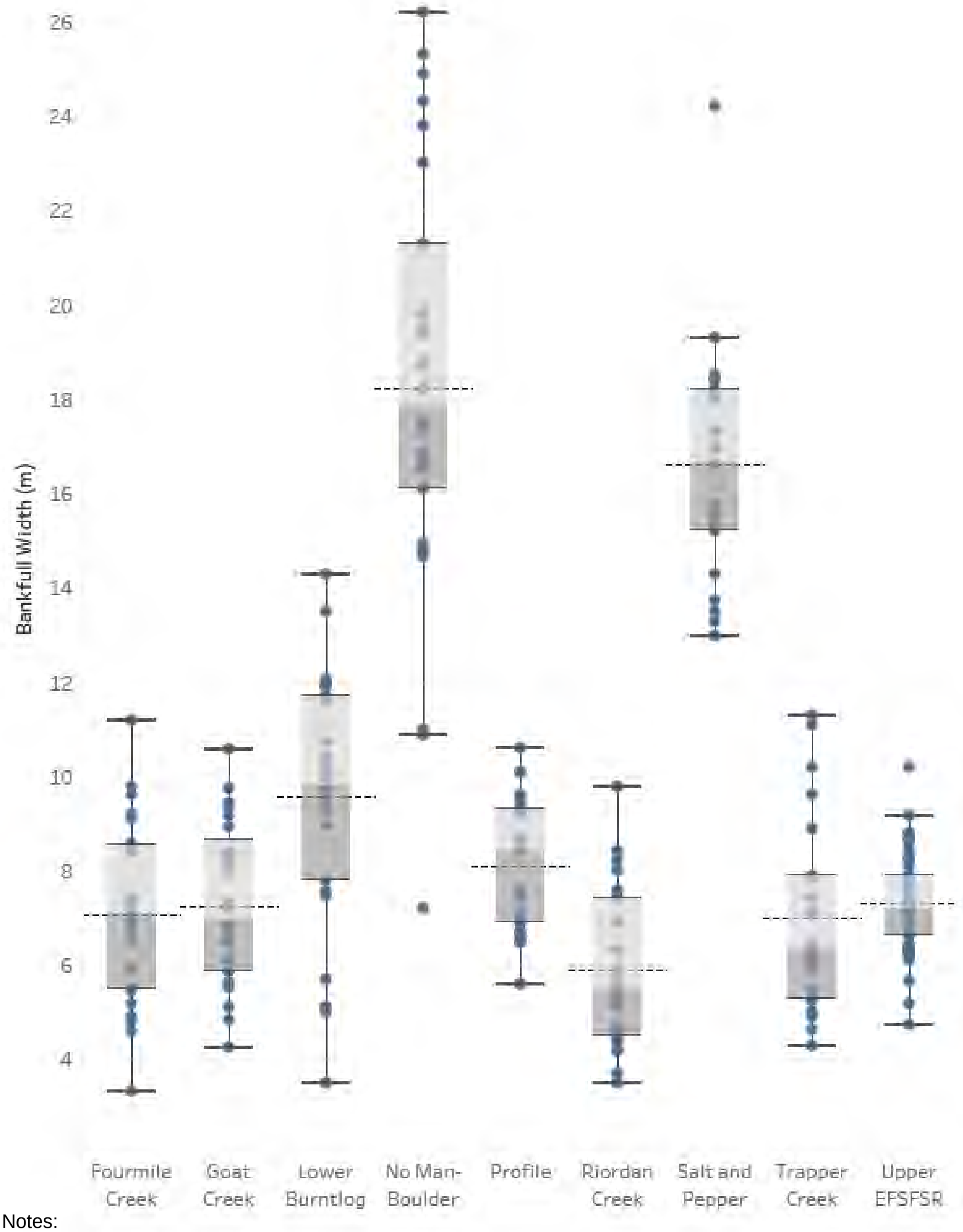
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-26. Box and Whisker Plot of the Bankfull Widths for all Subwatersheds in 2012



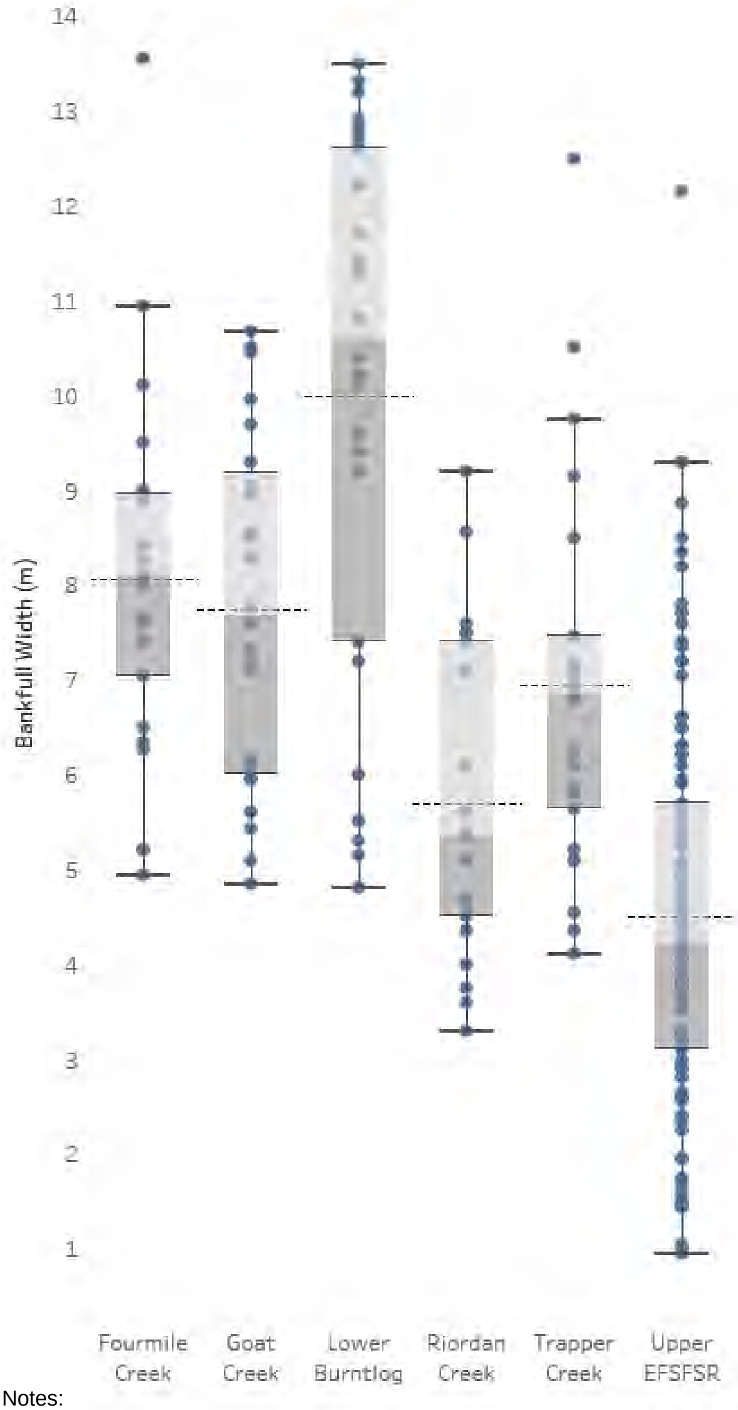
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-27. Box and Whisker Plot of the Bankfull Widths for all Subwatersheds in 2013



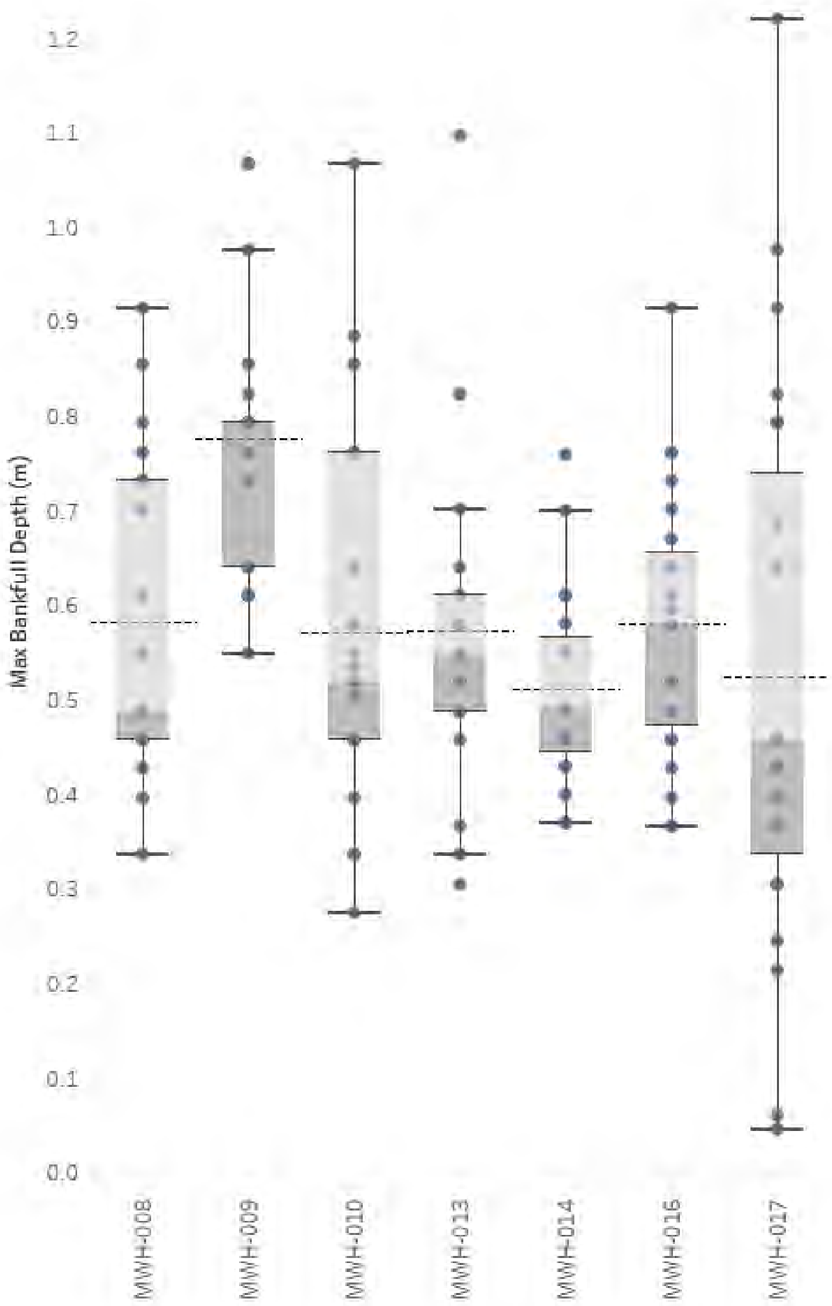
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-28. Box and Whisker Plot of the Bankfull Widths for all Subwatersheds in 2014



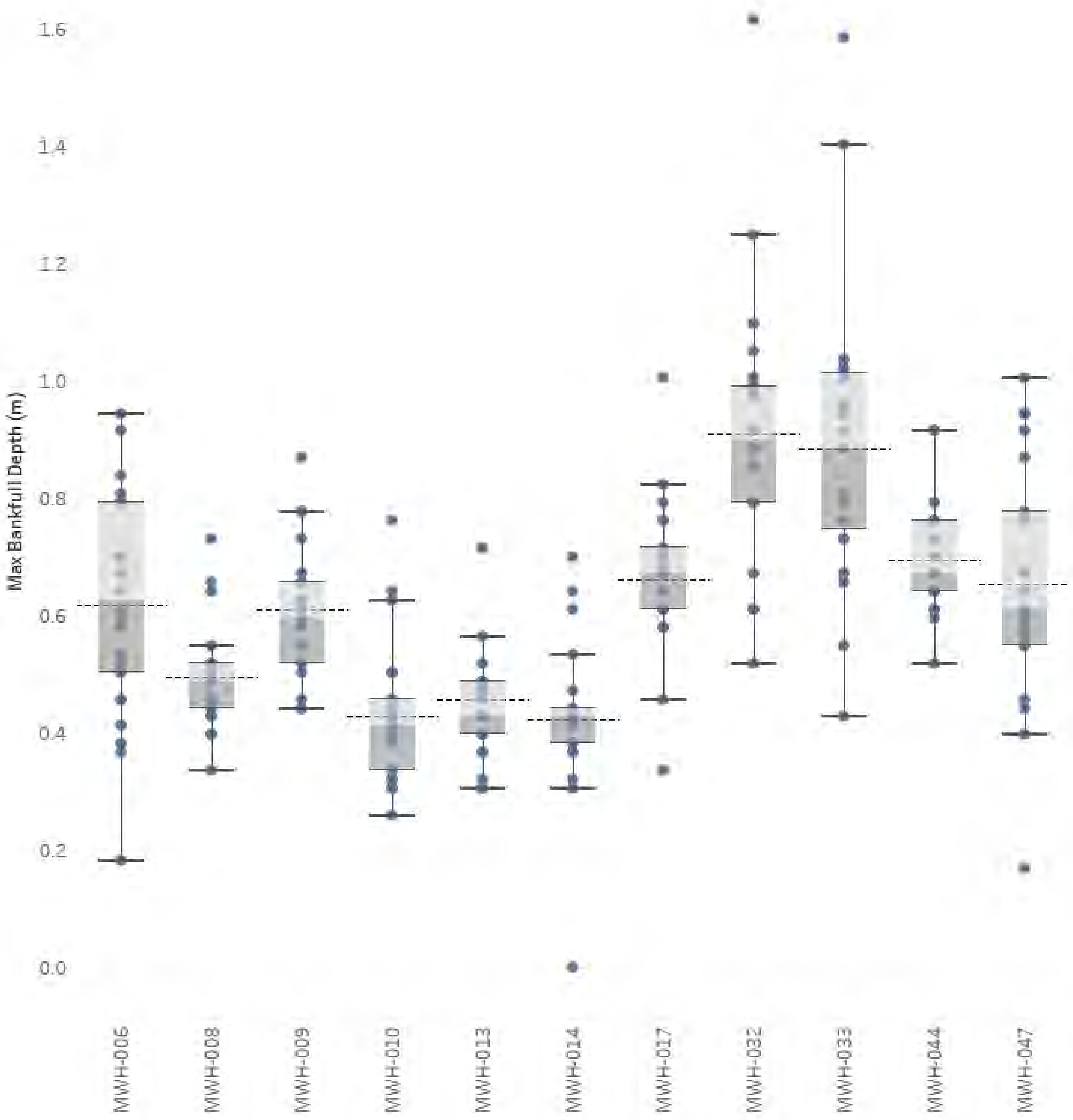
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-29. Box and Whisker Plot of the Bankfull Widths for all Subwatersheds in 2015



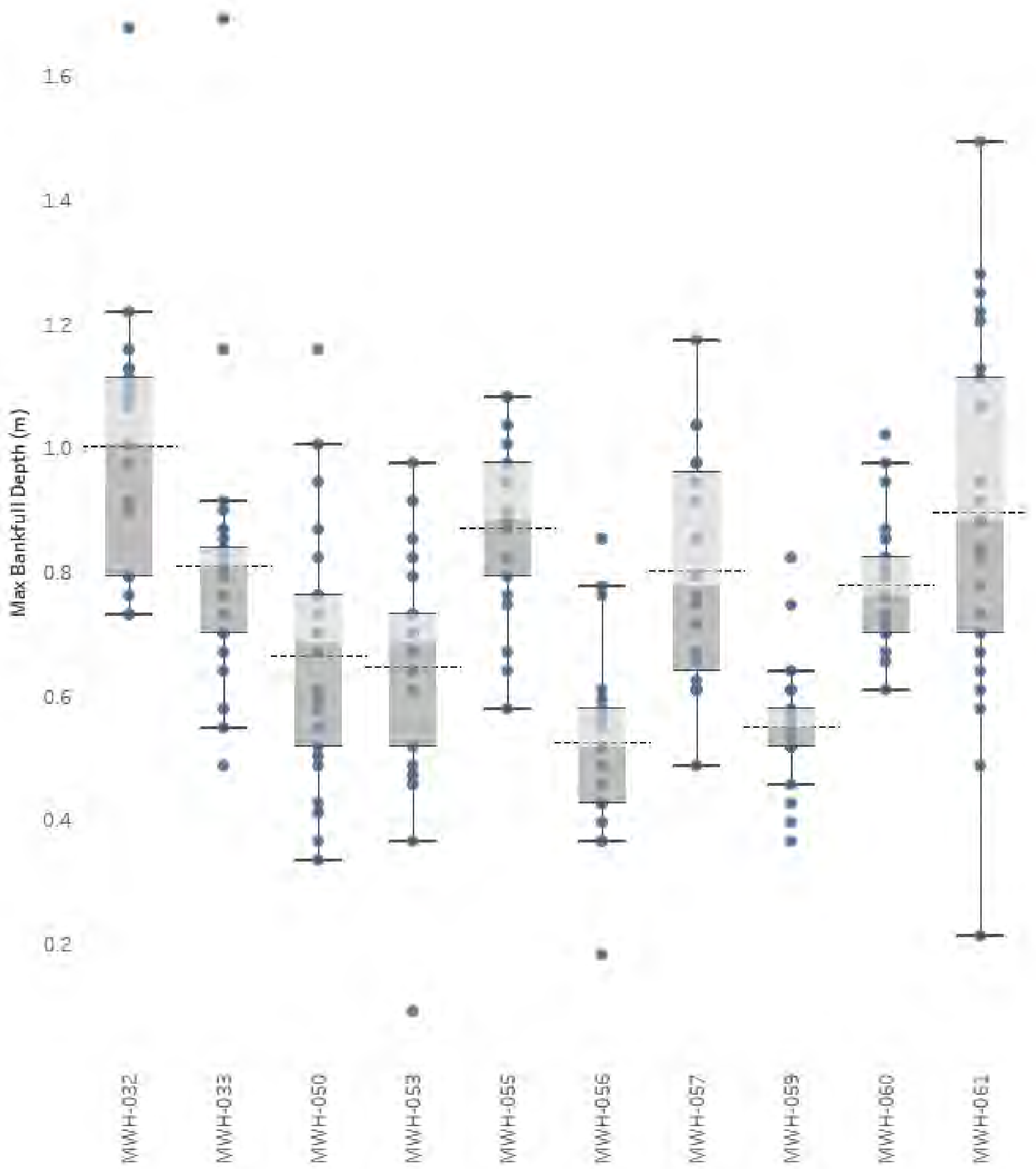
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-30. Box and Whisker Plot of the Maximum Bankfull Depths for all Survey Sites in 2012



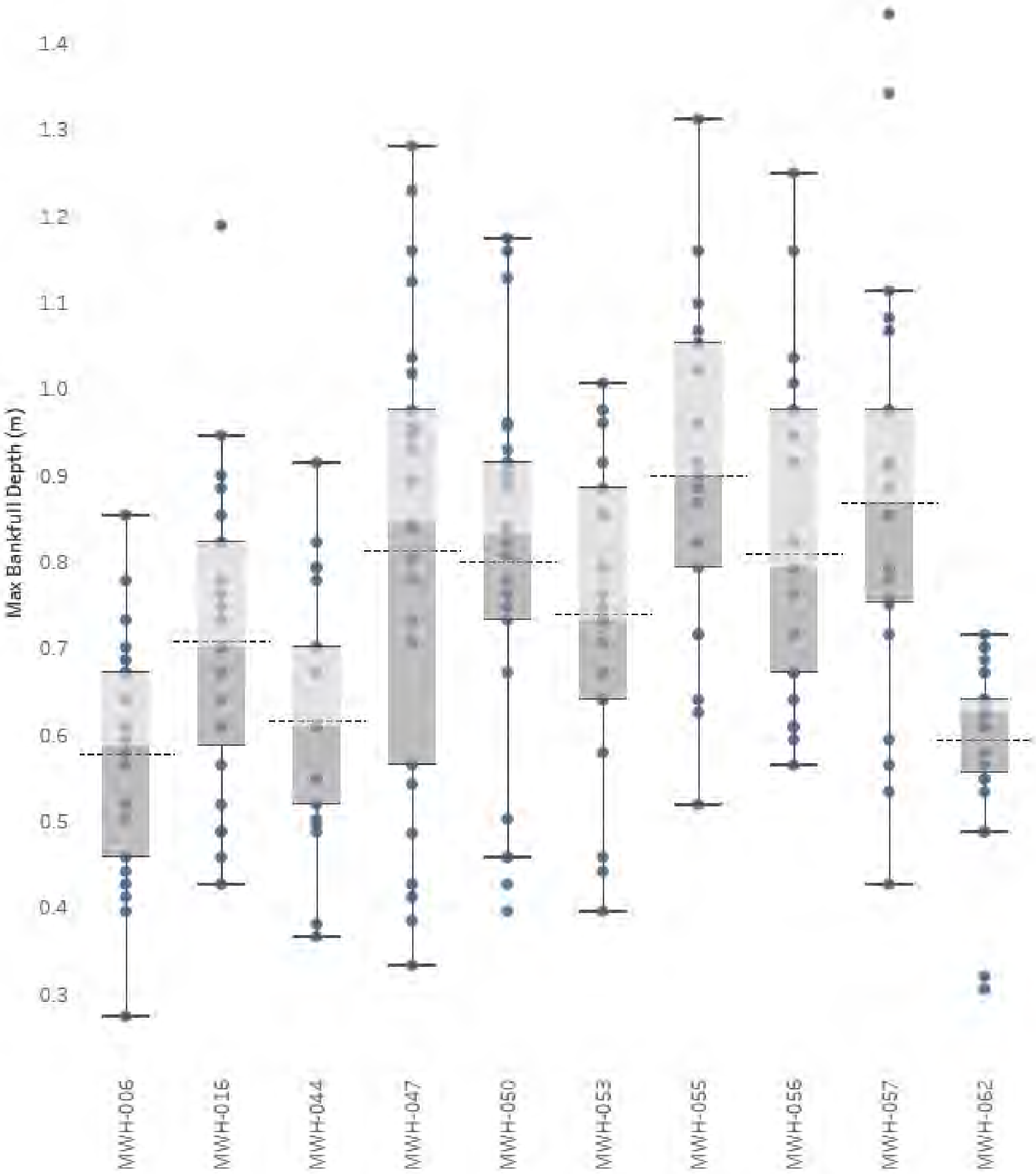
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-31. Box and Whisker Plot of the Maximum Bankfull Depths for all Survey Sites in 2013



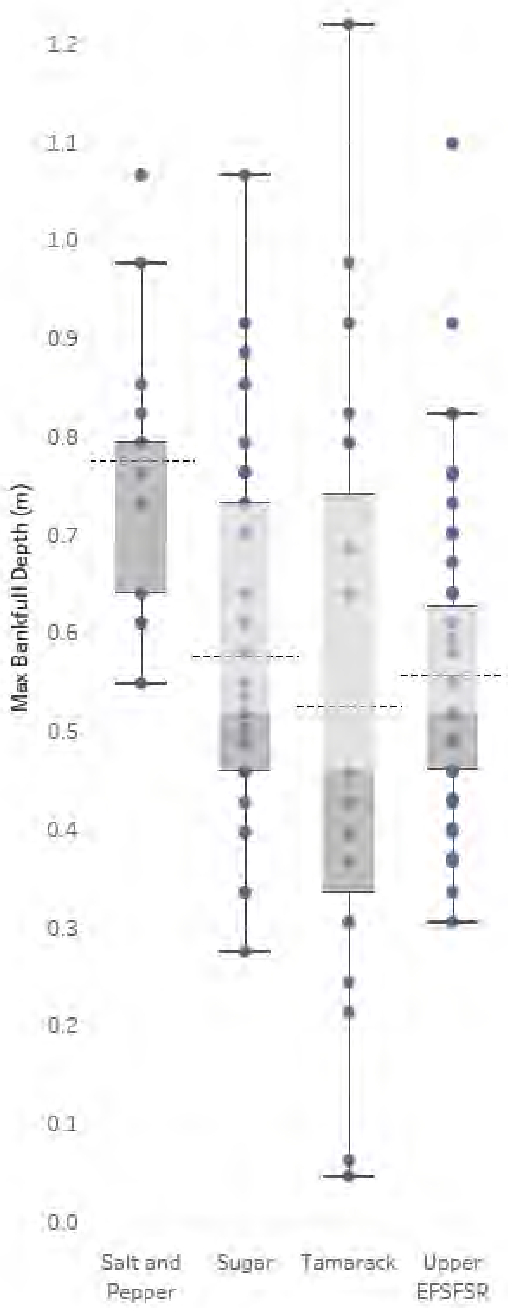
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-32. Box and Whisker Plot of the Maximum Bankfull Depths for all Survey Sites in 2014



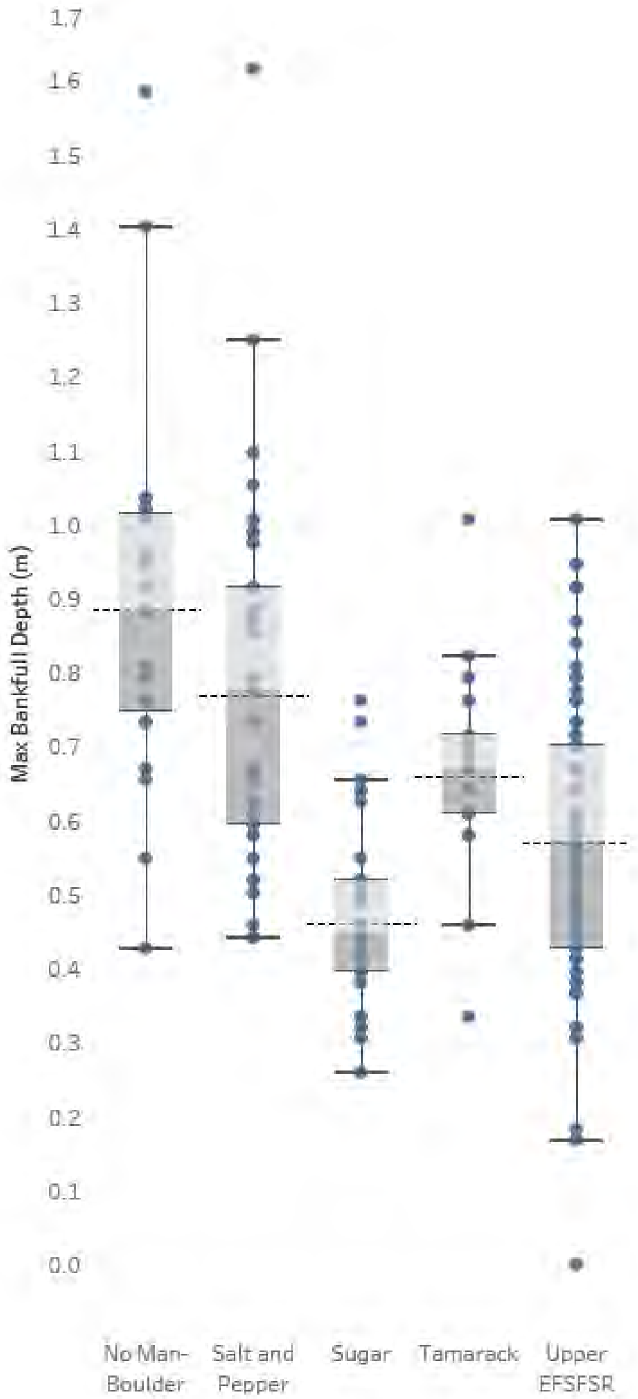
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-33. Box and Whisker Plot of the Maximum Bankfull Depths for all Survey Sites in 2015



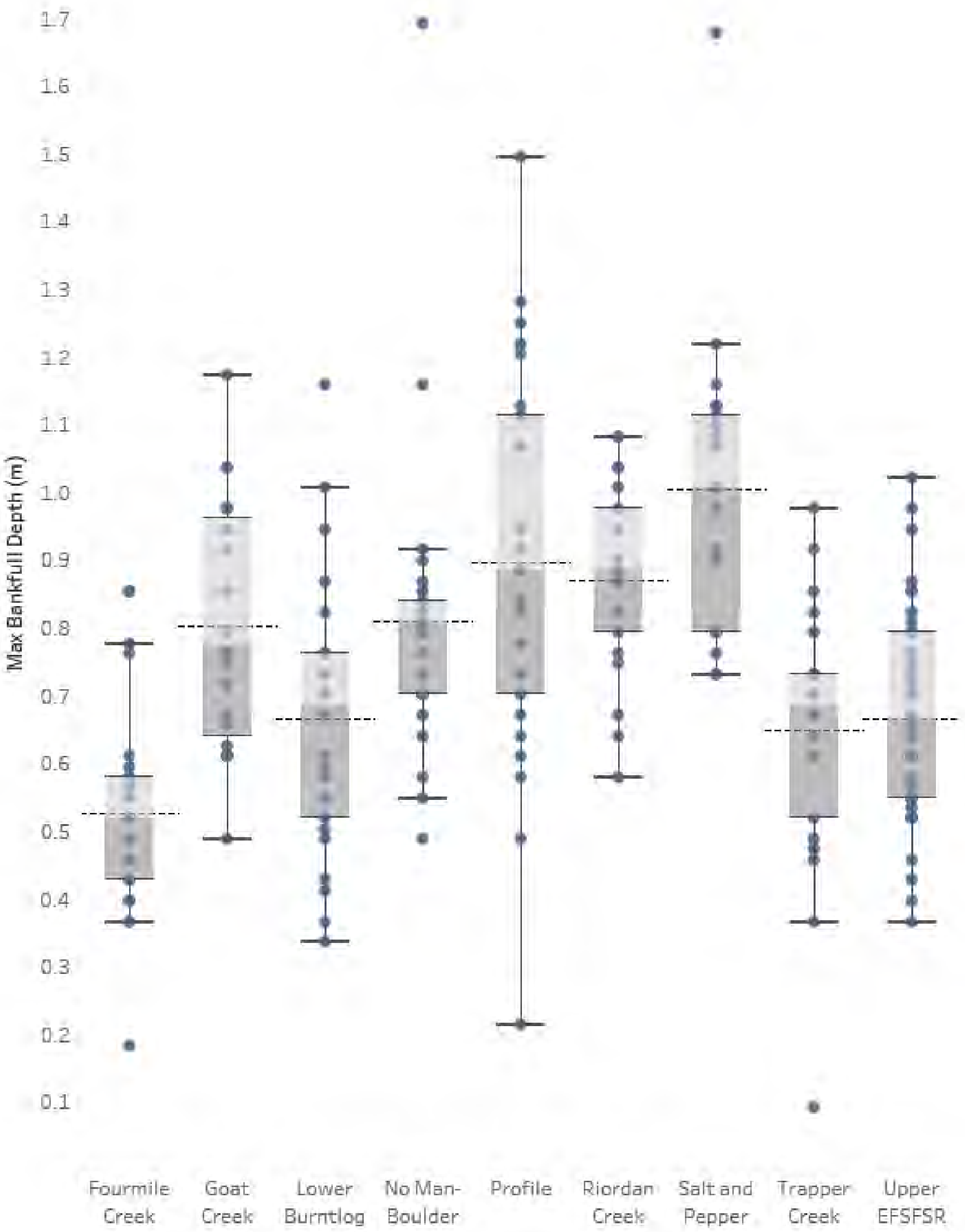
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-34. Box and Whisker Plot of the Maximum Bankfull Depths for all Subwatersheds in 2012



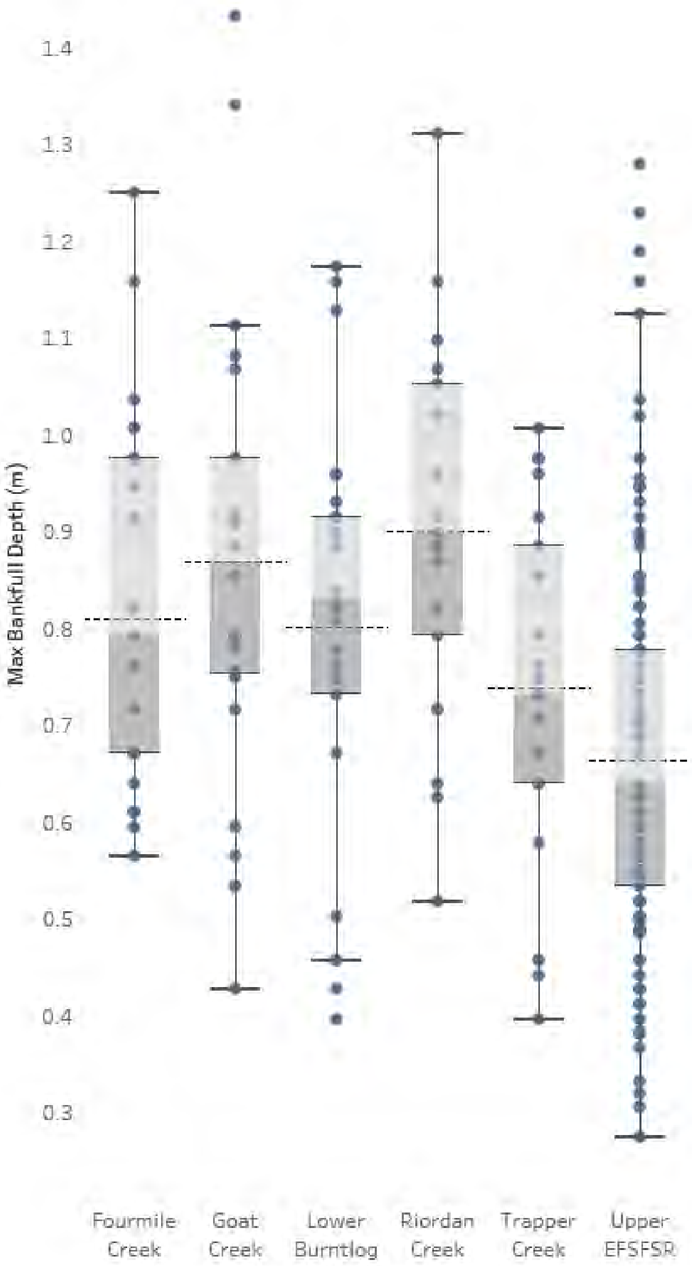
Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-35. Box and Whisker Plot of the Maximum Bankfull Depths for all Subwatersheds in 2013



Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-36. Box and Whisker Plot of the Maximum Bankfull Depths for all Subwatersheds in 2014

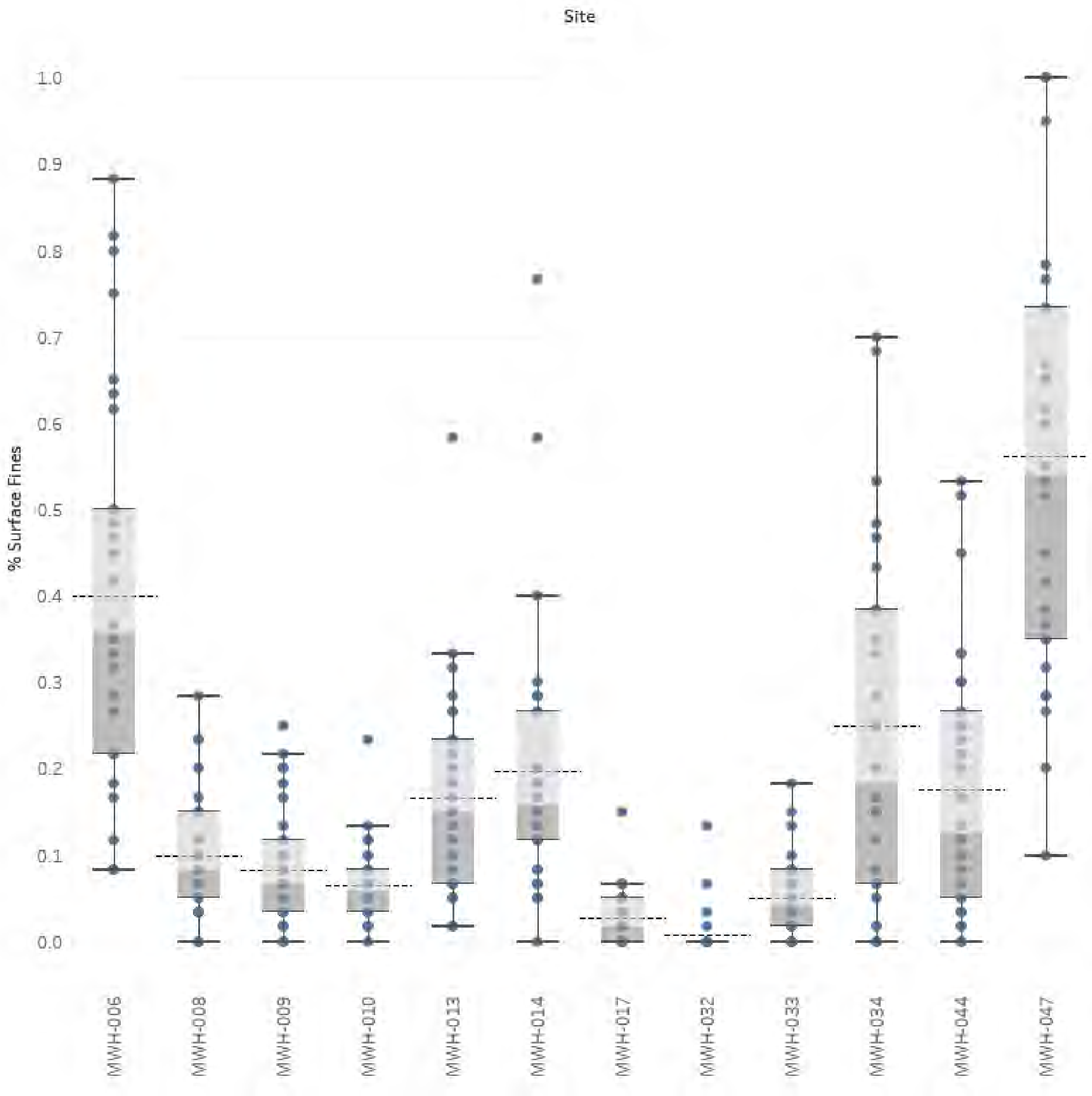


Notes:
Dashed lines in each box plot indicate sample mean

Figure 1-37. Box and Whisker Plot of the Maximum Bankfull Depths for all Subwatersheds in 2015

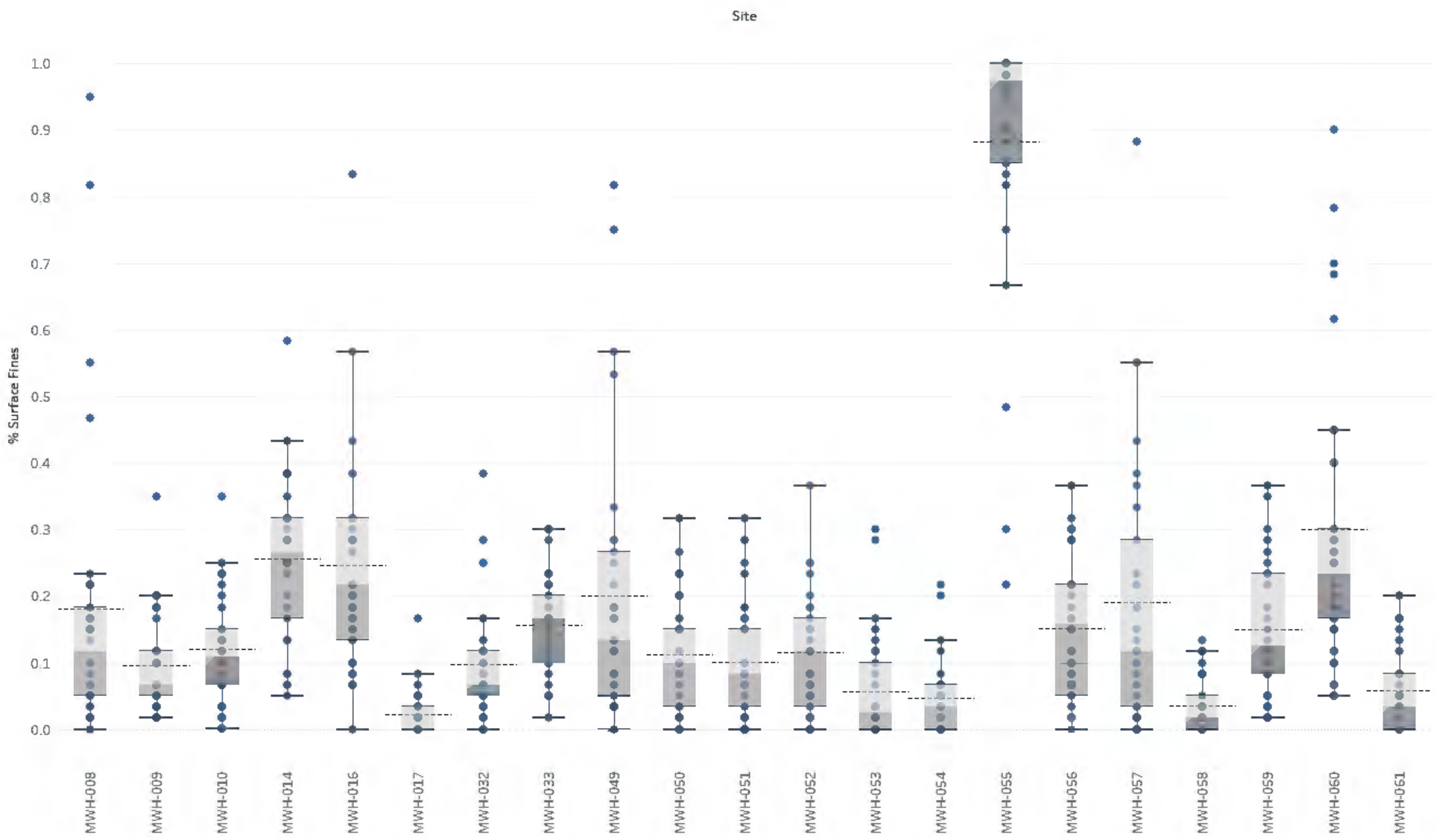
1.2 Free Matrix and Surface Fines Plots

Figure 1-38 through **Figure 1-53** are box and whisker plots showing free matrix and surface fines results for all sites and subwatersheds. Free matrix measures the amount of loose substrate and surface fine sediment.



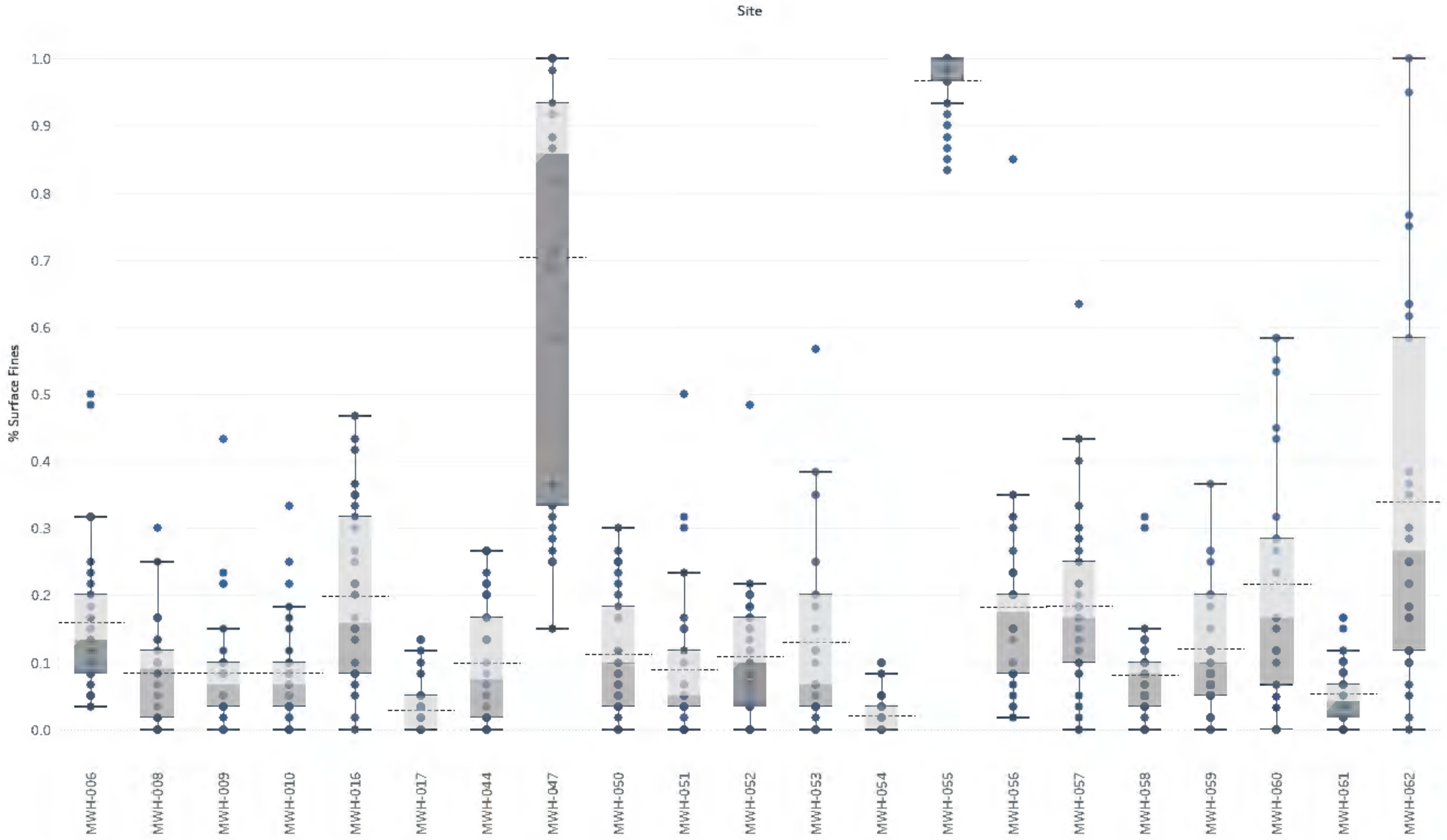
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-38. Box and Whisker Plot of the Percent Fines for all Sites in 2013



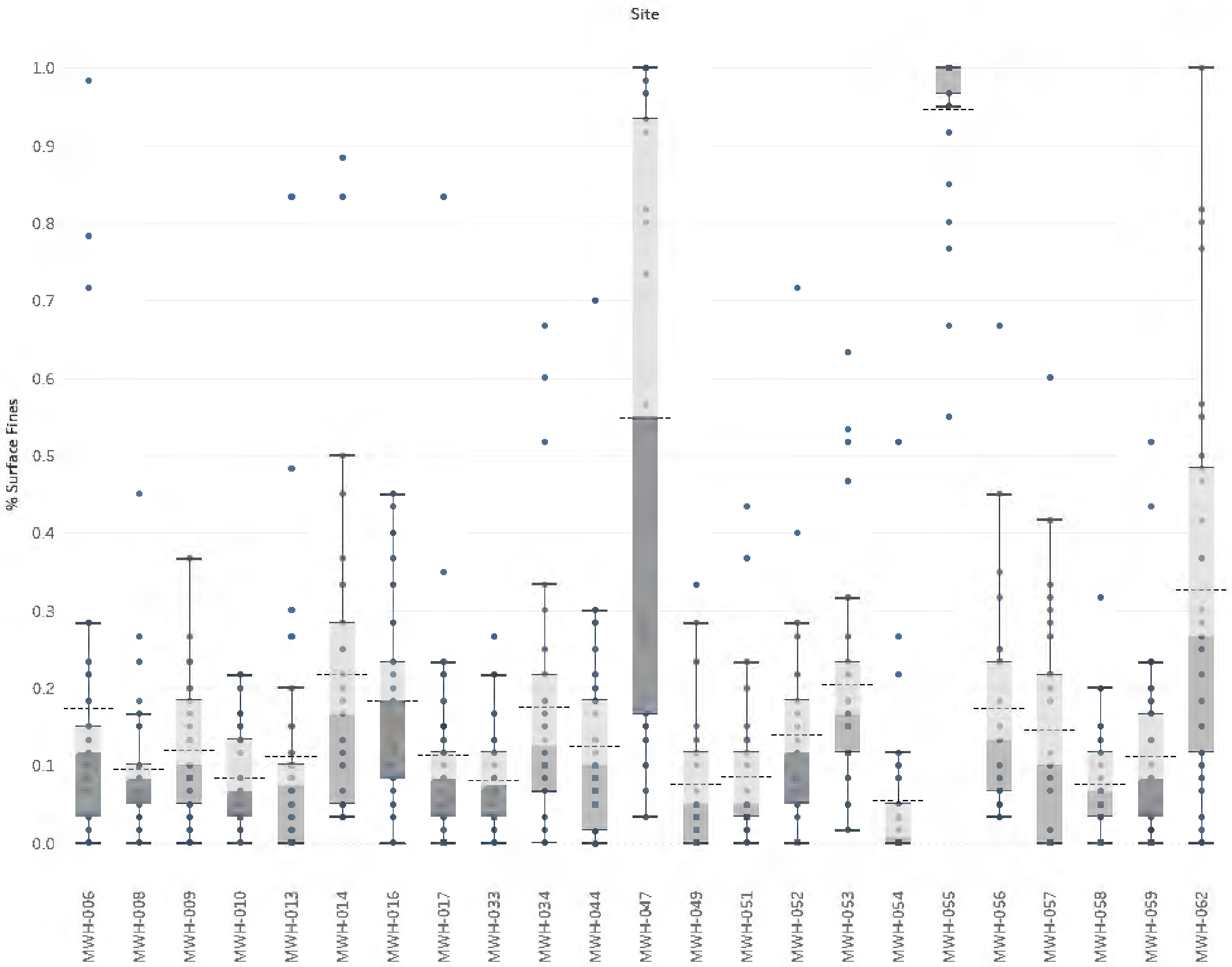
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-39. Box and Whisker Plot of the Percent Fines for all Sites in 2014



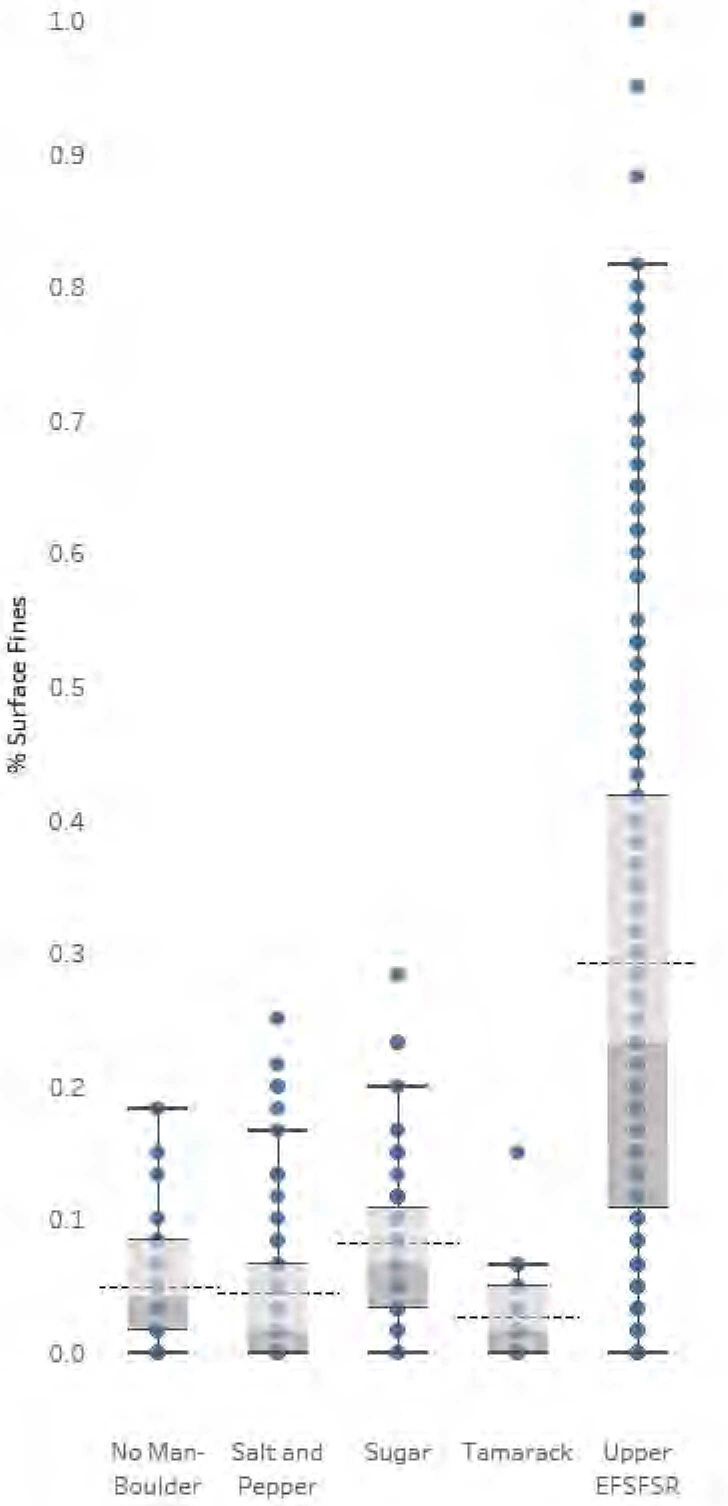
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-40. Box and Whisker Plot of the Percent Fines for all Sites in 2015



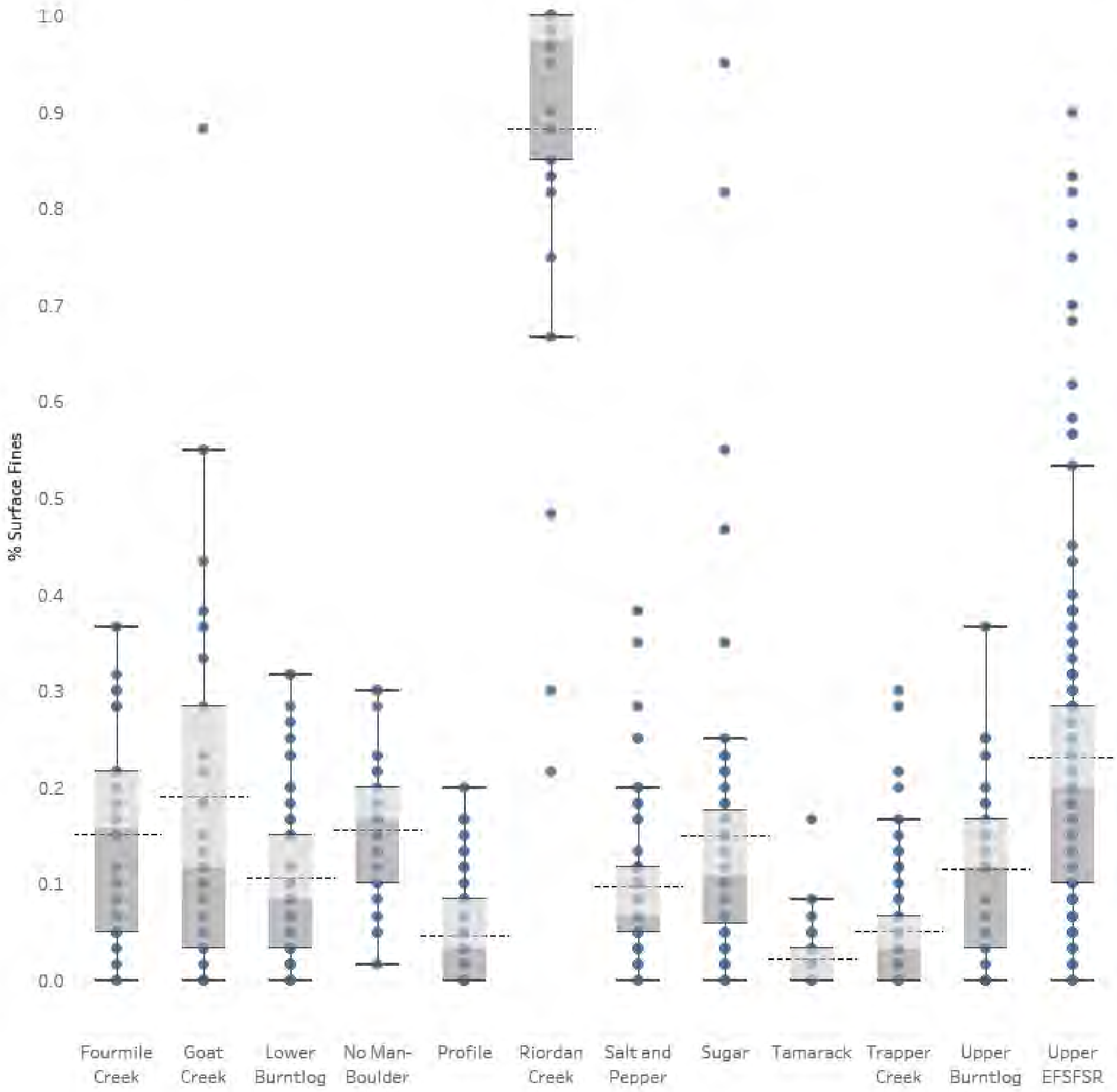
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-41. Box and Whisker Plot of the Percent Fines for all Sites in 2016



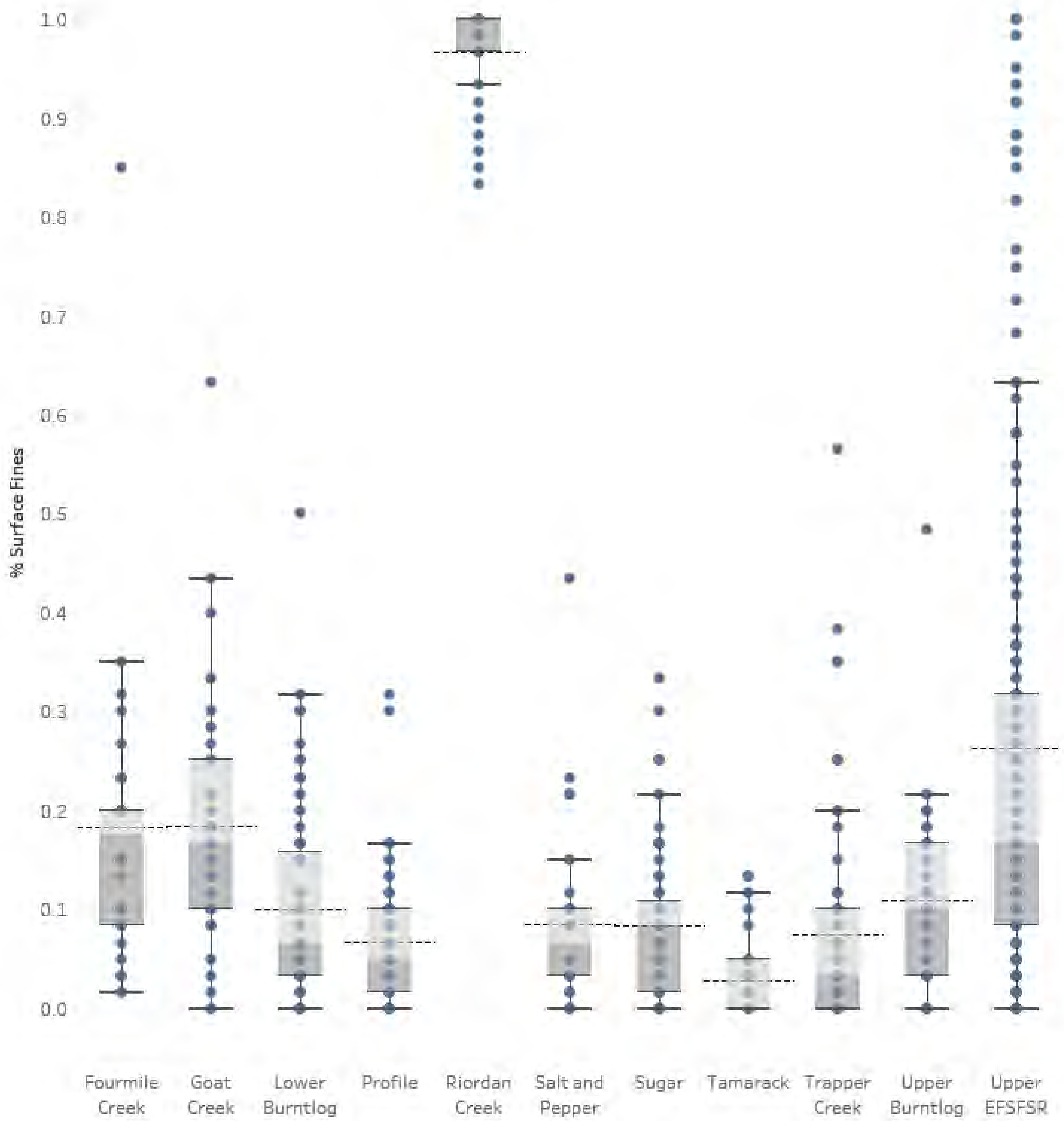
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-42. Box and Whisker Plot of the Percent Fines for all Subwatersheds in 2013



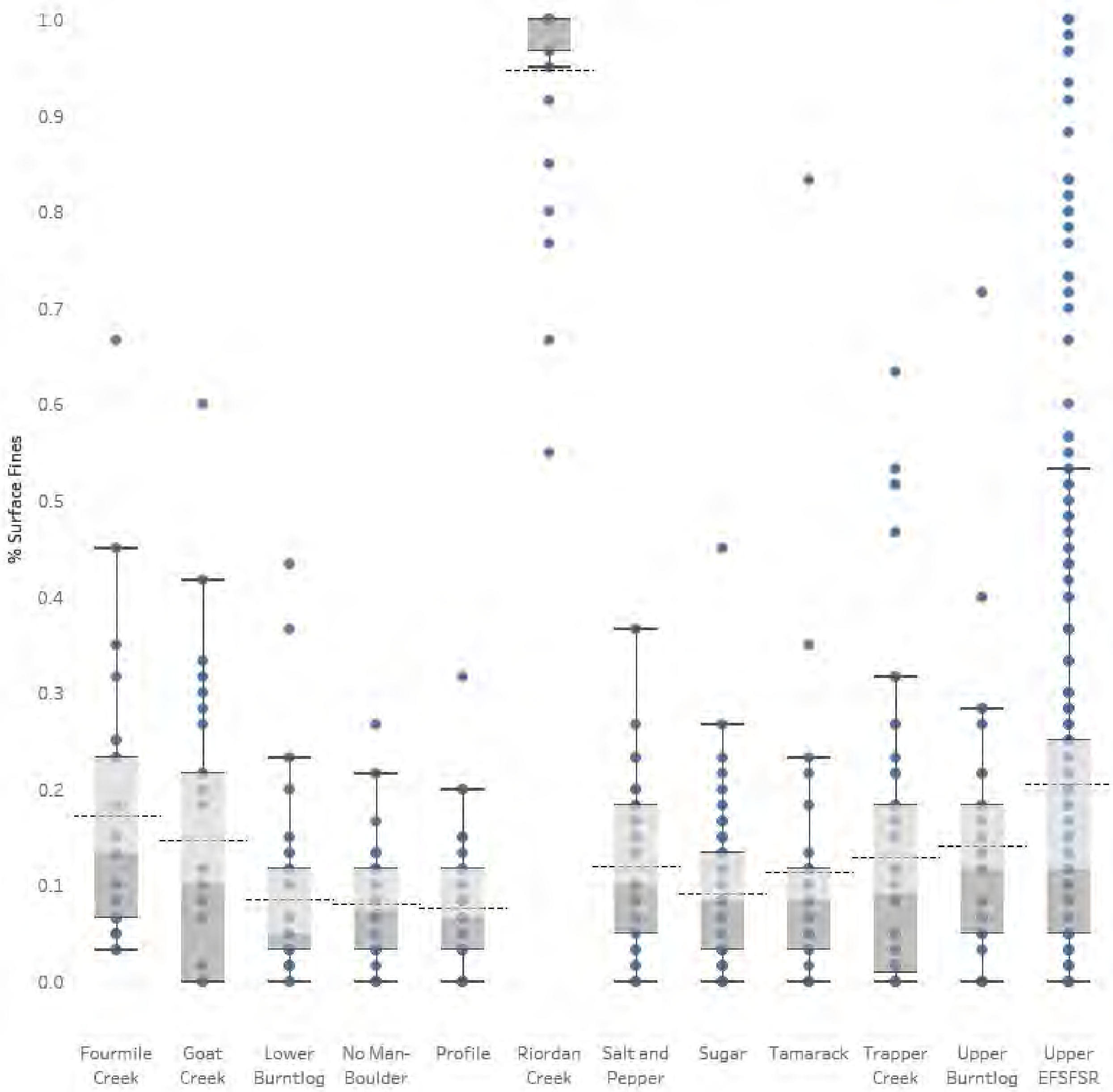
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-43. Box and Whisker Plot of the Percent Fines for all Subwatersheds in 2014



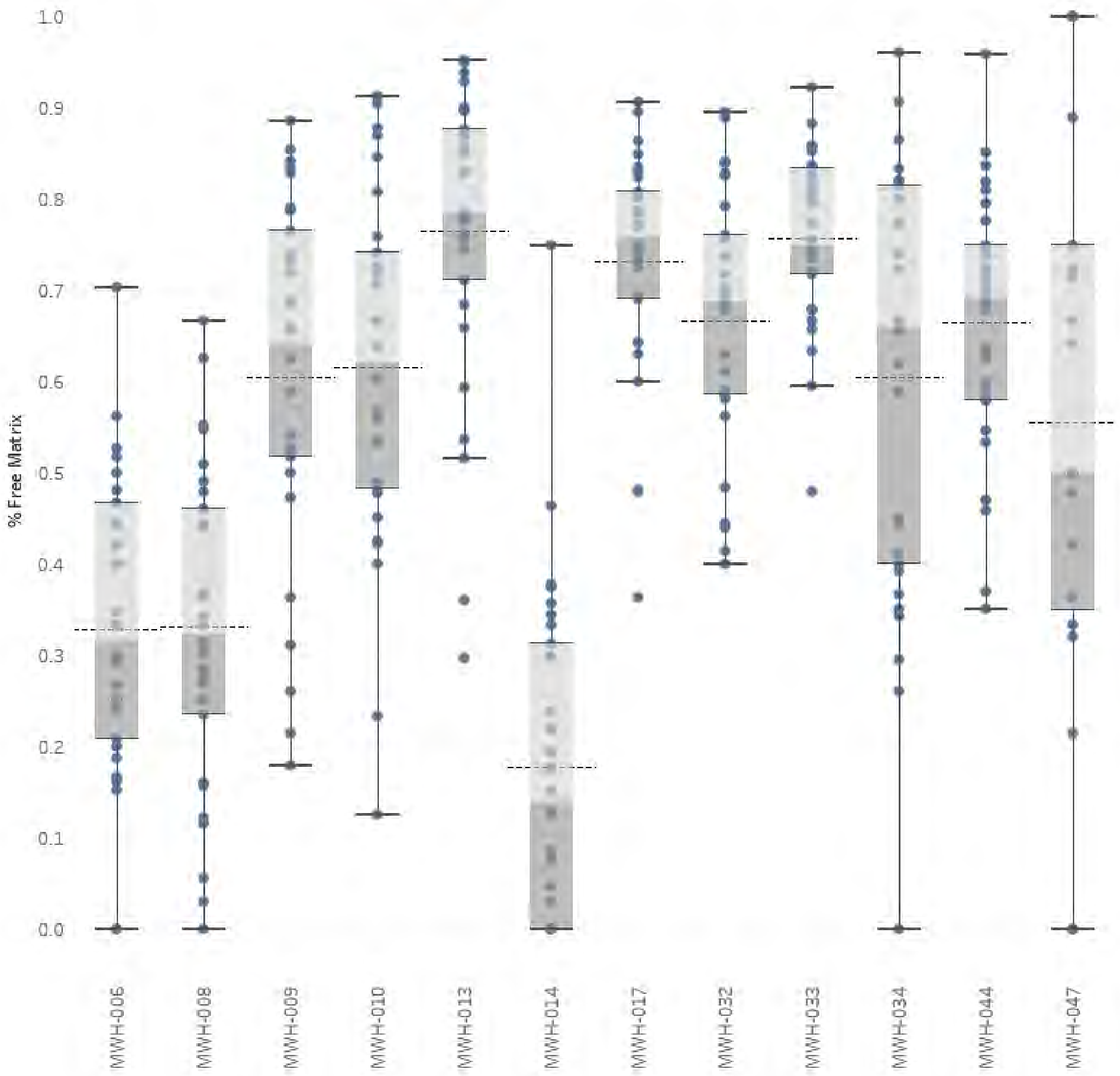
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-44. Box and Whisker Plot of the Percent Fines for all Subwatersheds in 2015



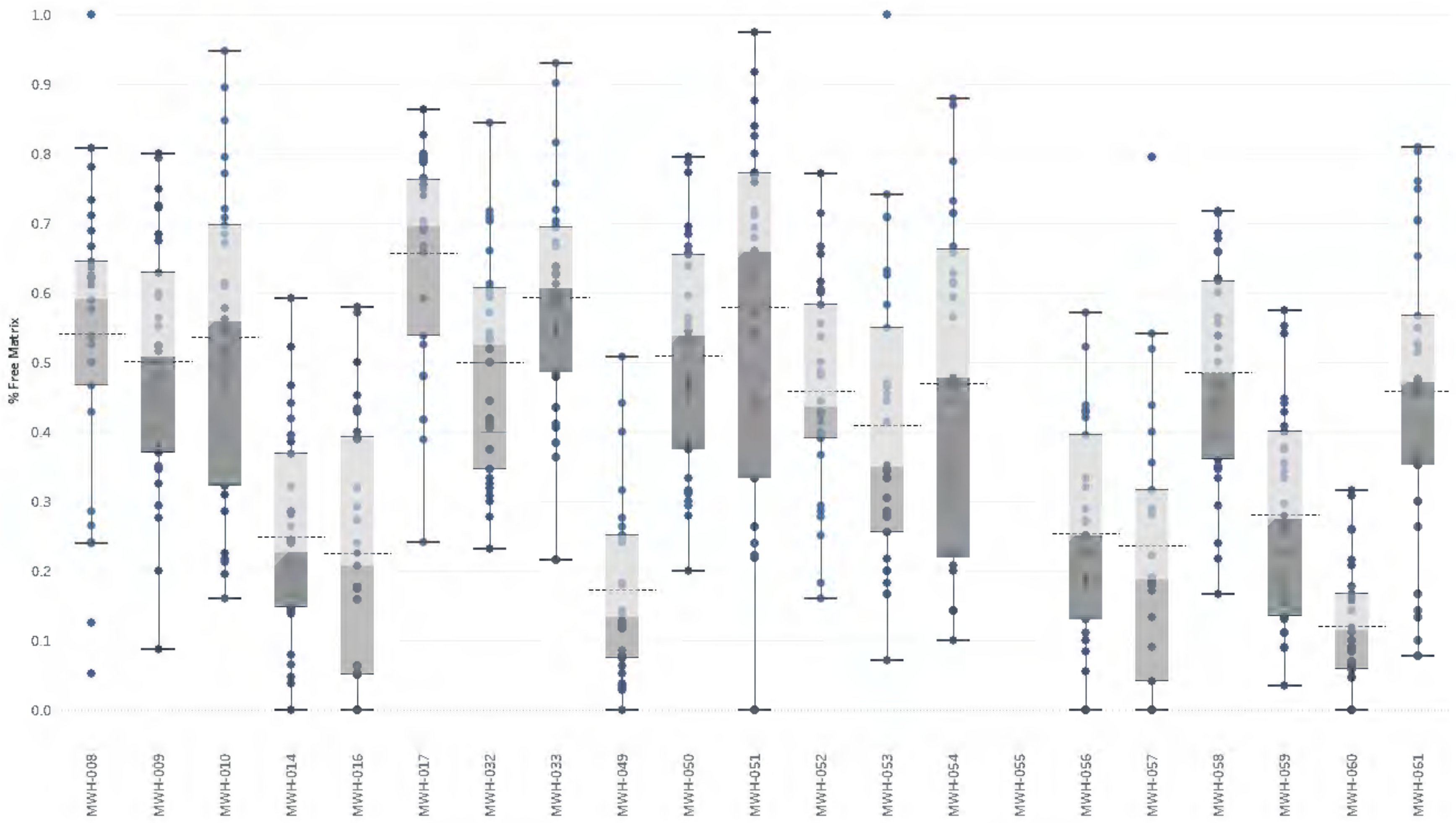
Note:
Percent fine sediment is measured in the free matrix survey
Dashed lines in each box plot indicate sample mean

Figure 1-45. Box and Whisker Plot of the Percent Fines for all Subwatersheds in 2016



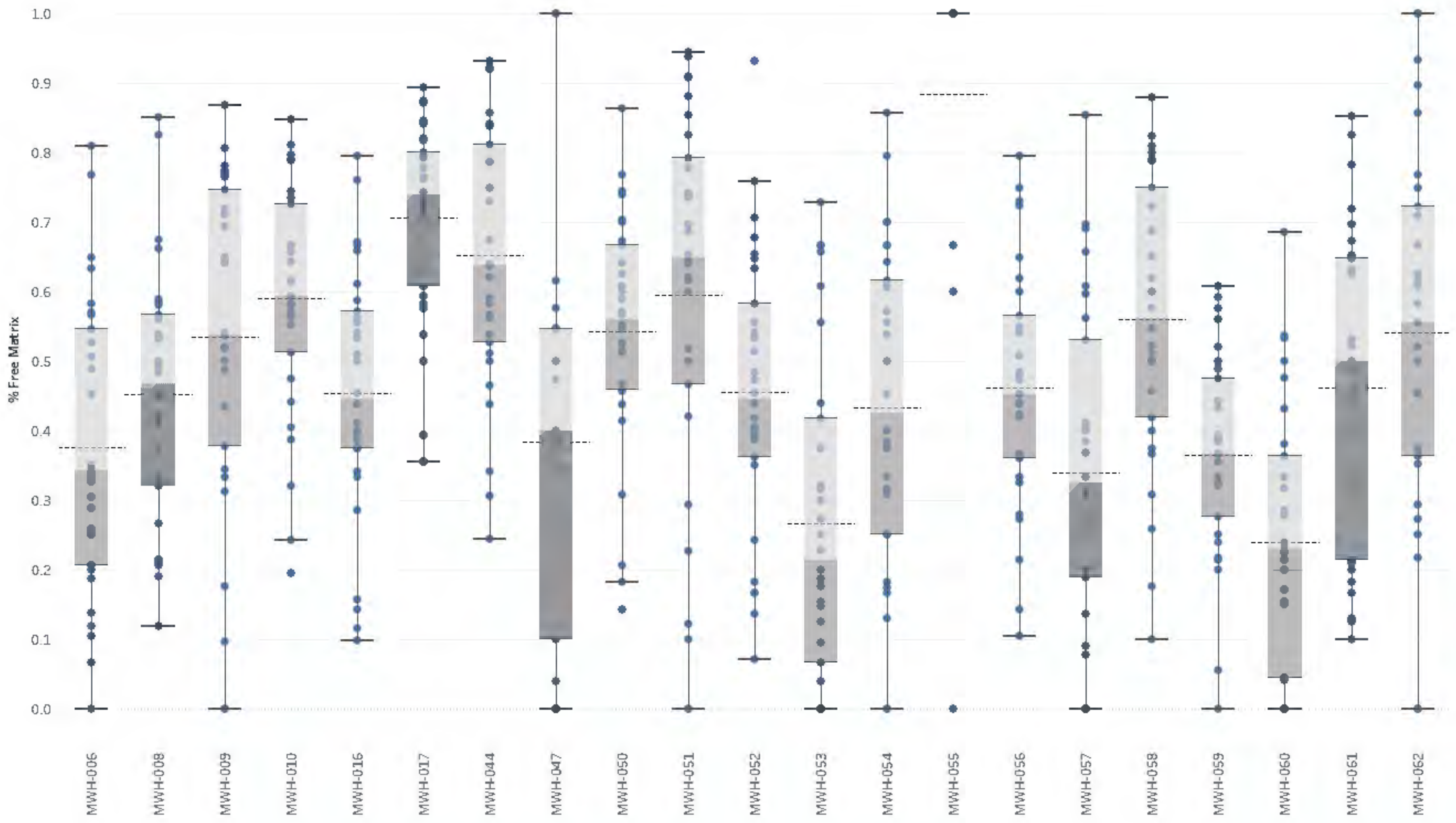
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-46. Box and Whisker Plot of the Percent Free Matrix for all Survey Sites in 2013



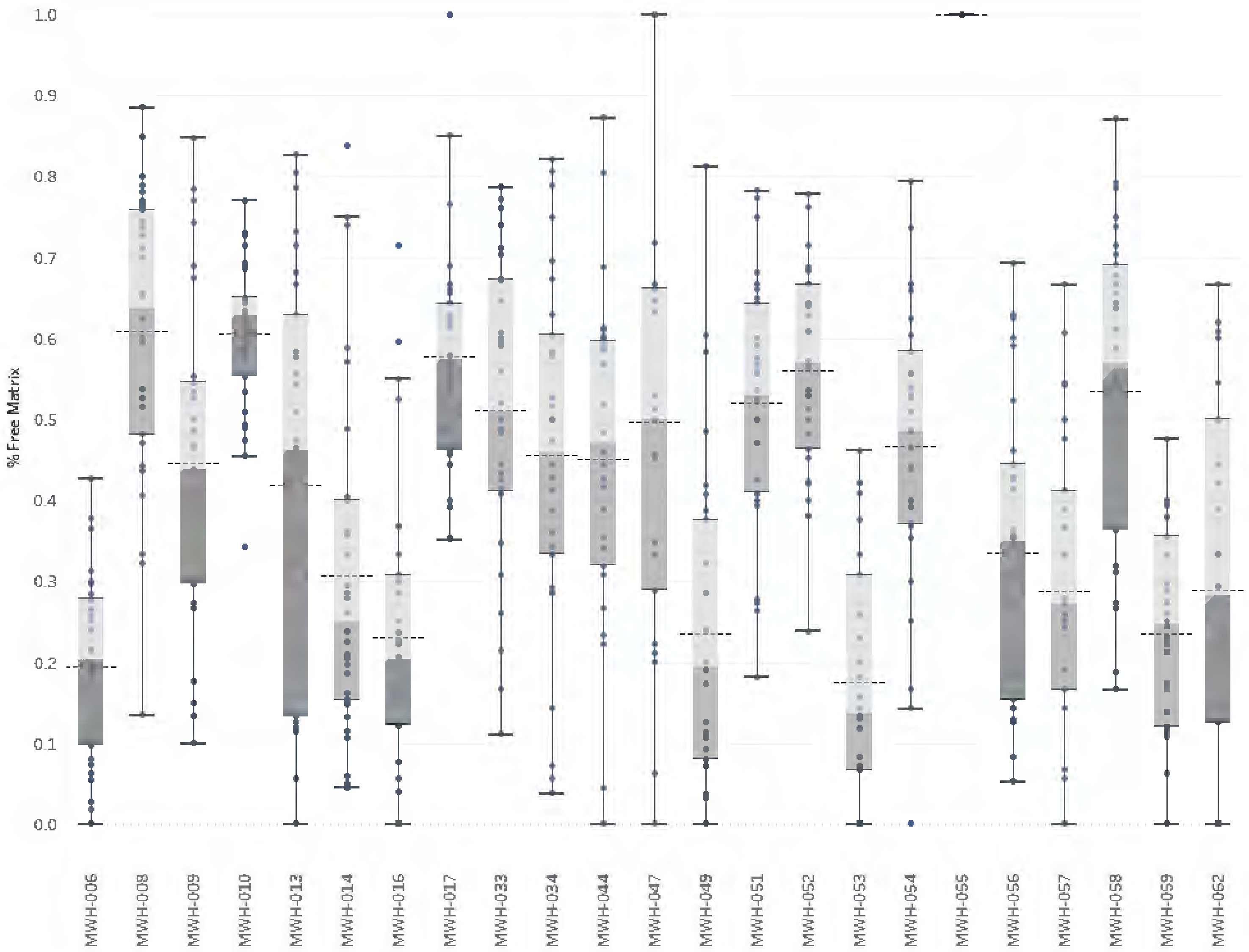
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-47. Box and Whisker Plot of the Percent Free Matrix for all Survey Sites in 2014



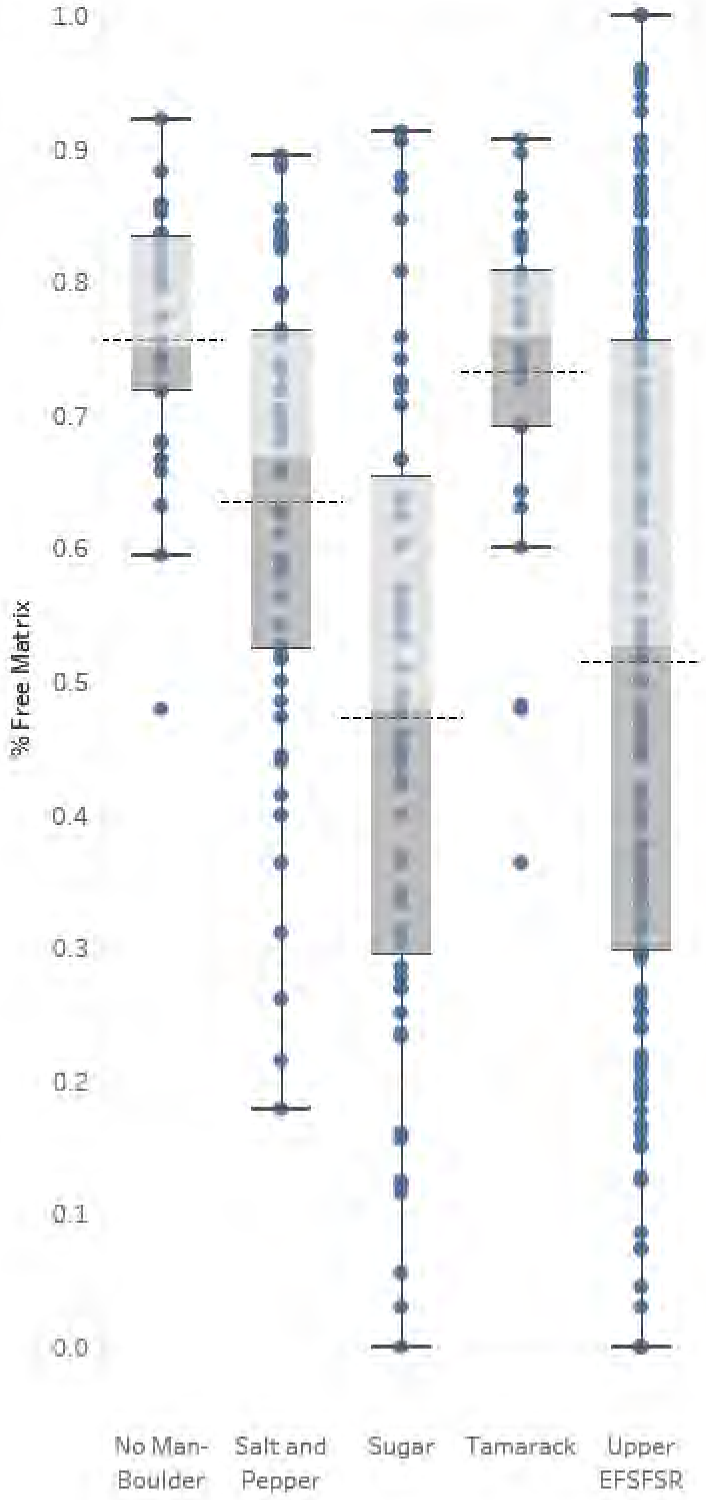
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-48. Box and Whisker Plot of the Percent Free Matrix for all Survey Sites in 2015



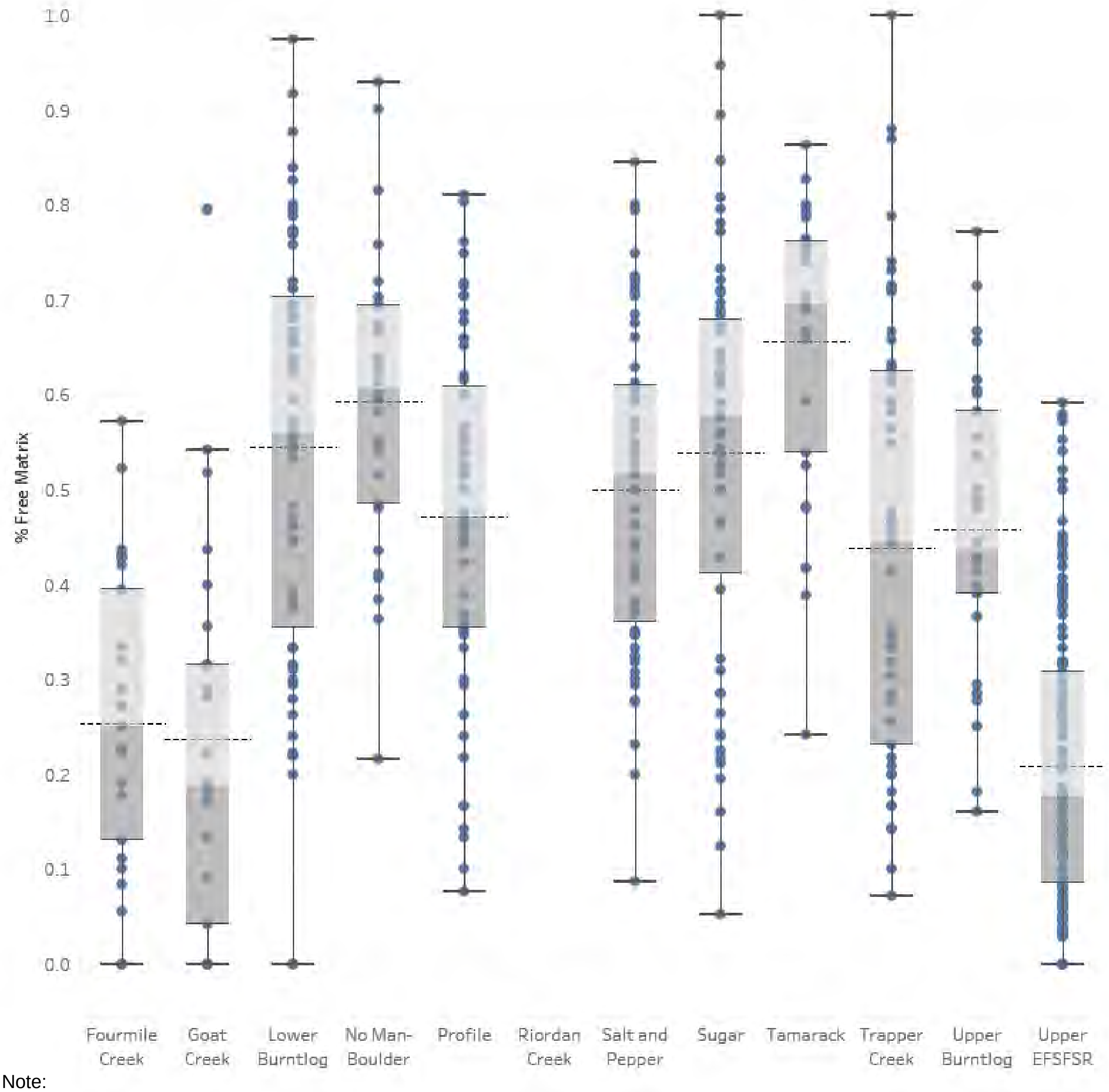
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-49. Box and Whisker Plot of the Percent Free Matrix for all Survey Sites in 2016



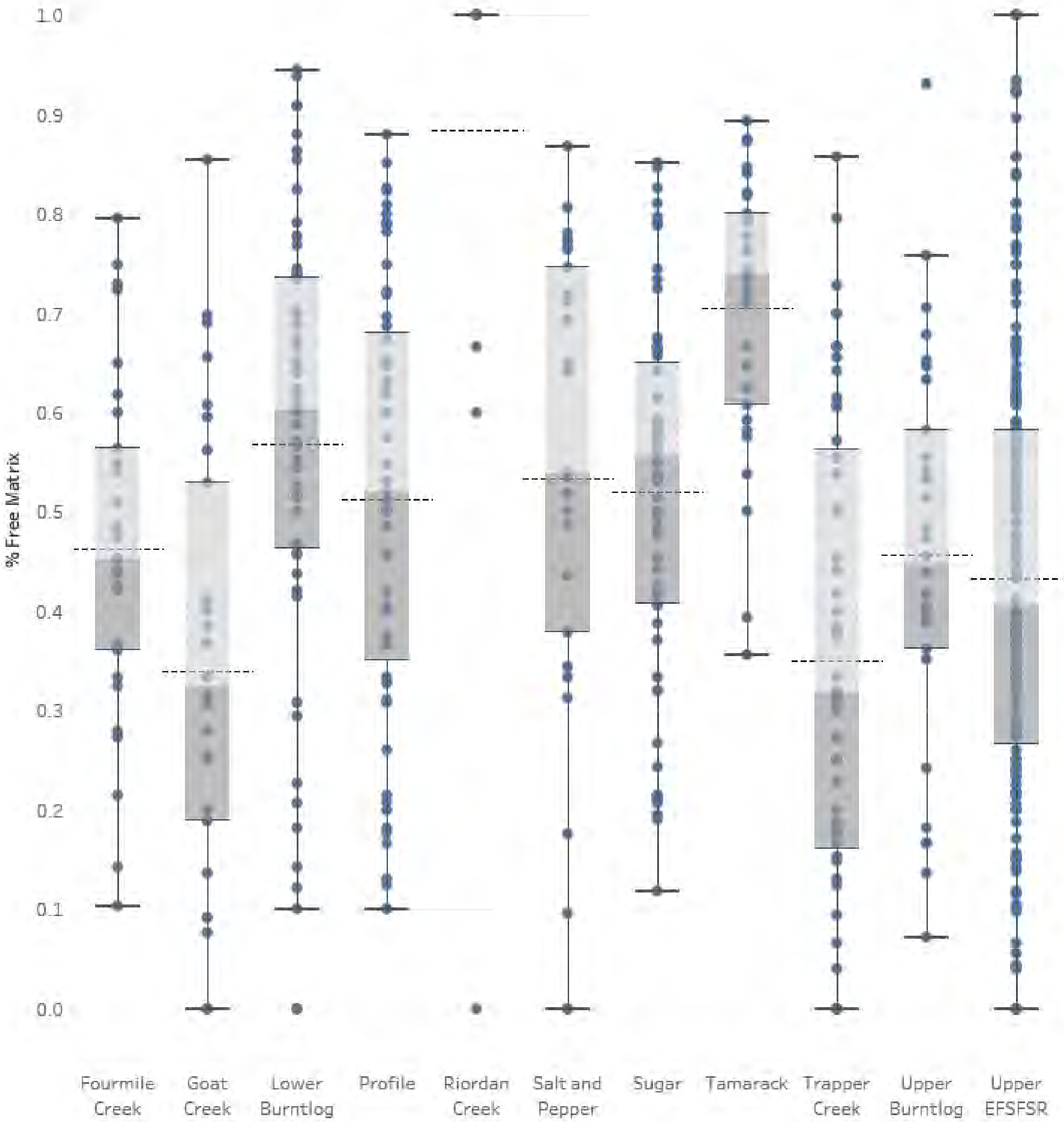
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-50. Box and Whisker Plot of the Percent Free Matrix for all Subwatersheds in 2013



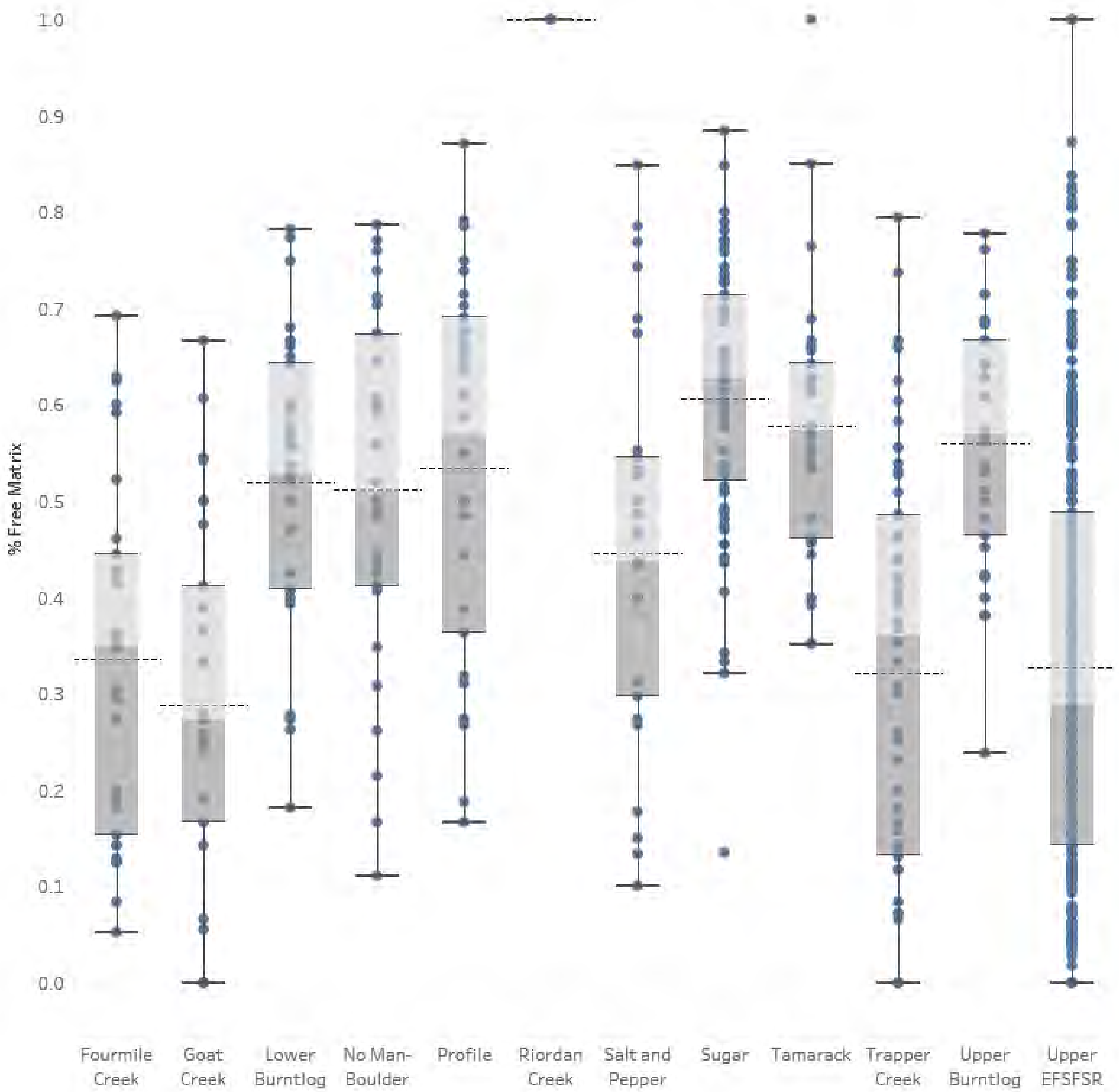
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-51. Box and Whisker Plot of the Percent Free Matrix for all Subwatersheds in 2014



Note:
Dashed lines in each box plot indicate sample mean

Figure 1-52. Box and Whisker Plot of the Percent Free Matrix for all Subwatersheds in 2015

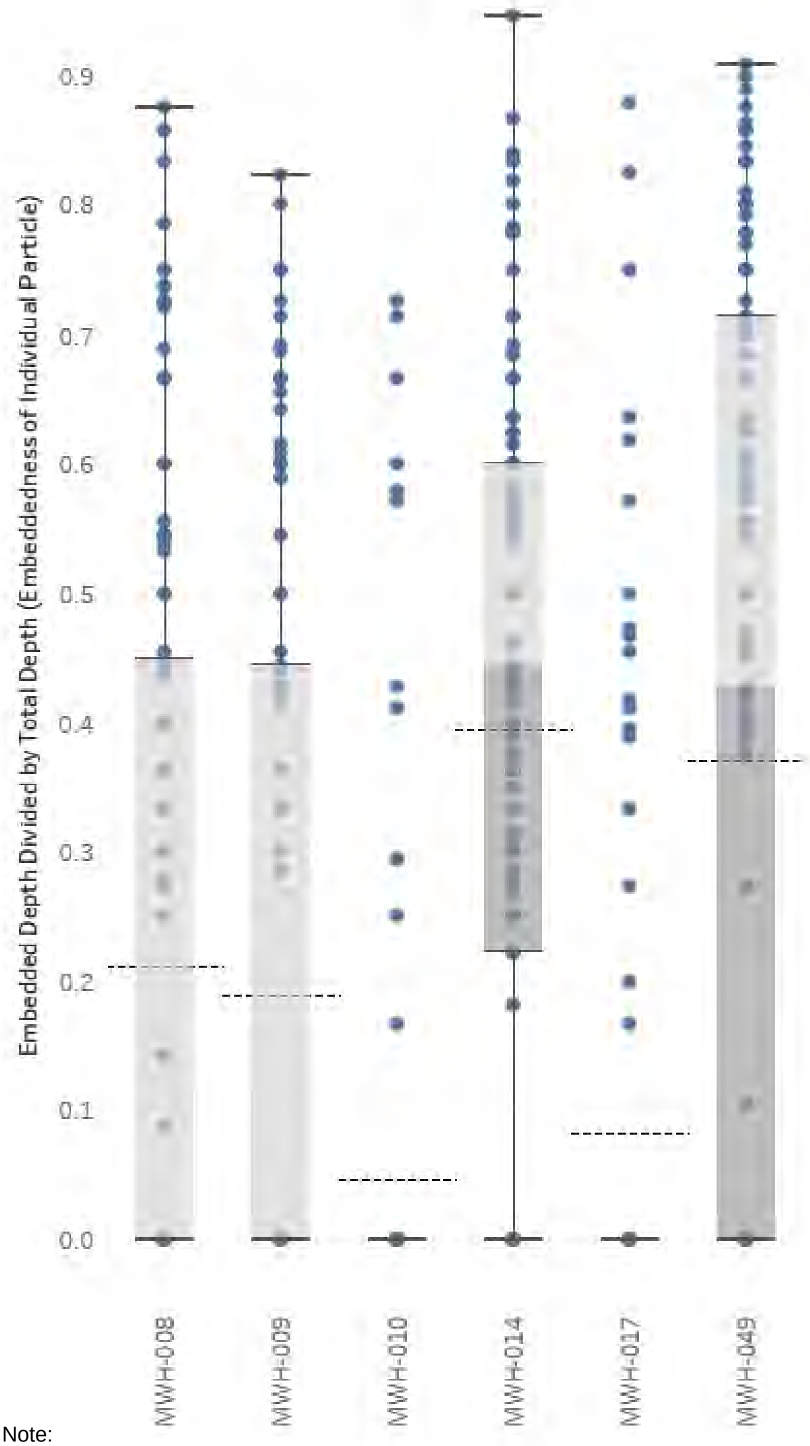


Note:
Dashed lines in each box plot indicate sample mean

Figure 1-53. Box and Whisker Plot of the Percent Free Matrix for all Subwatersheds in 2016

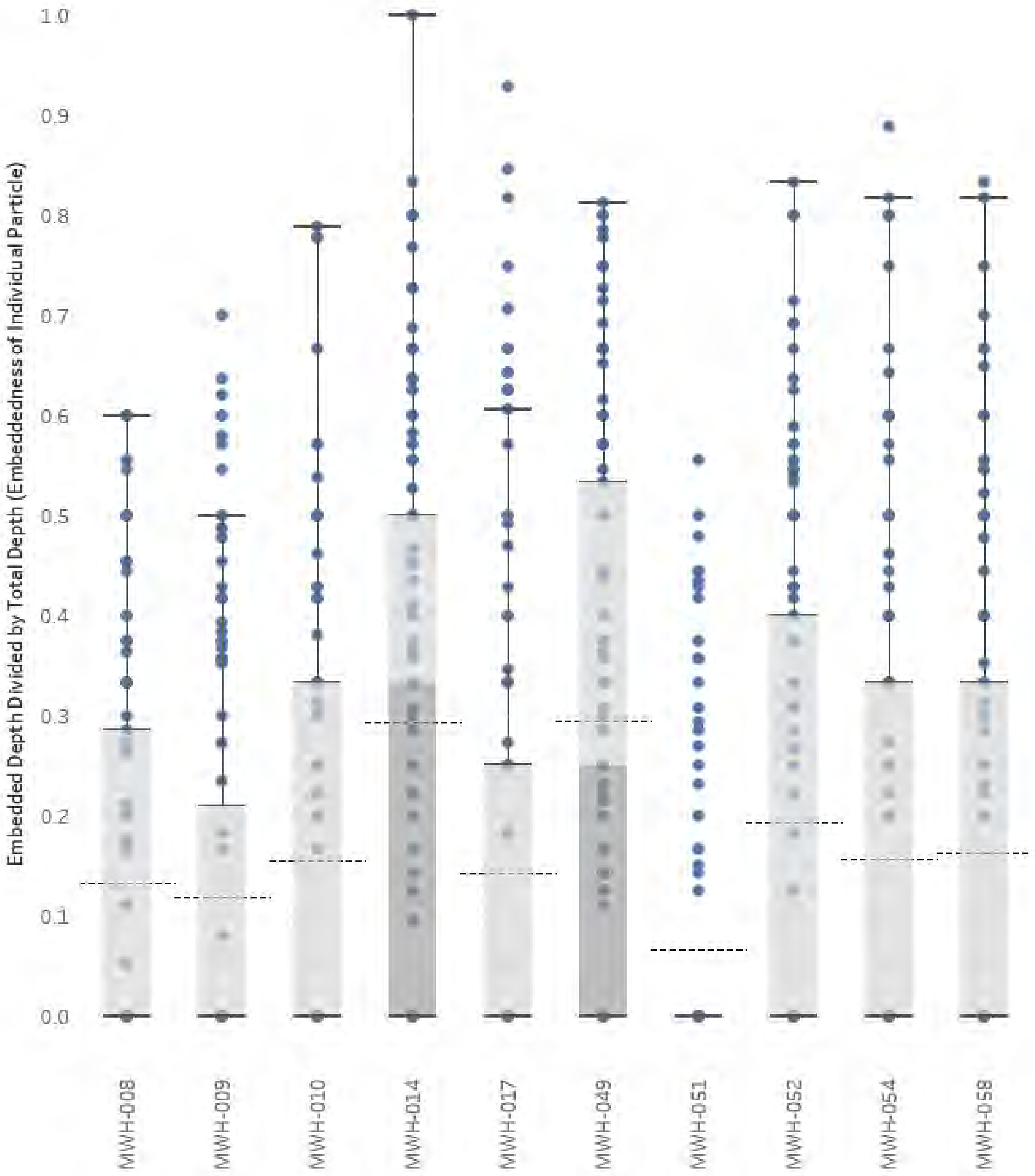
1.3 Cobble Embeddedness Plots

Cobble embeddedness measures the amount of cobble material that is buried in fine materials. Cobble embeddedness surveys were conducted by the PAF in 2012. The results from both PAF and MWH survey data are presented in **Figures 1-54** through **Figure 1-61**.



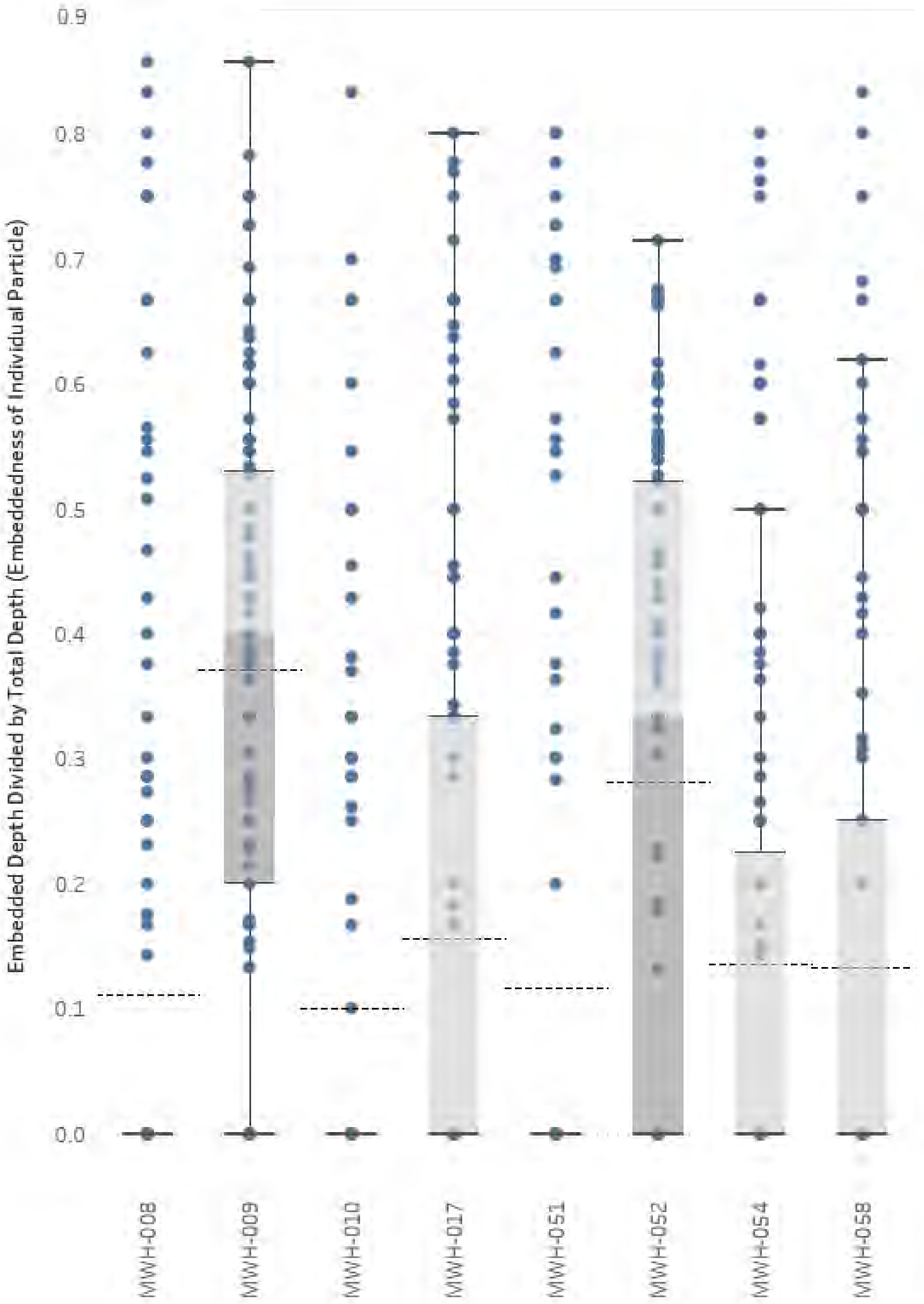
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-54. Box and Whisker Plot of the Cobble Embeddedness for all Sites in 2013



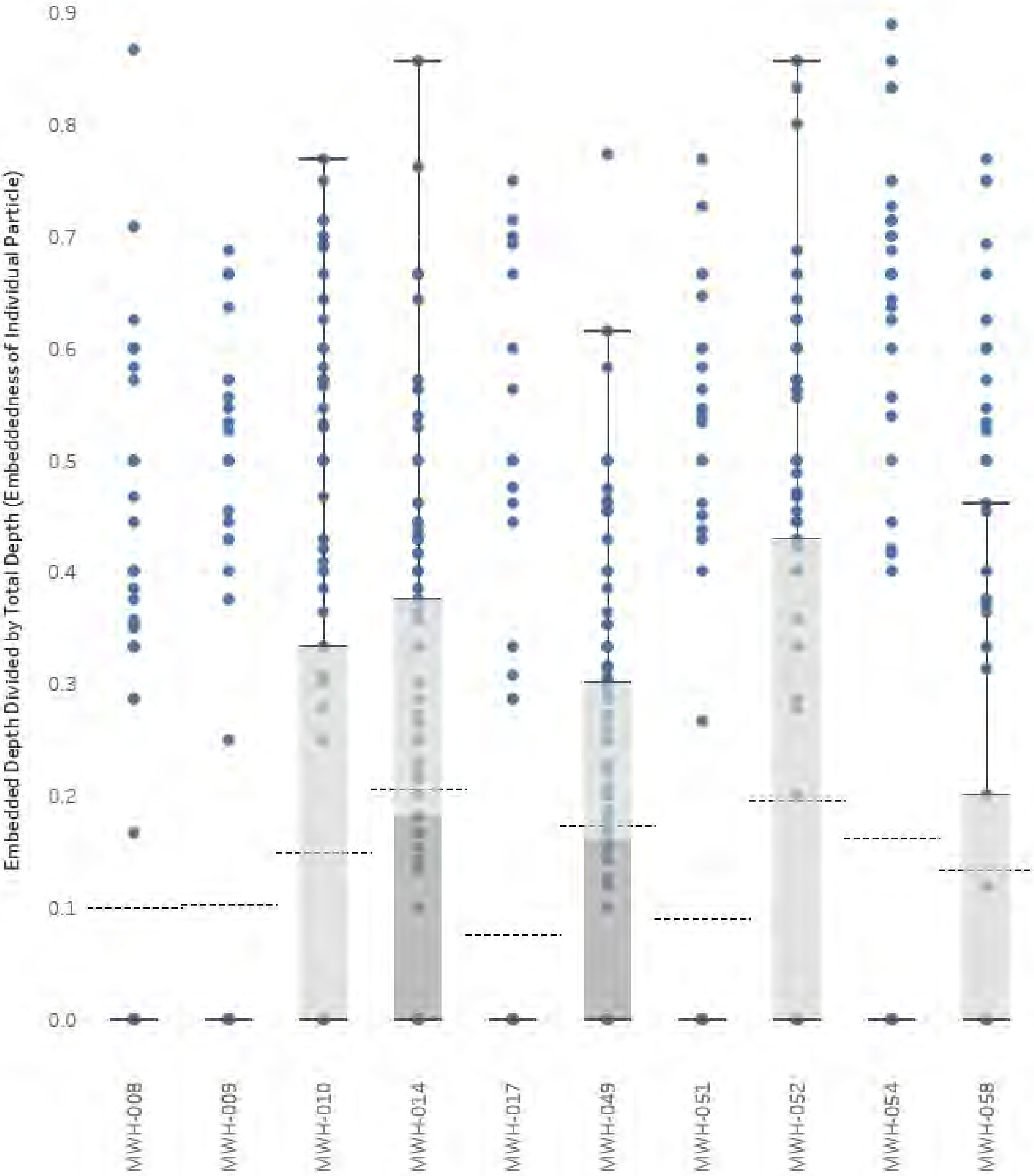
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-55. Box and Whisker Plot of the Cobble Embeddedness for all Sites in 2014



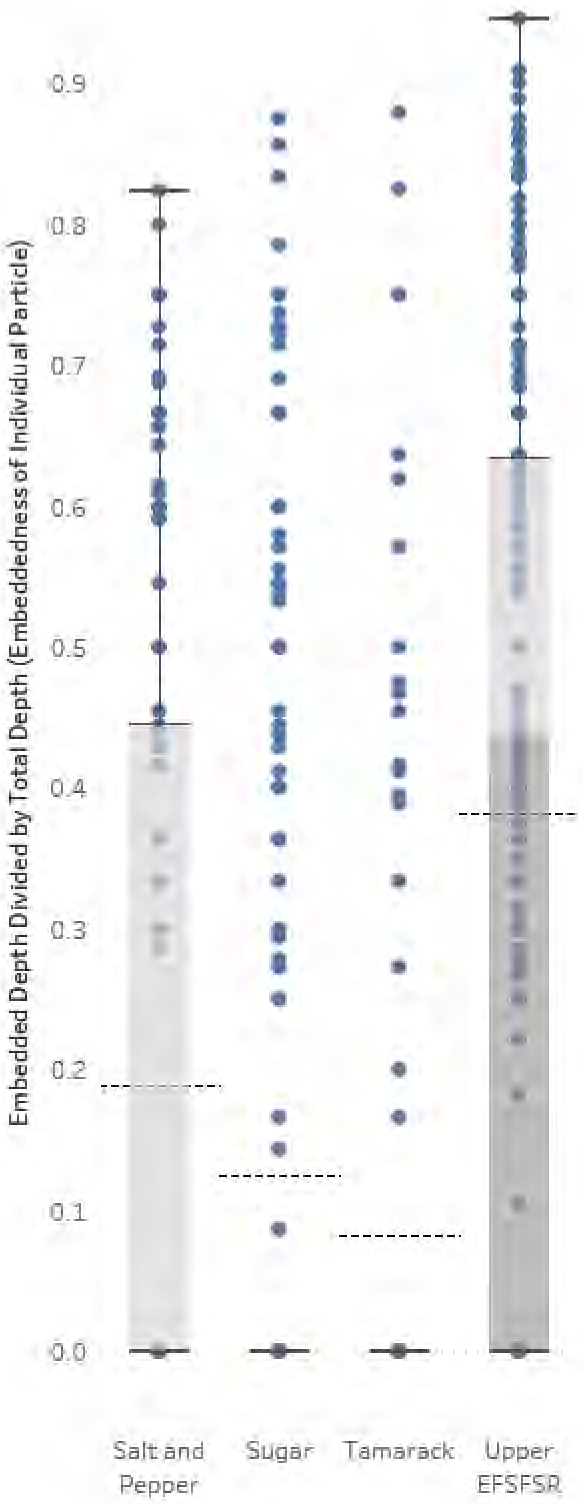
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-56. Box and Whisker Plot of the Cobble Embeddedness for all Sites in 2015



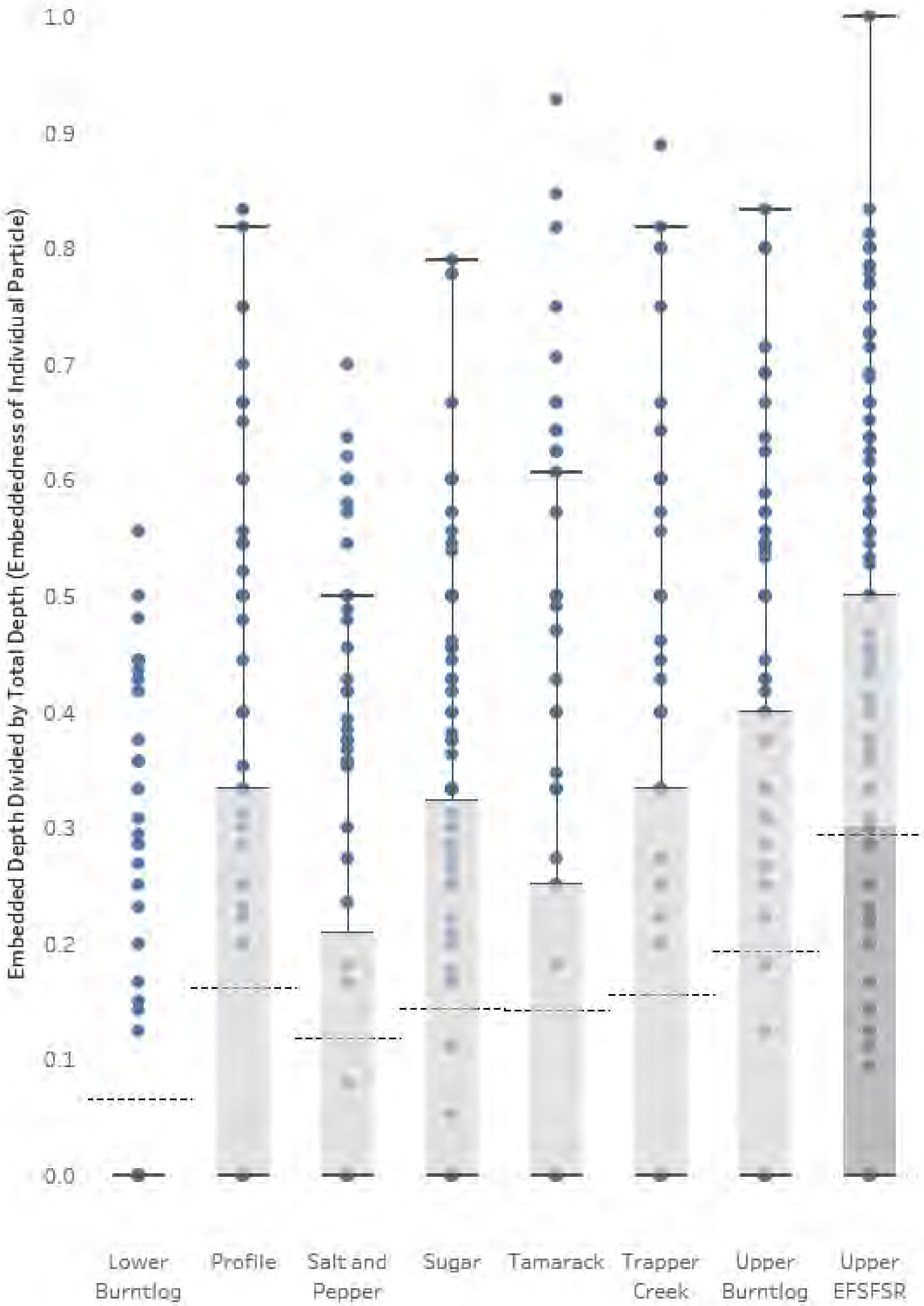
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-57. Box and Whisker Plot of the Cobble Embeddedness for all Sites in 2016



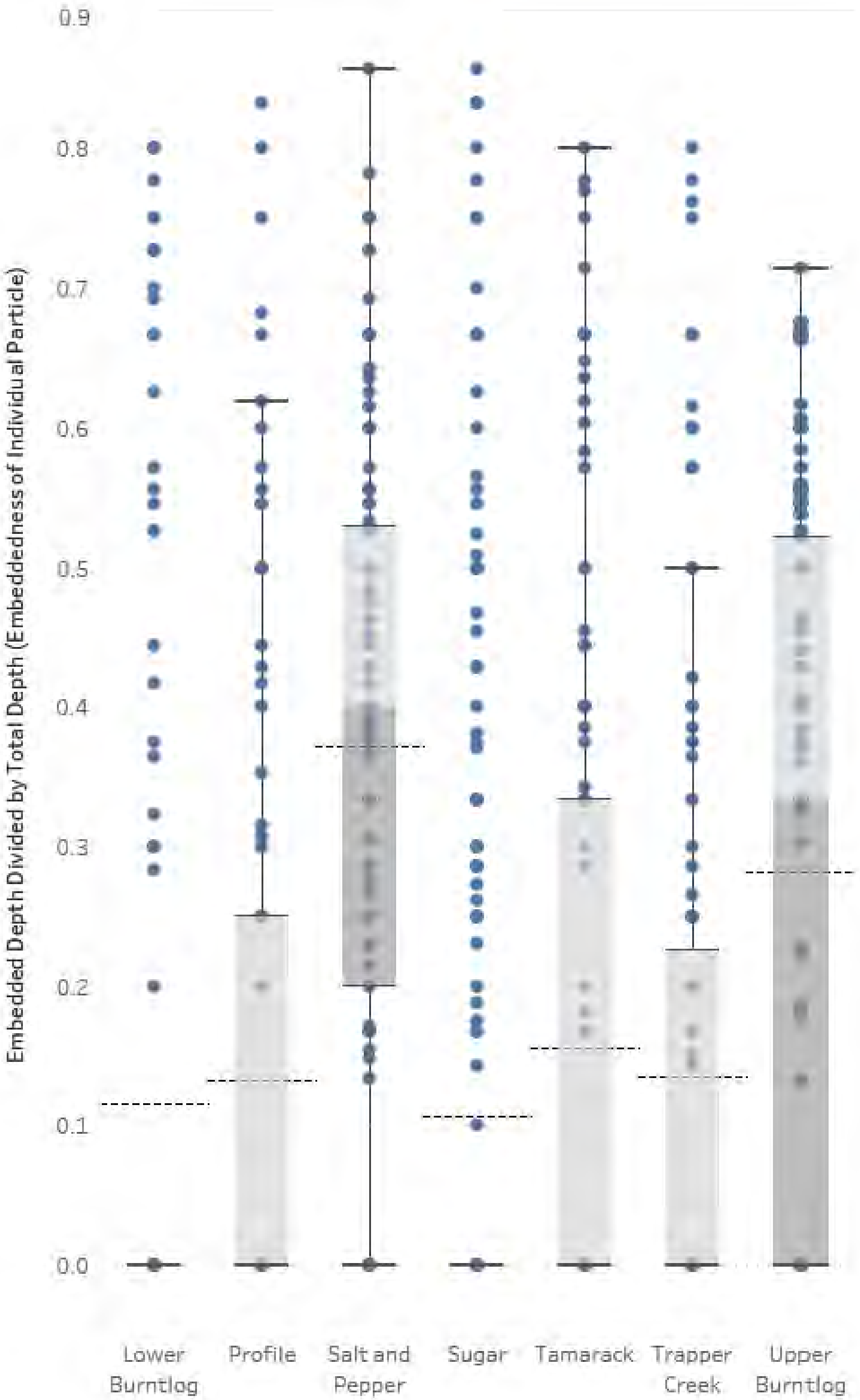
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-58. Box and Whisker Plot of the Cobble Embeddedness for all Subwatersheds in 2013



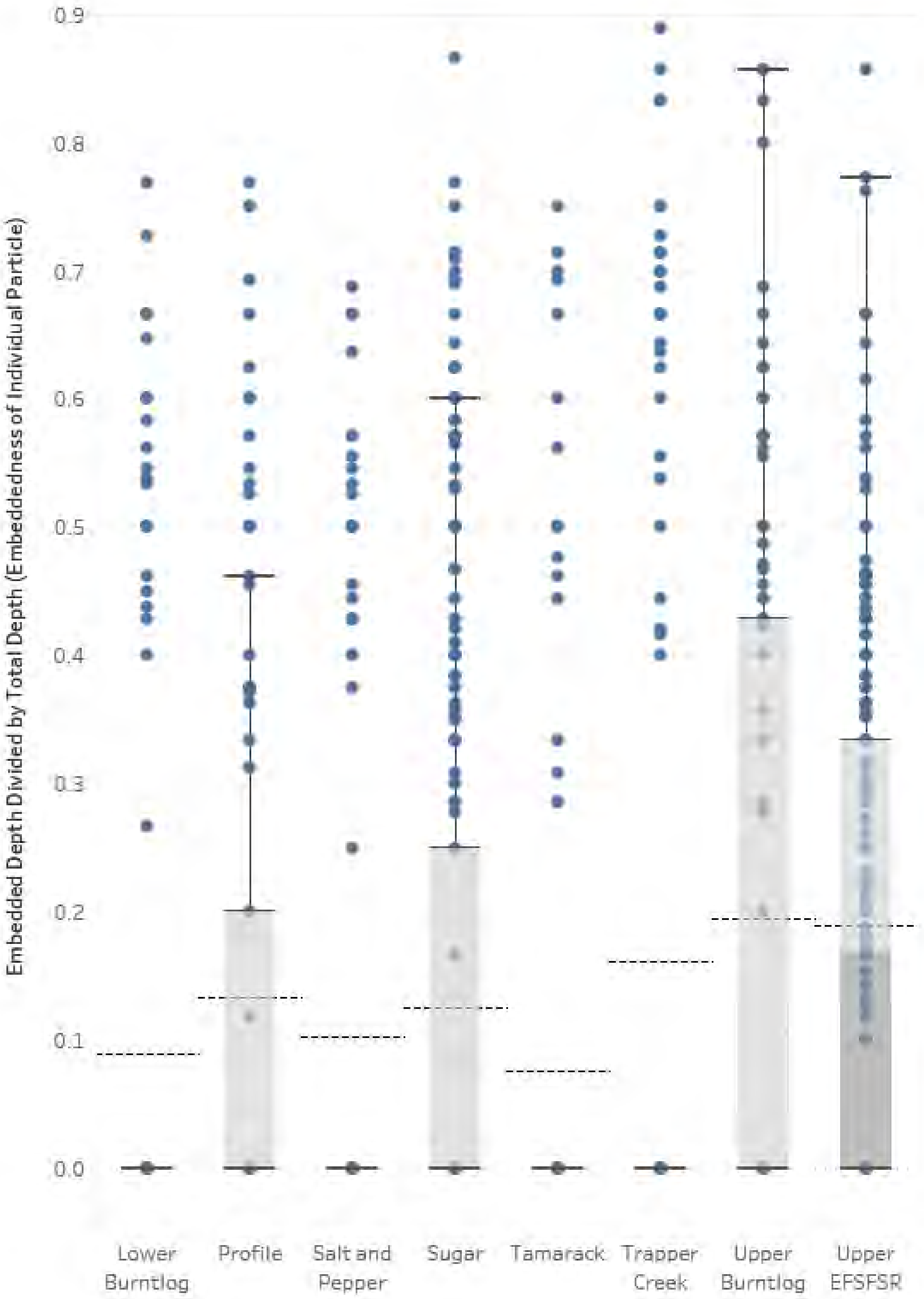
Note:
Dashed lines in each box plot indicate sample mean

Figure 1-59. Box and Whisker Plot of the Cobble Embeddedness for all Subwatersheds in 2014



Note:
Dashed lines in each box plot indicate sample mean

Figure 1-60. Box and Whisker Plot of the Cobble Embeddedness for all Subwatersheds in 2015

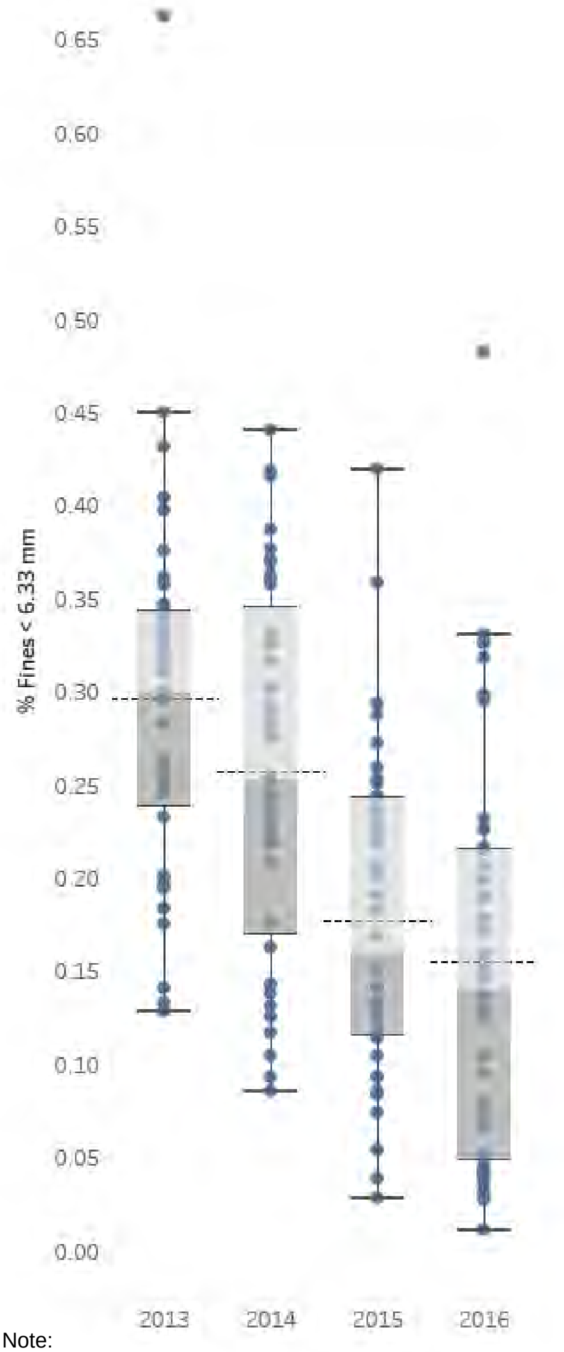


Note:
Dashed lines in each box plot indicate sample mean

Figure 1-61. Box and Whisker Plot of the Cobble Embeddedness for all Subwatersheds in 2016

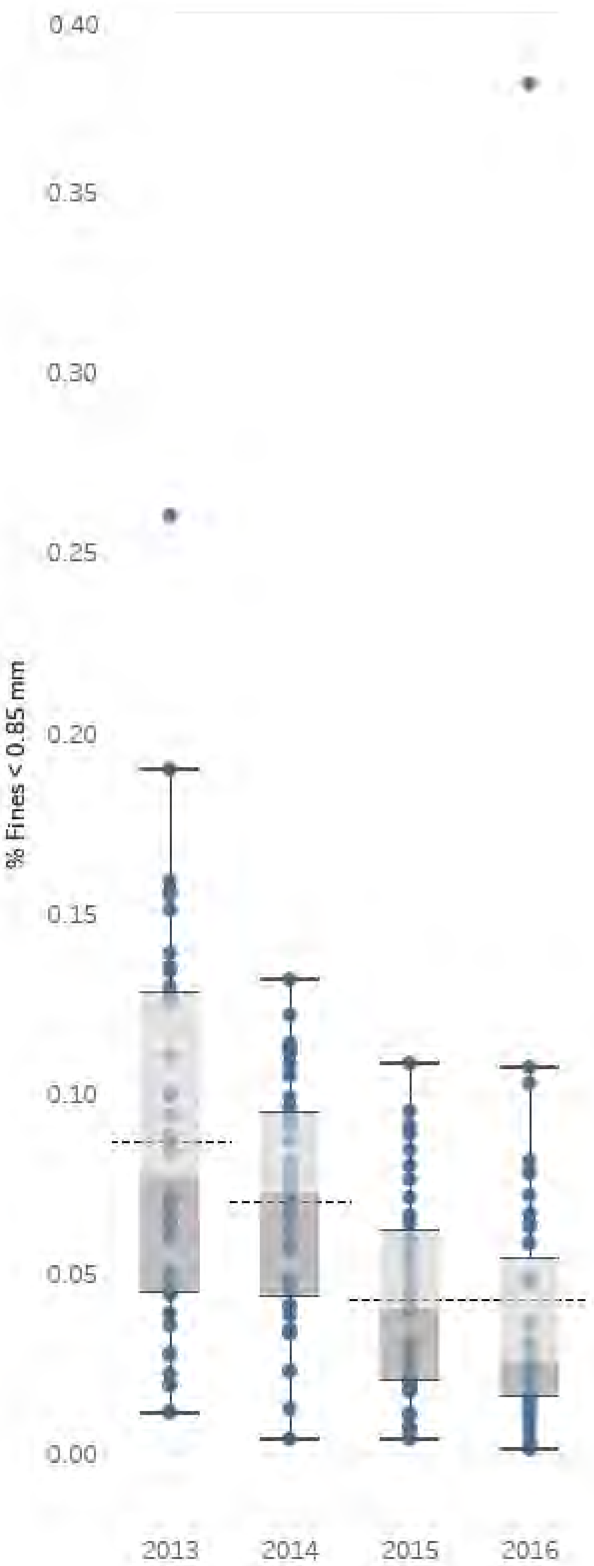
1.4 Core Sampling (Depth Fines) Plots

The modified McNeil core substrate sampling measures the proportion of the subsurface sediment that are fine materials, which are called depth fines. Percentage of depth fines is an indicator of spawning substrate quality for a reach. The results are presented in **Figure 1-62** and **Figure 1-63**.



Note:
Dashed lines in each box plot indicate sample mean

Figure 1-62. Box and Whisker Plot of the Percent Fine Substrate less than 6.33 millimeters for MWH-033 and the No Man-Boulder Subwatershed



Note:
Dashed lines in each box plot indicate sample mean

Figure 1-63. Box and Whisker Plot of the Percent Fine Substrate less than 0.85 millimeter for MWH-033 and the No Man-Boulder Subwatershed

1.5 Pool Frequency

Pool frequency is the number of pools per 100 meters of stream at a given site. There is only one data point per PIBO survey, which is insufficient data to develop box-and-whisker plots disaggregated by year and by site or subwatershed.

1.6 Large Woody Debris Frequency

Large Woody Debris (LWD) frequency is the number of LWD pieces per 100 meters of stream at a given site. There is only one data point per PIBO survey, which is insufficient data to develop box-and-whisker plots disaggregated by year and by site or subwatershed.

1.7 Median Particle Size – D_{50}

D_{50} is the median particle size of a reach, as calculated from PIBO survey pebble count data. There is only one data point per PIBO survey, which is insufficient data to develop box-and-whisker plots disaggregated by year and by site or subwatershed.

1.8 Percent Fine Sediments

Percent of fine sediments is the proportion of pebbles counted during PIBO survey pebble counts that was smaller than 6 millimeters (mm). There is only one data point per PIBO survey, which is insufficient data to develop box-and-whisker plots disaggregated by year and by site or subwatershed. These data are not the same as the surface fine sediment (measured in the free matrix surveys) or depth fines (measured in the modified McNeil core sampling surveys).

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SECTION 2: PIBO SUMMARY STATISTIC RESULTS TABLES

Tables 2-1 through 2-60 summarizes results of the PIBO surveys.

Table 2-1. Summary Statistics for Wetted Width: Wetted Depth Ratio for all Sites in 2012

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	23	34.7	26.08	5.44	±10.66	0.75	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	23	37.3	17.99	3.75	±7.35	0.48	Non-granitic
MWH-014	20	39.9	18.29	4.09	±8.01	0.46	Granitic
MWH-013	21	44.3	23.75	5.18	±10.16	0.54	Granitic
MWH-010	22	42.0	27.15	5.79	±11.34	0.65	Non-granitic
MWH-009	21	50.6	17.10	3.73	±7.31	0.34	Granitic
MWH-008	21	34.6	15.84	3.46	±6.78	0.46	Non-granitic

Table 2-2. Summary Statistics for Wetted Width:Wetted Depth Ratio for all Sites in 2013

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	22	43.9	25.93	5.53	±10.83	0.59	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	21	18.9	6.54	1.43	±2.8	0.35	Granitic
MWH-047	21	15.0	8.62	1.88	±3.69	0.58	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	23	71.6	42.81	8.93	±17.5	0.60	Non-granitic
MWH-032	24	61.4	32.44	6.62	±12.98	0.53	Non-granitic
MWH-017	22	38.5	24.07	5.13	±10.06	0.63	Non-granitic
MWH-014	21	38.6	16.27	3.55	±6.96	0.42	Granitic
MWH-013	21	39.1	20.64	4.50	±8.83	0.53	Granitic
MWH-010	21	46.1	25.73	5.61	±11	0.56	Non-granitic
MWH-009	21	51.0	22.21	4.85	±9.5	0.44	Granitic
MWH-008	21	35.8	12.21	2.67	±5.22	0.34	Non-granitic

Table 2-3. Summary Statistics for Wetted Width:Wetted Depth Ratio for all Sites in 2014

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	26	46.4	23.75	4.66	±9.13	0.51	Granitic
MWH-061	25	30.7	13.77	2.75	±5.4	0.45	Non-granitic
MWH-060	25	21.5	6.38	1.28	±2.5	0.30	Granitic
MWH-059	25	41.1	14.84	2.97	±5.82	0.36	Granitic
MWH-057	24	52.4	25.89	5.29	±10.36	0.49	Granitic
MWH-056	25	55.9	33.65	6.73	±13.19	0.60	Granitic
MWH-055	21	30.1	15.85	3.46	±6.78	0.53	Granitic
MWH-053	22	39.7	20.84	4.44	±8.71	0.53	Granitic
MWH-033	27	67.4	45.29	8.72	±17.08	0.67	Non-granitic
MWH-032	21	48.5	18.51	4.04	±7.92	0.38	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-4. Summary Statistics for Wetted Width:Wetted Depth Ratio for all Sites in 2015

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	22	43.3	20.16	4.30	±8.42	0.47	Granitic
MWH-016	23	43.5	23.05	4.81	±9.42	0.53	Granitic
MWH-044	21	24.1	11.31	2.47	±4.84	0.47	Granitic
MWH-047	25	18.1	10.23	2.05	±4.01	0.56	Granitic
MWH-050	26	49.4	29.44	5.77	±11.32	0.60	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	24	56.5	33.01	6.74	±13.21	0.58	Granitic
MWH-056	25	47.4	17.05	3.41	±6.68	0.36	Granitic
MWH-055	21	29.6	19.11	4.17	±8.17	0.65	Granitic
MWH-053	22	33.6	17.32	3.69	±7.24	0.52	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-062	27	36.6	29.73	5.72	±11.22	0.81	Granitic

Table 2-5. Summary Statistics for Large Woody Debris Frequency for all Sites in 2012

Site Number	Sample Size (n)	Annual Mean (pieces per 100m)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	1	8.2	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	1	11.4	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	1	0.0	N/A	N/A	N/A	N/A	Granitic
MWH-013	1	10.1	N/A	N/A	N/A	N/A	Granitic
MWH-010	1	6.3	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	1	2.4	N/A	N/A	N/A	N/A	Granitic
MWH-008	1	6.7	N/A	N/A	N/A	N/A	Non-granitic

Table 2-6. Summary Statistics for Large Woody Debris Frequency for all Sites in 2013

Site Number	Sample Size (n)	Annual Mean (pieces per 100m)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	1	2.3	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	1	3.2	N/A	N/A	N/A	N/A	Granitic
MWH-047	1	30.2	N/A	N/A	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	1	0.5	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	1	1.8	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	1	8.2	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	1	0.0	N/A	N/A	N/A	N/A	Granitic
MWH-013	1	13.1	N/A	N/A	N/A	N/A	Granitic
MWH-010	1	9.5	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	1	2.0	N/A	N/A	N/A	N/A	Granitic
MWH-008	1	6.7	N/A	N/A	N/A	N/A	Non-granitic

Table 2-7. Summary Statistics for Large Woody Debris Frequency for all Sites in 2014

Site Number	Sample Size (n)	Annual Mean (pieces per 100m)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	1	16.7	N/A	N/A	N/A	N/A	Granitic
MWH-061	1	0.0	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	1	0.0	N/A	N/A	N/A	N/A	Granitic
MWH-059	1	19.2	N/A	N/A	N/A	N/A	Granitic
MWH-057	1	31.4	N/A	N/A	N/A	N/A	Granitic
MWH-056	1	33.9	N/A	N/A	N/A	N/A	Granitic
MWH-055	1	16.7	N/A	N/A	N/A	N/A	Granitic
MWH-053	1	34.7	N/A	N/A	N/A	N/A	Granitic
MWH-033	1	14.8	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	1	32.3	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-8. Summary Statistics for Large Woody Debris Frequency for all Sites in 2015

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	4	0.3	0.09	0.04	±0.09	0.35	Granitic
MWH-016	8	0.4	0.08	0.03	±0.06	0.19	Granitic
MWH-044	7	0.5	0.15	0.06	±0.11	0.32	Granitic
MWH-047	5	0.5	0.27	0.12	±0.23	0.50	Granitic
MWH-050	9	0.6	0.19	0.06	±0.12	0.31	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	13	0.3	0.08	0.02	±0.04	0.23	Granitic
MWH-056	5	0.5	0.15	0.07	±0.13	0.29	Granitic
MWH-055	6	0.6	0.20	0.08	±0.16	0.31	Granitic
MWH-053	4	0.4	0.05	0.03	±0.05	0.12	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-062	12	0.3	0.08	0.02	±0.05	0.28	Granitic

Table 2-9. Summary Statistics for Maximum Pool Depth at all Sites in 2012

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	11	0.4	0.10	0.03	±0.06	0.22	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	8	0.5	0.14	0.05	±0.1	0.32	Non-granitic
MWH-014	7	0.4	0.12	0.05	±0.09	0.29	Granitic
MWH-013	9	0.5	0.16	0.05	±0.11	0.34	Granitic
MWH-010	6	0.5	0.17	0.07	±0.14	0.32	Non-granitic
MWH-009	7	0.6	0.27	0.10	±0.2	0.43	Granitic
MWH-008	14	0.5	0.19	0.05	±0.1	0.40	Non-granitic

Table 2-10. Summary Statistics for Maximum Pool Depth at all Sites in 2013

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	3	0.3	0.08	0.04	±0.09	0.22	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	6	0.5	0.12	0.05	±0.1	0.24	Granitic
MWH-047	8	0.8	0.21	0.07	±0.15	0.28	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	6	0.7	0.18	0.07	±0.15	0.26	Non-granitic
MWH-032	8	1.2	0.30	0.10	±0.21	0.25	Non-granitic
MWH-017	16	0.5	0.14	0.03	±0.07	0.31	Non-granitic
MWH-014	10	0.5	0.12	0.04	±0.08	0.25	Granitic
MWH-013	7	0.5	0.13	0.05	±0.1	0.25	Granitic
MWH-010	12	0.5	0.15	0.04	±0.08	0.27	Non-granitic
MWH-009	6	0.7	0.12	0.05	±0.1	0.17	Granitic
MWH-008	18	0.6	0.16	0.04	±0.07	0.28	Non-granitic

Table 2-11. Summary Statistics for Maximum Pool Depth at all Sites in 2014

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	6	0.7	0.24	0.10	±0.19	0.34	Granitic
MWH-061	3	0.8	0.14	0.08	±0.16	0.18	Non-granitic
MWH-060	1	0.0	N/A	N/A	N/A	N/A	Granitic
MWH-059	2	0.6	0.13	0.09	±0.18	0.20	Granitic
MWH-057	12	0.5	0.08	0.02	±0.04	0.16	Granitic
MWH-056	4	0.5	0.09	0.04	±0.09	0.16	Granitic
MWH-055	8	0.6	0.20	0.07	±0.14	0.32	Granitic
MWH-053	6	0.6	0.15	0.06	±0.12	0.26	Granitic
MWH-033	3	0.7	0.06	0.04	±0.07	0.09	Non-granitic
MWH-032	5	0.9	0.29	0.13	±0.26	0.31	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-12. Summary Statistics for Maximum Pool Depth at all Sites in 2015

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	4	0.3	0.09	0.04	±0.09	0.35	Granitic
MWH-016	8	0.4	0.08	0.03	±0.06	0.19	Granitic
MWH-044	7	0.5	0.15	0.06	±0.11	0.32	Granitic
MWH-047	5	0.5	0.27	0.12	±0.23	0.50	Granitic
MWH-050	9	0.6	0.19	0.06	±0.12	0.31	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	13	0.3	0.08	0.02	±0.04	0.23	Granitic
MWH-056	5	0.5	0.15	0.07	±0.13	0.29	Granitic
MWH-055	6	0.6	0.20	0.08	±0.16	0.31	Granitic
MWH-053	4	0.4	0.05	0.03	±0.05	0.12	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-062	12	0.3	0.08	0.02	±0.05	0.28	Granitic

Table 2-13. Summary Statistics for Pool Frequency at all Sites in 2012

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	11	6.0	0.00	0.00	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	8	4.3	0.00	0.00	±0	0.00	Non-granitic
MWH-014	7	4.4	0.00	0.00	N/A	N/A	Granitic
MWH-013	9	5.4	0.00	0.00	±0	0.00	Granitic
MWH-010	6	3.4	0.00	0.00	N/A	N/A	Non-granitic
MWH-009	7	2.8	0.00	0.00	±0	0.00	Granitic
MWH-008	14	6.7	0.00	0.00	N/A	N/A	Non-granitic

Table 2-14. Summary Statistics for Pool Frequency at all Sites in 2013

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	3	2.3	0.00	0.00	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	6	4.8	0.00	0.00	N/A	N/A	Granitic
MWH-047	8	6.3	0.00	0.00	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	6	1.4	0.00	0.00	N/A	N/A	Non-granitic
MWH-032	8	2.4	0.00	0.00	N/A	N/A	Non-granitic
MWH-017	16	8.7	0.00	0.00	±0	0.00	Non-granitic
MWH-014	10	6.0	0.00	0.00	±0	0.00	Granitic
MWH-013	7	4.2	0.00	0.00	±0	0.00	Granitic
MWH-010	12	7.1	0.00	0.00	±0	0.00	Non-granitic
MWH-009	6	2.4	0.00	0.00	N/A	N/A	Granitic
MWH-008	18	8.6	0.00	0.00	±0	0.00	Non-granitic

Table 2-15. Summary Statistics for Pool Frequency at all Sites in 2014

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	6	2.0	0.00	0.00	N/A	N/A	Granitic
MWH-061	3	1.5	0.00	0.00	N/A	N/A	Non-granitic
MWH-060	1	0.5	N/A	N/A	N/A	N/A	Granitic
MWH-059	2	0.8	0.00	0.00	N/A	N/A	Granitic
MWH-057	12	4.5	0.00	0.00	N/A	N/A	Granitic
MWH-056	4	1.7	0.00	0.00	N/A	N/A	Granitic
MWH-055	8	4.8	0.00	0.00	N/A	N/A	Granitic
MWH-053	6	3.4	0.00	0.00	N/A	N/A	Granitic
MWH-033	3	0.6	0.00	0.00	N/A	N/A	Non-granitic
MWH-032	5	1.7	0.00	0.00	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-16. Summary Statistics for Pool Frequency at all Sites in 2015

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	4	3.0	0.00	0.00	N/A	N/A	Granitic
MWH-016	8	4.3	0.00	0.00	±0	0.00	Granitic
MWH-044	7	5.6	0.00	0.00	±0	0.00	Granitic
MWH-047	5	4.0	0.00	0.00	±0	0.00	Granitic
MWH-050	9	3.1	0.00	0.00	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	13	4.9	0.01	0.00	±0.01	0.00	Granitic
MWH-056	5	2.2	0.00	0.00	N/A	N/A	Granitic
MWH-055	6	3.6	0.00	0.00	±0	0.00	Granitic
MWH-053	4	2.3	0.00	0.00	N/A	N/A	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-062	12	7.1	0.00	0.00	±0	0.00	Granitic

Table 2-17. Summary Statistics for Bank Angle for all Sites in 2014

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	26	124	31.77	6.23	±12.21	0.26	Granitic
MWH-061	25	113	36.71	7.34	±14.39	0.32	Non-granitic
MWH-060	25	160	3.10	0.62	±1.21	0.02	Granitic
MWH-059	25	142	20.77	4.15	±8.14	0.15	Granitic
MWH-057	24	109	27.65	5.64	±11.06	0.25	Granitic
MWH-056	25	123	30.97	6.19	±12.14	0.25	Granitic
MWH-055	21	91	27.22	5.94	±11.64	0.30	Granitic
MWH-053	22	108	31.96	6.81	±13.36	0.30	Granitic
MWH-033	27	105	64.24	12.36	±24.23	0.61	Non-granitic
MWH-032	21	147	26.15	5.71	±11.18	0.18	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Note: Bank angles were not included in the PIBO protocol during the 2012 and 2013 surveys.

Table 2-18. Summary Statistics for Bank Angle for all Sites in 2015

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	22	148	22.34	4.76	±9.34	0.15	Granitic
MWH-016	23	86	46.40	9.67	±18.96	0.54	Granitic
MWH-044	21	87	34.60	7.55	±14.8	0.40	Granitic
MWH-047	25	83	31.38	6.28	±12.3	0.38	Granitic
MWH-050	26	120	31.60	6.20	±12.15	0.26	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	24	108	33.25	6.79	±13.3	0.31	Granitic
MWH-056	25	104	36.46	7.29	±14.29	0.35	Granitic
MWH-055	21	86	31.49	6.87	±13.47	0.36	Granitic
MWH-053	22	109	32.79	6.99	±13.7	0.30	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-062	27	88	29.75	5.73	±11.22	0.34	Granitic

Note: Bank angles were not included in the PIBO protocol during the 2012 and 2013 surveys.

Table 2-19. Summary Statistics for Bank Stability at all Sites in 2012

Site Number	CS	UU	US	CU
MWH-006	0	0	0	0
MWH-008	14	1	4	2
MWH-009	13	5	1	2
MWH-010	6	3	7	6
MWH-013	16	1	4	0
MWH-014	15	2	0	3
MWH-016	20	0	1	2
MWH-017	21	1	1	0
MWH-032	0	0	0	0
MWH-033	0	0	0	0
MWH-044	0	0	0	0
MWH-047	0	0	0	0
MWH-050	0	0	0	0
MWH-053	0	0	0	0
MWH-055	0	0	0	0
MWH-056	0	0	0	0
MWH-057	0	0	0	0
MWH-059	0	0	0	0
MWH-060	0	0	0	0
MWH-061	0	0	0	0

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-20. Summary Statistics for Bank Stability at all Sites in 2013

Site Number	CS	UU	US	CU
MWH-006	4	12	6	0
MWH-016	0	0	0	0
MWH-044	21	0	0	0
MWH-047	18	0	3	0
MWH-050	0	0	0	0
MWH-061	0	0	0	0
MWH-060	0	0	0	0
MWH-059	0	0	0	0
MWH-057	0	0	0	0
MWH-056	0	0	0	0
MWH-055	0	0	0	0
MWH-053	0	0	0	0
MWH-033	22	0	1	0
MWH-032	24	0	0	0
MWH-017	21	0	1	0
MWH-014	19	0	2	0
MWH-013	17	0	4	0
MWH-010	12	0	9	0
MWH-009	17	1	3	0
MWH-008	20	0	1	0

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-21. Summary Statistics for Bank Stability at all Sites in 2014

Site Number	CS	UU	US	CU
MWH-006	0	0	0	0
MWH-016	0	0	0	0
MWH-044	0	0	0	0
MWH-047	0	0	0	0
MWH-050	19	2	5	0
MWH-061	25	0	0	0
MWH-060	25	0	0	0
MWH-059	23	2	0	0
MWH-057	21	0	3	0
MWH-056	17	2	5	0
MWH-055	20	0	1	0
MWH-053	18	3	1	0
MWH-033	14	6	6	1
MWH-032	20	0	1	0
MWH-017	0	0	0	0
MWH-014	0	0	0	0
MWH-013	0	0	0	0
MWH-010	0	0	0	0
MWH-009	0	0	0	0
MWH-008	0	0	0	0

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-22. Summary Statistics for Bank Stability at all Sites in 2015

Site Number	CS	UU	US	CU
MWH-006	8	0	14	0
MWH-016	21	0	2	0
MWH-044	17	0	4	0
MWH-047	23	0	0	2
MWH-050	19	0	7	0
MWH-061	0	0	0	0
MWH-060	0	0	0	0
MWH-059	0	0	0	0
MWH-057	16	0	8	0
MWH-056	19	1	5	0
MWH-055	18	0	3	0
MWH-053	14	1	7	0
MWH-033	0	0	0	0
MWH-032	0	0	0	0
MWH-017	0	0	0	0
MWH-014	0	0	0	0
MWH-013	0	0	0	0
MWH-010	0	0	0	0
MWH-009	0	0	0	0
MWH-008	0	0	0	0
MWH-062	21	1	5	0

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-23. Summary Statistics for Bankfull Widths for all Sites in 2012

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	23	4.5	0.96	0.20	±0.39	0.22	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	23	7.6	1.91	0.40	±0.78	0.25	Non-granitic
MWH-014	20	6.2	0.83	0.19	±0.36	0.13	Granitic
MWH-013	21	5.7	1.45	0.32	±0.62	0.25	Granitic
MWH-010	22	7.4	2.88	0.61	±1.2	0.39	Non-granitic
MWH-009	21	10.7	1.69	0.37	±0.72	0.16	Granitic
MWH-008	21	6.6	1.46	0.32	±0.62	0.22	Non-granitic

Table 2-24. Summary Statistics for Bankfull Widths for all Sites in 2013

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	22	6.4	1.90	0.41	±0.8	0.30	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	21	4.0	1.27	0.28	±0.54	0.32	Granitic
MWH-047	21	3.9	1.44	0.32	±0.62	0.37	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	23	19.4	6.45	1.34	±2.63	0.33	Non-granitic
MWH-032	24	16.3	4.17	0.85	±1.67	0.26	Non-granitic
MWH-017	22	7.3	1.53	0.33	±0.64	0.21	Non-granitic
MWH-014	21	5.8	0.56	0.12	±0.24	0.10	Granitic
MWH-013	21	4.8	1.32	0.29	±0.56	0.27	Granitic
MWH-010	21	6.8	1.91	0.42	±0.81	0.28	Non-granitic
MWH-009	21	10.6	1.74	0.38	±0.74	0.16	Granitic
MWH-008	21	6.6	1.13	0.25	±0.48	0.17	Non-granitic

Table 2-25. Summary Statistics for Bankfull Widths for all Sites in 2014

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	26	9.6	2.66	0.52	±1.02	0.28	Granitic
MWH-061	25	8.1	1.42	0.28	±0.56	0.17	Non-granitic
MWH-060	25	7.0	0.62	0.12	±0.24	0.09	Granitic
MWH-059	25	7.6	1.30	0.26	±0.51	0.17	Granitic
MWH-057	24	7.3	1.72	0.35	±0.69	0.24	Granitic
MWH-056	25	7.1	1.91	0.38	±0.75	0.27	Granitic
MWH-055	21	5.9	1.77	0.39	±0.76	0.30	Granitic
MWH-053	22	7.0	2.08	0.44	±0.87	0.30	Granitic
MWH-033	27	18.2	5.76	1.11	±2.17	0.32	Non-granitic
MWH-032	21	16.6	2.61	0.57	±1.12	0.16	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-26. Summary Statistics for Bankfull Widths for all Sites in 2015

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	22	6.4	1.82	0.39	±0.76	0.29	Granitic
MWH-016	23	5.9	2.13	0.44	±0.87	0.36	Granitic
MWH-044	21	3.9	0.66	0.14	±0.28	0.17	Granitic
MWH-047	25	4.4	1.76	0.35	±0.69	0.41	Granitic
MWH-050	26	10.0	2.85	0.56	±1.09	0.28	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	24	7.7	1.83	0.37	±0.73	0.24	Granitic
MWH-056	25	8.1	1.88	0.38	±0.74	0.23	Granitic
MWH-055	21	5.7	1.73	0.38	±0.74	0.30	Granitic
MWH-053	22	7.0	2.09	0.44	±0.87	0.30	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-062	27	2.5	0.85	0.16	±0.32	0.34	Granitic

Table 2-27. Summary Statistics for Maximum Bankfull Depths for all Sites in 2012

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	23	0.6	0.14	0.03	±0.06	0.24	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	23	0.5	0.30	0.06	±0.12	0.56	Non-granitic
MWH-014	20	0.5	0.10	0.02	±0.04	0.20	Granitic
MWH-013	21	0.6	0.18	0.04	±0.08	0.31	Granitic
MWH-010	22	0.6	0.20	0.04	±0.08	0.35	Non-granitic
MWH-009	21	0.8	0.14	0.03	±0.06	0.18	Granitic
MWH-008	21	0.6	0.17	0.04	±0.07	0.29	Non-granitic

Table 2-28. Summary Statistics for Maximum Bankfull Depths for all Sites in 2013

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	22	0.6	0.19	0.04	±0.08	0.31	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	21	0.7	0.10	0.02	±0.04	0.14	Granitic
MWH-047	21	0.7	0.21	0.05	±0.09	0.32	Granitic
MWH-050	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-056	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-055	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-053	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-033	23	0.9	0.25	0.05	±0.1	0.28	Non-granitic
MWH-032	24	0.9	0.22	0.05	±0.09	0.24	Non-granitic
MWH-017	22	0.7	0.13	0.03	±0.06	0.20	Non-granitic
MWH-014	21	0.4	0.14	0.03	±0.06	0.33	Granitic
MWH-013	21	0.5	0.11	0.02	±0.05	0.24	Granitic
MWH-010	21	0.4	0.12	0.03	±0.05	0.29	Non-granitic
MWH-009	21	0.6	0.11	0.02	±0.05	0.19	Granitic
MWH-008	21	0.5	0.09	0.02	±0.04	0.19	Non-granitic

Table 2-29. Summary Statistics for Maximum Bankfull Depths for all Sites in 2014

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-016	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-044	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-047	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-050	26	0.7	0.20	0.04	±0.08	0.30	Granitic
MWH-061	25	0.9	0.29	0.06	±0.11	0.32	Non-granitic
MWH-060	25	0.8	0.10	0.02	±0.04	0.13	Granitic
MWH-059	25	0.6	0.10	0.02	±0.04	0.17	Granitic
MWH-057	24	0.8	0.18	0.04	±0.07	0.22	Granitic
MWH-056	25	0.5	0.16	0.03	±0.06	0.30	Granitic
MWH-055	21	0.9	0.14	0.03	±0.06	0.16	Granitic
MWH-053	22	0.6	0.20	0.04	±0.08	0.30	Granitic
MWH-033	27	0.8	0.27	0.05	±0.1	0.33	Non-granitic
MWH-032	21	1.0	0.22	0.05	±0.09	0.22	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-30. Summary Statistics for Maximum Bankfull Depths for all Sites in 2015

Site Number	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
MWH-006	22	0.6	0.14	0.03	±0.06	0.24	Granitic
MWH-016	23	0.7	0.18	0.04	±0.07	0.26	Granitic
MWH-044	21	0.6	0.15	0.03	±0.06	0.24	Granitic
MWH-047	25	0.8	0.27	0.05	±0.11	0.34	Granitic
MWH-050	26	0.8	0.21	0.04	±0.08	0.27	Granitic
MWH-061	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-060	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-059	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-057	24	0.9	0.23	0.05	±0.09	0.27	Granitic
MWH-056	25	0.8	0.19	0.04	±0.07	0.23	Granitic
MWH-055	21	0.9	0.19	0.04	±0.08	0.21	Granitic
MWH-053	22	0.7	0.17	0.04	±0.07	0.24	Granitic
MWH-033	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-032	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-017	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-014	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-013	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-010	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-009	0	N/A	N/A	N/A	N/A	N/A	Granitic
MWH-008	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
MWH-062	27	0.6	0.10	0.02	±0.04	0.17	Granitic

Table 2-31. Summary Statistics for Wetted Width:Wetted Depth Ratio in all Subwatersheds in 2012

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	64	39.5	23.10	2.89	±5.66	0.59	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	0	--	--	--	--	--	Non-granitic
Salt and Pepper	21	50.6	17.10	3.73	±7.31	0.34	Granitic
Tamarack	23	37.3	17.99	3.75	±7.35	0.48	Non-granitic
Sugar	43	38.4	22.41	3.42	±6.7	0.58	Non-granitic

Key:
n = number

Table 2-32. Summary Statistics for Wetted Width:Wetted Depth Ratio in all Subwatersheds in 2013

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	106	31.2	20.70	2.01	±3.94	0.66	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	23	71.6	42.81	8.93	±17.5	0.60	Non-granitic
Salt and Pepper	45	56.5	28.32	4.22	±8.27	0.50	Granitic
Tamarack	22	38.5	24.07	5.13	±10.06	0.63	Non-granitic
Sugar	42	40.9	20.56	3.17	±6.22	0.50	Non-granitic

Key:
n = number

Table 2-33. Summary Statistics for Wetted Width:Wetted Depth Ratio in all Subwatersheds in 2014

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	50	31.3	15.05	2.13	±4.17	0.48	Granitic
Lower Burntlog	26	46.4	23.75	4.66	±9.13	0.51	Granitic
Profile	25	30.7	13.77	2.75	±5.4	0.45	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	25	55.9	33.65	6.73	±13.19	0.60	Granitic
Riordan	21	30.1	15.85	3.46	±6.78	0.53	Granitic
Trapper	22	39.7	20.84	4.44	±8.71	0.53	Granitic
No Man-Boulder	27	67.4	45.29	8.72	±17.08	0.67	Non-granitic
Salt and Pepper	21	48.5	18.51	4.04	±7.92	0.38	Granitic
Tamarack	0	--	--	--	--	--	Non-granitic
Sugar	0	--	--	--	--	--	Non-granitic

Key:
n = number

Table 2-34. Summary Statistics for Wetted Width:Wetted Depth Ratio in all Subwatersheds in 2015

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	118	33.1	22.77	2.10	±4.11	0.69	Granitic
Lower Burntlog	26	49.4	29.44	5.77	±11.32	0.60	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	24	56.5	33.01	6.74	±13.21	0.58	Granitic
Fourmile Creek	25	47.4	17.05	3.41	±6.68	0.36	Granitic
Riordan Creek	21	29.6	19.11	4.17	±8.17	0.65	Granitic
Trapper Creek	22	33.6	17.32	3.69	±7.24	0.52	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	0	N/A	N/A	N/A	N/A	N/A	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Key:
n = number

Table 2-35. Summary Statistics for Large Woody Debris Frequency in all Subwatersheds in 2012

Subwatershed	Sample Size (n)	Annual Mean Number per 100 meters	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	3	6.1	5.37	3.10	±6.07	0.88	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	0	--	--	--	--	--	Non-granitic
Salt and Pepper	1	2.4	--	--	--	--	Granitic
Tamarack	1	11.4	--	--	--	--	Non-granitic
Sugar	2	6.5	0.29	0.21	±0.41	0.05	Non-granitic

Key:
n = number

Table 2-36. Summary Statistics for Large Woody Debris Frequency in all Subwatersheds in 2013

Subwatershed	Sample Size (n)	Annual Mean Number per 100 meters	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	5	9.7	12.47	5.58	±10.93	1.28	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	1	0.5	--	--	--	--	Non-granitic
Salt and Pepper	2	1.9	0.14	0.10	±0.19	0.07	Granitic
Tamarack	1	8.2	--	--	--	--	Non-granitic
Sugar	2	8.1	2.02	1.43	±2.8	0.25	Non-granitic

Key:
n = number

Table 2-37. Summary Statistics for Large Woody Debris Frequency in all Subwatersheds in 2014

Subwatershed	Sample Size (n)	Annual Mean Number per 100 meters	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	2	9.6	13.58	9.60	±18.82	1.41	Granitic
Lower Burntlog	1	16.7	--	--	--	--	Granitic
Profile	1	0.0	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	1	33.9	--	--	--	--	Granitic
Riordan	1	16.7	--	--	--	--	Granitic
Trapper	1	34.7	--	--	--	--	Granitic
No Man-Boulder	1	14.8	--	--	--	--	Non-granitic
Salt and Pepper	1	32.3	--	--	--	--	Granitic
Tamarack	0	--	--	--	--	--	Non-granitic
Sugar	0	--	--	--	--	--	Non-granitic

Key:
n = number

Table 2-38. Summary Statistics for Large Woody Debris Frequency in all Subwatersheds in 2015

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	5	40.0	15.42	6.90	±13.51	0.39	Granitic
Lower Burntlog	1	17.3	N/A	N/A	N/A	N/A	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	1	70.5	N/A	N/A	N/A	N/A	Granitic
Fourmile Creek	1	37.8	N/A	N/A	N/A	N/A	Granitic
Riordan Creek	1	17.3	N/A	N/A	N/A	N/A	Granitic
Trapper Creek	1	40.9	N/A	N/A	N/A	N/A	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	0	N/A	N/A	N/A	N/A	N/A	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Key:
n = number

Table 2-39. Summary Statistics for Maximum Pool Depth in all Subwatersheds in 2012

Subwatershed	Sample Size (n)	Annual Mean (meter)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	27	0.4	0.13	0.02	±0.05	0.28	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	0	--	--	--	--	--	Non-granitic
Salt and Pepper	7	0.6	0.27	0.10	±0.2	0.43	Granitic
Tamarack	8	0.5	0.14	0.05	±0.1	0.32	Non-granitic
Sugar	20	0.5	0.18	0.04	±0.08	0.37	Non-granitic

Key:
n = number

Table 2-40. Summary Statistics for Maximum Pool Depth in all Subwatersheds in 2013

Subwatershed	Sample Size (n)	Annual Mean (meter)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	34	0.5	0.19	0.03	±0.06	0.34	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	6	0.7	0.18	0.07	±0.15	0.26	Non-granitic
Salt and Pepper	14	1.0	0.34	0.09	±0.18	0.35	Granitic
Tamarack	16	0.5	0.14	0.03	±0.07	0.31	Non-granitic
Sugar	30	0.6	0.15	0.03	±0.05	0.27	Non-granitic

Key:
n = number

Table 2-41. Summary Statistics for Maximum Pool Depth in all Subwatersheds in 2014

Site Number	Sample Size (n)	Annual Mean (meter)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	3	0.4	0.38	0.22	±0.43	0.89	Granitic
Lower Burntlog	6	0.7	0.24	0.10	±0.19	0.34	Granitic
Profile	3	0.8	0.14	0.08	±0.16	0.18	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	4	0.5	0.09	0.04	±0.09	0.16	Granitic
Riordan	8	0.6	0.20	0.07	±0.14	0.32	Granitic
Trapper	6	0.6	0.15	0.06	±0.12	0.26	Granitic
No Man-Boulder	3	0.7	0.06	0.04	±0.07	0.09	Non-granitic
Salt and Pepper	5	0.9	0.29	0.13	±0.26	0.31	Granitic
Tamarack	0	--	--	--	--	--	Non-granitic
Sugar	0	--	--	--	--	--	Non-granitic

Key:
n = number

Table 2-42. Summary Statistics for Maximum Pool Depth in all Subwatersheds in 2015

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	36	0.4	0.16	0.03	±0.05	0.42	Granitic
Lower Burntlog	9	0.6	0.19	0.06	±0.12	0.31	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	13	0.3	0.08	0.02	±0.04	0.23	Granitic
Fourmile Creek	5	0.5	0.15	0.07	±0.13	0.29	Granitic
Riordan Creek	6	0.6	0.20	0.08	±0.16	0.31	Granitic
Trapper Creek	4	0.4	0.05	0.03	±0.05	0.12	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	0	N/A	N/A	N/A	N/A	N/A	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Key:
n = number

Table 2-43. Summary Statistics for Pool Frequency in all Subwatersheds in 2012

Subwatershed	Sample Size (n)	Annual Mean (n)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	27	5.4	0.65	0.13	±0.25	0.12	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	0	--	--	--	--	--	Non-granitic
Salt and Pepper	7	2.8	0.00	0.00	±0	0.00	Granitic
Tamarack	8	4.3	0.00	0.00	±0	0.00	Non-granitic
Sugar	20	5.7	1.53	0.34	±0.67	0.27	Non-granitic

Key:
n = number

Table 2-44. Summary Statistics for Pool Frequency in all Subwatersheds in 2013

Subwatershed	Sample Size (n)	Annual Mean (n)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	34	5.1	1.24	0.21	±0.42	0.24	Granitic
Lower Burntlog	0	--	--	--	--	--	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	0	--	--	--	--	--	Granitic
Riordan	0	--	--	--	--	--	Granitic
Trapper	0	--	--	--	--	--	Granitic
No Man-Boulder	6	1.4	0.00	0.00	±0	0.00	Non-granitic
Salt and Pepper	14	2.4	0.00	0.00	±0	0.00	Granitic
Tamarack	16	8.7	0.00	0.00	±0	0.00	Non-granitic
Sugar	30	8.0	0.71	0.13	±0.25	0.09	Non-granitic

Key:
n = number

Table 2-45. Summary Statistics for Pool Frequency in all Subwatersheds in 2014

Subwatershed	Sample Size (n)	Annual Mean (n)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	3	0.7	0.17	0.10	±0.2	0.25	Granitic
Lower Burntlog	6	2.0	0.00	0.00	±0	0.00	Granitic
Profile	3	1.5	0.00	0.00	±0	0.00	Non-granitic
Goat	0	--	--	--	±0	--	Granitic
Fourmile	4	1.7	0.00	0.00	±0	0.00	Granitic
Riordan	8	4.8	0.00	0.00	±0	0.00	Granitic
Trapper	6	3.4	0.00	0.00	±0	0.00	Granitic
No Man-Boulder	3	0.6	0.00	0.00	±0	0.00	Non-granitic
Salt and Pepper	5	1.7	0.00	0.00	±0	0.00	Granitic
Tamarack	0	--	--	--	--	--	Non-granitic
Sugar	0	--	--	--	--	--	Non-granitic

Key:
n = number

Table 2-46. Summary Statistics for Pool Frequency in all Subwatersheds in 2015

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	36	5.3	1.49	0.25	±0.49	0.28	Granitic
Lower Burntlog	9	3.1	0.00	0.00	N/A	N/A	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	13	4.9	0.01	0.00	±0.01	0.00	Granitic
Fourmile Creek	5	2.2	0.00	0.00	N/A	N/A	Granitic
Riordan Creek	6	3.6	0.00	0.00	±0	0.00	Granitic
Trapper Creek	4	2.3	0.00	0.00	N/A	N/A	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	0	N/A	N/A	N/A	N/A	N/A	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Key:
n = number

Table 2-47. Summary Statistics for Bank Angle in all Subwatersheds in 2014

Subwatershed	Sample Size (n)	Annual Mean (degrees)	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	50	150.9	17.20	2.43	±4.77	0.11	Granitic
Lower Burntlog	26	124.3	31.77	6.23	±12.21	0.26	Granitic
Profile	0	--	--	--	--	--	Non-granitic
Goat	0	--	--	--	--	--	Granitic
Fourmile	25	123.1	30.97	6.19	±12.14	0.25	Granitic
Riordan	21	91.0	27.22	5.94	±11.64	0.30	Granitic
Trapper	22	108.2	31.96	6.81	±13.36	0.30	Granitic
No Man-Boulder	27	104.7	64.24	12.36	±24.23	0.61	Non-granitic
Salt and Pepper	21	146.8	26.15	5.71	±11.18	0.18	Granitic
Tamarack	0	--	--	--	--	--	Non-granitic
Sugar	0	--	--	--	--	--	Non-granitic

Note: Bank angles were not part of the PIBO protocol during the 2012 and 2013 surveys.

Table 2-48. Summary Statistics for Bank Angle in all Subwatersheds in 2015

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	118	97.6	41.21	3.79	±7.43	0.42	Granitic
Lower Burntlog	26	119.9	31.60	6.20	±12.15	0.26	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	24	108.4	33.25	6.79	±13.3	0.31	Granitic
Fourmile Creek	25	103.9	36.46	7.29	±14.29	0.35	Granitic
Riordan Creek	21	86.3	31.49	6.87	±13.47	0.36	Granitic
Trapper Creek	22	109.1	32.79	6.99	±13.7	0.30	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	0	N/A	N/A	N/A	N/A	N/A	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Note: Bank angles were not part of the PIBO protocol during the 2012 and 2013 surveys.

Table 2-49. Frequency Distribution of Bank Stability in all Subwatersheds in 2012

Subwatershed	CS	UU	US	CU
Upper EFSFSR	51	3	5	5
Lower Burntlog	0	0	0	0
Profile	0	0	0	0
Goat	0	0	0	0
Fourmile	0	0	0	0
Riordan	0	0	0	0
Trapper	0	0	0	0
No Man-Boulder	0	0	0	0
Salt and Pepper	13	5	1	2
Tamarack	21	1	1	0
Sugar	20	4	11	8

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-50. Frequency Distribution of Bank Stability in all Subwatersheds in 2013

Subwatershed	**CS**	**UU**	**US**	**CU**
Upper EFSFSR	79	12	15	0
Lower Burntlog	0	0	0	0
Profile	0	0	0	0
Goat Creek	0	0	0	0
Fourmile Creek	0	0	0	0
Riordan Creek	0	0	0	0
Trapper Creek	0	0	0	0
No Man-Boulder	22	0	1	0
Salt and Pepper	41	1	3	0
Tamarack	21	0	1	0
Sugar	32	0	10	0

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-51. Frequency Distribution of Bank Stability in all Subwatersheds in 2014

Subwatershed	CS	UU	US	CU
Upper EFSFSR	48	2	0	0
Lower Burntlog	19	2	5	0
Profile	0	0	0	0
Goat	0	0	0	0
Fourmile	17	2	5	0
Riordan	20	0	1	0
Trapper	18	3	1	0
No Man-Boulder	14	6	6	1
Salt and Pepper	20	0	1	0
Tamarack	0	0	0	0
Sugar	0	0	0	0

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-52. Frequency Distribution of Bank Stability in all Subwatersheds in 2015

Subwatershed	CS	UU	US	CU
Upper EFSFSR	90	1	25	2
Lower Burntlog	19	0	7	0
Profile	0	0	0	0
Goat Creek	16	0	8	0
Fourmile Creek	19	1	5	0
Riordan Creek	18	0	3	0
Trapper Creek	14	1	7	0
No Man-Boulder	0	0	0	0
Salt and Pepper	0	0	0	0
Tamarack	0	0	0	0
Sugar	0	0	0	0

Note:
Covered = greater than 50 percent covered by vegetation, roots or rocks
Uncovered = less than 50 percent covered by vegetation, roots or rocks
Stable = minimal or no visible fractures, cracks or slumping
Unstable = visible fractures, cracks or slumping
Key:
CS = Covered stable
UU = Uncovered unstable
US = Uncovered stable
CU = Covered unstable

Table 2-53. Summary Statistics for Bankfull Widths in all Subwatersheds in 2012

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	64	5.4	1.33	0.17	±0.33	0.25	Granitic
Lower Burntlog	0	N/A	N/A	N/A	N/A	N/A	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Fourmile Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Riordan Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Trapper Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	21	10.7	1.69	0.37	±0.72	0.16	Granitic
Tamarack	23	7.6	1.91	0.40	±0.78	0.25	Non-granitic
Sugar	43	7.0	2.31	0.35	±0.69	0.33	Non-granitic

Table 2-54. Summary Statistics for Bankfull Widths in all Subwatersheds in 2013

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	106	5.0	1.68	0.16	±0.32	0.34	Granitic
Lower Burntlog	0	N/A	N/A	N/A	N/A	N/A	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Fourmile Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Riordan Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Trapper Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
No Man-Boulder	23	19.4	6.45	1.34	±2.63	0.33	Non-granitic
Salt and Pepper	45	13.7	4.33	0.65	±1.26	0.32	Granitic
Tamarack	22	7.3	1.53	0.33	±0.64	0.21	Non-granitic
Sugar	42	6.7	1.55	0.24	±0.47	0.23	Non-granitic

Table 2-55. Summary Statistics for Bankfull Widths in all Subwatersheds in 2014

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	50	7.3	1.04	0.15	±0.29	0.14	Granitic
Lower Burntlog	26	9.6	2.66	0.52	±1.02	0.28	Granitic
Profile	25	8.1	1.42	0.28	±0.56	0.17	Non-granitic
Goat Creek	24	7.3	1.72	0.35	±0.69	0.24	Granitic
Fourmile Creek	25	7.1	1.91	0.38	±0.75	0.27	Granitic
Riordan Creek	21	5.9	1.77	0.39	±0.76	0.30	Granitic
Trapper Creek	22	7.0	2.08	0.44	±0.87	0.30	Granitic
No Man-Boulder	27	18.2	5.76	1.11	±2.17	0.32	Non-granitic
Salt and Pepper	21	16.6	2.61	0.57	±1.12	0.16	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-56. Summary Statistics for Bankfull Widths in all Subwatersheds in 2015

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	118	4.5	2.09	0.19	±0.38	0.46	Granitic
Lower Burntlog	26	10.0	2.85	0.56	±1.09	0.28	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	24	7.7	1.83	0.37	±0.73	0.24	Granitic
Fourmile Creek	25	8.1	1.88	0.38	±0.74	0.23	Granitic
Riordan Creek	21	5.7	1.73	0.38	±0.74	0.30	Granitic
Trapper Creek	22	7.0	2.09	0.44	±0.87	0.30	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	0	N/A	N/A	N/A	N/A	N/A	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-57. Summary Statistics for Maximum Bankfull Depths in all Subwatersheds in 2012

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	64	0.6	0.15	0.02	±0.04	0.26	Granitic
Lower Burntlog	0	N/A	N/A	N/A	N/A	N/A	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Fourmile Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Riordan Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Trapper Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	21	0.8	0.14	0.03	±0.06	0.18	Granitic
Tamarack	23	0.5	0.30	0.06	±0.12	0.56	Non-granitic
Sugar	43	0.6	0.18	0.03	±0.05	0.32	Non-granitic

Table 2-58. Summary Statistics for Maximum Bankfull Depths in all Subwatersheds in 2013

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	106	0.6	0.19	0.02	±0.04	0.33	Granitic
Lower Burntlog	0	N/A	N/A	N/A	N/A	N/A	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Fourmile Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Riordan Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
Trapper Creek	0	N/A	N/A	N/A	N/A	N/A	Granitic
No Man-Boulder	23	0.9	0.25	0.05	±0.1	0.28	Non-granitic
Salt and Pepper	45	0.8	0.23	0.03	±0.07	0.30	Granitic
Tamarack	22	0.7	0.13	0.03	±0.06	0.20	Non-granitic
Sugar	42	0.5	0.11	0.02	±0.03	0.25	Non-granitic

Table 2-59. Summary Statistics for Maximum Bankfull Depths in all Subwatersheds in 2014

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	50	0.7	0.15	0.02	±0.04	0.23	Granitic
Lower Burntlog	26	0.7	0.20	0.04	±0.08	0.30	Granitic
Profile	25	0.9	0.29	0.06	±0.11	0.32	Non-granitic
Goat Creek	24	0.8	0.18	0.04	±0.07	0.22	Granitic
Fourmile Creek	25	0.5	0.16	0.03	±0.06	0.30	Granitic
Riordan Creek	21	0.9	0.14	0.03	±0.06	0.16	Granitic
Trapper Creek	22	0.6	0.20	0.04	±0.08	0.30	Granitic
No Man-Boulder	27	0.8	0.27	0.05	±0.1	0.33	Non-granitic
Salt and Pepper	21	1.0	0.22	0.05	±0.09	0.22	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

Table 2-60. Summary Statistics for Maximum Bankfull Depths in all Subwatersheds in 2015

Subwatershed	Sample Size (n)	Annual Mean	Standard Deviation	Standard Error	95% Confidence Interval	Coefficient of Variation	Geologic Type
Upper EFSFSR	118	0.7	0.20	0.02	±0.04	0.30	Granitic
Lower Burntlog	26	0.8	0.21	0.04	±0.08	0.27	Granitic
Profile	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Goat Creek	24	0.9	0.23	0.05	±0.09	0.27	Granitic
Fourmile Creek	25	0.8	0.19	0.04	±0.07	0.23	Granitic
Riordan Creek	21	0.9	0.19	0.04	±0.08	0.21	Granitic
Trapper Creek	22	0.7	0.17	0.04	±0.07	0.24	Granitic
No Man-Boulder	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Salt and Pepper	0	N/A	N/A	N/A	N/A	N/A	Granitic
Tamarack	0	N/A	N/A	N/A	N/A	N/A	Non-granitic
Sugar	0	N/A	N/A	N/A	N/A	N/A	Non-granitic

SECTION 3: PIBO ANOVA RESULTS TABLES

Tables 3-1 through 3-3 present results from analysis of variance (ANOVA) tests for PIBO variables with sufficient data collected (bank angle, maximum pool depth, and WW:WD ratio). ANOVA tests compare the means of sampled groups to determine if any of those means are different from one another. Specifically, ANOVA tests the null hypothesis:

Null Hypothesis: The null hypothesis in ANOVA is that the means of the sites are equal for the parameter being tested. If the null hypothesis is not rejected, it means that the different sites are of the same sampling distribution.

Alternate Hypothesis: If the null hypothesis is rejected, the implication is the opposite – that the means of the sites are different.

A significance value (p) of 0.05 was used, indicating that we are 95 percent certain that the test has identified an actual difference when there was one. Assumptions of an ANOVA analysis include:

- Each group sample is from a normally distributed population
- Homogeneity of variances
- Independence of observations

To determine which sites when a difference in means was indicated, additional tests were then performed using Tukey's confidence intervals correction method at 95 percent confidence level (p=0.05). Tukey's method was used because it is robust as it does not underestimate the least significant difference between the means of two sites.

In **Table 3-1** through **Table 3-3**, a difference between two sites – as determined by the ANOVA at the p=0.05 level – is indicated by a colored square at the cross-section of the two sites. A white square at the cross-section of two sites indicates no difference in means between the sites.

Table 3-1. ANOVA Results for Bank Angle for 2014 and 2015

		EFMC	Meadow Creek (downstream to upstream)			EFSFSR (downstream to upstream)				Burntlog Creek	Trapper Creek	Riordan Creek	Fourmile Creek	Goat Creek	Profile Creek	Fiddle Creek
Stream/MWH ID		**006**	**060**	**047**	**016**	**033**	**032**	**059**	**044**	**050**	**053**	**055**	**056**	**057**	**061**	**062**
EFMC/006				🟥	🟥	🟥			🟥		🟥	🟥	🟥	🟥	🟥	🟥
Meadow Creek	**016**	🟥	🟥				🟥	🟥		🟥						
	047	🟥	🟥				🟥	🟥		🟥			🟥			
	060			🟥	🟥	🟥			🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥
EFSFSR	**032**			🟥	🟥	🟥			🟥		🟥	🟥	🟥	🟥		🟥
	033	🟥	🟥				🟥	🟥								
	044	🟥	🟥				🟥	🟥		🟥						
	059			🟥	🟥				🟥		🟥	🟥	🟥	🟥		🟥
Burntlog Creek/ 050			🟥	🟥	🟥				🟥			🟥				🟥
Trapper Creek/053		🟥	🟥				🟥	🟥								
Riordan Creek/055		🟥	🟥				🟥	🟥		🟥			🟥			
Fourmile Creek/ 056		🟥	🟥	🟥			🟥	🟥				🟥				
Goat Creek/057		🟥	🟥				🟥	🟥								
Profile Creek/061		🟥	🟥													
Fiddle Creek/062		🟥	🟥				🟥	🟥		🟥						

Note: Highlighted cells denote a statistically significant difference between sites

Key:

ANOVA = Analysis of Variance

EFMC = East Fork Meadow Creek

EFSFSR = East Fork of the South Fork of the Salmon River

Table 3-2. ANOVA Results for Pool Depth for 2012-2015

		EFMC	EFSFSR (downstream to upstream)					Sugar Creek (downstream to upstream		Meadow Creek (downstream to upstream)			Burntlog Creek	Trapper Creek	Riordan Creek	Tamarack Creek	Fourmile Creek	Goat Creek	Fiddle Creek
Stream/MWH ID		**006**	**009**	**013**	**032**	**033**	**044**	**008**	**010**	**014**	**016**	**047**	**050**	**053**	**055**	**017**	**056**	**057**	**062**
EFMC/006			🟥		🟥	🟥		🟥				🟥	🟥		🟥				
EFSFSR	**009**	🟥			🟥						🟥					🟥		🟥	🟥
	013				🟥	🟥													
	032	🟥	🟥	🟥		🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥
	033	🟥		🟥	🟥		🟥			🟥	🟥					🟥		🟥	🟥
	044				🟥	🟥													
Sugar Creek	**008**	🟥			🟥														🟥
	010				🟥														🟥
Meadow Creek	**014**				🟥	🟥						🟥	🟥						
	016		🟥		🟥	🟥						🟥	🟥						
	047	🟥			🟥					🟥	🟥					🟥		🟥	🟥
Burntlog Creek/050		🟥			🟥					🟥	🟥					🟥		🟥	🟥
Trapper Creek/053																			🟥
Riordan Creek/055		🟥			🟥													🟥	🟥
Tamarack Creek/017			🟥		🟥	🟥						🟥	🟥						
Fourmile Creek/056					🟥														
Goat Creek/057			🟥		🟥	🟥						🟥	🟥		🟥				
Fiddle Creek/062			🟥		🟥	🟥		🟥	🟥			🟥	🟥		🟥				

Note: Highlighted cells denote a statistically significant difference between sites
Key: ANOVA = Analysis of Variance
EFMC = East Fork Meadow Creek
EFSFSR = East Fork of the South Fork of the Salmon River

Table 3-3. ANOVA Results for Wetted Width-to-Wetted Depth Ratio for 2012-2015

		EFMC	EFSFSR (downstream to upstream)						Sugar Creek (downstream to upstream		Meadow Creek (downstream to upstream)				Burntlog Creek	Trapper Creek	Riordan Creek	Tamarack Creek	Fourmile Creek	Goat Creek	Profile Creek	Fiddle Creek
Stream/MWH ID		**006**	**009**	**013**	**032**	**033**	**044**	**059**	**008**	**010**	**014**	**016**	**047**	**060**	**050**	**053**	**055**	**017**	**056**	**057**	**061**	**062**
EFMC/006						🟥	🟥						🟥	🟥								
EFSFSR	**009**					🟥	🟥						🟥	🟥			🟥					
	013					🟥	🟥						🟥									
	032						🟥		🟥				🟥	🟥		🟥	🟥				🟥	
	033	🟥	🟥	🟥			🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥		🟥	🟥
	044	🟥	🟥	🟥	🟥	🟥				🟥					🟥				🟥	🟥		
	059																					
Sugar Creek	**008**				🟥	🟥							🟥							🟥		
	010					🟥	🟥						🟥	🟥								
Meadow Creek	**014**					🟥							🟥									
	016					🟥							🟥									
	047	🟥	🟥	🟥	🟥	🟥		🟥	🟥	🟥	🟥	🟥			🟥	🟥		🟥	🟥	🟥		
	060																					
Burntlog Creek/050						🟥	🟥						🟥									
Trapper Creek/053					🟥	🟥							🟥							🟥		
Riordan Creek/055			🟥		🟥	🟥									🟥				🟥	🟥		
Tamarack Creek/017						🟥							🟥									
Fourmile Creek/056						🟥	🟥						🟥	🟥			🟥				🟥	
Goat Creek/057							🟥		🟥				🟥	🟥		🟥	🟥				🟥	
Profile Creek/061					🟥	🟥													🟥	🟥		
Fiddle Creek/062						🟥																

Note: Highlighted cells denote a statistically significant difference between sites
Key: ANOVA = Analysis of Variance EFMC = East Fork Meadow Creek EFSFSR = East Fork of the South Fork of the Salmon River

Appendix 2:

Macroinvertebrate Survey Report for 2012 to 2016

Appendix 2: Macroinvertebrate Survey Report for 2012 to 2016

Stibnite Gold Project
Midas Gold Idaho, Inc.

April 2017

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SECTION 1: INTRODUCTION

EcoAnalysts, Inc. and MWH Americas, Inc. (MWH) conducted macroinvertebrate surveys in the summers of 2012 through 2014 and 2016 in the East Fork of the South Fork of the Salmon River (EFSFSR) and selected tributaries as part of an aquatic resources baseline study prior to the start of proposed mining operations at the Stibnite Gold Project in central Idaho. Macroinvertebrates are often used as biological indicators of water quality, being used to identify impaired waterways, assess aquatic life stressors, and indicate improvements. Macroinvertebrates provide a localized assessment of their response to stream conditions, making them a better indicator of water quality conditions than fish, which are typically more mobile. In addition to their value as a water quality indicator, macroinvertebrates are also the primary prey for most of the fish species in the aquatic resources study area.

The project, proposed by Midas Gold Idaho, Inc. (Midas Gold), is located in the Stibnite-Yellow Pine Mining District near Yellow Pine, Idaho and lies within the Salmon River Mountains near the Frank Church River of No Return Wilderness. The mining district is administered by the Krassel Ranger District of the Payette National Forest (PAF).

The terrain within the project area consists of narrow valleys surrounded by steep mountains. Elevations range from 6,000 to 6,600 feet above mean sea level along valley floors to more than 8,500 feet above mean sea level in the surrounding mountains. The EFSFSR is the main drainage basin in the project area.

Macroinvertebrates

Organisms without backbones that are visible without the aid of a microscope. Aquatic macroinvertebrates live on, under, and around rocks and sediment on the bottoms of lakes, rivers, and streams.

The purpose of these surveys was to evaluate stream health and water quality based on macroinvertebrates found at the sampling sites, and to allow future repeatable studies that can track any changes to habitat conditions that may result from mining activity. Species composition and abundances at each site were used to calculate quantitative measures of biological condition (metrics) that are based on habitat preferences, feeding strategies, water-quality tolerances, and expected occurrences of different macroinvertebrates. The magnitude and variation in these metrics provide useful information for understanding the water quality and habitat characteristics of streams in the project area.

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SECTION 2: METHODS

2.1 Field Methods

Benthic macroinvertebrate samples were collected from 11 sites (**Figure 2-1**) in the summers of 2012, 2013, 2014, and 2016 using protocols of the Pacific Anadromous Fish Strategy (PACFISH) Inland Fish Strategy (INFISH) Biological Opinion Effectiveness Monitoring Program (PIBO) (Heitke et al. 2011). Macroinvertebrates were collected at these sites with a 500-micron mesh Hess sampler (2012 – 2014) or D-net (2016), using a targeted composite method. Two individual samples were taken at randomized locations in each of four consecutive riffle/run habitat units at each sampling site, for a total of eight individual samples per site. These eight samples were then composited in the field into a single benthic macroinvertebrate sample per site, preserved in 95 percent ethanol, and transported to the EcoAnalysts, Inc. laboratory in Moscow, Idaho for sorting, subsampling, and taxonomic identification.

Benthic Macroinvertebrates

Organisms that live in or on the bottom sediments of rivers, streams, and lakes. The benthic invertebrate community is strongly affected by its environment, including sediment composition and quality, water quality, and hydrological factors that influence the physical habitat. Because the benthic community is so dependent on its surroundings, it serves as a biological indicator that reflects the overall condition of the aquatic environment.

2.2 Laboratory Methods

A subsample of 500 organisms was randomly sorted from each composite sample by rinsing the sample, mixing it to homogenize the composition, and spreading the mixed sample into a gridded tray. All organisms were picked from a random selection of grids until at least 500 organisms were removed from the composited sample. Once a grid was selected, all organisms were picked from that grid so that no partial grids were sorted. Therefore, subsamples typically exceeded 500 organisms, to a greater or lesser extent, depending on how many organisms were in the last grid sorted to achieve the minimum target of 500 organisms.

All organisms in the subsample were then identified and enumerated to the lowest practical level – generally by genus and species. If an individual subsample could not be identified to the lowest practical target resolution (e.g., due to poor condition, immaturity, or another indeterminate reason), it was identified to the lowest taxonomic resolution possible for that individual specimen. All individual organisms not identified to target resolution were noted as being unique or non-unique relative to the others in the sample.

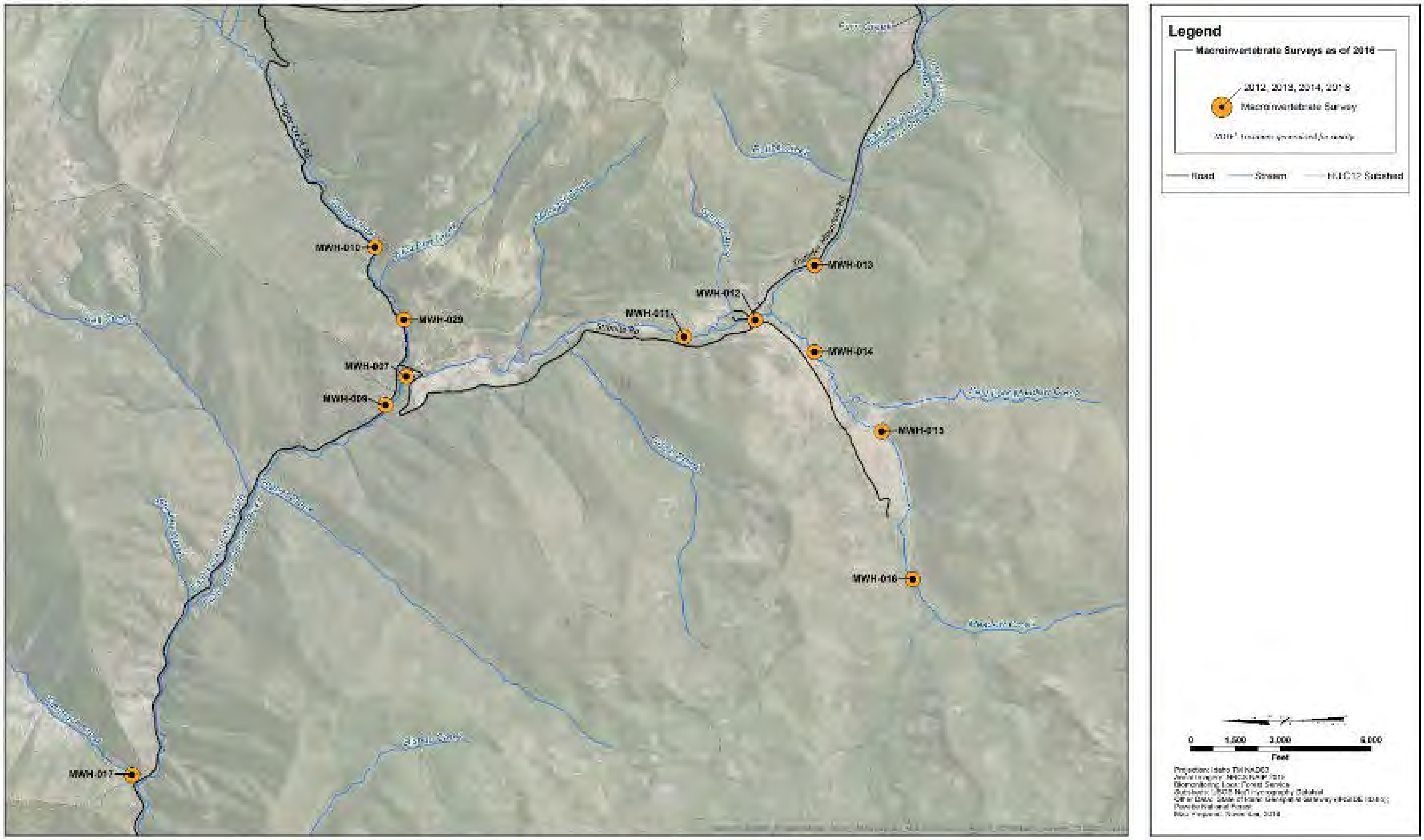


Figure 2-1. Macroinvertebrate Survey Site Locations since 2012

2.3 Data Analysis

2.3.1 Idaho Stream Macroinvertebrate Index

The Idaho Stream Macroinvertebrate Index (SMI) was used to assess conditions for all sites and sampling years. Developed by the Idaho Department of Environmental Quality, the SMI is a methodology for using different macroinvertebrate population indicators to evaluate stream conditions and is used extensively to assess stream conditions throughout Idaho (Grafe 2002). The SMI is used to convert macroinvertebrate population measurements (metrics) into scores that are then combined into an overall final score and stream condition rating based on the best available regional reference conditions that were used to develop the SMI.

The macroinvertebrate population includes insects and non-insects, such as clams, snails, and worms. These populations are indicators of the condition of existing stream habitat as well as changes over time since macroinvertebrates have different water quality, habitat, and feeding requirements. Changes in habitat conditions can also be detected over relatively short time periods because of the short live cycles of insects and quick response to changing habitat. Therefore, describing the macroinvertebrate community also describes many aspects of stream conditions.

The Idaho SMI has been calibrated for different Idaho regions to account for varying organism composition and natural habitat conditions. For this study, the scoring formulas for the Idaho SMI Central and Southern Mountains region (where the Stibnite Gold Project is located) were used. Non-unique taxa were excluded from all richness calculations because inclusion of non-unique taxa would falsely inflate the number of unique macroinvertebrates found at the survey sites. See Grafe (2002) for detailed information on development and calculation of the SMI.

When reading through the study results, it is important to understand the distinction between metric *values* and metric *scores*. The SMI scoring system is designed to convert metric *values* into metric *scores* so that higher metric *scores* always respond positively to greater habitat quality or function regardless of whether a metric *value* (used to calculate the score) responds positively or negatively to perturbations. Following are descriptions of SMI metrics including the predicted response of metric *values* to perturbations in habitat and/or water quality such as sedimentation, organic pollution, or chemical pollution as described by Barbour (1999) and Grafe (2002). Bold text indicates how macroinvertebrate populations and associated metric *values* generally respond to such perturbations.

Total Taxa Richness: Total number of identifiably distinct taxa in a sample. The biodiversity of a stream declines as flow regimes are altered, habitat is lost, chemicals are introduced, energy cycles are disrupted, and alien taxa invade. Total taxa richness includes all aquatic invertebrates including insects, clams, snails, and worms. ***Metric response to habitat/water quality perturbations = decrease***.

Ephemeroptera Taxa Richness: Total number of identifiably distinct taxa in the insect order Ephemeroptera (mayflies). The diversity of mayflies declines in response to most types of human influence. Many mayflies graze on algae and are particularly sensitive to chemical pollution. Mayflies may disappear when heavy metal concentrations are high while caddisflies and stoneflies are unaffected. Mayflies may also increase in numbers in response to nutrient enrichment. ***Metric response to habitat/water quality perturbations = decrease, but can be variable***.

Plecoptera Taxa Richness: Total number of identifiably distinct taxa in the insect order Plecoptera (stoneflies). Stoneflies are often some of the first taxa to disappear from a stream due to disturbance. They require as clean substrate, and cool highly-oxygenated water. Most Plecoptera are predators, but several taxa are shredders that feed on leaf litter that drops from an overhanging tree canopy. ***Metric response to habitat/water quality perturbations = decrease***.

Percent Plecoptera: Relative abundance of stoneflies, expressed as a percent of the total number of individuals in the sample. ***Metric response to habitat/water quality perturbations = decrease***.

Trichoptera Taxa Richness: Total number of identifiably distinct taxa in the insect order Trichoptera (caddisflies). Caddisflies are an ecologically diverse group of insects and the variety of taxa declines as the variety and complexity of habitat declines. ***Metric response to habitat/water quality perturbations = decrease***.

Hilsenhoff Biotic Index (HBI): An index of community tolerance to organic pollution and is a single value derived from the pollution tolerance values associated with each type of macroinvertebrate weighted by the abundance of those macroinvertebrates. Values range from 0 to 10, with higher values indicating more organic influence at a site. The index is influenced primarily by organic enrichment/compounds (i.e., organic pollution), but other factors, including temperature and sediment, can also have an influence. Different agencies may use different tolerance values for each species depending on geographical region. The default values used in this evaluation are the same as currently in use in Region 10 (Pacific Northwest) of the United States Environmental Protection Agency (EPA) (Barbour 1999). ***Metric response to habitat/water quality perturbations = increase***.

Percent 5 Dominant Taxa: The percentage of individuals in a sample comprised of the five most abundant taxa. This is a measure of taxa evenness, and as diversity declines, the tendency is for fewer numbers of taxa to make up a greater proportion of overall abundance. ***Metric response to habitat/water quality perturbations = increase***.

Scraper Taxa Richness: The total number of distinctly identifiable taxa in a sample whose primary feeding strategy is to scrape attached periphyton and other particulates. (Periphyton is a complex mixture of algae, cyanobacteria, heterotrophic microbes, and detritus that is attached to submerged surfaces in most aquatic ecosystems.) ***Metric response to habitat/water quality perturbations = decrease.***

Clinger Taxa Richness: The total number of clinger taxa in a sample. Clingers having morphological and behavioral adaptations allowing them to hold on to smooth, stable substrates in flowing water. Clinger taxa are sensitive to sediment deposition, which can fill in crevice habitat between rocks in the streambed. ***Metric response to habitat/water quality perturbations = decrease***.

2.3.2 Additional Selected Metrics

When developing a biological index such as the SMI, the final list of metrics are selected from a larger list of informative candidate metrics as those that best evaluate regional stream conditions. In fact, no two regionally-developed biological indices use identical metrics because of differences in regional conditions and also the scoring methods that researchers used to calculate the index. Basically, all candidate metrics provide useful information on stream condition whether or not they "make the cut" and are incorporated into the final index calculation. This section describes five additional non-SMI metrics selected as additional and informative descriptors of macroinvertebrate populations, habitat and water quality conditions. The fact that these other metrics are not included in the SMI is not a reflection of the limitations of the SMI metrics, but rather a reflection of the strength of the final SMI metrics at evaluating and scoring stream conditions in Idaho. The additional metrics described below were chosen to supplement the SMI and provide a better overall picture of the streams. Bold text indicates how macroinvertebrate populations and associated metric *values* generally respond to such perturbations.

Long-lived Taxa Richness: The total number of taxa in a sample that require more than one year to complete their life cycle. These taxa must overwinter in the stream and are exposed to any natural and human disturbance that may occur during the winter. They are not usually found in ephemeral streams or streams prone to severe flooding. ***Metric response to habitat/water quality perturbations = decrease.***

Metals Tolerance Index (MTI): McGuire's Metals Tolerance Index (MTI) was developed using benthic invertebrate communities and associated metal data (copper) in Montana's Clark Fork River (McGuire 1998). It is an index of community tolerance to metal contamination that ranks taxa according to their sensitivity to metals. It is calculated as a weighted average of tolerance values assigned to each taxon, similar to the HBI. As with the HBI, values range from 0 to 10, with higher values indicating that organisms are more tolerant of metals contamination. Values of 0 to 3 generally indicate little to no impact of metals on the macroinvertebrate community (i.e., relatively intolerant of metals contamination). ***Metric response to habitat/water quality perturbations = increase.***

Intolerant Taxa Richness: The number of taxa in a sample with HBI values of 0 to 2 (i.e., highly intolerant of organic pollution). Intolerant taxa are the most sensitive and the first to disappear as disturbance increases. They typically represent 5 to 10 percent of all taxa in a region, with the remainder being either moderately or very tolerant. ***Metric response to habitat/water quality perturbations = decrease.***

Percent Tolerant Individuals: The relative abundance of all individuals in a sample having HBI values of 8 to 10 (i.e., highly tolerant of organic pollution), expressed as a percentage of the total number of individuals in the sample. Although tolerant taxa may be found in many sites, they do not usually become dominant unless a disturbance removes intolerant taxa. The tolerant taxa can then dominate a community and fill in the niches left as intolerant taxa disappear. ***Metric response to habitat/water quality perturbations = increase.***

Shannon-Weaver H' (log e): A community diversity index that describes the degree of taxonomic richness and how evenly the counts of those taxa are distributed in a sample. Diversity and evenness metrics are good indicators of the ability of a system to support varied taxa. The most common diversity index is the Shannon-Weaver index; also known as the Shannon-Weiner index (Shannon and Weaver 1949). This index can be a useful measure to compare invertebrate communities; however it is often redundant with other measures of diversity such as taxa richness and percent dominance. Higher values indicate greater species diversity and evenness. ***Metric response to habitat/water quality perturbations = decrease.***

2.3.3 Functional Feeding Groups

The functional feeding group (FFG) composition of each sample was calculated as a percentage of individuals and number of taxa. The FFGs represented in the insect community are a direct function of available food and habitat resources. Some FFGs such as scraper taxa and predator taxa are commonly used in multimetric models because they are good indicators of habitat quality and stability. The expected or probable response to perturbations are listed below for each FFG, according to Barbour (1999) and Grafe (2002). The response of FFG distribution to perturbations is more variable that other metrics, but FFG distribution can be an indicator of habitat diversity and/or diversity of food resources within and between sampling sites. Bold text indicates how macroinvertebrate populations and associated metric *values* generally respond to such perturbations.

Percent Filterers: The relative abundance of all individuals in a sample whose primary feeding mechanism is to filter suspended fine particulates, expressed as a percentage of the total number of individuals in the sample. ***Metric response to habitat/water quality perturbations = variable.***

Percent Gatherers: The relative abundance of all individuals in a sample whose primary feeding mechanism is to gather deposited fine particulates, expressed as a percentage of the total number of individuals in the sample. ***Metric response to habitat/water quality perturbations = variable.***

Percent Predators: The relative abundance of all individuals in a sample whose primary feeding mechanism is to pierce or engulf other invertebrates, expressed as a percentage of the total number of individuals in the sample. Predators represent the top of the food web and depend on stable sources of other invertebrates to eat. The percentage of predators is an indicator of community complexity supported by a site. In general, less disturbed sites support a greater diversity of prey items and habitats. ***Metric response to habitat/water quality perturbations = variable, but often a decrease due to loss of habitat stability and diverse community structure.***

Percent Scrapers: The relative abundance of all individuals in a sample whose primary feeding strategy is to scrape attached periphyton and other particulates, expressed as a percentage of the total number of individuals in the sample. ***Metric response to habitat/water quality perturbations = decrease.***

Percent Shredders: The relative abundance of all individuals in a sample whose primary feeding mechanism is to shred coarse particulate organic matter (CPOM), expressed as a percentage of the total number of individuals in the sample. ***Metric response to habitat/water quality perturbations = variable.***

Percent Unclassified: The relative abundance of all individuals in a sample whose primary feeding mechanism is unknown or unclassified, expressed as a percentage of the total number of individuals in the sample. A taxa can be unclassified if the feeding group is unknown, undefined, or the taxa represents multiple feeding groups. This metric can usually be ignored due to usually low numbers of such taxa. ***Metric response to habitat/water quality perturbations = variable.***

Filterer Richness: The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to filter suspended fine particulates. ***Metric response to habitat/water quality perturbations = variable.***

Gatherer Richness: The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to gather deposited fine particulates. ***Metric response to habitat/water quality perturbations = variable.***

Predator Richness: The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to pierce or engulf other invertebrates. Predators represent the top of the food web and depend on a stable sources of other invertebrates to eat. The percentage of predators is an indicator of community complexity supported by a site. In general, less disturbed sites support a greater diversity of prey items and habitats. ***Metric response to habitat/water***

quality perturbations = variable, but often decrease due to loss of habitat stability and diverse community structure.

Scraper Richness: The total number of distinctly identifiable taxa in a sample in which the primary feeding strategy is to scrape attached periphyton and other particulates. (This is also an SMI metric – see additional description in SMI metric section.) ***Metric response to habitat/water quality perturbations = decrease.***

Shredder Richness: The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is to shred CPOM. This is an indicator of terrestrial vegetation input. ***Metric response to habitat/water quality perturbations = variable.***

Unclassified richness: The total number of distinctly identifiable taxa in a sample in which the primary feeding mechanism is unknown or unclassified. A taxa can be unclassified if the feeding group is unknown, undefined, or the taxa represents multiple feeding groups. This metric can often be ignored due to typically low numbers of such taxa. ***Metric response to habitat/water quality perturbations = variable.***

2.3.4 PIBO Observed/Expected Model

The PIBO observed/expected (O/E) index, derived from the statistical model RIVPACS (River Invertebrate Prediction and Classification System) was used to assess the biological condition of sites that were sampled in 2012, 2013, 2014, and 2016. The O/E index calculations were performed by Dr. Scott W. Miller, Director of the National Aquatic Monitoring Center at Utah State University, who developed RIVPACS model in 2009 in partnership with Robert Al-Chochachy of PIBO (PACFISH/INFISH Biological Opinion, U.S. Forest Service) and Chuck Hawkins of the Western Monitoring Center, Utah State University.

O/E models compare the macroinvertebrate taxa observed at sites of unknown biological condition (i.e., “test sites”) to the populations expected to be found in the absence of human-caused stressors (Hawkins et al. 2000). The PIBO O/E model is based on 174 reference conditions throughout the western United States grouped into 10 distinct classes based on the similarity of macroinvertebrate populations among sites following the standard methods of Hawkins et al. (2000) and described in detail in the western streams and rivers statistical summary of the EPA’s Environmental Monitoring and Assessment Program (Stoddard et al. 2006). The PIBO O/E model incorporates watershed area, long-term precipitation average, and maximum temperature to predict the expected macroinvertebrate populations for comparison to test sites.

Biological condition for this study was defined by how closely the measured macroinvertebrate community matched the expected community. Biological condition was assessed based on the precision of the western stream reference site data used to develop the PIBO O/E model (mean = 0.95, standard deviation (SD) = 0.16). In general, the amount a PIBO score differs from a score of 1.0 indicates the amount that the macroinvertebrate composition at a test site differs from what is expected under less disturbed conditions. Test sites scoring less than 1.0 SD below the mean of reference sites were rated in *good* biological condition (i.e., comparable to reference conditions); sites scoring between 1.0 SD and 2.0 SD below the mean in *fair* biological condition; and sites scoring more than 2.0 SD below the mean of reference sites in *poor* biological condition. All PIBO O/E scores greater than 1.0 are also rated as *good* because it indicates a higher than expected diversity of macroinvertebrate taxa in the test site relative to western reference sites, which is unlikely to occur under disturbed conditions.

PIBO O/E scores and rating categories are independent of SMI scores and rating categories. PIBO O/E scores and ratings evaluate only taxa richness in test sites based on 174 reference condition sites throughout the western United States. The SMI evaluates not only taxa richness, but incorporates other ecological information to come up with scores and rating categories based only on Idaho reference conditions.

SECTION 3: RESULTS AND DISCUSSION

3.1 Idaho Stream Macroinvertebrate Index (SMI) – Central and Southern Mountains

This section describes results of the analysis of stream conditions at all sites in all sampling years. The SMI scores shown in **Table 3-1** were calculated using scoring formulas for the Central and Southern Mountains region. A detailed description of the SMI methodology is found in Grafe (2002). The scoring methodology includes the following parameters (see details in Section 2.3.1):

- *Metric Values* are those values calculated most directly from the composition of macroinveterbrates in each sample. For example, Total Taxa simply equals the total number of unique taxa in a sample. Detailed descriptions and the responses of each metric value to habitat/water quality perturbations are described in **Section 2.3.1**.
- *Metric Scores* are calculated using on the Metric Valuesand always respond positively to higher quality habitat/water quality conditons.The equations for calculating each Metric Score were formulated based on Idaho reference conditions so that a score of 100 or greater indicates that a site is equivelent to the best reference sites used to develop the SMI in Idaho for that metric. Metric Scores cannot be less than 0, but there no maximum possible score.
- *SMI Rating* is the qualitative rating based the final SMI score. The levels for each rating category are indicated in **Figure 3-1**. The rating categories are as follows:
  - Very Poor (0 to 19)
  - Poor (20 to 39)
  - Fair (40 to 58)
  - Good (59 to 79)
  - Very Good (80 to 100)
- *Metric Scores 100 Maximum* are simply the Metric Scores adjusted so that any value over 100 is reset down to 100 for the purposes of standardizing the scores to calculate a final average SMI score that ranges from 0-100. All metric scores less than 100 remain unadjusted. This adjustement is necessary for the calculation of a final overall score, but it is also useful to know which metrics "max-out" at 100 because those are the metrics that are equivelent to, or better than the Idaho reference condition sites used to develop the SMI. Any score of 100 or greater have been highlighted grey in **Table 3-1** to aid in interpretation of which metrics are driving the overall score for each stream. In **Figures 3-2** to **3-10**, a line at a value of 100 illustrates which metric scores "max-out" for each sampling site.
- *SMI Score* is the average of the Metric Scores that have been adjusted down to 100 where necessary. This average is the final overall SMI score for each site and the SMI rating is based on this final score.

In general, the final SMI scores were consistently high across sites and years because individual scores for most metrics were high, with several consistently exceeding the highest score of 100 (**Table 3-1**, **Figures 3-2** through **3-10**). The corresponding overall rating was *very good* for 7 of the 11 sample sites in all four sampling years (the highest category in the SMI scoring system) (**Table 3-1**, **Figure 3-1**). Among these seven consistently *very good* sites, there was relatively little variation in SMI scores between years with the exception of MWH-010 (upper Sugar Creek) which had a decreased score of 83.2 in 2016 as compared to 92.4 to 95.6 from 2012 to 2014. Even though the overall rating at MWH-010 was still considered *very good,* it's worthy to note that the departure from previous scores appeared to be driven by lower Trichoptera richness, percent Plecoptera, and lower water quality tolerance (i.e., HBI).

Only six occurrences of scores lower than the highest SMI condition category were observed, all of which were the next highest SMI category of *good*. Two of these occurrences were at MWH-007 in 2014 and 2016 (immediately downstream from the Yellow Pine Pit on the EFSFSR), and two were at MWH-015 in 2012 and 2016 (the constructed channel on Meadow Creek). However, in all four of these instances the SMI scores were similar across years and changes in SMI rating category represented only slight changes in the SMI scores.

The remaining two occurrences of *good* SMI ratings were in 2016 at MWH-016 (the furthest upstream Meadow Creek site) and MWH-017 (Tamarack Creek, a control site), both of which were departures from previous years. In particular, the furthest upstream Meadow Creek site (MWH-016) had a much lower overall SMI score than in previous years due largely to dramatically lower taxa richness (particularly Trichoptera and Plecoptera richness) and greater water tolerance values (corresponding to lower HBI scores) for those taxa collected. Reasons for a decrease in taxa richness at MWH-016 are unclear while the HBI scores were lower in 2016 across most sites as compared to previous years (see discussion below). The decreased SMI score at MWH-017 was driven by somewhat lower scores for nearly all metrics. MWH-017 is a designated control site and MWH-016 is upstream of the Stibnite project area where there is little human activity within and upstream of the site.

SMI metrics that generally scored high across survey sites and years included total taxa richness, Ephemeroptera taxa richness (mayflies), Trichoptera taxa richness (caddisflies), percent 5 dominant taxa (the five most abundant taxa), HBI (a measure of water quality tolerance), scraper taxa richness, and clinger taxa richness. However, as discussed, lower 2016 SMI scores for MWH-007, MWH-010, MWH-015, MWH-016, and MWH-017 were generally the result of lower taxa richness (particularly Plecoptera and Trichoptera richness), percent Plecoptera, HBI scores, scraper taxa, percent-5 dominant, and clinger taxa. There is some redundancy in these measures, particularly among the richness metrics, so changes in overall diversity could affect all of these scores.

Plecoptera taxa richness (stoneflies) exhibited higher variation among all sites and years, but still produced fairly high metric scores (**Figure 3-4**, **Table 3-1**). A notable exception was relatively low stonefly richness at site MWH-007 on the EFSFSR immediately downstream of the Yellow Pine Pit outlet. While suggestive of some aspect of water quality such as temperature, the low stonefly richness remains unclear considering that other metric scores appear healthy. Another possibility to explain the low stonefly richness at this site is sampling bias and potential inconsistency between sampling events, as MWH-007 is extremely difficult to sample because of high gradients, high current velocities, and very large substrate making the site difficult to effectively sample with nets. Plecoptera richness was lower at several sites in 2016 than in previous years.

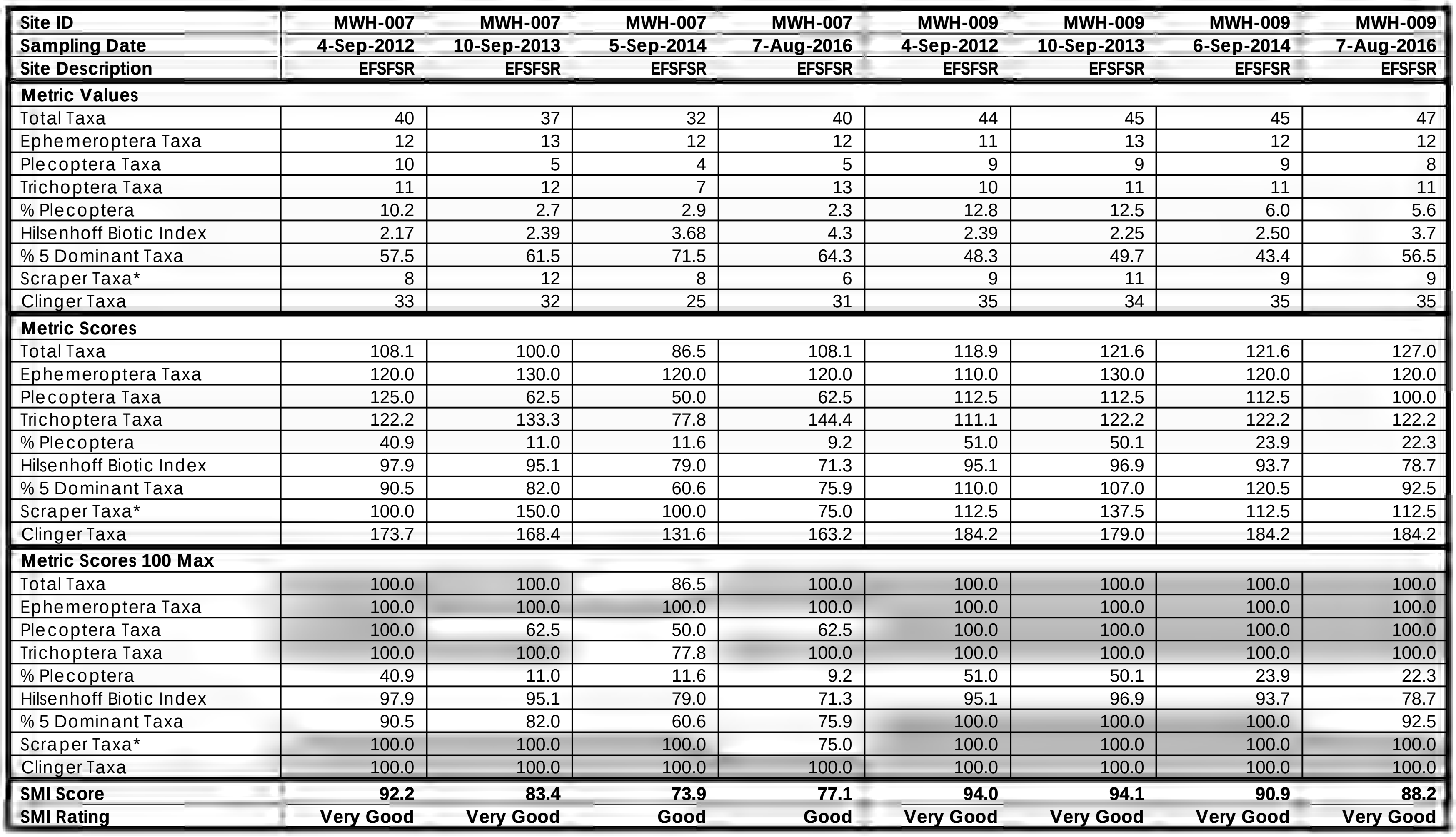
The lowest metric scores and widest variation among sites was for percent Plecoptera individuals (**Table 3-1**, **Figure 3-6**). Sites MWH-010 (upper Sugar Creek) and MWH-017 (Tamarack Creek) had the highest average percentage of Plecoptera individuals (stoneflies) over the four sampling years (about twice the average scores of the other sites), but these average scores were largely driven by particularly high scores at these sites in 2012, and were markedly lower in 2016. Site MWH-007 (just below Yellow Pine Pit) had the lowest stonefly abundance, but was still generally similar to low abundances seen at all other sites. As with Plecoptera richness, this may suggest that the site has different water quality properties than other sites, but sampling bias cannot be ruled out considering the difficulty in sampling the site, as previously discussed. In summary, most sites exhibited moderate to high Plecoptera diversity, but relatively low numbers.

Given the high taxa richness of all the sites, it is difficult to draw firm conclusions regarding low Plecoptera abundance. Ultimately, relatively low abundance of Plecoptera individuals did not significantly affect the overall SMI scores because of consistently high taxa richness, an abundance of taxa having low water quality tolerance scores, and an abundance of clinger and scraper taxa which require what is considered high-quality stream habitat in the Central and Southern Mountains region, namely clean cobble substrate.

While there was some variation, the overall HBI scores were fairly high (generally above 75) for most sites and years, which detracted little from the overall SMI scores, particularly in light of additional metrics presented in the next section that demonstrate the low numbers of tolerant individuals and very high numbers of intolerant taxa found at all sites.

It is notable that HBI scores were generally lower across all sites in 2016 than in previous years, indicating that the HBI *values* were higher, with HBI values being the combination of tolerance of organic pollution weighted by the abundance of those taxa in each sample. These higher HBI values (and corresponding lower HBI scores) mean that the types and abundances of taxa collected at those sites were skewed towards being more tolerant of organic pollution than in previous years and may warrant further investigation to see if such trends hold into the future. Similarly, there appeared to be a lower number of clinger and scraper taxa at a number of sites in 2016. A possible explanation for this observed trend in HBI and some taxa richness scores across sites in 2016 is that sampling was conducted using a D-net in 2016 rather than a Hess sampler as in 2012-2014. However, it is unclear whether sampling method affected 2016 results in a systematic way. Equal effort (i.e., time and depths sampled) and similar randomization of replicate locations were employed in all years regardless of sampling gear used. In addition, a consistent trend in scores was not found for all metrics and both methods are commonly approved, and are known to similarly collect, and methods the representative macroinvertebrate community within riffle habitat.

Table 3-1. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Survey Sites 2012-2016



Site ID	MWH-007	MWH-007	MWH-007	MWH-007	MWH-009	MWH-009	MWH-009	MWH-009
Sampling Date	**4-Sep-2012**	**10-Sep-2013**	**5-Sep-2014**	**7-Aug-2016**	**4-Sep-2012**	**10-Sep-2013**	**6-Sep-2014**	**7-Aug-2016**
Site Description	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**
Metric Values								
Total Taxa	40	37	32	40	44	45	45	47
Ephemeroptera Taxa	12	13	12	12	11	13	12	12
Plecoptera Taxa	10	5	4	5	9	9	9	8
Trichoptera Taxa	11	12	7	13	10	11	11	11
% Plecoptera	10.2	2.7	2.9	2.3	12.8	12.5	6.0	5.6
Hilsenhoff Biotic Index	2.17	2.39	3.68	4.3	2.39	2.25	2.50	3.7
% 5 Dominant Taxa	57.5	61.5	71.5	64.3	48.3	49.7	43.4	56.5
Scraper Taxa*	8	12	8	6	9	11	9	9
Clinger Taxa	33	32	25	31	35	34	35	35
Metric Scores								
Total Taxa	108.1	100.0	86.5	108.1	118.9	121.6	121.6	127.0
Ephemeroptera Taxa	120.0	130.0	120.0	120.0	110.0	130.0	120.0	120.0
Plecoptera Taxa	125.0	62.5	50.0	62.5	112.5	112.5	112.5	100.0
Trichoptera Taxa	122.2	133.3	77.8	144.4	111.1	122.2	122.2	122.2
% Plecoptera	40.9	11.0	11.6	9.2	51.0	50.1	23.9	22.3
Hilsenhoff Biotic Index	97.9	95.1	79.0	71.3	95.1	96.9	93.7	78.7
% 5 Dominant Taxa	90.5	82.0	60.6	75.9	110.0	107.0	120.5	92.5
Scraper Taxa*	100.0	150.0	100.0	75.0	112.5	137.5	112.5	112.5
Clinger Taxa	173.7	168.4	131.6	163.2	184.2	179.0	184.2	184.2
Metric Scores 100 Max								
Total Taxa	100.0	100.0	86.5	100.0	100.0	100.0	100.0	100.0
Ephemeroptera Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Plecoptera Taxa	100.0	62.5	50.0	62.5	100.0	100.0	100.0	100.0
Trichoptera Taxa	100.0	100.0	77.8	100.0	100.0	100.0	100.0	100.0
% Plecoptera	40.9	11.0	11.6	9.2	51.0	50.1	23.9	22.3
Hilsenhoff Biotic Index	97.9	95.1	79.0	71.3	95.1	96.9	93.7	78.7
% 5 Dominant Taxa	90.5	82.0	60.6	75.9	100.0	100.0	100.0	92.5
Scraper Taxa*	100.0	100.0	100.0	75.0	100.0	100.0	100.0	100.0
Clinger Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SMI Score	**92.2**	**83.4**	**73.9**	**77.1**	**94.0**	**94.1**	**90.9**	**88.2**
SMI Rating	**Very Good**	**Very Good**	**Good**	**Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**

Table 3-1. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Survey Sites 2012-2016 *(continued)*

Site ID	**MWH-010**	**MWH-010**	**MWH-010**	**MWH-010**	**MWH-029**	**MWH-029**	**MWH-029**	**MWH-029**
Sampling Date	**4-Sep-2012**	**10-Sep-2013**	**5-Sep-2014**	**7-Aug-2016**	**4-Sep-2012**	**11-Sep-2013**	**5-Sep-2014**	**7-Aug-2016**
Site Description	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**
Metric Values								
Total Taxa	45	41	45	38	39	41	40	47
Ephemeroptera Taxa	11	12	13	12	11	10	12	15
Plecoptera Taxa	9	11	10	8	8	8	6	9
Trichoptera Taxa	11	8	11	7	9	11	11	10
% Plecoptera	31.4	16.8	17.0	6.0	22.3	11.0	8.9	6.4
Hilsenhoff Biotic Index	2.95	2.86	2.77	4.22	2.27	2.01	2.45	3.99
% 5 Dominant Taxa	66.0	64.8	55.4	65.0	50.0	64.3	57.2	62.0
Scraper Taxa*	9	8	12	9	8	9	10	10
Clinger Taxa	34	33	37	29	31	30	29	38
Metric Scores								
Total Taxa	121.6	110.8	121.6	102.7	105.4	110.8	108.1	127.0
Ephemeroptera Taxa	110.0	120.0	130.0	120.0	110.0	100.0	120.0	150.0
Plecoptera Taxa	112.5	137.5	125.0	100.0	100.0	100.0	75.0	112.5
Trichoptera Taxa	122.2	88.9	122.2	77.8	100.0	122.2	122.2	111.1
% Plecoptera	125.8	67.1	67.9	23.9	89.2	44.0	35.5	25.7
Hilsenhoff Biotic Index	88.1	89.2	90.4	72.3	96.6	99.9	94.3	75.2
% 5 Dominant Taxa	72.4	74.8	94.9	74.4	106.4	76.1	91.1	80.9
Scraper Taxa*	112.5	100.0	150.0	112.5	100.0	112.5	125.0	125.0
Clinger Taxa	179.0	173.7	194.7	152.6	163.2	157.9	152.6	200.0
Metric Scores 100 Max								
Total Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ephemeroptera Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Plecoptera Taxa	100.0	100.0	100.0	100.0	100.0	100.0	75.0	100.0
Trichoptera Taxa	100.0	100.0	100.0	77.8	100.0	100.0	100.0	100.0
% Plecoptera	100.0	67.1	67.9	23.9	89.2	44.0	35.5	25.7
Hilsenhoff Biotic Index	88.1	89.2	90.4	72.3	96.6	99.9	94.3	75.2
% 5 Dominant Taxa	72.3	74.8	94.9	74.4	100.0	76.1	91.1	80.9
Scraper Taxa*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clinger Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SMI Score	**95.6**	**92.4**	**94.8**	**83.2**	**98.4**	**91.1**	**88.4**	**86.9**
SMI Rating	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**

Table 3-1. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Survey Sites 2012-2016 *(continued)*

Site ID	**MWH-011**	**MWH-011**	**MWH-011**	**MWH-011**	**MWH-012**	**MWH-012**	**MWH-012**	**MWH-012**
Sampling Date	**6-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**6-Aug-2016**	**6-Sep-2012**	**10-Sep-2013**	**3-Sep-2014**	**8-Aug-2016**
Site Description	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**
Metric Values								
Total Taxa	52	42	43	51	46	45	47	43
Ephemeroptera Taxa	14	13	11	14	13	12	10	14
Plecoptera Taxa	11	8	7	8	6	7	8	6
Trichoptera Taxa	13	10	13	13	13	13	13	14
% Plecoptera	9.8	10.3	5.1	4.8	6.6	7.8	5.6	3.6
Hilsenhoff Biotic Index	2.36	2.01	2.14	3.53	2.62	3.12	2.20	4.02
% 5 Dominant Taxa	55.4	59.5	53.1	52.7	57.0	57.3	47.5	53.0
Scraper Taxa*	11	9	10	9	10	9	11	9
Clinger Taxa	42	34	35	40	36	34	37	35
Metric Scores								
Total Taxa	140.5	113.5	116.2	137.8	124.3	121.6	127.0	116.2
Ephemeroptera Taxa	140.0	130.0	110.0	140.0	130.0	120.0	100.0	140.0
Plecoptera Taxa	137.5	100.0	87.5	100.0	75.0	87.5	100.0	75.0
Trichoptera Taxa	144.4	111.1	144.4	144.4	144.4	144.4	144.4	155.6
% Plecoptera	39.2	41.3	20.6	19.2	26.3	31.2	22.4	14.5
Hilsenhoff Biotic Index	95.5	99.8	98.3	80.9	92.3	86.0	97.5	74.7
% 5 Dominant Taxa	95.0	86.1	99.7	100.7	91.6	91.0	111.8	100.1
Scraper Taxa*	137.5	112.5	125.0	112.5	125.0	112.5	137.5	112.5
Clinger Taxa	221.1	179.0	184.2	210.5	189.5	179.0	194.7	184.2
Metric Scores 100 Max								
Total Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ephemeroptera Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Plecoptera Taxa	100.0	100.0	87.5	100.0	75.0	87.5	100.0	75.0
Trichoptera Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% Plecoptera	39.2	41.3	20.6	19.2	26.3	31.2	22.4	14.5
Hilsenhoff Biotic Index	95.5	99.8	98.3	80.9	92.3	86.0	97.5	74.7
% 5 Dominant Taxa	95.0	86.1	99.7	100.0	91.6	91.0	100.0	100.0
Scraper Taxa*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clinger Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SMI Score	**92.2**	**91.9**	**89.6**	**88.9**	**87.2**	**88.4**	**91.1**	**84.9**
SMI Rating	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**

Table 3-1. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Survey Sites 2012-2016 *(continued)*

Site ID	**MWH-013**	**MWH-013**	**MWH-013**	**MWH-013**	**MWH-014**	**MWH-014**	**MWH-014**	**MWH-014**
Sampling Date	**5-Sep-2012**	**10-Sep-2013**	**3-Sep-2014**	**8-Aug-2016**	**6-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**8-Aug-2016**
Site Description	**EFSFSR**	**EFSFSR**	**EFSFSR**	**EFSFSR**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**
Metric Values								
Total Taxa	47	44	47	39	40	37	49	42
Ephemeroptera Taxa	12	12	11	11	12	13	14	16
Plecoptera Taxa	11	9	10	8	7	6	7	6
Trichoptera Taxa	11	13	11	8	8	9	8	8
% Plecoptera	17.7	12.2	8.4	7.5	7.3	9.3	11.3	5.1
Hilsenhoff Biotic Index	2.93	3.25	4.55	4.38	3.44	3.62	3.33	4.31
% 5 Dominant Taxa	51.4	60.7	65.8	68.7	60.8	65.5	52.6	56.6
Scraper Taxa*	11	9	9	9	9	10	11	12
Clinger Taxa	38	33	36	31	30	30	35	32
Metric Scores								
Total Taxa	127.0	118.9	127.0	105.4	108.1	100.0	132.4	113.5
Ephemeroptera Taxa	120.0	120.0	110.0	110.0	120.0	130.0	140.0	160.0
Plecoptera Taxa	137.5	112.5	125.0	100.0	87.5	75.0	87.5	75.0
Trichoptera Taxa	122.2	144.4	122.2	88.9	88.9	100.0	88.9	88.9
% Plecoptera	70.9	49.0	33.4	30.1	29.1	37.3	45.3	20.4
Hilsenhoff Biotic Index	88.4	84.3	68.1	70.2	82.0	79.8	83.3	71.2
% 5 Dominant Taxa	103.3	83.6	72.7	66.6	83.4	73.4	100.9	92.3
Scraper Taxa*	137.5	112.5	112.5	112.5	112.5	125.0	137.5	150.0
Clinger Taxa	200.0	173.7	189.5	163.2	157.9	157.9	184.2	168.4
Metric Scores 100 Max								
Total Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ephemeroptera Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Plecoptera Taxa	100.0	100.0	100.0	100.0	87.5	75.0	87.5	75.0
Trichoptera Taxa	100.0	100.0	100.0	88.9	88.9	100.0	88.9	88.9
% Plecoptera	70.9	49.0	33.4	30.1	29.1	37.3	45.3	20.4
Hilsenhoff Biotic Index	88.4	84.3	68.1	70.2	82.0	79.8	83.3	71.2
% 5 Dominant Taxa	100.0	83.6	72.7	66.6	83.4	73.4	100.0	92.3
Scraper Taxa*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Clinger Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SMI Score	**95.5**	**90.8**	**86.0**	**84.0**	**85.7**	**85.1**	**89.5**	**83.1**
SMI Rating	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**	**Very Good**

Table 3-1. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Survey Sites 2012-2016 *(continued)*

Site ID	**MWH-015**	**MWH-015**	**MWH-015**	**MWH-015**	**MWH-016**	**MWH-016**	**MWH-016**	**MWH-016**
Sampling Date	**5-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**8-Aug-2016**	**5-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**11-Aug-2016**
Site Description	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**
Metric Values								
Total Taxa	35	40	37	35	50	45	46	29
Ephemeroptera Taxa	10	9	12	15	11	11	13	10
Plecoptera Taxa	5	8	7	8	13	9	9	7
Trichoptera Taxa	8	11	10	4	10	13	9	2
% Plecoptera	4.1	7.3	8.5	7.5	13.6	11.1	5.6	3.2
Hilsenhoff Biotic Index	4.66	3.81	3.42	4.73	3.39	3.17	3.78	5.04
% 5 Dominant Taxa	74.1	65.7	57.6	69.6	55.1	57.5	58.2	82.4
Scraper Taxa*	8	8	9	8	7	12	9	6
Clinger Taxa	27	31	32	30	36	34	34	22
Metric Scores								
Total Taxa	94.6	108.1	100.0	94.6	135.1	121.6	124.3	78.4
Ephemeroptera Taxa	100.0	90.0	120.0	150.0	110.0	110.0	130.0	100.0
Plecoptera Taxa	62.5	100.0	87.5	100.0	162.5	112.5	112.5	87.5
Trichoptera Taxa	88.9	122.2	111.1	44.4	111.1	144.4	100.0	22.2
% Plecoptera	16.2	29.0	33.9	30.2	54.2	44.5	22.6	12.7
Hilsenhoff Biotic Index	66.8	77.4	82.2	65.9	82.6	85.4	77.8	62.1
% 5 Dominant Taxa	55.0	73.1	90.2	64.6	95.5	90.4	89.0	37.5
Scraper Taxa*	100.0	100.0	112.5	100.0	87.5	150.0	112.5	75.0
Clinger Taxa	142.1	163.2	168.4	157.9	189.5	179.0	179.0	115.8
Metric Scores 100 Max								
Total Taxa	94.6	100.0	100.0	94.6	100.0	100.0	100.0	78.4
Ephemeroptera Taxa	100.0	90.0	100.0	100.0	100.0	100.0	100.0	100.0
Plecoptera Taxa	62.5	100.0	87.5	100.0	100.0	100.0	100.0	87.5
Trichoptera Taxa	88.9	100.0	100.0	44.4	100.0	100.0	100.0	22.2
% Plecoptera	16.2	29.0	33.9	30.2	54.2	44.5	22.6	12.7
Hilsenhoff Biotic Index	66.8	77.4	82.2	65.9	82.6	85.4	77.8	62.1
% 5 Dominant Taxa	55.0	73.1	90.2	64.6	95.5	90.4	89.0	37.5
Scraper Taxa*	100.0	100.0	100.0	100.0	87.5	100.0	100.0	75.0
Clinger Taxa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SMI Score	**76.0**	**85.5**	**88.2**	**77.7**	**91.1**	**91.1**	**87.7**	**63.9**
SMI Rating	**Good**	**Very Good**	**Very Good**	**Good**	**Very Good**	**Very Good**	**Very Good**	**Good**

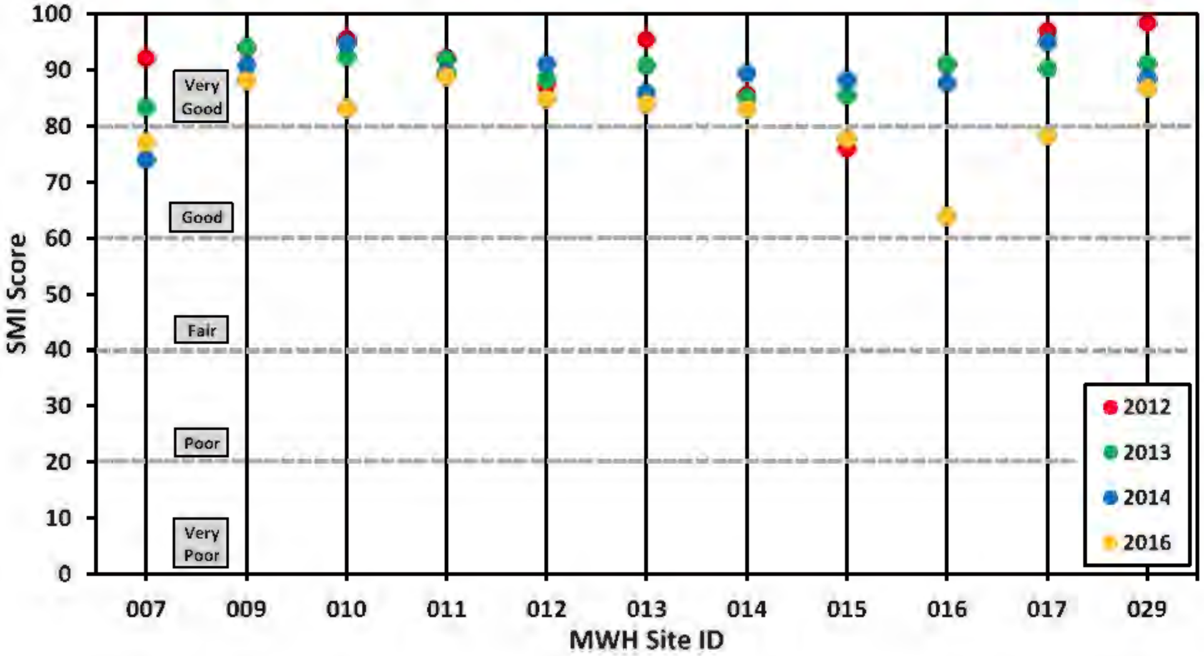
Table 3-1. Idaho Stream Macroinvertebrate Index Metrics, Scores and Ratings for Survey Sites 2012-2016 *(continued)*

Site ID	**MWH-017**	**MWH-017**	**MWH-017**	**MWH-017**
Sampling Date	**3-Sep-2012**	**10-Sep-2013**	**2-Sep-2014**	**7-Aug-2016**
Site Description	**Tamarack Creek**	**Tamarack Creek**	**Tamarack Creek**	**Tamarack Creek**
Metric Values				
Total Taxa	39	42	48	36
Ephemeroptera Taxa	12	10	13	11
Plecoptera Taxa	9	10	10	6
Trichoptera Taxa	9	11	12	8
% Plecoptera	29.1	12.3	19.6	6.9
Hilsenhoff Biotic Index	2.29	3.91	3.21	4.79
% 5 Dominant Taxa	58.2	58.9	56.7	69.8
Scraper Taxa*	7	8	11	7
Clinger Taxa	32	34	37	27
Metric Scores				
Total Taxa	105.4	113.5	129.7	97.3
Ephemeroptera Taxa	120.0	100.0	130.0	110.0
Plecoptera Taxa	112.5	125.0	125.0	75.0
Trichoptera Taxa	100.0	122.2	133.3	88.9
% Plecoptera	116.3	49.1	78.3	27.8
Hilsenhoff Biotic Index	96.3	76.1	84.8	65.1
% 5 Dominant Taxa	89.1	87.4	92.1	64.2
Scraper Taxa*	87.5	100.0	137.5	87.5
Clinger Taxa	168.4	179.0	194.7	142.1
Metric Scores 100 Max				
Total Taxa	100.0	100.0	100.0	97.3
Ephemeroptera Taxa	100.0	100.0	100.0	100.0
Plecoptera Taxa	100.0	100.0	100.0	75.0
Trichoptera Taxa	100.0	100.0	100.0	88.9
% Plecoptera	100.0	49.1	78.3	27.8
Hilsenhoff Biotic Index	96.3	76.1	84.8	65.1
% 5 Dominant Taxa	89.1	87.4	92.1	64.2
Scraper Taxa*	87.5	100.0	100.0	87.5
Clinger Taxa	100.0	100.0	100.0	100.0
SMI Score	**97.0**	**90.3**	**95.0**	**78.4**
SMI Rating	**Very Good**	**Very Good**	**Very Good**	**Good**

Note: Shaded cells are scores that were set to the maximum allowable value of 100 because the calculated metric scores exceeded 100

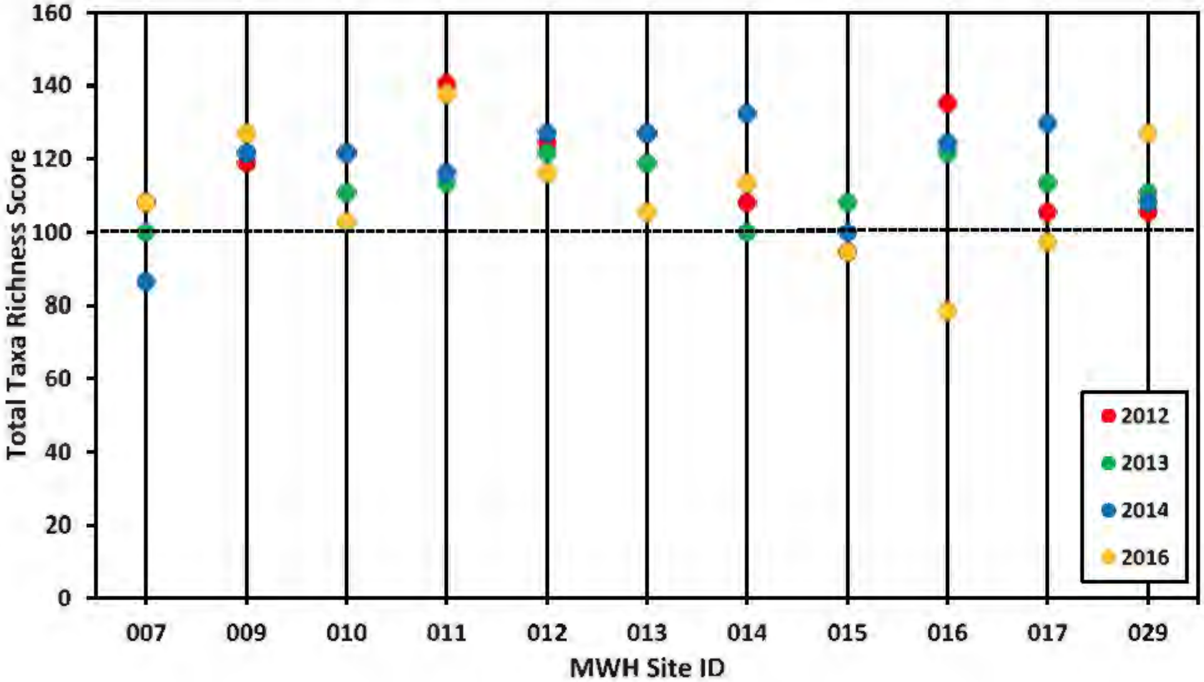
*Values for scraper taxa generated in the standard metrics output is generally lower that values calculated for SMI scores because, when designating FFGs for the SMI metrics, taxa that are partially designated as scraper taxa are included in the FFG, but excluded from the standard metrics output.

Note: The SMI scores are calculated using formulas for the *Central and Southern Mountains* ecoregion.



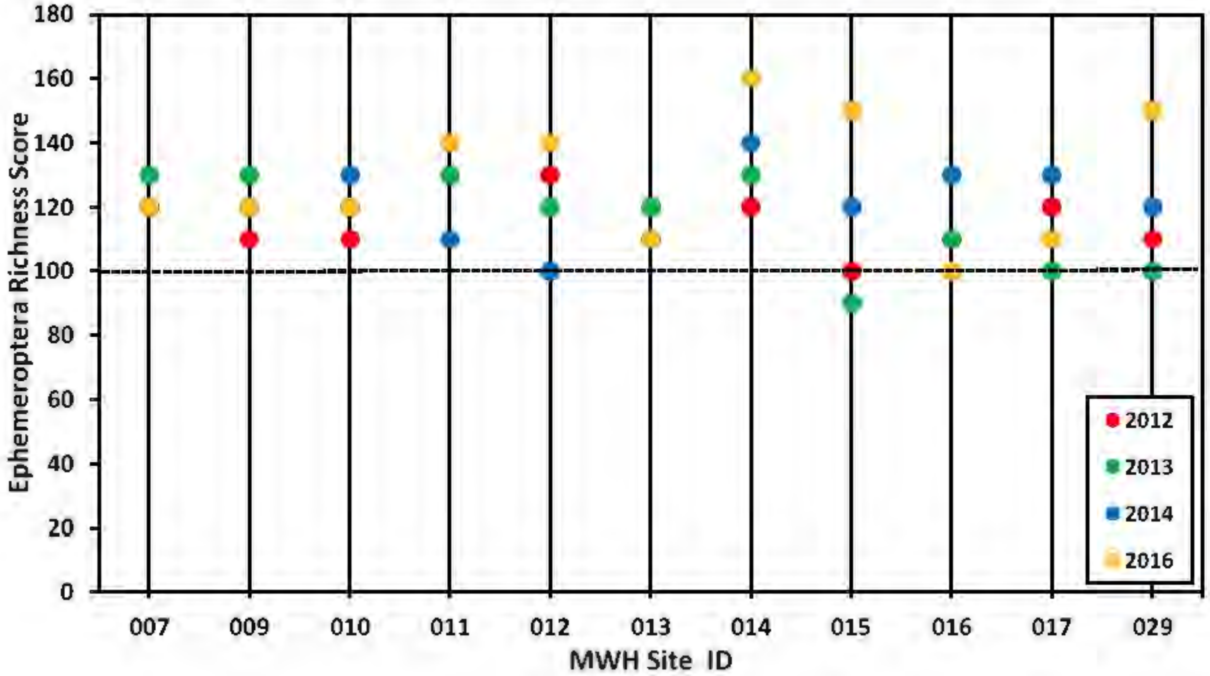
Note: Higher scores indicate better overall stream condition as evaluated by the SMI

Figure 3-1: Idaho Stream Macroinvertebrate Index (SMI) Final Composite Scores



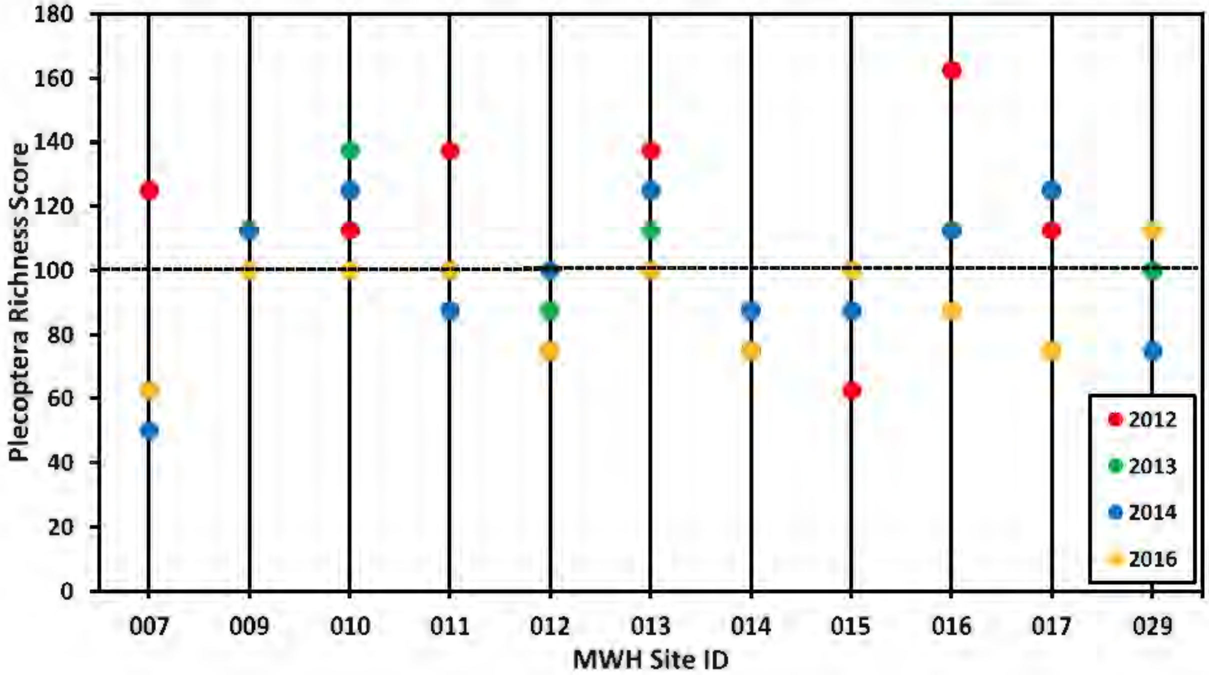
Note: Higher scores indicate greater numbers of all macroinvertebrate taxa

Figure 3-2: Idaho SMI Metric Scores: Total Taxa Richness



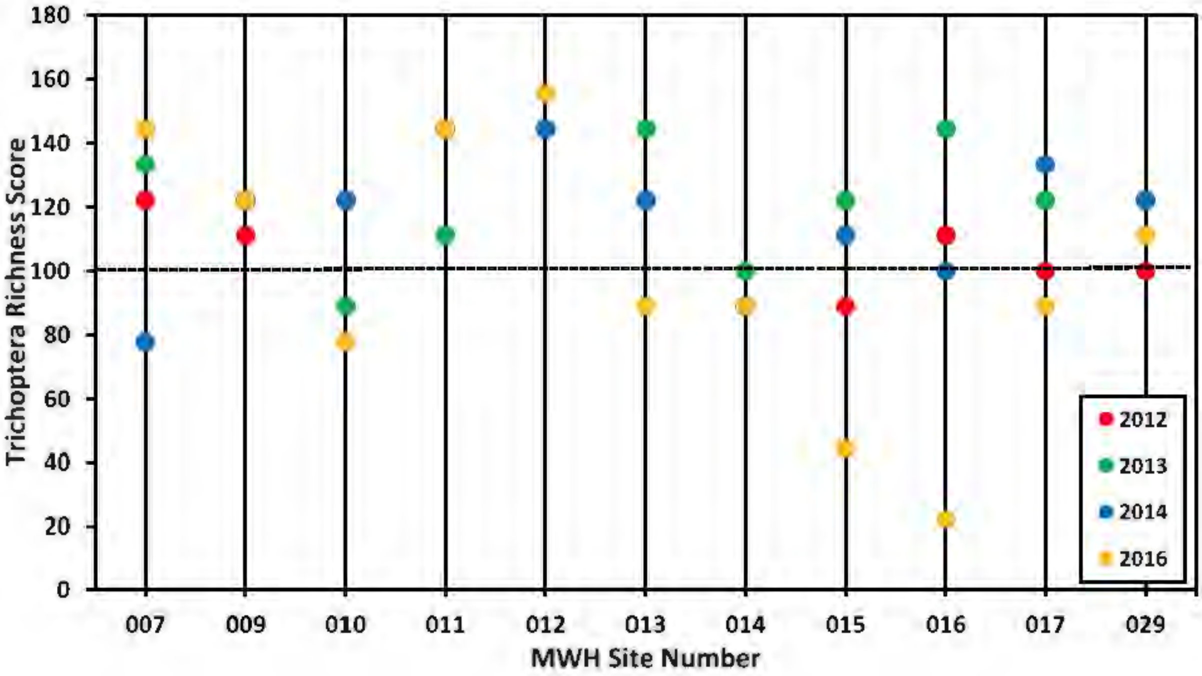
Note: Higher scores indicate greater numbers of Ephemeroptera taxa

Figure 3-3: Idaho SMI Metric Scores: Ephemeroptera Taxa Richness



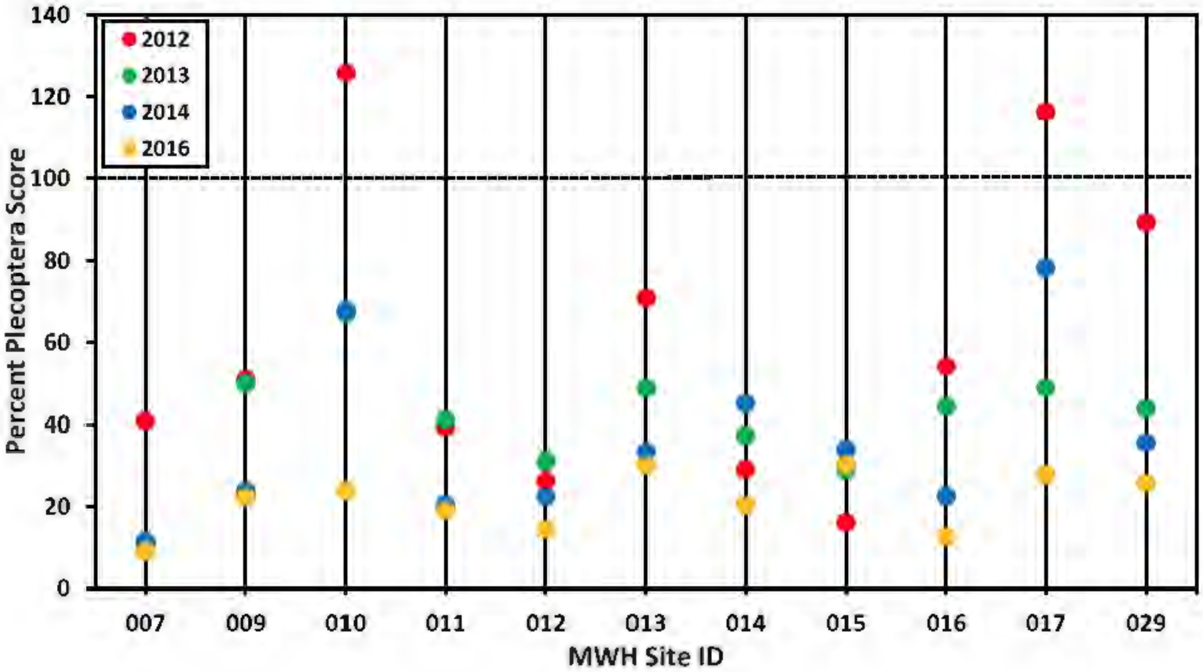
Note: Higher scores indicate greater numbers of Plecoptera taxa

Figure 3-4: Idaho SMI Metric Scores: Plecoptera Taxa Richness



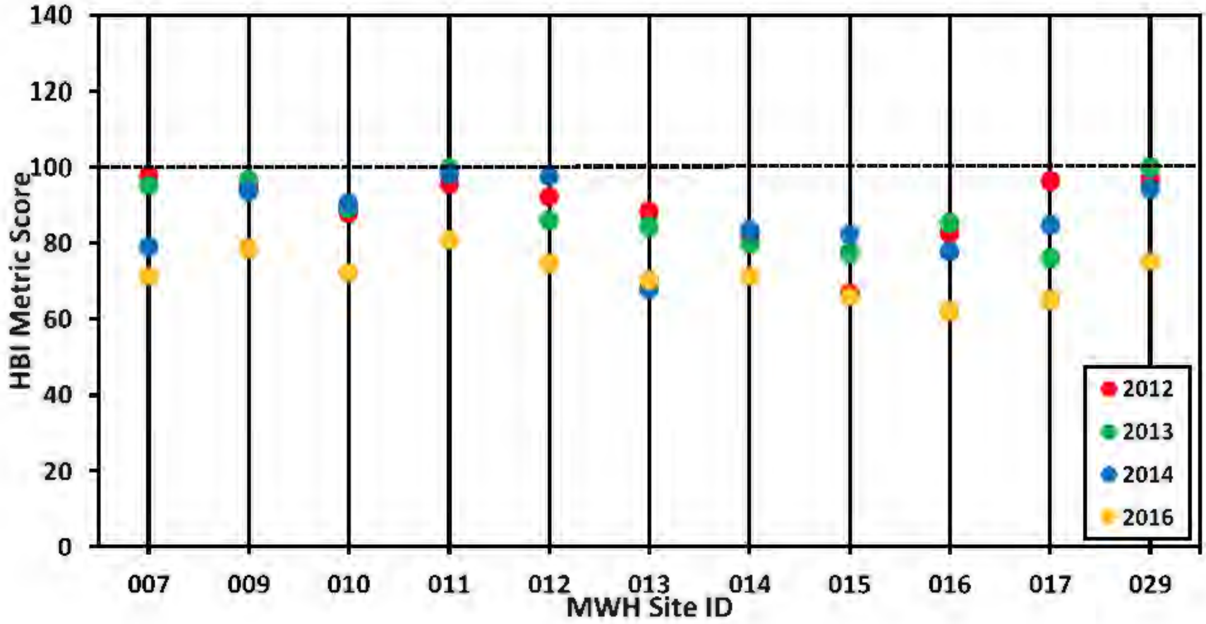
Note: Higher scores indicate greater numbers of Trichoptera taxa

Figure 3-5: Idaho SMI Metric Scores: Trichoptera Taxa Richness



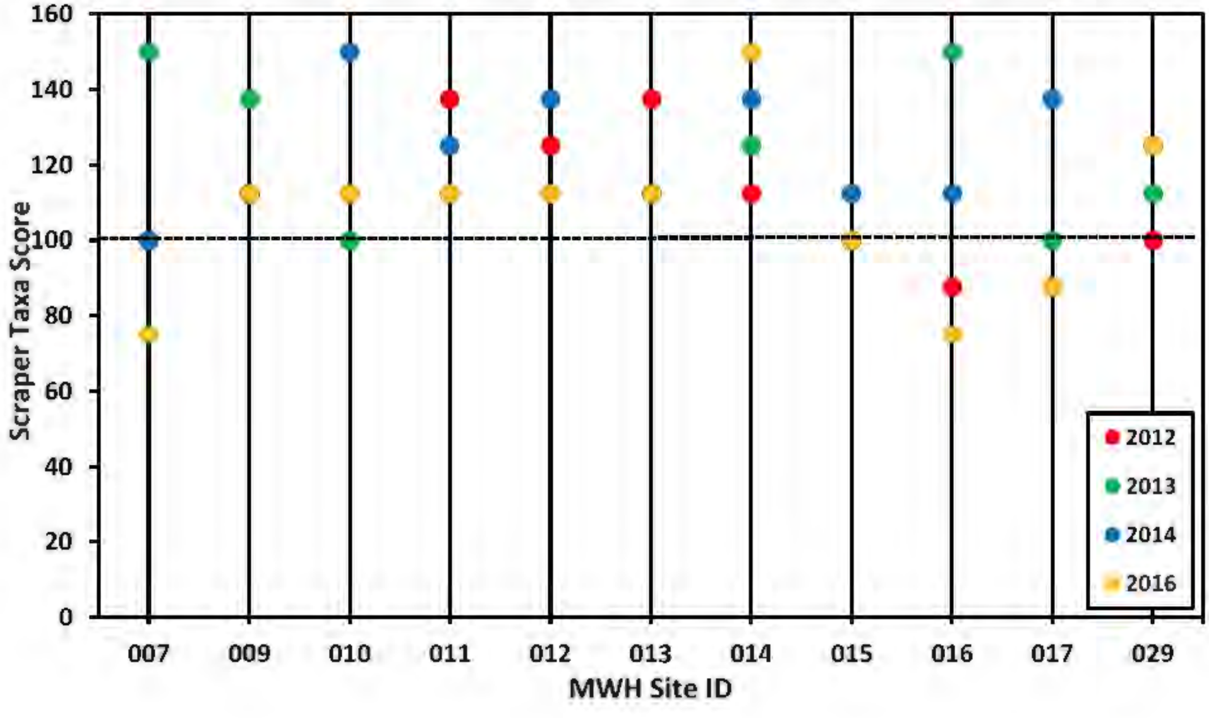
Note: Higher scores indicate that Plecoptera comprise a greater proportion of the macroinvertebrate abundance

Figure 3-6: Idaho SMI Metric Scores: Percent Plecoptera



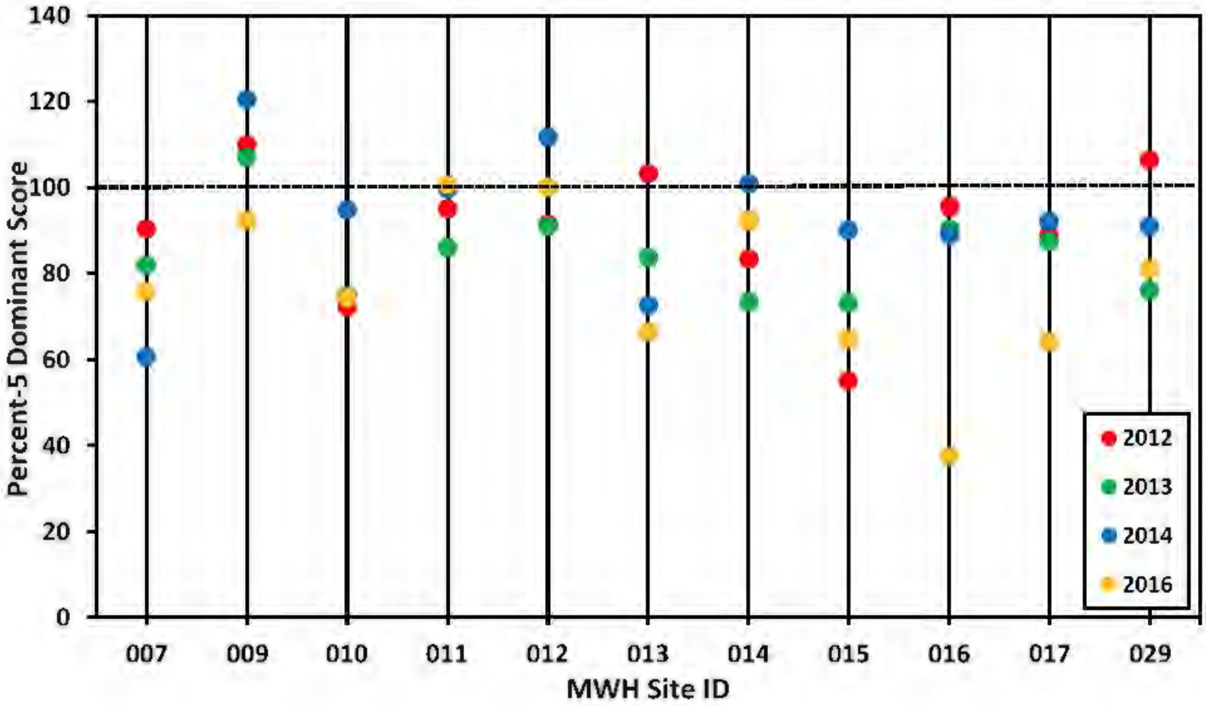
Note: Higher scores indicate that macroinvertebrates are less tolerant of organic pollution

Figure 3-7: Idaho SMI Metric Scores: Hilsenhoff Biotic Index (HBI)



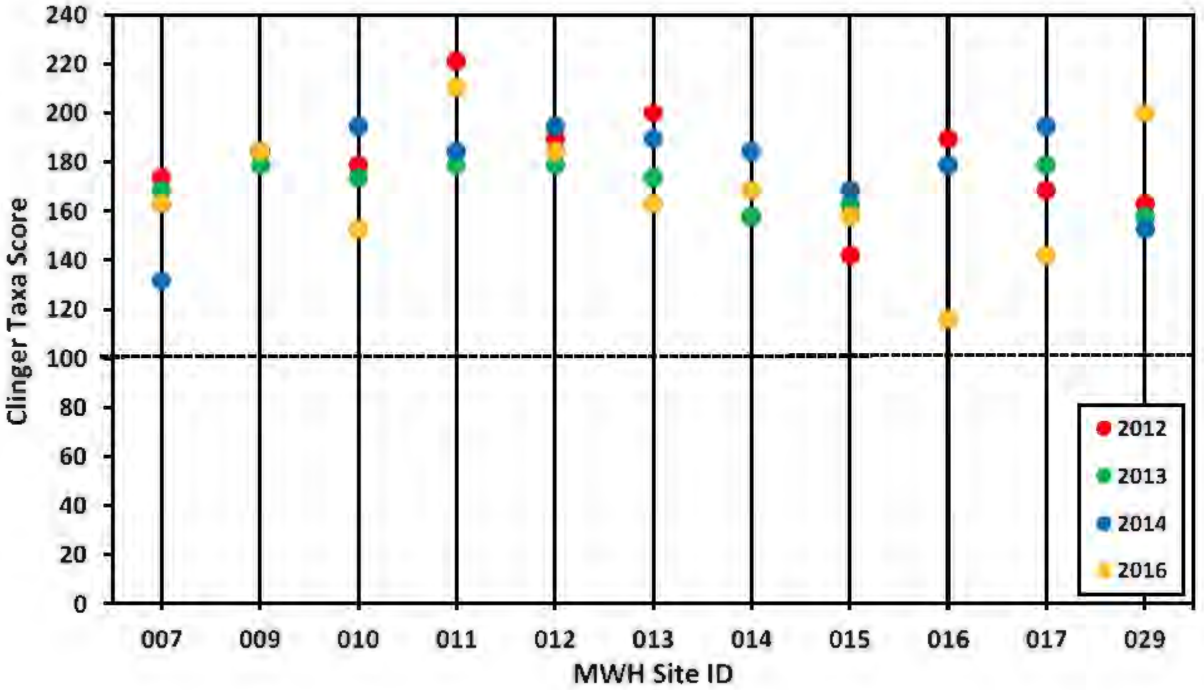
Note: Higher scores indicate greater numbers of taxa that exhibit scraper feeding behavior which is indicative of quality substrate habitat

Figure 3-8: Idaho SMI Metric Scores: Scraper Taxa Richness



Note: Higher scores indicate greater taxa diversity and that it is less likely that a few taxa comprise most of the macroinvertebrate population

Figure 3-9: Idaho SMI Metric Scores: Percent 5 Dominant Taxa



Note: Higher scores indicate greater numbers of taxa that exhibit clinger behavior which is indicative of quality substrate habitat

Figure 3-10: Idaho SMI Metric Scores: Clinger Taxa Richness

3.2 Additional Selected Metrics

This section describes results of the analysis of the five additional metrics for all sites and sampling years. As described in **Section 2.3.2**, these were added to the SMI metrics because they provide valuable additional data for describing overall habitat quality.

The values and scores discussed below and shown in **Table 3-2** were calculated and include the following parameters:

- Feeding Groups are listed by percentage of the relative abundance of all individuals in a sample based on feeding mechanism.
- Richness Scores (including unclassified species) are a measurement of the total number of identifiably distinct organisms in a sample.
- Long-lived Taxa Richness lists the total number of what are considered long-lived taxa in a sample.
- Metals Tolerance Index is a weighted average of tolerance to metal contamination assigned to each taxon, with values range from 0 to 10; higher values indicate greater tolerance to metals.
- Intolerant Taxa Richness lists the number of taxa in a sample with low tolerance values of 0 to 2; indicating that those taxa are considered highly intolerant of organic pollution at a site.
- Percent Tolerant Individuals shows the percentage of all individuals in a sample having tolerance values of 8 to 10 and considered highly tolerant of poor water quality.
- Shannon-Weaver H’ (log e) is an index indicating the ability of a system to support species diversity, with higher values indicating greater species diversity and evenness.

Long-lived Taxa Richness (**Table 3-2, Figure 3-11***):* All sites from 2012 through 2014 sample years had long-lived taxa abundances of 5 to 10, indicating habitat availability is relatively stable. This also held true in 2016 except for MWH-016, which is the farthest upstream site on Meadow Creek. However, taxa richness among many groups was lower at this site than in previous years, so slightly fewer long-lived taxa in 2016 may not be the result of factors that can disproportionately affect long-lived taxa such as habitat instability or overwintering conditions.

Metals Tolerance Index (MTI) (**Table 3-2, Figure 3-12**): MTI values of 0 to 3 indicate “no impact” according to McGuire (1993). Across sites from 2012 to 2014, the MTI values were low, ranging from 1.46 to 3.09, and show relatively little variation across years, with one exception. In 2012, the MTI value was 4.7 at site MWH-015 (constructed channel on Meadow Creek), and decreased to 2.42 in 2013, and 1.98 by 2014. This indicates a shift toward a greater number of taxa and/or proportion of individuals that are relatively intolerant of metals contamination. In this case, the most notable change in metals-intolerant taxa was an increase in Tanytarsini midges from 2012 (0.19 percent) to 2014 (2.12 percent), suggesting that metals concentrations within the constructed channel may be decreasing over time. In 2016, two sites exhibited MTI values greater than 3.0. These sites were MWH-007 (immediately downstream of the Yellow Pine Pit; MTI = 3.49) and at MWH-016 (the furthest upstream Meadow Creek site; MTI = 3.81). In particular, the increased MTI score (i.e., lower tolerance to metals) at the upstream Meadow Creek site is a marked departure from earlier year’s results. Another site showing a notable departure from previous years is at site MWH-009 (EFSFSR), the next site downstream from

MWH-007. The MTI values at this site from 2012 to 2014 were consistently around 2.0, whereas in 2016 the value was 2.97, again indicating possible increased metals contamination at this site.

Intolerant taxa richness (**Table 3-2**, **Figure 3-13**): Intolerant taxa richness was extremely high for all sites and years – about 75 percent of the taxa in individual samples. Typically, these taxa represent 5 to 10 percent of all taxa in a region, with the remainder being either moderately or very tolerant. As with other 2016 richness metrics, we observed a notable decrease in intolerant taxa richness at site MWH-016 that was a sharp departure from previous years. In fact, this site had the highest and most consistent number of taxa intolerant of organic pollution from 2012 to 2014, but had the lowest number of intolerant taxa in 2016. While intolerant taxa still made up a large proportion of the macroinvertebrate community, this decrease along with the other observed decreases in taxa richness warrants further monitoring to determine if this trend continues.

Percent Tolerant Individuals (**Table 3-2**, **Figure 3-14**): As expected with such abundance of intolerant taxa in the samples, the percent of tolerant individuals was quite low – comprising no more than four percent of all individuals in any sites from 2012 to 2014. This was consistent with other metrics in those years that indicate high water quality among all sites in the project area. In 2016, there was a relatively large increase in percent tolerant individuals at the furthest downstream Meadow Creek site (MWH-014) and at the site immediately downstream from there, Site MWH-12 (just below the Meadow Creek/EFSF confluence). Although the intolerant macroinvertebrates comprised only about four to six percent of the samples at those sites in 2016, in previous years intolerant organisms comprised no more than two percent of the samples in any given year. This may represent an increase in pollution, particularly when other changes in taxa richness and metals tolerance at Meadow Creek sites are taken into account.

Shannon-Weaver Diversity Index (**Table 3-2**, **Figure 3-15**): From 2012 to 2014, Shannon-Weaver index values ranged from 2.68 to 3.56, with few sites having values less than 3.0. This indicates high diversity and evenness among all sites, which is well-supported by other measures of richness and evenness for these sites. The lowest values of any site during those years were 2.68 at MWH-007 (just below the Yellow Pine Pit) in 2014 and 2.72 at MWH-014 (farthest downstream site in Meadow Creek) in 2013. The relatively low index value at MWH-007 in 2014 was likely due to a large number of blackfly larvae in the sample (see description of functional feeding group below). The index value for the downstream Meadow Creek site in 2013 was lower than 2012 and 2014, so no trend was observed. No site had consistently lower diversity index values than other sites, and no directional trends in diversity were found at any sites from 2012 to 2014. In 2016, the index values were comparable to previous years at all sites except for notably higher values at MWH-011 (SW Index = 3.58) and MWH-012 (SW Index = 3.73), which are the two sites immediately below the Meadow Creek/EFSFSR confluence. In general, the consistently good Shannon-Weaver index values can be explained by high taxa richness and the abundances of taxa being spread evenly among those taxa found at the sites rather than only a few taxa dominating the samples.

Table 3-2. Macroinvertebrate Functional Feeding Group Composition and Other Selected Metrics for MWH Macroinvertebrate Survey Sites, 2012-2016.

Site ID	**MWH-007**	**MWH-007**	**MWH-007**	**MWH-007**	**MWH-009**	**MWH-009**	**MWH-009**	**MWH-009**
Sampling Date	**4-Sep-2012**	**10-Sep-2013**	**5-Sep-2014**	**7-Aug-2016**	**4-Sep-2012**	**10-Sep-2013**	**6-Sep-2014**	**7-Aug-2016**
Site Description	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**
Feeding Groups								
% Filterers	4.3	17.5	41.1	18.6	2.5	3.0	8.0	3.5
% Gatherers	44.2	32.2	37.0	58.1	37.0	33.0	39.1	53.9
% Predators	12.4	5.5	5.8	11.1	9.5	14.6	20.9	20.2
% Scrapers*	25.9	31.9	11.8	5.8	35.7	34.4	24.1	16.5
% Shredders	8.6	8.6	2.5	5.1	10.8	8.8	2.1	2.1
% Unclassified	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.9
Richness Scores								
Filterer Richness	3	4	6	6	4	4	5	5
Gatherer Richness	16	17	19	29	24	21	24	22
Predator Richness	19	9	11	16	21	20	20	24
Scraper Richness*	5	10	6	6	8	9	7	7
Shredder Richness	11	5	3	5	5	6	5	5
Unclassified	0	0	0	1	0	0	1	3
Additional Metrics								
Long-Lived Taxa Richness	10	7	5	7	11	8	9	9
Metals Tolerance Index	1.71	2.17	2.98	3.49	2.16	2.04	1.89	2.97
Intolerant Taxa Richness	32	26	22	28	31	32	37	30
% Tolerant Individuals	0.0	0.2	0.0	0.7	0.2	0.6	0.4	0.3
Shannon-Weaver H' (log e)	3.13	3.00	2.68	3.36	3.41	3.29	3.56	3.45

Table 3-2. Macroinvertebrate Functional Feeding Group Composition and Other Selected Metrics for MWH Macroinvertebrate Survey Sites, 2012-2016 *(continued)*

Site ID	**MWH-010**	**MWH-010**	**MWH-010**	**MWH-010**	**MWH-008**	**MWH-029**	**MWH-029**	**MWH-029**
Sampling Date	**4-Sep-2012**	**10-Sep-2013**	**5-Sep-2014**	**7-Aug-2016**	**4-Sep-2012**	**11-Sep-2013**	**5-Sep-2014**	**7-Aug-2016**
Site Description	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**	**Sugar Creek**
Feeding Groups								
% Filterers	1.5	0.7	2.2	0.6	1.9	1.3	0.8	1.6
% Gatherers	33.6	17.0	24.6	51.3	21.9	17.9	33.3	59.0
% Predators	18.7	19.8	16.6	12.1	16.9	8.0	14.4	13.0
% Scrapers*	12.3	21.6	29.1	19.3	34.4	53.5	30.2	20.1
% Shredders	27.4	32.0	18.1	9.2	18.2	10.6	5.3	3.8
% Unclassified	0.0	0.2	0.0	0.2	0.0	0.0	0.6	0.0
Richness Scores								
Filterer Richness	3	2	2	2	3	2	2	4
Gatherer Richness	17	17	18	20	18	13	24	27
Predator Richness	22	22	24	16	21	16	19	21
Scraper Richness*	8	6	10	8	7	8	9	10
Shredder Richness	7	6	7	9	3	8	4	9
Unclassified	0	1	0	1	0	0	2	0
Additional Metrics								
Long-Lived Taxa Richness	10	9	9	7	6	7	7	8
Metals Tolerance Index	2.62	2.69	2.10	1.90	1.75	1.64	1.57	2.29
Intolerant Taxa Richness	34	32	35	28	30	29	29	33
% Tolerant Individuals	0.1	0.4	1.1	0.8	0.3	0.3	1.3	0.9
Shannon-Weaver H’ (log e)	3.13	2.99	3.37	3.30	3.26	2.80	3.30	3.58

Table 3-2. Macroinvertebrate Functional Feeding Group Composition and Other Selected Metrics for MWH Macroinvertebrate Survey Sites, 2012-2016 (continued)

Site ID	**MWH-011**	**MWH-011**	**MWH-011**	**MWH-011**	**MWH-012**	**MWH-012**	**MWH-012**	**MWH-012**
Sampling Date	**6-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**6-Aug-2016**	**6-Sep-2012**	**10-Sep-2013**	**3-Sep-2014**	**8-Aug-2016**
Site Description	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**
Feeding Groups								
% Filterers	0.6	3.5	4.4	7.7	0.4	1.3	3.3	2.3
% Gatherers	24.0	23.0	24.4	50.6	26.7	38.0	29.8	49.0
% Predators	16.7	14.0	13.7	14.6	17.7	14.0	16.5	14.9
% Scrapers*	41.6	39.5	47.8	20.7	22.2	27.9	32.9	14.3
% Shredders	9.7	14.8	4.2	4.2	18.6	12.3	5.4	12.2
% Unclassified	0.0	0.8	0.4	0.4	0.4	0.0	0.7	0.4
Richness Scores								
Filterer Richness	2	3	5	3	1	4	3	5
Gatherer Richness	24	19	15	26	16	23	20	30
Predator Richness	23	15	17	23	20	15	20	17
Scraper Richness*	9	7	10	8	8	8	9	8
Shredder Richness	10	6	7	7	5	8	8	6
Unclassified	0	2	1	1	2	0	3	1
Additional Metrics								
Long-Lived Taxa Richness	10	7	8	10	8	6	9	7
Metals Tolerance Index	1.57	1.93	1.46	2.28	2.05	2.16	1.63	2.51
Intolerant Taxa Richness	36	28	32	31	32	32	31	32
% Tolerant Individuals	1.1	0.2	1.0	1.9	0.2	0.7	1.3	4.3
Shannon-Weaver H' (log e)	3.15	2.93	3.06	3.58	3.19	3.20	3.35	3.73

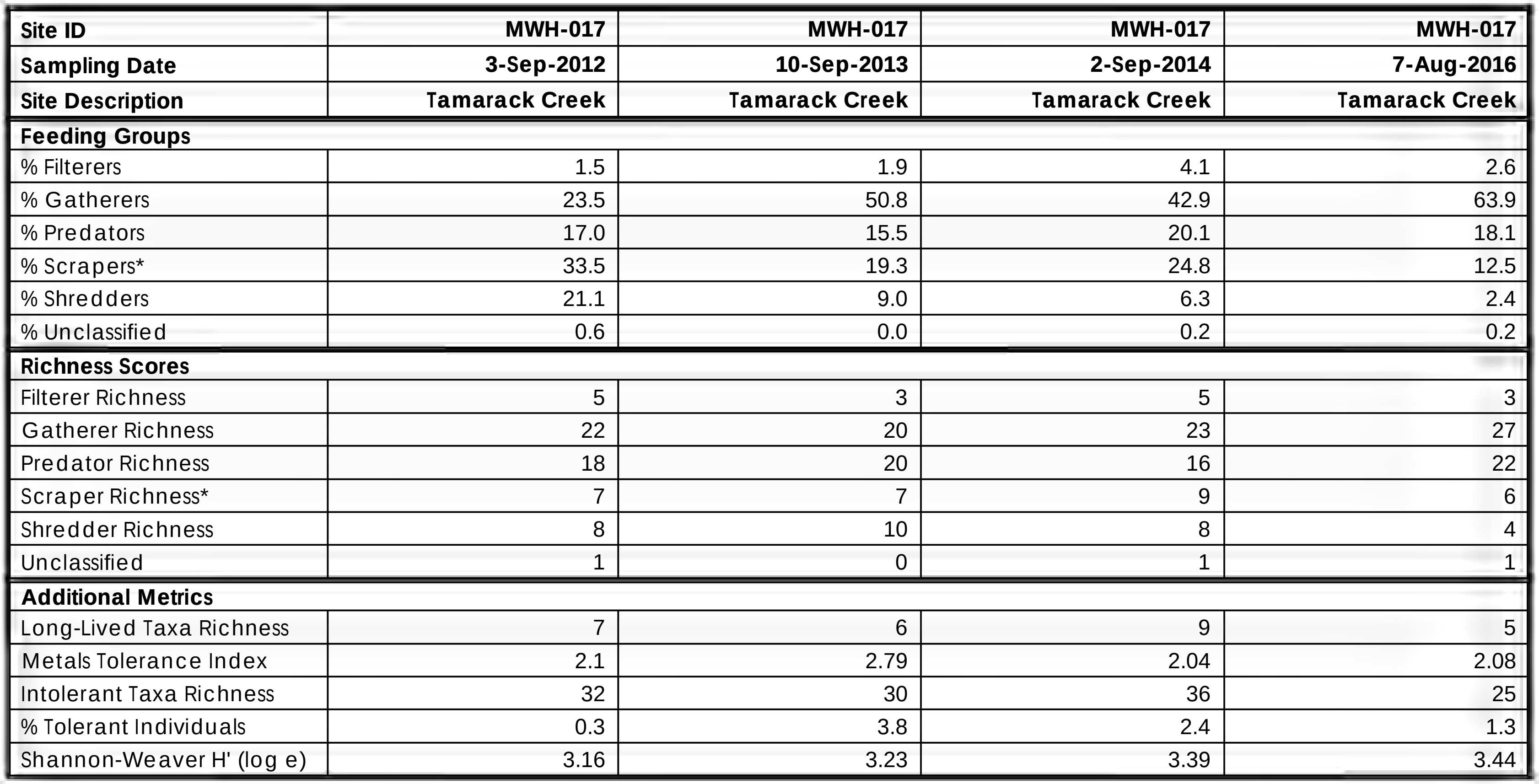
Table 3-2. Macroinvertebrate Functional Feeding Group Composition and Other Selected Metrics for MWH Macroinvertebrate Survey Sites, 2012-2016 (*continued*)

Site ID	**MWH-013**	**MWH-013**	**MWH-013**	**MWH-013**	**MWH-014**	**MWH-014**	**MWH-014**	**MWH-014**
Sampling Date	**5-Sep-2012**	**10-Sep-2013**	**3-Sep-2014**	**8-Aug-2016**	**6-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**8-Aug-2016**
Site Description	**EFSRSR**	**EFSRSR**	**EFSRSR**	**EFSRSR**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**
Feeding Groups								
% Filterers	3.2	1.2	4.3	1.2	0.0	1.2	3.0	0.9
% Gatherers	12.8	32.3	39.2	55.3	41.6	20.8	37.0	49.4
% Predators	15.1	8.8	12.8	9.3	13.6	9.0	8.9	16.0
% Scrapers*	22.5	27.0	11.3	12.1	13.8	16.6	21.6	22.6
% Shredders	40.4	26.0	27.0	17.2	11.2	42.6	15.2	4.2
% Unclassified	1.3	0.3	0.6	0.2	0.9	0.0	0.7	0.6
Richness Scores								
Filterer Richness	2	3	4	3	0	1	4	1
Gatherer Richness	13	15	21	22	23	17	26	27
Predator Richness	20	14	20	19	19	13	18	17
Scraper Richness*	10	8	7	8	6	8	10	10
Shredder Richness	9	9	8	5	5	5	5	5
Unclassified	2	2	2	1	1	0	1	1
Additional Metrics								
Long-Lived Taxa Richness	11	10	11	7	7	5	6	9
Metals Tolerance Index	2.68	2.19	2.26	2.52	2.19	3.09	1.84	1.90
Intolerant Taxa Richness	35	33	33	29	25	25	28	29
% Tolerant Individuals	0.0	0.1	3.9	1.6	1.8	0.2	1.9	5.1
Shannon-Weaver H' (log e)	3.17	3.08	2.98	3.38	3.31	2.72	3.44	3.51

Table 3-2. Macroinvertebrate Functional Feeding Group Composition and Other Selected Metrics for MWH Macroinvertebrate Survey Sites, 2012-2016 *(continued)*

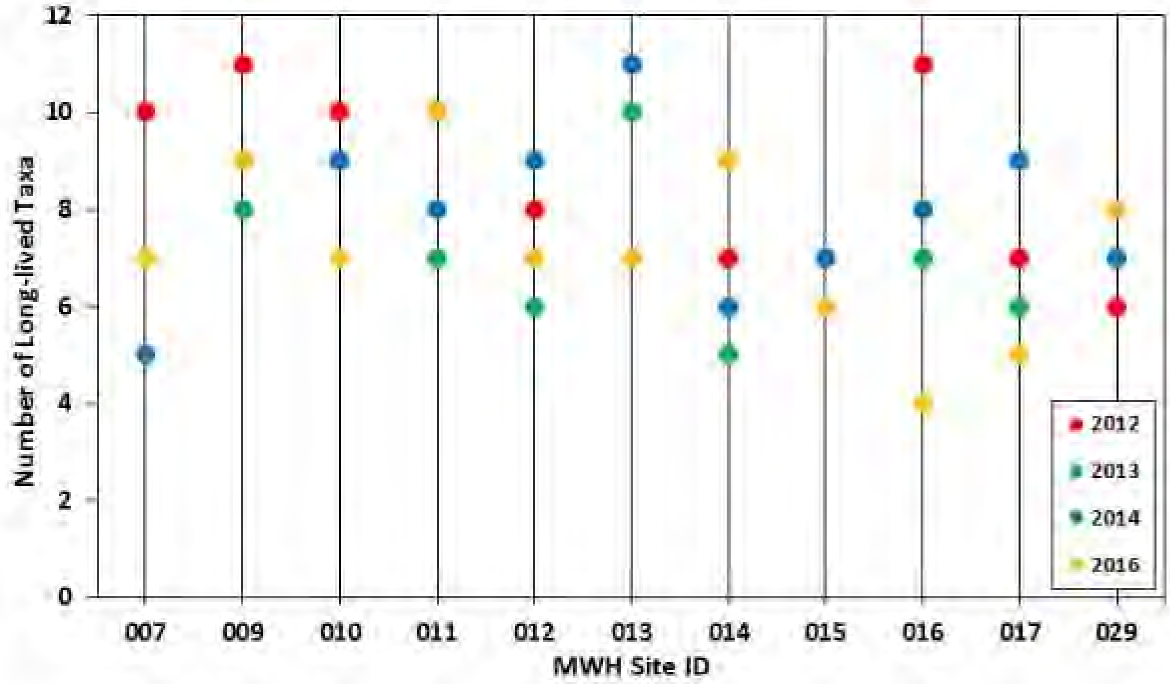
Site ID	MWH-015	MWH-015	MWH-015	MWH-015	MWH-016	MWH-016	MWH-016	MWH-016
Sampling Date	**5-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**8-Aug-2016**	**5-Sep-2012**	**10-Sep-2013**	**4-Sep-2014**	**11-Aug-2016**
Site Description	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**	**Meadow Creek**
Feeding Groups								
% Filterers	0.2	0.0	4.2	1.2	5.6	0.3	1.2	0.0
% Gatherers	56.0	41.2	43.2	68.1	29.6	26.4	37.7	75.5
% Predators	26.6	16.8	16.8	6.2	12.5	27.2	14.0	4.8
% Scrapers*	2.1	19.1	11.0	8.7	32.6	18.5	16.5	5.2
% Shredders	4.3	10.3	7.9	12.2	10.9	11.8	19.8	10.1
% Unclassified	0.0	0.0	0.2	0.0	0.0	0.5	1.2	0.2
Richness Scores								
Filterer Richness	1	0	4	2	3	1	4	0
Gatherer Richness	25	18	24	27	22	16	22	25
Predator Richness	17	20	18	16	22	20	20	13
Scraper Richness*	5	5	6	6	6	12	8	5
Shredder Richness	5	6	5	6	12	6	7	7
Unclassified	0	0	1	0	0	1	2	1
Additional Metrics								
Long-Lived Taxa Richness	7	7	7	6	11	7	8	4
Metals Tolerance Index	4.63	2.42	1.98	2.79	1.54	2.01	2.60	3.81
Intolerant Taxa Richness	23	25	31	27	37	35	36	20
% Tolerant Individuals	2.9	2.9	1.0	2.2	3.8	1.6	2.4	1.0
Shannon-Weaver H' (log e)	3.22	3.24	3.47	3.20	3.26	3.14	3.37	3.15

Table 3-2. Macroinvertebrate Functional Feeding Group Composition and Other Selected Metrics for MWH Macroinvertebrate Survey Sites, 2012-2016 *(continued)*



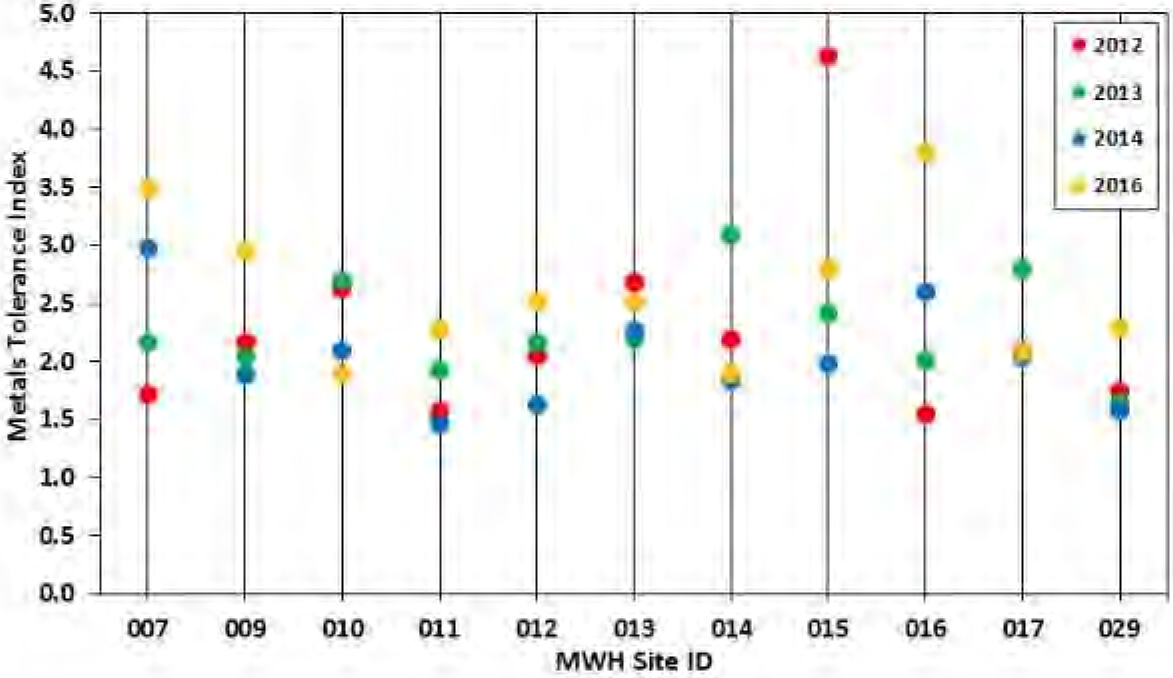
Site ID	**MWH-017**	**MWH-017**	**MWH-017**	**MWH-017**
Sampling Date	**3-Sep-2012**	**10-Sep-2013**	**2-Sep-2014**	**7-Aug-2016**
Site Description	**Tamarack Creek**	**Tamarack Creek**	**Tamarack Creek**	**Tamarack Creek**
Feeding Groups				
% Filterers	1.5	1.9	4.1	2.6
% Gatherers	23.5	50.8	42.9	63.9
% Predators	17.0	15.5	20.1	18.1
% Scrapers*	33.5	19.3	24.8	12.5
% Shredders	21.1	9.0	6.3	2.4
% Unclassified	0.6	0.0	0.2	0.2
Richness Scores				
Filterer Richness	5	3	5	3
Gatherer Richness	22	20	23	27
Predator Richness	18	20	16	22
Scraper Richness*	7	7	9	6
Shredder Richness	8	10	8	4
Unclassified	1	0	1	1
Additional Metrics				
Long-Lived Taxa Richness	7	6	9	5
Metals Tolerance Index	2.1	2.79	2.04	2.08
Intolerant Taxa Richness	32	30	36	25
% Tolerant Individuals	0.3	3.8	2.4	1.3
Shannon-Weaver H' (log e)	3.16	3.23	3.39	3.44

*Values for scraper taxa generated in the standard metrics output is generally lower that values calculated for SMI scores because, when designating FFGs for the SMI metrics, taxa that are partially designated as scraper taxa are included in the FFG but excluded from the standard metrics output.



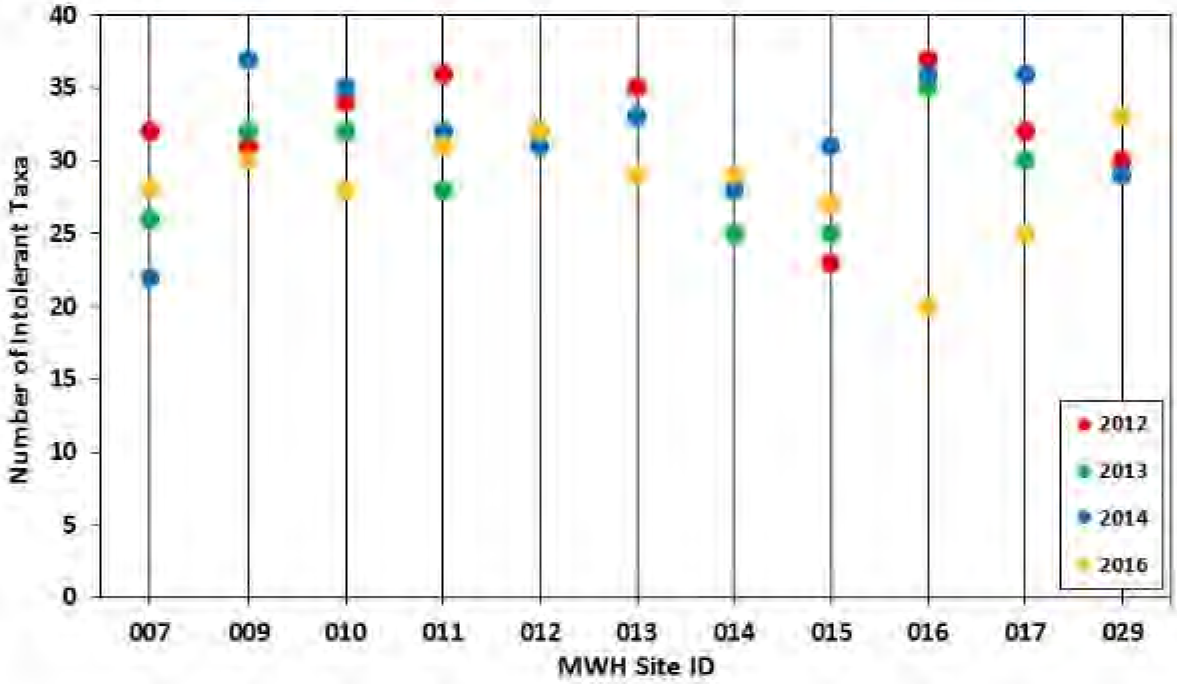
Note: Higher values indicate greater numbers of long-lived taxa which require stable and diverse habitat

Figure 3-11: Additional Selected Metrics: Long-lived Taxa Richness



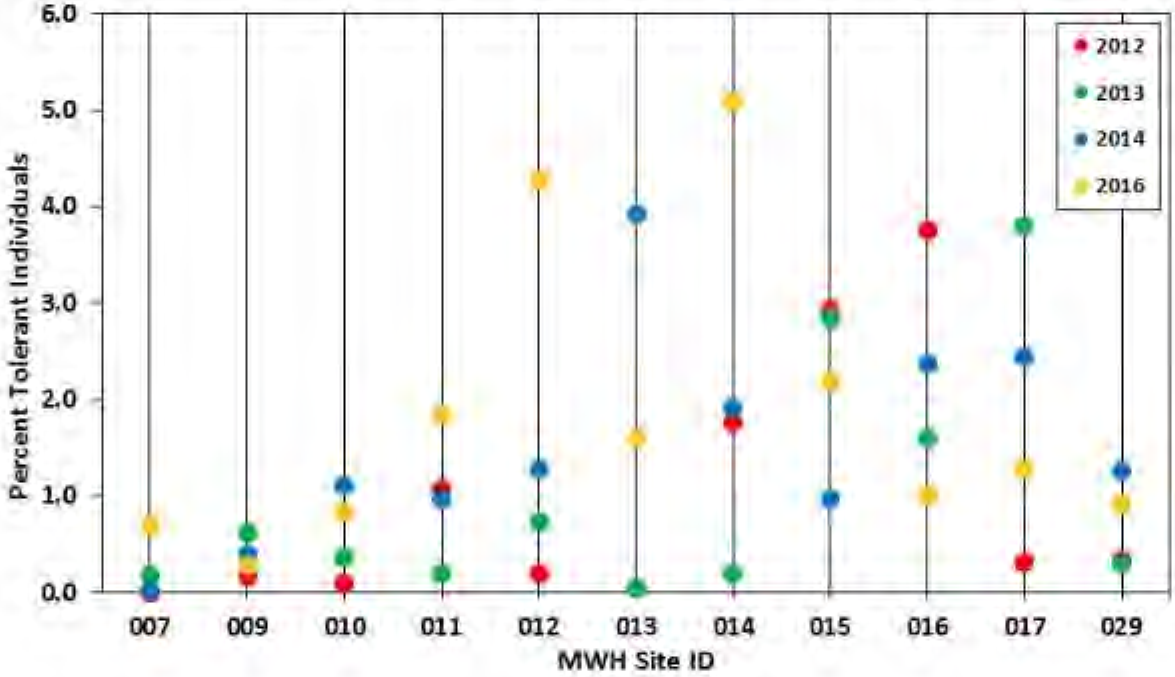
Note: Higher values indicate that the macroinvertebrate community is more tolerant of metals

Figure 3-12: Additional Selected Metrics: Metals Tolerance Index (MTI) Values



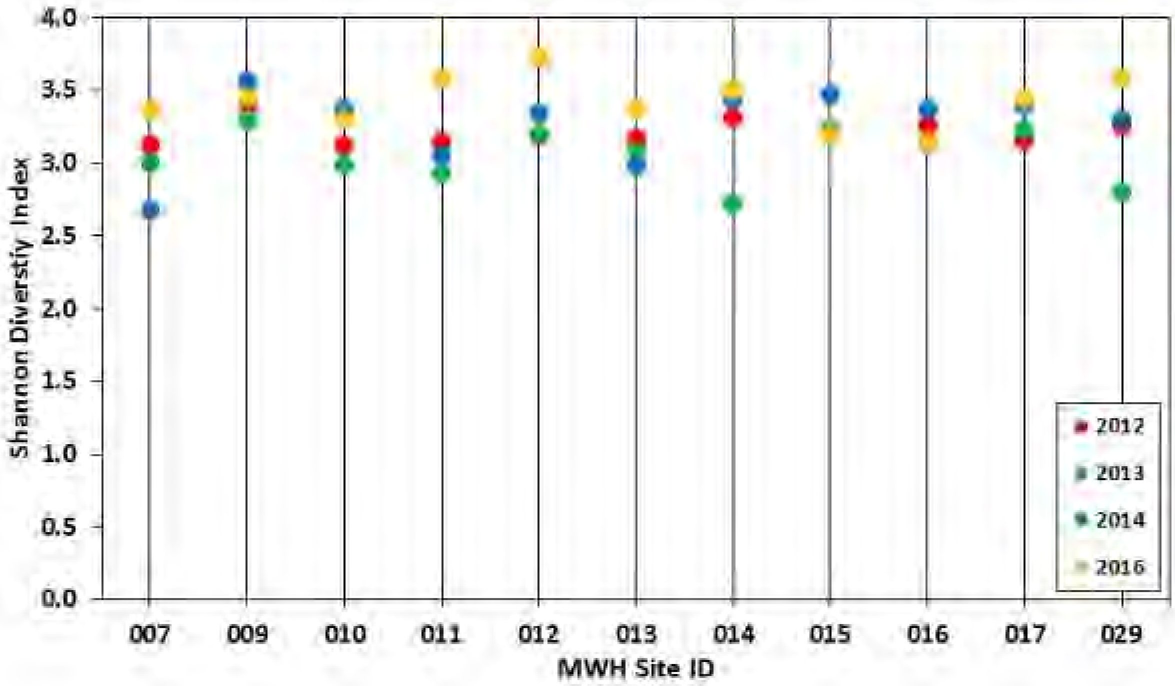
Note: (higher values indicate greater numbers of taxa that are intolerant of poor water quality)

Figure 3-13: Additional Selected Metrics: Intolerant Taxa Richness



Note: Low values indicate low numbers of individuals that are considered tolerant of poor water quality

Figure 3-4: Additional Selected Metrics: Percentage of Tolerant Individuals



Note: Higher scores indicate greater macroinvertebrate species diversity

Figure 3-5: Additional Selected Metrics: Shannon-Weaver Diversity Index Values

3.3 Functional Feeding Groups

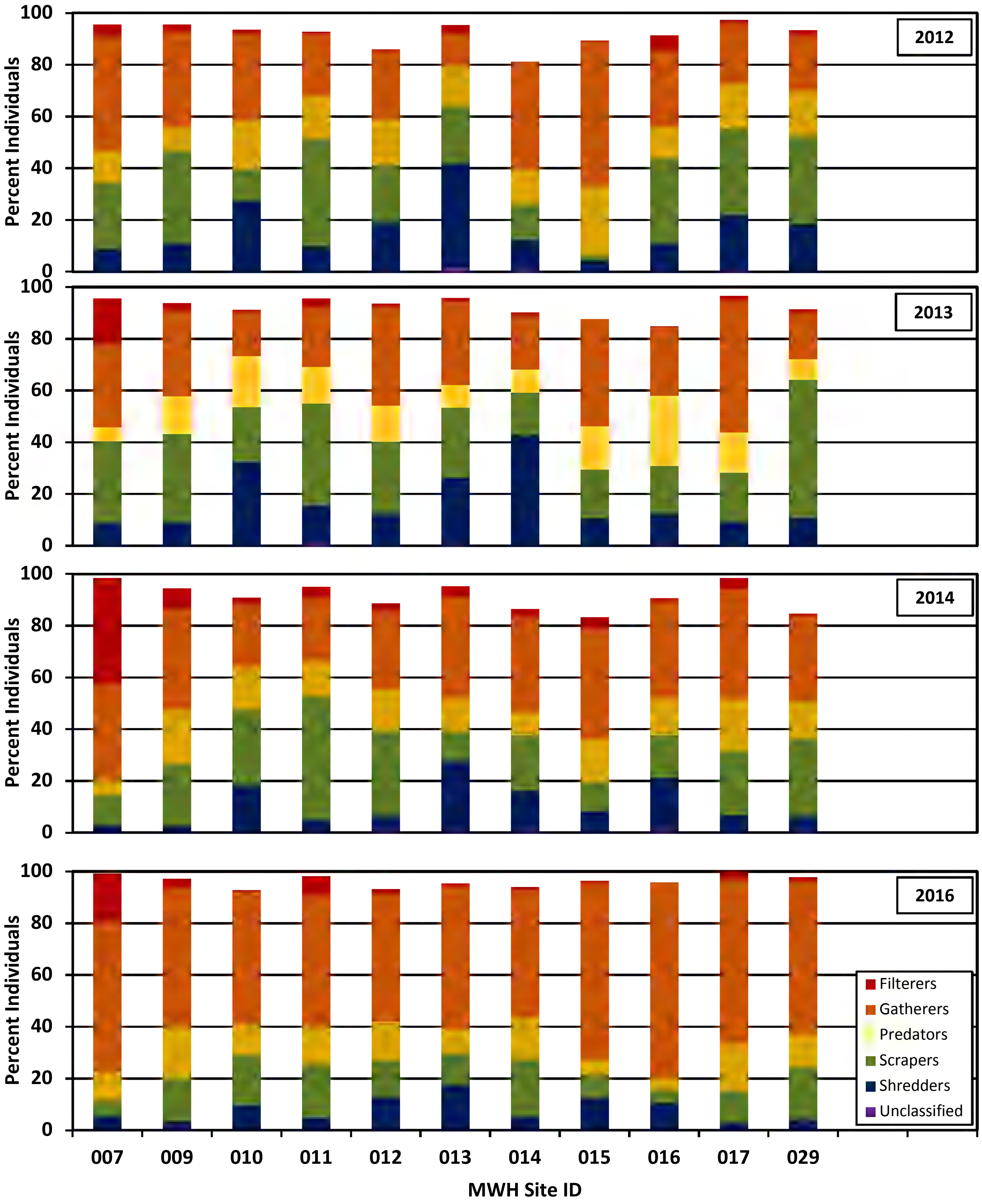
The FFG composition of samples across all sites and years was remarkably consistent and stable, particularly for richness values across all years at sites in all survey years, which is an indication of no notable shifts in in habitat conditions (**Table 3-2**, **Figure 3-16** and **Figure 3-17**). Richness across sites and years was dominated by gatherers and predators, to a lesser extent shredders and scrapers, and also a low, but stable percentage of filterer taxa.

Once again, the data indicate a high level of stability and consistency of available habitat and food sources at the study sites, particularly with the apparently rich predator population, which is dependent on diverse and stable food resources in the form of other macroinvertebrates.

Functional feeding group composition measured as a percentage of individuals was not as consistent as taxa richness, but largely mirrored the observed disposition of taxa FFGs. Less consistency in FFG abundances is expected since it is easier to consistently sample taxa richness at a site than to consistently sample both abundance and taxa richness due to spatial variation in macroinvertebrate numbers within a stream. In terms of abundance, numbers of individuals were dominated by scrapers and gatherers, with a few notable instances of a high proportion of shredders (MWH-013 in all years, and MWH-014 in 2013).

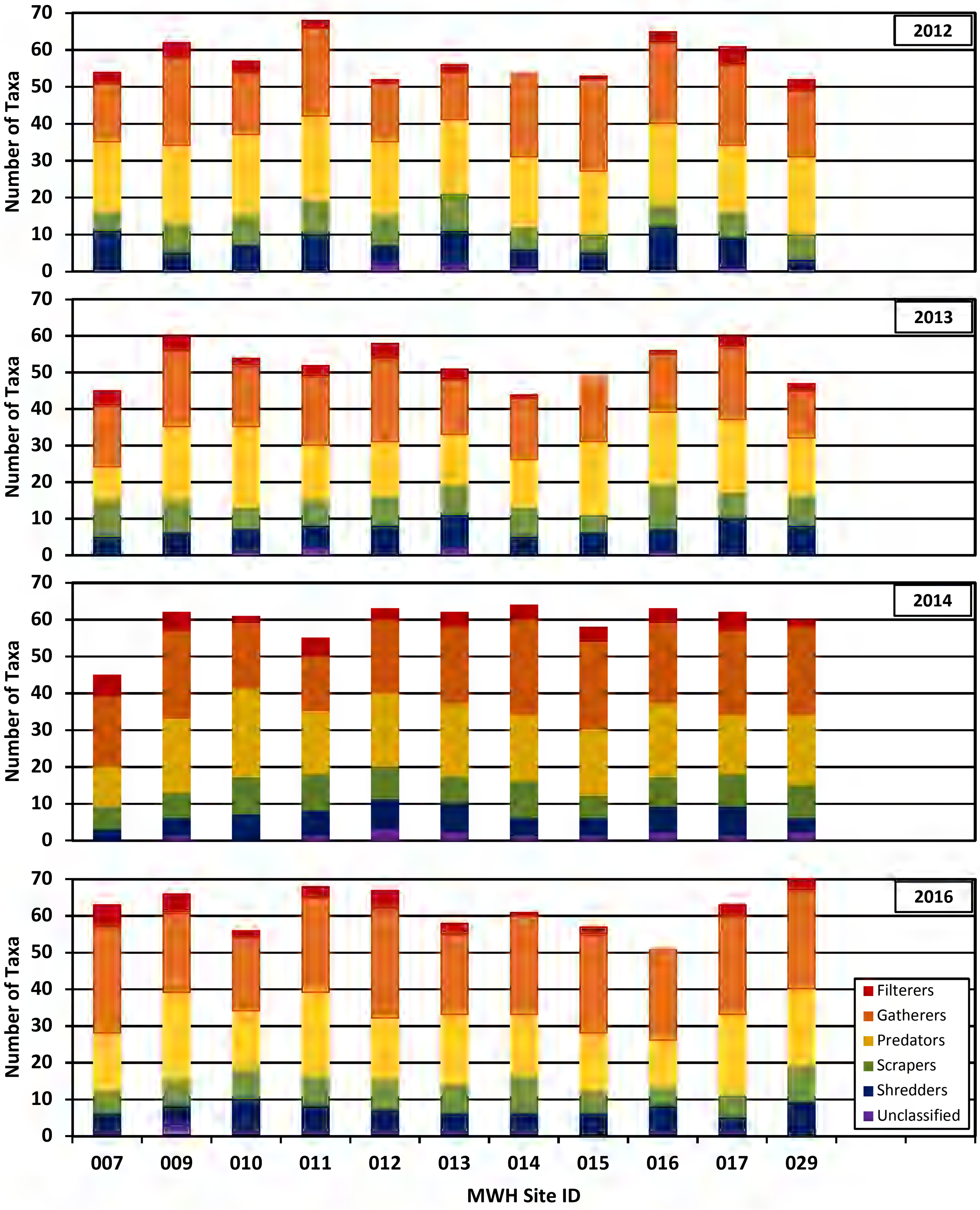
The most obvious difference in FFG abundance was the larger proportion of filterers at MWH-007 (downstream from the Yellow Pine Pit outlet) that was observed at other sites, which was almost entirely due to a large number of blackflies in the sample. This site is classic habitat for blackflies, which thrive in areas of high-gradient, cold-water, abundant clean substrate, and where a lake outlet provides abundant particulates that the blackfly larvae feed on (Kim and Merritt 1987).

The increase in filterer abundance from 2012 to later sampling years at MWH-007 may indicate an increase in organic and particulate discharge from the Yellow Pine Pit, which likely warrants further investigation or monitoring because of the potential implications for stream conditions further downstream. However, the change in abundances may also be due to sampling bias. Because blackfly larvae can be found in extremely high densities in such habitat, it is possible for even a single sampling repetition to inadvertently contribute a disproportionate number of individuals to a combined sample. Another source of potential bias would be that MWH-007 was the most difficult of all the sites to sample due to the large substrate size and fast current as previously discussed. Therefore, high densities of blackflies may have been present in 2012, but were not well-represented in the sample.



Note: each bar represents a single sample for each sampling site per year and the colors correspond to the either the percent of all individuals or number of taxa within each feeding group in that sample

Figure 3-6: Functional Feeding Group Composition for Macroinvertebrates Collected Between 2012 and 2016 Expressed as the Percentage of Individuals Per Sample



Note: each bar represents a single sample for each sampling site per year and the colors correspond to the either the percent of all individuals or number of taxa within each feeding group in that sample

Figure 3-77: Functional Feeding Group Composition for Macroinvertebrates Collected Between 2012 and 2016 Expressed as the Number of Taxa Per Sample

3.4 PIBO Observed/Expected Index (RIVPACS)

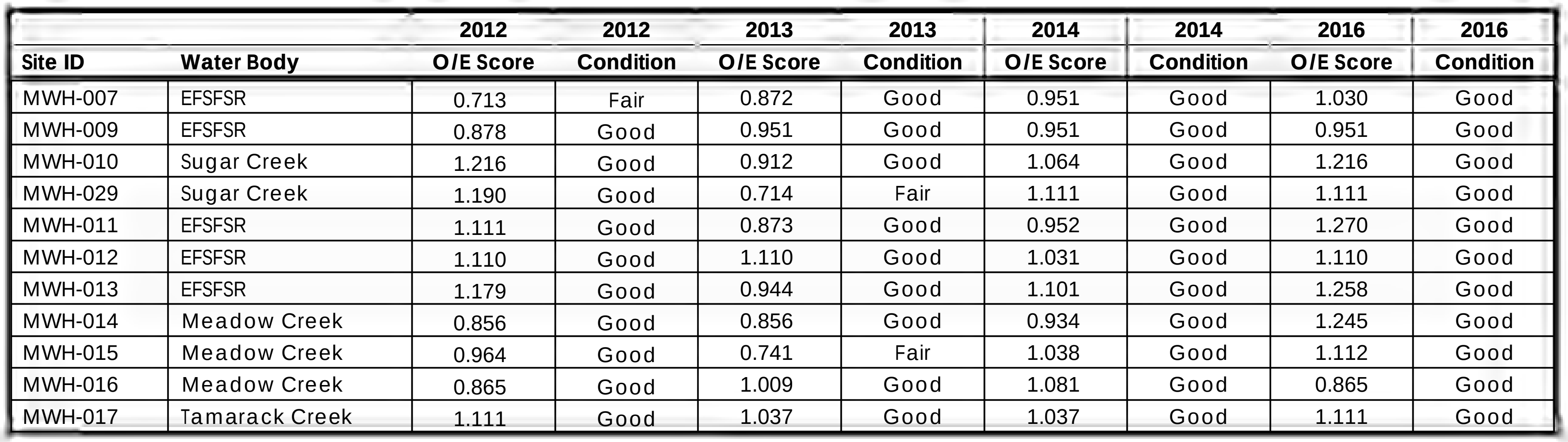
This section describes results of the analysis of the sampled sites in 2012, 2013, 2014, and 2016 using the PIBO O/E index from the RIVPACS statistical model (see Section 2.3.4).

The O/E scores discussed below and shown in **Table 3-3** are based on reference site data from throughout the West, with a mean of 0.95 and a standard deviation of 0.16. In general, departures from an O/E ratio of 1.0 indicate that the taxonomic composition in a stream sample differs from that expected under less disturbed conditions. The biological condition rating for each sampling site is a qualitative rating compared to reference sites ranging from:

- Poor (more than 2 standard deviations below the mean of reference sites)
- Fair (between 1 and 2 standard deviations below the mean of reference sites)
- Good (either less than one standard deviation below the mean of reference sites or a value greater than 1.0)

The O/E scores among sampling sites from 2012 through 2016 consistently rated as being in *good* biological condition except in three instances where a site was rated as *fair* (**Table 3-3**). A *fair* condition rating was found in 2012 at MWH-007 (Meadow Creek confluence) and in 2013 at sites MWH-029 (downstream Sugar Creek site) and MWH-015 (Meadow Creek constructed channel). In all three instances, sites with *fair* O/E scores improved to *good* in subsequent sampling years. The O/E condition rating results indicate that the macroinvertebrate assemblages are consistently very comparable to reference conditions in the western states ecoregion for which the O/E model was developed (Stoddard et al. 2006).

Table 3-3. PIBO Observed/Expected Index (RIVPACS) Scores for MWH Survey Sites, 2012-2016



Site ID	Water Body	2012 O/E Score	2012 Condition	2013 O/E Score	2013 Condition	2014 O/E Score	2014 Condition	2016 O/E Score	2016 Condition
MWH-007	EFSFSR	0.713	Fair	0.872	Good	0.951	Good	1.030	Good
MWH-009	EFSFSR	0.878	Good	0.951	Good	0.951	Good	0.951	Good
MWH-010	Sugar Creek	1.216	Good	0.912	Good	1.064	Good	1.216	Good
MWH-029	Sugar Creek	1.190	Good	0.714	Fair	1.111	Good	1.111	Good
MWH-011	EFSFSR	1.111	Good	0.873	Good	0.952	Good	1.270	Good
MWH-012	EFSFSR	1.110	Good	1.110	Good	1.031	Good	1.110	Good
MWH-013	EFSFSR	1.179	Good	0.944	Good	1.101	Good	1.258	Good
MWH-014	Meadow Creek	0.856	Good	0.856	Good	0.934	Good	1.245	Good
MWH-015	Meadow Creek	0.964	Good	0.741	Fair	1.038	Good	1.112	Good
MWH-016	Meadow Creek	0.865	Good	1.009	Good	1.081	Good	0.865	Good
MWH-017	Tamarack Creek	1.111	Good	1.037	Good	1.037	Good	1.111	Good

3.5 Results by Sampling Site

All sites were similar in many respects. They all had high overall SMI scores, indicating that the streams were in *very good* or *good* condition in all sampling years relative to the regional reference sites used to develop the Central and Southern Mountains SMI. These high scores were consistently the result of high taxa richness, diversity/evenness measures, high HBI scores (indicating an abundance of taxa requiring high water quality), and large numbers of scraper and clinger taxa that require high quality substrate. Abundance of Plecoptera was generally lower than expected across all sites in all years. As previous described, in 2016 many sites had notably lower taxa richness for some groups as well as lower HBI scores indicating a greater tolerance of organic pollution. Several other metrics consistently supported the SMI metric calculations namely high Shannon-Weaver diversity values; many long-lived taxa that require stable habitats; high numbers of intolerant taxa; low numbers of tolerant individuals; and an even distribution of several FFGs, most notably a large proportion of predator taxa. Metals tolerance also fluctuated somewhat among sites and years. Specific results for each site are presented in the following site summaries.

3.5.1 MWH-007

This site, located on the EFSFSR immediately downstream of the Yellow Pine Pit outlet, is characterized by very large substrate sizes and high gradient relative to the other macroinvertebrate sampling sites. It is unique among the sites because it is most directly influenced by an impoundment, which likely affects water quality in terms of temperature, chemical properties and productivity. MWH-007 had SMI ratings of *very good* in 2012 and 2013, and lower ratings of *good* in 2014 and 2016. The overall SMI scores were similar across years and the change in condition category represented only a slight decrease in some metrics that comprise the overall SMI score. Notable, were lower scraper taxa richness and HBI scores in 2016, which were observed at several sites. As with most sites in almost all years, the percent of Plecoptera in samples was lower than expected.

Most richness and evenness metrics tended to be more variable and have lower values than other sites, which is expected given the likely influence of the upstream impoundment. Filterer abundance is notably greatest at this site because it is ideal habitat for blackflies, which can occur in very high densities. An increasing trend in blackfly abundance at this site may indicate changes in water quality; however sampling bias is possible since the site is difficult to sample and lake outlets commonly have large blackfly populations. A notable change from previous years was an increase in the MTI in 2016.

PIBO O/E scores indicated that this site was in *fair* condition in 2012 and was rated as *good* in 2013, 2014, and 2016.

3.5.2 MWH-009

This site is located on the EFSFSR approximately one mile downstream of the Yellow Pine Pit. MWH-009 had a SMI rating of *very good* in all sampling years, but lower scores for scraper taxa, HBI, and percent 5 dominant taxa were observed in 2016. Metrics at this site are similar to most other sites, with high taxa richness, taxa indicative of good water quality, and stable diverse habitat availability. As with most sites in almost all years, the percent of Plecoptera in samples was lower than expected. In addition, as at MWH-007 immediately upstream, the MTI was somewhat elevated in 2016 relative to previous years.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

3.5.3 MWH-010

This is the upstream site on Sugar Creek and was rated as *very good* in all sampling years, although the overall SMI score was lower in 2016 (SMI score = 83.2) as compared scores ranging from 92.4 to 95.6 from 2012 to 2014. This departure from previous years was driven by lower scores for several metrics including Plecoptera richness, Trichoptera richness, HBI, clinger taxa, and a large decrease in percent Plecoptera,. Lower numbers of intolerant taxa and long-lived taxa were also found in 2016. Prior to 2016, the only notable difference in the macroinvertebrate community relative to other sites was a higher average number of Plecoptera. In this respect, the upstream Sugar Creek site was most similar to the Tamarack Creek control site (MWH-017). In general, it is difficult to draw any firm conclusions regarding potential changes in habitat over time considering the high scores for most metrics and the overall SMI scores across all years. However, the observed decrease in some metric scores seen in 2016, particularly the decrease in Plecoptera numbers, warrants future observation to see if these trends continue.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

3.5.4 MWH-029

This site is the downstream site on Sugar Creek immediately upstream of the confluence with the EFSFSR and was rated as *very good* in all sampling years. The metric scores at this site were similar to most other sites and characterized by high taxa richness, taxa indicative of good water quality, and stable diverse habitat availability. In 2016, somewhat lower HBI scores and elevated MTI values relative to previous years were observed. As with most sites in almost all years, the percent of Plecoptera in samples was lower than expected.

PIBO O/E scores in 2013 indicated that this site was in *fair* condition and was rated as *good* in 2012, 2014 and 2016.

3.5.5 MWH-011

This site is located on the EFSFSR just downstream of, and in close proximity to, the mining camp at the project station. MWH-011 was rated as *very good* with extremely similar overall SMI scores across sampling years. Metrics at this site were similar to most other sites, with high taxa richness, taxa indicative of good water quality, and stable diverse habitat availability. As with most sites in almost all years, the percent of Plecoptera in samples was lower than expected, and in 2016 we observed somewhat lower HBI scores than in previous years. Consistent with a slightly lower HBI score in 2016 was a slight increase in numbers of macroinvertebrates that are highly tolerant of organic pollution.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

3.5.6 MWH-012

This site is located on the EFSFSR immediately downstream of the confluence with Meadow Creek and upstream of the bridge crossing of the EFSFR near the project station. MWH-012 was rated as *very good* in all sampling years based on generally high taxa richness, taxa indicative of good water quality, and stable diverse habitat availability. As with most sites in almost all years, the percent of Plecoptera in samples was lower than expected, and in 2016 we observed somewhat lower HBI scores than in previous years. Also observed in 2016 was a large relative increase in the percentage of macroinvertebrates that are highly tolerant of organic pollution.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

3.5.7 MWH-013

This is the farthest upstream site on the EFSFSR and was rated as *very good* across all sampling years. Metrics were similar to most other sites, with high taxa richness, taxa indicative of good water quality, and stable diverse habitat availability. As with most sites in almost all years, the percent of Plecoptera in samples was lower than expected, but HBI scores were not lower in 2016 than in previous years as observed at many other sites.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

3.5.8 MWH-014

This is the farthest downstream site located on Meadow Creek and was rated as *very good* across all sampling years with little change among all SMI metrics. Metrics were similar to most other sites, with high taxa richness, taxa indicative of good water quality, stable diverse habitat availability, and lower than expected Plecoptera abundance. However, in 2016 there was a large relative increase in the percentage of macroinvertebrate individuals that are highly tolerant of organic. This result is similar to what was also observed MWH-012 immediately downstream from this site.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

3.5.9 MWH-015

This site is located within the constructed channel on Meadow Creek. It was rated as *very good* sites in 2013 and 2104 and rated as *good* in 2012 and 2016. However, in all four of these instances the SMI scores were similar across years and changes in SMI rating category represented only slight changes in the actual SMI scores. Most richness and evenness metrics tended to be more variable and have lower values at this site than other sites, but the metrics are still similar to most other sites including lower than expected Plecoptera abundance. A sharp change in MTI value was found at this site, decreasing from high 2012 levels to values similar to other sampling sites in 2013, 2014, and 2016 indicating that metals contamination may have decreased after 2012. There was also a notable decrease in observed Trichoptera richness in 2016 as compared to previous years. HBI scores were not lower in 2016 than in previous years as found at many other sites.

PIBO O/E scores in 2013 indicated that this site was in *fair* condition, but was rated as *good* in 2012, 2014 and 2016.

3.5.10 MWH-016

This is the furthest upstream site located on Meadow Creek. MWH-016 was rated as *very good* from 2012 through 2014, but had a substantially lower SMI score and rating in 2016. From 2012 to 2014, metrics were similar to most other sites, with high taxa richness, taxa indicative of good water quality, stable diverse habitat availability, and lower than expected Plecoptera abundance. A decreased overall SMI score/condition rating was observed in 2016 that was determined by decreased taxa richness of several taxa groups, decreased taxa evenness, fewer clinger taxa, and a lower HBI score (indicating that the taxa found had greater tolerance of organic pollution). Similar to the change in HBI values, there was a large decrease in the number of taxa that are highly intolerant of organic pollution. In addition, the MTI value in 2016 was notably higher than in previous years indicating the macroinvertebrate community sampled in 2016 was more tolerant of metals contamination. Reasons for such changes in metric scores are unclear since MWH-016 is upstream of the Stibnite project area where little human activity would be expected.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

3.5.11 MWH-017

This control site is located on Tamarack Creek. MWH-017 rated as *very good* from 2012 through 2014 and showed a slight decrease in overall SMI score in 2016 which was *good*. The decreased 2016 SMI score was driven by somewhat lower scores for virtually all metrics. In general though, metric scores were were similar to most other sites, with high taxa richness, taxa indicative of good water quality, stable diverse habitat availability. One distinction between MWH-017 and most other sites was a somewhat higher abundance of Plecoptera, which is most similar to the upstream site on Sugar Creek in this respect.

PIBO O/E scores indicated that this site was rated as *good* in all sampling years.

SECTION 4: CONCLUSIONS

The macroinvertebrate assemblages at all MWH macroinvertebrate sites are generally indicative of high water quality and relatively stable habitat availability. This is indicated by high taxa richness, the presence of many predator and long-lived taxa, taxa that require clean cobble substrate, low MTI values, high HBI scores, high proportions of taxa that are intolerant of poor water quality, and low numbers of individuals that are tolerant of poor water quality. Lower than expected numbers of Plecoptera were found among all sites in all years. In 2016, HBI scores were consistently lower across most sites indicating a general lower tolerance of organic pollution or some undetermined aspect of sampling bias. Richness of some taxonomic groups was also lower in 2016, but this did not occur in a consistent pattern across sites as would be expected if sampling bias was a factor.

High proportions of clinger and scraper taxa were also indicative of abundant clean substrate, although some sites in 2016 had lower scraper and clinger taxa richness relative to previous years.

Notable differences in macroinvertebrate composition included a larger proportion of filterers (in this case blackfly larvae) just downstream of the Yellow Pine Pit outlet at MWH-007, somewhat greater numbers of stoneflies at the upstream Sugar Creek and Tamarack Creek sites, and a sharp decrease in MTI values within the Meadow Creek constructed channel, indicating that metals contamination may have decreased since 2012 at MWH-015. In 2016, a decrease in the overall SMI score was observed at the furthest upstream Meadow Creek site (MWH-016). Additionally an increased MTI value and a decrease in the number of taxa intolerant of organic pollution relative to previous years was observed at MWH-016. Other sites exhibiting potential decreases in water quality include an increase in MTI values at sites most immediately downstream of the Yellow Pine Pit (MWH-007 and MWH-009) and increases in the number of intolerant individuals near the confluence of Meadow Creek and EFSFSR.

PIBO O/E scores rated all sites across all sampling years as *good* with respect to regionally expected macroinvertebrate populations with only three exceptions across sampling years. These exceptions included *fair* ratings just below the Yellow Pine Pit (MWH-007) in 2012, lower Sugar Creek in 2013 (MWH-029), and the Meadow Creek constructed channel (MWH-015) in 2013.

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SECTION 5: REFERENCES

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5.2 Abbreviations and Acronyms

Abbreviation/Acronym	**Definition**
CPOM	coarse particulate organic matter
EFSFSR	East Fork South Fork Salmon River
FFG	Functional feeding group
HBI	Hilsenhoff Biotic Index
INFISH	Inland Fish Strategy
MTI	Metals Tolerance index
MWH	MWH Americas, Inc.
O/E	observed/expected
PACFISH	Pacific Anadromous Fish Strategy
PIBO	PACFISH/INFISH Biological Assessment
RIVPACS	River Invertebrate Prediction and Classification System
SMI	Stream Macroinvertebrate Index

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Stantec.		
Stephanie Theis	Fisheries Biologist	Aquatics Baseline Study technical lead, technical review
Payette National Forest		
Clayton Nalder	Fisheries Biologist	Aquatics survey methodology support

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Appendix 3:

Water Temperature Watershed Condition Indicators and Monitoring Results

Appendix 3: Water Temperature Watershed Condition Indicators and Monitoring Results

Stibnite Gold Project
Midas Gold Idaho, Inc.

April 2017

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List of Tables

List of Figures

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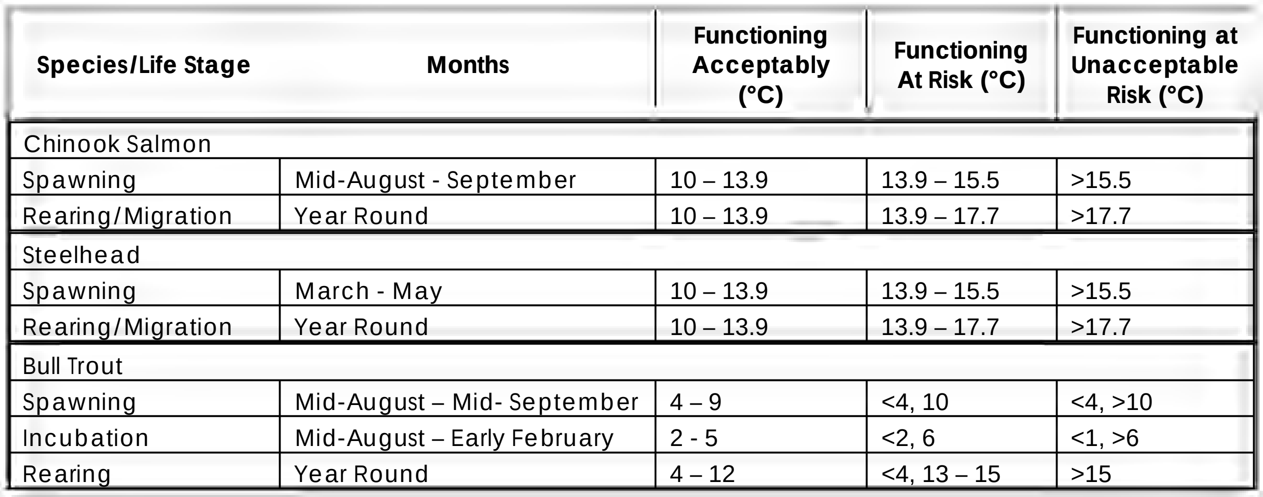
WATER TEMPERATURE MONITORING RESULTS AND WATERSHED CONDITION INDICATORS

The following figures are plots of 7-day average maximum water temperature overlain on the water temperature Watershed Condition Indicator (WCI) ranges for spawning and rearing Chinook salmon and steelhead, and bull trout spawning, incubation and rearing. **Table 1** summarizes the water temperature WCIs from Appendix B of the Land and Resource Management Plan (PAF 2003).

Table 1. Water Temperature Watershed Condition Indicators for Chinook Salmon, Steelhead and Bull Trout Based on the 7-Day Average Maximum Temperature



Species/Life Stage	Months	Functioning Acceptably (°C)	Functioning At Risk (°C)	Functioning at Unacceptable Risk (°C)
Chinook Salmon				
Spawning	Mid-August - September	10 – 13.9	13.9 – 15.5	>15.5
Rearing/Migration	Year Round	10 – 13.9	13.9 – 17.7	>17.7
Steelhead				
Spawning	March - May	10 – 13.9	13.9 – 15.5	>15.5
Rearing/Migration	Year Round	10 – 13.9	13.9 – 17.7	>17.7
Bull Trout				
Spawning	Mid-August – Mid- September	4 – 9	<4, 10	<4, >10
Incubation	Mid-August – Early February	2 - 5	<2, 6	<1, >6
Rearing	Year Round	4 – 12	<4, 13 – 15	>15

Source: PAF 2003, page B-13 in Appendix B

Sites where the thermographs were not installed until 2014, were lost, or were inaccessible during late fall data collections activities, show as data gaps in the figures below. USGS gage data for 5 stations are also included. The WCIs are shown in all figures by a color bar:

- Green represents ‘Functioning Appropriately’
- Yellow represents ‘Functioning at Risk’
- Red represents ‘Functioning at Unacceptable Risk’

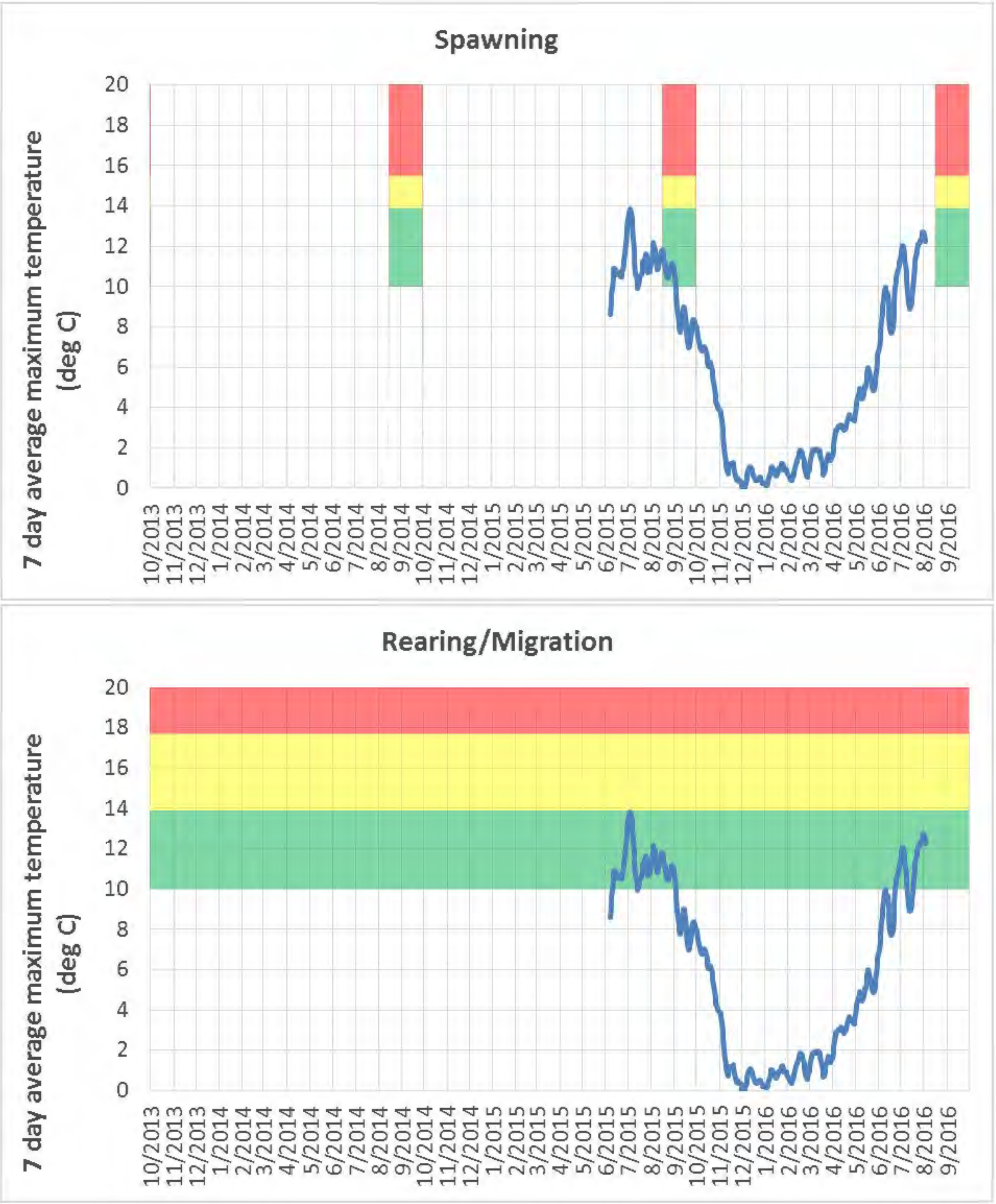


Figure 1. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in the East Fork of the South Fork of the Salmon River, MWH-001

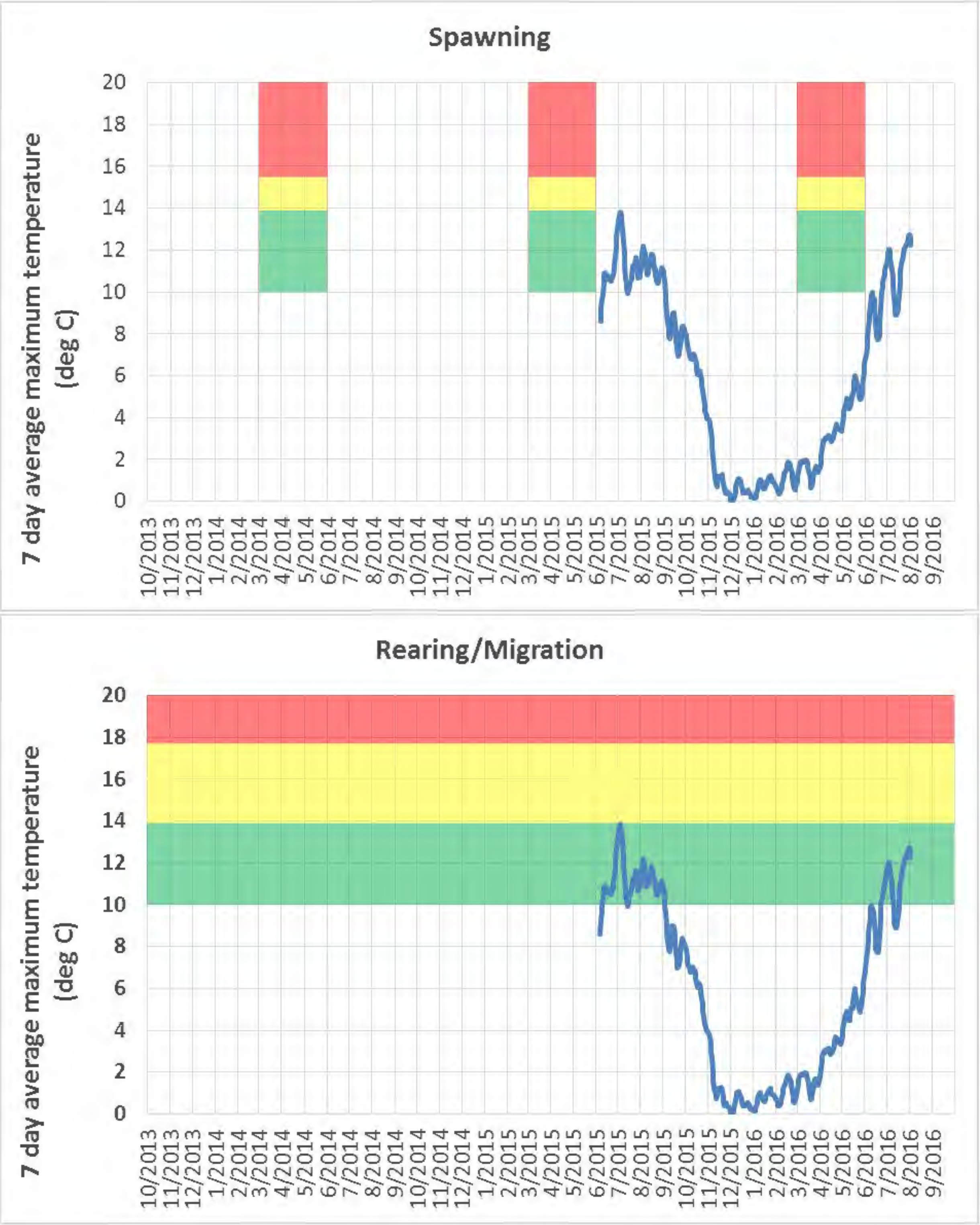


Figure 2. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in the EFSFSR, MWH-001

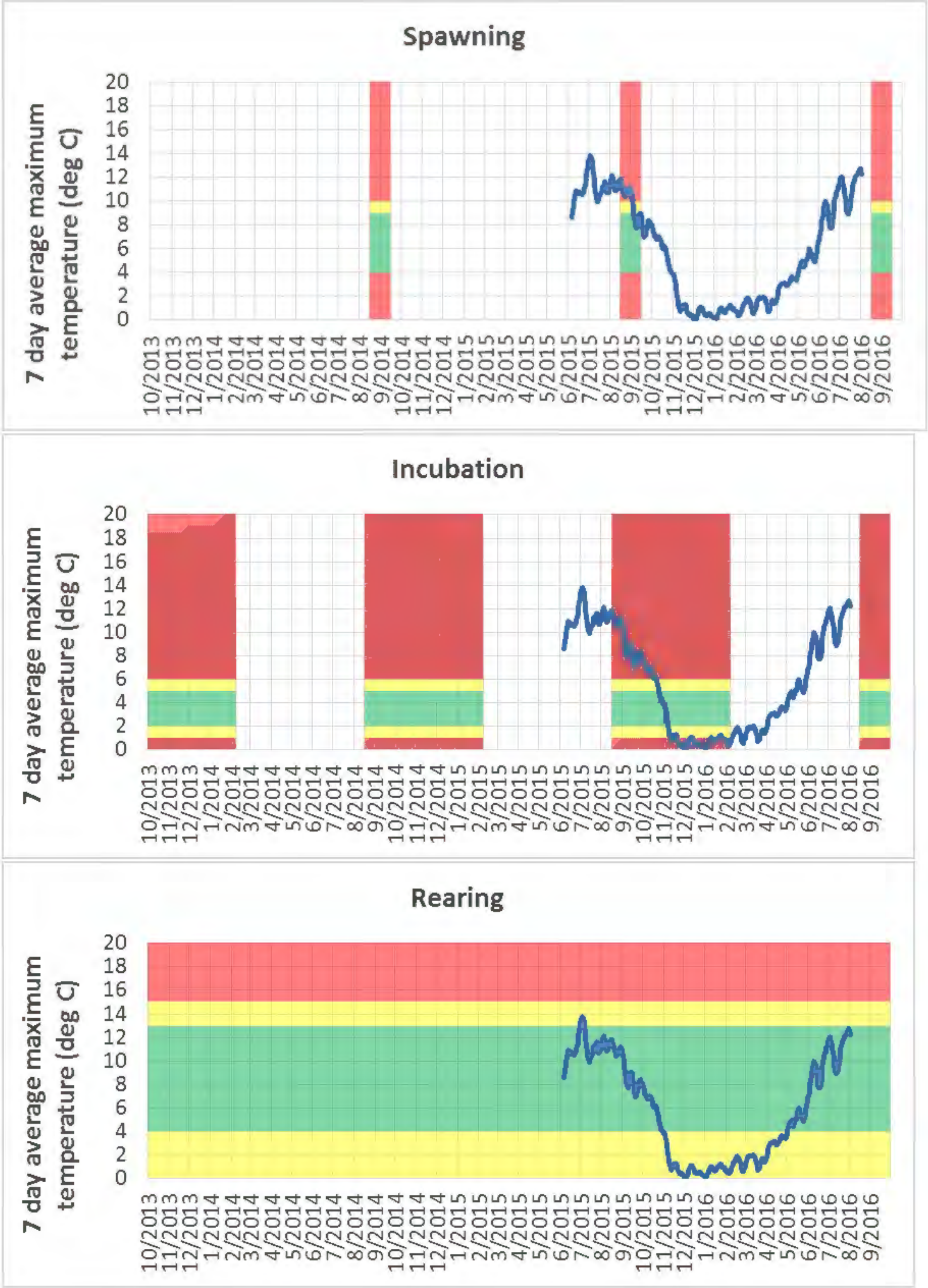


Figure 3. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in the EFSFSR, MWH-001

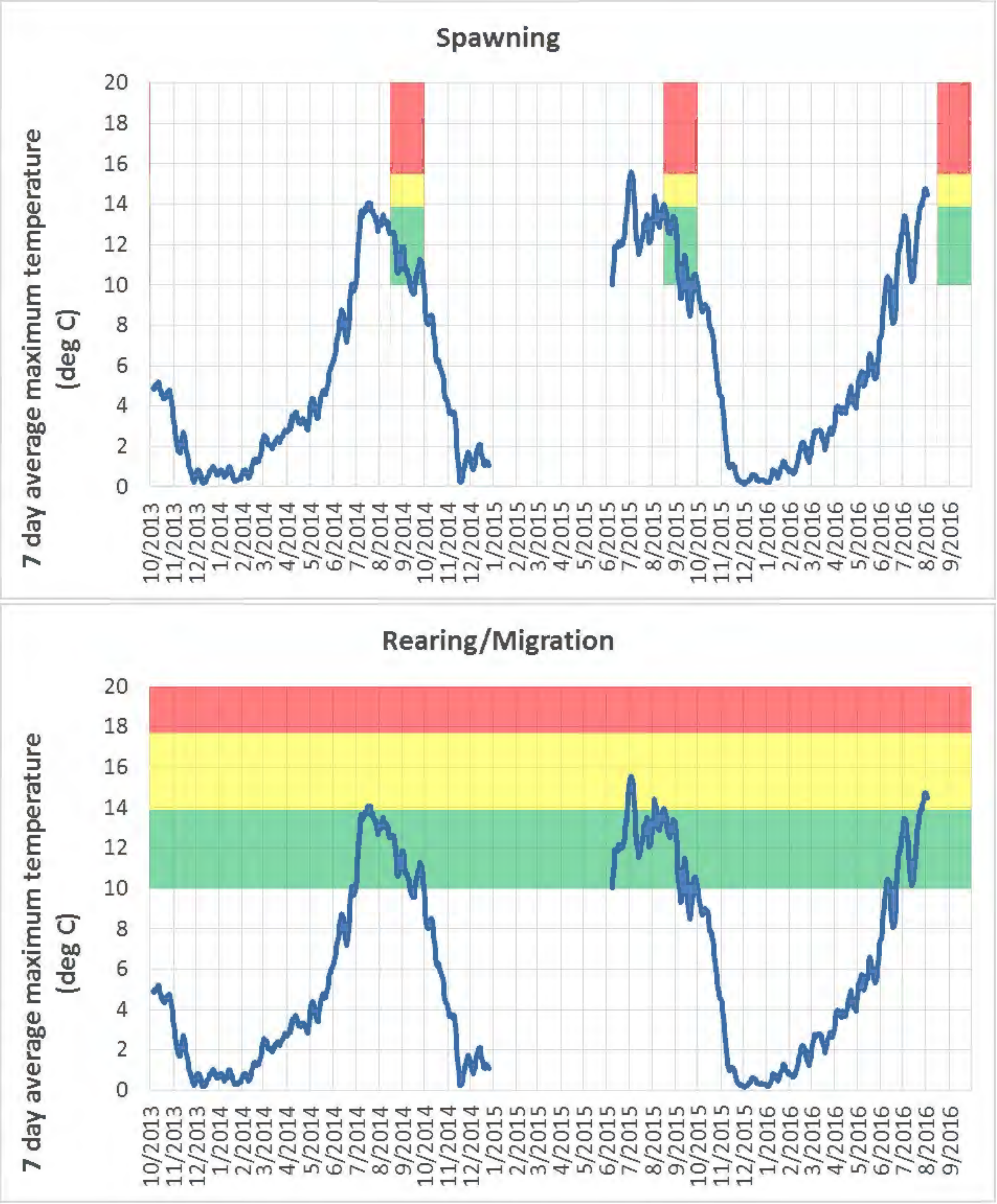


Figure 4. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Meadow Creek, MWH-003

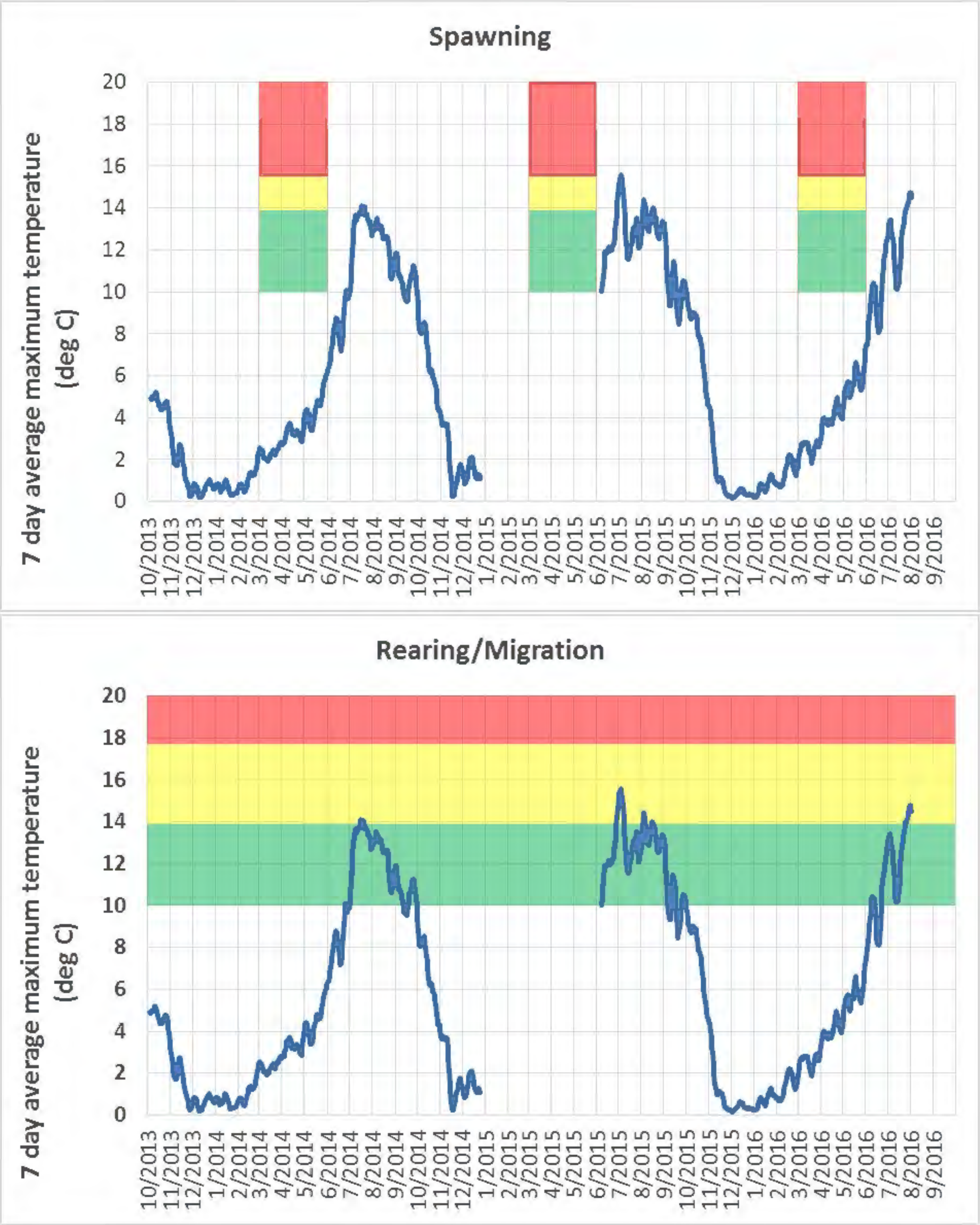


Figure 5. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Meadow Creek, MWH-003

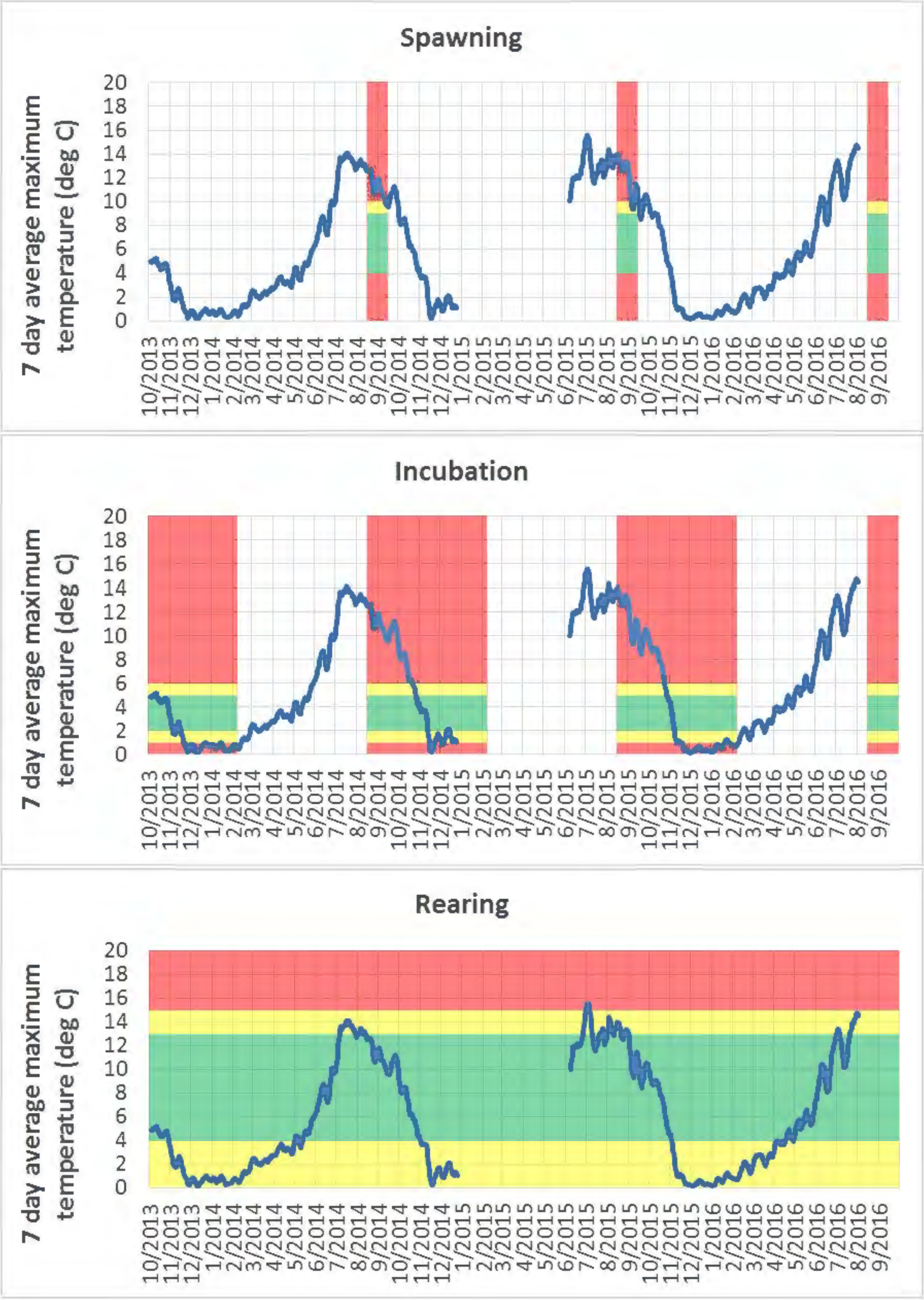


Figure 6. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Meadow Creek, MWH-003

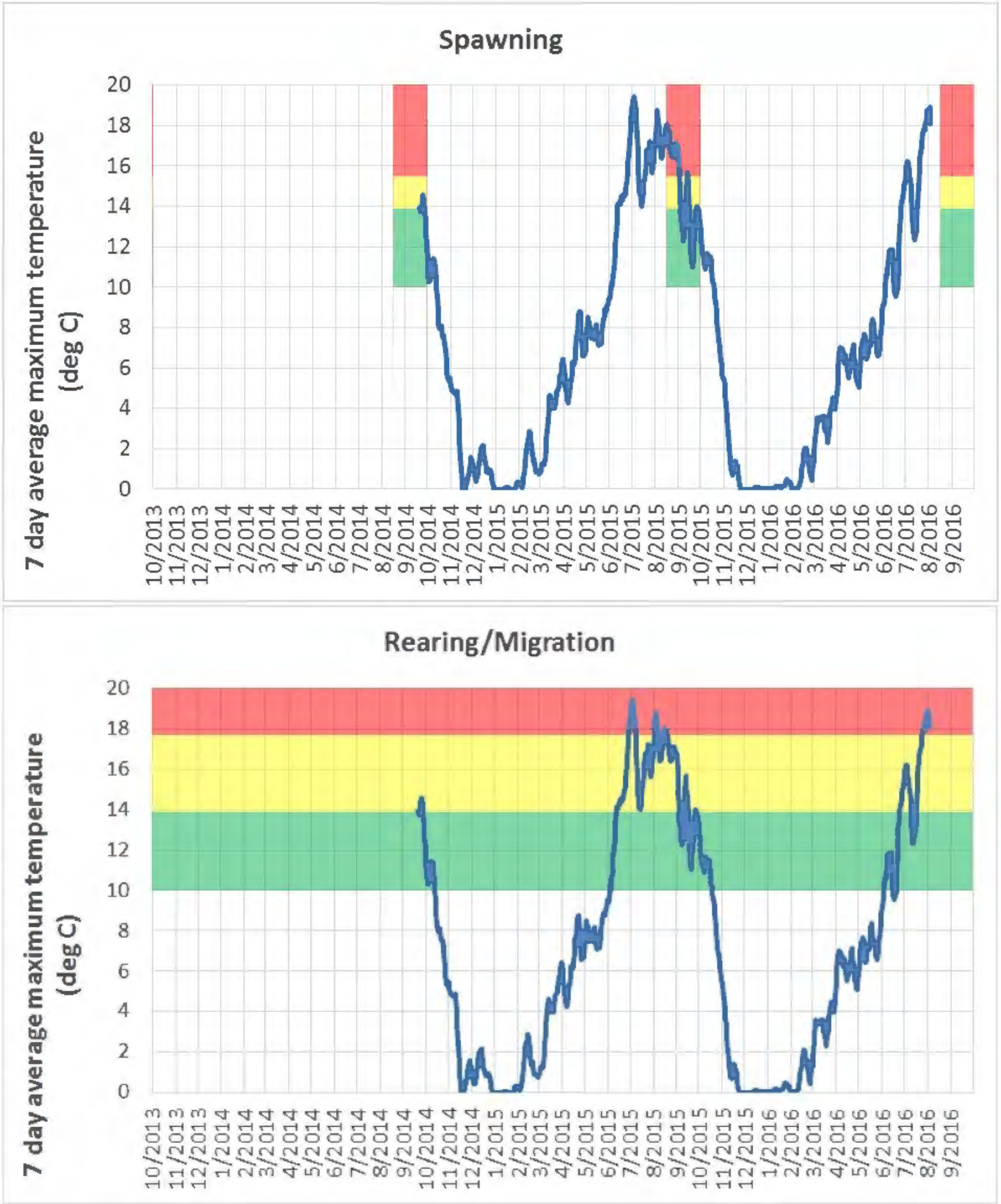


Figure 7. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Meadow Creek, MWH-004

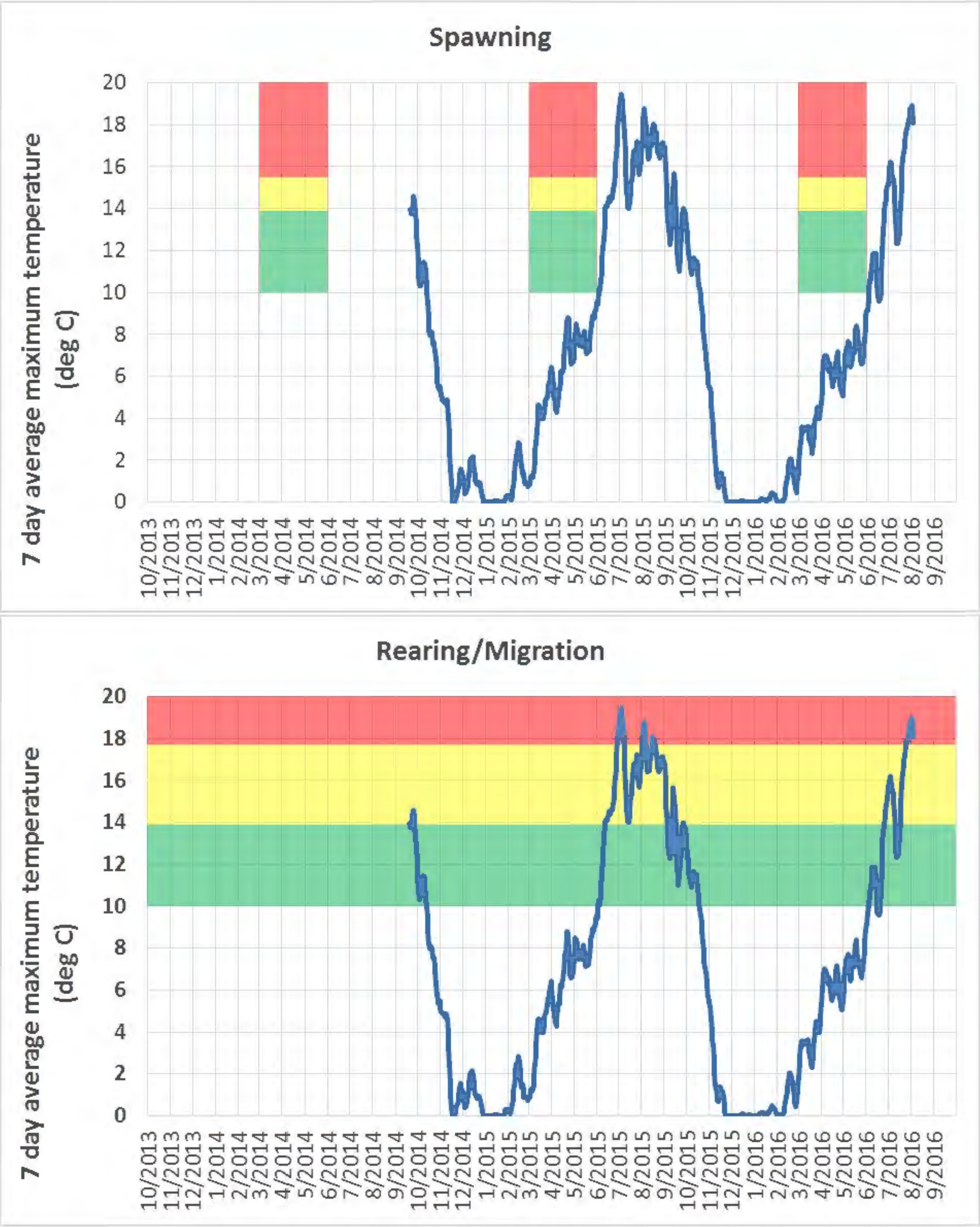


Figure 8. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Meadow Creek, MWH-004

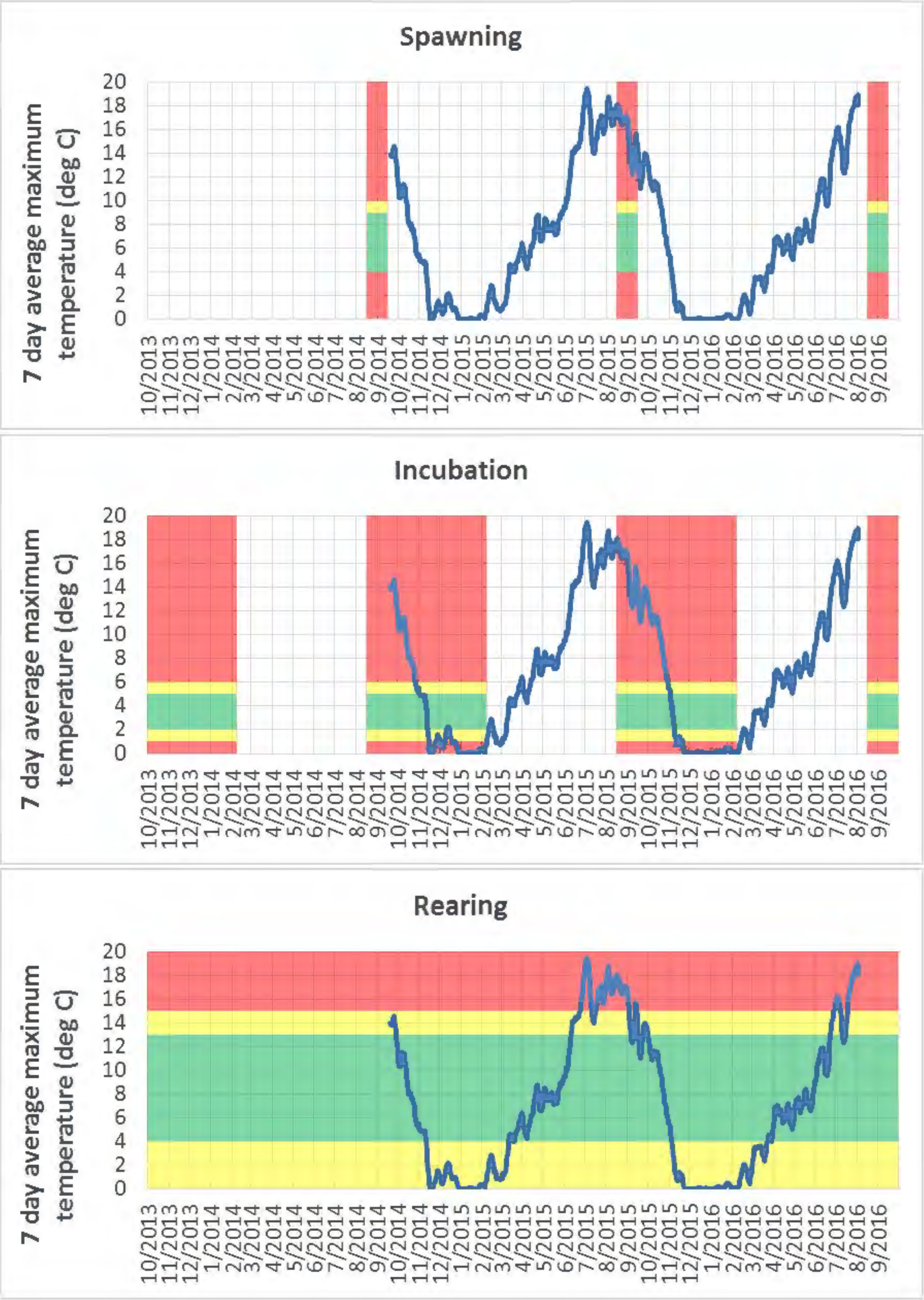


Figure 9. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Meadow Creek, MWH-004

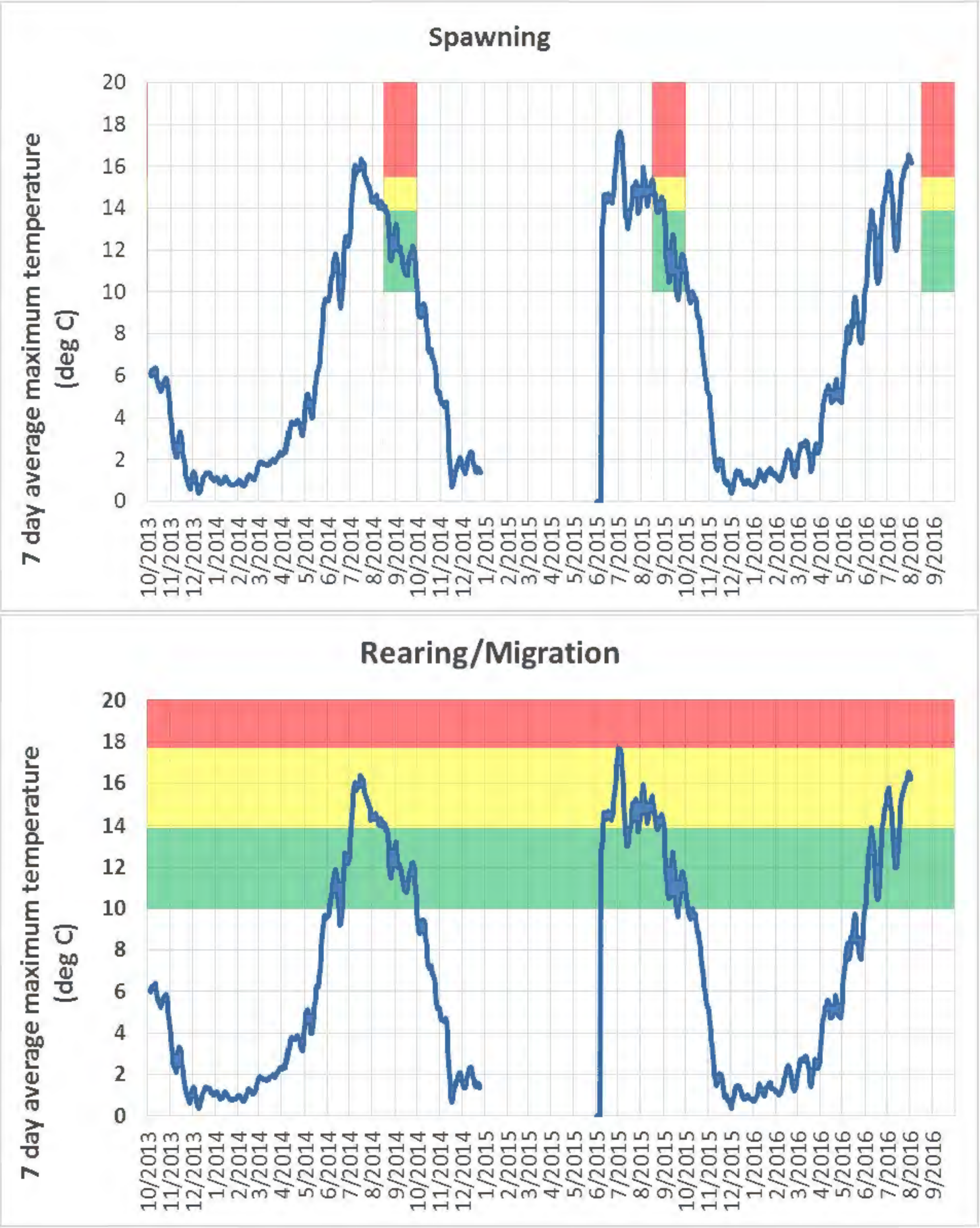


Figure 10. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in the East Fork Meadow Creek, MWH-006

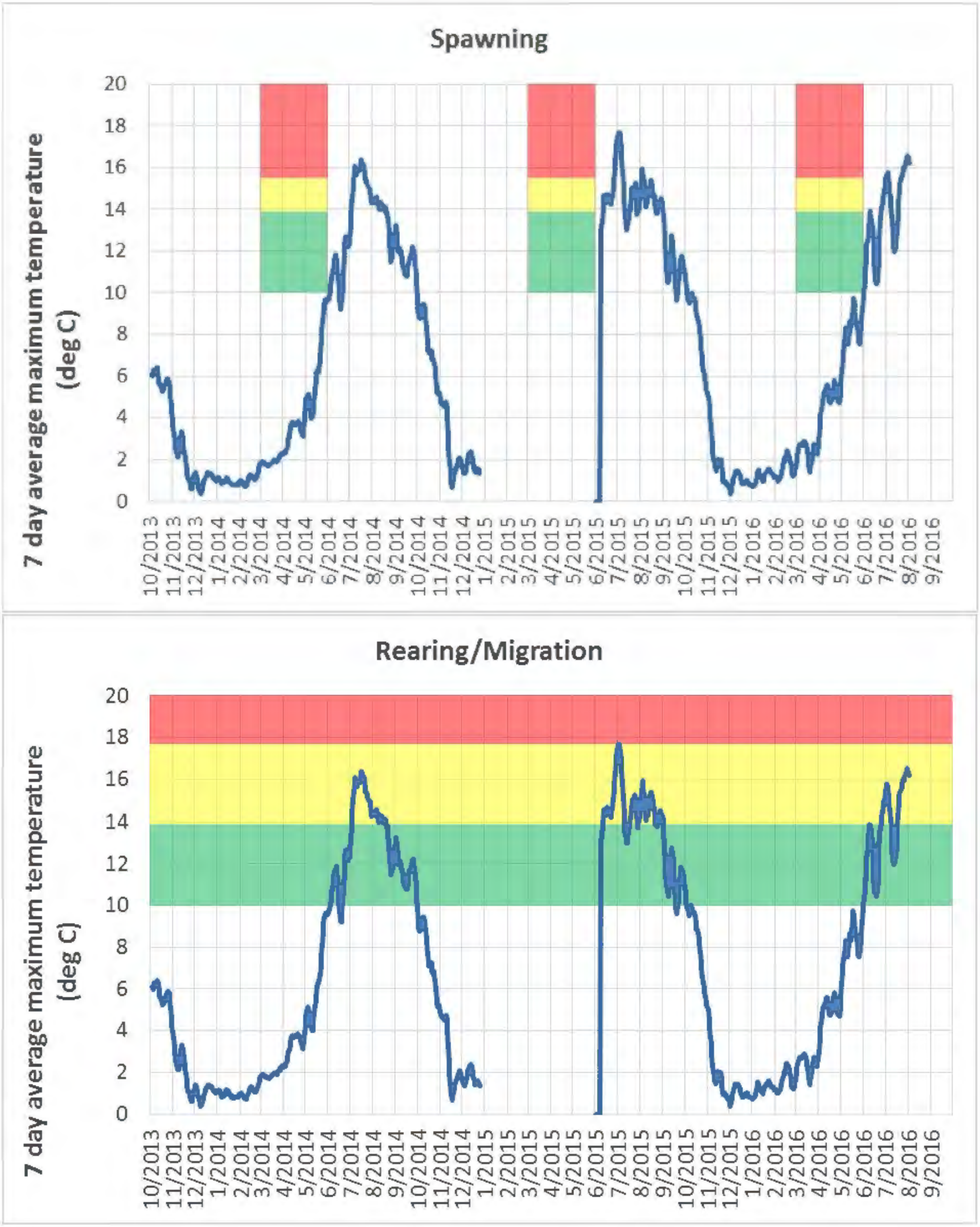


Figure 11. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in the East Fork Meadow Creek, MWH-006

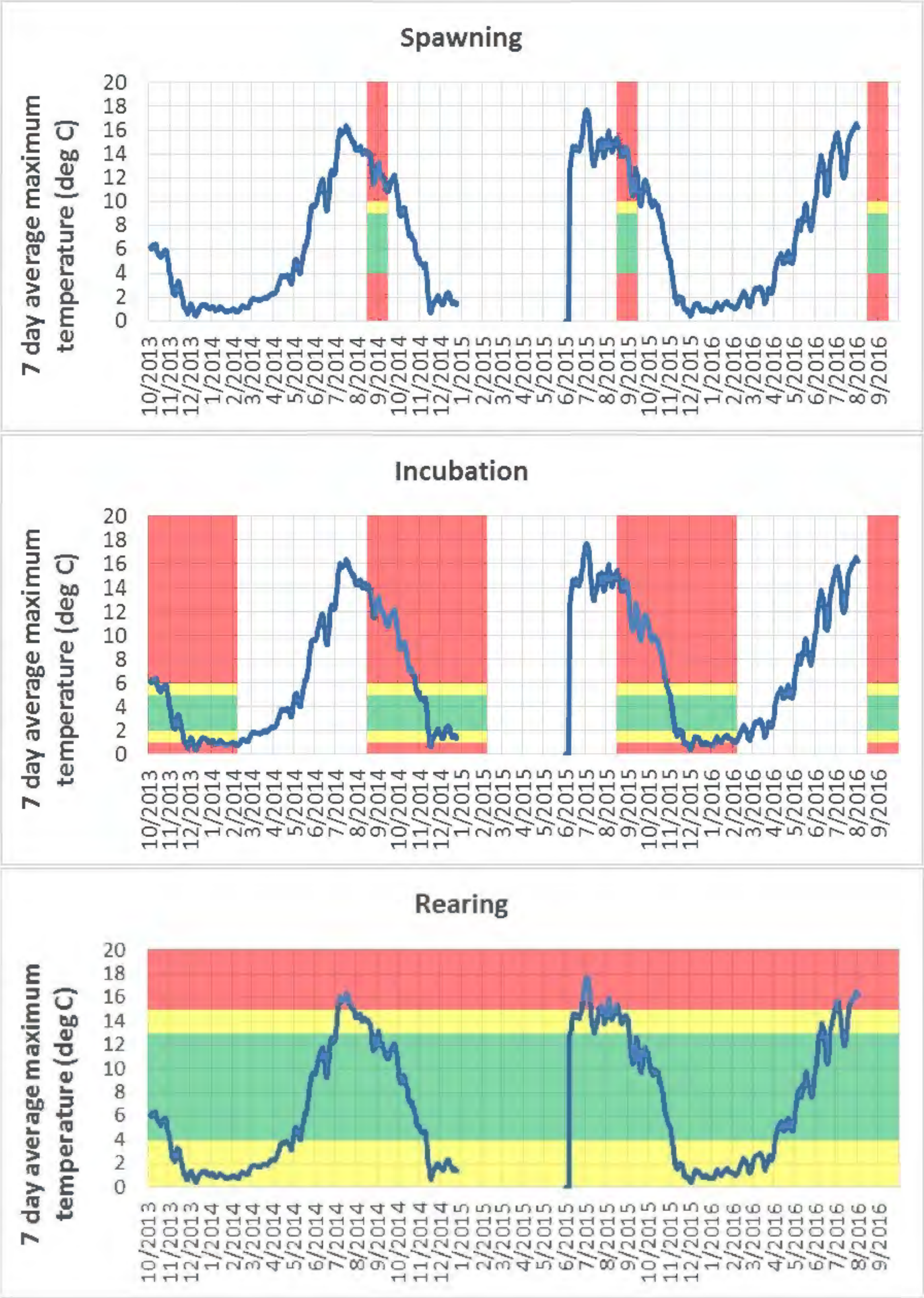


Figure 12. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in the East Fork Meadow Creek, MWH-006

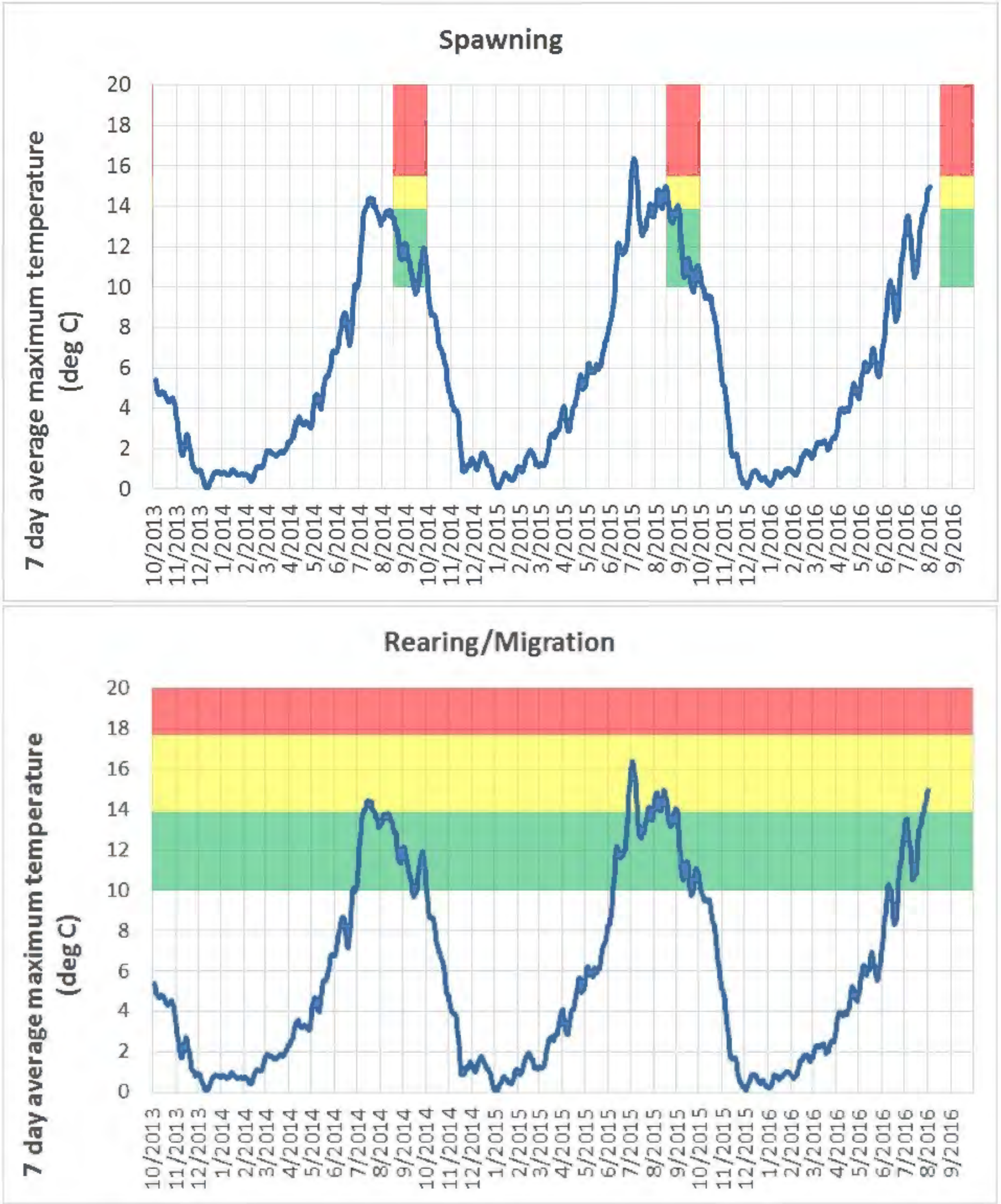


Figure 13. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in the East Fork of the South Fork of the Salmon River, MWH-007

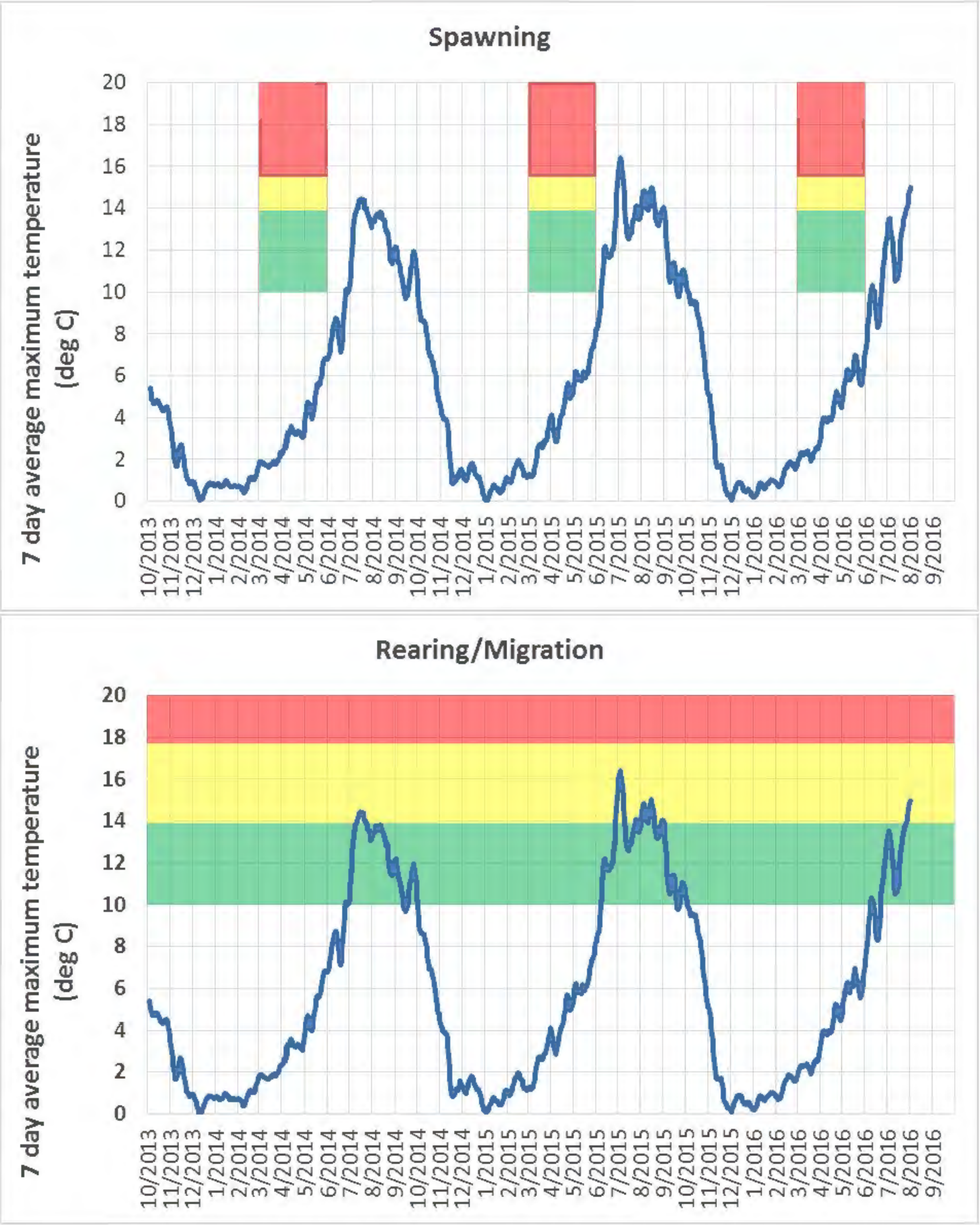


Figure 14. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in the East Fork of the South Fork of the Salmon River, MWH-007

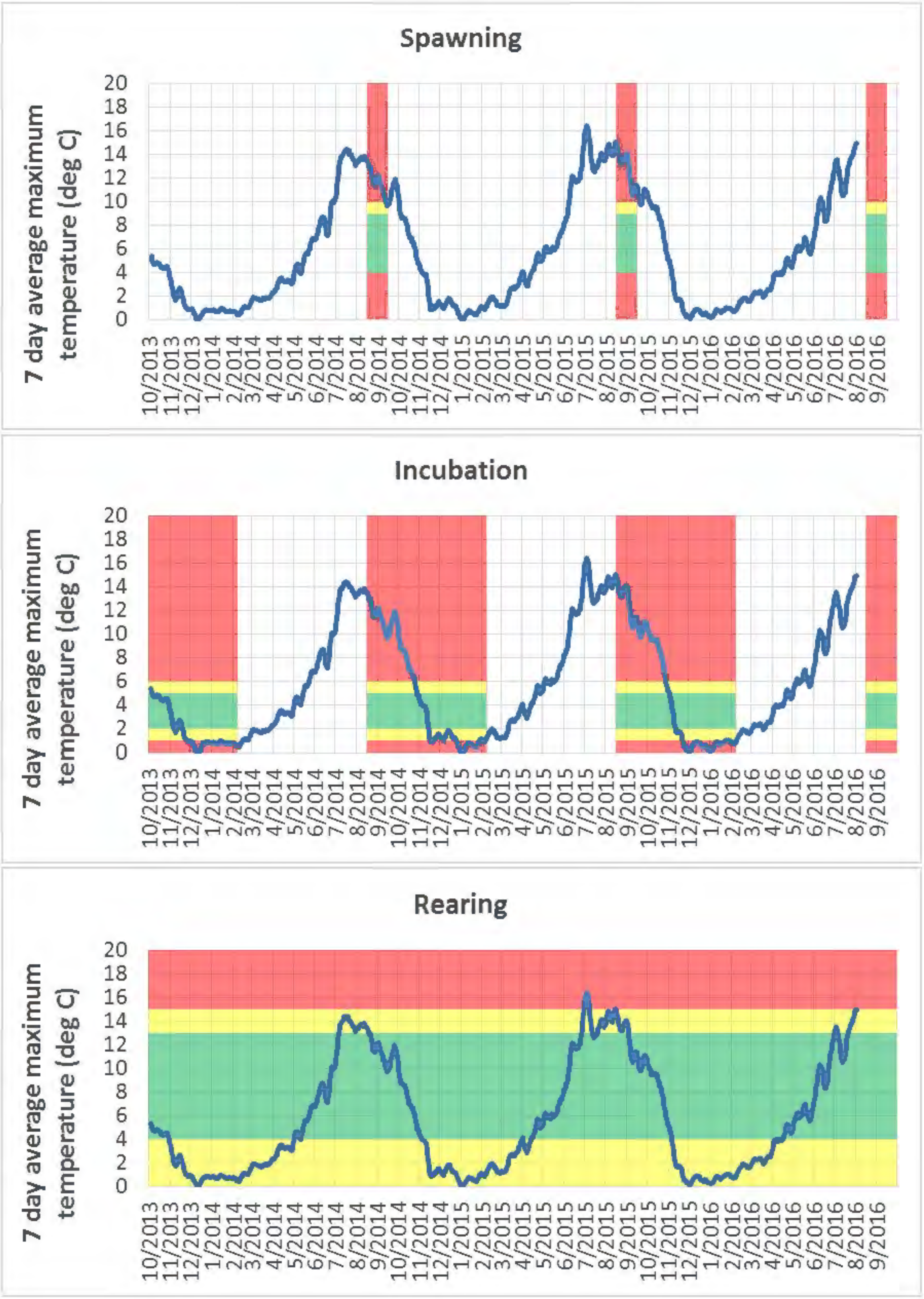


Figure 15. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in the East Fork of the South Fork of the Salmon River, MWH-007

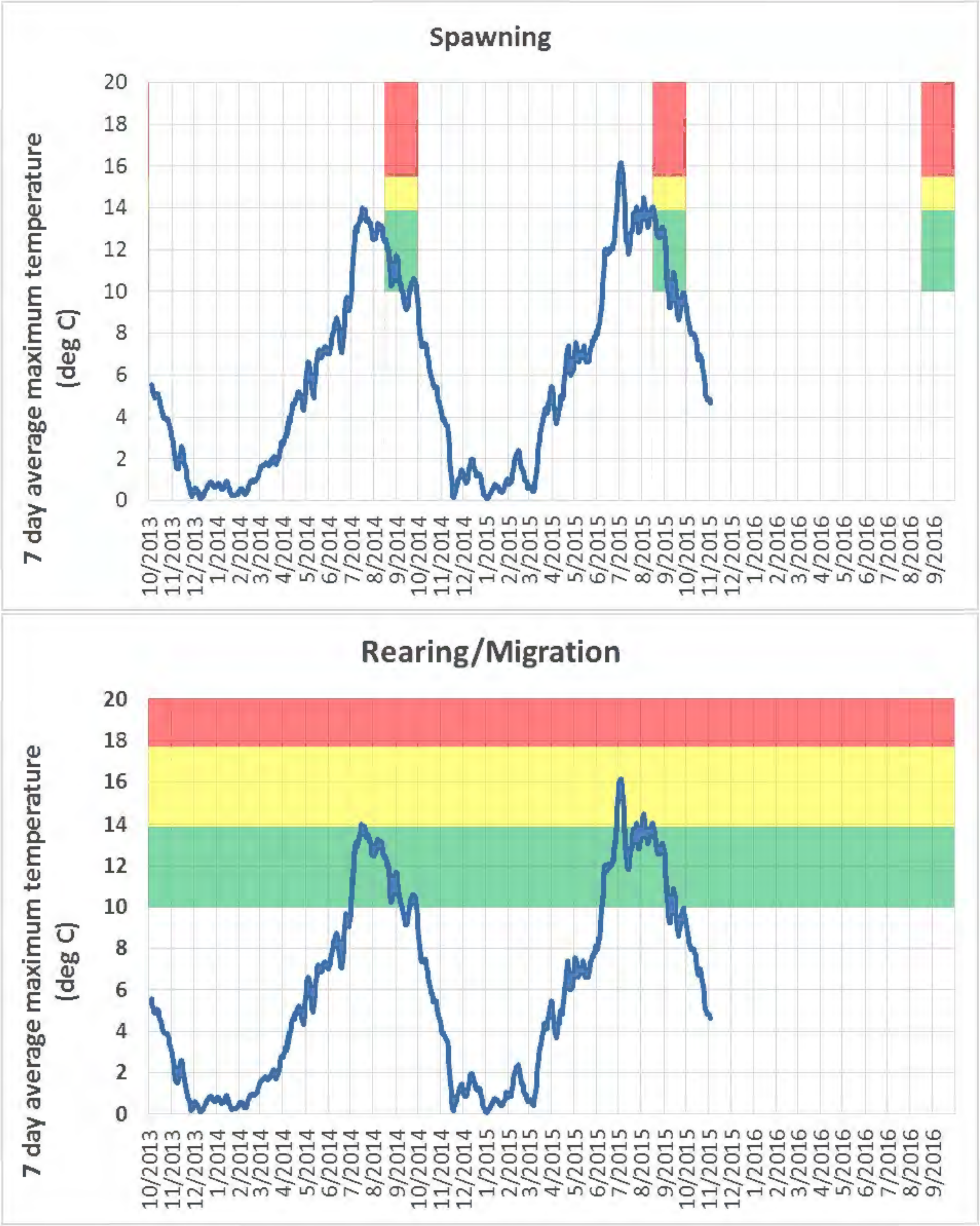


Figure 16. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Sugar Creek, MWH-008

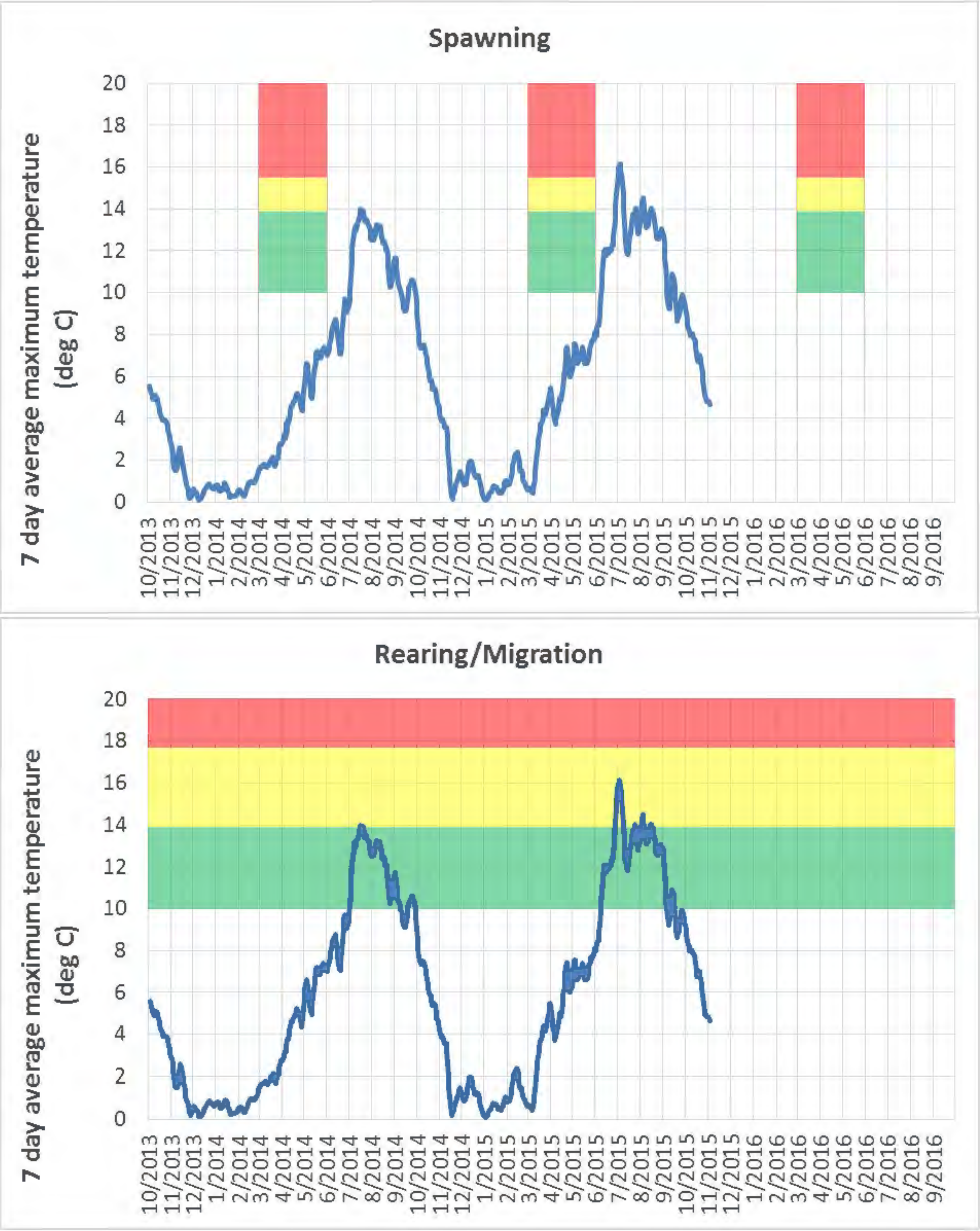


Figure 17. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Sugar Creek, MWH-008

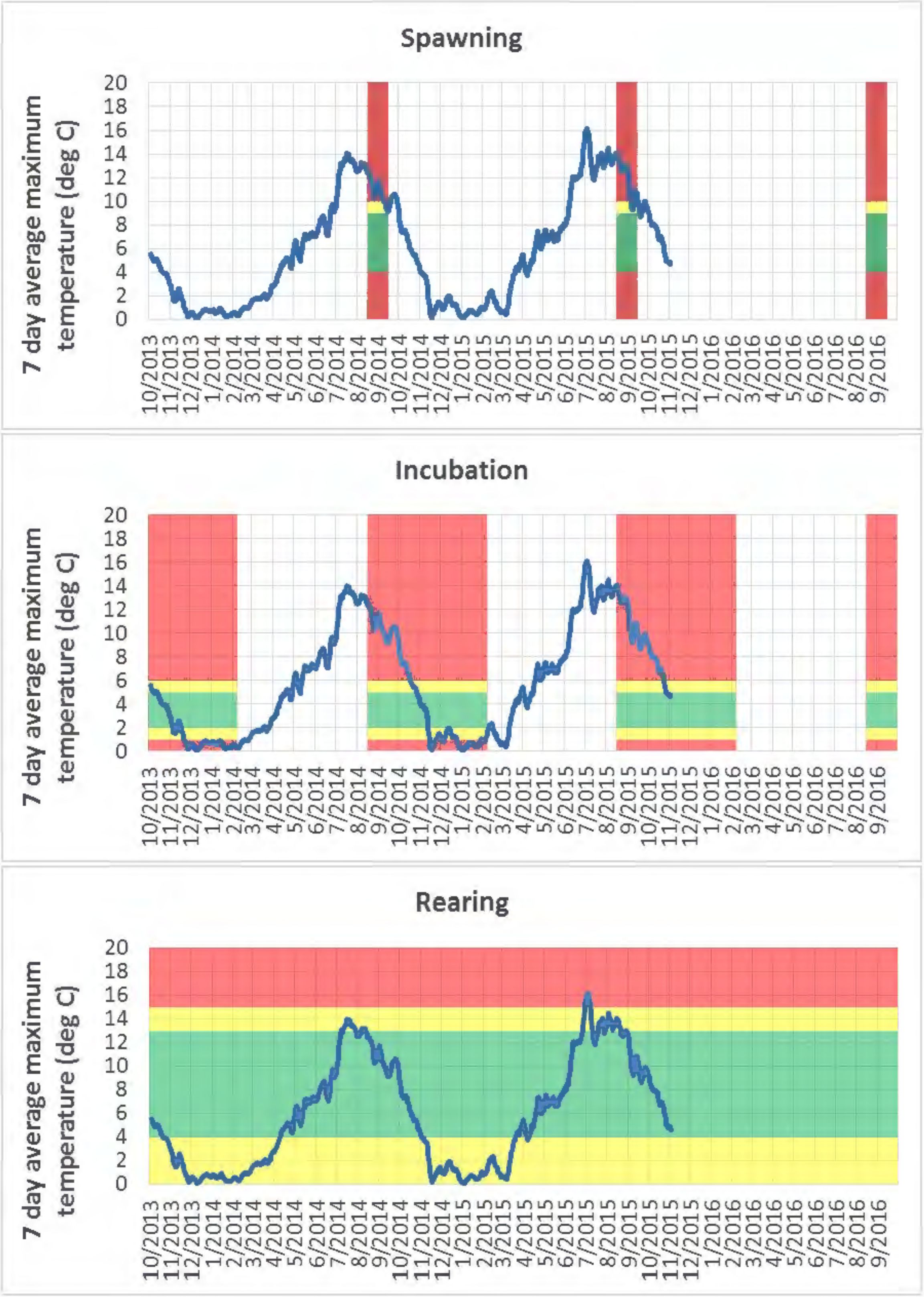


Figure 18. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Sugar Creek, MWH-008

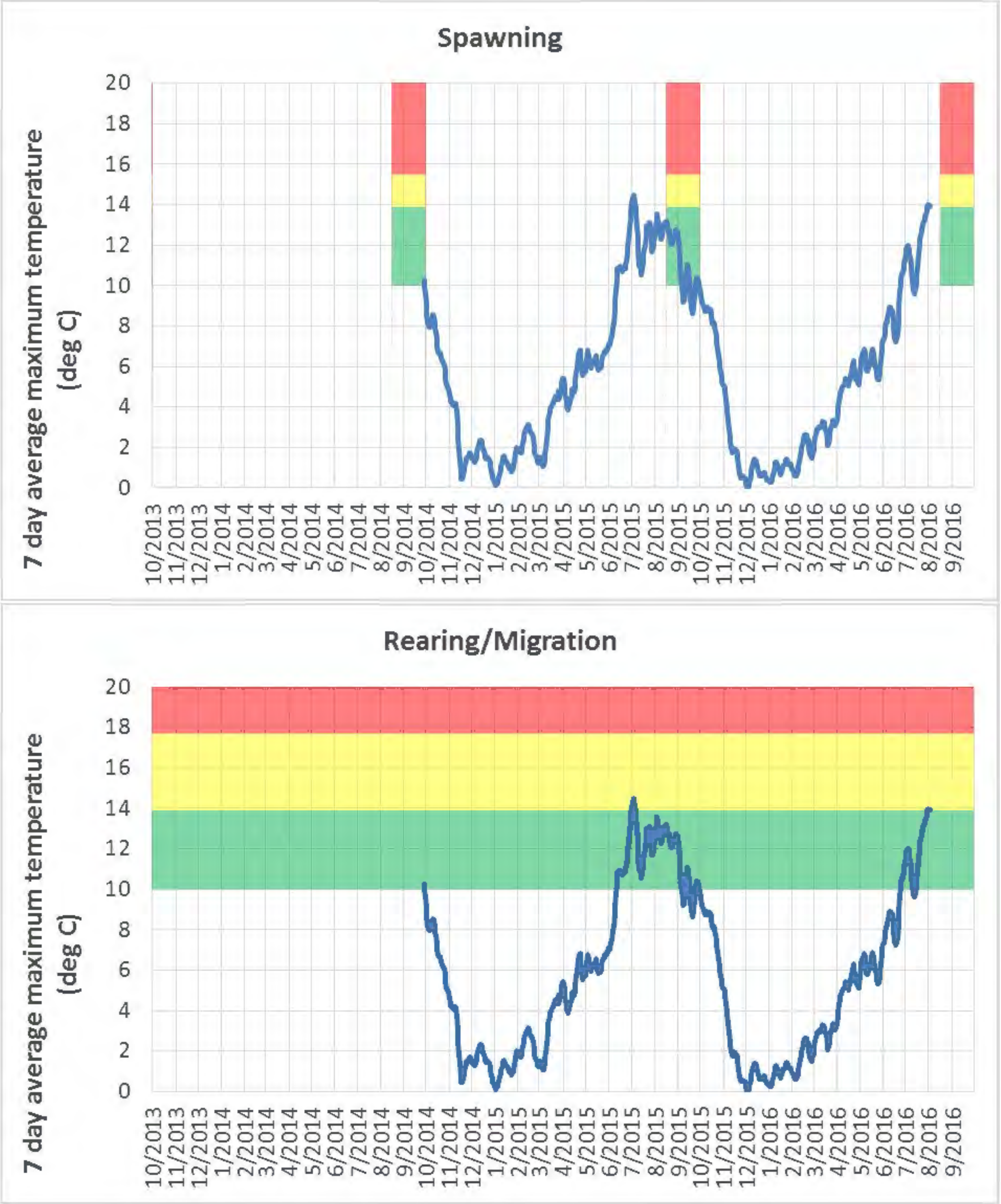


Figure 19. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Cane Creek, MWH-021

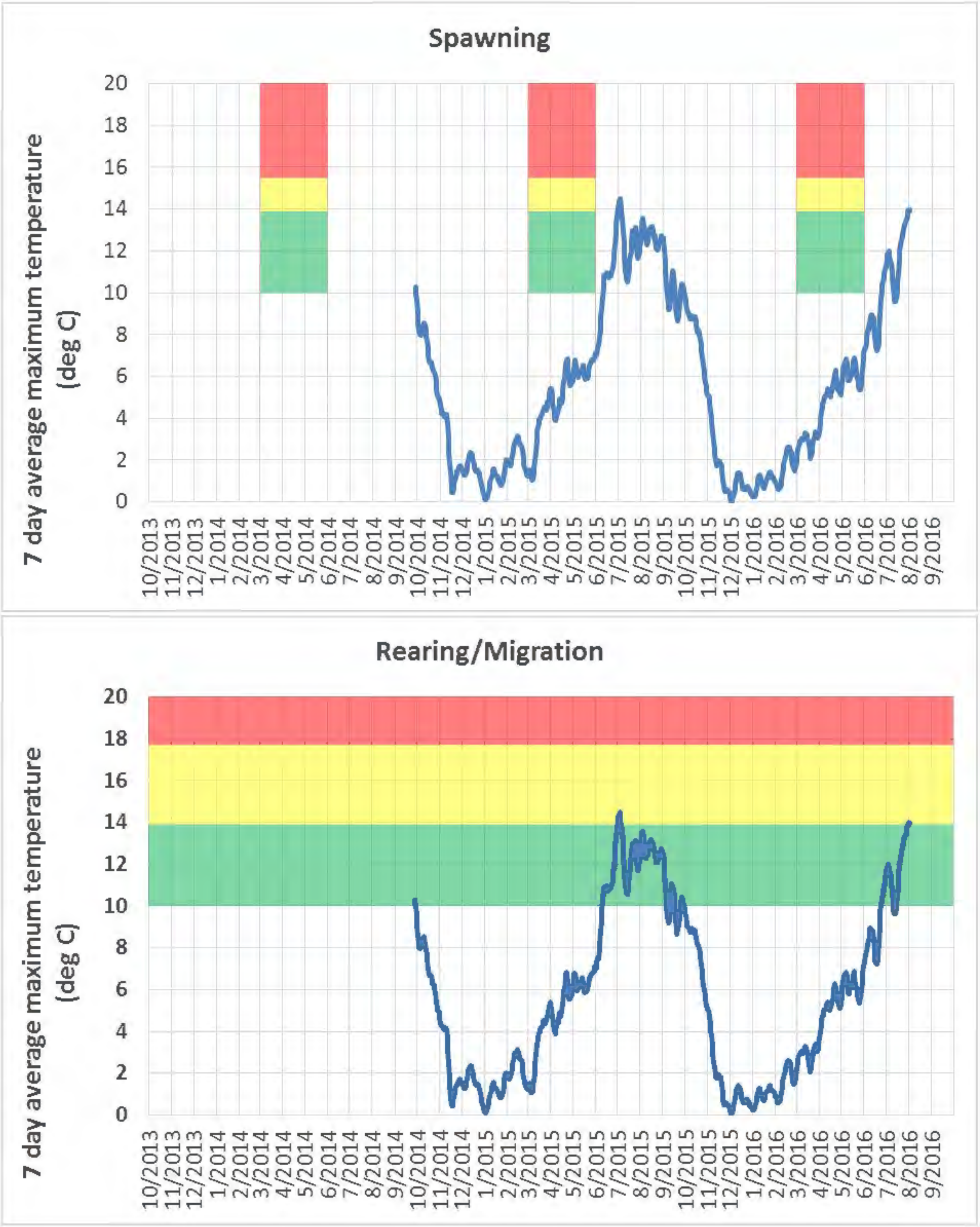


Figure 20. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Cane Creek, MWH-021

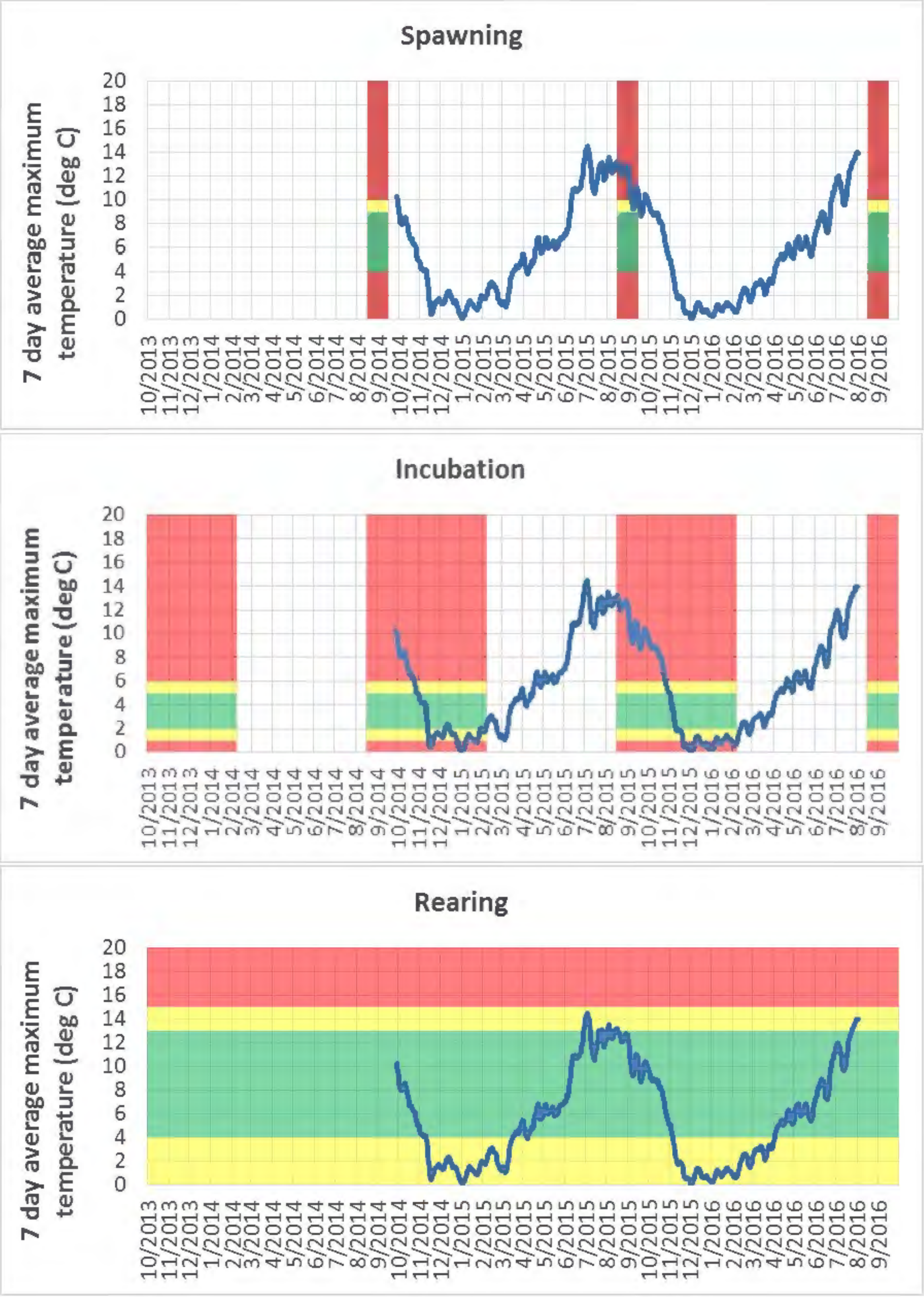


Figure 21. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Cane Creek, MWH-021

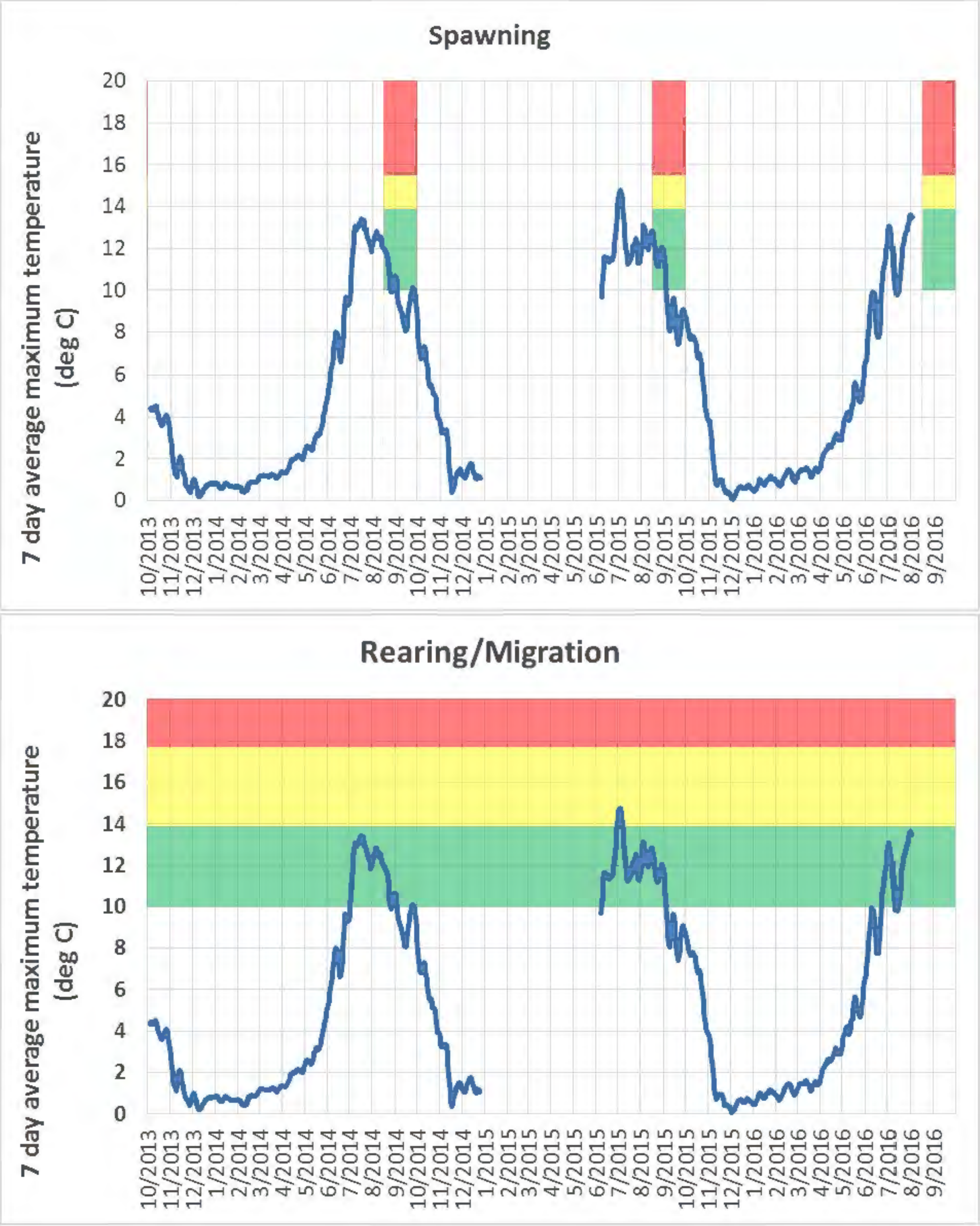


Figure 22. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Meadow Creek, MWH-034

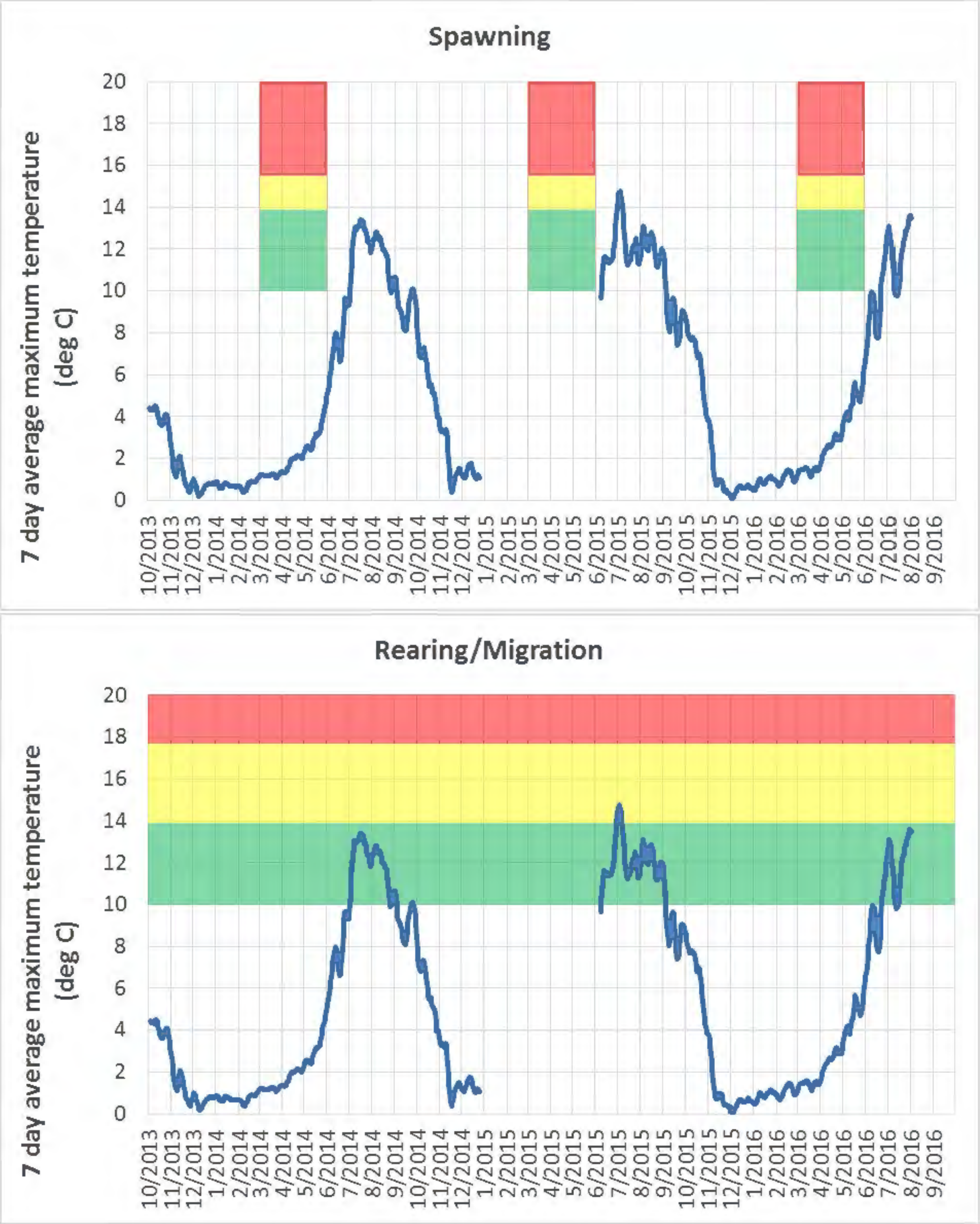


Figure 23. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Meadow Creek, MWH-034

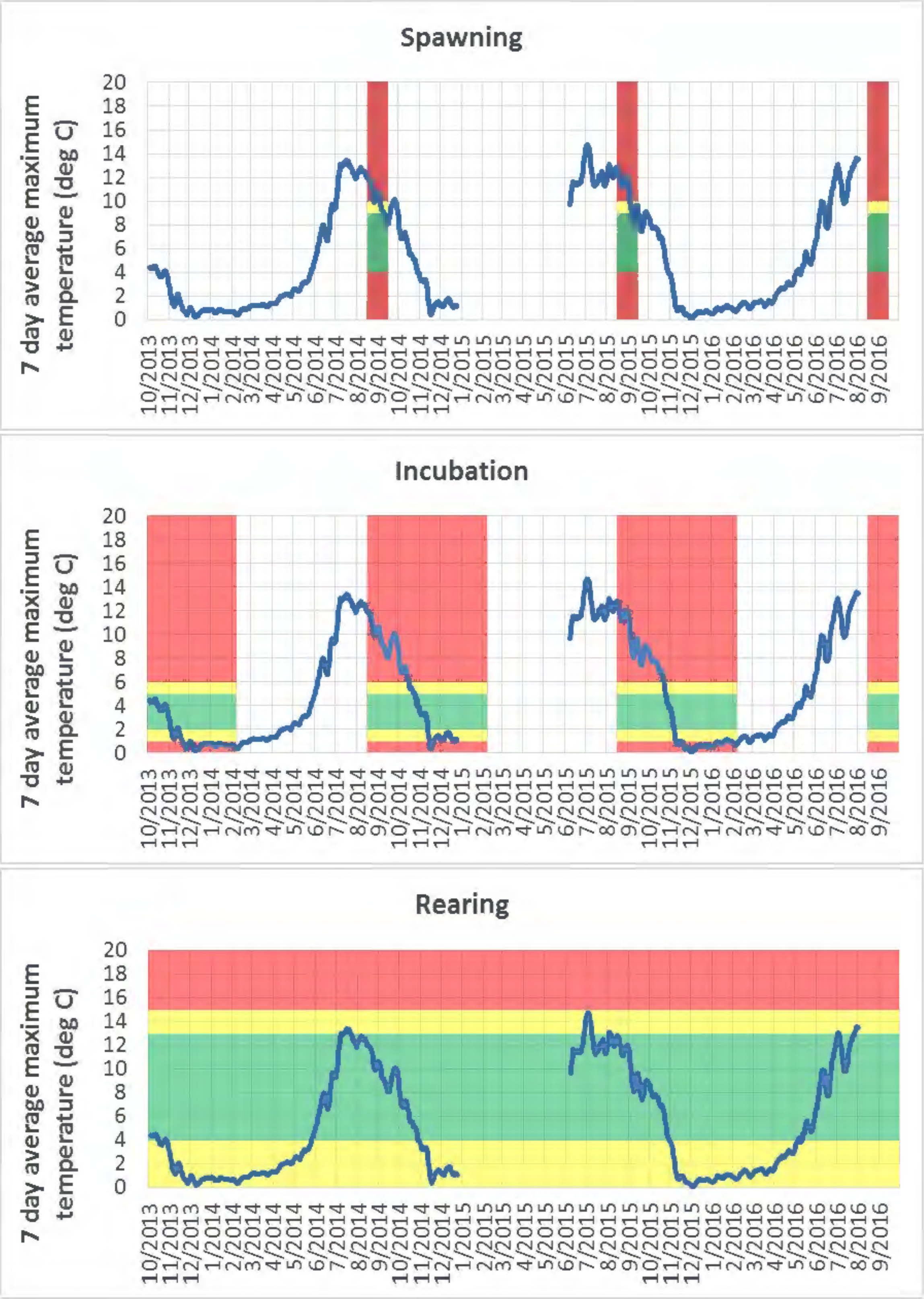


Figure 24. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Meadow Creek, MWH-034

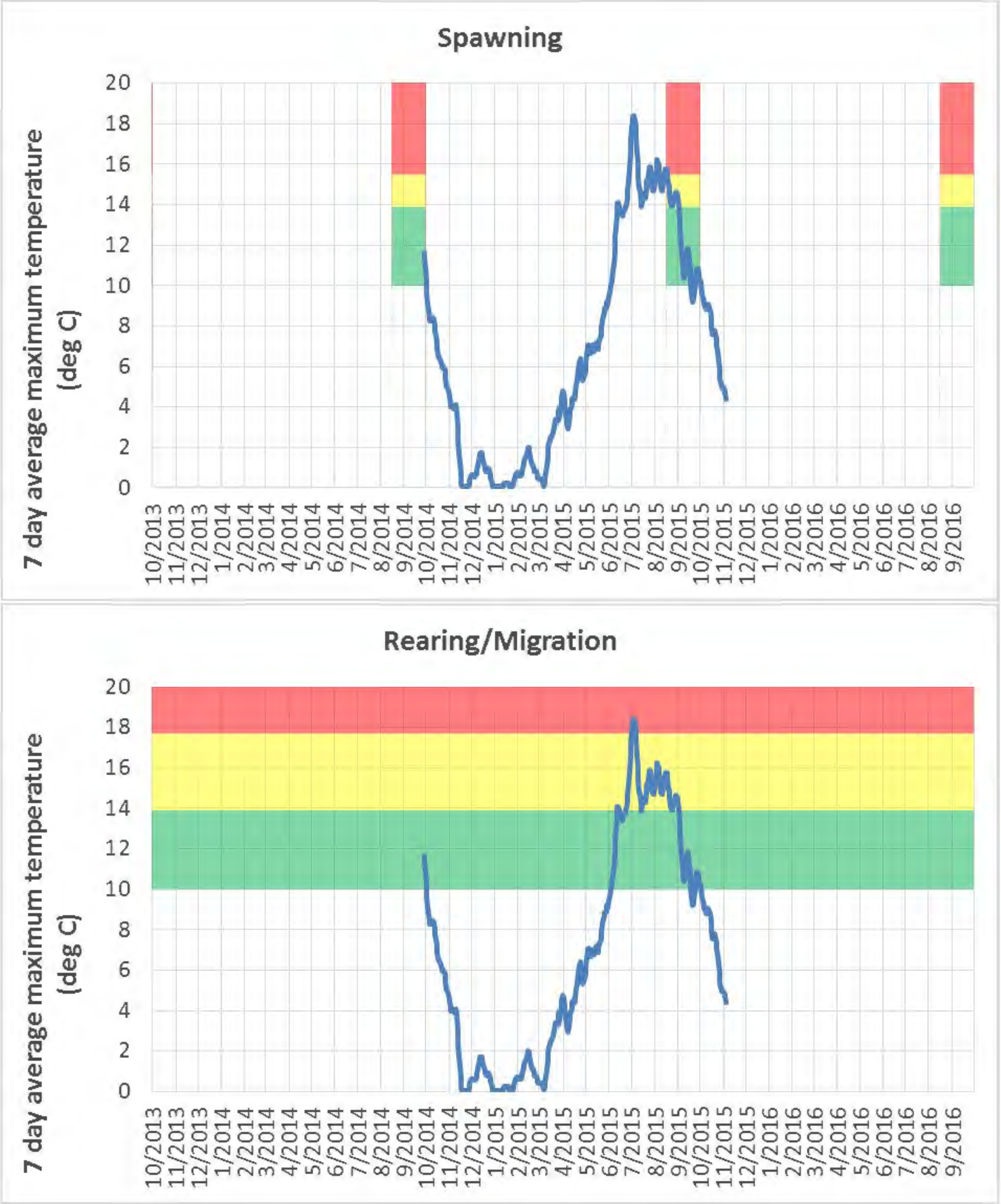


Figure 25. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Burntlog Creek, MWH-051

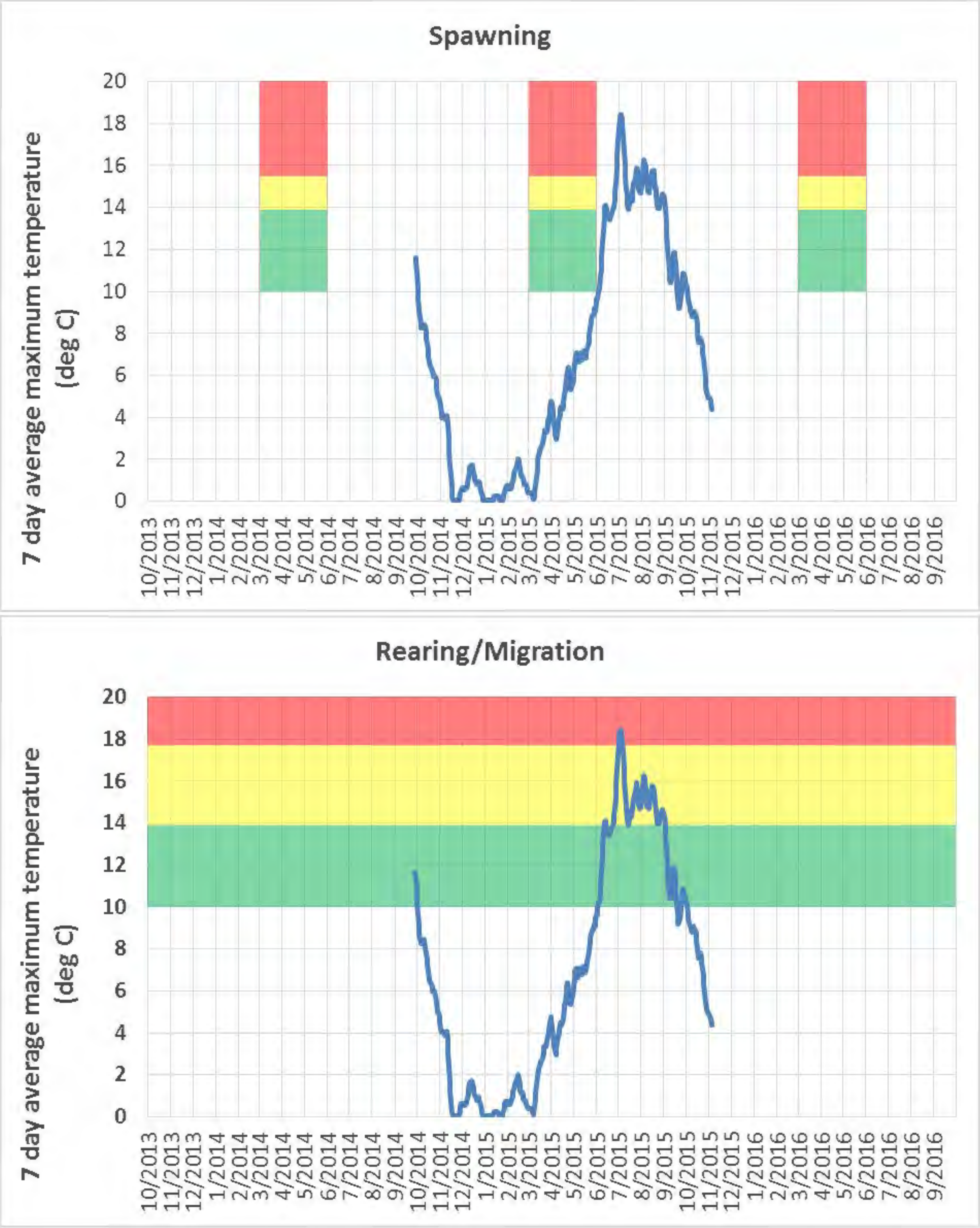


Figure 26. **Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Burntlog Creek, MWH-051**

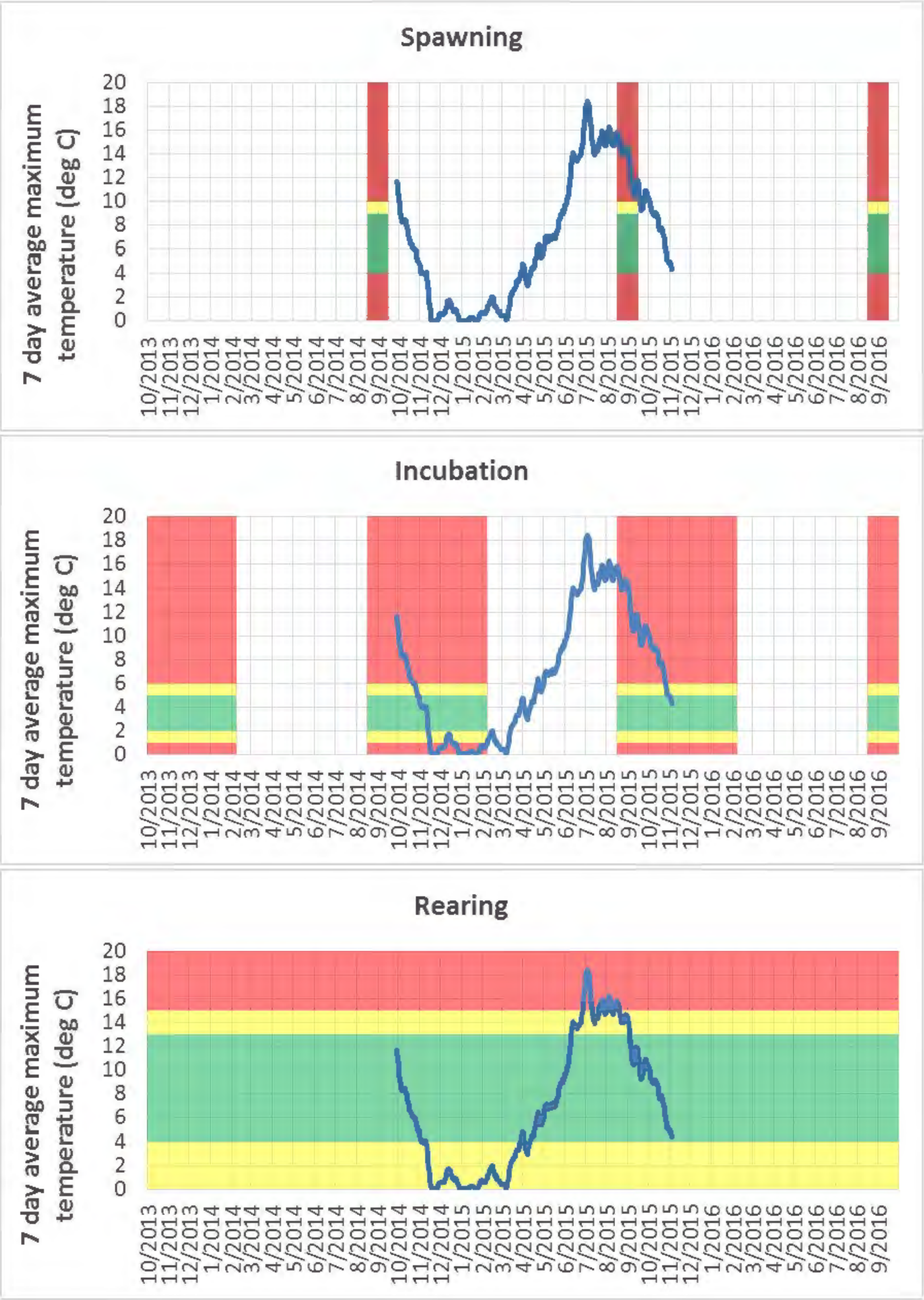


Figure 27. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Burntlog Creek, MWH-051

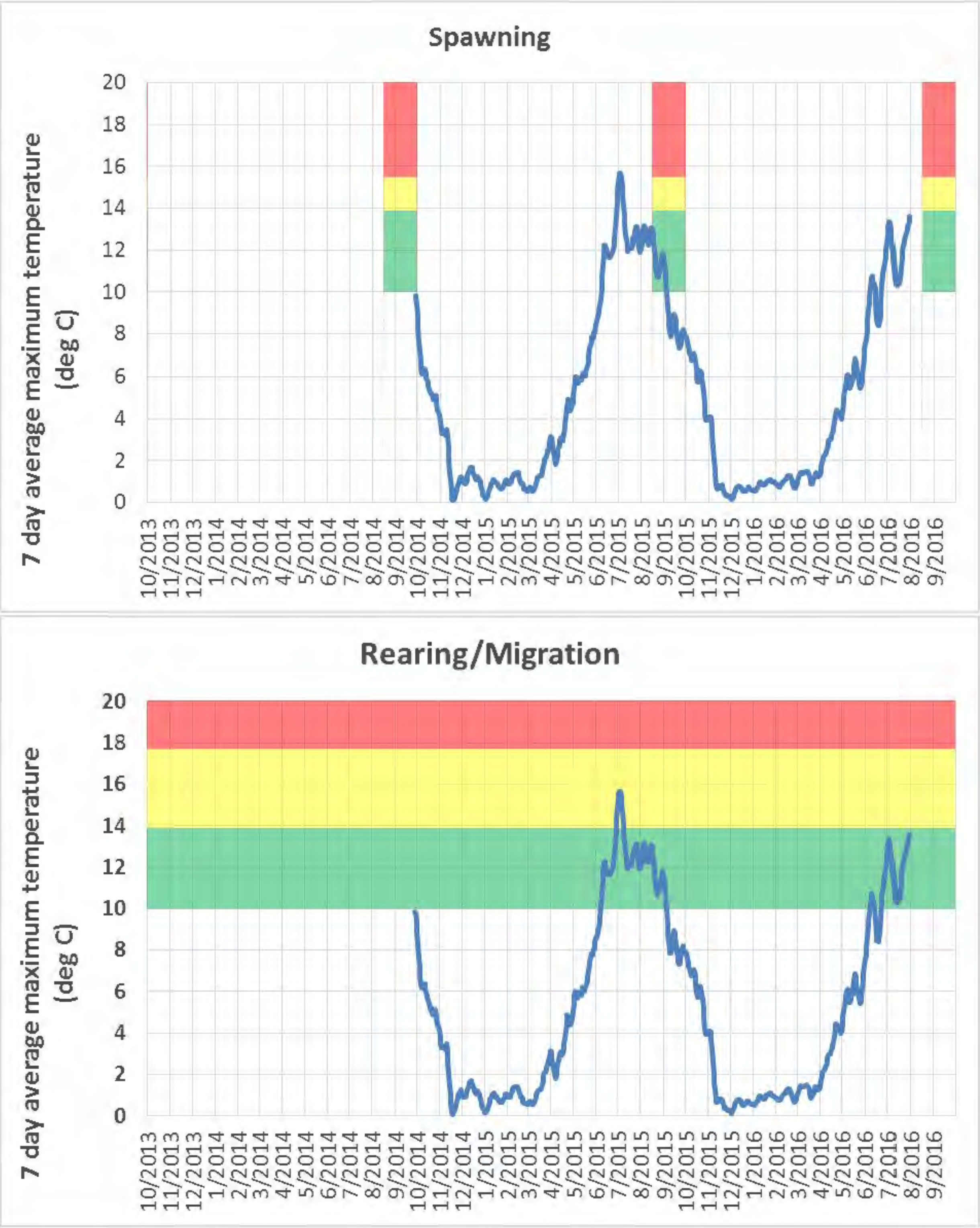


Figure 28. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Trapper Creek, MWH-054

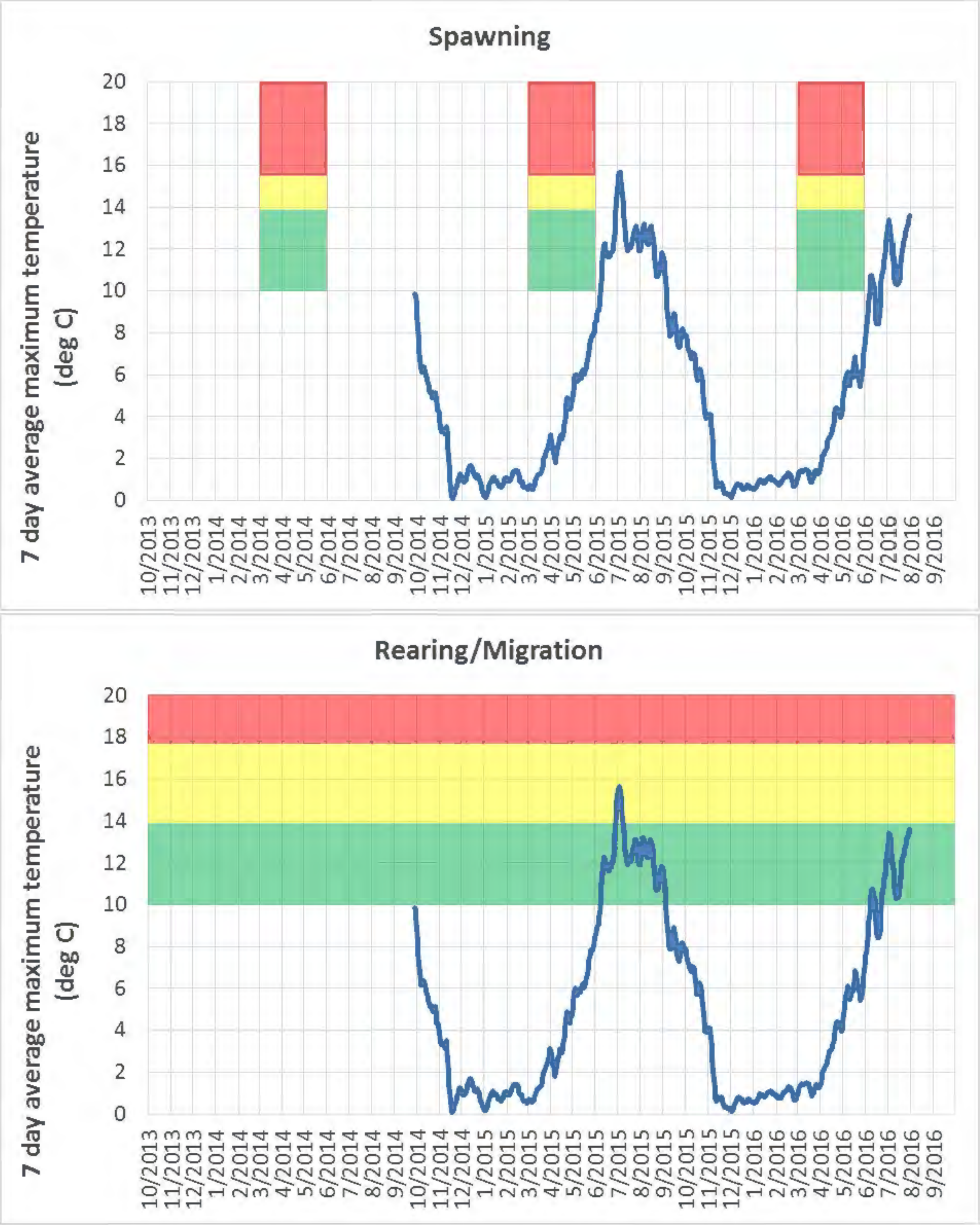


Figure 29. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Trapper Creek, MWH-054

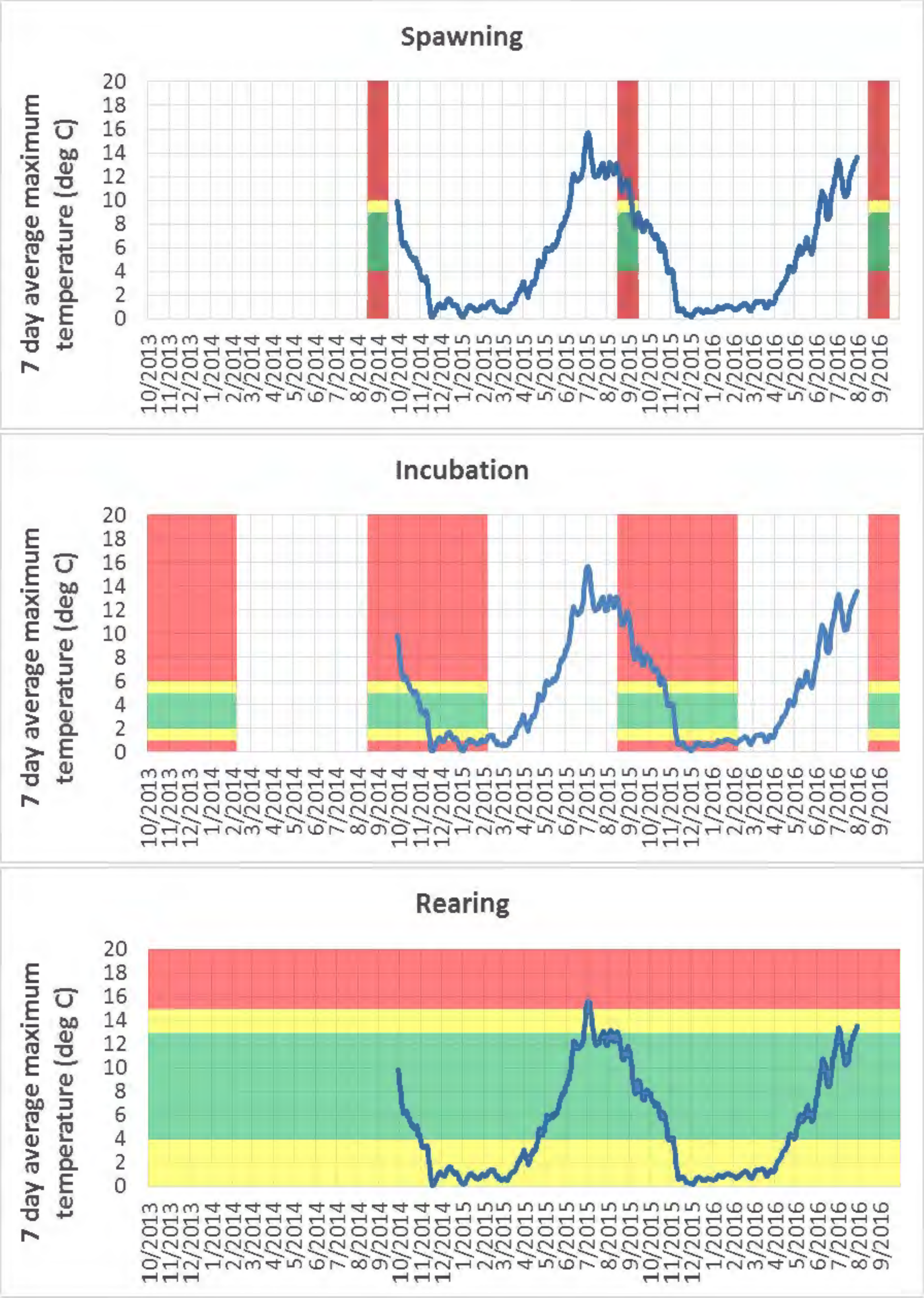


Figure 30. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Trapper Creek, MWH-054

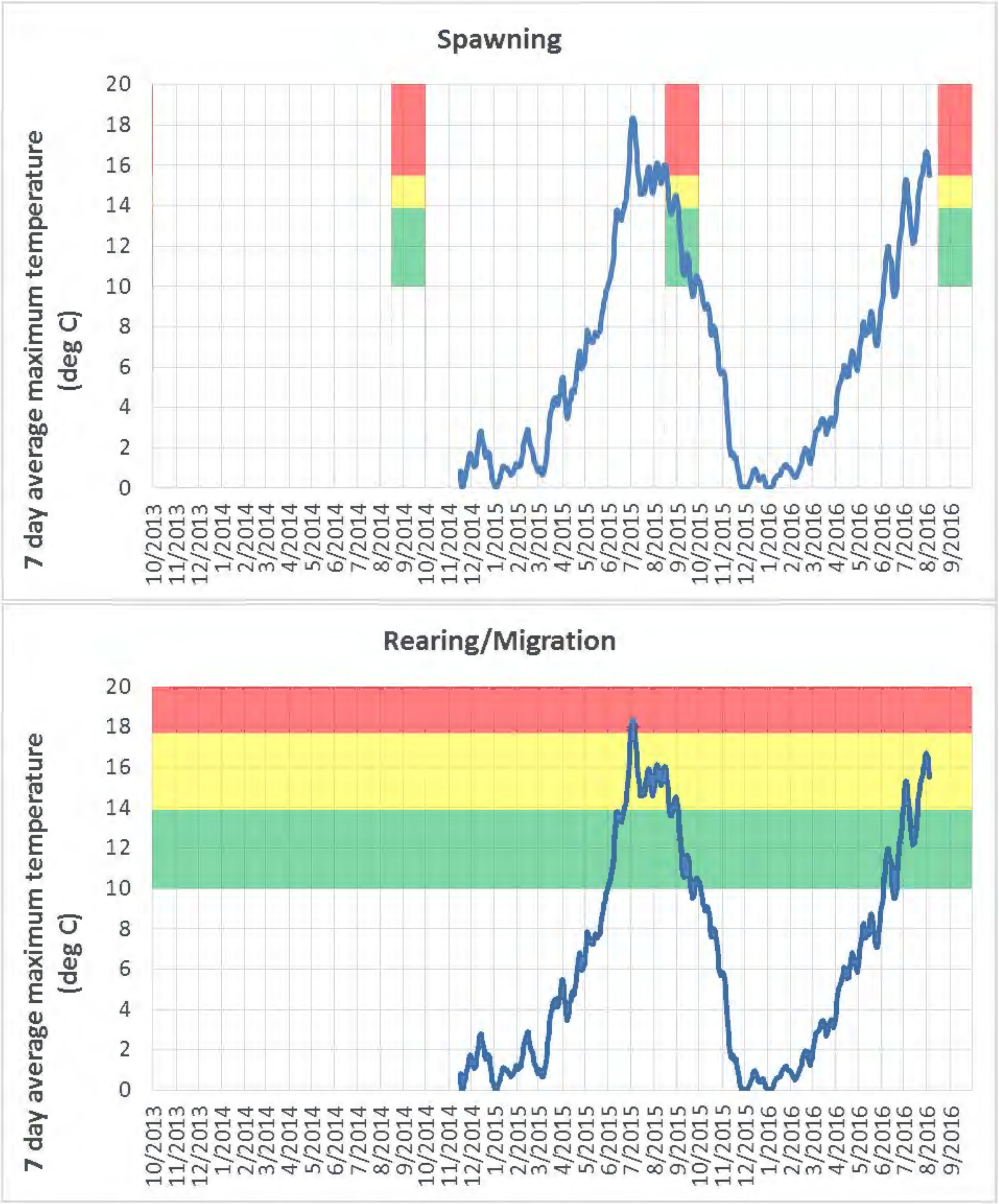


Figure 31. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Fourmile Creek, MWH-056

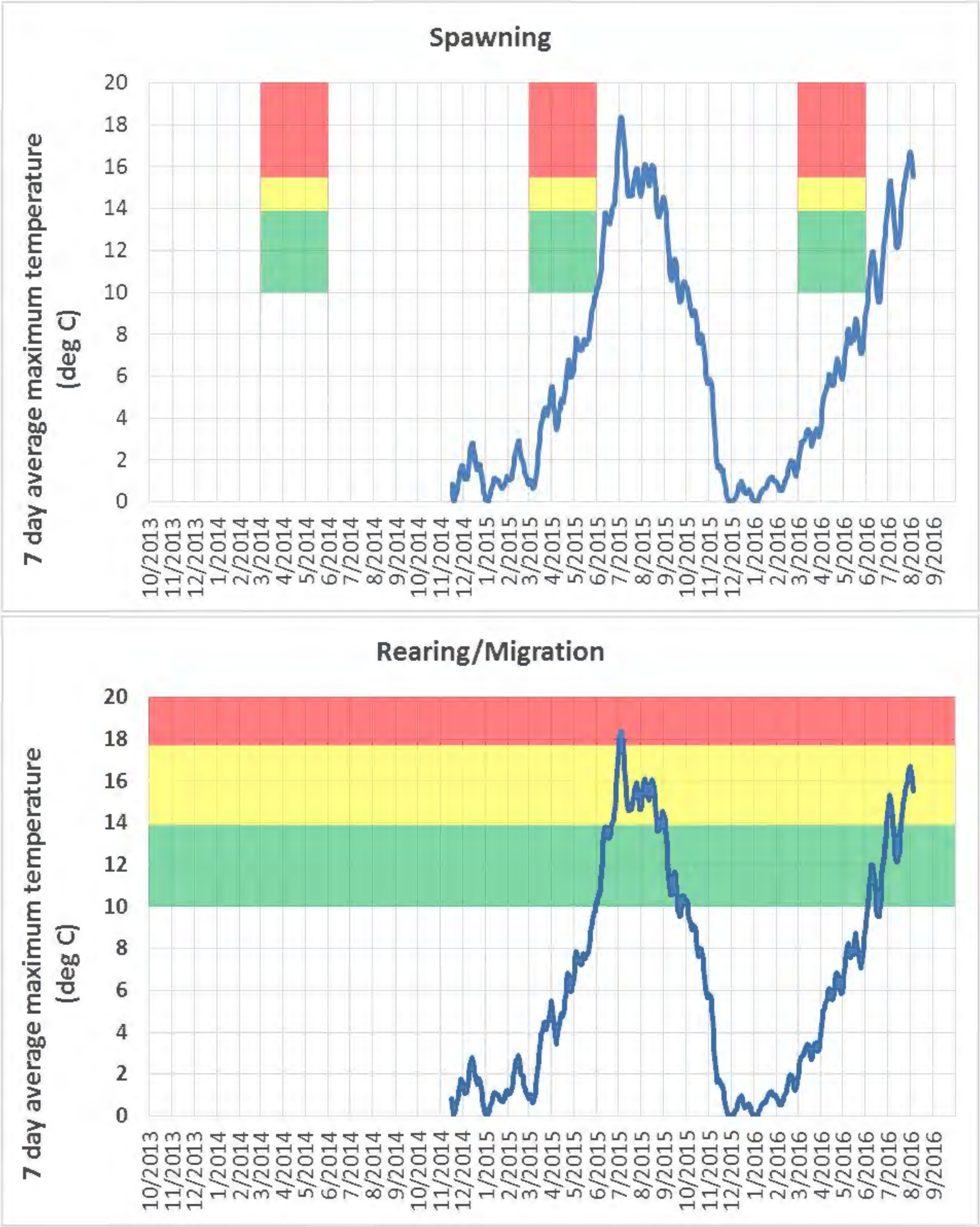


Figure 32. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Fourmile Creek, MWH-056

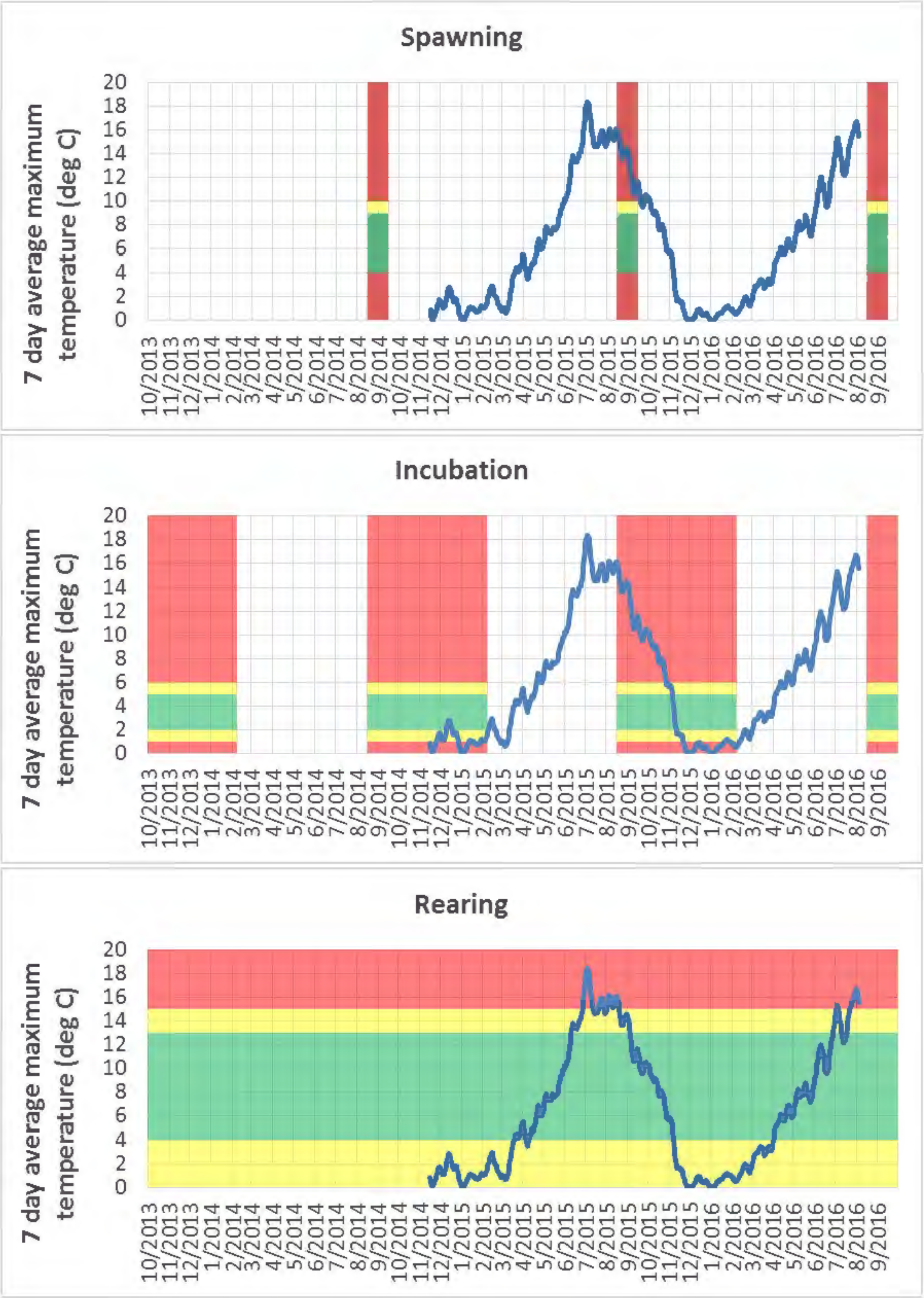


Figure 33. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Fourmile Creek, MWH-056

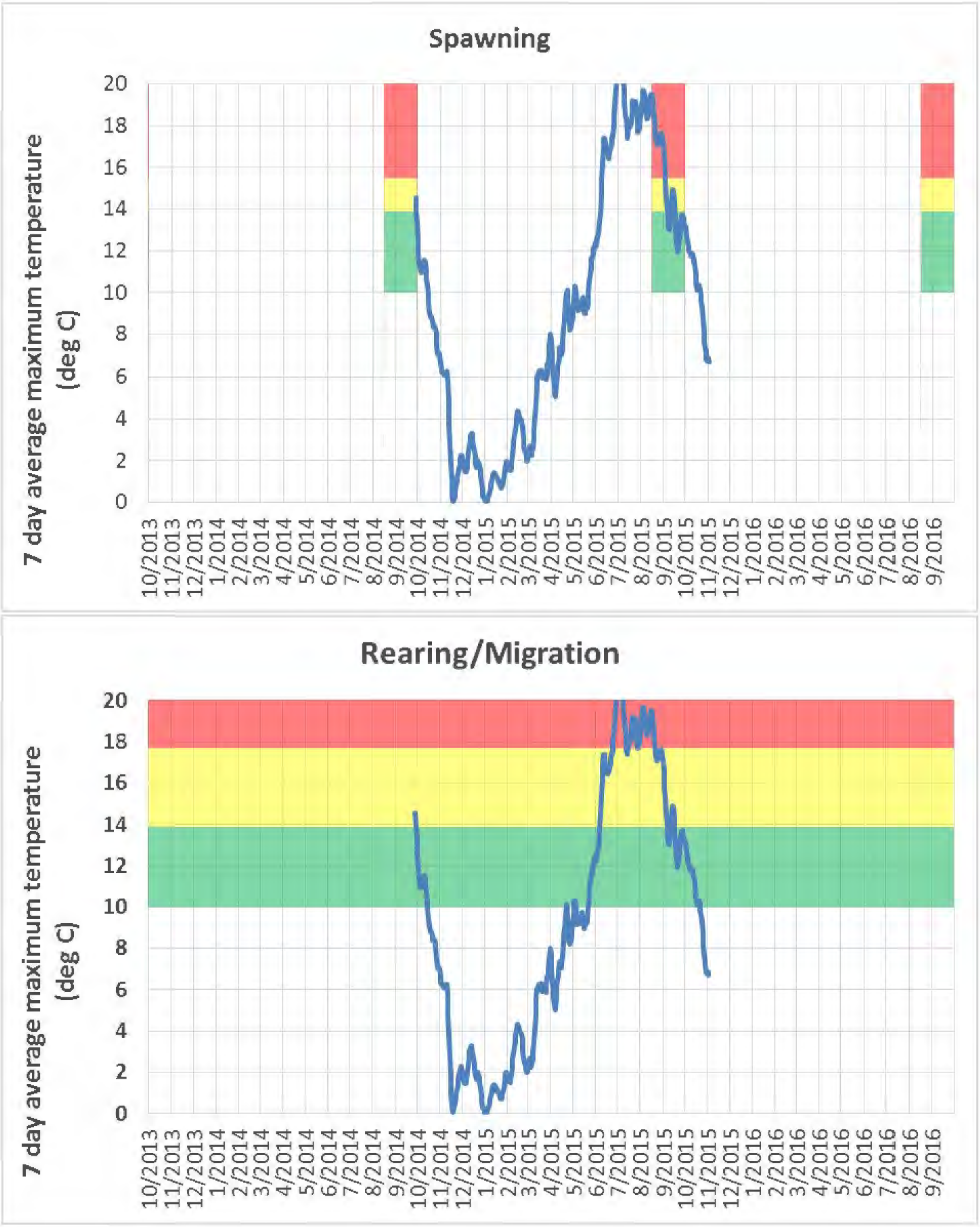


Figure 34. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Goat Creek, MWH-057

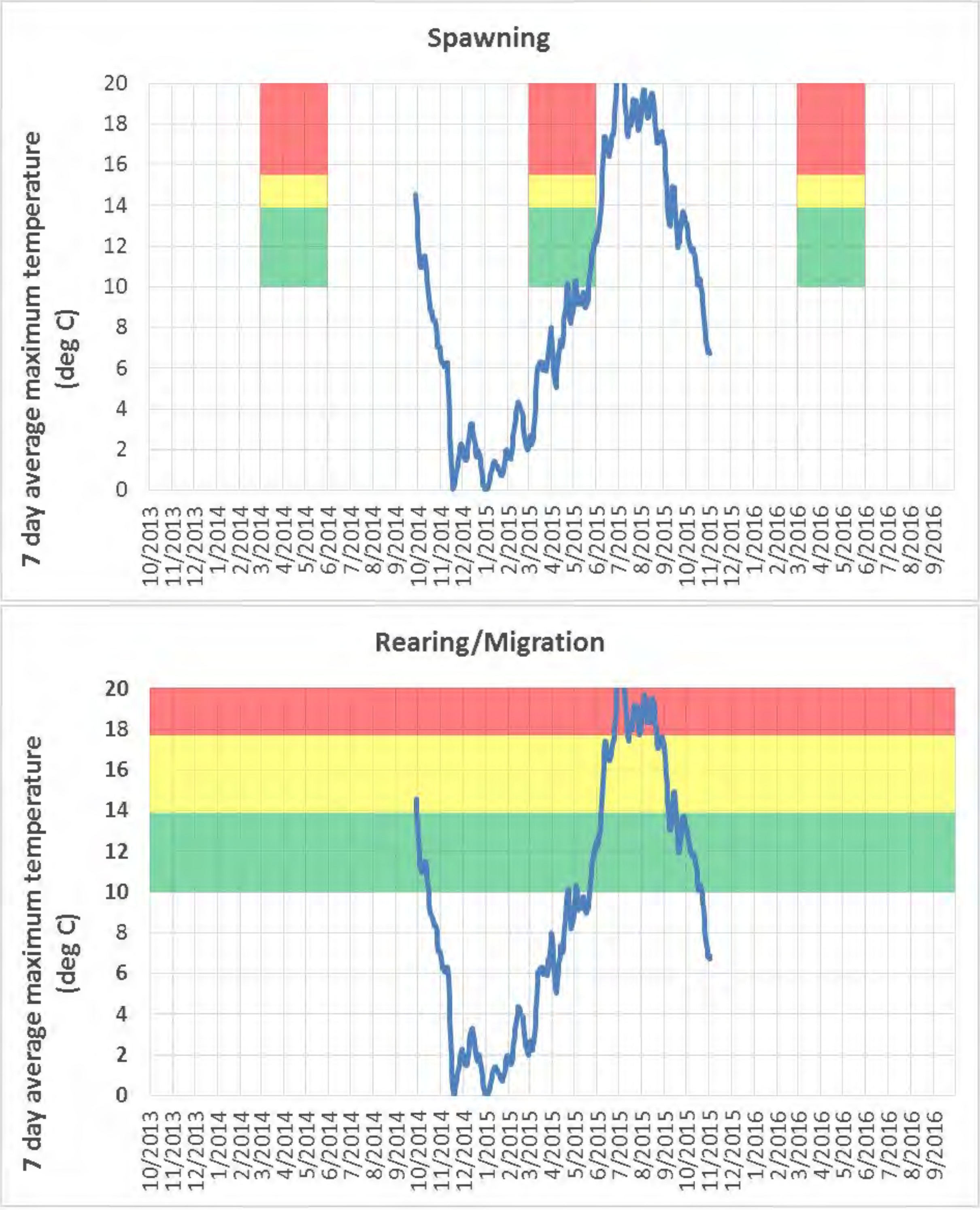


Figure 35. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Goat Creek, MWH-057

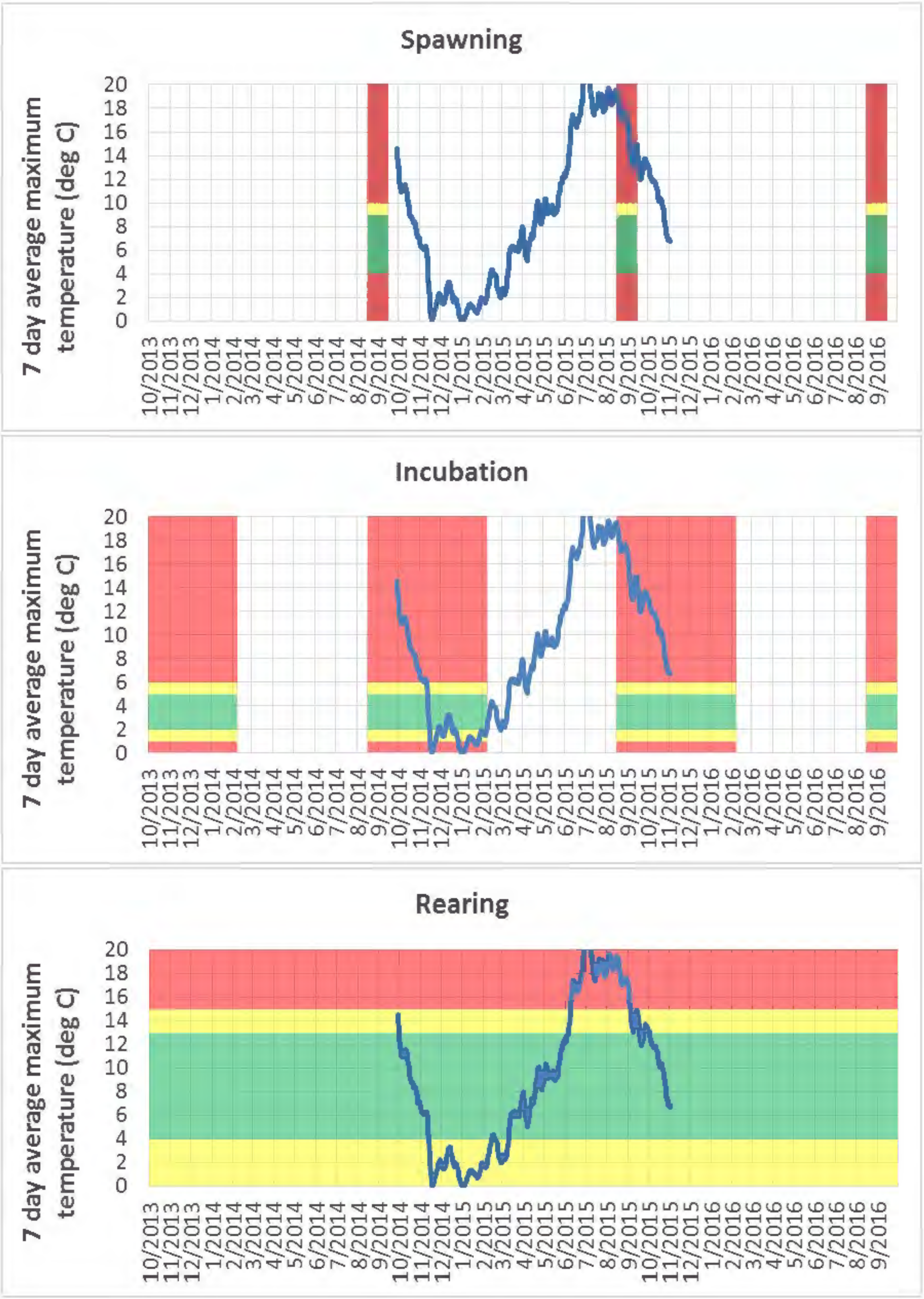


Figure 36. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Goat Creek, MWH-057

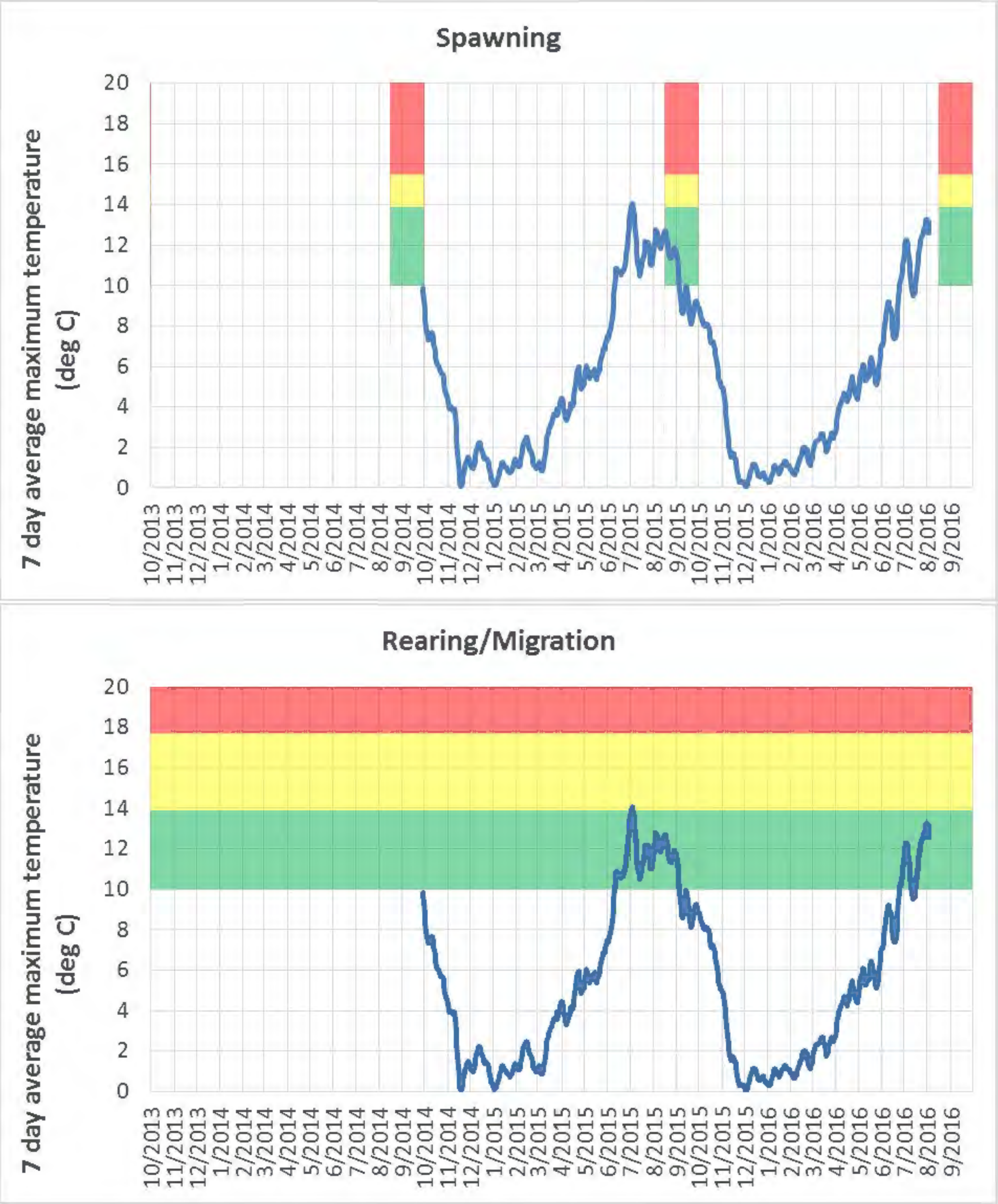


Figure 37. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon in Profile Creek, MWH-061

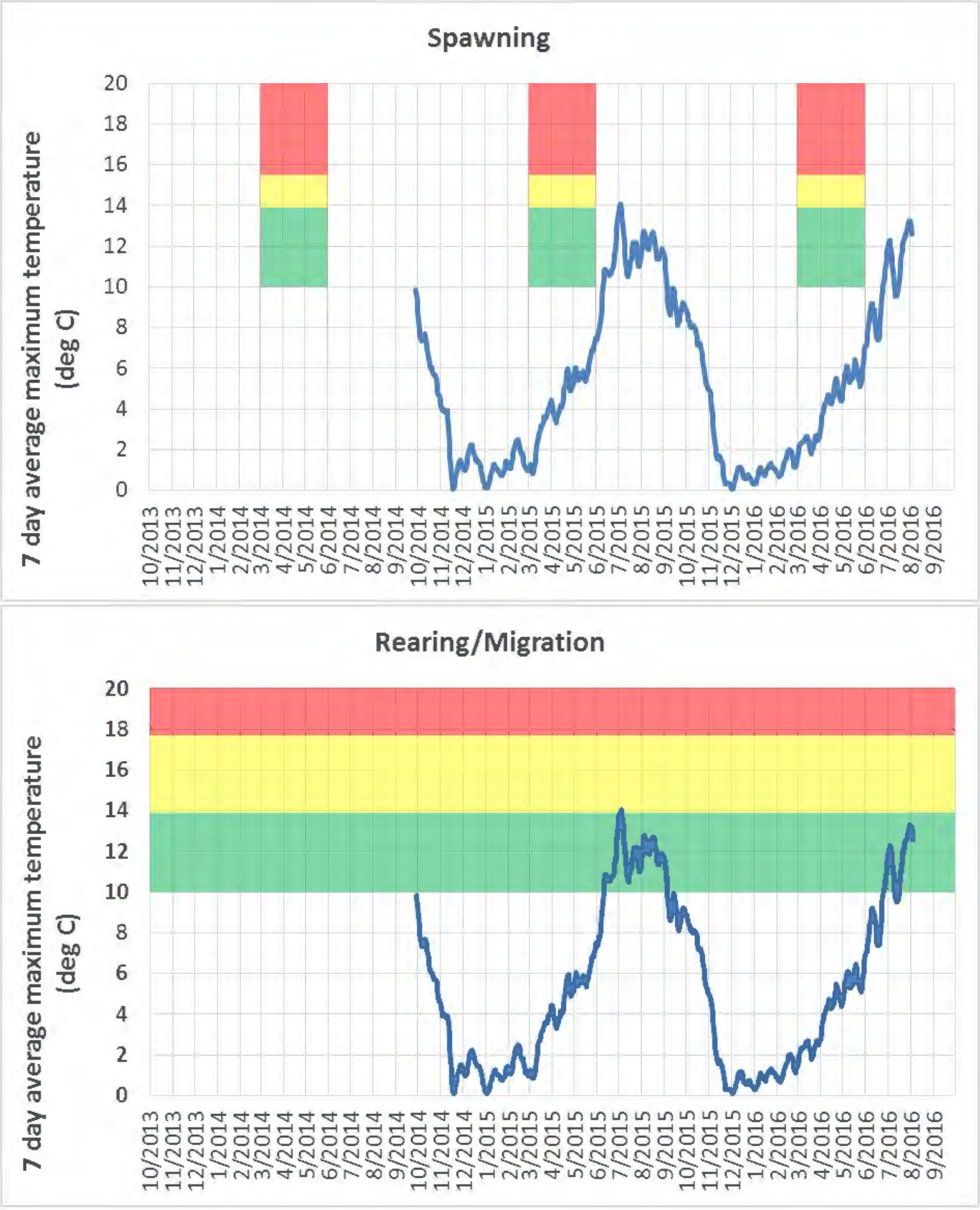


Figure 38. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead in Profile Creek, MWH-061

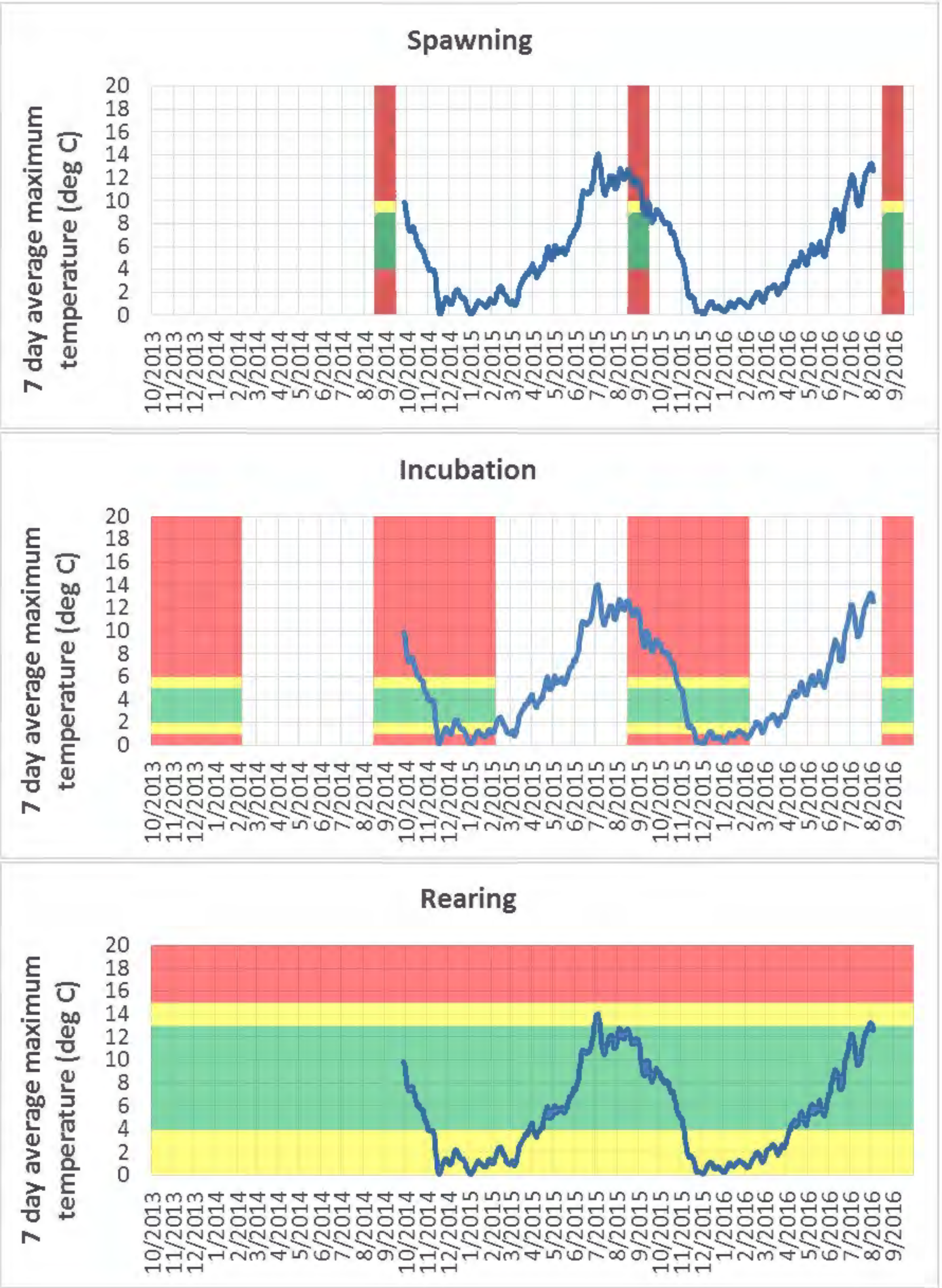


Figure 39. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout in Profile Creek, MWH-061

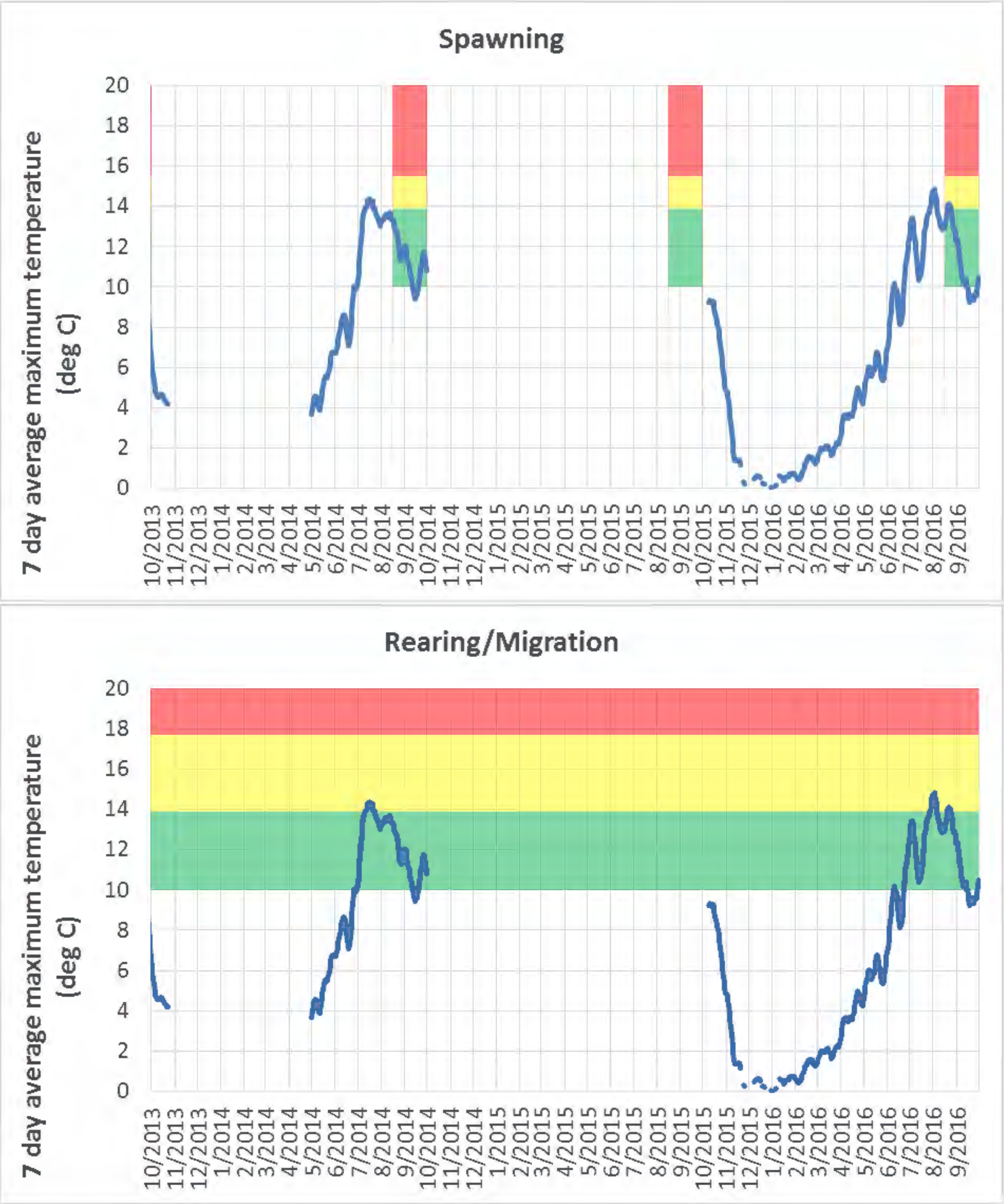


Figure 40. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon at the U.S. Geological Survey Gage, 13311250 in the East Fork of the South Fork of the Salmon River

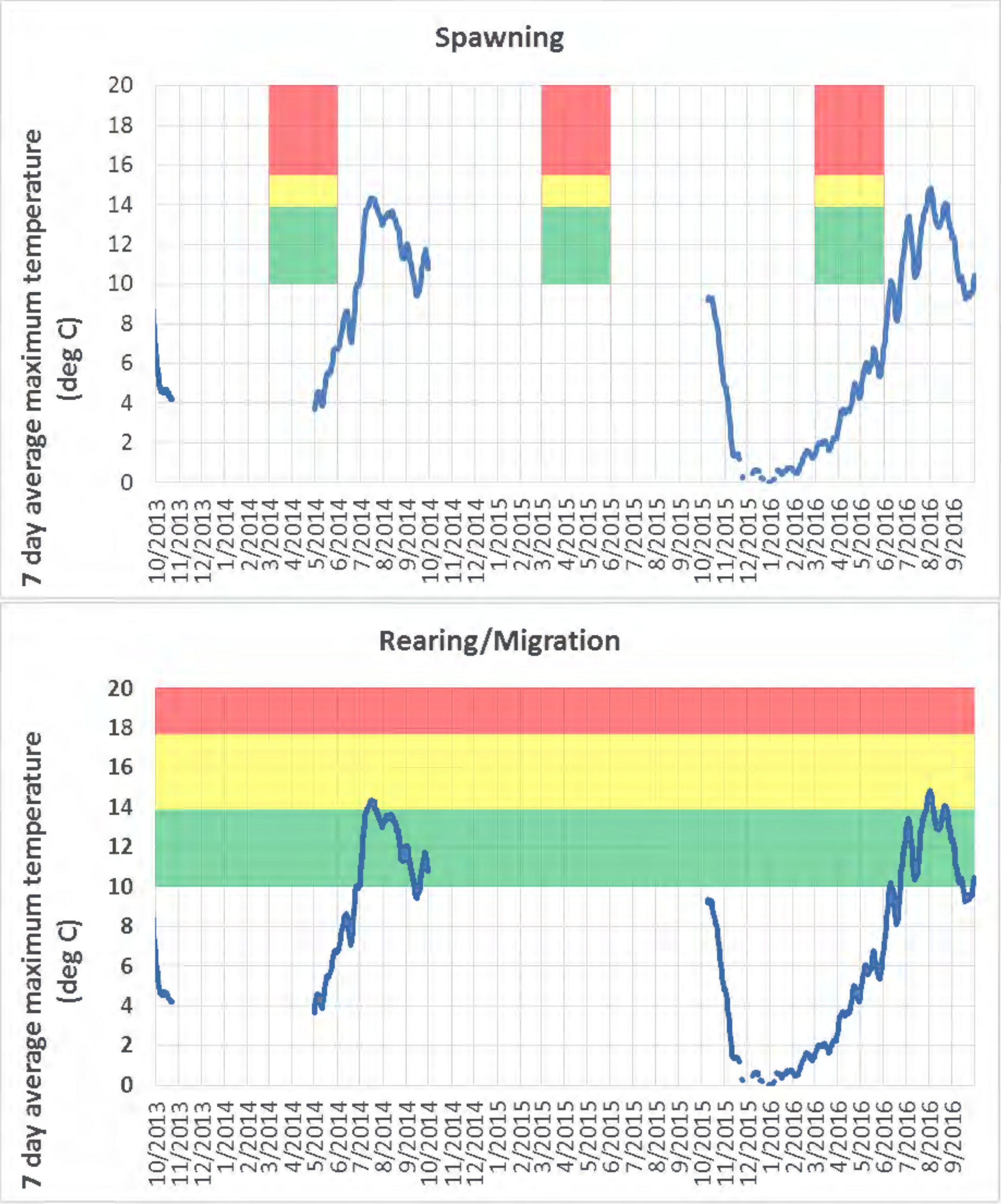


Figure 41. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead at the U.S. Geological Survey Gage, 13311250 in the East Fork of the South Fork of the Salmon River

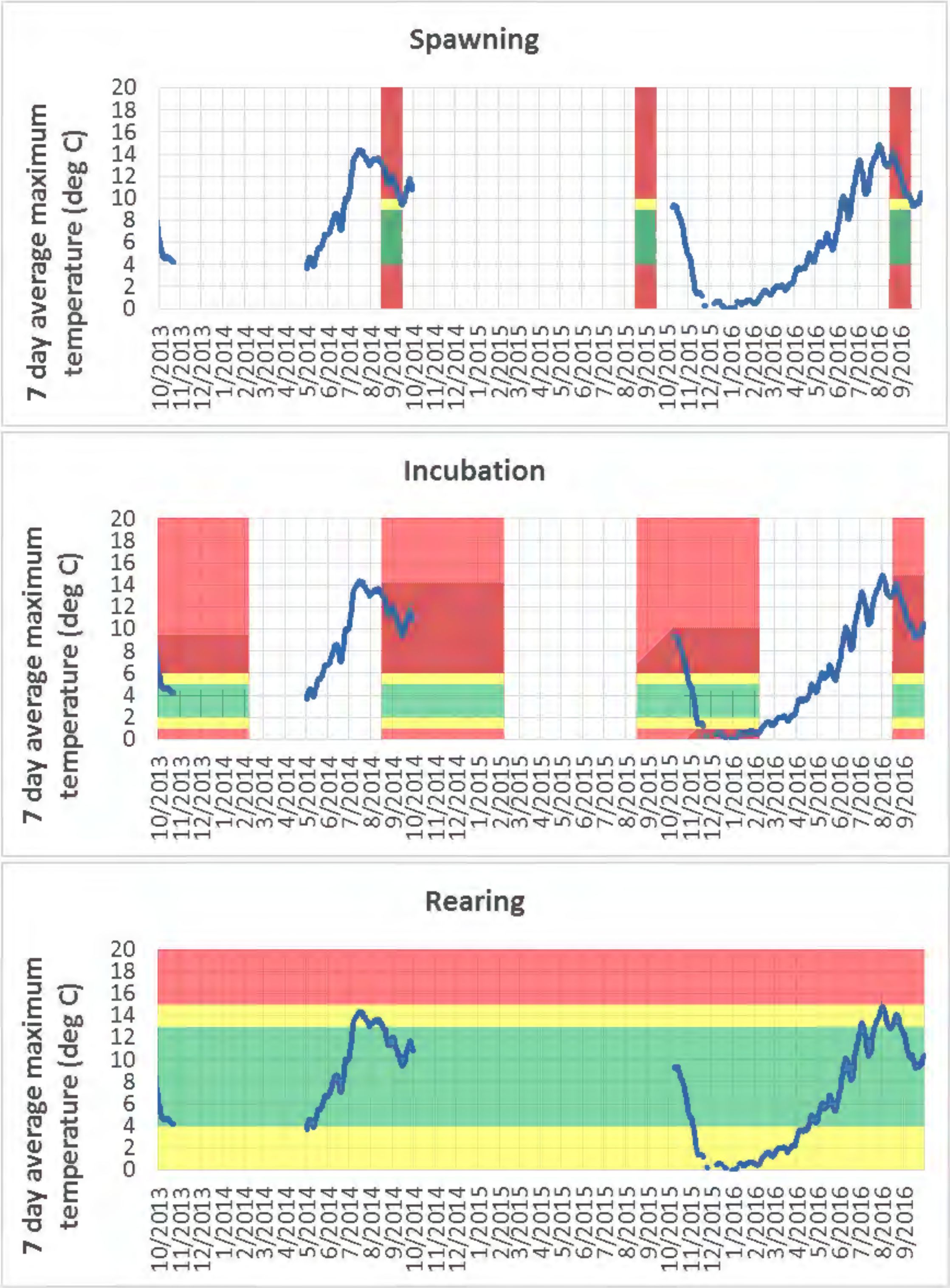


Figure 42. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout at the U.S. Geological Survey Gage, 13311250 in the East Fork of the South Fork of the Salmon River

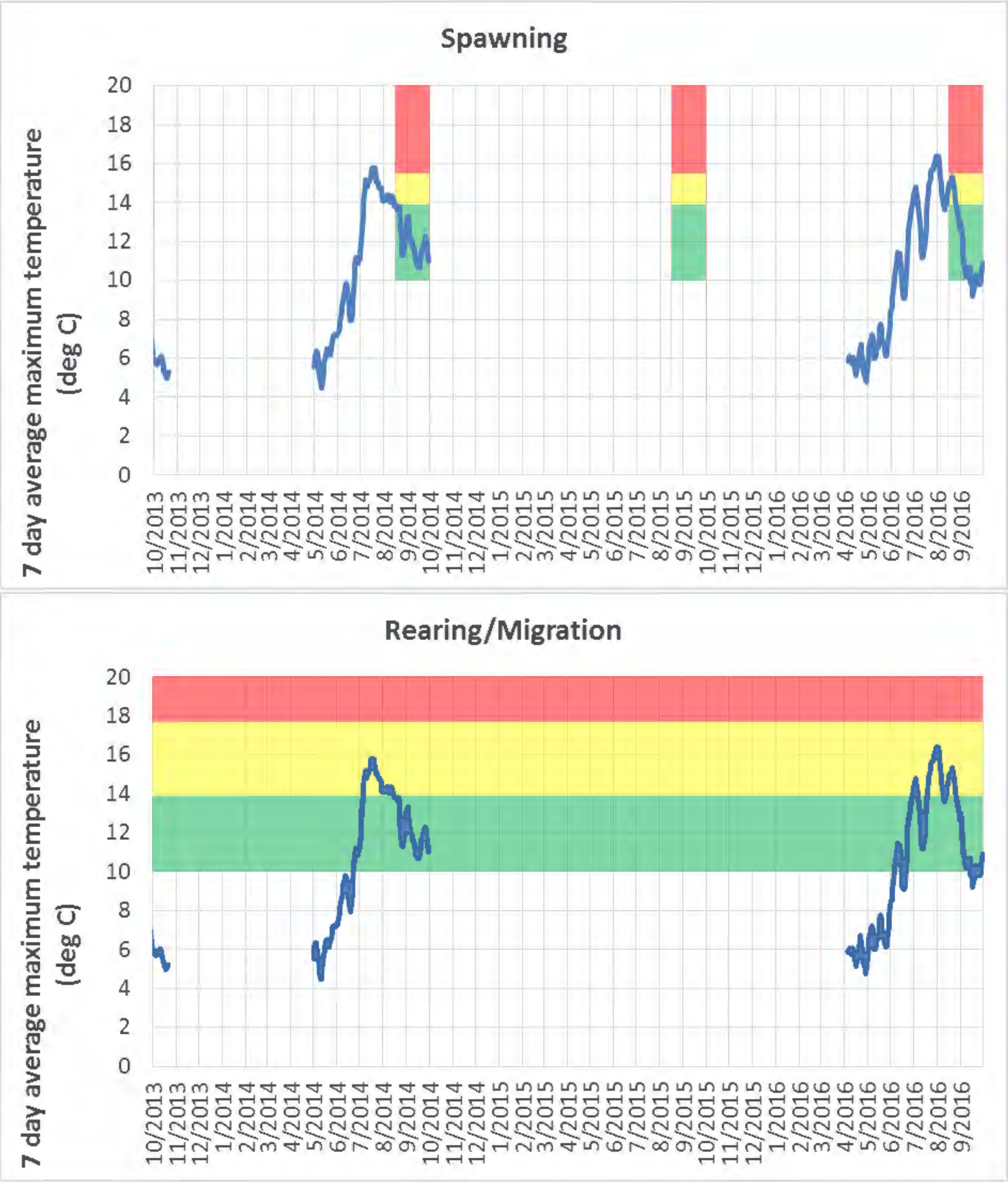


Figure 43. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon at the U.S. Geological Survey Gage, 13311000 in the East Fork of the South Fork of the Salmon River

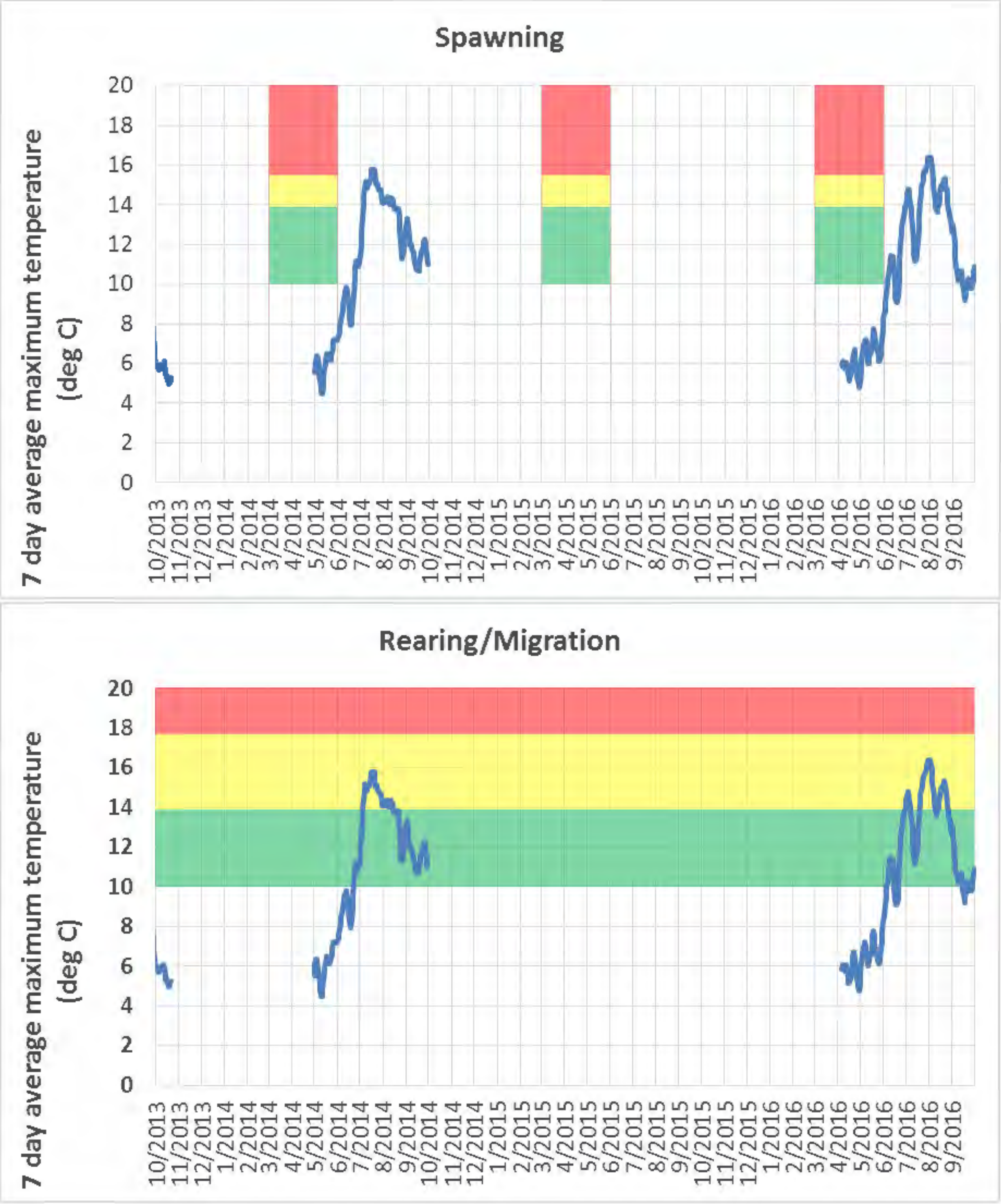


Figure 44. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead at the U.S. Geological Survey Gage, 13311000 in the East Fork of the South Fork of the Salmon River

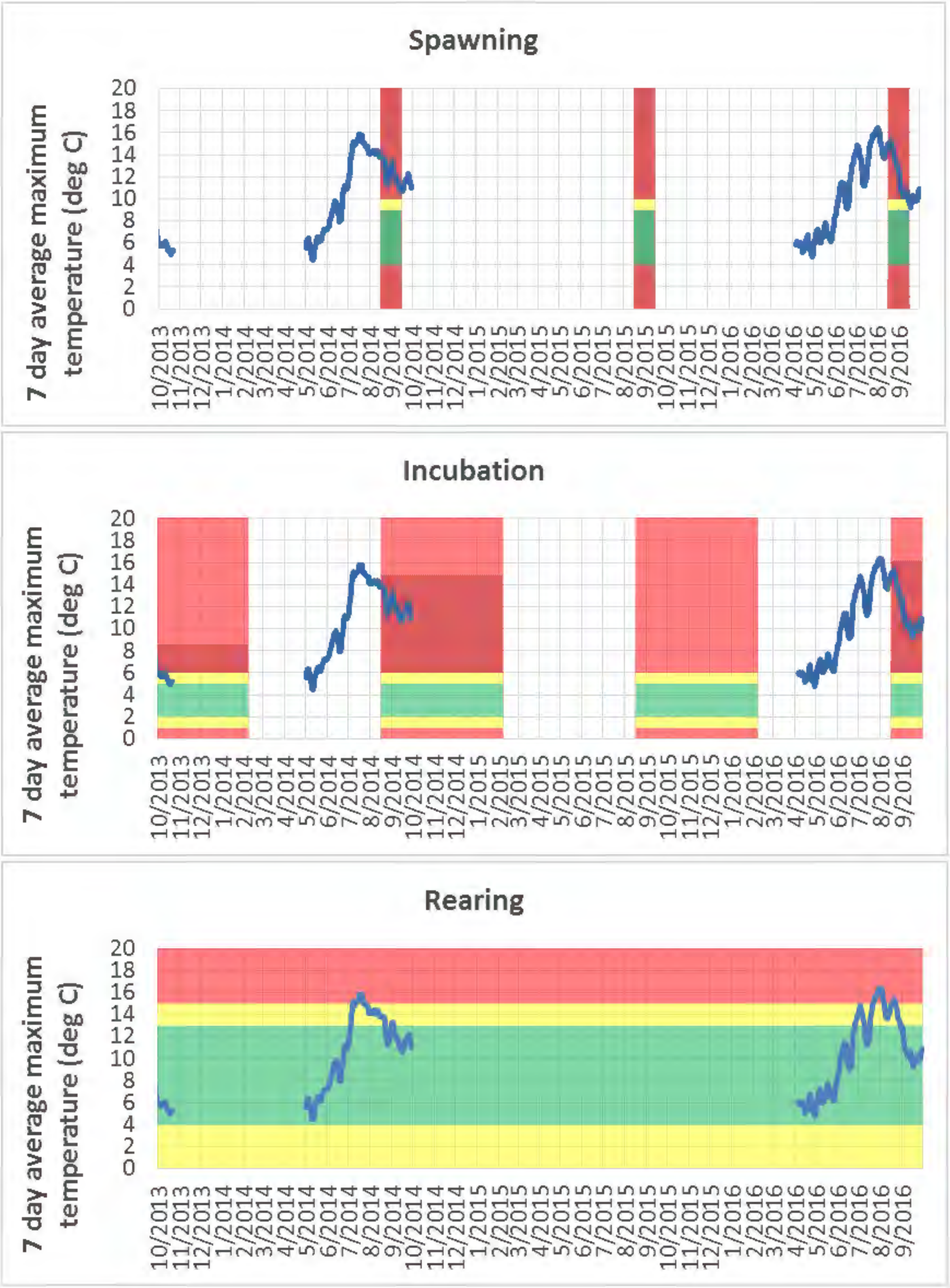


Figure 45. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout at the U.S. Geological Survey Gage, 13311000 in the East Fork of the South Fork of the Salmon River

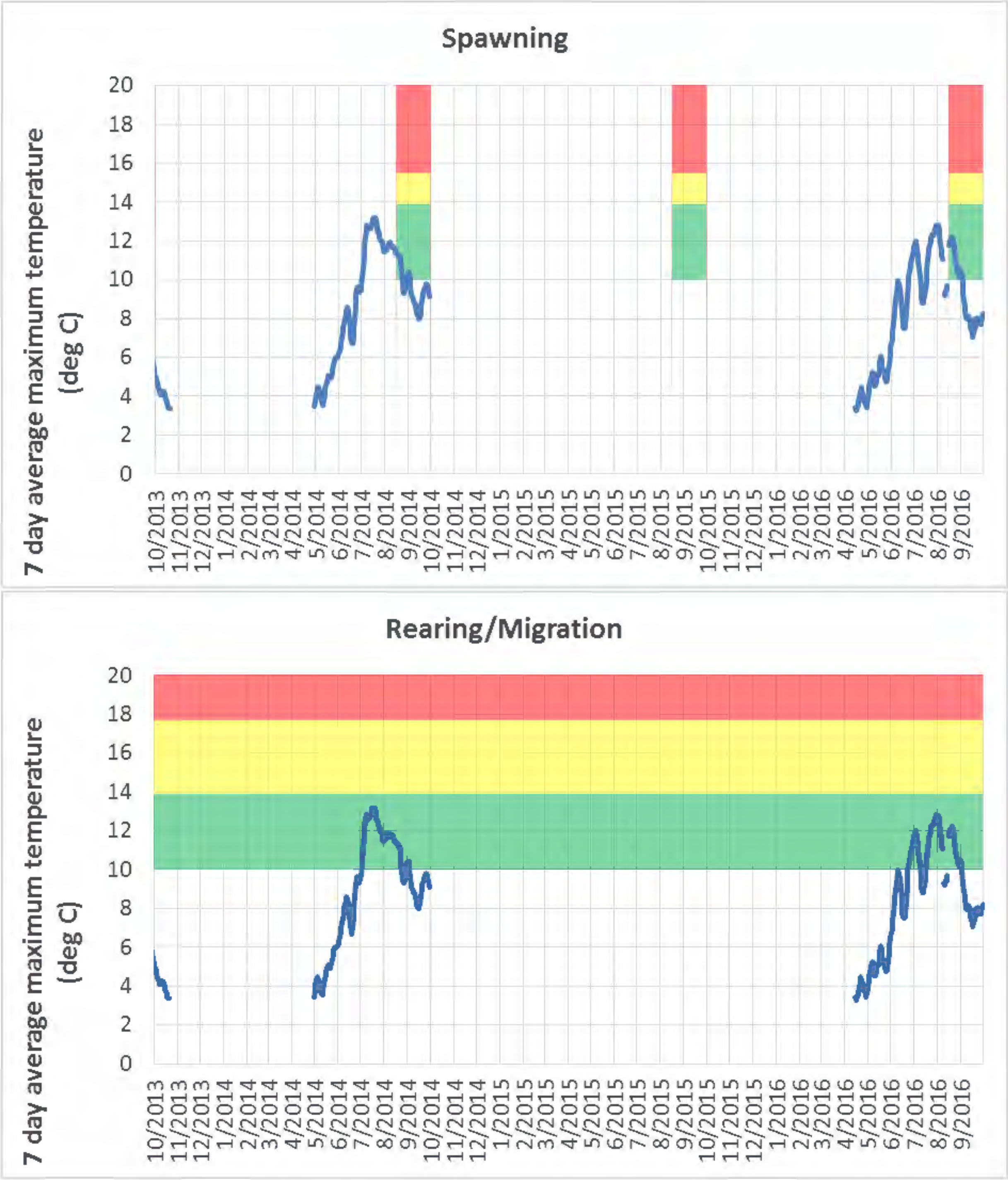


Figure 46. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon at the U.S. Geological Survey Gage, 13310800 in the East Fork of the South Fork of the Salmon River

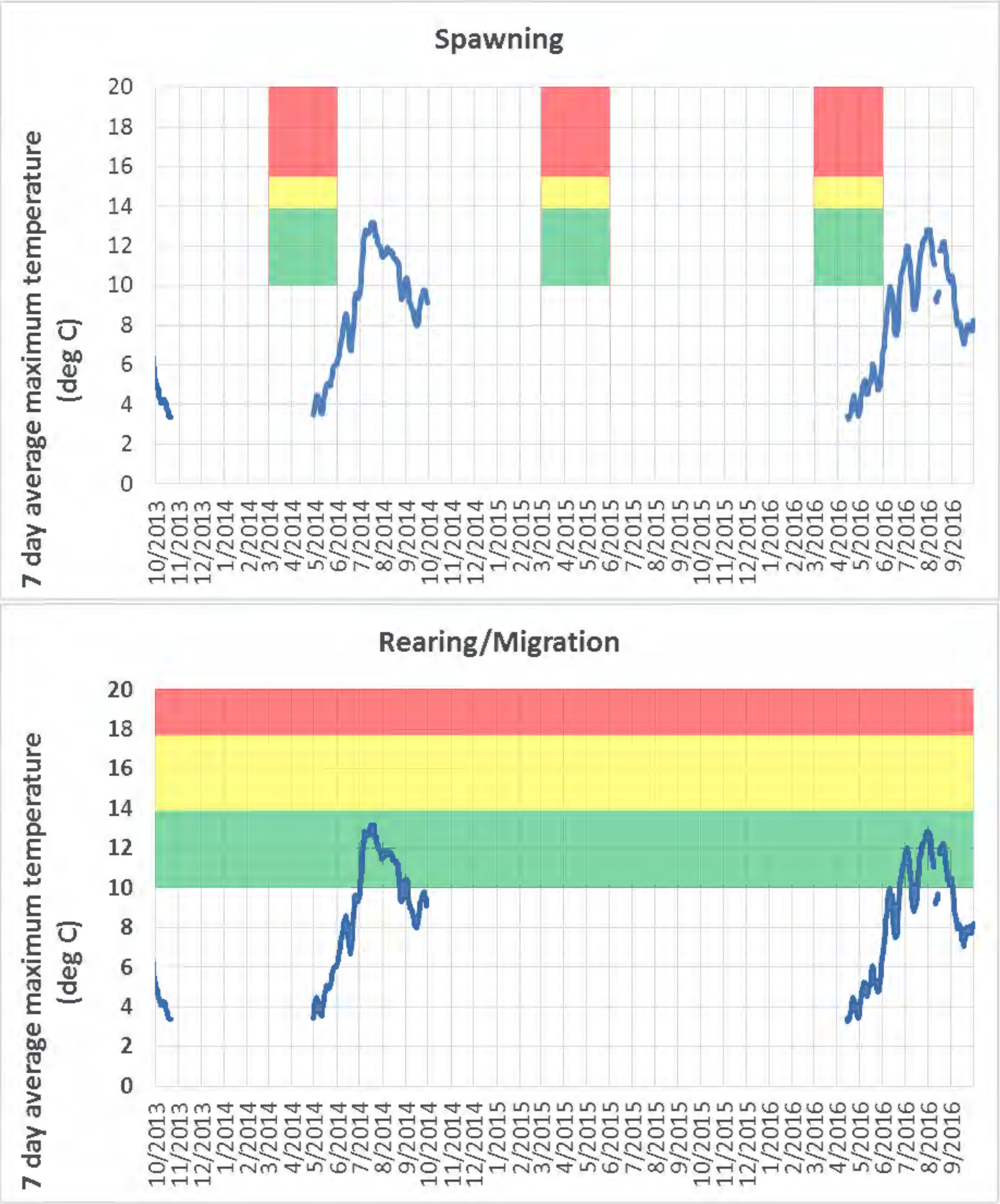


Figure 47. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead at the U.S. Geological Survey Gage, 13310800 in the East Fork of the South Fork of the Salmon River

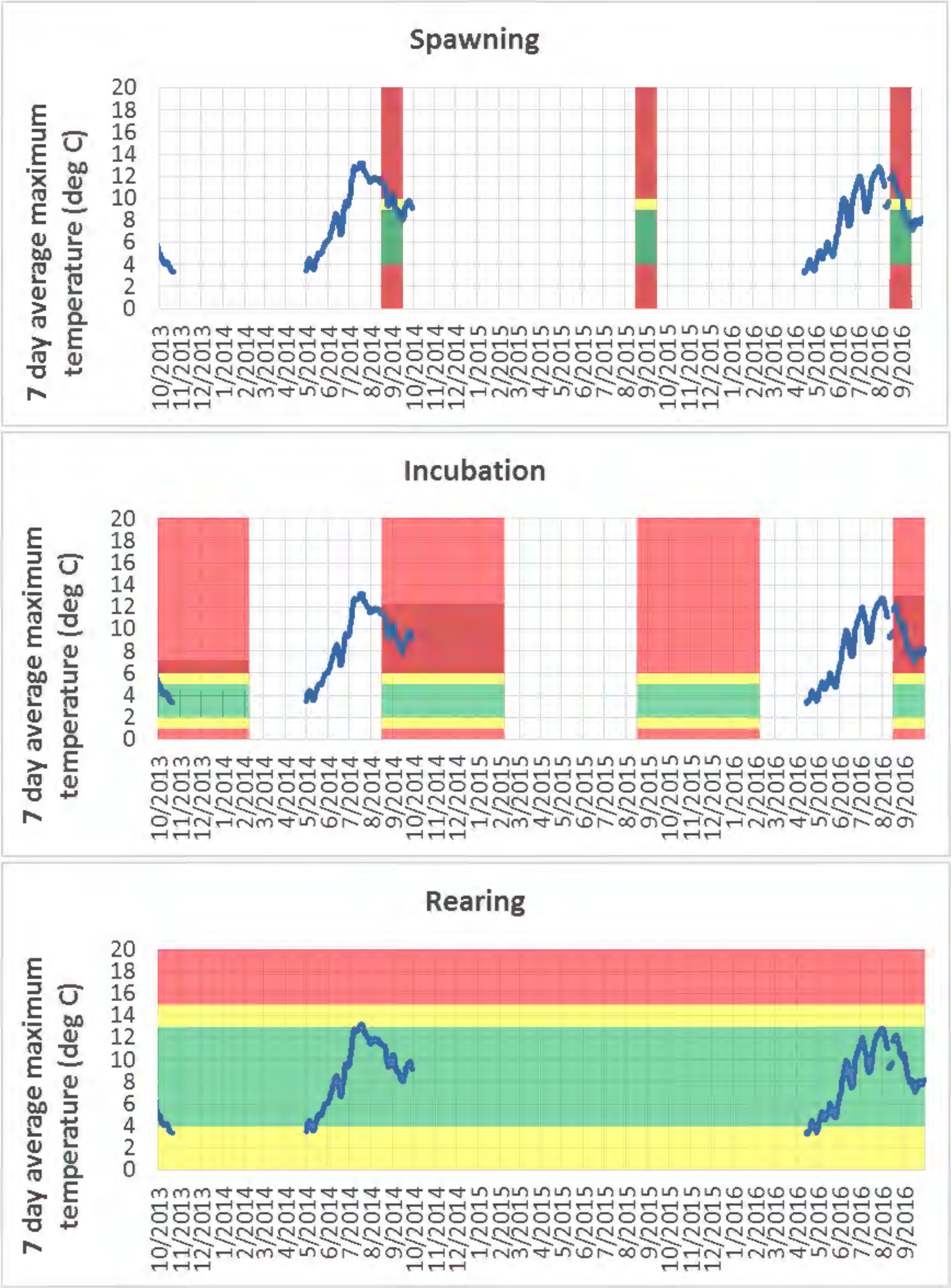


Figure 48. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout at the U.S. Geological Survey Gage, 13310800 in the East Fork of the South Fork of the Salmon River

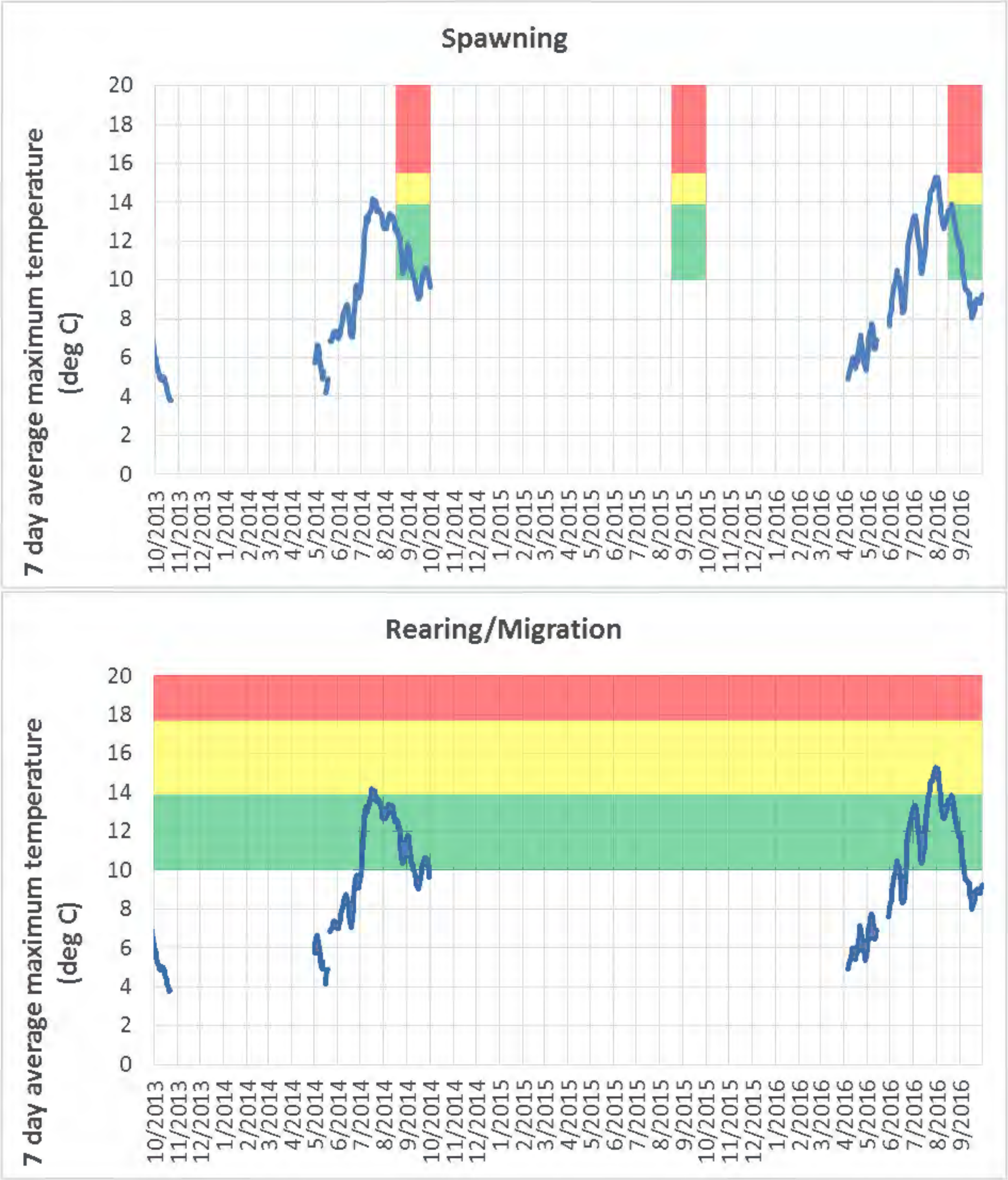


Figure 49. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon at the U.S. Geological Survey Gage, 13311450 in Sugar Creek

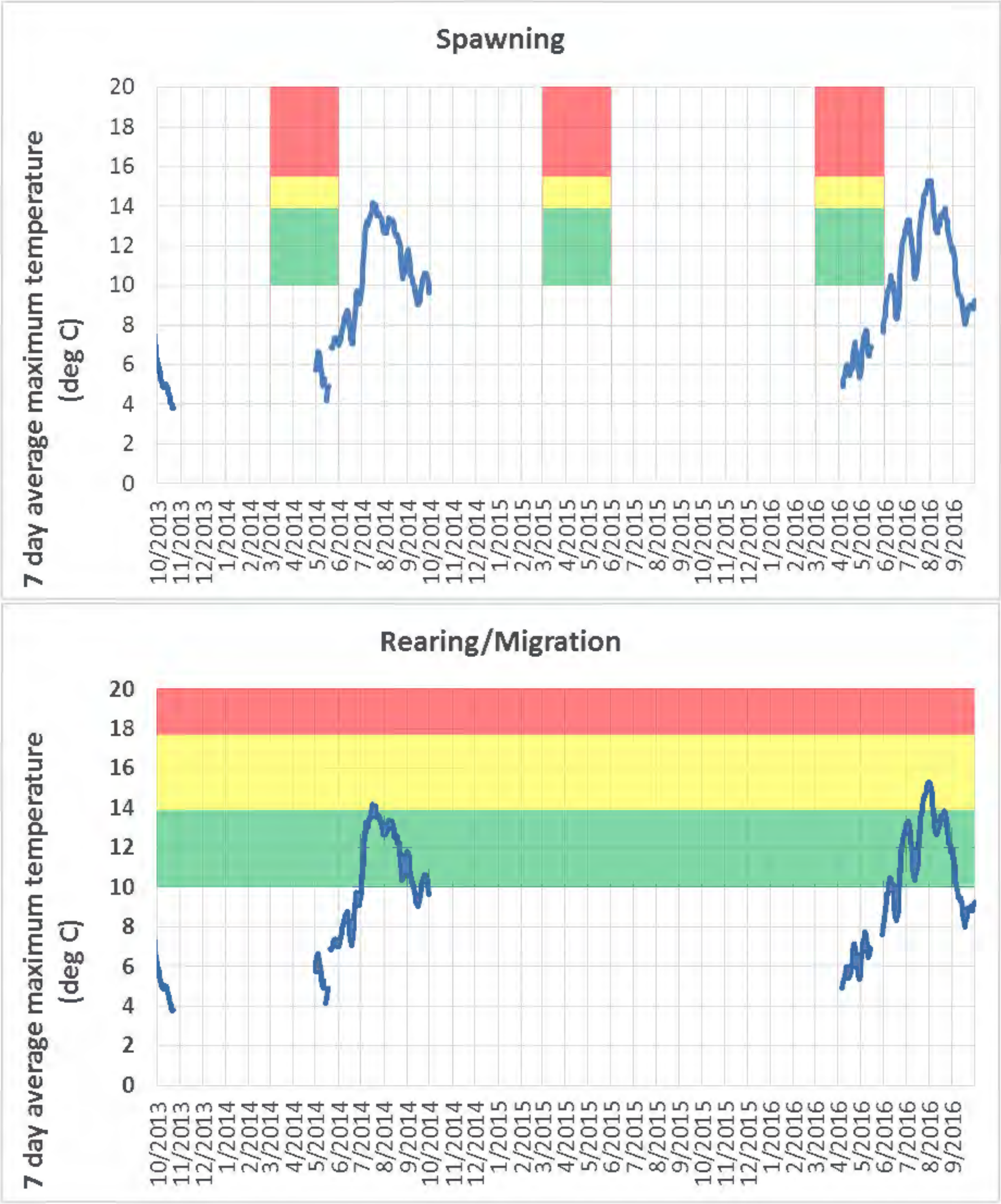


Figure 50. Water Temperature Monitoring Results and Watershed Condition Indicators for Steelhead at the U.S. Geological Survey Gage, 13311450 in Sugar Creek

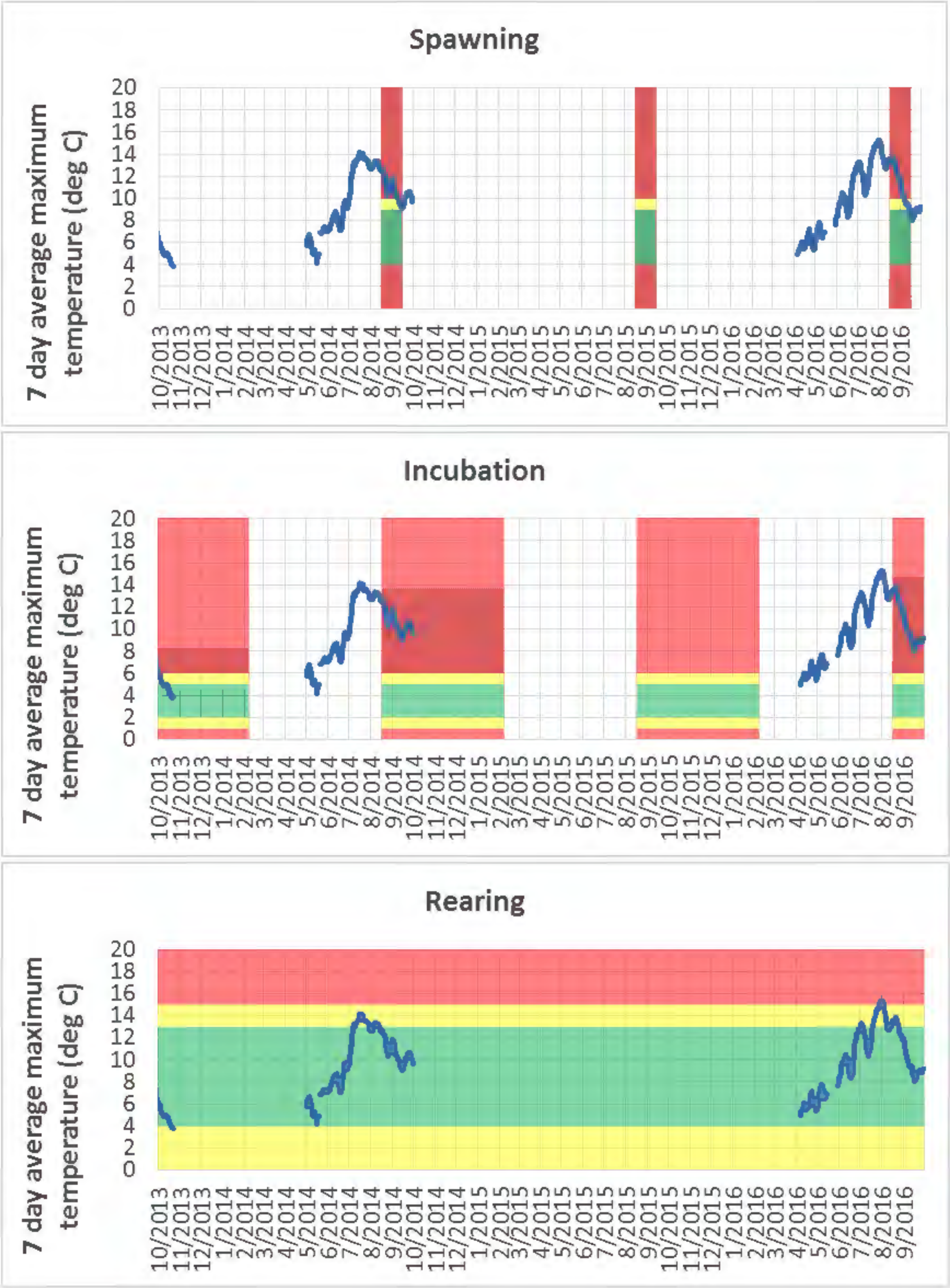


Figure 51. Water Temperature Monitoring Results and Watershed Condition Indicators for Bull Trout at the U.S. Geological Survey Gage, 13311450 in Sugar Creek

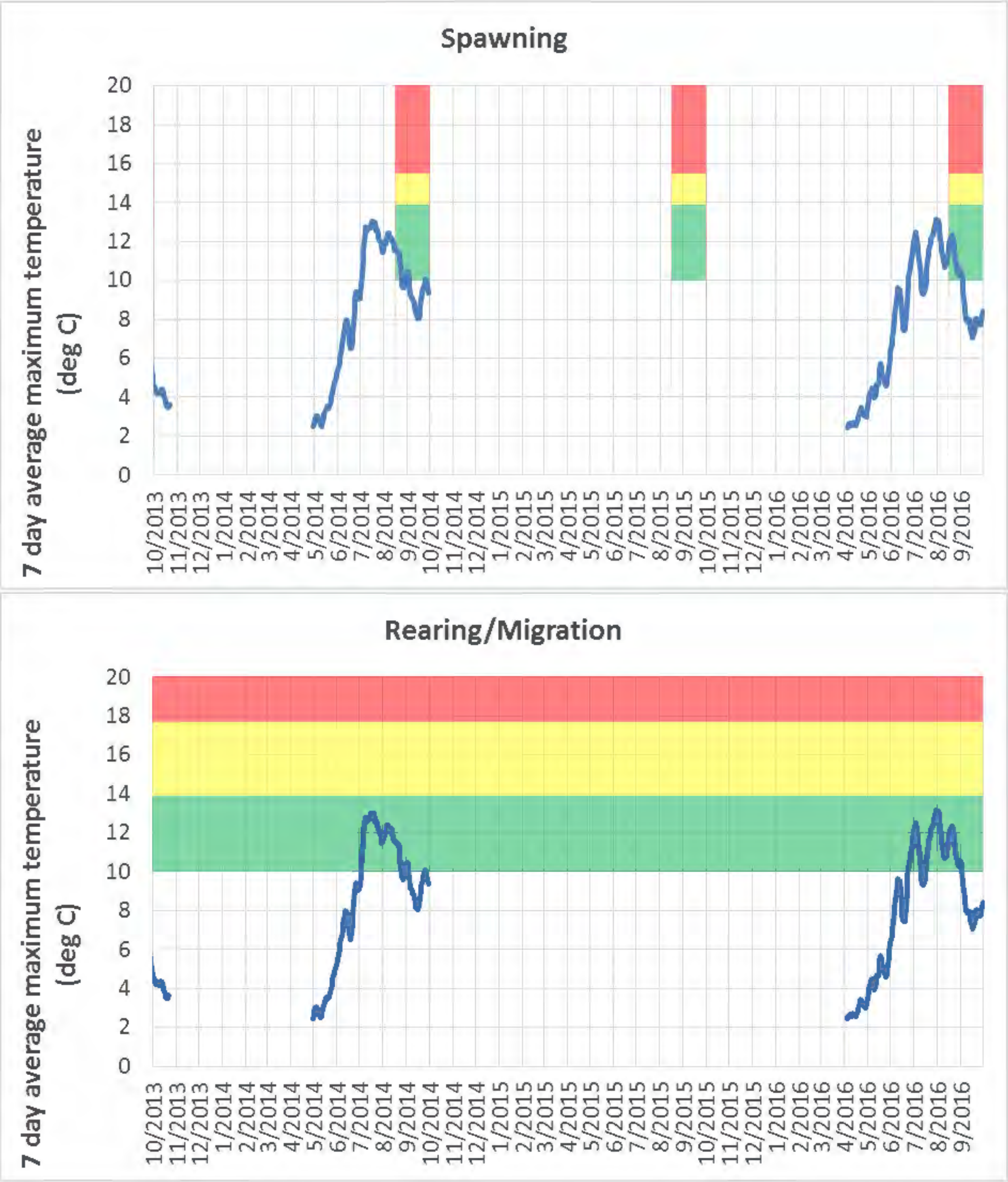


Figure 52. Water Temperature Monitoring Results and Watershed Condition Indicators for Chinook Salmon at the U.S. Geological Survey Gage, 13310850 in Meadow Creek

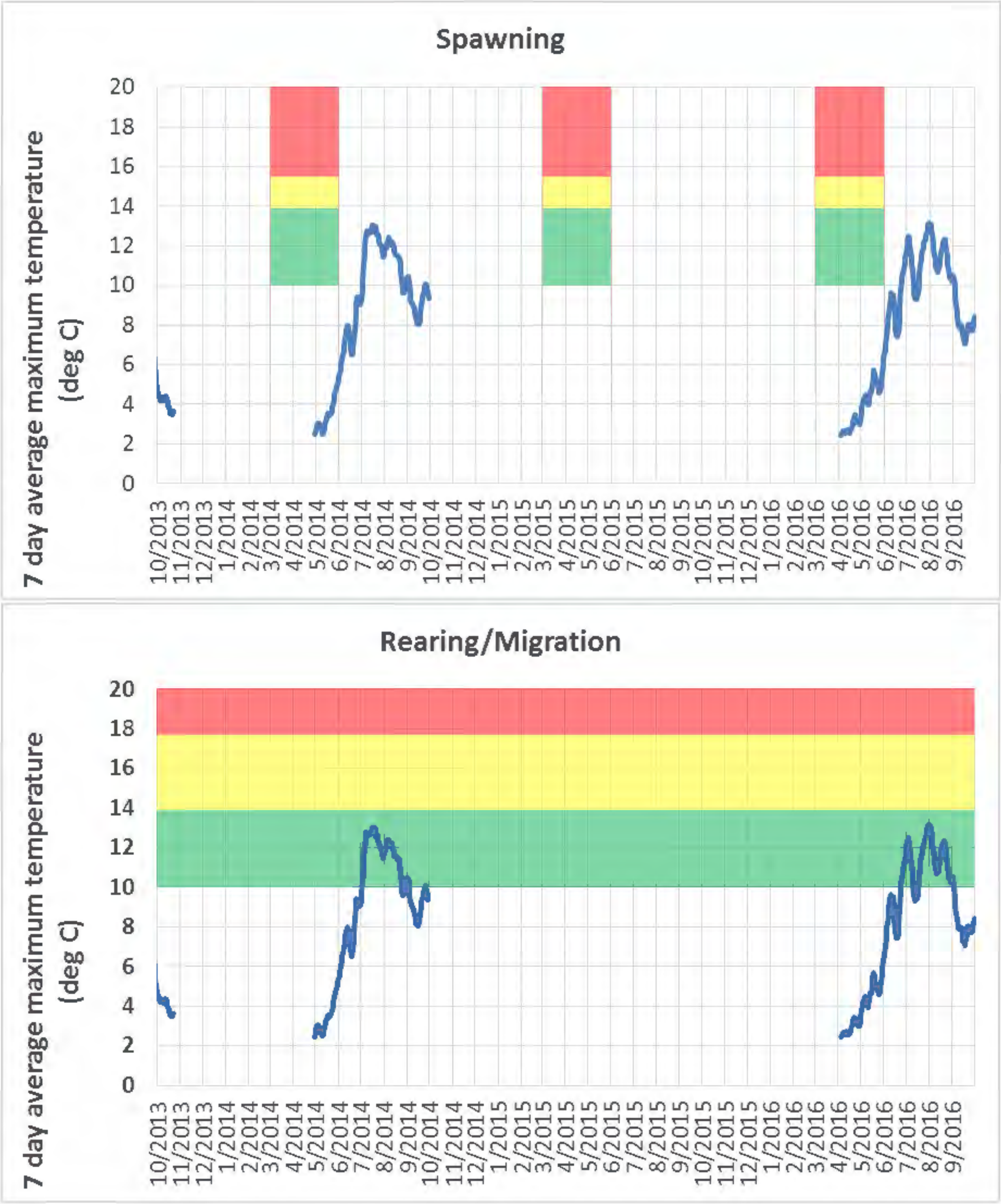


Figure 53. Water Temperature Monitoring Results and Watershed Condition Indicators Steelhead at the U.S. Geological Survey Gage, 13310850 in Meadow Creek

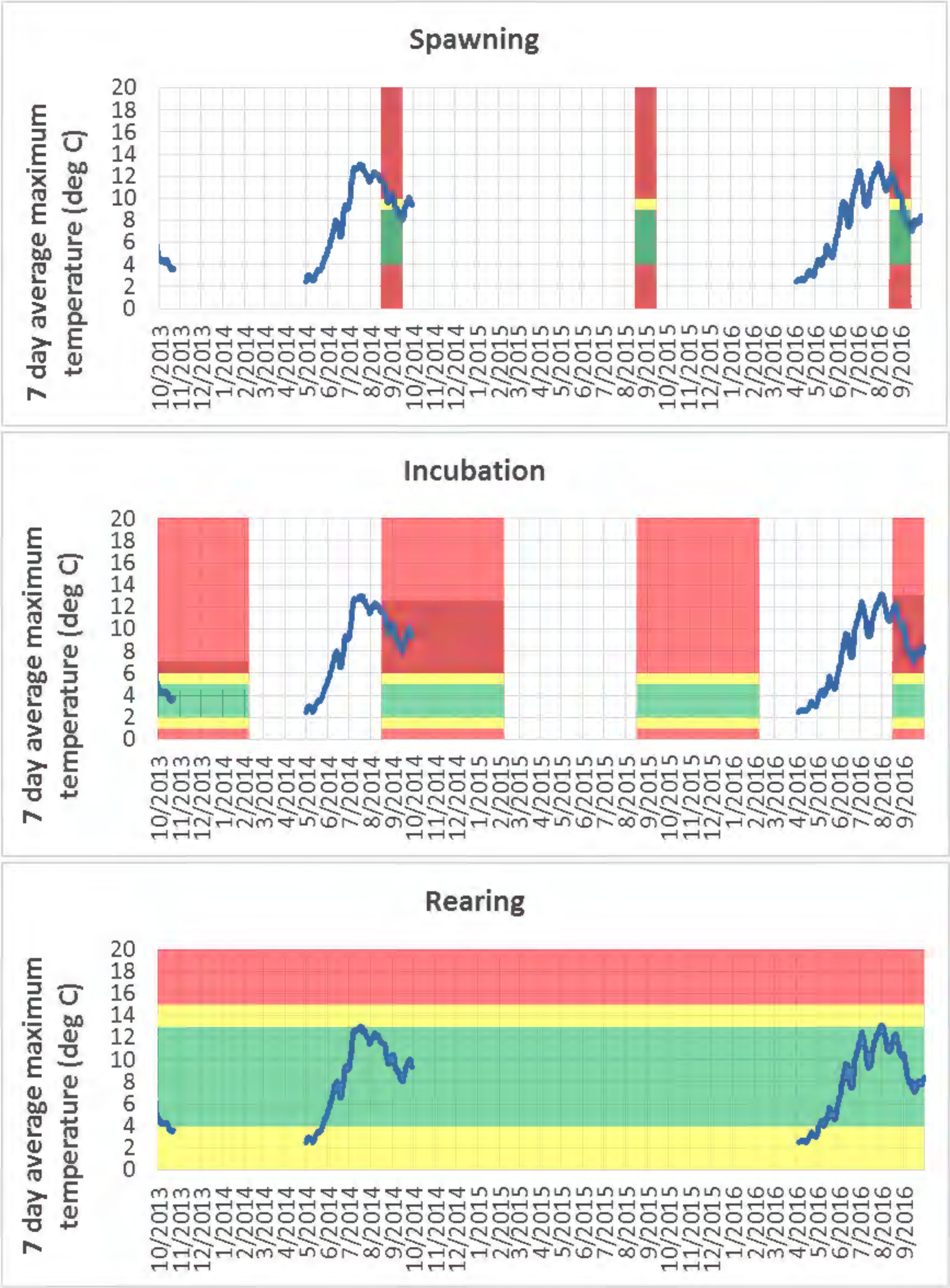


Figure 54. Water Temperature Monitoring Results and Watershed Condition Indicators Bull Trout at the U.S. Geological Survey Gage, 13310850 in Meadow Creek

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Appendix 4:

Sediment, Macroinvertebrate, and Fish Tissue Metal Concentration Results

Appendix 4: Sediment, Macroinvertebrate, and Fish Tissue Metal Concentration Laboratory Reports

Stibnite Gold Project
Midas Gold Idaho, Inc.

MIDAS GOLD

April 2017

Prepared by

MWH Americas, Inc.
727 E. Riverpark Lane, Suite 150
Boise, Idaho 83706

Sediment Metal Concentration Results

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Sampled By	Date Received	Notes
MWH-007	W6H0498-01	Sediment	11-Aug-16 19:00	JNE	19-Aug-2016	
MWH-009	W6H0498-02	Sediment	09-Aug-16 14:30	JNE	19-Aug-2016	
MWH-011	W6H0498-03	Sediment	10-Aug-16 14:00	JNE	19-Aug-2016	
MWH-012	W6H0498-04	Sediment	10-Aug-16 17:30	JNE	19-Aug-2016	
MWH-013	W6H0498-05	Sediment	10-Aug-16 16:00	JNE	19-Aug-2016	
MWH-014	W6H0498-06	Sediment	11-Aug-16 10:45	JNE	19-Aug-2016	
MWH-016	W6H0498-07	Sediment	11-Aug-16 16:45	JNE	19-Aug-2016	
MWH-017	W6H0498-08	Sediment	09-Aug-16 12:30	JNE	19-Aug-2016	
MWH-029	W6H0498-09	Sediment	09-Aug-16 17:00	JNE	19-Aug-2016	
MWH-030	W6H0498-10	Sediment	13-Aug-16 14:30	JNE	19-Aug-2016	
MWH-069	W6H0498-11	Sediment	09-Aug-16 15:15	JNE	19-Aug-2016	
MWH-070	W6H0498-12	Sediment	12-Aug-16 17:30	JNE	19-Aug-2016	
MWH-071	W6H0498-13	Sediment	12-Aug-16 17:00	JNE	19-Aug-2016	
MWH-072	W6H0498-14	Sediment	12-Aug-16 14:30	JNE	19-Aug-2016	
MWH-073	W6H0498-15	Sediment	12-Aug-16 16:30	JNE	19-Aug-2016	
MWH-074	W6H0498-16	Sediment	13-Aug-16 17:00	JNE	19-Aug-2016	
MWH-075	W6H0498-17	Sediment	13-Aug-16 12:00	JNE	19-Aug-2016	

Solid samples are analyzed on an as-received, wet-weight basis, unless otherwise requested.
Sample preparation is defined by the client as per their Data Quality Objectives.
This report supercedes any previous reports for this Work Order. The complete report includes pages for each sample, a full QC report, and a notes section.
The results presented in this report relate only to the samples, and meet all requirements of the NELAC Standards unless otherwise noted.

Case Narrative: W6H0498

08/23/16 HJG - Standing water was decanted from all samples prior to analysis per client directive.

MWH Global (AZ)	**Project Name: Stibnite Sediment 2016**
1620 W. Fountainhead Pkwy - Suite 202	Work Order: **W6H0498**
Tempe, AZ 85282	Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-007**
SVL Sample ID: **W6H0498-01 (Sediment)**

Sample Report Page 1 of 1

Sampled: 11-Aug-16 19:00
Received: 19-Aug-16
Sampled By: JNE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	**Aluminum**	7490	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:03	M1
EPA 6010C	**Antimony**	152	mg/kg	2.0	0.5		W636025	SMB	08/31/16 09:52	
EPA 6010C	**Arsenic**	1090	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:03	M3
EPA 6010C	**Barium**	101	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Beryllium**	1.09	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:03	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:03	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Cadmium**	1.10	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Calcium**	5010	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:03	M1
EPA 6010C	**Chromium**	8.93	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Cobalt**	5.63	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Copper**	13.7	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Gallium**	2.1	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Iron**	18300	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:03	M3
EPA 6010C	**Lanthanum**	20.4	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Lead**	6.2	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Lithium**	10.2	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Magnesium**	3080	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Manganese**	733	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:03	M3
EPA 6010C	**Molybdenum**	2.35	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Nickel**	6.08	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Phosphorus**	1610	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:03	M3
EPA 6010C	**Potassium**	2490	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:03	M1
EPA 6010C	**Scandium**	1.86	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:03	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Silver**	0.97	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Sodium**	110	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Strontium**	27.0	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:03	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:03	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Titanium**	446	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:03	M3
EPA 6010C	**Vanadium**	16.3	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:03	
EPA 6010C	**Zinc**	41.0	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:03	
EPA 7471B	**Mercury**	1.40	mg/kg	0.033	0.004		W635142	MWD	08/26/16 10:26	
Classical Chemistry Parameters										
ASTM D-3682	**Silica (SiO2)**	13.6	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2
TCLP Extraction Parameters										
EPA 1311	**Final pH**	4.98	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	59.0	%				W635088	ESB	08/30/16 09:15	
TCLP Leachates (Metals) Extracted: 08/30/16 09:15										
EPA 6010C	**Arsenic**	0.231	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 05:59	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 05:59	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 05:59	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 05:59	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 05:59	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 05:59	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 05:59	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 10:59	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-009**
SVL Sample ID: **W6H0498-02 (Sediment)**

Sample Report Page 1 of 1

Sampled: 09-Aug-16 14:30
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	10200	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Antimony**	48.0	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:00	
EPA 6010C	**Arsenic**	219	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Barium**	84.1	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Beryllium**	0.80	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:12	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:12	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Cadmium**	0.29	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Calcium**	4230	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Chromium**	11.7	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Cobalt**	5.50	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Copper**	8.47	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Gallium**	3.3	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Iron**	14700	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Lanthanum**	20.5	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Lead**	6.1	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Lithium**	16.3	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Magnesium**	5130	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Manganese**	337	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Molybdenum**	2.56	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Nickel**	8.42	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Phosphorus**	804	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Potassium**	2060	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Scandium**	1.71	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:12	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:12	
EPA 6010C	Silver	< 0.50	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Sodium**	116	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Strontium**	28.0	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:12	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:12	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Titanium**	411	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Vanadium**	15.0	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:12	
EPA 6010C	**Zinc**	38.3	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:12	
EPA 7471B	**Mercury**	62.6	mg/kg	1.65	0.190	50	W635142	MWD	08/26/16 11:22	D2

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	14.2	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.03	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	71.2	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Arsenic**	0.180	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:02	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:02	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:02	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:02	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:02	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:02	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:02	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:04	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-011**
SVL Sample ID: **W6H0498-03 (Sediment)**

Sample Report Page 1 of 1

Sampled: 10-Aug-16 14:00
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	6590	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Antimony**	222	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:03	
EPA 6010C	**Arsenic**	246	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Barium**	69.4	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Beryllium**	0.43	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:16	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:16	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Cadmium**	0.34	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Calcium**	4880	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Chromium**	6.43	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Cobalt**	2.88	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Copper**	7.74	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Gallium**	2.0	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Iron**	11400	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Lanthanum**	20.8	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Lead**	5.7	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Lithium**	9.8	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Magnesium**	3430	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Manganese**	304	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Molybdenum**	1.42	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Nickel**	3.78	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Phosphorus**	1630	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Potassium**	1860	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Scandium**	1.39	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:16	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Silver**	1.09	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Sodium**	136	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Strontium**	22.1	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:16	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:16	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Titanium**	512	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Vanadium**	13.9	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:16	
EPA 6010C	**Zinc**	22.7	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:16	
EPA 7471B	**Mercury**	0.305	mg/kg	0.033	0.004		W635142	MWD	08/26/16 10:32	

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	14.9	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	4.98	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	76.8	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Arsenic**	0.381	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:12	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:12	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:12	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:12	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:12	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:12	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:12	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:09	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-012**
SVL Sample ID: **W6H0498-04 (Sediment)**

Sample Report Page 1 of 1

Sampled: 10-Aug-16 17:30
Received: 19-Aug-16
Sampled By: JNE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	**Aluminum**	5470	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Antimony**	743	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:06	
EPA 6010C	**Arsenic**	200	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Barium**	56.1	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Beryllium**	0.37	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:19	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:19	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Cadmium**	0.30	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Calcium**	3310	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Chromium**	5.03	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Cobalt**	2.16	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Copper**	6.88	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:19	
EPA 6010C	Gallium	< 2.0	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Iron**	8640	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Lanthanum**	18.5	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Lead**	12.2	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Lithium**	9.1	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Magnesium**	2520	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Manganese**	205	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Molybdenum**	1.11	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Nickel**	2.54	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Phosphorus**	1020	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Potassium**	1530	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Scandium**	1.33	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Selenium**	4.3	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Silver**	2.00	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Sodium**	89.9	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Strontium**	18.1	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:19	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:19	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Titanium**	393	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Vanadium**	11.1	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:19	
EPA 6010C	**Zinc**	21.9	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:19	
EPA 7471B	**Mercury**	11.6	mg/kg	0.330	0.038	10	W635142	MWD	08/26/16 11:26	D2
Classical Chemistry Parameters										
ASTM D-3682	**Silica (SiO2)**	11.5	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2,M2
TCLP Extraction Parameters										
EPA 1311	**Final pH**	4.97	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	71.8	%				W635088	ESB	08/30/16 09:15	
TCLP Leachates (Metals) Extracted: 08/30/16 09:15										
EPA 6010C	**Arsenic**	0.246	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:15	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:15	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:15	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:15	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:15	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:15	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:15	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:11	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-013**
SVL Sample ID: **W6H0498-05 (Sediment)**

Sample Report Page 1 of 1

Sampled: 10-Aug-16 16:00
Received: 19-Aug-16
Sampled By: JNE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	**Aluminum**	9990	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Antimony**	6.9	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:09	
EPA 6010C	**Arsenic**	44.6	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Barium**	84.6	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Beryllium**	0.62	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:22	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:22	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:22	
EPA 6010C	Cadmium	< 0.20	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Calcium**	5850	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Chromium**	7.58	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Cobalt**	3.79	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Copper**	12.1	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Gallium**	3.1	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Iron**	13500	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Lanthanum**	33.1	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Lead**	4.8	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Lithium**	19.0	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Magnesium**	3530	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Manganese**	316	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Molybdenum**	2.12	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Nickel**	4.37	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Phosphorus**	1880	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Potassium**	2030	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Scandium**	1.47	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:22	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:22	
EPA 6010C	Silver	< 0.50	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Sodium**	85.3	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Strontium**	27.6	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:22	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:22	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Titanium**	649	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Vanadium**	18.9	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:22	
EPA 6010C	**Zinc**	38.7	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:22	
EPA 7471B	**Mercury**	4.45	mg/kg	0.330	0.038	10	W635142	MWD	08/26/16 11:28	D2,M3
Classical Chemistry Parameters										
ASTM D-3682	**Silica (SiO2)**	13.0	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2
TCLP Extraction Parameters										
EPA 1311	**Final pH**	5.01	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	52.9	%				W635088	ESB	08/30/16 09:15	
TCLP Leachates (Metals) Extracted: 08/30/16 09:15										
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:18	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:18	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:18	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:18	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:18	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:18	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:18	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:13	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-014**
SVL Sample ID: **W6H0498-06 (Sediment)**

Sample Report Page 1 of 1

Sampled: 11-Aug-16 10:45
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	6800	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Antimony**	19.8	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:12	
EPA 6010C	**Arsenic**	52.8	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Barium**	62.2	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Beryllium**	0.42	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:25	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:25	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:25	
EPA 6010C	Cadmium	< 0.20	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Calcium**	4200	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Chromium**	7.47	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Cobalt**	2.72	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Copper**	6.31	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:25	
EPA 6010C	Gallium	< 2.0	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Iron**	10700	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Lanthanum**	18.4	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Lead**	2.5	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Lithium**	10.0	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Magnesium**	3560	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Manganese**	256	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Molybdenum**	1.44	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Nickel**	4.46	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Phosphorus**	1350	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Potassium**	2040	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Scandium**	1.42	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:25	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:25	
EPA 6010C	Silver	< 0.50	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Sodium**	148	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Strontium**	15.9	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:25	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:25	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Titanium**	588	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Vanadium**	14.8	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:25	
EPA 6010C	**Zinc**	21.1	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:25	
EPA 7471B	**Mercury**	0.153	mg/kg	0.033	0.004		W635142	MWD	08/26/16 10:50	

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	13.6	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	4.99	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	79.5	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:28	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:28	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:28	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:28	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:28	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:28	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:28	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:15	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-016**
SVL Sample ID: **W6H0498-07 (Sediment)**

Sample Report Page 1 of 1

Sampled: 11-Aug-16 16:45
Received: 19-Aug-16
Sampled By: JNE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	**Aluminum**	15000	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Antimony**	2.9	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:21	
EPA 6010C	**Arsenic**	11.1	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Barium**	75.7	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Beryllium**	0.64	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:36	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:36	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:36	
EPA 6010C	Cadmium	< 0.20	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Calcium**	4950	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Chromium**	16.6	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Cobalt**	3.81	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Copper**	6.89	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Gallium**	4.1	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Iron**	13900	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Lanthanum**	18.5	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Lead**	4.4	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Lithium**	18.9	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Magnesium**	4260	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Manganese**	234	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Molybdenum**	2.32	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Nickel**	8.09	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Phosphorus**	947	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Potassium**	1940	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Scandium**	2.27	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:36	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:36	
EPA 6010C	Silver	< 0.50	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Sodium**	321	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Strontium**	32.4	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:36	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:36	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Titanium**	921	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Vanadium**	24.2	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:36	
EPA 6010C	**Zinc**	34.3	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:36	
EPA 7471B	**Mercury**	0.037	mg/kg	0.033	0.004		W635142	MWD	08/26/16 10:52	
Classical Chemistry Parameters										
ASTM D-3682	**Silica (SiO2)**	13.9	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2
TCLP Extraction Parameters										
EPA 1311	**Final pH**	4.99	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	67.8	%				W635088	ESB	08/30/16 09:15	
TCLP Leachates (Metals) Extracted: 08/30/16 09:15										
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:31	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:31	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:31	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:31	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:31	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:31	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:31	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:17	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-017**
SVL Sample ID: **W6H0498-08 (Sediment)**

Sample Report Page 1 of 1

Sampled: 09-Aug-16 12:30
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	10800	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Antimony**	3.4	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:24	
EPA 6010C	**Arsenic**	9.5	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Barium**	51.1	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Beryllium**	0.65	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:39	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:39	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:39	
EPA 6010C	Cadmium	< 0.20	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Calcium**	4520	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Chromium**	27.0	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Cobalt**	7.04	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Copper**	56.0	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Gallium**	3.4	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Iron**	17400	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Lanthanum**	14.8	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Lead**	3.6	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Lithium**	19.6	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Magnesium**	7840	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Manganese**	254	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Molybdenum**	2.74	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Nickel**	15.7	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Phosphorus**	673	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Potassium**	1920	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Scandium**	2.31	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:39	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:39	
EPA 6010C	Silver	< 0.50	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Sodium**	147	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Strontium**	17.9	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:39	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:39	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Titanium**	611	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Vanadium**	22.5	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:39	
EPA 6010C	**Zinc**	34.3	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:39	
EPA 7471B	Mercury	< 0.033	mg/kg	0.033	0.004		W635142	MWD	08/26/16 10:53	

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	15.5	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.02	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	68.1	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:34	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:34	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:34	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:34	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:34	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:34	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:34	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:18	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)	**Project Name: Stibnite Sediment 2016**
1620 W. Fountainhead Pkwy - Suite 202	Work Order: **W6H0498**
Tempe, AZ 85282	Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-029**
SVL Sample ID: **W6H0498-09 (Sediment)**

Sample Report Page 1 of 1

Sampled: 09-Aug-16 17:00
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	9780	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Antimony**	19.0	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:27	
EPA 6010C	**Arsenic**	80.0	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Barium**	62.2	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Beryllium**	0.73	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:42	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:42	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:42	
EPA 6010C	Cadmium	< 0.20	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Calcium**	4510	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Chromium**	12.3	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Cobalt**	6.25	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Copper**	11.1	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Gallium**	3.6	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Iron**	13500	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Lanthanum**	22.2	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Lead**	5.9	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Lithium**	16.2	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Magnesium**	5170	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Manganese**	199	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Molybdenum**	1.89	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Nickel**	9.83	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Phosphorus**	789	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Potassium**	1830	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Scandium**	1.60	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:42	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:42	
EPA 6010C	Silver	< 0.50	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Sodium**	104	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Strontium**	23.3	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:42	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:42	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Titanium**	304	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Vanadium**	13.5	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:42	
EPA 6010C	**Zinc**	35.1	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:42	
EPA 7471B	**Mercury**	61.8	mg/kg	1.65	0.190	50	W635142	MWD	08/26/16 11:33	D2

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	14.0	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.05	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	70.9	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:37	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:37	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:37	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:37	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:37	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:37	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:37	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:20	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-030**
SVL Sample ID: **W6H0498-10 (Sediment)**

Sample Report Page 1 of 1

Sampled: 13-Aug-16 14:30
Received: 19-Aug-16
Sampled By: JNE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	**Aluminum**	8950	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Antimony**	241	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:30	
EPA 6010C	**Arsenic**	1640	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Barium**	107	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Beryllium**	1.11	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:45	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:45	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Cadmium**	1.71	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Calcium**	4690	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Chromium**	8.90	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Cobalt**	5.77	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Copper**	11.1	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Gallium**	2.6	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Iron**	20400	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Lanthanum**	20.8	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Lead**	7.5	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Lithium**	12.6	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Magnesium**	3480	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Manganese**	685	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Molybdenum**	2.49	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Nickel**	5.81	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Phosphorus**	1460	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Potassium**	2920	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Scandium**	2.04	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:45	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Silver**	1.00	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Sodium**	134	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Strontium**	33.7	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:45	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:45	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Titanium**	522	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Vanadium**	17.7	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:45	
EPA 6010C	**Zinc**	43.2	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:45	
EPA 7471B	**Mercury**	0.640	mg/kg	0.033	0.004		W635142	MWD	08/26/16 10:59	
Classical Chemistry Parameters										
ASTM D-3682	**Silica (SiO2)**	15.3	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2
TCLP Extraction Parameters										
EPA 1311	**Final pH**	5.03	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	56.6	%				W635088	ESB	08/30/16 09:15	
TCLP Leachates (Metals) Extracted: 08/30/16 09:15										
EPA 6010C	**Arsenic**	0.295	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:41	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:41	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:41	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:41	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:41	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:41	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:41	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:26	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-069**
SVL Sample ID: **W6H0498-11 (Sediment)**

Sample Report Page 1 of 1

Sampled: 09-Aug-16 15:15
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	9850	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Antimony**	19.3	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:33	
EPA 6010C	**Arsenic**	81.2	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Barium**	58.7	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Beryllium**	0.72	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:49	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:49	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:49	
EPA 6010C	Cadmium	< 0.20	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Calcium**	4560	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Chromium**	12.2	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Cobalt**	6.46	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Copper**	10.9	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Gallium**	3.7	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Iron**	13500	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Lanthanum**	23.2	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Lead**	5.8	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Lithium**	16.4	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Magnesium**	5440	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Manganese**	195	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Molybdenum**	1.76	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Nickel**	9.39	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Phosphorus**	772	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Potassium**	1840	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Scandium**	1.58	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:49	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:49	
EPA 6010C	Silver	< 0.50	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Sodium**	103	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Strontium**	22.9	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:49	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:49	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Titanium**	333	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Vanadium**	13.6	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:49	
EPA 6010C	**Zinc**	35.2	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:49	
EPA 7471B	**Mercury**	70.2	mg/kg	1.65	0.190	50	W635142	MWD	08/26/16 11:38	D2

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	14.8	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.07	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	76.1	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 06:44	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 06:44	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 06:44	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 06:44	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 06:44	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 06:44	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 06:44	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:27	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-070**
SVL Sample ID: **W6H0498-12 (Sediment)**

Sample Report Page 1 of 1

Sampled: 12-Aug-16 17:30
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	13200	mg/kg	8.0	4.9		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Antimony**	196	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:36	
EPA 6010C	**Arsenic**	206	mg/kg	2.5	0.6		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Barium**	131	mg/kg	0.20	0.14		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Beryllium**	1.07	mg/kg	0.20	0.07		W636023	SMB	09/02/16 07:52	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 07:52	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Cadmium**	0.34	mg/kg	0.20	0.06		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Calcium**	4350	mg/kg	10.0	3.5		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Chromium**	12.3	mg/kg	0.60	0.13		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Cobalt**	5.58	mg/kg	0.60	0.30		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Copper**	12.8	mg/kg	1.00	0.16		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Gallium**	3.6	mg/kg	2.0	0.4		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Iron**	21300	mg/kg	10.0	4.0		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Lanthanum**	24.8	mg/kg	0.50	0.32		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Lead**	9.1	mg/kg	0.8	0.3		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Lithium**	19.2	mg/kg	2.0	0.9		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Magnesium**	4500	mg/kg	20.0	8.7		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Manganese**	479	mg/kg	0.80	0.22		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Molybdenum**	2.62	mg/kg	0.80	0.13		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Nickel**	7.77	mg/kg	1.00	0.14		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Phosphorus**	1420	mg/kg	5.0	1.1		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Potassium**	3110	mg/kg	50.0	13.0		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Scandium**	2.51	mg/kg	0.20	0.13		W636023	SMB	09/02/16 07:52	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Silver**	0.92	mg/kg	0.50	0.14		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Sodium**	159	mg/kg	50.0	4.7		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Strontium**	32.9	mg/kg	0.50	0.05		W636023	SMB	09/02/16 07:52	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 07:52	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Titanium**	817	mg/kg	0.50	0.08		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Vanadium**	25.0	mg/kg	0.50	0.15		W636023	SMB	09/02/16 07:52	
EPA 6010C	**Zinc**	47.7	mg/kg	1.0	0.5		W636023	SMB	09/02/16 07:52	
EPA 7471B	**Mercury**	1.31	mg/kg	0.033	0.004		W635142	MWD	08/26/16 11:04	

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	14.0	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.04	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	47.8	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Arsenic**	0.053	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 07:10	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 07:10	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 07:10	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 07:10	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 07:10	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 07:10	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 07:10	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:29	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-071**
SVL Sample ID: **W6H0498-13 (Sediment)**

Sample Report Page 1 of 1

Sampled: 12-Aug-16 17:00
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	17700	mg/kg	8.0	4.9		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Antimony**	169	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:39	
EPA 6010C	**Arsenic**	248	mg/kg	2.5	0.6		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Barium**	180	mg/kg	0.20	0.14		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Beryllium**	1.21	mg/kg	0.20	0.07		W636023	SMB	09/02/16 08:12	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 08:12	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Cadmium**	0.37	mg/kg	0.20	0.06		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Calcium**	5110	mg/kg	10.0	3.5		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Chromium**	16.3	mg/kg	0.60	0.13		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Cobalt**	6.10	mg/kg	0.60	0.30		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Copper**	13.2	mg/kg	1.00	0.16		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Gallium**	5.3	mg/kg	2.0	0.4		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Iron**	23500	mg/kg	10.0	4.0		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Lanthanum**	27.0	mg/kg	0.50	0.32		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Lead**	9.3	mg/kg	0.8	0.3		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Lithium**	26.1	mg/kg	2.0	0.9		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Magnesium**	6000	mg/kg	20.0	8.7		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Manganese**	513	mg/kg	0.80	0.22		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Molybdenum**	3.41	mg/kg	0.80	0.13		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Nickel**	8.96	mg/kg	1.00	0.14		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Phosphorus**	1210	mg/kg	5.0	1.1		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Potassium**	4650	mg/kg	50.0	13.0		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Scandium**	3.45	mg/kg	0.20	0.13		W636023	SMB	09/02/16 08:12	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Silver**	0.86	mg/kg	0.50	0.14		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Sodium**	197	mg/kg	50.0	4.7		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Strontium**	39.6	mg/kg	0.50	0.05		W636023	SMB	09/02/16 08:12	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 08:12	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Titanium**	1270	mg/kg	0.50	0.08		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Vanadium**	34.7	mg/kg	0.50	0.15		W636023	SMB	09/02/16 08:12	
EPA 6010C	**Zinc**	60.3	mg/kg	1.0	0.5		W636023	SMB	09/02/16 08:12	
EPA 7471B	**Mercury**	0.492	mg/kg	0.033	0.004		W635142	MWD	08/26/16 11:06	

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	16.0	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.04	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	46.7	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 07:13	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 07:13	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 07:13	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 07:13	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 07:13	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 07:13	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 07:13	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:31	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-072**
SVL Sample ID: **W6H0498-14 (Sediment)**

Sample Report Page 1 of 1

Sampled: 12-Aug-16 14:30
Received: 19-Aug-16
Sampled By: JNE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	**Aluminum**	16300	mg/kg	8.0	4.9		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Antimony**	114	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:42	
EPA 6010C	**Arsenic**	293	mg/kg	2.5	0.6		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Barium**	161	mg/kg	0.20	0.14		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Beryllium**	1.05	mg/kg	0.20	0.07		W636023	SMB	09/02/16 08:15	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 08:15	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Cadmium**	0.41	mg/kg	0.20	0.06		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Calcium**	5190	mg/kg	10.0	3.5		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Chromium**	15.7	mg/kg	0.60	0.13		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Cobalt**	6.04	mg/kg	0.60	0.30		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Copper**	11.9	mg/kg	1.00	0.16		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Gallium**	4.7	mg/kg	2.0	0.4		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Iron**	22500	mg/kg	10.0	4.0		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Lanthanum**	25.4	mg/kg	0.50	0.32		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Lead**	7.9	mg/kg	0.8	0.3		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Lithium**	24.5	mg/kg	2.0	0.9		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Magnesium**	6000	mg/kg	20.0	8.7		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Manganese**	525	mg/kg	0.80	0.22		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Molybdenum**	2.82	mg/kg	0.80	0.13		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Nickel**	8.73	mg/kg	1.00	0.14		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Phosphorus**	1200	mg/kg	5.0	1.1		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Potassium**	4340	mg/kg	50.0	13.0		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Scandium**	3.23	mg/kg	0.20	0.13		W636023	SMB	09/02/16 08:15	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Silver**	0.81	mg/kg	0.50	0.14		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Sodium**	207	mg/kg	50.0	4.7		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Strontium**	38.5	mg/kg	0.50	0.05		W636023	SMB	09/02/16 08:15	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 08:15	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Titanium**	1180	mg/kg	0.50	0.08		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Vanadium**	30.8	mg/kg	0.50	0.15		W636023	SMB	09/02/16 08:15	
EPA 6010C	**Zinc**	55.1	mg/kg	1.0	0.5		W636023	SMB	09/02/16 08:15	
EPA 7471B	**Mercury**	0.447	mg/kg	0.033	0.004		W635142	MWD	08/26/16 11:08	
Classical Chemistry Parameters										
ASTM D-3682	**Silica (SiO2)**	13.2	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2
TCLP Extraction Parameters										
EPA 1311	**Final pH**	5.06	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	50.9	%				W635088	ESB	08/30/16 09:15	
TCLP Leachates (Metals) Extracted: 08/30/16 09:15										
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 07:16	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 07:16	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 07:16	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 07:16	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 07:16	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 07:16	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 07:16	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:33	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-073**
SVL Sample ID: **W6H0498-15 (Sediment)**

Sample Report Page 1 of 1

Sampled: 12-Aug-16 16:30
Received: 19-Aug-16
Sampled By: JNE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	**Aluminum**	14400	mg/kg	8.0	4.9		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Antimony**	164	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:45	
EPA 6010C	**Arsenic**	611	mg/kg	2.5	0.6		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Barium**	149	mg/kg	0.20	0.14		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Beryllium**	0.93	mg/kg	0.20	0.07		W636023	SMB	09/02/16 08:19	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 08:19	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Cadmium**	0.71	mg/kg	0.20	0.06		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Calcium**	5020	mg/kg	10.0	3.5		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Chromium**	14.1	mg/kg	0.60	0.13		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Cobalt**	5.42	mg/kg	0.60	0.30		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Copper**	11.8	mg/kg	1.00	0.16		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Gallium**	4.7	mg/kg	2.0	0.4		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Iron**	20600	mg/kg	10.0	4.0		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Lanthanum**	23.8	mg/kg	0.50	0.32		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Lead**	7.7	mg/kg	0.8	0.3		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Lithium**	22.0	mg/kg	2.0	0.9		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Magnesium**	5450	mg/kg	20.0	8.7		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Manganese**	320	mg/kg	0.80	0.22		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Molybdenum**	2.56	mg/kg	0.80	0.13		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Nickel**	7.95	mg/kg	1.00	0.14		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Phosphorus**	1180	mg/kg	5.0	1.1		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Potassium**	3890	mg/kg	50.0	13.0		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Scandium**	2.92	mg/kg	0.20	0.13		W636023	SMB	09/02/16 08:19	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Silver**	0.80	mg/kg	0.50	0.14		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Sodium**	206	mg/kg	50.0	4.7		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Strontium**	36.3	mg/kg	0.50	0.05		W636023	SMB	09/02/16 08:19	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 08:19	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Titanium**	1030	mg/kg	0.50	0.08		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Vanadium**	26.8	mg/kg	0.50	0.15		W636023	SMB	09/02/16 08:19	
EPA 6010C	**Zinc**	50.0	mg/kg	1.0	0.5		W636023	SMB	09/02/16 08:19	
EPA 7471B	**Mercury**	0.460	mg/kg	0.033	0.004		W635142	MWD	08/26/16 11:13	
Classical Chemistry Parameters										
ASTM D-3682	**Silica (SiO2)**	14.4	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2
TCLP Extraction Parameters										
EPA 1311	**Final pH**	5.06	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	53.2	%				W635088	ESB	08/30/16 09:15	
TCLP Leachates (Metals) Extracted: 08/30/16 09:15										
EPA 6010C	**Arsenic**	0.103	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 07:19	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 07:19	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 07:19	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 07:19	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 07:19	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 07:19	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 07:19	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:34	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT(TNI)**:ID000192015-1, **WA**:C573

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-074**
SVL Sample ID: **W6H0498-16 (Sediment)**

Sample Report Page 1 of 1

Sampled: 13-Aug-16 17:00
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	9210	mg/kg	8.0	4.9		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Antimony**	138	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:48	
EPA 6010C	**Arsenic**	184	mg/kg	2.5	0.6		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Barium**	91.8	mg/kg	0.20	0.14		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Beryllium**	0.72	mg/kg	0.20	0.07		W636023	SMB	09/02/16 08:22	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 08:22	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Cadmium**	0.27	mg/kg	0.20	0.06		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Calcium**	4420	mg/kg	10.0	3.5		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Chromium**	9.00	mg/kg	0.60	0.13		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Cobalt**	4.07	mg/kg	0.60	0.30		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Copper**	9.33	mg/kg	1.00	0.16		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Gallium**	2.8	mg/kg	2.0	0.4		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Iron**	14500	mg/kg	10.0	4.0		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Lanthanum**	21.3	mg/kg	0.50	0.32		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Lead**	6.2	mg/kg	0.8	0.3		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Lithium**	14.5	mg/kg	2.0	0.9		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Magnesium**	4170	mg/kg	20.0	8.7		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Manganese**	368	mg/kg	0.80	0.22		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Molybdenum**	2.24	mg/kg	0.80	0.13		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Nickel**	5.49	mg/kg	1.00	0.14		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Phosphorus**	1210	mg/kg	5.0	1.1		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Potassium**	2640	mg/kg	50.0	13.0		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Scandium**	1.90	mg/kg	0.20	0.13		W636023	SMB	09/02/16 08:22	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Silver**	0.59	mg/kg	0.50	0.14		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Sodium**	154	mg/kg	50.0	4.7		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Strontium**	23.6	mg/kg	0.50	0.05		W636023	SMB	09/02/16 08:22	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 08:22	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Titanium**	711	mg/kg	0.50	0.08		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Vanadium**	18.6	mg/kg	0.50	0.15		W636023	SMB	09/02/16 08:22	
EPA 6010C	**Zinc**	35.3	mg/kg	1.0	0.5		W636023	SMB	09/02/16 08:22	
EPA 7471B	**Mercury**	0.962	mg/kg	0.033	0.004		W635142	MWD	08/26/16 11:15	

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	13.1	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.04	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	67.4	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	Arsenic	< 0.050	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 07:22	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 07:22	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 07:22	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 07:22	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 07:22	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 07:22	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 07:22	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:36	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

MWH Global (AZ)	**Project Name: Stibnite Sediment 2016**
1620 W. Fountainhead Pkwy - Suite 202	Work Order: **W6H0498**
Tempe, AZ 85282	Reported: 06-Sep-16 10:59

Client Sample ID: **MWH-075**
SVL Sample ID: **W6H0498-17 (Sediment)**

Sample Report Page 1 of 1

Sampled: 13-Aug-16 12:00
Received: 19-Aug-16
Sampled By: JNE

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Aluminum**	8540	mg/kg	8.0	4.9		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Antimony**	186	mg/kg	2.0	0.5		W636025	SMB	08/31/16 10:58	
EPA 6010C	**Arsenic**	307	mg/kg	2.5	0.6		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Barium**	61.1	mg/kg	0.20	0.14		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Beryllium**	0.58	mg/kg	0.20	0.07		W636023	SMB	09/02/16 08:25	
EPA 6010C	Bismuth	< 6.0	mg/kg	6.0	0.8		W636023	SMB	09/02/16 08:25	
EPA 6010C	Boron	< 4.0	mg/kg	4.0	0.5		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Cadmium**	0.39	mg/kg	0.20	0.06		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Calcium**	3380	mg/kg	10.0	3.5		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Chromium**	9.25	mg/kg	0.60	0.13		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Cobalt**	2.93	mg/kg	0.60	0.30		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Copper**	9.81	mg/kg	1.00	0.16		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Gallium**	2.1	mg/kg	2.0	0.4		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Iron**	12300	mg/kg	10.0	4.0		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Lanthanum**	14.3	mg/kg	0.50	0.32		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Lead**	16.2	mg/kg	0.8	0.3		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Lithium**	10.7	mg/kg	2.0	0.9		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Magnesium**	2520	mg/kg	20.0	8.7		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Manganese**	241	mg/kg	0.80	0.22		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Molybdenum**	1.61	mg/kg	0.80	0.13		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Nickel**	5.00	mg/kg	1.00	0.14		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Phosphorus**	842	mg/kg	5.0	1.1		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Potassium**	1480	mg/kg	50.0	13.0		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Scandium**	1.56	mg/kg	0.20	0.13		W636023	SMB	09/02/16 08:25	
EPA 6010C	Selenium	< 4.0	mg/kg	4.0	1.4		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Silver**	0.95	mg/kg	0.50	0.14		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Sodium**	137	mg/kg	50.0	4.7		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Strontium**	20.9	mg/kg	0.50	0.05		W636023	SMB	09/02/16 08:25	
EPA 6010C	Thallium	< 1.5	mg/kg	1.5	0.4		W636023	SMB	09/02/16 08:25	
EPA 6010C	Tin	< 5.0	mg/kg	5.0	0.4		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Titanium**	499	mg/kg	0.50	0.08		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Vanadium**	14.9	mg/kg	0.50	0.15		W636023	SMB	09/02/16 08:25	
EPA 6010C	**Zinc**	24.7	mg/kg	1.0	0.5		W636023	SMB	09/02/16 08:25	
EPA 7471B	**Mercury**	0.447	mg/kg	0.033	0.004		W635142	MWD	08/26/16 11:21	

Classical Chemistry Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
ASTM D-3682	**Silica (SiO2)**	14.6	%	1.00	0.22	2	W636152	SM	09/02/16 17:02	D2

TCLP Extraction Parameters

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 1311	**Final pH**	5.06	pH Units				W635088	ESB	08/30/16 09:15	
EPA 1311	**% Dry Solids**	58.0	%				W635088	ESB	08/30/16 09:15	

TCLP Leachates (Metals) Extracted: 08/30/16 09:15

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
EPA 6010C	**Arsenic**	0.061	mg/L Extract	0.050	0.008		W636112	SMB	09/02/16 07:26	
EPA 6010C	Barium	< 1.00	mg/L Extract	1.00	0.0010		W636112	SMB	09/02/16 07:26	
EPA 6010C	Cadmium	< 0.0100	mg/L Extract	0.0100	0.0009		W636112	SMB	09/02/16 07:26	
EPA 6010C	Chromium	< 0.0500	mg/L Extract	0.0500	0.0015		W636112	SMB	09/02/16 07:26	
EPA 6010C	Lead	< 0.0500	mg/L Extract	0.0500	0.0036		W636112	SMB	09/02/16 07:26	
EPA 6010C	Selenium	< 0.050	mg/L Extract	0.050	0.018		W636112	SMB	09/02/16 07:26	
EPA 6010C	Silver	< 0.0500	mg/L Extract	0.0500	0.0016		W636112	SMB	09/02/16 07:26	
EPA 7470A	Mercury	< 0.00020	mg/L Extract	0.00020	0.000053		W636175	MWD	09/01/16 11:38	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern

John Kern
Laboratory Director

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AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

Quality Control - BLANK Data

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
EPA 6010C	Aluminum	mg/kg	<8.0	4.9	8.0	W636023	02-Sep-16	
EPA 6010C	Antimony	mg/kg	<2.0	0.5	2.0	W636025	31-Aug-16	
EPA 6010C	Arsenic	mg/kg	<2.5	0.6	2.5	W636023	02-Sep-16	
EPA 6010C	Barium	mg/kg	<0.20	0.14	0.20	W636023	02-Sep-16	
EPA 6010C	Beryllium	mg/kg	<0.20	0.07	0.20	W636023	02-Sep-16	
EPA 6010C	Bismuth	mg/kg	<6.0	0.8	6.0	W636023	02-Sep-16	
EPA 6010C	Boron	mg/kg	<4.0	0.5	4.0	W636023	02-Sep-16	
EPA 6010C	Cadmium	mg/kg	<0.20	0.06	0.20	W636023	02-Sep-16	
EPA 6010C	Calcium	mg/kg	<10.0	3.5	10.0	W636023	02-Sep-16	
EPA 6010C	Chromium	mg/kg	<0.60	0.13	0.60	W636023	02-Sep-16	
EPA 6010C	Cobalt	mg/kg	<0.60	0.30	0.60	W636023	02-Sep-16	
EPA 6010C	Copper	mg/kg	<1.00	0.16	1.00	W636023	02-Sep-16	
EPA 6010C	Gallium	mg/kg	<2.0	0.4	2.0	W636023	02-Sep-16	
EPA 6010C	Iron	mg/kg	<10.0	4.0	10.0	W636023	02-Sep-16	
EPA 6010C	Lanthanum	mg/kg	<0.50	0.32	0.50	W636023	02-Sep-16	
EPA 6010C	Lead	mg/kg	<0.8	0.3	0.8	W636023	02-Sep-16	
EPA 6010C	Lithium	mg/kg	<2.0	0.9	2.0	W636023	02-Sep-16	
EPA 6010C	Magnesium	mg/kg	<20.0	8.7	20.0	W636023	02-Sep-16	
EPA 6010C	Manganese	mg/kg	<0.80	0.22	0.80	W636023	02-Sep-16	
EPA 6010C	Molybdenum	mg/kg	<0.80	0.13	0.80	W636023	02-Sep-16	
EPA 6010C	Nickel	mg/kg	<1.00	0.14	1.00	W636023	02-Sep-16	
EPA 6010C	Phosphorus	mg/kg	<5.0	1.1	5.0	W636023	02-Sep-16	
EPA 6010C	Potassium	mg/kg	<50.0	13.0	50.0	W636023	02-Sep-16	
EPA 6010C	Scandium	mg/kg	<0.20	0.13	0.20	W636023	02-Sep-16	
EPA 6010C	Selenium	mg/kg	<4.0	1.4	4.0	W636023	02-Sep-16	
EPA 6010C	Silver	mg/kg	<0.50	0.14	0.50	W636023	02-Sep-16	
EPA 6010C	Sodium	mg/kg	<50.0	4.7	50.0	W636023	02-Sep-16	
EPA 6010C	Strontium	mg/kg	<0.50	0.05	0.50	W636023	02-Sep-16	
EPA 6010C	Thallium	mg/kg	<1.5	0.4	1.5	W636023	02-Sep-16	
EPA 6010C	Tin	mg/kg	<5.0	0.4	5.0	W636023	02-Sep-16	
EPA 6010C	Titanium	mg/kg	<0.50	0.08	0.50	W636023	02-Sep-16	
EPA 6010C	Vanadium	mg/kg	<0.50	0.15	0.50	W636023	02-Sep-16	
EPA 6010C	Zinc	mg/kg	<1.0	0.5	1.0	W636023	02-Sep-16	
EPA 7471B	Mercury	mg/kg	<0.033	0.004	0.033	W635142	26-Aug-16	

Classical Chemistry Parameters

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
ASTM D-3682	Silica (SiO2)	%	<0.50	0.11	0.50	W636152	02-Sep-16	

TCLP Extraction Parameters

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
EPA 1311	Final pH	pH Units	4.90			W635088	30-Aug-16	
EPA 1311	% Dry Solids	%	0.00			W635088	30-Aug-16	

Quality Control - EXTRACTION BLANK Data

TCLP Leachates (Metals) Extracted: 08/30/16 09:15 Batch: W635088

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
EPA 6010C	Arsenic	mg/L Extract	<0.050	0.008	0.050	W636112	02-Sep-16	
EPA 6010C	Barium	mg/L Extract	<1.00	0.0010	1.00	W636112	02-Sep-16	
EPA 6010C	Cadmium	mg/L Extract	<0.0100	0.0009	0.0100	W636112	02-Sep-16	
EPA 6010C	Chromium	mg/L Extract	<0.0500	0.0015	0.0500	W636112	02-Sep-16	
EPA 6010C	Lead	mg/L Extract	<0.0500	0.0036	0.0500	W636112	02-Sep-16	
EPA 6010C	Selenium	mg/L Extract	<0.050	0.018	0.050	W636112	02-Sep-16	

Quality Control - EXTRACTION BLANK Data (Continued)

TCLP Leachates (Metals) Extracted: 08/30/16 09:15 Batch: W635088 (Continued)

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
EPA 6010C	Silver	mg/L Extract	<0.0500	0.0016	0.0500	W636112	02-Sep-16	
EPA 7470A	Mercury	mg/L Extract	<0.00020	0.000053	0.00020	W636175	01-Sep-16	

Quality Control - LABORATORY CONTROL SAMPLE Data

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods									
EPA 6010C	Aluminum	mg/kg	98.2	100	98.2	80 - 120	W636023	02-Sep-16	
EPA 6010C	Antimony	mg/kg	102	100	102	80 - 120	W636025	31-Aug-16	
EPA 6010C	Arsenic	mg/kg	94.9	100	94.9	80 - 120	W636023	02-Sep-16	
EPA 6010C	Barium	mg/kg	96.7	100	96.7	80 - 120	W636023	02-Sep-16	
EPA 6010C	Beryllium	mg/kg	99.3	100	99.3	80 - 120	W636023	02-Sep-16	
EPA 6010C	Bismuth	mg/kg	96.1	100	96.1	80 - 120	W636023	02-Sep-16	
EPA 6010C	Boron	mg/kg	89.1	100	89.1	80 - 120	W636023	02-Sep-16	
EPA 6010C	Cadmium	mg/kg	95.3	100	95.3	80 - 120	W636023	02-Sep-16	
EPA 6010C	Calcium	mg/kg	1900	2000	94.8	80 - 120	W636023	02-Sep-16	
EPA 6010C	Chromium	mg/kg	102	100	102	80 - 120	W636023	02-Sep-16	
EPA 6010C	Cobalt	mg/kg	98.5	100	98.5	80 - 120	W636023	02-Sep-16	
EPA 6010C	Copper	mg/kg	99.7	100	99.7	80 - 120	W636023	02-Sep-16	
EPA 6010C	Gallium	mg/kg	95.8	100	95.8	80 - 120	W636023	02-Sep-16	
EPA 6010C	Iron	mg/kg	937	1000	93.7	80 - 120	W636023	02-Sep-16	
EPA 6010C	Lanthanum	mg/kg	92.3	100	92.3	80 - 120	W636023	02-Sep-16	
EPA 6010C	Lead	mg/kg	97.0	100	97.0	80 - 120	W636023	02-Sep-16	
EPA 6010C	Lithium	mg/kg	97.4	100	97.4	80 - 120	W636023	02-Sep-16	
EPA 6010C	Magnesium	mg/kg	1870	2000	93.5	80 - 120	W636023	02-Sep-16	
EPA 6010C	Manganese	mg/kg	99.4	100	99.4	80 - 120	W636023	02-Sep-16	
EPA 6010C	Molybdenum	mg/kg	102	100	102	80 - 120	W636023	02-Sep-16	
EPA 6010C	Nickel	mg/kg	97.9	100	97.9	80 - 120	W636023	02-Sep-16	
EPA 6010C	Phosphorus	mg/kg	93.0	100	93.0	80 - 120	W636023	02-Sep-16	
EPA 6010C	Potassium	mg/kg	1910	2000	95.5	80 - 120	W636023	02-Sep-16	
EPA 6010C	Scandium	mg/kg	50.3	50.0	101	80 - 120	W636023	02-Sep-16	
EPA 6010C	Selenium	mg/kg	87.2	100	87.2	80 - 120	W636023	02-Sep-16	
EPA 6010C	Silver	mg/kg	4.88	5.00	97.5	80 - 120	W636023	02-Sep-16	
EPA 6010C	Sodium	mg/kg	1760	1900	92.5	80 - 120	W636023	02-Sep-16	
EPA 6010C	Strontium	mg/kg	99.2	100	99.2	80 - 120	W636023	02-Sep-16	
EPA 6010C	Thallium	mg/kg	96.8	100	96.8	80 - 120	W636023	02-Sep-16	
EPA 6010C	Tin	mg/kg	97.6	100	97.6	80 - 120	W636023	02-Sep-16	
EPA 6010C	Titanium	mg/kg	102	100	102	80 - 120	W636023	02-Sep-16	
EPA 6010C	Vanadium	mg/kg	102	100	102	80 - 120	W636023	02-Sep-16	
EPA 6010C	Zinc	mg/kg	96.5	100	96.5	80 - 120	W636023	02-Sep-16	
EPA 7471B	Mercury	mg/kg	0.830	0.833	99.6	80 - 120	W635142	26-Aug-16	
Classical Chemistry Parameters									
ASTM D-3682	Silica (SiO2)	%	2.47	2.36	105	80 - 120	W636152	02-Sep-16	
TCLP Leachates (Metals)									
EPA 6010C	Arsenic	mg/L Extract	1.04	1.00	104	80 - 120	W636112	02-Sep-16	
EPA 6010C	Barium	mg/L Extract	18.7	20.0	93.7	80 - 120	W636112	02-Sep-16	
EPA 6010C	Cadmium	mg/L Extract	0.200	0.200	100	80 - 120	W636112	02-Sep-16	
EPA 6010C	Chromium	mg/L Extract	0.930	1.00	93.0	80 - 120	W636112	02-Sep-16	
EPA 6010C	Lead	mg/L Extract	0.926	1.00	92.6	80 - 120	W636112	02-Sep-16	
EPA 6010C	Selenium	mg/L Extract	0.208	0.200	104	80 - 120	W636112	02-Sep-16	

Quality Control - LABORATORY CONTROL SAMPLE Data (Continued)

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
TCLP Leachates (Metals) (Continued)									
EPA 6010C	Silver	mg/L Extract	1.01	1.00	101	80 - 120	W636112	02-Sep-16	
EPA 7470A	Mercury	mg/L Extract	0.00530	0.00500	106	80 - 120	W636175	01-Sep-16	

Quality Control - MATRIX SPIKE Data

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	Aluminum	mg/kg	10200	7490	100	R > 4S	75 - 125	W636023	02-Sep-16	M1
EPA 6010C	Antimony	mg/kg	250	152	100	97.8	75 - 125	W636025	31-Aug-16	
EPA 6010C	Arsenic	mg/kg	1150	1090	100	R > 4S	75 - 125	W636023	02-Sep-16	M3
EPA 6010C	Barium	mg/kg	199	101	100	97.6	75 - 125	W636023	02-Sep-16	
EPA 6010C	Beryllium	mg/kg	102	1.09	100	101	75 - 125	W636023	02-Sep-16	
EPA 6010C	Bismuth	mg/kg	98.5	<6.0	100	98.5	75 - 125	W636023	02-Sep-16	
EPA 6010C	Boron	mg/kg	94.5	<4.0	100	91.9	75 - 125	W636023	02-Sep-16	
EPA 6010C	Cadmium	mg/kg	101	1.10	100	99.8	75 - 125	W636023	02-Sep-16	
EPA 6010C	Calcium	mg/kg	7090	5010	2000	104	75 - 125	W636023	02-Sep-16	
EPA 6010C	Chromium	mg/kg	113	8.93	100	104	75 - 125	W636023	02-Sep-16	
EPA 6010C	Cobalt	mg/kg	105	5.63	100	99.4	75 - 125	W636023	02-Sep-16	
EPA 6010C	Copper	mg/kg	119	13.7	100	105	75 - 125	W636023	02-Sep-16	
EPA 6010C	Gallium	mg/kg	103	2.1	100	101	75 - 125	W636023	02-Sep-16	
EPA 6010C	Iron	mg/kg	18700	18300	1000	R > 4S	75 - 125	W636023	02-Sep-16	M3
EPA 6010C	Lanthanum	mg/kg	123	20.4	100	102	75 - 125	W636023	02-Sep-16	
EPA 6010C	Lead	mg/kg	104	6.2	100	97.5	75 - 125	W636023	02-Sep-16	
EPA 6010C	Lithium	mg/kg	112	10.2	100	102	75 - 125	W636023	02-Sep-16	
EPA 6010C	Magnesium	mg/kg	5050	3080	2000	98.4	75 - 125	W636023	02-Sep-16	
EPA 6010C	Manganese	mg/kg	770	733	100	R > 4S	75 - 125	W636023	02-Sep-16	M3
EPA 6010C	Molybdenum	mg/kg	105	2.35	100	103	75 - 125	W636023	02-Sep-16	
EPA 6010C	Nickel	mg/kg	105	6.08	100	98.8	75 - 125	W636023	02-Sep-16	
EPA 6010C	Phosphorus	mg/kg	1740	1610	100	R > 4S	75 - 125	W636023	02-Sep-16	M3
EPA 6010C	Potassium	mg/kg	5130	2490	2000	132	75 - 125	W636023	02-Sep-16	M1
EPA 6010C	Scandium	mg/kg	53.6	1.86	50.0	103	75 - 125	W636023	02-Sep-16	
EPA 6010C	Selenium	mg/kg	92.7	<4.0	100	91.3	75 - 125	W636023	02-Sep-16	
EPA 6010C	Silver	mg/kg	5.98	0.97	5.00	100	75 - 125	W636023	02-Sep-16	
EPA 6010C	Sodium	mg/kg	1960	110	1900	97.2	75 - 125	W636023	02-Sep-16	
EPA 6010C	Strontium	mg/kg	129	27.0	100	102	75 - 125	W636023	02-Sep-16	
EPA 6010C	Thallium	mg/kg	96.9	<1.5	100	96.9	75 - 125	W636023	02-Sep-16	
EPA 6010C	Tin	mg/kg	99.1	<5.0	100	97.8	75 - 125	W636023	02-Sep-16	
EPA 6010C	Titanium	mg/kg	600	446	100	R > 4S	75 - 125	W636023	02-Sep-16	M3
EPA 6010C	Vanadium	mg/kg	122	16.3	100	106	75 - 125	W636023	02-Sep-16	
EPA 6010C	Zinc	mg/kg	133	41.0	100	92.2	75 - 125	W636023	02-Sep-16	
EPA 7471B	Mercury	mg/kg	9.90	4.45	0.333	R > 4S	75 - 125	W635142	26-Aug-16	D2,M3
Classical Chemistry Parameters										
ASTM D-3682	Silica (SiO2)	%	15.0	11.5	10.0	34.9	75 - 125	W636152	02-Sep-16	D2,M2
TCLP Leachates (Metals)										
EPA 6010C	Arsenic	mg/L Extract	1.21	0.180	1.00	103	75 - 125	W636112	02-Sep-16	
EPA 6010C	Barium	mg/L Extract	19.5	<1.00	20.0	94.2	75 - 125	W636112	02-Sep-16	
EPA 6010C	Cadmium	mg/L Extract	0.202	<0.0100	0.200	101	75 - 125	W636112	02-Sep-16	
EPA 6010C	Chromium	mg/L Extract	0.931	<0.0500	1.00	93.1	75 - 125	W636112	02-Sep-16	
EPA 6010C	Lead	mg/L Extract	0.917	<0.0500	1.00	91.7	75 - 125	W636112	02-Sep-16	
EPA 6010C	Selenium	mg/L Extract	0.207	<0.050	0.200	104	75 - 125	W636112	02-Sep-16	
EPA 6010C	Silver	mg/L Extract	1.00	<0.0500	1.00	100	75 - 125	W636112	02-Sep-16	

Quality Control - MATRIX SPIKE Data (Continued)

TCLP Leachates (Metals) (Continued)

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
EPA 7470A	Mercury	mg/L Extract	0.00101	<0.00020	0.00100	101	70 - 130	W636175	01-Sep-16	

Quality Control - MATRIX SPIKE DUPLICATE Data

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Units	MSD Result	Spike Result	Spike Level	%R	RPD	RPD Limit	Batch ID	Analyzed	Notes
EPA 6010C	Aluminum	mg/kg	11300	10200	100	R > 4S	10.5	20	W636023	02-Sep-16	M1
EPA 6010C	Antimony	mg/kg	262	250	100	110	4.6	20	W636025	31-Aug-16	
EPA 6010C	Arsenic	mg/kg	1310	1150	100	R > 4S	12.4	20	W636023	02-Sep-16	M3
EPA 6010C	Barium	mg/kg	224	199	100	123	11.9	20	W636023	02-Sep-16	
EPA 6010C	Beryllium	mg/kg	110	102	100	109	7.4	20	W636023	02-Sep-16	
EPA 6010C	Bismuth	mg/kg	105	98.5	100	105	6.6	20	W636023	02-Sep-16	
EPA 6010C	Boron	mg/kg	99.7	94.5	100	97.1	5.4	20	W636023	02-Sep-16	
EPA 6010C	Cadmium	mg/kg	107	101	100	106	6.3	20	W636023	02-Sep-16	
EPA 6010C	Calcium	mg/kg	7870	7090	2000	143	10.4	20	W636023	02-Sep-16	M1
EPA 6010C	Chromium	mg/kg	122	113	100	113	7.4	20	W636023	02-Sep-16	
EPA 6010C	Cobalt	mg/kg	112	105	100	106	6.6	20	W636023	02-Sep-16	
EPA 6010C	Copper	mg/kg	130	119	100	116	8.8	20	W636023	02-Sep-16	
EPA 6010C	Gallium	mg/kg	111	103	100	109	7.0	20	W636023	02-Sep-16	
EPA 6010C	Iron	mg/kg	21300	18700	1000	R > 4S	13.0	20	W636023	02-Sep-16	M3
EPA 6010C	Lanthanum	mg/kg	134	123	100	114	8.8	20	W636023	02-Sep-16	
EPA 6010C	Lead	mg/kg	111	104	100	104	6.3	20	W636023	02-Sep-16	
EPA 6010C	Lithium	mg/kg	121	112	100	111	7.9	20	W636023	02-Sep-16	
EPA 6010C	Magnesium	mg/kg	5530	5050	2000	122	9.1	20	W636023	02-Sep-16	
EPA 6010C	Manganese	mg/kg	931	770	100	R > 4S	19.0	20	W636023	02-Sep-16	M3
EPA 6010C	Molybdenum	mg/kg	112	105	100	110	6.6	20	W636023	02-Sep-16	
EPA 6010C	Nickel	mg/kg	112	105	100	106	6.4	20	W636023	02-Sep-16	
EPA 6010C	Phosphorus	mg/kg	1910	1740	100	R > 4S	9.0	20	W636023	02-Sep-16	M3
EPA 6010C	Potassium	mg/kg	5540	5130	2000	152	7.6	20	W636023	02-Sep-16	M1
EPA 6010C	Scandium	mg/kg	57.6	53.6	50.0	111	7.2	20	W636023	02-Sep-16	
EPA 6010C	Selenium	mg/kg	99.4	92.7	100	98.0	6.9	20	W636023	02-Sep-16	
EPA 6010C	Silver	mg/kg	7.06	5.98	5.00	122	16.6	20	W636023	02-Sep-16	
EPA 6010C	Sodium	mg/kg	2110	1960	1900	105	7.4	20	W636023	02-Sep-16	
EPA 6010C	Strontium	mg/kg	142	129	100	115	9.8	20	W636023	02-Sep-16	
EPA 6010C	Thallium	mg/kg	103	96.9	100	103	6.1	20	W636023	02-Sep-16	
EPA 6010C	Tin	mg/kg	106	99.1	100	105	6.7	20	W636023	02-Sep-16	
EPA 6010C	Titanium	mg/kg	666	600	100	R > 4S	10.5	20	W636023	02-Sep-16	M3
EPA 6010C	Vanadium	mg/kg	132	122	100	115	7.6	20	W636023	02-Sep-16	
EPA 6010C	Zinc	mg/kg	147	133	100	106	10.2	20	W636023	02-Sep-16	
EPA 7471B	Mercury	mg/kg	9.17	9.90	0.333	R > 4S	7.7	20	W635142	26-Aug-16	D2,M3

Classical Chemistry Parameters

Method	Analyte	Units	MSD Result	Spike Result	Spike Level	%R	RPD	RPD Limit	Batch ID	Analyzed	Notes
ASTM D-3682	Silica (SiO_2)	%	14.7	15.0	10.0	32.1	1.9	20	W636152	02-Sep-16	D2,M2

TCLP Leachates (Metals)

Method	Analyte	Units	MSD Result	Spike Result	Spike Level	%R	RPD	RPD Limit	Batch ID	Analyzed	Notes
EPA 6010C	Arsenic	mg/L Extract	1.21	1.21	1.00	103	0.1	20	W636112	02-Sep-16	
EPA 6010C	Barium	mg/L Extract	19.7	19.5	20.0	95.3	1.2	20	W636112	02-Sep-16	
EPA 6010C	Cadmium	mg/L Extract	0.201	0.202	0.200	101	0.3	20	W636112	02-Sep-16	
EPA 6010C	Chromium	mg/L Extract	0.953	0.931	1.00	95.3	2.3	20	W636112	02-Sep-16	
EPA 6010C	Lead	mg/L Extract	0.919	0.917	1.00	91.9	0.2	20	W636112	02-Sep-16	
EPA 6010C	Selenium	mg/L Extract	0.213	0.207	0.200	107	2.7	20	W636112	02-Sep-16	
EPA 6010C	Silver	mg/L Extract	1.03	1.00	1.00	103	2.9	20	W636112	02-Sep-16	
EPA 7470A	Mercury	mg/L Extract	0.00098	0.00101	0.00100	97.9	3.2	20	W636175	01-Sep-16	

MWH Global (AZ)
1620 W. Fountainhead Pkwy - Suite 202
Tempe, AZ 85282

Project Name: Stibnite Sediment 2016
Work Order: **W6H0498**
Reported: 06-Sep-16 10:59

Quality Control - POST DIGESTION SPIKE Data

Metals (Total) by EPA 6000/7000 Methods

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
EPA 6010C	Aluminum	mg/kg	7760	7490	80.0	337	75 - 125	W636023	02-Sep-16	M3
EPA 6010C	Calcium	mg/kg	5500	5010	400	123	75 - 125	W636023	02-Sep-16	
EPA 6010C	Potassium	mg/kg	3050	2490	500	112	75 - 125	W636023	02-Sep-16	

Notes and Definitions

D2	Sample required dilution due to high concentration of target analyte.
M1	Matrix spike recovery was high, but the LCS recovery was acceptable.
M2	Matrix spike recovery was low, but the LCS recovery was acceptable.
M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level. The LCS was acceptable.
LCS	Laboratory Control Sample (Blank Spike)
RPD	Relative Percent Difference
UDL	A result is less than the detection limit
R > 4S	% recovery not applicable, sample concentration more than four times greater than spike level
<RL	A result is less than the reporting limit
MRL	Method Reporting Limit
MDL	Method Detection Limit
N/A	Not Applicable

Macroinvertebrate Metal Concentration Results

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October 10, 2016

Analytical Report for Service Request No: K1609659

Jeremy Collyard
MWH Global, Inc
1620 West Fountainhead Parkway
Suite 202
Tempe, AZ 85282

RE: Metals in Sediment and Tissue 2016 / 10509465.2000

Dear Jeremy,

Enclosed are the results of the sample(s) submitted to our laboratory August 19, 2016
For your reference, these analyses have been assigned our service request number **K1609659.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at gregory.salata@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Gregory Salata

Gregory Salata, Ph.D.
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Table of Contents

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

ALS Environmental—Kelso Laboratory
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ALS ENVIRONMENTAL

Client:	MWH Global, Inc	**Service Request No.:**	K1609659
Project:	Metals in Sediment and Tissue 2016/ 10509465.2000	**Date Received:**	08/19/16
Sample Matrix:	Animal Tissue		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier IV validation deliverables including summary forms and all of the associated raw data for each of the analyses. When appropriate to the method, method blank results have been reported with each analytical test.

Sample Receipt

Thirteen animal tissue samples were received for analysis at ALS Environmental on 08/19/16. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at –20ºC upon receipt at the laboratory.

Lipids

No anomalies associated with the analysis of these samples were observed.

Total Metals

Matrix Spike Recovery Exceptions:
The control criteria for matrix spike recovery of Aluminum, Calcium, Iron, Magnesium, Manganese, Potassium, and Sodium for sample MWH-011 were not applicable. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

The matrix spike recovery of Antimony for sample MWH-011 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. The matrix spike outlier suggested a potential low bias in this matrix. No further corrective action was appropriate.

Relative Percent Difference Exceptions:
The Relative Percent Difference (RPD) for the replicate analysis of Iron in sample MWH-011 was outside the normal ALS control limits (23% RPD versus a control limit of 20%). The samples were homogenized, freeze dried, then ground prior to digestion, however this was not sufficient to achieve a completely uniform distribution of Iron in the tissue.

No other anomalies associated with the analysis of these samples were observed.

Approved by Gregory Salata

Chain of Custody

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001

SR# K1609659
COC Set____of____
COC#__________
Page 1 of 2

Project Name: Metals in Sediment/Tissues 2016
Project Number: 10509465.2000
Project Manager: Jeremy Collyard / Stephanie Theis
Company: MWH Global, Inc.
Address: 1620 W. Fountainhead Pkw, Ste 202 Tempe AZ 85282
Phone # 480-756-5315
email: jeremy.collyard@mwhglobal.com
Sampler Signature: Stephanie Theis
Sampler Printed Name: Stephanie Theis

CLIENT SAMPLE ID	LABID	SAMPLING Date	SAMPLING Time	Matrix	NUMBER OF CONTAINERS	14D	180D			365D	999D							Remarks
						Lipids / LIPIDS	6010C / Metals T	6020A / Metals T	7742 / Se T	1631app / Hg LL T	Frz Dry / Frz Dry	Homogen / Homogen	1	2	3	4	5	Invertebrates
1. MWH-007	839547	8/11/16	1900		1													
2. MWH-009	839558	8/9/16	1430		1													
3. MWH-01[illegible]	840103	8/10/16	1400															
4. MWH-012	840117	8/10/16	1740															
5. MWH-014	839553	8/11/16	1045															
6. MWH-016	839549	8/11/16	1645															
7. MWH-017	840107	8/9/16	1230															
8. MWH-029	840110	8/9/16	1700															
9. MWH-030	840116	8/13/16	1430															
10. MWH 069	839551	8/9/16	1515															

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

Invoice Information

P.O.#__________
Bill To:__________

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
_X_ Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other_____(Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature Jared Erickson	Signature	Signature	Signature	Signature	Signature
Printed Name Jared Erickson	Printed Name ALS	Printed Name	Printed Name	Printed Name	Printed Name
Firm MWH Global	Firm 8-19-16 9:30	Firm	Firm	Firm	Firm
Date/Time 8/18/16 10:00 AM	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

ALS Environmental

CHAIN OF CUSTODY
72297

001

SR# K1609659

COC Set____of____

COC#________

Page 1 of 1

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Project Name	Project Number:
Project Manager	
Company	
Address	
Phone #	email
Sampler Signature	Sampler Printed Name

CLIENT SAMPLE ID	LABID	SAMPLING Date	SAMPLING Time	Matrix	NUMBER OF CONTAINERS	14D Lipids / LIPIDS	180D 6010C / Metals T	180D 6020A / Metals T	180D 7742 / Se T	365D 1631app / Hg LL T	999D Frz Dry / Frz Dry	999D Homogen / Homogen	1	2	3	4	5	Remarks
																		Invertabrates
1. MWH-074	840119	8/13/16	1700															↓
2. MWH-075	839554	8/13/16	1200															
3. MWH-013	840118	8/10/16	1645															
4.																		
5.																		
6.																		
7.																		
8.																		
9.																		
10.																		

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.#________

Bill To:________

Turnaround Requirements

___ 24 hr.
___ 48 hr.
X 5 Day Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____(Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
	Cun Sugel				
Signature Jed Erickson	Signature C. Snyder	Signature	Signature	Signature	Signature
Printed Name Jed Erickson	Printed Name ACS	Printed Name	Printed Name	Printed Name	Printed Name
Firm MWH Global	Firm 8-14-16 9:30	Firm	Firm	Firm	Firm
Date/Time 8/14/16 10:00AM	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

ALS

PC Greg

Cooler Receipt and Preservation Form

Client MWH Global Service Request K16 09659

Received: 8-19-16 Opened: 8-14-16 By: ES Unloaded: 8-14-16 By: ES

1. Samples were received via? USPS [✓ Fed Ex] UPS DHL PDX Courier Hand Delivered
2. Samples were received in: (circle) [✓ Cooler] Box Envelope Other ______ NA
3. Were custody seals on coolers? NA Y [✓ N] If yes, how many and where? ______

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected. Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
1.2	1.0	1.1	0.4	-0.2	370	72297	7770 2420 4364	

4. Packing material: Inserts Baggies [✓ Bubble Wrap] Gel Packs [✓ Wet Ice] Dry Ice Sleeves ______
5. Were custody papers properly filled out (ink, signed, etc.)? NA [✓ Y] N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA [✓ Y] N
   If applicable, tissue samples were received: *Frozen* *Partially Thawed* [✓ *Thawed*]
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA [✓ Y] N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA [✓ Y] N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA [✓ Y] N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* [✓ NA] Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* [✓ NA] Y N
12. Was C12/Res negative? [✓ NA] Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: ______

7/25/16

Page ____ ***of*** ____

Total Solids

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dba ALS Environmental

Analytical Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	08/09/16 - 08/13/16
Sample Matrix:	Animal Tissue	**Date Received:**	08/19/16
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
MWH-007	K1609659-001	**17.6**	-	-	1	08/26/16 10:00	
MWH-009	K1609659-002	**6.57**	-	-	1	08/26/16 10:00	
MWH-011	K1609659-003	**17.0**	-	-	1	08/26/16 10:00	
MWH-012	K1609659-004	**16.5**	-	-	1	08/26/16 10:00	
MWH-014	K1609659-005	**14.1**	-	-	1	08/26/16 10:00	
MWH-016	K1609659-006	**14.4**	-	-	1	08/26/16 10:00	
MWH-017	K1609659-007	**15.8**	-	-	1	08/26/16 10:00	
MWH-029	K1609659-008	**16.4**	-	-	1	08/26/16 10:00	
MWH-030	K1609659-009	**19.3**	-	-	1	08/26/16 10:00	
MWH-069	K1609659-010	**18.0**	-	-	1	08/26/16 10:00	
MWH-074	K1609659-011	**10.7**	-	-	1	08/26/16 10:00	
MWH-075	K1609659-012	**15.7**	-	-	1	08/26/16 10:00	
MWH-013	K1609659-013	**15.3**	-	-	1	08/26/16 10:00	

LIPIDS

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ALS ENVIRONMENTAL

Analytical Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	8/9-13/2016
Sample Matrix:	Animal tissue	**Date Received:**	8/19/2016

Lipids, Total

Prep Method:	EPA 3541	Units:	PERCENT
Analysis Method:	NOAA	Basis:	Wet Weight
Test Notes:			

13 samples?

Sample Name	Lab Code	MRL	Date Extracted	Date Analyzed	Result	Result Notes
MWH-007	K1609659-001	0.03	9/22/2016	10/3/2016	1.6	
MWH-009	K1609659-002	0.03	9/22/2016	10/3/2016	0.95	
MWH-011	K1609659-003	0.03	9/22/2016	10/3/2016	0.63	
MWH-012	K1609659-004	0.03	9/22/2016	10/3/2016	0.53	
MWH-014	K1609659-005	0.03	9/22/2016	10/3/2016	0.35	
MWH-016	K1609659-006	0.03	9/22/2016	10/3/2016	0.99	
MWH-017	K1609659-007	0.03	9/22/2016	10/3/2016	1.6	
MWH-029	K1609659-008	0.03	9/22/2016	10/3/2016	1.6	
MWH-030	K1609659-009	0.03	9/22/2016	10/3/2016	2.6	
MWH-069	K1609659-010	0.03	9/22/2016	10/3/2016	1.8	
MWH-074	K1609659-011	0.03	9/22/2016	10/3/2016	1.6	
MWH-075	K1609659-012	0.03	9/22/2016	10/3/2016	1.3	
MWH-013	K1609659-013	0.03	9/22/2016	10/3/2016	1.4	
Method Blank	KWG1607862-4 MB	0.03	9/22/2016	10/3/2016	0.03	U

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QA/QC Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	N/A
Sample Matrix:	Animal tissue	**Date Received:**	N/A
		Date Extracted:	9/22/2016
		Date Analyzed:	10/3/2016

Triplicate Summary
Lipids, Total

Sample Name:	Batch QC	Units:	PERCENT
Lab Code:	K1609528-016 TRP	Basis:	Wet Weight
Test Notes:			

Analyte	**Prep Method**	**Analysis Method**	**MRL**	**Sample Result**	**Duplicate Sample Result**	**Triplicate Sample Result**	**Average**	**Percent Relative Standard Deviation**	**Result Notes**
Lipids, Total	EPA 3541	NOAA	0.03	1.1	1.2	1.3	1.2	10	

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	NA
Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	9/22/2016
		Date Analyzed:	10/3/2016

Laboratory Control Sample
Lipids, Total

Sample Name: KWG1607862-3 LCS

Units: PERCENT
Basis: Wet Weight

Test Notes:

Analyte	**Prep Method**	**Analysis Method**	**Spike Level Percent**	**Result**	**CAS Advisory Limits**	**Result Notes**
Lipids, Total	EPA 3541	NOAA	100	98	70-130	

Metals

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dba ALS Environmental

Analytical Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	08/11/16
Sample Matrix:	Animal tissue	**Date Received:**	08/19/16

Mercury, Total

Prep Method:	METHOD	Units:	ng/g
Analysis Method:	1631E	Basis:	Wet
Test Notes:			

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
MWH-007	K1609659-001	0.88	0.05	5	09/06/16	09/07/16	31.2	
MWH-009	K1609659-002	0.68	0.04	5	09/06/16	09/07/16	28.1	
MWH-011	K1609659-003	0.84	0.05	5	09/06/16	09/07/16	31.5	
MWH-012	K1609659-004	0.81	0.05	5	09/06/16	09/07/16	38.3	
MWH-014	K1609659-005	0.70	0.04	5	09/06/16	09/07/16	28.8	
MWH-016	K1609659-006	0.70	0.04	5	09/06/16	09/07/16	16.6	
MWH-017	K1609659-007	0.78	0.05	5	09/06/16	09/07/16	4.71	
MWH-029	K1609659-008	8.0	0.48	50	09/06/16	09/07/16	338	
MWH-030	K1609659-009	0.95	0.06	5	09/06/16	09/07/16	127	
MWH-069	K1609659-010	10	0.6	50	09/06/16	09/07/16	461	
MWH-074	K1609659-011	0.51	0.03	5	09/06/16	09/07/16	18.6	
MWH-075	K1609659-012	0.76	0.05	5	09/06/16	09/07/16	27.8	
MWH-013	K1609659-013	1.5	0.09	5	09/06/16	09/07/16	38.6	
Method Blank	K1609659-MB1	0.2	0.01	1	09/06/16	09/07/16	ND	
Method Blank	K1609659-MB2	0.2	0.01	1	09/06/16	09/07/16	ND	
Method Blank	K1609659-MB3	0.2	0.01	1	09/06/16	09/07/16	0.02	

ALS Group USA, Corp.

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Analytical Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	08/11/16
Sample Matrix:	Animal tissue	**Date Received:**	08/19/16

Mercury, Total

Prep Method:	METHOD	Units:	ng/g
Analysis Method:	1631E	Basis:	Dry
Test Notes:			

Sample Name	**Lab Code**	**MRL**	**MDL**	**Dilution Factor**	**Date Extracted**	**Date Analyzed**	**Result**	**Result Notes**
MWH-007	K1609659-001	5.0	0.3	5	09/06/16	09/07/16	177	
MWH-009	K1609659-002	10	0.6	5	09/06/16	09/07/16	427	
MWH-011	K1609659-003	5.0	0.3	5	09/06/16	09/07/16	185	
MWH-012	K1609659-004	4.9	0.3	5	09/06/16	09/07/16	232	
MWH-014	K1609659-005	5.0	0.3	5	09/06/16	09/07/16	204	
MWH-016	K1609659-006	4.9	0.3	5	09/06/16	09/07/16	115	
MWH-017	K1609659-007	5.0	0.3	5	09/06/16	09/07/16	29.8	
MWH-029	K1609659-008	49	2.9	50	09/06/16	09/07/16	2060	
MWH-030	K1609659-009	4.9	0.3	5	09/06/16	09/07/16	656	
MWH-069	K1609659-010	57	3.4	50	09/06/16	09/07/16	2560	
MWH-074	K1609659-011	4.8	0.3	5	09/06/16	09/07/16	174	
MWH-075	K1609659-012	4.9	0.3	5	09/06/16	09/07/16	177	
MWH-013	K1609659-013	10	0.6	5	09/06/16	09/07/16	252	
Method Blank	K1609659-MB1	1.0	0.06	1	09/06/16	09/07/16	ND	
Method Blank	K1609659-MB2	1.0	0.06	1	09/06/16	09/07/16	ND	
Method Blank	K1609659-MB3	1.0	0.06	1	09/06/16	09/07/16	0.15	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	09/06/16
		Date Analyzed:	09/07/16

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Batch QC		Units:	ng/g
Lab Code:	K1607170-002MS,	K1607170-002MSD	Basis:	Dry
Test Notes:				

									Percent Recovery				
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**Spike Level MS**	**Spike Level DMS**	**Sample Result**	**Spike Result MS**	**Spike Result DMS**	**MS**	**DMS**	**ALS Acceptance Limits**	**Relative Percent Difference**	**Result Notes**
Mercury	METHOD	1631E	4.9	248	247	132	406	392	110	105	70-130	4	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	09/07/16

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name:	Ongoing Precision and Recovery (Initial)	Units:	ng/g
		Basis:	NA

Test Notes:

Analyte	**Prep Method**	**Analysis Method**	**True Value**	**Result**	**Percent Recovery**	**ALS Percent Recovery Acceptance Limits**	**Result Notes**
Mercury	METHOD	1631E	5.00	4.93	99	70-130	

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	09/07/16

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name:	Ongoing Precision and Recovery (Final)	Units:	ng/g
		Basis:	NA

Test Notes:

Analyte	**Prep Method**	**Analysis Method**	**True Value**	**Result**	**Percent Recovery**	**ALS Percent Recovery Acceptance Limits**	**Result Notes**
Mercury	METHOD	1631E	5.00	4.51	90	70-130	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	09/06/16
		Date Analyzed:	09/07/16

Quality Control Sample (QCS) Summary
Total Metals

Sample Name:	Quality Control Sample	Units:	ng/g
Lab Code:		Basis:	Dry
Test Notes:			

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	292	298	102	70-130	

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/11/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: MWH-007 **Lab Code:** K1609659-001

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.34	0.03	5.0	09/01/16	09/07/16	102		
Antimony	6020A	0.0086	0.0003	5.0	09/01/16	09/07/16	4.78		N
Arsenic	6020A	0.086	0.003	5.0	09/01/16	09/07/16	58.3		
Barium	6020A	0.0086	0.0009	5.0	09/01/16	09/07/16	5.6		
Beryllium	6020A	0.0034	0.0005	5.0	09/01/16	09/07/16	0.0161		
Cadmium	6020A	0.0034	0.0003	5.0	09/01/16	09/07/16	0.0247		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	156		
Chromium	6020A	0.034	0.003	5.0	09/01/16	09/07/16	0.167		
Cobalt	6020A	0.0034	0.0005	5.0	09/01/16	09/07/16	0.331		
Copper	6020A	0.017	0.003	5.0	09/01/16	09/07/16	5.44		
Iron	6010C	0.34	0.17	1.0	09/01/16	09/27/16	615		*
Lead	6020A	0.0034	0.00009	5.0	09/01/16	09/07/16	0.178		
Magnesium	6010C	0.17	0.10	1.0	09/01/16	09/27/16	194		
Manganese	6010C	0.034	0.005	1.0	09/01/16	09/27/16	125		
Nickel	6020A	0.034	0.003	5.0	09/01/16	09/07/16	0.236		
Potassium	6010C	3.4	1.6	1.0	09/01/16	09/27/16	1830		
Selenium	6020A	0.17	0.03	5.0	09/01/16	09/07/16	0.60		
Silver	6020A	0.0034	0.0010	5.0	09/01/16	09/07/16	0.0190		
Sodium	6010C	3.4	0.3	1.0	09/01/16	09/27/16	678		
Thallium	6020A	0.0034	0.00015	5.0	09/01/16	09/07/16	0.0026	J	
Vanadium	6020A	0.034	0.001	5.0	09/01/16	09/07/16	0.316		
Zinc	6020A	0.086	0.010	5.0	09/01/16	09/07/16	27.6		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: MWH-009 **Lab Code:** K1609659-002

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.13	0.01	5.0	09/01/16	09/07/16	39.0		
Antimony	6020A	0.0032	0.0001	5.0	09/01/16	09/07/16	0.529		N
Arsenic	6020A	0.032	0.001	5.0	09/01/16	09/07/16	6.60		
Barium	6020A	0.0032	0.0003	5.0	09/01/16	09/07/16	1.1		
Beryllium	6020A	0.0013	0.0002	5.0	09/01/16	09/07/16	0.0061		
Cadmium	6020A	0.0013	0.0001	5.0	09/01/16	09/07/16	0.0212		
Calcium	6010C	0.1	0.1	1.0	09/01/16	09/27/16	101		
Chromium	6020A	0.013	0.001	5.0	09/01/16	09/07/16	0.100		
Cobalt	6020A	0.0013	0.0002	5.0	09/01/16	09/07/16	0.187		
Copper	6020A	0.006	0.001	5.0	09/01/16	09/07/16	1.39		
Iron	6010C	0.13	0.06	1.0	09/01/16	09/27/16	105		*
Lead	6020A	0.0013	0.00003	5.0	09/01/16	09/07/16	0.0522		
Magnesium	6010C	0.06	0.04	1.0	09/01/16	09/27/16	89.1		
Manganese	6010C	0.013	0.002	1.0	09/01/16	09/27/16	24.5		
Nickel	6020A	0.013	0.001	5.0	09/01/16	09/07/16	0.105		
Potassium	6010C	1.3	0.6	1.0	09/01/16	09/27/16	421		
Selenium	6020A	0.06	0.01	5.0	09/01/16	09/07/16	0.22		
Silver	6020A	0.0013	0.0004	5.0	09/01/16	09/07/16	0.0080		
Sodium	6010C	1.3	0.1	1.0	09/01/16	09/27/16	204		
Thallium	6020A	0.0013	0.00006	5.0	09/01/16	09/07/16	0.0043		
Vanadium	6020A	0.013	0.000	5.0	09/01/16	09/07/16	0.071		
Zinc	6020A	0.032	0.004	5.0	09/01/16	09/07/16	15.4		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/10/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-011** **Lab Code:** **K1609659-003**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.34	0.03	5.0	09/01/16	09/07/16	150		
Antimony	6020A	0.0085	0.0003	5.0	09/01/16	09/07/16	1.08		N
Arsenic	6020A	0.085	0.003	5.0	09/01/16	09/07/16	9.82		
Barium	6020A	0.0085	0.0008	5.0	09/01/16	09/07/16	3.5		
Beryllium	6020A	0.0034	0.0005	5.0	09/01/16	09/07/16	0.0112		
Cadmium	6020A	0.0034	0.0003	5.0	09/01/16	09/07/16	0.0575		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	308		
Chromium	6020A	0.034	0.003	5.0	09/01/16	09/07/16	0.263		
Cobalt	6020A	0.0034	0.0005	5.0	09/01/16	09/07/16	0.393		
Copper	6020A	0.017	0.003	5.0	09/01/16	09/07/16	2.61		
Iron	6010C	0.34	0.17	1.0	09/01/16	09/27/16	361		*
Lead	6020A	0.0034	0.00008	5.0	09/01/16	09/07/16	0.0808		
Magnesium	6010C	0.17	0.10	1.0	09/01/16	09/27/16	256		
Manganese	6010C	0.034	0.005	1.0	09/01/16	09/27/16	52.0		
Nickel	6020A	0.034	0.003	5.0	09/01/16	09/07/16	0.262		
Potassium	6010C	3.4	1.5	1.0	09/01/16	09/27/16	1400		
Selenium	6020A	0.17	0.03	5.0	09/01/16	09/07/16	0.55		
Silver	6020A	0.0034	0.0010	5.0	09/01/16	09/07/16	0.0157		
Sodium	6010C	3.4	0.3	1.0	09/01/16	09/27/16	778		
Thallium	6020A	0.0034	0.00015	5.0	09/01/16	09/07/16	0.0043		
Vanadium	6020A	0.034	0.001	5.0	09/01/16	09/07/16	0.304		
Zinc	6020A	0.085	0.010	5.0	09/01/16	09/07/16	26.7		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/10/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-012** **Lab Code:** **K1609659-004**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.32	0.03	5.0	09/01/16	09/07/16	114		
Antimony	6020A	0.0080	0.0003	5.0	09/01/16	09/07/16	2.19		N
Arsenic	6020A	0.080	0.003	5.0	09/01/16	09/07/16	6.30		
Barium	6020A	0.0080	0.0008	5.0	09/01/16	09/07/16	5.7		
Beryllium	6020A	0.0032	0.0005	5.0	09/01/16	09/07/16	0.0091		
Cadmium	6020A	0.0032	0.0003	5.0	09/01/16	09/07/16	0.0499		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	196		
Chromium	6020A	0.032	0.003	5.0	09/01/16	09/07/16	0.154		
Cobalt	6020A	0.0032	0.0005	5.0	09/01/16	09/07/16	0.296		
Copper	6020A	0.016	0.003	5.0	09/01/16	09/07/16	2.53		
Iron	6010C	0.32	0.16	1.0	09/01/16	09/27/16	284		*
Lead	6020A	0.0032	0.00008	5.0	09/01/16	09/07/16	0.0913		
Magnesium	6010C	0.16	0.10	1.0	09/01/16	09/27/16	204		
Manganese	6010C	0.032	0.005	1.0	09/01/16	09/27/16	55.3		
Nickel	6020A	0.032	0.003	5.0	09/01/16	09/07/16	0.172		
Potassium	6010C	3.2	1.4	1.0	09/01/16	09/27/16	1420		
Selenium	6020A	0.16	0.03	5.0	09/01/16	09/07/16	0.44		
Silver	6020A	0.0032	0.0010	5.0	09/01/16	09/07/16	0.0208		
Sodium	6010C	3.2	0.3	1.0	09/01/16	09/27/16	692		
Thallium	6020A	0.0032	0.00014	5.0	09/01/16	09/07/16	0.0038		
Vanadium	6020A	0.032	0.001	5.0	09/01/16	09/07/16	0.236		
Zinc	6020A	0.080	0.010	5.0	09/01/16	09/07/16	29.9		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/11/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-014** **Lab Code:** **K1609659-005**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.28	0.03	5.0	09/01/16	09/07/16	120		
Antimony	6020A	0.0070	0.0003	5.0	09/01/16	09/07/16	0.260		N
Arsenic	6020A	0.070	0.003	5.0	09/01/16	09/07/16	10.1		
Barium	6020A	0.0070	0.0007	5.0	09/01/16	09/07/16	2.9		
Beryllium	6020A	0.0028	0.0004	5.0	09/01/16	09/07/16	0.0082		
Cadmium	6020A	0.0028	0.0003	5.0	09/01/16	09/07/16	0.0344		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	167		
Chromium	6020A	0.028	0.003	5.0	09/01/16	09/07/16	0.183		
Cobalt	6020A	0.0028	0.0004	5.0	09/01/16	09/07/16	0.307		
Copper	6020A	0.014	0.003	5.0	09/01/16	09/07/16	2.27		
Iron	6010C	0.28	0.14	1.0	09/01/16	09/27/16	348		*
Lead	6020A	0.0028	0.00007	5.0	09/01/16	09/07/16	0.0661		
Magnesium	6010C	0.14	0.08	1.0	09/01/16	09/27/16	168		
Manganese	6010C	0.028	0.004	1.0	09/01/16	09/27/16	54.5		
Nickel	6020A	0.028	0.003	5.0	09/01/16	09/07/16	0.223		
Potassium	6010C	2.8	1.3	1.0	09/01/16	09/27/16	1260		
Selenium	6020A	0.14	0.03	5.0	09/01/16	09/07/16	0.51		
Silver	6020A	0.0028	0.0008	5.0	09/01/16	09/07/16	0.0100		
Sodium	6010C	2.8	0.3	1.0	09/01/16	09/27/16	688		
Thallium	6020A	0.0028	0.00013	5.0	09/01/16	09/07/16	0.0030		
Vanadium	6020A	0.028	0.001	5.0	09/01/16	09/07/16	0.251		
Zinc	6020A	0.070	0.008	5.0	09/01/16	09/07/16	18.7		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/11/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-016** **Lab Code:** **K1609659-006**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.27	0.03	5.0	09/01/16	09/07/16	113		
Antimony	6020A	0.0067	0.0003	5.0	09/01/16	09/07/16	0.0342		N
Arsenic	6020A	0.067	0.003	5.0	09/01/16	09/07/16	0.935		
Barium	6020A	0.0067	0.0007	5.0	09/01/16	09/07/16	9.1		
Beryllium	6020A	0.0027	0.0004	5.0	09/01/16	09/07/16	0.0078		
Cadmium	6020A	0.0027	0.0003	5.0	09/01/16	09/07/16	0.0616		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	207		
Chromium	6020A	0.027	0.003	5.0	09/01/16	09/07/16	0.137		
Cobalt	6020A	0.0027	0.0004	5.0	09/01/16	09/07/16	0.283		
Copper	6020A	0.013	0.003	5.0	09/01/16	09/07/16	1.65		
Iron	6010C	0.27	0.13	1.0	09/01/16	09/27/16	128		*
Lead	6020A	0.0027	0.00007	5.0	09/01/16	09/07/16	0.0435		
Magnesium	6010C	0.13	0.08	1.0	09/01/16	09/27/16	173		
Manganese	6010C	0.027	0.004	1.0	09/01/16	09/27/16	19.6		
Nickel	6020A	0.027	0.003	5.0	09/01/16	09/07/16	0.173		
Potassium	6010C	2.7	1.2	1.0	09/01/16	09/27/16	1280		
Selenium	6020A	0.13	0.03	5.0	09/01/16	09/07/16	0.35		
Silver	6020A	0.0027	0.0008	5.0	09/01/16	09/07/16	0.0118		
Sodium	6010C	2.7	0.3	1.0	09/01/16	09/27/16	719		
Thallium	6020A	0.0027	0.00012	5.0	09/01/16	09/07/16	0.0019	J	
Vanadium	6020A	0.027	0.001	5.0	09/01/16	09/07/16	0.179		
Zinc	6020A	0.067	0.008	5.0	09/01/16	09/07/16	24.6		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-017** **Lab Code:** **K1609659-007**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.31	0.03	5.0	09/01/16	09/07/16	120		
Antimony	6020A	0.0079	0.0003	5.0	09/01/16	09/07/16	0.0103		N
Arsenic	6020A	0.079	0.003	5.0	09/01/16	09/07/16	0.691		
Barium	6020A	0.0079	0.0008	5.0	09/01/16	09/07/16	1.1		
Beryllium	6020A	0.0031	0.0005	5.0	09/01/16	09/07/16	0.0088		
Cadmium	6020A	0.0031	0.0003	5.0	09/01/16	09/07/16	0.163		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	517		
Chromium	6020A	0.031	0.003	5.0	09/01/16	09/07/16	0.440		
Cobalt	6020A	0.0031	0.0005	5.0	09/01/16	09/07/16	0.163		
Copper	6020A	0.016	0.003	5.0	09/01/16	09/07/16	3.38		
Iron	6010C	0.31	0.16	1.0	09/01/16	09/27/16	146		*
Lead	6020A	0.0031	0.00008	5.0	09/01/16	09/07/16	0.0340		
Magnesium	6010C	0.16	0.09	1.0	09/01/16	09/27/16	271		
Manganese	6010C	0.031	0.005	1.0	09/01/16	09/27/16	8.07		
Nickel	6020A	0.031	0.003	5.0	09/01/16	09/07/16	0.219		
Potassium	6010C	3.1	1.4	1.0	09/01/16	09/27/16	1290		
Selenium	6020A	0.16	0.03	5.0	09/01/16	09/07/16	0.35		
Silver	6020A	0.0031	0.0009	5.0	09/01/16	09/07/16	0.0417		
Sodium	6010C	3.1	0.3	1.0	09/01/16	09/27/16	695		
Thallium	6020A	0.0031	0.00014	5.0	09/01/16	09/07/16	0.0015	J	
Vanadium	6020A	0.031	0.001	5.0	09/01/16	09/07/16	0.246		
Zinc	6020A	0.079	0.009	5.0	09/01/16	09/07/16	24.6		

Comments:

Metals
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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-029** **Lab Code:** **K1609659-008**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.32	0.03	5.0	09/01/16	09/07/16	93.5		
Antimony	6020A	0.0080	0.0003	5.0	09/01/16	09/07/16	0.0642		N
Arsenic	6020A	0.080	0.003	5.0	09/01/16	09/07/16	1.53		
Barium	6020A	0.0080	0.0008	5.0	09/01/16	09/07/16	1.3		
Beryllium	6020A	0.0032	0.0005	5.0	09/01/16	09/07/16	0.0133		
Cadmium	6020A	0.0032	0.0003	5.0	09/01/16	09/07/16	0.0711		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	237		
Chromium	6020A	0.032	0.003	5.0	09/01/16	09/07/16	0.179		
Cobalt	6020A	0.0032	0.0005	5.0	09/01/16	09/07/16	0.368		
Copper	6020A	0.016	0.003	5.0	09/01/16	09/07/16	2.22		
Iron	6010C	0.32	0.16	1.0	09/01/16	09/27/16	95.9		*
Lead	6020A	0.0032	0.00008	5.0	09/01/16	09/07/16	0.0507		
Magnesium	6010C	0.16	0.10	1.0	09/01/16	09/27/16	216		
Manganese	6010C	0.032	0.005	1.0	09/01/16	09/27/16	9.74		
Nickel	6020A	0.032	0.003	5.0	09/01/16	09/07/16	0.366		
Potassium	6010C	3.2	1.4	1.0	09/01/16	09/27/16	1280		
Selenium	6020A	0.16	0.03	5.0	09/01/16	09/07/16	0.42		
Silver	6020A	0.0032	0.0010	5.0	09/01/16	09/07/16	0.0115		
Sodium	6010C	3.2	0.3	1.0	09/01/16	09/27/16	608		
Thallium	6020A	0.0032	0.00014	5.0	09/01/16	09/07/16	0.0309		
Vanadium	6020A	0.032	0.001	5.0	09/01/16	09/07/16	0.113		
Zinc	6020A	0.080	0.010	5.0	09/01/16	09/07/16	24.7		

Comments:

Metals
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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/13/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-030** **Lab Code:** **K1609659-009**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.38	0.04	5.0	09/01/16	09/07/16	156		
Antimony	6020A	0.0095	0.0004	5.0	09/01/16	09/07/16	4.12		N
Arsenic	6020A	0.095	0.004	5.0	09/01/16	09/07/16	110		
Barium	6020A	0.0095	0.0009	5.0	09/01/16	09/07/16	10.6		
Beryllium	6020A	0.0038	0.0006	5.0	09/01/16	09/07/16	0.0192		
Cadmium	6020A	0.0038	0.0004	5.0	09/01/16	09/07/16	0.0227		
Calcium	6010C	0.4	0.4	1.0	09/01/16	09/27/16	309		
Chromium	6020A	0.038	0.004	5.0	09/01/16	09/07/16	0.193		
Cobalt	6020A	0.0038	0.0006	5.0	09/01/16	09/07/16	0.423		
Copper	6020A	0.019	0.004	5.0	09/01/16	09/07/16	4.65		
Iron	6010C	0.38	0.19	1.0	09/01/16	09/27/16	787		*
Lead	6020A	0.0038	0.00009	5.0	09/01/16	09/07/16	0.163		
Magnesium	6010C	0.19	0.11	1.0	09/01/16	09/27/16	246		
Manganese	6010C	0.038	0.006	1.0	09/01/16	09/27/16	203		
Nickel	6020A	0.038	0.004	5.0	09/01/16	09/07/16	0.223		
Potassium	6010C	3.8	1.7	1.0	09/01/16	09/27/16	1650		
Selenium	6020A	0.19	0.04	5.0	09/01/16	09/07/16	0.63		
Silver	6020A	0.0038	0.0011	5.0	09/01/16	09/07/16	0.0468		
Sodium	6010C	3.8	0.4	1.0	09/01/16	09/27/16	836		
Thallium	6020A	0.0038	0.00017	5.0	09/01/16	09/07/16	0.0068		
Vanadium	6020A	0.038	0.001	5.0	09/01/16	09/07/16	0.371		
Zinc	6020A	0.095	0.011	5.0	09/01/16	09/07/16	28.3		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-069** **Lab Code:** **K1609659-010**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.36	0.04	5.0	09/01/16	09/07/16	150		
Antimony	6020A	0.0089	0.0004	5.0	09/01/16	09/07/16	0.199		N
Arsenic	6020A	0.089	0.004	5.0	09/01/16	09/07/16	4.33		
Barium	6020A	0.0089	0.0009	5.0	09/01/16	09/07/16	1.9		
Beryllium	6020A	0.0035	0.0005	5.0	09/01/16	09/07/16	0.0184		
Cadmium	6020A	0.0035	0.0004	5.0	09/01/16	09/07/16	0.0936		
Calcium	6010C	0.4	0.4	1.0	09/01/16	09/27/16	254		
Chromium	6020A	0.035	0.004	5.0	09/01/16	09/07/16	0.232		
Cobalt	6020A	0.0035	0.0005	5.0	09/01/16	09/07/16	0.592		
Copper	6020A	0.018	0.004	5.0	09/01/16	09/07/16	2.97		
Iron	6010C	0.36	0.18	1.0	09/01/16	09/27/16	162		*
Lead	6020A	0.0036	0.00009	5.0	09/01/16	09/07/16	0.0869		
Magnesium	6010C	0.18	0.11	1.0	09/01/16	09/27/16	261		
Manganese	6010C	0.035	0.005	1.0	09/01/16	09/27/16	17.8		
Nickel	6020A	0.035	0.004	5.0	09/01/16	09/07/16	0.502		
Potassium	6010C	3.6	1.6	1.0	09/01/16	09/27/16	1500		
Selenium	6020A	0.18	0.04	5.0	09/01/16	09/07/16	0.37		
Silver	6020A	0.0035	0.0011	5.0	09/01/16	09/07/16	0.0123		
Sodium	6010C	3.6	0.4	1.0	09/01/16	09/27/16	652		
Thallium	6020A	0.0036	0.00016	5.0	09/01/16	09/07/16	0.0403		
Vanadium	6020A	0.035	0.001	5.0	09/01/16	09/07/16	0.170		
Zinc	6020A	0.089	0.011	5.0	09/01/16	09/07/16	28.0		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/13/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-074** **Lab Code:** **K1609659-011**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.21	0.02	5.0	09/01/16	09/07/16	43.9		
Antimony	6020A	0.0052	0.0002	5.0	09/01/16	09/07/16	0.714		N
Arsenic	6020A	0.052	0.002	5.0	09/01/16	09/07/16	3.12		
Barium	6020A	0.0052	0.0005	5.0	09/01/16	09/07/16	0.901		
Beryllium	6020A	0.0021	0.0003	5.0	09/01/16	09/07/16	0.0060		
Cadmium	6020A	0.0021	0.0002	5.0	09/01/16	09/07/16	0.0338		
Calcium	6010C	0.2	0.2	1.0	09/01/16	09/27/16	148		
Chromium	6020A	0.021	0.002	5.0	09/01/16	09/07/16	0.078		
Cobalt	6020A	0.0021	0.0003	5.0	09/01/16	09/07/16	0.359		
Copper	6020A	0.010	0.002	5.0	09/01/16	09/07/16	2.01		
Iron	6010C	0.21	0.11	1.0	09/01/16	09/27/16	93.8		*
Lead	6020A	0.0021	0.00005	5.0	09/01/16	09/07/16	0.0411		
Magnesium	6010C	0.11	0.06	1.0	09/01/16	09/27/16	145		
Manganese	6010C	0.021	0.003	1.0	09/01/16	09/27/16	24.0		
Nickel	6020A	0.021	0.002	5.0	09/01/16	09/07/16	0.140		
Potassium	6010C	2.1	0.9	1.0	09/01/16	09/27/16	787		
Selenium	6020A	0.11	0.02	5.0	09/01/16	09/07/16	0.46		
Silver	6020A	0.0021	0.0006	5.0	09/01/16	09/07/16	0.0100		
Sodium	6010C	2.1	0.2	1.0	09/01/16	09/27/16	349		
Thallium	6020A	0.0021	0.00009	5.0	09/01/16	09/07/16	0.0034		
Vanadium	6020A	0.021	0.001	5.0	09/01/16	09/07/16	0.070		
Zinc	6020A	0.052	0.006	5.0	09/01/16	09/07/16	16.8		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/13/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-075** **Lab Code:** **K1609659-012**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.31	0.03	5.0	09/01/16	09/07/16	81.2		
Antimony	6020A	0.0077	0.0003	5.0	09/01/16	09/07/16	0.157		N
Arsenic	6020A	0.077	0.003	5.0	09/01/16	09/07/16	8.71		
Barium	6020A	0.0077	0.0008	5.0	09/01/16	09/07/16	2.3		
Beryllium	6020A	0.0031	0.0005	5.0	09/01/16	09/07/16	0.0061		
Cadmium	6020A	0.0031	0.0003	5.0	09/01/16	09/07/16	0.0396		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	173		
Chromium	6020A	0.031	0.003	5.0	09/01/16	09/07/16	0.219		
Cobalt	6020A	0.0031	0.0005	5.0	09/01/16	09/07/16	0.191		
Copper	6020A	0.015	0.003	5.0	09/01/16	09/07/16	1.90		
Iron	6010C	0.31	0.16	1.0	09/01/16	09/27/16	303		*
Lead	6020A	0.0031	0.00008	5.0	09/01/16	09/07/16	0.0666		
Magnesium	6010C	0.16	0.09	1.0	09/01/16	09/27/16	163		
Manganese	6010C	0.031	0.005	1.0	09/01/16	09/27/16	55.7		
Nickel	6020A	0.031	0.003	5.0	09/01/16	09/07/16	0.184		
Potassium	6010C	3.1	1.4	1.0	09/01/16	09/27/16	1260		
Selenium	6020A	0.16	0.03	5.0	09/01/16	09/07/16	0.47		
Silver	6020A	0.0031	0.0009	5.0	09/01/16	09/07/16	0.0111		
Sodium	6010C	3.1	0.3	1.0	09/01/16	09/27/16	654		
Thallium	6020A	0.0031	0.00014	5.0	09/01/16	09/07/16	0.0030	J	
Vanadium	6020A	0.031	0.001	5.0	09/01/16	09/07/16	0.185		
Zinc	6020A	0.077	0.009	5.0	09/01/16	09/07/16	20.2		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/10/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **MWH-013** **Lab Code:** **K1609659-013**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.30	0.03	5.0	09/01/16	09/07/16	119		
Antimony	6020A	0.0075	0.0003	5.0	09/01/16	09/07/16	0.0886		N
Arsenic	6020A	0.075	0.003	5.0	09/01/16	09/07/16	1.44		
Barium	6020A	0.0075	0.0008	5.0	09/01/16	09/07/16	7.5		
Beryllium	6020A	0.0030	0.0005	5.0	09/01/16	09/07/16	0.0122		
Cadmium	6020A	0.0030	0.0003	5.0	09/01/16	09/07/16	0.132		
Calcium	6010C	0.3	0.3	1.0	09/01/16	09/27/16	247		
Chromium	6020A	0.030	0.003	5.0	09/01/16	09/07/16	0.199		
Cobalt	6020A	0.0030	0.0005	5.0	09/01/16	09/07/16	0.412		
Copper	6020A	0.015	0.003	5.0	09/01/16	09/07/16	2.12		
Iron	6010C	0.30	0.15	1.0	09/01/16	09/27/16	153		*
Lead	6020A	0.0030	0.00008	5.0	09/01/16	09/07/16	0.0784		
Magnesium	6010C	0.15	0.09	1.0	09/01/16	09/27/16	225		
Manganese	6010C	0.030	0.005	1.0	09/01/16	09/27/16	20.8		
Nickel	6020A	0.030	0.003	5.0	09/01/16	09/07/16	0.134		
Potassium	6010C	3.0	1.4	1.0	09/01/16	09/27/16	1350		
Selenium	6020A	0.15	0.03	5.0	09/01/16	09/07/16	0.15	J	
Silver	6020A	0.0030	0.0009	5.0	09/01/16	09/07/16	0.0159		
Sodium	6010C	3.0	0.3	1.0	09/01/16	09/27/16	747		
Thallium	6020A	0.0030	0.00014	5.0	09/01/16	09/07/16	0.0053		
Vanadium	6020A	0.030	0.001	5.0	09/01/16	09/07/16	0.228		
Zinc	6020A	0.075	0.009	5.0	09/01/16	09/07/16	59.4		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	WET

Sample Name: **Method Blank** **Lab Code:** **KQ1610520-01**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	0.20	0.02	5.0	09/01/16	09/07/16	0.02	U	
Antimony	6020A	0.0050	0.0002	5.0	09/01/16	09/07/16	0.0002	U	N
Arsenic	6020A	0.050	0.002	5.0	09/01/16	09/07/16	0.002	U	
Barium	6020A	0.0050	0.0005	5.0	09/01/16	09/07/16	0.0007	J	
Beryllium	6020A	0.0020	0.0003	5.0	09/01/16	09/07/16	0.0003	U	
Cadmium	6020A	0.0020	0.0002	5.0	09/01/16	09/07/16	0.0002	U	
Calcium	6010C	0.2	0.2	1.0	09/01/16	09/27/16	0.9		
Chromium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.002	U	
Cobalt	6020A	0.0020	0.0003	5.0	09/01/16	09/07/16	0.0003	U	
Copper	6020A	0.010	0.002	5.0	09/01/16	09/07/16	0.015		
Iron	6010C	0.20	0.10	1.0	09/01/16	09/27/16	0.10	U	*
Lead	6020A	0.0020	0.00005	5.0	09/01/16	09/07/16	0.00012	J	
Magnesium	6010C	0.10	0.06	1.0	09/01/16	09/27/16	0.15		
Manganese	6010C	0.020	0.003	1.0	09/01/16	09/27/16	0.003	U	
Nickel	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.002	U	
Potassium	6010C	2.0	0.9	1.0	09/01/16	09/27/16	0.9	U	
Selenium	6020A	0.10	0.02	5.0	09/01/16	09/07/16	0.02	U	
Silver	6020A	0.0020	0.0006	5.0	09/01/16	09/07/16	0.0006	U	
Sodium	6010C	2.0	0.2	1.0	09/01/16	09/27/16	0.2	U	
Thallium	6020A	0.0020	0.00009	5.0	09/01/16	09/07/16	0.00009	U	
Vanadium	6020A	0.020	0.001	5.0	09/01/16	09/07/16	0.001	U	
Zinc	6020A	0.050	0.006	5.0	09/01/16	09/07/16	0.006	U	

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/11/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-007** **Lab Code:** **K1609659-001**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	582		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	27.2		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	331		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	32.0		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.092		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.140		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	886		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	0.95		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	1.88		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	30.9		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	3490		*
Lead	6020A	0.0195	0.0005	5.0	09/01/16	09/07/16	1.01		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1100		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	707		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.34		
Potassium	6010C	20	8.8	1.0	09/01/16	09/27/16	10400		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	3.4		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.108		
Sodium	6010C	19.5	2.0	1.0	09/01/16	09/27/16	3850		
Thallium	6020A	0.0195	0.0009	5.0	09/01/16	09/07/16	0.0148	J	
Vanadium	6020A	0.195	0.007	5.0	09/01/16	09/07/16	1.80		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	157		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-009** **Lab Code:** **K1609659-002**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	1.9	0.2	5.0	09/01/16	09/07/16	593		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	8.06		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	100		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	16.5		
Beryllium	6020A	0.019	0.003	5.0	09/01/16	09/07/16	0.093		
Cadmium	6020A	0.019	0.002	5.0	09/01/16	09/07/16	0.323		
Calcium	6010C	1.9	1.9	1.0	09/01/16	09/27/16	1530		
Chromium	6020A	0.19	0.02	5.0	09/01/16	09/07/16	1.52		
Cobalt	6020A	0.019	0.003	5.0	09/01/16	09/07/16	2.85		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	21.2		
Iron	6010C	1.9	1.0	1.0	09/01/16	09/27/16	1600		*
Lead	6020A	0.0194	0.0005	5.0	09/01/16	09/07/16	0.794		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1360		
Manganese	6010C	0.19	0.03	1.0	09/01/16	09/27/16	372		
Nickel	6020A	0.19	0.02	5.0	09/01/16	09/07/16	1.59		
Potassium	6010C	19	8.7	1.0	09/01/16	09/27/16	6410		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	3.4		
Silver	6020A	0.019	0.006	5.0	09/01/16	09/07/16	0.122		
Sodium	6010C	19.4	1.9	1.0	09/01/16	09/27/16	3100		
Thallium	6020A	0.0194	0.0009	5.0	09/01/16	09/07/16	0.0649		
Vanadium	6020A	0.194	0.007	5.0	09/01/16	09/07/16	1.08		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	234		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/10/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-011** **Lab Code:** **K1609659-003**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	881		
Antimony	6020A	0.050	0.002	5.0	09/01/16	09/07/16	6.33		N
Arsenic	6020A	0.50	0.02	5.0	09/01/16	09/07/16	57.8		
Barium	6020A	0.050	0.005	5.0	09/01/16	09/07/16	20.8		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.066		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.338		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1810		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.55		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	2.31		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	15.3		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	2130		*
Lead	6020A	0.0200	0.0005	5.0	09/01/16	09/07/16	0.475		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1510		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	306		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.54		
Potassium	6010C	20	9.0	1.0	09/01/16	09/27/16	8260		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	3.2		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.092		
Sodium	6010C	20.0	2.0	1.0	09/01/16	09/27/16	4580		
Thallium	6020A	0.0200	0.0009	5.0	09/01/16	09/07/16	0.0251		
Vanadium	6020A	0.200	0.007	5.0	09/01/16	09/07/16	1.79		
Zinc	6020A	0.50	0.06	5.0	09/01/16	09/07/16	157		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/10/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-012** **Lab Code:** **K1609659-004**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	1.9	0.2	5.0	09/01/16	09/07/16	689		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	13.3		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	38.2		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	34.6		
Beryllium	6020A	0.019	0.003	5.0	09/01/16	09/07/16	0.055		
Cadmium	6020A	0.019	0.002	5.0	09/01/16	09/07/16	0.303		
Calcium	6010C	1.9	1.9	1.0	09/01/16	09/27/16	1190		
Chromium	6020A	0.19	0.02	5.0	09/01/16	09/07/16	0.93		
Cobalt	6020A	0.019	0.003	5.0	09/01/16	09/07/16	1.80		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	15.3		
Iron	6010C	1.9	1.0	1.0	09/01/16	09/27/16	1720		*
Lead	6020A	0.0194	0.0005	5.0	09/01/16	09/07/16	0.553		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1240		
Manganese	6010C	0.19	0.03	1.0	09/01/16	09/27/16	335		
Nickel	6020A	0.19	0.02	5.0	09/01/16	09/07/16	1.04		
Potassium	6010C	19	8.7	1.0	09/01/16	09/27/16	8580		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	2.6		
Silver	6020A	0.019	0.006	5.0	09/01/16	09/07/16	0.126		
Sodium	6010C	19.4	1.9	1.0	09/01/16	09/27/16	4190		
Thallium	6020A	0.0194	0.0009	5.0	09/01/16	09/07/16	0.0231		
Vanadium	6020A	0.194	0.007	5.0	09/01/16	09/07/16	1.43		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	181		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/11/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-014** **Lab Code:** **K1609659-005**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	853		
Antimony	6020A	0.050	0.002	5.0	09/01/16	09/07/16	1.84		N
Arsenic	6020A	0.50	0.02	5.0	09/01/16	09/07/16	71.9		
Barium	6020A	0.050	0.005	5.0	09/01/16	09/07/16	20.3		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.058		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.244		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1190		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.30		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	2.18		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	16.1		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	2470		*
Lead	6020A	0.0198	0.0005	5.0	09/01/16	09/07/16	0.469		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1190		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	387		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.58		
Potassium	6010C	20	8.9	1.0	09/01/16	09/27/16	8940		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	3.6		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.071		
Sodium	6010C	19.8	2.0	1.0	09/01/16	09/27/16	4880		
Thallium	6020A	0.0198	0.0009	5.0	09/01/16	09/07/16	0.0211		
Vanadium	6020A	0.198	0.007	5.0	09/01/16	09/07/16	1.78		
Zinc	6020A	0.50	0.06	5.0	09/01/16	09/07/16	133		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/11/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-016** **Lab Code:** **K1609659-006**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	1.9	0.2	5.0	09/01/16	09/07/16	785		
Antimony	6020A	0.047	0.002	5.0	09/01/16	09/07/16	0.238		N
Arsenic	6020A	0.47	0.02	5.0	09/01/16	09/07/16	6.49		
Barium	6020A	0.047	0.005	5.0	09/01/16	09/07/16	62.9		
Beryllium	6020A	0.019	0.003	5.0	09/01/16	09/07/16	0.054		
Cadmium	6020A	0.019	0.002	5.0	09/01/16	09/07/16	0.428		
Calcium	6010C	1.9	1.9	1.0	09/01/16	09/27/16	1440		
Chromium	6020A	0.19	0.02	5.0	09/01/16	09/07/16	0.95		
Cobalt	6020A	0.019	0.003	5.0	09/01/16	09/07/16	1.97		
Copper	6020A	0.09	0.02	5.0	09/01/16	09/07/16	11.5		
Iron	6010C	1.9	0.9	1.0	09/01/16	09/27/16	887		*
Lead	6020A	0.0186	0.0005	5.0	09/01/16	09/07/16	0.302		
Magnesium	6010C	0.9	0.6	1.0	09/01/16	09/27/16	1200		
Manganese	6010C	0.19	0.03	1.0	09/01/16	09/27/16	136		
Nickel	6020A	0.19	0.02	5.0	09/01/16	09/07/16	1.20		
Potassium	6010C	19	8.4	1.0	09/01/16	09/27/16	8880		
Selenium	6020A	0.9	0.2	5.0	09/01/16	09/07/16	2.4		
Silver	6020A	0.019	0.006	5.0	09/01/16	09/07/16	0.082		
Sodium	6010C	18.6	1.9	1.0	09/01/16	09/27/16	4990		
Thallium	6020A	0.0186	0.0008	5.0	09/01/16	09/07/16	0.0133	J	
Vanadium	6020A	0.186	0.007	5.0	09/01/16	09/07/16	1.24		
Zinc	6020A	0.47	0.06	5.0	09/01/16	09/07/16	171		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-017** **Lab Code:** **K1609659-007**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	758		
Antimony	6020A	0.050	0.002	5.0	09/01/16	09/07/16	0.065		N
Arsenic	6020A	0.50	0.02	5.0	09/01/16	09/07/16	4.38		
Barium	6020A	0.050	0.005	5.0	09/01/16	09/07/16	6.63		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.056		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	1.03		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	3270		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	2.78		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	1.03		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	21.4		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	923		*
Lead	6020A	0.0199	0.0005	5.0	09/01/16	09/07/16	0.215		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1720		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	51.1		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.39		
Potassium	6010C	20	9.0	1.0	09/01/16	09/27/16	8190		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	2.2		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.264		
Sodium	6010C	19.9	2.0	1.0	09/01/16	09/27/16	4400		
Thallium	6020A	0.0199	0.0009	5.0	09/01/16	09/07/16	0.0097	J	
Vanadium	6020A	0.199	0.007	5.0	09/01/16	09/07/16	1.55		
Zinc	6020A	0.50	0.06	5.0	09/01/16	09/07/16	156		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: MWH-029 **Lab Code:** K1609659-008

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	570		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	0.391		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	9.35		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	7.88		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.081		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.433		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1450		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.09		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	2.24		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	13.5		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	584		*
Lead	6020A	0.0195	0.0005	5.0	09/01/16	09/07/16	0.309		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1310		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	59.4		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	2.23		
Potassium	6010C	20	8.8	1.0	09/01/16	09/27/16	7790		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	2.6		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.070		
Sodium	6010C	19.5	2.0	1.0	09/01/16	09/27/16	3710		
Thallium	6020A	0.0195	0.0009	5.0	09/01/16	09/07/16	0.189		
Vanadium	6020A	0.195	0.007	5.0	09/01/16	09/07/16	0.692		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	150		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/13/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-030** **Lab Code:** **K1609659-009**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	810		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	21.3		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	572		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	54.9		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.100		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.117		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1600		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.00		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	2.19		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	24.1		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	4080		*
Lead	6020A	0.0196	0.0005	5.0	09/01/16	09/07/16	0.846		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1270		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	1050		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.16		
Potassium	6010C	20	8.8	1.0	09/01/16	09/27/16	8560		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	3.2		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.242		
Sodium	6010C	19.6	2.0	1.0	09/01/16	09/27/16	4330		
Thallium	6020A	0.0196	0.0009	5.0	09/01/16	09/07/16	0.0353		
Vanadium	6020A	0.196	0.007	5.0	09/01/16	09/07/16	1.92		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	147		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/9/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-069** **Lab Code:** **K1609659-010**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	835		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	1.11		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	24.0		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	10.5		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.102		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.520		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1410		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.29		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	3.29		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	16.5		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	899		*
Lead	6020A	0.0197	0.0005	5.0	09/01/16	09/07/16	0.482		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1450		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	98.8		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	2.79		
Potassium	6010C	20	8.9	1.0	09/01/16	09/27/16	8330		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	2.1		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.068		
Sodium	6010C	19.7	2.0	1.0	09/01/16	09/27/16	3620		
Thallium	6020A	0.0197	0.0009	5.0	09/01/16	09/07/16	0.224		
Vanadium	6020A	0.197	0.007	5.0	09/01/16	09/07/16	0.946		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	155		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/13/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-074** **Lab Code:** **K1609659-011**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	410		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	6.67		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	29.1		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	8.42		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.056		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.316		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1380		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	0.73		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	3.35		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	18.7		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	876		*
Lead	6020A	0.0196	0.0005	5.0	09/01/16	09/07/16	0.384		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1360		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	224		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.31		
Potassium	6010C	20	8.8	1.0	09/01/16	09/27/16	7350		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	4.3		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.094		
Sodium	6010C	19.6	2.0	1.0	09/01/16	09/27/16	3260		
Thallium	6020A	0.0196	0.0009	5.0	09/01/16	09/07/16	0.0321		
Vanadium	6020A	0.196	0.007	5.0	09/01/16	09/07/16	0.653		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	157		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/13/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-075** **Lab Code:** **K1609659-012**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	517		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	0.999		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	55.5		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	14.7		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.039		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.253		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1100		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.39		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	1.22		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	12.1		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	1930		*
Lead	6020A	0.0197	0.0005	5.0	09/01/16	09/07/16	0.424		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1040		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	354		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.18		
Potassium	6010C	20	8.9	1.0	09/01/16	09/27/16	8050		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	3.0		
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.071		
Sodium	6010C	19.7	2.0	1.0	09/01/16	09/27/16	4160		
Thallium	6020A	0.0197	0.0009	5.0	09/01/16	09/07/16	0.0192	J	
Vanadium	6020A	0.197	0.007	5.0	09/01/16	09/07/16	1.18		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	129		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	8/10/2016
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	8/19/2016
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **MWH-013** **Lab Code:** **K1609659-013**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	780		
Antimony	6020A	0.049	0.002	5.0	09/01/16	09/07/16	0.579		N
Arsenic	6020A	0.49	0.02	5.0	09/01/16	09/07/16	9.39		
Barium	6020A	0.049	0.005	5.0	09/01/16	09/07/16	49.0		
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.080		
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.865		
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	1610		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	1.30		
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	2.69		
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	13.9		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	1000		*
Lead	6020A	0.0197	0.0005	5.0	09/01/16	09/07/16	0.513		
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1470		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	136		
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	0.87		
Potassium	6010C	20	8.9	1.0	09/01/16	09/27/16	8810		
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	0.9	J	
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.104		
Sodium	6010C	19.7	2.0	1.0	09/01/16	09/27/16	4880		
Thallium	6020A	0.0197	0.0009	5.0	09/01/16	09/07/16	0.0347		
Vanadium	6020A	0.197	0.007	5.0	09/01/16	09/07/16	1.49		
Zinc	6020A	0.49	0.06	5.0	09/01/16	09/07/16	388		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Date Collected:**	
Project Name:	Metals in Sediment and Tissue 20	**Date Received:**	
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **Method Blank** **Lab Code:** **KQ1610520-01**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Aluminum	6020A	2.0	0.2	5.0	09/01/16	09/07/16	0.2	U	
Antimony	6020A	0.050	0.002	5.0	09/01/16	09/07/16	0.002	U	N
Arsenic	6020A	0.50	0.02	5.0	09/01/16	09/07/16	0.02	U	
Barium	6020A	0.050	0.005	5.0	09/01/16	09/07/16	0.007	J	
Beryllium	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	09/01/16	09/07/16	0.002	U	
Calcium	6010C	2.0	2.0	1.0	09/01/16	09/27/16	9.2		
Chromium	6020A	0.20	0.02	5.0	09/01/16	09/07/16	0.02	U	
Cobalt	6020A	0.020	0.003	5.0	09/01/16	09/07/16	0.003	U	
Copper	6020A	0.10	0.02	5.0	09/01/16	09/07/16	0.15		
Iron	6010C	2.0	1.0	1.0	09/01/16	09/27/16	1.0	U	*
Lead	6020A	0.0200	0.0005	5.0	09/01/16	09/07/16	0.0012	J	
Magnesium	6010C	1.0	0.6	1.0	09/01/16	09/27/16	1.5		
Manganese	6010C	0.20	0.03	1.0	09/01/16	09/27/16	0.03	U	
Nickel	6020A	0.20	0.02	5.0	09/01/16	09/07/16	0.02	U	
Potassium	6010C	20	9.0	1.0	09/01/16	09/27/16	9.0	U	
Selenium	6020A	1.0	0.2	5.0	09/01/16	09/07/16	0.2	U	
Silver	6020A	0.020	0.006	5.0	09/01/16	09/07/16	0.006	U	
Sodium	6010C	20.0	2.0	1.0	09/01/16	09/27/16	2.0	U	
Thallium	6020A	0.0200	0.0009	5.0	09/01/16	09/07/16	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	09/01/16	09/07/16	0.007	U	
Zinc	6020A	0.50	0.06	5.0	09/01/16	09/07/16	0.06	U	

Comments:

Metals

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INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICV Source: Inorganic Ventures **CCV Source:** ALS MIXED

Concentration Units: ug/L

	Initial Calibration			Continuing Calibration					
Analyte	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	Method
Aluminum	100.0	99.0	99	25.0	25.6	102	25.1	100	6020A
Antimony	25.0	25.3	101	25.0	25.0	100	24.4	98	6020A
Arsenic	25.0	25.8	103	25.0	24.5	98	25.0	100	6020A
Barium	100.0	99.4	99	25.0	24.7	99	24.3	97	6020A
Beryllium	2.5	2.6	104	25.0	24.8	99	24.3	97	6020A
Cadmium	12.5	12.6	101	25.0	24.5	98	24.5	98	6020A
Calcium	5000	4932	99	500	501	100	501	100	6010C
Calcium	12500	12280	98	10000	10220	102	10070	101	6010C
Chromium	10.0	10.3	103	25.0	24.9	100	25.7	103	6020A
Cobalt	25.0	26.3	105	25.0	25.0	100	25.9	104	6020A
Copper	12.5	12.7	102	25.0	24.6	98	25.5	102	6020A
Iron	2500.0	2484	99	10000.0	10140	101	10080	101	6010C
Lead	25.0	26.2	105	25.0	25.5	102	24.9	100	6020A
Magnesium	12500.0	12360	99	10000.0	10000	100	9908	99	6010C
Magnesium	5000.0	4870	97	250.0	253	101	253	101	6010C
Manganese	1250.0	1194	96	250.0	255	102	253	101	6010C
Manganese	10000.0	9813	98	1000.0	986	99	977	98	6010C
Nickel	25.0	26.1	104	25.0	24.7	99	25.6	102	6020A
Potassium	12500.0	12070	97	10000.0	9762	98	9733	97	6010C
Selenium	25.0	25.7	103	25.0	23.9	96	24.1	96	6020A
Silver	12.5	12.7	102	25.0	24.7	99	24.4	98	6020A
Sodium	12500.0	12080	97	10000.0	9729	97	9708	97	6010C
Thallium	25.0	25.7	103	25.0	25.4	102	25.2	101	6020A
Vanadium	25.0	25.9	104	25.0	24.8	99	25.5	102	6020A
Zinc	25.0	24.9	100	25.0	24.1	96	24.0	96	6020A

Metals
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INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICV Source: Inorganic Ventures **CCV Source:** ALS MIXED

Concentration Units: ug/L

	Initial Calibration			Continuing Calibration					
Analyte	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	Method
Aluminum				25.0	24.5	98	25.1	100	6020A
Antimony				25.0	24.6	98	24.5	98	6020A
Arsenic				25.0	24.7	99	25.2	101	6020A
Barium				25.0	23.5	94	23.6	94	6020A
Beryllium				25.0	24.3	97	24.0	96	6020A
Cadmium				25.0	25.0	100	25.4	102	6020A
Calcium				10000	10010	100	9946	99	6010C
Calcium				500	504	101	500	100	6010C
Chromium				25.0	24.6	98	24.5	98	6020A
Cobalt				25.0	25.1	100	24.5	98	6020A
Copper				25.0	25.2	101	24.5	98	6020A
Iron				10000.0	10070	101	10030	100	6010C
Lead				25.0	25.3	101	24.7	99	6020A
Magnesium				10000.0	10070	101	10140	101	6010C
Magnesium				250.0	252	101	251	100	6010C
Manganese				250.0	254	102	251	100	6010C
Manganese				1000.0	988	99	995	100	6010C
Nickel				25.0	25.4	102	24.2	97	6020A
Potassium				10000.0	9933	99	10040	100	6010C
Selenium				25.0	23.5	94	24.8	99	6020A
Silver				25.0	24.6	98	24.7	99	6020A
Sodium				10000.0	9969	100	10020	100	6010C
Thallium				25.0	25.3	101	24.7	99	6020A
Vanadium				25.0	24.7	99	24.4	98	6020A
Zinc				25.0	24.5	98	23.8	95	6020A

Metals
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INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICV Source: Inorganic Ventures **CCV Source:** ALS MIXED

Concentration Units: ug/L

	Initial Calibration			Continuing Calibration					
Analyte	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	Method
Aluminum				25.0	25.7	103	24.8	99	6020A
Antimony				25.0	25.2	101	24.3	97	6020A
Arsenic				25.0	24.8	99	24.9	100	6020A
Barium				25.0	24.0	96	22.8	91	6020A
Beryllium				25.0	24.7	99	23.8	95	6020A
Cadmium				25.0	24.9	100	25.1	100	6020A
Chromium				25.0	24.6	98	25.7	103	6020A
Cobalt				25.0	24.5	98	26.2	105	6020A
Copper				25.0	25.0	100	25.9	104	6020A
Lead				25.0	25.1	100	24.4	98	6020A
Nickel				25.0	24.8	99	25.9	104	6020A
Selenium				25.0	24.3	97	25.0	100	6020A
Silver				25.0	24.2	97	24.7	99	6020A
Thallium				25.0	25.1	100	24.8	99	6020A
Vanadium				25.0	25.0	100	25.3	101	6020A
Zinc				25.0	24.0	96	25.3	101	6020A

Metals
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INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICV Source: Inorganic Ventures **CCV Source:** ALS MIXED

Concentration Units: ug/L

	Initial Calibration			Continuing Calibration					
Analyte	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	Method
Aluminum				25.0	25.5	102	25.7	103	6020A
Antimony				25.0	23.8	95	25.4	102	6020A
Arsenic				25.0	24.8	99	25.1	100	6020A
Barium				25.0	23.1	92	23.5	94	6020A
Beryllium				25.0	24.0	96	24.1	96	6020A
Cadmium				25.0	25.0	100	25.5	102	6020A
Chromium				25.0	26.1	104	25.2	101	6020A
Cobalt				25.0	26.5	106	25.8	103	6020A
Copper				25.0	26.5	106	25.7	103	6020A
Lead				25.0	24.8	99	24.4	98	6020A
Nickel				25.0	26.6	106	25.8	103	6020A
Selenium				25.0	24.5	98	24.2	97	6020A
Silver				25.0	24.4	98	24.8	99	6020A
Thallium				25.0	25.0	100	24.5	98	6020A
Vanadium				25.0	25.6	102	24.9	100	6020A
Zinc				25.0	25.6	102	24.6	98	6020A

Metals

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LOW LEVEL INITIAL CALIBRATION AND LOW LEVEL CONTINUING CALIBRATION VERIFICATION

Client: MWH Global, Inc **SDG No.:** K1609659

Contract: 10509465.2000 **Lab Code:** ALSK **Case No.:** **SAS No.:**

Initial Calibration Source: Inorganic Ventures

Continuing Calibration Source: ALS MIXED

Sample ID	Analyte	Result ug/L	True Value ug/L	% Recovery	Acceptance Window (%R)	M	Analysis Date	Analysis Time	Run Number
LLICVT1									
	Aluminum	4.266	4.000	107	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Antimony	0.092	0.100	92	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Arsenic	1.001	1.000	100	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Barium	0.102	0.100	102	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Beryllium	0.040	0.040	100	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Cadmium	0.038	0.040	95	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Chromium	0.414	0.400	104	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Cobalt	0.038	0.040	95	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Copper	0.198	0.200	99	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Lead	0.043	0.040	108	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Nickel	0.427	0.400	107	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Selenium	1.721	2.000	86	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Silver	0.040	0.040	100	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Thallium	0.043	0.040	108	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Vanadium	0.429	0.400	107	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
	Zinc	0.932	1.000	93	70.0 - 130.0	MS	9/7/2016	14:06	090716a1
LLCCVT1									
	Aluminum	4.110	4.000	103	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Antimony	0.096	0.100	96	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Arsenic	1.033	1.000	103	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Barium	0.106	0.100	106	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Beryllium	0.041	0.040	102	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Cadmium	0.035	0.040	88	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Chromium	0.435	0.400	109	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Cobalt	0.039	0.040	98	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Copper	0.229	0.200	114	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Lead	0.043	0.040	108	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Nickel	0.433	0.400	108	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Selenium	2.176	2.000	109	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Silver	0.042	0.040	105	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Thallium	0.040	0.040	100	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Vanadium	0.413	0.400	103	70.0 - 130.0	MS	9/7/2016	16:16	090716a1
	Zinc	0.993	1.000	99	70.0 - 130.0	MS	9/7/2016	16:16	090716a1

Metals

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LOW LEVEL INITIAL CALIBRATION AND LOW LEVEL CONTINUING CALIBRATION VERIFICATION

Client: MWH Global, Inc **SDG No.:** K1609659

Contract: 10509465.2000 **Lab Code:** ALSK **Case No.:** **SAS No.:**

Initial Calibration Source: Inorganic Ventures

Continuing Calibration Source: ALS MIXED

Sample ID	Analyte	Result ug/L	True Value ug/L	% Recovery	Acceptance Window (%R)	M	Analysis Date	Analysis Time	Run Number
LLCCVT2									
	Aluminum	4.005	4.000	100	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Antimony	0.101	0.100	101	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Arsenic	0.979	1.000	98	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Barium	0.102	0.100	102	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Beryllium	0.038	0.040	95	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Cadmium	0.037	0.040	92	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Chromium	0.416	0.400	104	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Cobalt	0.043	0.040	108	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Copper	0.206	0.200	103	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Lead	0.040	0.040	100	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Nickel	0.419	0.400	105	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Selenium	2.242	2.000	112	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Silver	0.041	0.040	102	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Thallium	0.039	0.040	98	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Vanadium	0.427	0.400	107	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
	Zinc	1.035	1.000	104	70.0 - 130.0	MS	9/7/2016	18:28	090716a1
LLCCVT3									
	Aluminum	4.058	4.000	101	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Antimony	0.103	0.100	103	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Arsenic	1.034	1.000	103	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Barium	0.100	0.100	100	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Beryllium	0.039	0.040	98	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Cadmium	0.038	0.040	95	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Chromium	0.406	0.400	102	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Cobalt	0.044	0.040	110	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Copper	0.213	0.200	106	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Lead	0.042	0.040	105	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Nickel	0.406	0.400	102	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Selenium	1.817	2.000	91	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Silver	0.041	0.040	102	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Thallium	0.039	0.040	98	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Vanadium	0.379	0.400	95	70.0 - 130.0	MS	9/7/2016	20:34	090716a1
	Zinc	0.941	1.000	94	70.0 - 130.0	MS	9/7/2016	20:34	090716a1

Metals

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LOW LEVEL INITIAL CALIBRATION AND LOW LEVEL CONTINUING CALIBRATION VERIFICATION

Client: MWH Global, Inc **SDG No.:** K1609659

Contract: 10509465.2000 **Lab Code:** ALSK **Case No.:** **SAS No.:**

Initial Calibration Source: Inorganic Ventures

Continuing Calibration Source: ALS MIXED

Sample ID	Analyte	Result ug/L	True Value ug/L	% Recovery	Acceptance Window (%R)	M	Analysis Date	Analysis Time	Run Number
LLICV1									
	Calcium	20	20	100	70.0 - 130.0	P	9/27/2016	08:41	092716AICP
	Iron	19	20.0	95	70.0 - 130.0	P	9/27/2016	08:41	092716AICP
	Magnesium	6	5.0	100	70.0 - 130.0	P	9/27/2016	08:41	092716AICP
	Manganese	1	1.0	100	70.0 - 130.0	P	9/27/2016	08:41	092716AICP
	Potassium	191	200.0	96	70.0 - 130.0	P	9/27/2016	08:41	092716AICP
	Sodium	195	200.0	98	70.0 - 130.0	P	9/27/2016	08:41	092716AICP
LLCCV1									
	Calcium	20	20	100	70.0 - 130.0	P	9/27/2016	10:37	092716AICP
	Iron	15	20.0	75	70.0 - 130.0	P	9/27/2016	10:37	092716AICP
	Magnesium	6	5.0	100	70.0 - 130.0	P	9/27/2016	10:37	092716AICP
	Manganese	1	1.0	100	70.0 - 130.0	P	9/27/2016	10:37	092716AICP
	Potassium	222	200.0	111	70.0 - 130.0	P	9/27/2016	10:37	092716AICP
	Sodium	196	200.0	98	70.0 - 130.0	P	9/27/2016	10:37	092716AICP

Metals

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BLANKS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): ug/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Method
Aluminum	0.4	U	0.4	U	0.4	U	0.4	U	6020A
Antimony	0.022	J	0.004	U	0.016	J	0.023	J	6020A
Arsenic	0.04	U	0.04	U	0.04	U	0.04	U	6020A
Barium	0.010	U	0.010	U	0.010	U	0.010	U	6020A
Beryllium	0.007	J	0.006	U	0.006	U	0.006	U	6020A
Cadmium	0.004	U	-0.005	J	-0.004	J	0.004	U	6020A
Calcium	20.0	U	20.0	U	20.0	U	20.0	U	6010C
Chromium	0.04	U	0.04	U	0.04	U	0.04	U	6020A
Cobalt	0.006	U	0.006	U	0.006	U	0.006	U	6020A
Copper	0.04	U	0.04	U	0.04	U	0.04	U	6020A
Iron	-10.0	J	10.0	U	10.0	U	10.0	U	6010C
Lead	0.0060	J	0.0010	U	0.0010	U	0.0019	J	6020A
Magnesium	6.0	U	6.0	U	6.0	U	6.0	U	6010C
Manganese	0.30	U	0.30	U	0.30	U	1.60	J	6010C
Nickel	0.04	U	0.04	U	0.04	U	0.04	U	6020A
Potassium	90	U	90	U	90	U	90	U	6010C
Selenium	0.4	U	0.4	U	0.4	U	0.4	U	6020A
Silver	0.012	U	0.012	U	0.012	U	0.012	U	6020A
Sodium	20.0	U	20.0	U	20.0	U	20.0	U	6010C
Thallium	0.0043	J	0.0018	U	-0.0018	J	0.0018	U	6020A
Vanadium	0.014	U	0.014	U	0.014	U	0.014	U	6020A
Zinc	0.12	U	0.12	U	0.12	U	0.12	U	6020A

Metals

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BLANKS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): ug/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Method
Aluminum			0.4	U	0.4	U	0.4	U	6020A
Antimony			0.020	J	0.016	J	0.017	J	6020A
Arsenic			0.04	U	0.04	U	0.04	U	6020A
Barium			0.010	U	0.010	U	0.010	U	6020A
Beryllium			0.006	U	0.006	U	0.006	U	6020A
Cadmium			0.004	U	0.004	U	0.004	U	6020A
Calcium			20.0	U					6010C
Chromium			0.04	U	0.04	U	0.04	U	6020A
Cobalt			0.006	U	0.006	U	0.006	U	6020A
Copper			0.04	U	0.04	U	0.04	U	6020A
Iron			10.0	U					6010C
Lead			0.0017	J	0.0010	U	0.0010	U	6020A
Magnesium			6.0	U					6010C
Manganese			0.30	U					6010C
Nickel			0.04	U	0.04	U	0.04	U	6020A
Potassium			90	U					6010C
Selenium			0.4	U	0.4	U	0.4	U	6020A
Silver			0.012	U	0.012	U	0.012	U	6020A
Sodium			20.0	U					6010C
Thallium			-0.0027	J	-0.0030	J	-0.0038	J	6020A
Vanadium			0.014	U	0.014	U	0.014	U	6020A
Zinc			0.12	U	0.12	U	0.12	U	6020A

Metals

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BLANKS

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000		
Project Name:	Metals in Sediment and Tissue 20		

Preparation Blank Matrix (soil/water): **WATER**

Preparation Blank Concentration Units (ug/L or mg/kg): **ug/L**

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Method
Aluminum			0.4	U	0.4	U			6020A
Antimony			0.021	J	0.021	J			6020A
Arsenic			0.04	U	0.04	U			6020A
Barium			0.010	U	0.010	U			6020A
Beryllium			0.006	U	0.006	U			6020A
Cadmium			0.004	U	0.004	U			6020A
Chromium			0.04	U	0.04	U			6020A
Cobalt			0.006	U	0.006	U			6020A
Copper			0.04	U	0.04	U			6020A
Lead			0.0010	U	0.0010	U			6020A
Nickel			0.04	U	0.04	U			6020A
Selenium			0.4	U	0.4	U			6020A
Silver			0.012	U	0.012	U			6020A
Thallium			-0.0025	J	-0.0018	J			6020A
Vanadium			0.014	U	0.014	U			6020A
Zinc			0.12	U	0.12	U			6020A

Metals

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ICP INTERFERENCE CHECK SAMPLE

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: K-ICP-AES-04 **ICS Source:** Inorganic Ventures

Concentration Units): ug/L

Analyte	True		Initial Found			Final Found		
	Sol.A	Sol.AB	Sol.A	Sol.AB	%R	Sol.A	Sol.AB	%R
Calcium	500000.0	500000.0	494900.0	491200.0	98			
Iron	200000.0	200000.0	192200.0	191500.0	96			
Magnesium	500000.0	500000.0	438400.0	434500.0	87			
Manganese	0.0	500.0	0.3	474.8	95			
Potassium	0.0		-22.0	-32.3				
Sodium	0.0		18.7	17.4				

Metals
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ICP INTERFERENCE CHECK SAMPLE

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-MS-04** **ICS Source:** **Inorganic Ventures**

Concentration Units): **ug/L**

Analyte	True		Initial Found			Final Found		
	Sol.A	Sol.AB	Sol.A	Sol.AB	%R	Sol.A	Sol.AB	%R
Aluminum			20989	21077		21073	21264	
Antimony			0	0		0	0	
Arsenic		25	0	25	100	0	25	100
Barium			1	1		1	1	
Beryllium			0	0		0	0	
Cadmium		25	0	23	92	0	24	96
Chromium		50	1	55	110	1	54	108
Cobalt		50	1	55	110	1	54	108
Copper		50	1	48	96	1	48	96
Lead			0	0		0	0	
Nickel		50	0	52	104	0	51	102
Selenium		25	0	23	92	0	24	96
Silver	0.0	12.5	0	11.5	92	0	11.5	92
Thallium	0.0		0	0.0		0	0.0	
Vanadium		50	0	58	116	0	56	112
Zinc		25	0	23	92	0	23	92

Metals
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SPIKE SAMPLE RECOVERY

Client: MWH Global, Inc
Service Request: K1609659
Project No.: 10509465.2000
Units: MG/KG
Project Name: Metals in Sediment and Tissue 20
Basis: DRY
Matrix: TISSUE

Sample Name: **MWH-011S**
Lab Code: **K1609659-003S**

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Aluminum		1348.4		881.0		199.0	235		6020A
Antimony	75 - 125	41.807		6.334		49.751	71	N	6020A
Arsenic	75 - 125	86.67		57.78		24.88	116		6020A
Barium	75 - 125	109.783		20.831		99.502	89		6020A
Beryllium	75 - 125	4.831		0.066		4.975	96		6020A
Cadmium	75 - 125	5.350		0.338		4.975	101		6020A
Calcium		1990		1810		248.76	72		6010C
Chromium	75 - 125	21.18		1.55		19.90	99		6020A
Cobalt	75 - 125	52.759		2.311		49.751	101		6020A
Copper	75 - 125	40.00		15.33		24.88	99		6020A
Iron		2330		2130		99.50	201		6010C
Lead	75 - 125	44.8679		0.4752		49.7512	89		6020A
Magnesium		1800		1510		248.76	117		6010C
Manganese		357		306		49.75	103		6010C
Nickel	75 - 125	50.20		1.54		49.75	98		6020A
Potassium		8710		8260		248.76	181		6010C
Selenium	75 - 125	30.3		3.2		24.9	109		6020A
Silver	75 - 125	4.853		0.092		4.975	96		6020A
Sodium		4830		4580		248.76	100		6010C
Thallium	75 - 125	4.5433		0.0251		4.9751	91		6020A
Vanadium	75 - 125	51.925		1.787		49.751	101		6020A
Zinc	75 - 125	205.22		156.96		49.75	97		6020A

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

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POST SPIKE SAMPLE RECOVERY

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Units:**	UG/L
Project Name:	Metals in Sediment and Tissue 20	**Basis:**	DRY
Matrix:	WATER		

Sample Name: **MWH-011A** **Lab Code:** **K1609659-003A**

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Aluminum	80 - 120	1807.2		1761.9		50.0	91		6020A
Antimony	80 - 120	63.741		12.668		50.0	102		6020A
Arsenic	80 - 120	169.61		115.56		50.0	108		6020A
Barium	80 - 120	88.925		41.662		50.0	95		6020A
Beryllium	80 - 120	51.277		0.132		50.0	102		6020A
Cadmium	80 - 120	53.054		0.676		50.0	105		6020A
Chromium	80 - 120	54.50		3.09		50.0	103		6020A
Cobalt	80 - 120	57.403		4.623		50.0	106		6020A
Copper	80 - 120	82.56		30.65		50.0	104		6020A
Lead	80 - 120	47.8545		0.9504		50.0	94		6020A
Nickel	80 - 120	55.44		3.08		50.0	105		6020A
Selenium	80 - 120	61.6		6.5		50.0	110		6020A
Silver	80 - 120	9.729		0.185		10.0	95		6020A
Thallium	80 - 120	46.7035		0.0503		50.0	93		6020A
Vanadium	80 - 120	56.195		3.574		50.0	105		6020A
Zinc	80 - 120	372.23		313.91		50.0	117		6020A

Metals

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DUPLICATES

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Units:**	MG/KG
Project Name:	Metals in Sediment and Tissue 20	**Basis:**	DRY
Matrix:	TISSUE		

Sample Name: **MWH-011D** **Lab Code:** **K1609659-003D**

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Aluminum	20	881.0		800.8		9.5		6020A
Antimony	20	6.334		6.586		3.9		6020A
Arsenic	20	57.78		57.38		0.7		6020A
Barium	20	20.831		20.194		3.1		6020A
Beryllium		0.066		0.056		16.4		6020A
Cadmium	20	0.338		0.383		12.5		6020A
Calcium	20	1810		1690		6.9		6010C
Chromium	20	1.55		1.42		8.8		6020A
Cobalt	20	2.311		2.395		3.6		6020A
Copper	20	15.33		15.32		0.1		6020A
Iron	20	2130		1690		23.0	*	6010C
Lead	20	0.4752		0.4844		1.9		6020A
Magnesium	20	1510		1430		5.4		6010C
Manganese	20	306		313		2.3		6010C
Nickel	20	1.54		1.37		11.7		6020A
Potassium	20	8260		8630		4.4		6010C
Selenium		3.2		3.5		9.0		6020A
Silver		0.092		0.090		2.2		6020A
Sodium	20	4580		4810		4.9		6010C
Thallium		0.0251		0.0273		8.4		6020A
Vanadium	20	1.787		1.476		19.1		6020A
Zinc	20	156.96		158.06		0.7		6020A

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals
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LABORATORY CONTROL SAMPLE

Client: MWH Global, Inc
Service Request: K1609659
Project No.: 10509465.2000
Project Name: Metals in Sediment and Tissue 20

Aqueous LCS Source: ALS MIXED
Solid LCS Source: ERA D065540

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Aluminum	2000.0	1924.6	96						
Antimony	500.0	465.3	93						
Arsenic	250.0	238.9	96						
Barium	1000.0	866.3	87						
Beryllium	50.0	46.1	92						
Cadmium	50.0	48.5	97						
Calcium	2500	2430	97						
Chromium	200.0	192.6	96						
Cobalt	500.0	494.9	99						
Copper	250.0	244.8	98						
Iron	1000	962	96						
Lead	500.0	462.6	93						
Magnesium	2500	2350	94						
Manganese	500	459	92						
Nickel	500.0	491.3	98						
Potassium	2500	2360	94						
Selenium	250.0	243.9	98						
Silver	50.0	46.9	94						
Sodium	2500	2400	96						
Thallium	50.0	46.5	93						
Vanadium	500.0	485.2	97						
Zinc	500.0	474.5	95						

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	MWH Global, Inc.	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/01/16
		Date Analyzed:	09/07,27/16

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1609659-SRM1	Basis:	Dry
Test Notes:	Dorm-4 Solids = 94.5%		

Source: N.R.C.C. Dorm-4

Analyte	**Prep Method**	**Analysis Method**	**True Value**	**Result**	**Percent Recovery**	**Control Limits**	**Result Notes**
Arsenic	PSEP Tissue	6020A	6.8	7.24	106	4.93-8.93	
Cadmium	PSEP Tissue	6020A	0.306	0.302	99	0.233 - 0.385	
Chromium	PSEP Tissue	6020A	1.87	1.71	91	1.37-2.44	
Copper	PSEP Tissue	6020A	15.9	16.0	101	12.0 - 20.2	
Iron	PSEP Tissue	6010C	341	322	94	251-442	
Lead	PSEP Tissue	6020A	0.416	0.308	74	0.290 - 0.563	
Nickel	PSEP Tissue	6020A	1.36	1.33	98	0.912-1.9	
Selenium	PSEP Tissue	6020A	3.56	4.09	115	2.58 - 4.68	
Zinc	PSEP Tissue	6020A	52.2	52.3	100	39.2 - 66.5	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	MWH Global, Inc.	**Service Request:**	K1609659
Project:	Metals in Sediment and Tissue 2016/10509465.2000	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/01/16
		Date Analyzed:	09/07,27/16

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1609659-SRM2	Basis:	Dry
Test Notes:	Tort-3 Solids = 99.1%		

Source: N.R.C.C. Tort-3

Analyte	**Prep Method**	**Analysis Method**	**True Value**	**Result**	**Percent Recovery**	**Control Limits**	**Result Notes**
Arsenic	PSEP Tissue	6020A	59.5	62.3	105	44.6-76.0	
Cadmium	PSEP Tissue	6020A	42.3	40.1	95	32.4-52.9	
Chromium	PSEP Tissue	6020A	1.95	1.84	94	1.37-2.63	
Copper	PSEP Tissue	6020A	497	446	90	380-623	
Iron	PSEP Tissue	6010C	179	164	92	137-224	
Lead	PSEP Tissue	6020A	0.225	0.260	116	0.166-0.292	
Manganese	PSEP Tissue	6010C	15.6	14.0	90	11.7-19.9	
Nickel	PSEP Tissue	6020A	5.3	5.06	95	4.05-6.65	
Selenium	PSEP Tissue	6020A	10.9	11.3	104	7.9-14.3	
Vanadium	PSEP Tissue	6020A	9.1	8.94	98	7.0-11.4	
Zinc	PSEP Tissue	6020A	136	131	96	104-170	

Metals

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ICP SERIAL DILUTIONS

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Units:**	UG/L
Project Name:	Metals in Sediment and Tissue 20		

Sample Name: **MWH-011L** **Lab Code:** **K1609659-003L**

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% - Differ-ence	Q	M
Aluminum	1761.9		1700.7		3		MS
Antimony	12.668		11.724		7		MS
Arsenic	115.56		103.12		11	E	MS
Barium	41.662		39.267		6		MS
Beryllium	0.132		0.111	J	16		MS
Cadmium	0.676		0.571		16	E	MS
Calcium	18130.0		18345.0		1.2		P
Chromium	3.09		2.82		9		MS
Cobalt	4.623		4.291		7		MS
Copper	30.65		29.28		4		MS
Iron	21250.0		21310.0		0.3		P
Lead	0.9504		0.9143		4		MS
Magnesium	15080.0		14145.0		6.2		P
Manganese	3061.30		3122.45		2.0		P
Nickel	3.08		3.10		1		MS
Potassium	82630.0		77600.0		6.1		P
Selenium	6.5		5.0	J	23		MS
Silver	0.185		0.174	J	6		MS
Sodium	45770.0		43050.0		5.9		P
Thallium	0.0503		0.0250	J	50		MS
Vanadium	3.574		3.173		11	E	MS
Zinc	313.91		286.51		9		MS

Metals

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DETECTION LIMITS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP/ICP-MS ID #:

GFAA ID #: **AA ID #:**

Analyte	Wave-length (nm)	Back-ground	MRL mg/Kg	MDL mg/Kg	M
Calcium	393.3		20.0	20.0	P
Iron	259.9		20.0	10.0	P
Magnesium	279.5		10.0	6.0	P
Manganese	257.6		2.00	0.30	P
Potassium	766.5		200.0	90.0	P
Sodium	589.5		200.0	20.0	P

Comments:

Metals

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DETECTION LIMITS

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000		
Project Name:	Metals in Sediment and Tissue 20		

ICP/ICP-MS ID #: **K-ICP-MS-04**

GFAA ID #:

AA ID #:

Analyte	Isotope	Back-ground	MRL ug/L	MDL ug/L	M
Aluminum	27		4.0	0.4	MS
Antimony	123		0.100	0.004	MS
Arsenic	75		1.00	0.04	MS
Barium	137		0.100	0.010	MS
Beryllium	9		0.040	0.006	MS
Cadmium	111		0.040	0.004	MS
Chromium	52		0.40	0.04	MS
Cobalt	59		0.040	0.006	MS
Copper	65		0.20	0.04	MS
Lead	208		0.0400	0.0010	MS
Nickel	60		0.40	0.04	MS
Selenium	78		2.0	0.4	MS
Silver	107		0.040	0.012	MS
Thallium	205		0.0400	0.0018	MS
Vanadium	51		0.400	0.014	MS
Zinc	66		1.00	0.12	MS

Comments:

Metals

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ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Analyte	Wave-length (nm)	Interelement Correction Factors for: Al	Ca	Fe	Mg	B
Aluminum	394.401	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Antimony	217.581	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	189.042	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Barium	455.403	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	234.861	0.0000000	0.0000000	0.0000140	0.0000000	0.0000000
Boron	249.678	0.0000000	0.0000000	-0.0007250	0.0000000	0.0000000
Cadmium	226.502	-0.0000020	0.0000000	0.0001740	0.0000000	0.0000000
Calcium	393.366	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.716	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cobalt	228.616	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Copper	327.396	0.0000000	0.0000100	0.0000000	0.0000000	0.0000000
Iron	259.94	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Lead	220.353	-0.0000700	0.0000000	0.0000000	0.0000000	0.0000000
Lithium	670.784	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Magnesium	285.213	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Manganese	260.569	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Molybdenum	202.03	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Nickel	231.604	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Phosphorus	214.914	-0.0006680	0.0000000	0.0014460	0.0000000	0.0000000
Potassium	766.491	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.0	0.0000000	0.0000000	-0.0001420	0.0000000	0.0000000
Silicon	251.611	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Silver	328.068	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	589.592	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Strontium	407.771	0.0000000	0.0000110	0.0000000	0.0000000	0.0000000
Thallium	190.856	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Tin	189.989	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Titanium	336.121	0.0000000	0.0000100	0.0000000	0.0000440	0.0000000
Vanadium	292.402	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Comments:

Metals

- 11A -

ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Zinc	213.856	0.0000000	0.0000000	0.0001110	0.0000000	0.0000000

Comments:

Metals

- 11B -

ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Analyte	Wave-length (nm)	Interelement Correction Factors for:				
		Ba	Cd	Co	Cr	Cu
Aluminum	394.401	0.0000000	0.0000000	0.0000000	0.0001600	0.0000000
Antimony	217.581	0.0000000	0.0000000	0.0000000	0.0114130	0.0000000
Arsenic	189.042	0.0000000	0.0000000	0.0000000	0.0005700	0.0000000
Barium	455.403	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	234.861	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Boron	249.678	0.0000000	0.0000000	0.0036060	0.0001960	0.0000000
Cadmium	226.502	0.0000000	0.0000000	0.0002690	0.0000490	0.0000000
Calcium	393.366	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.716	0.0000000	-0.0002500	0.0000000	0.0000000	0.0000000
Cobalt	228.616	0.0000000	0.0000000	0.0000000	-0.0004220	0.0000000
Copper	327.396	0.0000000	0.0000000	0.0002680	0.0000000	0.0000000
Iron	259.94	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Lead	220.353	0.0000000	0.0000000	0.0000000	0.0000000	0.0010380
Lithium	670.784	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Magnesium	285.213	0.0000000	0.0000000	0.0000000	0.0000560	0.0000000
Manganese	260.569	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Molybdenum	202.03	0.0000000	0.0000000	0.0000000	0.0000680	0.0000000
Nickel	231.604	0.0000000	0.0000000	-0.0001460	-0.0000780	0.0000000
Phosphorus	214.914	0.0000000	-0.0031440	0.0000000	0.0000000	0.0012730
Potassium	766.491	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.0	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Silicon	251.611	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Silver	328.068	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	589.592	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Strontium	407.771	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.856	0.0000000	0.0000000	0.0006580	0.0003850	0.0000000
Tin	189.989	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Titanium	336.121	0.0000000	0.0000000	0.0000230	0.0000000	0.0000000
Vanadium	292.402	0.0000000	0.0000000	0.0000000	-0.0050650	-0.0000600

Comments:

Form XI (PART 2) - IN

Metals

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ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Zinc	213.856	0.0000000	0.0000000	0.0000000	0.0000000	0.0015480

Comments:

Metals

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ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Analyte	Wave-length (nm)	Interelement Correction Factors for:				
		Mn	Mo	Ni	Pb	Sb
Aluminum	394.401	0.0000000	0.0000000	0.0004130	0.0000000	0.0000000
Antimony	217.581	0.0000000	0.0005870	0.0000000	0.0000000	0.0000000
Arsenic	189.042	-0.0001290	0.0005100	0.0000000	0.0000000	0.0000000
Barium	455.403	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	234.861	-0.0000220	-0.0002010	-0.0000240	0.0000000	0.0000000
Boron	249.678	0.0000000	-0.0012960	0.0000000	0.0000000	0.0000000
Cadmium	226.502	0.0000000	0.0001010	-0.0000200	0.0000000	0.0000000
Calcium	393.366	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.716	0.0001680	0.0000000	0.0000000	0.0000000	0.0000000
Cobalt	228.616	0.0000000	0.0006550	0.0001080	0.0000000	0.0000000
Copper	327.396	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Iron	259.94	0.0000000	-0.0008550	0.0000000	0.0000000	0.0000000
Lead	220.353	0.0000000	-0.0005780	0.0000000	0.0000000	0.0000000
Lithium	670.784	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Magnesium	285.213	0.0000000	-0.0000680	0.0000000	0.0000000	0.0000000
Manganese	260.569	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Molybdenum	202.03	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Nickel	231.604	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Phosphorus	214.914	-0.0003960	0.0078990	0.0000000	0.0000000	0.0000000
Potassium	766.491	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.0	0.0006270	0.0000000	0.0000000	0.0000000	0.0000000
Silicon	251.611	0.0000000	0.0252510	0.0000000	0.0000000	0.0035000
Silver	328.068	0.0001600	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	589.592	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Strontium	407.771	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.856	-0.0007330	0.0000000	0.0000000	0.0000000	0.0000000
Tin	189.989	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Titanium	336.121	0.0000000	0.0000400	0.0001250	0.0000000	0.0000000
Vanadium	292.402	-0.0002890	-0.0000740	0.0000000	0.0000000	0.0000000

Comments:

Metals

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ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Zinc	213.856	0.0000000	-0.0001040	0.0049240	0.0000000	0.0000000

Comments:

Metals

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ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc

Service Request: K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Analyte	Wave-length (nm)	Interelement Correction Factors for: Si	Ti	V		
Aluminum	394.401	0.0000000	0.0000000	0.0002890		
Antimony	217.581	0.0000000	0.0004310	0.0000000		
Arsenic	189.042	0.0000000	0.0000000	0.0001290		
Barium	455.403	0.0000000	0.0000000	0.0000000		
Beryllium	234.861	0.0000000	0.0000000	0.0000000		
Boron	249.678	0.0000000	0.0000000	-0.0004700		
Cadmium	226.502	0.0000000	0.0001130	0.0000000		
Calcium	393.366	0.0000000	0.0000000	0.0000000		
Chromium	267.716	0.0000000	0.0000000	-0.0001290		
Cobalt	228.616	0.0000000	0.0023450	0.0000000		
Copper	327.396	0.0000000	0.0000890	-0.0000950		
Iron	259.94	0.0000000	0.0000000	0.0000000		
Lead	220.353	0.0002720	0.0000000	0.0000000		
Lithium	670.784	0.0000000	0.0000000	0.0000000		
Magnesium	285.213	0.0000000	0.0000000	-0.0000820		
Manganese	260.569	0.0000000	0.0000000	0.0000000		
Molybdenum	202.03	0.0000000	0.0000000	0.0000000		
Nickel	231.604	0.0000000	0.0000000	0.0000000		
Phosphorus	214.914	0.0000000	0.0000000	-0.0012350		
Potassium	766.491	0.0000000	0.0000000	0.0000000		
Selenium	196.0	0.0000000	0.0000000	0.0000000		
Silicon	251.611	0.0000000	0.0000000	0.0000000		
Silver	328.068	0.0000000	0.0000000	0.0000750		
Sodium	589.592	0.0000000	0.0000000	0.0000000		
Strontium	407.771	0.0000000	0.0000000	0.0000000		
Thallium	190.856	0.0000000	-0.0003210	0.0001210		
Tin	189.989	0.0000000	0.0000000	0.0000000		
Titanium	336.121	0.0000000	0.0000000	0.0000000		
Vanadium	292.402	0.0000000	0.0030700	0.0000000		

Comments:

Metals

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ICP INTERELEMENT CORRECTION FACTORS

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: **K-ICP-AES-04**

Zinc	213.856	0.0000000	-0.0003530	0.0000000		

Comments:

Metals
-12-
ICP LINEAR RANGES (QUARTERLY)

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000		
Project Name:	Metals in Sediment and Tissue 20		

ICP ID Number: **K-ICP-AES-04**

Analyte	Integ. Time (Sec.)	Concentration (ug/L)	Method
Calcium	15.000	450000	6010C
Iron	15.000	360000	6010C
Magnesium	15.000	90000	6010C
Manganese	15.000	180000	6010C
Potassium	15.000	450000	6010C
Sodium	15.000	450000	6010C

Comments:

Metals
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ICP LINEAR RANGES (QUARTERLY)

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

ICP ID Number: K-ICP-MS-04

Analyte	Integ. Time (Sec.)	Concentration (ug/L)	Method
Aluminum	45.000	18000	6020A
Antimony	45.000	900	6020A
Arsenic	45.000	3000	6020A
Barium	45.000	3000	6020A
Beryllium	45.000	900	6020A
Cadmium	45.000	3000	6020A
Chromium	45.000	3000	6020A
Cobalt	45.000	3000	6020A
Copper	45.000	3000	6020A
Lead	45.000	3000	6020A
Nickel	45.000	3000	6020A
Selenium	45.000	3000	6020A
Silver	45.000	900	6020A
Thallium	45.000	3000	6020A
Vanadium	45.000	3000	6020A
Zinc	45.000	3000	6020A

Comments:

Metals
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PREPARATION LOG

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

Method: P

Sample ID	Preparation Date	Initial Volume	Final Volume(mL)
K1609659-001	9/1/2016	0.2050	20.0
K1609659-002	9/1/2016	0.2060	20.0
K1609659-003	9/1/2016	0.2000	20.0
K1609659-003D	9/1/2016	0.2000	20.0
K1609659-003S	9/1/2016	0.2010	20.0
K1609659-004	9/1/2016	0.2060	20.0
K1609659-005	9/1/2016	0.2020	20.0
K1609659-006	9/1/2016	0.2150	20.0
K1609659-007	9/1/2016	0.2010	20.0
K1609659-008	9/1/2016	0.2050	20.0
K1609659-009	9/1/2016	0.2040	20.0
K1609659-010	9/1/2016	0.2030	20.0
K1609659-011	9/1/2016	0.2040	20.0
K1609659-012	9/1/2016	0.2030	20.0
K1609659-013	9/1/2016	0.2030	20.0
KQ1610520-01	9/1/2016	0.2000	20.0
KQ1610520-02	9/1/2016	20.0	20.0
KQ1610520-03	9/1/2016	0.2030	20.0
KQ1610520-04	9/1/2016	0.2100	20.0

Metals
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PREPARATION LOG

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000

Project Name: Metals in Sediment and Tissue 20

Method: MS

Sample ID	Preparation Date	Initial Volume	Final Volume(mL)
K1609659-001	9/1/2016	0.2050	20.0
K1609659-002	9/1/2016	0.2060	20.0
K1609659-003	9/1/2016	0.2000	20.0
K1609659-003D	9/1/2016	0.2000	20.0
K1609659-003S	9/1/2016	0.2010	20.0
K1609659-004	9/1/2016	0.2060	20.0
K1609659-005	9/1/2016	0.2020	20.0
K1609659-006	9/1/2016	0.2150	20.0
K1609659-007	9/1/2016	0.2010	20.0
K1609659-008	9/1/2016	0.2050	20.0
K1609659-009	9/1/2016	0.2040	20.0
K1609659-010	9/1/2016	0.2030	20.0
K1609659-011	9/1/2016	0.2040	20.0
K1609659-012	9/1/2016	0.2030	20.0
K1609659-013	9/1/2016	0.2030	20.0
KQ1610520-01	9/1/2016	0.2000	20.0
KQ1610520-02	9/1/2016	20.0	20.0
KQ1610520-03	9/1/2016	0.2030	20.0
KQ1610520-04	9/1/2016	0.2100	20.0

Metals
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ANALYSIS RUN LOG

Client: MWH Global, Inc
Service Request: K1609659

Project No.: 10509465.2000
Run Number: 092716AICP04

Project Name: Metals in Sediment and Tissue 20

Instrument ID Number: K-ICP-AES-04
Method: P

Start Date: 9/27/2016
End Date: 9/27/2016

Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
BLK	1.0	08:21								X				X		X	X			X			X				
STD A	1.0	08:24								X						X	X										
STD B	1.0	08:26								X				X		X	X			X			X				
ZZZZZZ	1.0	08:31																									
ICV1	1.0	08:33								X						X	X										
ICV1	1.0	08:36								X				X		X	X			X			X				
ICB1	1.0	08:38								X				X		X	X			X			X				
LLICV1	1.0	08:41								X				X		X	X			X			X				
ZZZZZZ	1.0	08:43																									
ZZZZZZ	1.0	08:46																									
CCV1	1.0	08:48								X				X		X	X			X			X				
CCV1	1.0	08:51								X						X	X										
CCB1	1.0	08:53								X				X		X	X			X			X				
ICS-A1	1.0	08:55								X				X		X	X			X			X				
ICS-AB1	1.0	08:58								X				X		X	X			X			X				
KQ1610520-01	1.0	09:19								X						X	X			X			X				
KQ1610520-01	1.0	09:24												X													
KQ1610520-02	1.0	09:26								X				X		X	X			X			X				
KQ1610520-03	1.0	09:28																									
KQ1610520-04	1.0	09:31																									
K1609659-003	1.0	09:34								X				X		X	X			X			X				
K1609659-003L	5.0	09:36								X				X		X	X			X			X				
K1609659-003D	1.0	09:39								X				X		X	X			X			X				
K1609659-003S	1.0	09:41								X				X		X	X			X			X				
K1609659-001	1.0	09:44								X				X		X	X			X			X				
CCV2	1.0	09:46								X				X		X	X			X			X				
CCV2	1.0	09:49								X						X	X										
CCB2	1.0	09:51								X				X		X	X			X			X				
K1609659-002	1.0	09:53								X				X		X	X			X			X				
K1609659-004	1.0	09:56								X				X		X	X			X			X				
K1609659-005	1.0	09:58								X				X		X	X			X			X				
K1609659-006	1.0	10:01								X				X		X	X			X			X				

*** - Denotes additional elements (other than the standard CLP elements) are represented on another Form 14**

Metals
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ANALYSIS RUN LOG

Client: MWH Global, Inc

Service Request: K1609659

Project No.: 10509465.2000

Run Number: 092716AICP04

Project Name: Metals in Sediment and Tissue 20

Instrument ID Number: K-ICP-AES-04

Method: P

Start Date: 9/27/2016

End Date: 9/27/2016

Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
K1609659-007	1.0	10:03								X				X		X	X			X			X				
K1609659-008	1.0	10:05								X				X		X	X			X			X				
K1609659-009	1.0	10:08								X				X		X	X			X			X				
K1609659-010	1.0	10:10								X				X		X	X			X			X				
K1609659-011	1.0	10:13								X				X		X	X			X			X				
K1609659-012	1.0	10:15								X				X		X	X			X			X				
CCV3	1.0	10:17								X				X		X	X			X			X				
CCV3	1.0	10:20								X						X	X										
CCB3	1.0	10:22								X				X		X	X			X			X				
K1609659-013	1.0	10:24								X				X		X	X			X			X				
CCV4	1.0	10:28								X				X		X	X			X			X				
CCV4	1.0	10:30								X						X	X										
CCB4	1.0	10:32								X				X		X	X			X			X				
ZZZZZZ	1.0	10:35																									
LLCCV1	1.0	10:37								X				X		X	X			X			X				

*** - Denotes additional elements (other than the standard CLP elements) are represented on another Form 14**

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ANALYSIS RUN LOG

Client:	MWH Global, Inc	**Service Request:**	K1609659
Project No.:	10509465.2000	**Run Number:**	090716a1
Project Name:	Metals in Sediment and Tissue 20		
Instrument ID Number:	**K-ICP-MS-04**	**Method:**	**MS**
Start Date:	**9/7/2016**	**End Date:**	**9/7/2016**

Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
Blank	1.0	13:37		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
Standard 1	1.0	13:42		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ICV1	1.0	13:47		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCV1	1.0	13:52		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ICB1	1.0	13:56		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCB1	1.0	14:01		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
LLICVT1	1.0	14:06		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ICS-A1	1.0	14:11		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ICS-AB1	1.0	14:16		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	14:21																									
ZZZZZZ	1.0	14:26																									
ZZZZZZ	1.0	14:30																									
ZZZZZZ	1.0	14:35																									
ZZZZZZ	1.0	14:40																									
ZZZZZZ	1.0	14:45																									
ZZZZZZ	1.0	14:50																									
ZZZZZZ	1.0	14:55																									
CCV2	1.0	14:59		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCB2	1.0	15:04		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	15:09																									
ZZZZZZ	1.0	15:14																									
ZZZZZZ	5.0	15:19																									
ZZZZZZ	1.0	15:24																									
ZZZZZZ	1.0	15:29																									
ZZZZZZ	1.0	15:33																									
ZZZZZZ	1.0	15:38																									
ZZZZZZ	1.0	15:43																									
ZZZZZZ	1.0	15:48																									
ZZZZZZ	1.0	15:53																									
ZZZZZZ	1.0	15:58																									
CCV3	1.0	16:02		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCB3	1.0	16:07		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	

*** - Denotes additional elements (other than the standard CLP elements) are represented on another Form 14**

Metals
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ANALYSIS RUN LOG

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000 **Run Number:** 090716a1

Project Name: Metals in Sediment and Tissue 20

Instrument ID Number: **K-ICP-MS-04** **Method:** **MS**

Start Date: **9/7/2016** **End Date:** **9/7/2016**

Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
ZZZZZZ	1.0	16:12																									
LLCCVT1	1.0	16:16		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	16:32																									
ZZZZZZ	1.0	16:37																									
ZZZZZZ	1.0	16:42																									
ZZZZZZ	1.0	16:46																									
ZZZZZZ	5.0	16:51																									
ZZZZZZ	1.0	16:56																									
ZZZZZZ	1.0	17:01																									
ZZZZZZ	1.0	17:06																									
ZZZZZZ	1.0	17:11																									
ZZZZZZ	1.0	17:15																									
CCV4	1.0	17:20		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCB4	1.0	17:25		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	17:30																									
ZZZZZZ	1.0	17:35																									
ZZZZZZ	1.0	17:40																									
ZZZZZZ	1.0	17:45																									
ZZZZZZ	1.0	17:49																									
ZZZZZZ	1.0	17:54																									
ZZZZZZ	1.0	17:59																									
ZZZZZZ	1.0	18:04																									
ZZZZZZ	1.0	18:09																									
ZZZZZZ	5.0	18:14																									
CCV5	1.0	18:18		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCB5	1.0	18:23		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
LLCCVT2	1.0	18:28		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	18:33																									
ZZZZZZ	1.0	18:38																									
ZZZZZZ	1.0	18:43																									
ZZZZZZ	1.0	18:48																									
ZZZZZZ	1.0	18:52																									

*** - Denotes additional elements (other than the standard CLP elements) are represented on another Form 14**

Metals
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ANALYSIS RUN LOG

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000 **Run Number:** 090716a1

Project Name: Metals in Sediment and Tissue 20

Instrument ID Number: K-ICP-MS-04 **Method:** MS

Start Date: 9/7/2016 **End Date:** 9/7/2016

Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
ZZZZZZ	1.0	18:57																									
ZZZZZZ	1.0	19:02																									
KQ1610520-01	5.0	19:07		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
KQ1610520-03	5.0	19:12																									
KQ1610520-04	5.0	19:17																									
CCV6	1.0	19:21		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCB6	1.0	19:26		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-001	5.0	19:31		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-002	5.0	19:36		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-003	5.0	19:41		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-003D	5.0	19:46		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-003L	5.0	19:51		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-003A	5.0	19:55		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-003S	5.0	20:00		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
KQ1610520-02	5.0	20:05		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	20:10																									
K1609659-004	5.0	20:15		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
CCV7	1.0	20:20		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	20:24																									
CCB7	1.0	20:29		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
LLCCVT3	1.0	20:34		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-005	5.0	20:39		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-006	5.0	20:44		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-007	5.0	20:48		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-008	5.0	20:53		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-009	5.0	20:58		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-010	5.0	21:03		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-011	5.0	21:08		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-012	5.0	21:13		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
K1609659-013	5.0	21:17		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ZZZZZZ	1.0	21:22																									
CCV8	1.0	21:27		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	

*** - Denotes additional elements (other than the standard CLP elements) are represented on another Form 14**

ALS Group USA, Corp.
dba ALS Environmental

Metals
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ANALYSIS RUN LOG

Client: MWH Global, Inc **Service Request:** K1609659

Project No.: 10509465.2000 **Run Number:** 090716a1

Project Name: Metals in Sediment and Tissue 20

Instrument ID Number: **K-ICP-MS-04** **Method:** **MS**

Start Date: **9/7/2016** **End Date:** **9/7/2016**

Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
ZZZZZZ	1.0	21:32																									
CCB8	1.0	21:37		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ICS-A2	1.0	21:41		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	
ICS-AB2	1.0	21:46		X	X	X	X	X	X		X	X	X		X				X		X	X		X	X	X	

*** - Denotes additional elements (other than the standard CLP elements) are represented on another Form 14**

Metals

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ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Lab Name: ALS Group USA, Corp. Contract: 10509465.2000

Lab Code: ALSK Case No.: NRAS No.: SDG NO.: K1609659

ICP-MS Instrument ID: K-ICP-MS-04 Start Date: 09/07/2016 End Date: 09/07/2016

Sample No.	Client ID	Time	Internal Standards %RI For: Element Li6 KED1	Q	Element Ge72 KED2	Q	Element Ge72 KED3	Q	Element Rh103 KED2	Q	Element In115 KED1	Q	Element In115 KED2	Q
Blank	Blank	1337	100		100		100		100		100		100	
Standard 1	Standard 1	1342	104		100		100		100		97		101	
ICV1	ICV	1347	106		102		100		101		100		102	
CCV1	CCV	1352	104		102		99		101		99		100	
ICB1	ICB	1356	102		101		97		99		98		100	
CCB1	CCB	1401	103		100		103		101		98		100	
LLICVT1	LLICVT1	1406	102		102		99		101		102		102	
ICS-A1	ICSA	1411	102		95		92		91		90		97	
ICS-AB1	ICSAB	1416	104		95		91		92		93		97	
ZZZZZZ	ZZZZZZ	1421												
ZZZZZZ	ZZZZZZ	1426												
ZZZZZZ	ZZZZZZ	1430												
ZZZZZZ	ZZZZZZ	1435												
ZZZZZZ	ZZZZZZ	1440												
ZZZZZZ	ZZZZZZ	1445												
ZZZZZZ	ZZZZZZ	1450												
ZZZZZZ	ZZZZZZ	1455												
CCV2	CCV	1459	109		102		98		101		103		101	
CCB2	CCB	1504	108		101		96		100		100		100	
ZZZZZZ	ZZZZZZ	1509												
ZZZZZZ	ZZZZZZ	1514												
ZZZZZZ	ZZZZZZ	1519												
ZZZZZZ	ZZZZZZ	1524												
ZZZZZZ	ZZZZZZ	1529												
ZZZZZZ	ZZZZZZ	1533												
ZZZZZZ	ZZZZZZ	1538												
ZZZZZZ	ZZZZZZ	1543												
ZZZZZZ	ZZZZZZ	1548												
ZZZZZZ	ZZZZZZ	1553												
ZZZZZZ	ZZZZZZ	1558												
CCV3	CCV	1602	106		96		94		94		99		93	
CCB3	CCB	1607	103		96		93		95		98		95	
ZZZZZZ	ZZZZZZ	1612												
LLCCVT1	LLCCVT1	1616	104		94		93		93		99		91	
ZZZZZZ	ZZZZZZ	1632												
ZZZZZZ	ZZZZZZ	1637												
ZZZZZZ	ZZZZZZ	1642												
ZZZZZZ	ZZZZZZ	1646												
ZZZZZZ	ZZZZZZ	1651												
ZZZZZZ	ZZZZZZ	1656												
ZZZZZZ	ZZZZZZ	1701												
ZZZZZZ	ZZZZZZ	1706												
ZZZZZZ	ZZZZZZ	1711												
ZZZZZZ	ZZZZZZ	1715												

Metals

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ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Lab Name: ALS Group USA, Corp. Contract: 10509465.2000

Lab Code: ALSK Case No.: NRAS No.: SDG NO.: K1609659

ICP-MS Instrument ID: K-ICP-MS-04 Start Date: 09/07/2016 End Date: 09/07/2016

Sample No.	Client ID	Time	Internal Standards %RI For:											
			Element Li6 KED1	Q	Element Ge72 KED2	Q	Element Ge72 KED3	Q	Element Rh103 KED2	Q	Element In115 KED1	Q	Element In115 KED2	Q
CCV4	CCV	1720	107		97		98		99		101		96	
CCB4	CCB	1725	102		96		97		95		99		94	
ZZZZZZ	ZZZZZZ	1730												
ZZZZZZ	ZZZZZZ	1735												
ZZZZZZ	ZZZZZZ	1740												
ZZZZZZ	ZZZZZZ	1745												
ZZZZZZ	ZZZZZZ	1749												
ZZZZZZ	ZZZZZZ	1754												
ZZZZZZ	ZZZZZZ	1759												
ZZZZZZ	ZZZZZZ	1804												
ZZZZZZ	ZZZZZZ	1809												
ZZZZZZ	ZZZZZZ	1814												
CCV5	CCV	1818	108		98		97		99		99		97	
CCB5	CCB	1823	107		96		92		95		98		96	
LLCCVT2	LLCCVT2	1828	107		94		94		95		98		93	
ZZZZZZ	ZZZZZZ	1833												
ZZZZZZ	ZZZZZZ	1838												
ZZZZZZ	ZZZZZZ	1843												
ZZZZZZ	ZZZZZZ	1848												
ZZZZZZ	ZZZZZZ	1852												
ZZZZZZ	ZZZZZZ	1857												
ZZZZZZ	ZZZZZZ	1902												
KQ1610520-01	Method Blank	1907	113		96		92		97		103		94	
KQ1610520-03	Standard	1912	110		94		90		94		101		94	
KQ1610520-04	Standard	1917	109		94		90		91		99		92	
CCV6	CCV	1921	110		95		93		96		103		95	
CCB6	CCB	1926	110		95		92		95		103		93	
K1609659-001	MWH-007	1931	106		97		92		96		99		97	
K1609659-002	MWH-009	1936	108		97		92		97		105		97	
K1609659-003	MWH-011	1941	111		97		92		96		103		96	
K1609659-003D	MWH-011D	1946	112		97		94		98		104		97	
K1609659-003L	MWH-011L	1951	111		99		97		100		107		99	
K1609659-003A	MWH-011A	1955	110		97		92		96		105		96	
K1609659-003S	MWH-011S	2000	118		97		92		96		111		98	
KQ1610520-02	Lab Control	2005	115		100		95		100		109		99	
ZZZZZZ	ZZZZZZ	2010												
K1609659-004	MWH-012	2015	112		97		94		98		107		97	
CCV7	CCV	2020	112		97		93		100		107		97	
ZZZZZZ	ZZZZZZ	2024												
CCB7	CCB	2029	109		95		94		95		104		94	
LLCCVT3	LLCCVT3	2034	111		97		94		98		103		95	
K1609659-005	MWH-014	2039	111		98		92		96		105		97	
K1609659-006	MWH-016	2044	112		96		92		95		103		95	
K1609659-007	MWH-017	2048	109		94		90		94		103		94	

Metals

15-IN

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Lab Name: ALS Group USA, Corp. Contract: 10509465.2000

Lab Code: ALSK Case No.: NRAS No.: SDG NO.: K1609659

ICP-MS Instrument ID: K-ICP-MS-04 Start Date: 09/07/2016 End Date: 09/07/2016

Sample No.	Client ID	Time	Internal Standards %RI For:											
			Element Li6 KED1	Q	Element Ge72 KED2	Q	Element Ge72 KED3	Q	Element Rh103 KED2	Q	Element In115 KED1	Q	Element In115 KED2	Q
K1609659-008	MWH-029	2053	108		92		91		92		101		91	
K1609659-009	MWH-030	2058	105		93		87		93		101		93	
K1609659-010	MWH-069	2103	106		93		90		94		100		93	
K1609659-011	MWH-074	2108	107		94		92		95		102		94	
K1609659-012	MWH-075	2113	108		94		91		93		103		93	
K1609659-013	MWH-013	2117	106		93		89		93		100		91	
ZZZZZZ	ZZZZZZ	2122												
CCV8	CCV	2127	104		92		90		94		97		91	
ZZZZZZ	ZZZZZZ	2132												
CCB8	CCB	2137	104		93		90		93		99		92	
ICS-A2	ICSA	2141	99		84		82		82		89		85	
ICS-AB2	ICSAB	2146	98		83		80		81		90		84	

Metals

15-IN

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Lab Name: ALS Group USA, Corp. Contract: 10509465.2000

Lab Code: ALSK Case No.: NRAS No.: SDG NO.: K1609659

ICP-MS Instrument ID: K-ICP-MS-04 Start Date: 09/07/2016 End Date: 09/07/2016

Sample No.	Client ID	Time	Internal Standards %RI For: Element Lu175 KED	Q	Element	Q	Element	Q	Element	Q	Element	Q	
Blank	Blank	1337	100										
Standard 1	Standard 1	1342	104										
ICV1	ICV	1347	104										
CCV1	CCV	1352	102										
ICB1	ICB	1356	104										
CCB1	CCB	1401	102										
LLICVT1	LLICVT1	1406	104										
ICS-A1	ICSA	1411	100										
ICS-AB1	ICSAB	1416	100										
ZZZZZZ	ZZZZZZ	1421											
ZZZZZZ	ZZZZZZ	1426											
ZZZZZZ	ZZZZZZ	1430											
ZZZZZZ	ZZZZZZ	1435											
ZZZZZZ	ZZZZZZ	1440											
ZZZZZZ	ZZZZZZ	1445											
ZZZZZZ	ZZZZZZ	1450											
ZZZZZZ	ZZZZZZ	1455											
CCV2	CCV	1459	106										
CCB2	CCB	1504	104										
ZZZZZZ	ZZZZZZ	1509											
ZZZZZZ	ZZZZZZ	1514											
ZZZZZZ	ZZZZZZ	1519											
ZZZZZZ	ZZZZZZ	1524											
ZZZZZZ	ZZZZZZ	1529											
ZZZZZZ	ZZZZZZ	1533											
ZZZZZZ	ZZZZZZ	1538											
ZZZZZZ	ZZZZZZ	1543											
ZZZZZZ	ZZZZZZ	1548											
ZZZZZZ	ZZZZZZ	1553											
ZZZZZZ	ZZZZZZ	1558											
CCV3	CCV	1602	99										
CCB3	CCB	1607	96										
ZZZZZZ	ZZZZZZ	1612											
LLCCVT1	LLCCVT1	1616	99										
ZZZZZZ	ZZZZZZ	1632											
ZZZZZZ	ZZZZZZ	1637											
ZZZZZZ	ZZZZZZ	1642											
ZZZZZZ	ZZZZZZ	1646											
ZZZZZZ	ZZZZZZ	1651											
ZZZZZZ	ZZZZZZ	1656											
ZZZZZZ	ZZZZZZ	1701											
ZZZZZZ	ZZZZZZ	1706											
ZZZZZZ	ZZZZZZ	1711											
ZZZZZZ	ZZZZZZ	1715											

Metals

15-IN

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Lab Name: ALS Group USA, Corp.
Contract: 10509465.2000
Lab Code: ALSK
Case No.: ____
NRAS No.: ____
SDG NO.: K1609659
ICP-MS Instrument ID: K-ICP-MS-04
Start Date: 09/07/2016
End Date: 09/07/2016

Sample No.	Client ID	Time	Internal Standards %RI For:											
			Element Lu175 KED	Q	Element	Q	Element	Q	Element	Q	Element	Q		
CCV4	CCV	1720	103											
CCB4	CCB	1725	98											
ZZZZZZ	ZZZZZZ	1730												
ZZZZZZ	ZZZZZZ	1735												
ZZZZZZ	ZZZZZZ	1740												
ZZZZZZ	ZZZZZZ	1745												
ZZZZZZ	ZZZZZZ	1749												
ZZZZZZ	ZZZZZZ	1754												
ZZZZZZ	ZZZZZZ	1759												
ZZZZZZ	ZZZZZZ	1804												
ZZZZZZ	ZZZZZZ	1809												
ZZZZZZ	ZZZZZZ	1814												
CCV5	CCV	1818	100											
CCB5	CCB	1823	100											
LLCCVT2	LLCCVT2	1828	99											
ZZZZZZ	ZZZZZZ	1833												
ZZZZZZ	ZZZZZZ	1838												
ZZZZZZ	ZZZZZZ	1843												
ZZZZZZ	ZZZZZZ	1848												
ZZZZZZ	ZZZZZZ	1852												
ZZZZZZ	ZZZZZZ	1857												
ZZZZZZ	ZZZZZZ	1902												
KQ1610520-01	Method Blank	1907	101											
KQ1610520-03	Standard	1912	105											
KQ1610520-04	Standard	1917	103											
CCV6	CCV	1921	103											
CCB6	CCB	1926	102											
K1609659-001	MWH-007	1931	105											
K1609659-002	MWH-009	1936	106											
K1609659-003	MWH-011	1941	108											
K1609659-003D	MWH-011D	1946	109											
K1609659-003L	MWH-011L	1951	108											
K1609659-003A	MWH-011A	1955	108											
K1609659-003S	MWH-011S	2000	112											
KQ1610520-02	Lab Control	2005	108											
ZZZZZZ	ZZZZZZ	2010												
K1609659-004	MWH-012	2015	110											
CCV7	CCV	2020	106											
ZZZZZZ	ZZZZZZ	2024												
CCB7	CCB	2029	103											
LLCCVT3	LLCCVT3	2034	103											
K1609659-005	MWH-014	2039	106											
K1609659-006	MWH-016	2044	107											
K1609659-007	MWH-017	2048	108											

Metals

15-IN

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Lab Name: ALS Group USA, Corp. Contract: 10509465.2000

Lab Code: ALSK Case No.: NRAS No.: SDG NO.: K1609659

ICP-MS Instrument ID: K-ICP-MS-04 Start Date: 09/07/2016 End Date: 09/07/2016

Sample No.	Client ID	Time	Internal Standards %RI For:											
			Element Lu175 KED	Q	Element	Q	Element	Q	Element	Q	Element	Q		
K1609659-008	MWH-029	2053	105											
K1609659-009	MWH-030	2058	103											
K1609659-010	MWH-069	2103	102											
K1609659-011	MWH-074	2108	103											
K1609659-012	MWH-075	2113	103											
K1609659-013	MWH-013	2117	104											
ZZZZZZ	ZZZZZZ	2122												
CCV8	CCV	2127	99											
ZZZZZZ	ZZZZZZ	2132												
CCB8	CCB	2137	101											
ICS-A2	ICSA	2141	97											
ICS-AB2	ICSAB	2146	94											

FORM XV-IN

Raw Data

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Total Solids

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Service Request Number(s): K1609659

Blank Data

Laboratory ID		Date	Time	Bottle Type	Preservative	
Rinsate Blank		8/23/16	5:15	1L Amber	N/A	
↓		↓	↓	500ml	HNO_3	

DM

Project Name:

Associated Sample(s):

Equipment used: Hand Mixer, ~~Ste~~ metal cup,

Comments:

Analyst:	Date: 8/23/16
Reviewed:	Date: 8/24/16

R\:ICP\misc\digforms\TISSUE Aliquot Bench Sheets1

ALS Inc.

Service Request Number(s): K1609659

Analysis for:
Lipids

ALIQUOT DATA

Service Request #		Wet Wt. (g)		Tare Wt. (g)		Matrix
K1609659-001		~~2.[illegible]~~ DM		~~22.587~~ DM 8/23		
2		~~2.[illegible]7~~ DM	3.287	22.521		
3		~~2.[illegible]52~~ DM	3.059	22.286		
4		~~2.[illegible]6~~ DM	3.001	22.257		
5		~~2.[illegible]77~~ DM	3.049	22.618		
6		~~2.[illegible]62~~ DM	3.114	22.243		
7		~~2.035~~ DM	3.046	22.155		
8		3.120		22.112		
9		3.042		22.240		
10		3.040		22.061		
11		3.049		22.005		
12		3.056		22.096		
13		3.145		22.077		
001		~~2.386~~ DM	3.130	22.587		

DM

Comments: Please weigh approximately ~~2g~~ 3g DM in 40 ml Voa Vial with Dup/Trip

Balance ID:

Date Balance Checked:

Analyst: Dustin Meyer

Date: 8/24/16

Reviewed:

Date: 8/24/16

R:\ICP\misc\digforms\TISSUE Aliquot Bench Sheets1

ALS Environmental, Inc.

Service Request #: ______

Analysis For: Freeze Dried Solids

Lab Code	Wet Weight (g)	Tare (g)	Tare + Dry Wt.(g)	Dry Weight (g)	% Total Solids
K1604659-001	5.894	17.019			
2	6.030	~~16~~ 17.180			
3	7.168	17.035			
4	6.270	17.045			
5	6.850	16.724			
6	~~7.93~~	~~16.949~~			
7	5.433	16.736			
8	5.514	16.976			
9	5.097	17.115			
10	3.475	17.351			
11	6.498	17.072			
12	5.725	17.121			
13	3.057	16.674			
006	5.934	16.949			

Date/Time in Freeze Dryer: ______ Date/Time out of Freeze Dryer: ______

Balance ID: ______ Initial Date Balance checked: ______

After Freeze Drying Balance Check: ______

Weigh 8 to 10 grams

Comments:

High - Low / Average = RPD x = RPD

Analyst:	Date: 8/24/16
Reviewed By:	Date: 8/24

R:ICP\MISC\DIGFORMS\FISH TISSUE ALIQUOT BENCH SHEETS

ALS Inc.

Service Request Number(s):	K1609659
Analysis for:	Lipids

ALIQUOT DATA

Service Request #		Wet Wt. (g)		Tare Wt. (g)		Matrix
K1609659-001		~~2.[illegible]~~ DM		~~22.587~~ DM 8/23		
2		~~2.[illegible]27~~ DM	3.287	22.521		
3		~~2.[illegible]52~~ DM	3.059	22.286		
4		~~2.[illegible]6~~ DM	3.001	22.257		
5		~~2.[illegible]17~~ DM	3.049	22.618		
6		~~2.[illegible]62~~ DM	3.114	22.243		
7		~~2.035~~ DM	3.046	22.155		
8		3.120		22.112		
9		3.042		22.240		
10		3.040		22.061		
11		3.049		22.005		
12		3.056		22.096		
13		3.145		22.077		
001		~~2.38[illegible]~~ DM	3.130	22.587		

Comments: Please weigh approximately ~~2g~~ 3g DM in 40 ml Voa Vial with Dup/Trip

Balance ID: 45

Date Balance Checked: 8/24/16

Analyst: Dustin Meyer

Date: 8/24/16

Reviewed:

Date: 8/24/16

R\:ICP\misc\digforms\TISSUE Aliquot Bench Sheets1

Service Request Number(s): ~~K1609561~~ AR 8/23/16 K1609557 K1609659

Blank Data

Laboratory ID		Date	Time	Bottle Type	Preservative	
Rinsate Blank		8/23/16	~~9:45~~ 8:45	500 ml	HNO_3	
Rinsate Blank		8/23/16	~~9:45~~ 8:45	Amber	none	
Homogenization		8/23/16	~~8~~9:00	500 ml	HNO_3	
Homogenization		8/23/16	~~8:~~ 9:00	Amber	none	
Homogenization		8/23/16	10:30am	500 ml	HNO_3	
Homogenization		8/23/16	10:30am	Amber	none	

8/24/16

Project Name: Quantico Site 100

Associated Sample(s): All

Equipment used: Hand mixer, metal cup, scoopula

Comments:

Analyst: Rosa Marquez	Date: 8/23/16
Reviewed:	Date: 8/24/16

ALS Inc.

Service Request Number(s): K1609659

Blank Data

Laboratory ID		Date	Time	Bottle Type	Preservative	
Rinsate Blank		8/23/16	5:15	1L Amber	N/A	
↓		↓	↓	500ml	HNO_3	

Project Name:

Associated Sample(s):

Equipment used: Hand Mixer, metal cup,

Comments:

Analyst: Dustin [illegible]	Date: 8/23/16
Reviewed:	Date: 8/24/16

R\:ICP\misc\digforms\TISSUE Aliquot Bench Sheets1

Benchsheet

Service Request #:	**K1609659**	**Run #:**	**511624**
Test:	**Frz Dry**	**Balance ID:**	**K-Balance-45**
Method:	**Frz Dry**		

Pan ID:	Lab Code:	Tare (g)	Wet Wt. (g)	Tare + Dry Wt. (g)	Dry Weight (g)	% Total Solids	RPD
	K1609659-001	17.019	5.894	18.058	1.04	17.6	
	K1609659-002	17.180	6.030	17.576	0.396	6.57	
	K1609659-003	17.035	7.168	18.250	1.22	17.0	
	K1609659-004	17.045	6.270	18.082	1.04	16.5	
	K1609659-005	16.724	6.850	17.692	0.968	14.1	
	K1609659-006	16.949	5.934	17.802	0.853	14.4	
	K1609659-007	16.736	5.433	17.592	0.856	15.8	
	K1609659-008	16.976	5.514	17.880	0.904	16.4	
	K1609659-009	17.115	5.097	18.097	0.982	19.3	
	K1609659-010	17.351	3.475	17.978	0.627	18.0	
	K1609659-011	17.072	6.498	17.766	0.694	10.7	
	K1609659-012	17.121	5.725	18.022	0.901	15.7	
	K1609659-013	16.674	3.057	17.141	0.467	15.3	

	FreezeDryer ID	Date In	Time In	Date Out	Time Out	Thermometer ID
FreezeDry		**8/26/2016**	**10:00**	**8/29/2016**	**10:15**	

Cal EQID	Cal Start Value	Cal End Value	Start Date	Start Time	End Date	End Time

Comments: Data entered 8-29-16 L.J. Reviewed 8/29/16 A.C.

LIPIDS

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Lipids Raw Benchsheet

Lab ID	Client ID	Sample Weight (g)	Wt. Dish (g)	Wt. Dish + Lipid (g)
K1609659-001	MWH-007	3.130	1.30514	1.31527
K1609659-002	MWH-009	3.287	1.31155	1.31785
K1609659-003	MWH-011	3.059	1.31399	1.31788
K1609659-004	MWH-012	3.001	1.30680	1.3~~09~~1004
K1609659-005	MWH-014	3.049	1.32240	1.32458
K1609659-006	MWH-016	3.114	1.31563	1.32181
K1609659-007	MWH-017	3.046	1.32258	1.33211
K1609659-008	MWH-029	3.120	1.2~~8~~9063	1.30082
K1609659-009	MWH-030	3.042	1.29867	1.31473
K1609659-010	MWH-069	3.040	1.29318	1.30440
K1609659-011	MWH-074	3.049	1.33489	1.34490
K1609659-012	MWH-075	3.056	1.31341	1.32141
K1609659-013	MWH-013	3.145	1.31899	1.32756
KWG1607862-4 MB	Method Blank	3.287	1.32024	1.32028
K1609528-016	Batch QC	3.214	1.32469	1.33146
K1609528-016 DUP	Sample Duplicate	3.061	1.31197	1.31941
K1609528-016 TRP	Sample Triplicate	3.155	1.32122	1.32934
KWG1607862-3 LCS	Laboratory Control Sample	0.946	1.33094	1.51549

Extraction Start Time/Date: 1305 9/22/16
Extraction Stop Time/Date: 0945 9/23/16
Extracted By: AP

Extraction Method: 3541
DCM Lot #: DQ 241
Sulfate Lot #: ~~15149~~ 0
131774

Intermediate Volume of Extracts: 10 mL

Aliquot used for % Lipids: 2 mL

Date Analyzed: 10/3/16
Analyzed By: CV

Balance ID: EAB-03

Prep Run #: 271388

DEB 10/3/16

Reviewed By:

Date: 10-4-16

% Lipids - As Received - Electronic Benchsheet

wo #	wet wt	dish	dish/lip	% lip	mb corr	% lipids (rounded)	MRL
K1609659-001	3.130	1.30514	1.31527	1.611821	0.00004	1.6	0.0319
K1609659-002	3.287	1.31155	1.31785	0.952236	0.00004	0.95	0.0304
K1609659-003	3.059	1.31399	1.31788	0.629291	0.00004	0.63	0.0327
K1609659-004	3.001	1.30680	1.31004	0.533156	0.00004	0.53	0.0333
K1609659-005	3.049	1.32240	1.32458	0.350935	0.00004	0.35	0.0328
K1609659-006	3.114	1.31563	1.32181	0.98587	0.00004	0.99	0.0321
K1609659-007	3.046	1.32258	1.33211	1.557781	0.00004	1.6	0.0328
K1609659-008	3.120	1.29063	1.30082	1.626603	0.00004	1.6	0.0321
K1609659-009	3.042	1.29867	1.31473	2.633136	0.00004	2.6	0.0329
K1609659-010	3.040	1.29318	1.30440	1.838816	0.00004	1.8	0.0329
K1609659-011	3.049	1.33489	1.34490	1.634962	0.00004	1.6	0.0328
K1609659-012	3.056	1.31341	1.32141	1.302356	0.00004	1.3	0.0327
K1609659-013	3.145	1.31899	1.32756	1.356121	0.00004	1.4	0.0318
KWG1607862-4 MB	3.287	1.32024	1.32028	0.000000	0.00004	0.00	0.0304
K1609528-016	3.214	1.32469	1.33146	1.046982	0.00004	1.05	0.0311
K1609528-016 DUP	3.061	1.31197	1.31941	1.208755	0.00004	1.2	0.0327
K1609528-016 TRP	3.155	1.32122	1.32934	1.280507	0.00004	1.3	0.0317
KWG1607862-3 LCS	0.946	1.33044	1.51549	97.78541	0.00004	98	0.1057

Reviewed By: ______________________ Date: 10-4-16

Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Service Request #: K1607170, K1609659

MS/MSD with #: K1607170
StarLims Run # : 513047

VER Stansard ID:	RE2-76-J	Expiration Date:	09/22/16
OPR Standard ID:	RE2-77-A	Expiration Date:	09/22/16
QCS Standard ID:	RE2-77-B	Expiration Date:	09/22/16
Parent OPR/VER ID:	RE2-76-A	Expiration Date:	01/18/17
Parent QCS ID:	RE2-74-B	Expiration Date:	04/29/17

1631 Tissue Data Review Form

	Yes	No	NA
1. 20 samples (or less) in batch	X		
2. MS/MSD every 10 samples	X		
3. Current Calibration factor used	X		
4. Calibration data included	X		
5. Method blank below MRL	X		
6. 3 Bubbler Blanks Ran Avg < 25 pg	X		
7. Bubbler Blanks < 50 pg	X		
8. Verification Standards Passed (75-123%)	X		
9. OPR, QCS in control (70-130%)	X		
10. MS/MSD recovery 70-130%	X		
11. Spike RPD within 30%	X		
12. All samples within the linear range	X		
13. All corresponding charts included	X		
14. Dilution factors calculated	X		
15. Bench sheet signed	X		
16. Reagent Blank below 20 pg	X		

Comments

Primary Reviewed by BS Date 9/12/16

Secondary Reviewed by Date 9/19/16

Batch Information Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run Duration:	2.5	Method Blank Type:	Concentration
Heating Duration:	2.5	Integration Mode:	Auto Total Hg
Retention Start Time:	0.7	Integration Type:	Peak Area
Retention Stop Time:	1.3	Result Units:	ng/L
Purge Duration:	6.0		
Drying Duration:	6.0		
Calibration File:	This File		

Analyst Comments:
PMT: 525 OFFSET: 3,039 NOISE: 36

Run Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Peak	Peak Area	Analyzed Result (pg)	Final Result (ng/L)	QA Results	Criteria	Notes
1	X	CCB	RINSE		1	64,280	0.229		0.229	< 50	accept
2	Y	CCB	RINSE		1	57,095	-0.328		-0.328	< 50	accept
3	X	CB	CB-1		1	61,350	4.76		4.76	< 50	accept
4	Y	CB	CB-2		1	72,182	5.60		5.60	< 50	accept
5	X	CB	CB-3		1	63,687	4.94		4.94	< 50	accept
6	Y	CB	CB-4		1	48,094	3.73		3.73	< 50	accept
7	X	STD	5 pg		1	123,983	4.86		97.2	75-125	accept
8	Y	STD	10 pg		1	185,870	9.66		96.6	75-125	accept
9	X	STD	25 pg		1	384,193	25.1		100.	75-125	accept
10	Y	STD	100 pg		1	1,403,052	104		104	75-125	accept
11	X	STD	500 pg		1	6,560,160	504		101	75-125	accept
12	Y	STD	2500 pg		1	33,101,890	2,560		103	75-125	accept
13	X	STD	7500 pg		1	96,003,525	7,440		99.3	75-125	accept
14	Y	STD	10000 pg		1	128,469,450	9,960		99.6	75-125	accept
15	X	OPR	OPR-1		1	1,841,971	138	5.53	111	77-123	accept
16	Y	QCS	QCS-1		1	1,768,722	132	5.30	106	77-123	accept
17	X	MBA	MB-1		1	95,960	2.69	0.107	0.107	< 0.5	accept
18	Y	S	K1610152-001		1	222,239	12.5	0.499		< HS	accept
19	X	MS	K1610152-001		1	16,824,699	1,300	52.0	103	71-125	accept
20	Y	MSD	K1610152-001		1	17,271,608	1,340	53.4	106	71-125	accept
21	X	S	K1610152-002		1	200,055	10.8	0.431		< HS	accept
22	Y	S	K1610152-003		1	198,870	10.7	0.427		< HS	accept
23	X	S	K1610152-004		1	134,204	5.65	0.226		< HS	accept
24	Y	S	K1610152-005		1	222,391	12.5	0.500		< HS	accept
25	X	S	K1610152-006		1	151,243	6.98	0.279		< HS	accept
26	Y	S	K1610152-007		1	119,869	4.54	0.182		< HS	accept
27	X	S	K1610152-008		1	140,770	6.16	0.247		< HS	accept
28	Y	S	K1610152-009		1	127,569	5.14	0.206		< HS	accept
29	X	S	K1610152-010		1	135,231	5.73	0.229		< HS	accept
30	Y	MBA	MB-2		1	84,037	1.76	0.0705	0.0705	< 0.5	accept
31	X	S	K1610152-011		1	123,028	4.79	0.191		< HS	accept
32	Y	MS	K1610152-011		1	15,618,114	1,210	48.3	96.2	71-125	accept
33	X	MSD	K1610152-011		1	15,914,302	1,230	49.2	98.0	71-125	accept

Run Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Peak	Peak Area	Analyzed Result (pg)	Final Result (ng/L)	QA Results	Criteria	Notes
34	Y	S	K1610152-012		1	171,426	8.54	0.342		< HS	accept
35	X	S	K1610152-013		1	128,175	5.19	0.207		< HS	accept
36	Y	S	K1610152-014		1	136,859	5.86	0.234		< HS	accept
37	X	S	K1610152-015		1	136,530	5.83	0.233		< HS	accept
38	Y	S	K1610152-016		1	202,161	10.9	0.437		< HS	accept
39	X	S	K1610152-017		1	124,061	4.87	0.195		< HS	accept
40	Y	S	K1610152-018		1	780,831	55.8	2.23		< HS	accept
41	X	S	K1610274-001		1	119,462	4.51	0.180		< HS	accept
42	Y	S	K1610274-002		1	1,192,839	87.8	35.1		< HS	accept
43	X	MBA	MB-3		1	54,202	-0.553	-0.0221	-0.0221	< 0.5	accept
44	Y	OPR	OPR-2		1	1,691,299	126	5.06	101	77-123	accept
45	X	QCS	QCS-1		1	1,670,989	125	5.00	99.9	77-123	accept
46	Y	MBA	MB-1		1	56,973	-0.338	-0.0135	-0.0135	< 0.5	accept
47	X	S	K1610270-002		1	347,939	22.2	0.890		< HS	accept
48	Y	MS	K1610270-002		1	17,366,624	1,340	53.7	106	71-125	accept
49	X	MSD	K1610270-002		1	16,579,232	1,280	51.3	101	71-125	accept
50	Y	S	K1610270-001		1	362,856	23.4	0.936		< HS	accept
51	X	S	K1610270-003		1	333,403	21.1	0.844		< HS	accept
52	Y	S	K1610270-004		1	406,637	26.8	1.07		< HS	accept
53	X	S	K1610270-005		1	3,821,353	292	58.3		< HS	accept
54	Y	S	K1610270-006		1	2,999,849	228	45.6		< HS	accept
55	X	S	K1610270-007		1	5,100,913	391	78.2		< HS	accept
56	Y	S	K1610266-002		1	254,568	15.0	0.600		< HS	accept
57	X	S	K1610266-001DISS		1	360,289	23.2	0.928		< HS	accept
58	Y	S	K1610266-002DISS		1	180,740	9.27	0.371		< HS	accept
59	X	MBA	MB-2		1	82,157	1.62	0.0646	0.0646	< 0.5	accept
60	Y	S	K1610266-001		1	192,247	10.2	0.406		< HS	accept
61	X	MS	K1610266-001		1	18,830,750	1,460	58.3	116	71-125	accept
62	Y	MSD	K1610266-001		1	18,977,821	1,470	58.7	117	71-125	accept
63	X	S	K1610267-001		1	384,829	25.1	1.00		< HS	accept
64	Y	S	K1610267-002		1	671,820	47.4	1.89		< HS	accept
65	X	S	K1610267-003		1	245,038	14.3	0.570		< HS	accept
66	Y	S	K1610267-001DISS		1	388,757	25.4	1.02		< HS	accept

Run Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Peak	Peak Area	Analyzed Result (pg)	Final Result (ng/L)	QA Results	Criteria	Notes
67	X	S	K1610267-002DISS		1	400,003	26.3	1.05		< HS	accept
68	Y	S	K1610267-003DISS		1	336,726	21.4	0.855		< HS	accept
69	X	S	K1610275-001		1	7,133,751	549	110.		< HS	accept
70	Y	S	K1610275-002		1	1,071,845	78.4	3.14		< HS	accept
71	X	MBA	MB-3		1	65,001	0.285	0.0114	0.0114	< 0.5	accept
72	Y	OPR	OPR-3		1	1,801,943	135	5.40	108	77-123	accept
73	X	OPR	OPR-1(SOIL)		1	3,235,575	246	4.93	98.5	77-123	accept
74	Y	MBA	MB-1		1	96,882	2.76	0.0552	0.0552	< 0.5	accept
75	X	MBA	MB-2		1	98,846	2.91	0.0582	0.0582	< 0.5	accept
76	Y	QCS	TORT-2		1	38,266,832	2,960	298	102	77-123	accept
77	X	S	K1607170-002		1	17,384,396	1,340	132		< HS	accept
78	Y	MS	K1607170-002		1	52,783,216	4,090	406	110.	71-125	accept
79	X	MSD	K1607170-002		1	51,183,687	3,970	392	105	71-125	accept
80	Y	S	K1609659-001		1	22,718,692	1,760	177		< HS	accept
81	X	S	K1609659-002		1	26,730,867	2,070	427		< HS	accept
82	Y	S	K1609659-003		1	24,103,345	1,870	185		< HS	accept
83	X	S	K1609659-004		1	30,420,865	2,360	232		< HS	accept
84	Y	S	K1609659-005		1	26,522,756	2,050	204		< HS	accept
85	X	S	K1609659-006		1	15,248,290	1,180	115		< HS	accept
86	Y	S	K1609659-007		1	3,932,512	300.	29.8		< HS	accept
~~87~~	~~X~~	~~S~~	~~K1609659-008~~		~~1~~	~~>188,623,406~~	~~14,600~~	1,430		< HS	reject
88	Y	S	K1609659-009		1	85,687,412	6,640	656		< HS	accept
89	X	OPR	OPR-4		1	1,982,641	149	5.96	119	77-123	accept
~~90~~	~~Y~~	~~S~~	~~K1609659-010~~		~~3~~	~~>204,186,094~~	~~15,800~~	~~1,800~~		~~< HS~~	~~reject~~
91	X	S	K1609659-011		1	23,482,517	1,820	174		< HS	accept
92	Y	S	K1609659-012		2	23,512,403	1,820	177		< HS	accept
93	X	S	K1609659-013		1	16,408,396	1,270	252		< HS	accept
94	Y	S	K1609659-008		1	27,285,938	2,110	2,060		< HS	accept
95	X	S	K1609659-010		1	29,139,839	2,260	2,560		< HS	accept
96	Y	MBA	MB-3		1	156,845	7.41	0.148	0.148	< 0.5	accept
97	X	OPR	OPR-2(SOIL)		1	2,966,109	225	4.51	90.2	77-123	accept
98	Y	OPR	OPR/VER-5		1	1,743,475	131	5.22	104	77-123	accept
99	X	OPR	OPR-1(SOIL)		1	3,338,747	254	5.09	102	77-123	accept

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9/12/16

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Run Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Peak	Peak Area	Analyzed Result (pg)	Final Result (ng/L)	QA Results	Criteria	Notes
100	Y	MBA	MB-1		1	109,317	3.72	0.0745	0.0745	< 0.5	accept
101	X	MBA	MB-2		1	106,350	3.49	0.0699	0.0699	< 0.5	accept
102	Y	QCS	QCS-1		1	3,222,797	245	4.91	98.1	77-123	accept
103	X	QCS	2702		1	13,521,400	1,040	413	92.3	77-123	accept
104	Y	S	K1610165-001		1	16,432,596	1,270	27.7		< HS	accept
105	X	MS	K1610165-001		1	80,311,475	6,230	136	99.5	71-125	accept
106	Y	MSD	K1610165-001		1	86,060,284	6,670	139	107	71-125	accept
107	X	S	K1610165-002		1	7,236,480	557	9.79		< HS	accept
108	Y	S	K1610165-003		1	7,143,650	550.	11.7		< HS	accept
109	X	S	K1610165-004		1	4,138,442	316	6.10		< HS	accept
110	Y	S	K1610165-005		1	2,102,313	158	2.74		< HS	accept
111	X	S	K1610165-006		1	10,020,154	773	11.5		< HS	accept
112	Y	S	K1610165-007		1	7,479,950	576	12.2		< HS	accept
113	X	S	K1610165-008		1	5,713,501	439	7.20		< HS	accept
114	Y	S	K1610165-009		1	58,121,893	4,500	151		< HS	accept
~~115~~	~~X~~	~~S~~	~~K1610165-010~~		~~1~~	~~>148,839,094~~	~~11,500~~	~~213~~		~~< HS~~	~~reject~~ BS 9/12/16
116	Y	OPR	OPR/VER-6		1	1,913,769	144	5.75	115	77-123	accept
117	X	S	K1610048-001		1	72,124,076	5,590	274		< HS	accept
118	Y	S	K1610048-001		1	18,987,107	1,470	72.1		< HS	accept
119	X	S	K1609677-001		1	8,771,857	676	13.4		< HS	accept
120	Y	MS	K1609677-001		1	73,064,744	5,660	117	100.	71-125	accept
121	X	MSD	K1609677-001		1	79,119,152	6,130	127	110.	71-125	accept
122	Y	S	K1609677-002		1	9,936,678	766	14.9		< HS	accept
123	X	S	K1609677-003		1	5,102,073	391	7.47		< HS	accept
124	Y	S	K1609677-004		1	14,880,396	1,150	22.9		< HS	accept
125	X	S	K1609677-005		1	12,399,227	957	19.0		< HS	accept
126	Y	S	K1609677-006		1	25,739,854	1,990	37.4		< HS	accept
127	X	S	K1609677-007		1	13,861,513	1,070	20.3		< HS	accept
128	Y	S	K1609677-008		1	16,085,843	1,240	23.7		< HS	accept
129	X	S	K1609897-001		1	3,443,304	262	5.50		< HS	accept
130	Y	MBA	MB-3		1	128,358	5.20	0.104	0.104	< 0.5	accept
131	X	OPR	OPR-2(SOIL)		1	2,888,552	219	4.39	87.7	77-123	accept
132	Y	OPR	OPR/VER-7		1	1,679,471	126	5.02	100.	77-123	accept

Run Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Peak	Peak Area	Analyzed Result (pg)	Final Result (ng/L)	QA Results	Criteria	Notes
~~133~~	~~X~~	~~OPR~~	~~OPR/VER-8~~		1	>146,475,090	11,400	454	90.9	77-123	reject
134	Y	S	K1610165-010		1	~~20,068,097~~	~~1,550~~	287		< HS	reject
135	X	OPR	OPR/VER-9		1	>148,670,913	11,500	461	92.2	~~77-123~~	~~reject~~
136	X	OPR	OPR/VER-10		1	1,700,500	127	5.09	102	77-123	accept
137	Y	S	K1610165-010		1	19,881,138	1,540	284		< HS	accept
138	X	S	K1609222-010		1	15,217,072	1,180	47.0		< HS	accept
139	Y	OPR	VER/OPR-11		1	1,771,601	133	5.31	106	77-123	accept

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Analyst Comments:

PMT: 525
OFFSET: 3,039
NOISE: 36

QA Summary Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Bias and Precision

Type	Name/ID	Final Result	Units	Spike Level	Source Result	% REC	% REC Limit	RPD	RPD Limit	Notes
MS	K1610152-001	52.0	ng/L	50.0	0.499	103	71-125			accept
	K1610152-011	48.3	ng/L	50.0	0.191	96.2	71-125			accept
	K1610270-002	53.7	ng/L	50.0	0.890	106	71-125			accept
	K1610266-001	58.3	ng/L	50.0	0.406	116	71-125			accept
	K1607170-002	406	ng/L	248	132	110.	71-125			accept
	K1610165-001	136	ng/L	109	27.7	99.5	71-125			accept
	K1609677-001	117	ng/L	103	13.4	100.	71-125			accept
MSD	K1610152-001	53.4	ng/L	50.0	0.499	106	71-125	2.63	< 24	accept
	K1610152-011	49.2	ng/L	50.0	0.191	98.0	71-125	1.89	< 24	accept
	K1610270-002	51.3	ng/L	50.0	0.890	101	71-125	4.66	< 24	accept
	K1610266-001	58.7	ng/L	50.0	0.406	117	71-125	0.781	< 24	accept
	K1607170-002	392	ng/L	247	132	105	71-125	3.58	< 24	accept
	K1610165-001	139	ng/L	104	27.7	107	71-125			accept
	K1609677-001	127	ng/L	104	13.4	110.	71-125			accept
OPR	OPR-1	5.53	ng/L	5		111	77-123			accept
	OPR-2	5.06	ng/L	5.0		101	77-123			accept
	OPR-3	5.40	ng/L	5.0		108	77-123			accept
	OPR-1(SOIL)	4.93	ng/L	5.0		98.5	77-123			accept
	OPR-4	5.96	ng/L	5.0		119	77-123			accept
	OPR-2(SOIL)	4.51	ng/L	5.0		90.2	77-123			accept
	OPR/VER-5	5.22	ng/L	5.0		104	77-123			accept
	OPR-1(SOIL)	5.09	ng/L	5.0		102	77-123			accept
	OPR/VER-6	5.75	ng/L	5.0		115	77-123			accept

QA Summary Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Bias and Precision

Type	Name/ID	Final Result	Units	Spike Level	Source Result	% REC	% REC Limit	RPD	RPD Limit	Notes
OPR	OPR-2(SOIL)	4.39	ng/L	5.0		87.7	77-123			accept
	OPR/VER-7	5.02	ng/L	5.0		100.	77-123			accept
	~~OPR/VER-8~~	~~454~~	~~ng/L~~	~~500~~		~~90.9~~	~~77-123~~			~~reject~~
	OPR/VER-9	461	ng/L	500		92.2	77-123			reject
	OPR/VER-10	5.09	ng/L	5.0		102	77-123			accept
	VER/OPR-11	5.31	ng/L	5.0		106	77-123			accept

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QA Summary Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Calibration

QA Sample Type	Name/ID	Analyzed Result	Units	Spike Level	% REC	% REC Limit	RSD	RSD Limit	Notes
Calibration	5 pg	4.86	pg	5	97.2	75-125			accept
	10 pg	9.66	pg	10	96.6	75-125			accept
	25 pg	25.1	pg	25	100.	75-125			accept
	100 pg	104	pg	100	104	75-125			accept
	500 pg	504	pg	500	101	75-125			accept
	2500 pg	2,560	pg	2500	103	75-125			accept
	7500 pg	7,440	pg	7500	99.3	75-125			accept
	10000 pg	9,960	pg	10000	99.6	75-125			accept
Calibration Factor		0.0000776	pg/PA				2.49	< 15	accept
Calibration Date		9/7/16							

QA Summary Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Blank Summary

QA Sample Type	Name/ID	Analyzed Result	Units	Criteria	StDev	StDev Limit	Notes
CB	CB-1	4.76	pg	< 50			accept
	CB-2	5.60	pg	< 50			accept
	CB-3	4.94	pg	< 50			accept
	CB-4	3.73	pg	< 50			accept
Average		4.76	pg	< 25	0.774	< 10	accept
MBA	MB-1	0.107	ng/L	< 0.5			accept
	MB-2	0.0705	ng/L	< 0.5			accept
	MB-3	-0.0221	ng/L	< 0.5			accept
	MB-1	-0.0135	ng/L	< 0.5			accept
	MB-2	0.0646	ng/L	< 0.5			accept
	MB-3	0.0114	ng/L	< 0.5			accept
	MB-1	0.0552	ng/L	< 0.5			accept
	MB-2	0.0582	ng/L	< 0.5			accept
	MB-3	0.148	ng/L	< 0.5			accept
	MB-1	0.0745	ng/L	< 0.5			accept
	MB-2	0.0699	ng/L	< 0.5			accept
	MB-3	0.104	ng/L	< 0.5			accept
Average		0.0606	ng/L		0.0494		

QA Summary Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

QA Comments:

Sample Results Summary Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Name/ID	Final Result (ng/L)	Notes
77	K1607170-002	132	accept
80	K1609659-001	177	accept
81	K1609659-002	427	accept
82	K1609659-003	185	accept
83	K1609659-004	232	accept
84	K1609659-005	204	accept
85	K1609659-006	115	accept
86	K1609659-007	29.8	accept
~~87~~	~~K1609659-008~~	~~1,430~~	~~reject~~
94	K1609659-008	2,060	accept
88	K1609659-009	656	accept
~~90~~	~~K1609659-010~~	~~1,800~~	~~reject~~
95	K1609659-010	2,560	accept
91	K1609659-011	174	accept
92	K1609659-012	177	accept
93	K1609659-013	252	accept

BS 9/12/16

Run Information Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Sample Vol/Wt	Dilution Vol (ml)	Analyzed Vol (ml)	Expected Value	Notes
1	X	CCB	RINSE						
2	Y	CCB	RINSE						
3	X	CB	CB-1						
4	Y	CB	CB-2						
5	X	CB	CB-3						
6	Y	CB	CB-4						
7	X	STD	5 pg					5	
8	Y	STD	10 pg					10	
9	X	STD	25 pg					25	
10	Y	STD	100 pg					100	
11	X	STD	500 pg					500	
12	Y	STD	2500 pg					2500	
13	X	STD	7500 pg					7500	
14	Y	STD	10000 pg					10000	
15	X	OPR	OPR/VER-1		25	25	25	5	
16	Y	QCS	QCS-1		25	25	25	5	
17	X	MBA	MB-1		250	250	25		
18	Y	S	K1610152-001		500	500	25		
19	X	MS	K1610152-001		500	500	25	50.0	
20	Y	MSD	K1610152-001		500	500	25	50.0	
21	X	S	K1610152-002		500	500	25		
22	Y	S	K1610152-003		500	500	25		
23	X	S	K1610152-004		500	500	25		
24	Y	S	K1610152-005		500	500	25		
25	X	S	K1610152-006		500	500	25		
26	Y	S	K1610152-007		500	500	25		
27	X	S	K1610152-008		500	500	25		
28	Y	S	K1610152-009		500	500	25		
29	X	S	K1610152-010		500	500	25		
30	Y	MBA	MB-2		250	250	25		
31	X	S	K1610152-011		500	500	25		
32	Y	MS	K1610152-011		500	500	25	50.0	
33	X	MSD	K1610152-011		500	500	25	50.0	

Run Information Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Sample Vol/Wt	Dilution Vol (ml)	Analyzed Vol (ml)	Expected Value	Notes
34	Y	S	K1610152-012		500	500	25		
35	X	S	K1610152-013		500	500	25		
36	Y	S	K1610152-014		500	500	25		
37	X	S	K1610152-015		500	500	25		
38	Y	S	K1610152-016		500	500	25		
39	X	S	K1610152-017		500	500	25		
40	Y	S	K1610152-018		500	500	25		
41	X	S	K1610274-001		250	250	25		
42	Y	S	K1610274-002		250	250	2.5		
43	X	MBA	MB-3		250	250	25		
44	Y	OPR	OPR/VER-2		25	25	25	5.0	
45	X	QCS	QCS-1		25	25	25	5.0	
46	Y	MBA	MB-1		250	250	25		
47	X	S	K1610270-002		250	250	25		
48	Y	MS	K1610270-002		250	250	25	50.0	
49	X	MSD	K1610270-002		250	250	25	50.0	
50	Y	S	K1610270-001		250	250	25		
51	X	S	K1610270-003		250	250	25		
52	Y	S	K1610270-004		250	250	25		
53	X	S	K1610270-005		250	250	5.0		
54	Y	S	K1610270-006		250	250	5.0		
55	X	S	K1610270-007		250	250	5.0		
56	Y	S	K1610266-002		250	250	25		
57	X	S	K1610266-001DISS		250	250	25		
58	Y	S	K1610266-002DISS		250	250	25		
59	X	MBA	MB-2		250	250	25		
60	Y	S	K1610266-001		250	250	25		
61	X	MS	K1610266-001		250	250	25	50.0	
62	Y	MSD	K1610266-001		250	250	25	50.0	
63	X	S	K1610267-001		250	250	25		
64	Y	S	K1610267-002		250	250	25		
65	X	S	K1610267-003		250	250	25		
66	Y	S	K1610267-001DISS		250	250	25		

Run Information Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Sample Vol/Wt	Dilution Vol (ml)	Analyzed Vol (ml)	Expected Value	Notes
67	X	S	K1610267-002DISS		250	250	25		
68	Y	S	K1610267-003DISS		250	250	25		
69	X	S	K1610275-001		250	250	5.0		
70	Y	S	K1610275-002		250	250	25		
71	X	MBA	MB-3		250	250	25		
72	Y	OPR	OPR/VER-3		25	25	25	5.0	
73	X	OPR	OPR-1(SOIL)		400	40	5.0	5.0	
74	Y	MBA	MB-1		400	40	5.0		
75	X	MBA	MB-2		400	40	5.0		
76	Y	QCS	TORT-2		398	40	1.0	292	
77	X	S	K1607170-002		407	40	1.0		
78	Y	MS	K1607170-002		403	40	1.0	248	
79	X	MSD	K1607170-002		405	40	1.0	247	
80	Y	S	K1609659-001		398	40	1.0		
81	X	S	K1609659-002		194	40	1.0		
82	Y	S	K1609659-003		404	40	1.0		
83	X	S	K1609659-004		406	40	1.0		
84	Y	S	K1609659-005		402	40	1.0		
85	X	S	K1609659-006		411	40	1.0		
86	Y	S	K1609659-007		403	40	1.0		
~~87~~	~~X~~	~~S~~	~~K1609659-008~~		~~410~~	~~40~~	~~1.0~~		
88	Y	S	K1609659-009		405	40	1.0	BS 9/12/16	
89	X	OPR	OPR/VER-4		25	25	25	5.0	
~~90~~	~~Y~~	~~S~~	~~K1609659-010~~		~~352~~	~~40~~	~~1.0~~		
91	X	S	K1609659-011		417	40	1.0		
92	Y	S	K1609659-012		411	40	1.0		
93	X	S	K1609659-013		201	40	1.0		
94	Y	S	K1609659-008		410	40	0.1		
95	X	S	K1609659-010		352	40	0.1		
96	Y	MBA	MB-3		400	40	5.0		
97	X	OPR	OPR-2(SOIL)		400	40	5.0	5.0	
98	Y	OPR	OPR/VER-5		25	25	25	5.0	
99	X	OPR	OPR-1(SOIL)		400	40	5.0	5.0	

Run Information Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Sample Vol/Wt	Dilution Vol (ml)	Analyzed Vol (ml)	Expected Value	Notes
100	Y	MBA	MB-1		400	40	5.0		
101	X	MBA	MB-2		400	40	5.0		
102	Y	QCS	QCS-1		400	40	5.0	5.0	
103	X	QCS	2702		405	40	0.25	447	
104	Y	S	K1610165-001		367	40	5.0		
105	X	MS	K1610165-001		366	40	5.0	109	
106	Y	MSD	K1610165-001		385	40	5.0	104	
107	X	S	K1610165-002		455	40	5.0		
108	Y	S	K1610165-003		375	40	5.0		
109	X	S	K1610165-004		415	40	5.0		
110	Y	S	K1610165-005		462	40	5.0		
111	X	S	K1610165-006		537	40	5.0		
112	Y	S	K1610165-007		378	40	5.0		
113	X	S	K1610165-008		487	40	5.0		
114	Y	S	K1610165-009		238	40	5.0		
115	X	S	K1610165-010		433	40	5.0		
116	Y	OPR	OPR/VER-6		25	25	25	5.0	
117	X	S	K1610048-001		163	40	5.0		
118	Y	S	K1610048-001		163	40	5.0		
119	X	S	K1609677-001		403	40	5.0		
120	Y	MS	K1609677-001		388	40	5.0	103	
121	X	MSD	K1609677-001		385	40	5.0	104	
122	Y	S	K1609677-002		412	40	5.0		
123	X	S	K1609677-003		419	40	5.0		
124	Y	S	K1609677-004		402	40	5.0		
125	X	S	K1609677-005		403	40	5.0		
126	Y	S	K1609677-006		426	40	5.0		
127	X	S	K1609677-007		421	40	5.0		
128	Y	S	K1609677-008		420	40	5.0		
129	X	S	K1609897-001		382	40	5.0		
130	Y	MBA	MB-3		400	40	5.0		
131	X	OPR	OPR-2(SOIL)		400	40	5.0	5.0	
132	Y	OPR	OPR/VER-7		25	25	25	5.0	

Run Information Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

Run	Trap	Type	Name/ID	Method Blank	Sample Vol/Wt	Dilution Vol (ml)	Analyzed Vol (ml)	Expected Value	Notes
133	X	OPR	OPR/VER-8		25	25	25	500	
134	Y	S	K1610165-010		433	40	0.5		
135	X	OPR	OPR/VER-9		25	25	25	500	
136	X	OPR	OPR/VER-10		25	25	25	5.0	
137	Y	S	K1610165-010		433	40	0.5		
138	X	S	K1609222-010		500	500	25		
139	Y	OPR	VER/OPR-11		25	25	25	5.0	

Metals Digestion Sheet

StarLims Number: 270236

Method : **1631EApp.**

Analysis for : **CVAFS**

Sample	Matrices	Dry	Wet	Initial Weight (g)	Final Volume (ml)	Matrix
VER-1	Water		x	25ml	25ml	0.5% BrCl
VER-2	Water		x	25ml	25ml	0.5% BrCl
Method Blank		x		0.400	40	0.02N BrCl
Method Blank		x		0.400	40	0.02N BrCl
Method Blank		x		0.400	40	0.02N BrCl
OPR-1		x		0.400	40	0.02N BrCl
TORT-3		x		~~0.400~~ 0.402	40	0.02N BrCl
K1607170-002			x	0.407	40	0.02N BrCl
K1607170-002MS			x	0.403	40	0.02N BrCl
K1607170-002MSD			x	0.405	40	0.02N BrCl
K1609659-001			x	0.398	40	0.02N BrCl
K1609659-002			x	0.194	40	0.02N BrCl
K1609659-003			x	0.404	40	0.02N BrCl
K1609659-004			x	0.406	40	0.02N BrCl
K1609659-005			x	0.402	40	0.02N BrCl
K1609659-006			x	0.411	40	0.02N BrCl
K1609659-007			x	0.403	40	0.02N BrCl
K1609659-008			x	0.410	40	0.02N BrCl
K1609659-009			x	0.405	40	0.02N BrCl
K1609659-010			x	0.352	40	0.02N BrCl
K1609659-011			x	0.417	40	0.02N BrCl
K1609659-012			x	0.411	40	0.02N BrCl
K1609659-013			x	0.201	40	0.02N BrCl
~~K1609659-014~~			~~x~~		~~40~~	~~0.02N BrCl~~
~~MS~~			~~x~~		~~40~~	~~0.02N BrCl~~
~~MSD~~			~~x~~		~~40~~	~~0.02N BrCl~~
OPR-2		x		0.400	40	0.02N BrCl
VER-3	Water		x	25ml	25ml	0.5% BrCl

BS 9/6/16

BrCl = RE2-73-J

RE2-77-A *(40ppb)* **OPR: 0.05ml** **Digestion Acid Mixture: RE2-63-A**

1st MS / DMS: 0.1mL **Balance ID:** 21B

2nd MS / DMS:

Comments: TORT-3 Solids: 99.1%

K1609659: not enough sample for Q.C

Time Digestion Started: 11:00a —

Analyst Ben Sh **Date** 9/6/16

1631Dig.XLS
06/17/04

Tissue Dry Wt. MRL and MDL Calculations:

Standard MRL = 1.0
Standard MDL = 0.06
Standard Dilution = 1
Standard Sample Mass = 0.40

			Weight & Dilution Adjuste	
Sample I.D.	**Dry Weight**	**Dilution**	**MRL**	**MDL**
K1607170-002	0.4070	5	**4.9**	**0.3**
K1607170-002MS	0.4030	5	**5.0**	**0.3**
K1607170-002MSD	0.4050	5	**4.9**	**0.3**
K1609659-001	0.3980	5	**5.0**	**0.3**
K1609659-002	0.1940	5	**10.3**	**0.6**
K1609659-003	0.4040	5	**5.0**	**0.3**
K1609659-004	0.4060	5	**4.9**	**0.3**
K1609659-005	0.4020	5	**5.0**	**0.3**
K1609659-006	0.4110	5	**4.9**	**0.3**
K1609659-007	0.4030	5	**5.0**	**0.3**
K1609659-008	0.4100	50	**48.8**	**2.9**
K1609659-009	0.4050	5	**4.9**	**0.3**
K1609659-010	0.3520	50	**56.8**	**3.4**
K1609659-011	0.4170	5	**4.8**	**0.3**
K1609659-012	0.4110	5	**4.9**	**0.3**
K1609659-013	0.2010	5	**10.0**	**0.6**
		1	**#DIV/0!**	**#DIV/0!**
		1	**#DIV/0!**	**#DIV/0!**
		1	**#DIV/0!**	**#DIV/0!**
		1	**#DIV/0!**	**#DIV/0!**
		1	**#DIV/0!**	**#DIV/0!**
		1	**#DIV/0!**	**#DIV/0!**
		1	**#DIV/0!**	**#DIV/0!**
		1	**#DIV/0!**	**#DIV/0!**
Method Blank	**0.4000**	1	**1.0**	**0.06**

Conversion from dry weight to wet weight:

Standard MRL = 1.0
Standard MDL = 0.06
Standard Dilution = 1
Standard Sample Mass = 0.40

					Weight & Dilution Adjuste	
Sample I.D.	**Dry Weight**	**Percent Solids**	**Wet Weight**	**Dilution**	**MRL**	**MDL**
K1609659-001	0.398	17.6	**2.261**	5	**0.88**	**0.05**
K1609659-002	0.194	6.6	**2.953**	5	**0.68**	**0.04**
K1609659-003	0.404	17.0	**2.376**	5	**0.84**	**0.05**
K1609659-004	0.406	16.5	**2.461**	5	**0.81**	**0.05**
K1609659-005	0.402	14.1	**2.851**	5	**0.70**	**0.04**
K1609659-006	0.411	14.4	**2.854**	5	**0.70**	**0.04**
K1609659-007	0.403	15.8	**2.551**	5	**0.78**	**0.05**
K1609659-008	0.410	16.4	**2.500**	50	**8.00**	**0.48**
K1609659-009	0.405	19.3	**2.098**	5	**0.95**	**0.06**
K1609659-010	0.352	18.0	**1.956**	50	**10.23**	**0.61**
K1609659-011	0.417	10.7	**3.897**	5	**0.51**	**0.03**
K1609659-012	0.411	15.7	**2.618**	5	**0.76**	**0.05**
K1609659-013	0.201	15.3	**1.314**	5	**1.52**	**0.09**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
			#DIV/0!	1	**#DIV/0!**	**#DIV/0!**
Method Blank	0.400	15.000	**2.667**	1	**0.2**	**0.01**

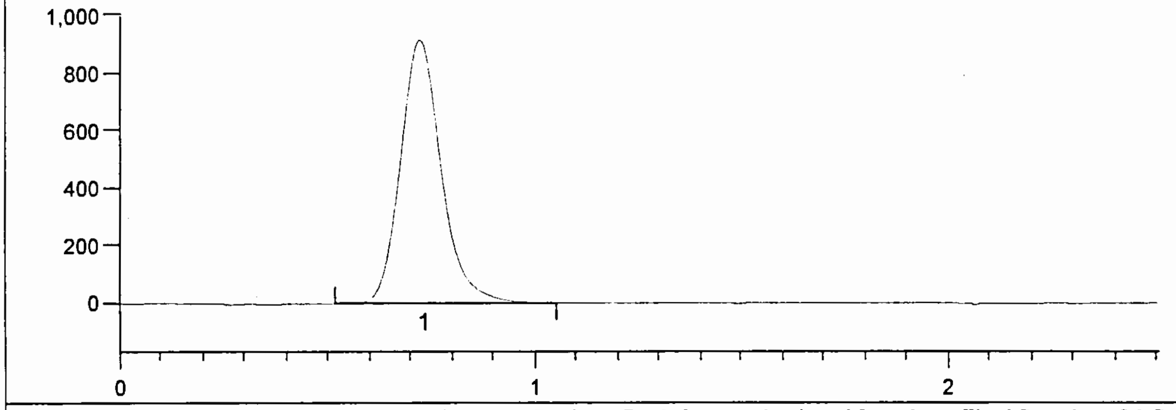
Peak Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

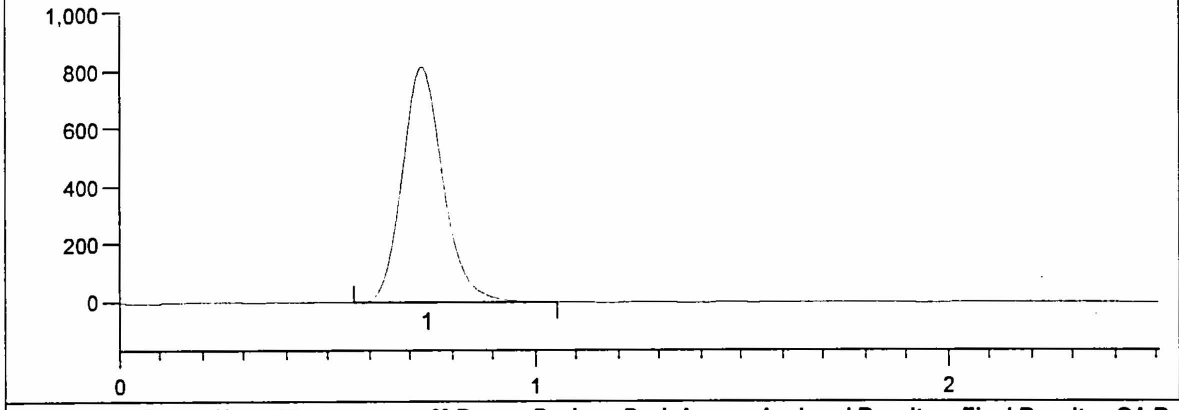
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 6:49 AM

Peak	rt	Area
1	0.72	64,280

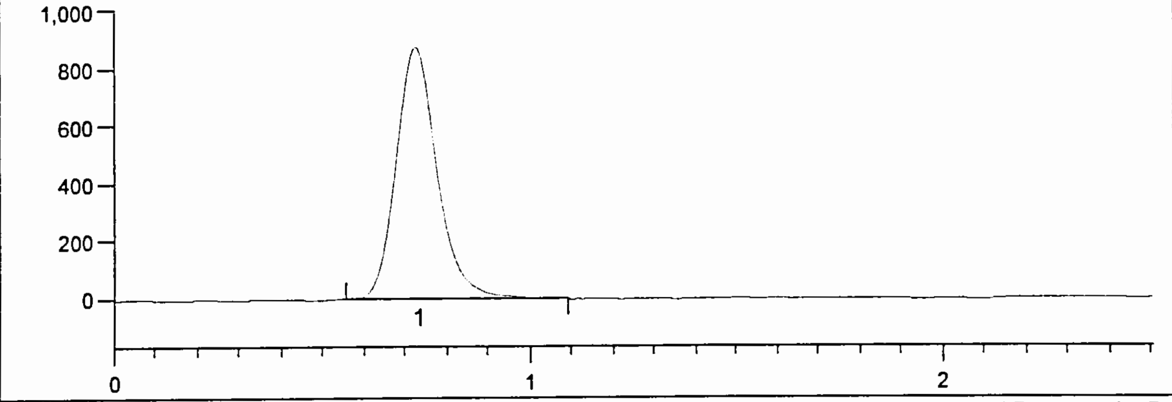
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
1	X	CCB	RINSE		1	64,280	0.229		0.229	< 50	accept
Notes											



Date: 9/7/16
Time: 6:54 AM

Peak	rt	Area
1	0.72	57,095

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
2	Y	CCB	RINSE		1	57,095	-0.328		-0.328	< 50	accept
Notes											



Date: 9/7/16
Time: 6:59 AM

Peak	rt	Area
1	0.72	61,350

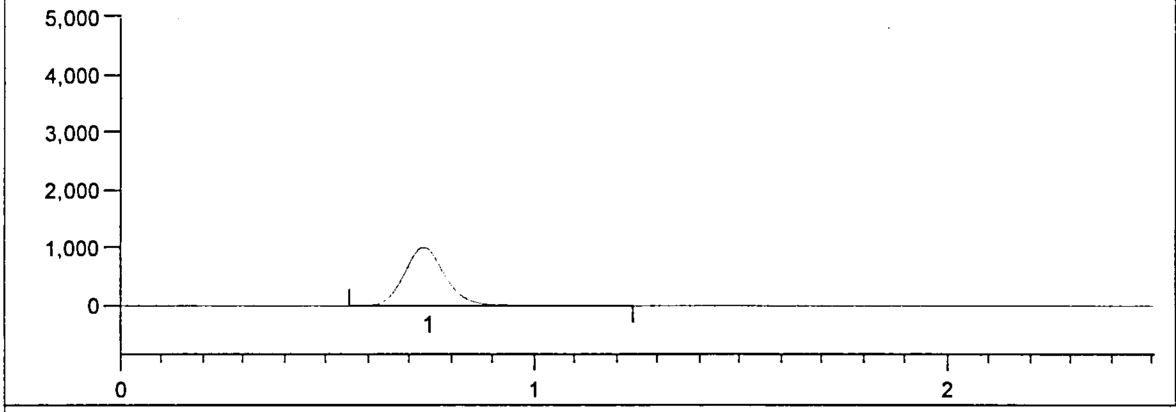
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
3	X	CB	CB-1		1	61,350	4.76		4.76	< 50	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

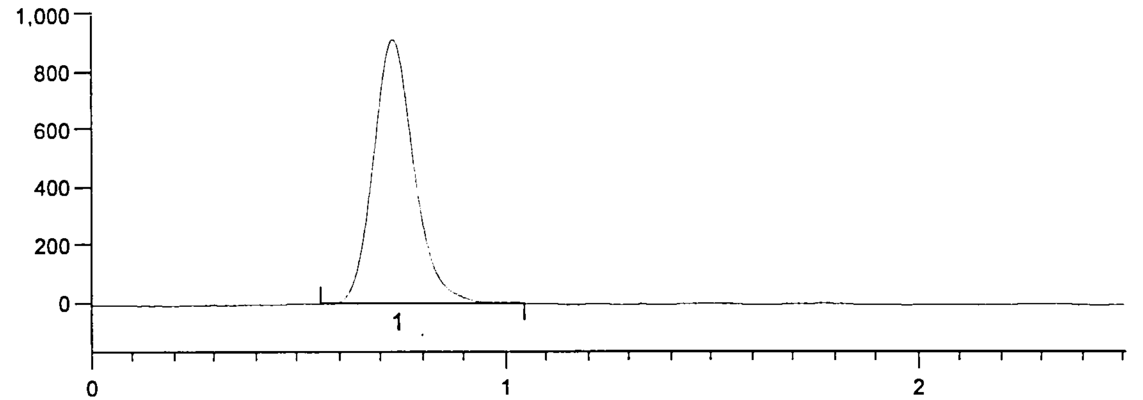
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 7:04 AM

Peak	rt	Area
1	0.73	72,182

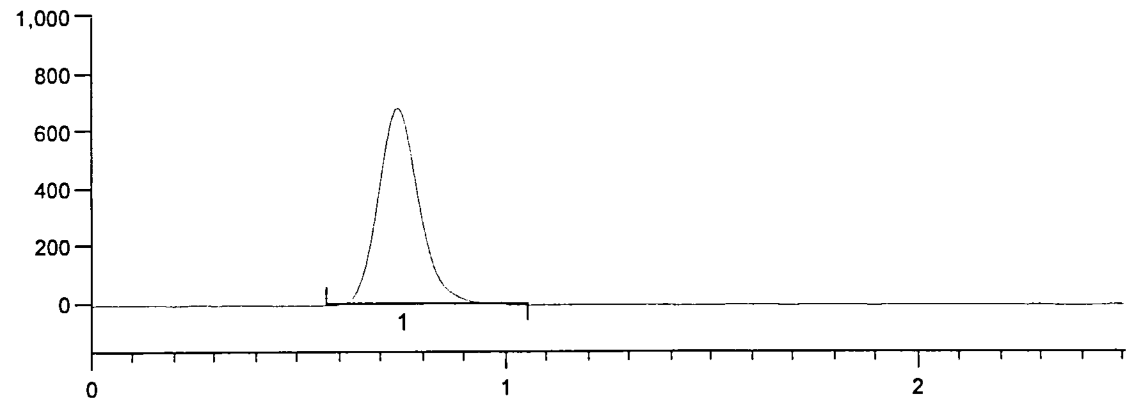
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
4	Y	CB	CB-2		1	72,182	5.60		5.60	< 50	accept
Notes											



Date: 9/7/16
Time: 7:09 AM

Peak	rt	Area
1	0.72	63,687

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
5	X	CB	CB-3		1	63,687	4.94		4.94	< 50	accept
Notes											



Date: 9/7/16
Time: 7:14 AM

Peak	rt	Area
1	0.74	48,094

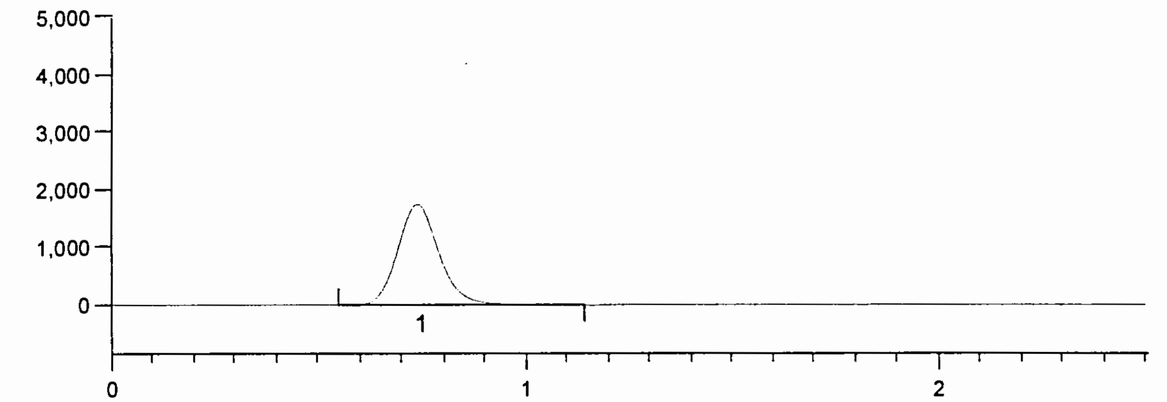
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
6	Y	CB	CB-4		1	48,094	3.73		3.73	< 50	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

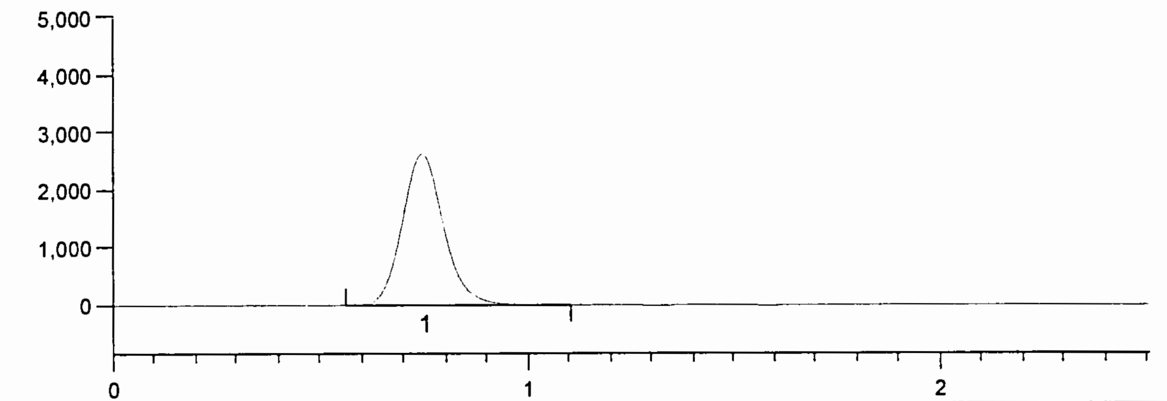
Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



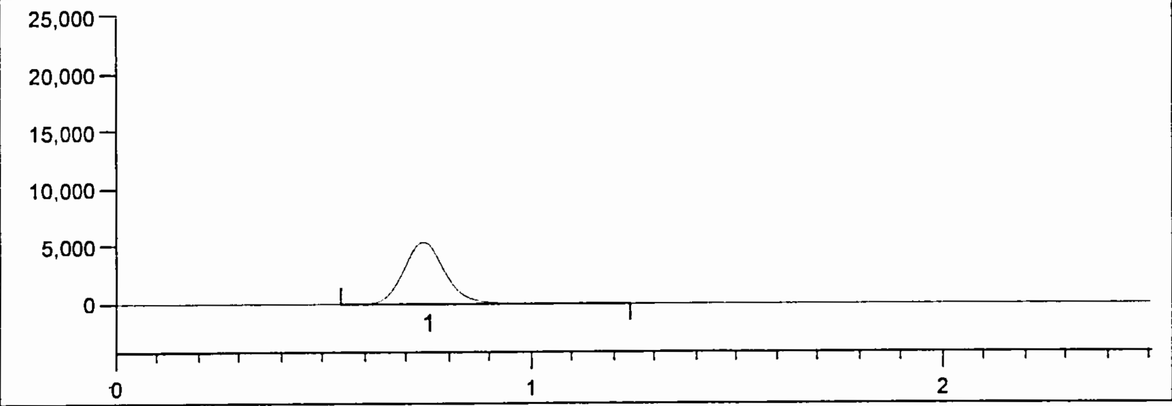
Date:	9/7/16	
Time:	7:19 AM	
Peak	**rt**	**Area**
1	0.73	123,983

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
7	X	STD	5 pg		1	123,983	4.86		97.2	75-125	accept
Notes											



Date:	9/7/16	
Time:	7:24 AM	
Peak	**rt**	**Area**
1	0.74	185,870

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
8	Y	STD	10 pg		1	185,870	9.66		96.6	75-125	accept
Notes											



Date:	9/7/16	
Time:	7:29 AM	
Peak	**rt**	**Area**
1	0.74	384,193

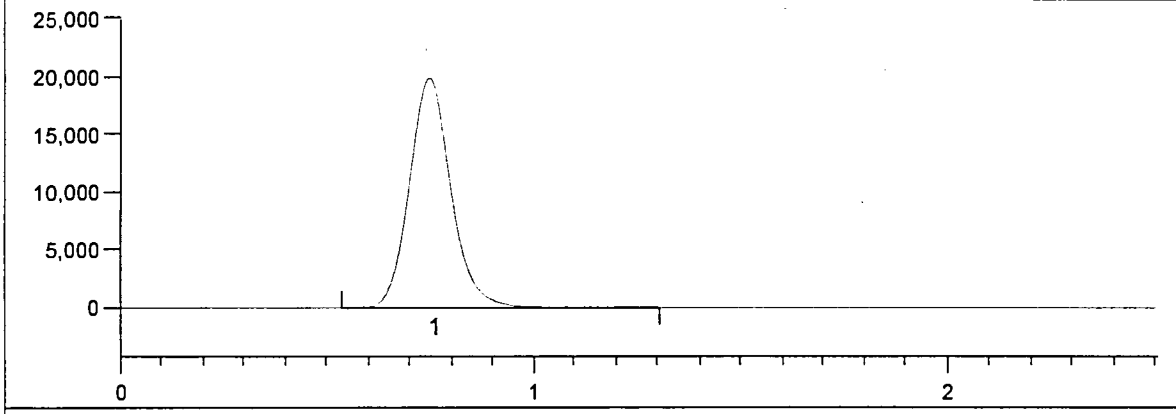
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
9	X	STD	25 pg		1	384,193	25.1		100.	75-125	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

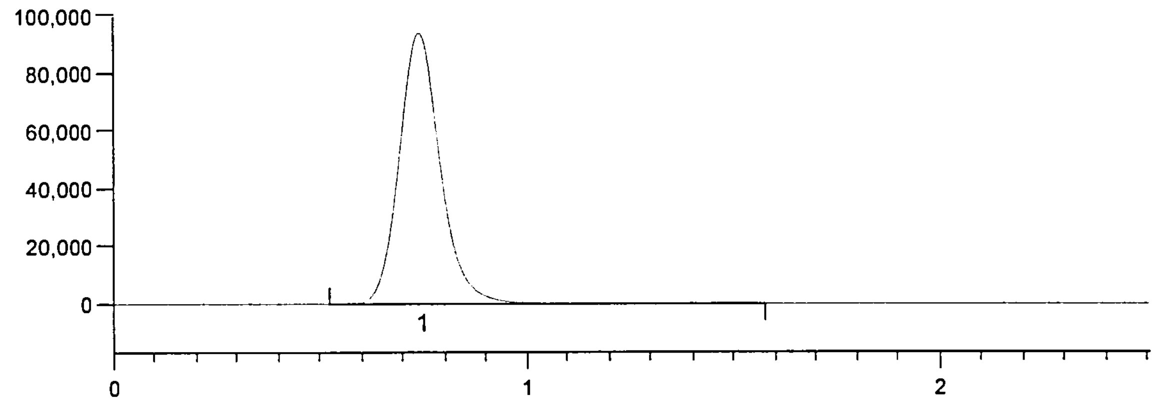
Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



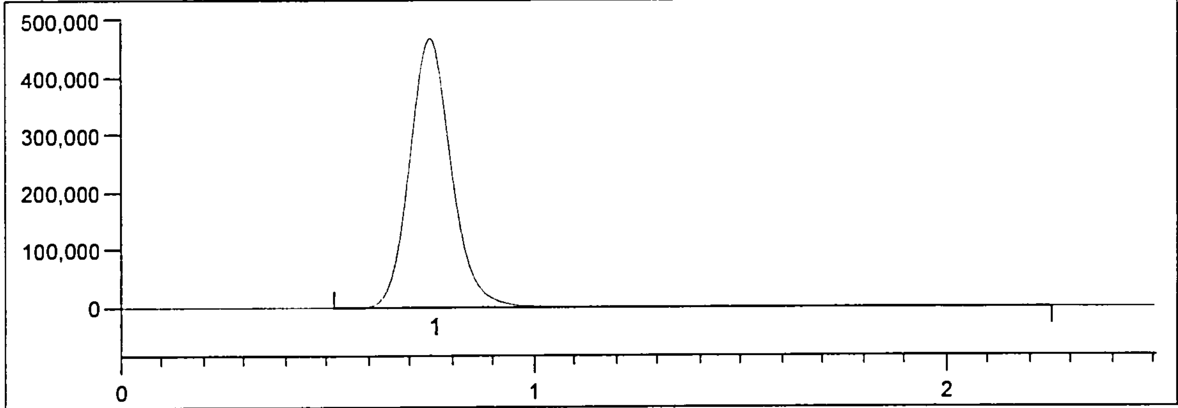
Date:	9/7/16	
Time:	7:34 AM	
Peak	rt	Area
1	0.74	1,403,052

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
10	Y	STD	100 pg		1	1,403,052	104		104	75-125	accept
Notes											



Date:	9/7/16	
Time:	7:39 AM	
Peak	rt	Area
1	0.73	6,560,160

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
11	X	STD	500 pg		1	6,560,160	504		101	75-125	accept
Notes											



Date:	9/7/16	
Time:	7:44 AM	
Peak	rt	Area
1	0.74	33,101,890

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
12	Y	STD	2500 pg		1	33,101,890	2,560		103	75-125	accept
Notes											

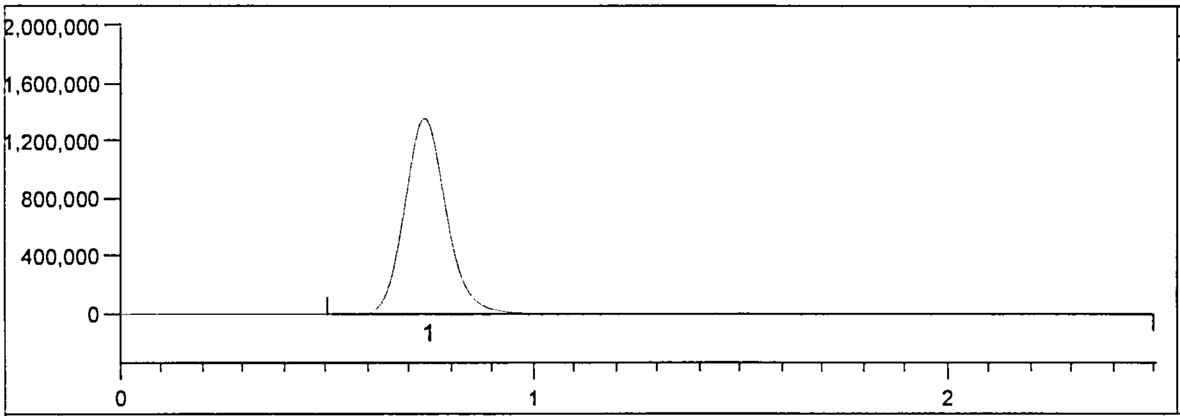
Peak Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

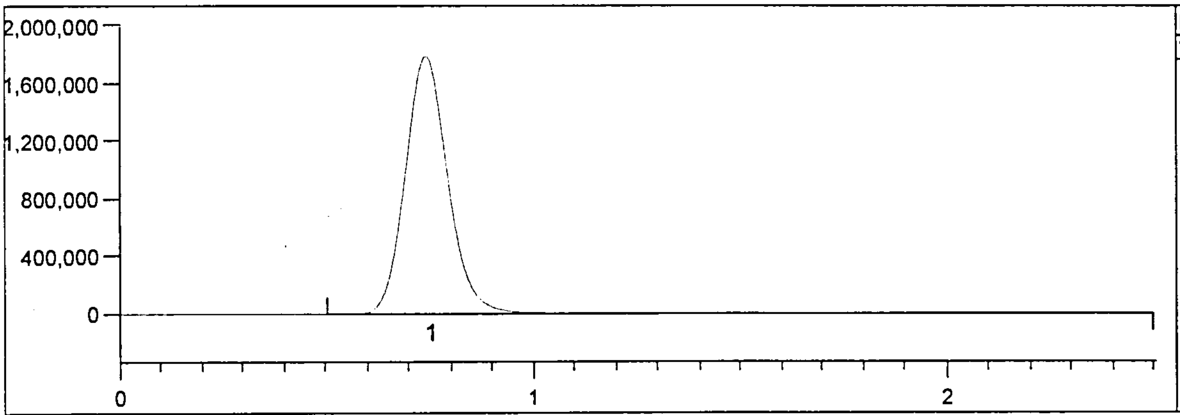
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 7:49 AM

Peak	rt	Area
1	0.73	96,003,525

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
13	X	STD	7500 pg		1	96,003,525	7,440		99.3	75-125	accept
Notes											



Date: 9/7/16
Time: 7:54 AM

Peak	rt	Area
1	0.74	128,469,450

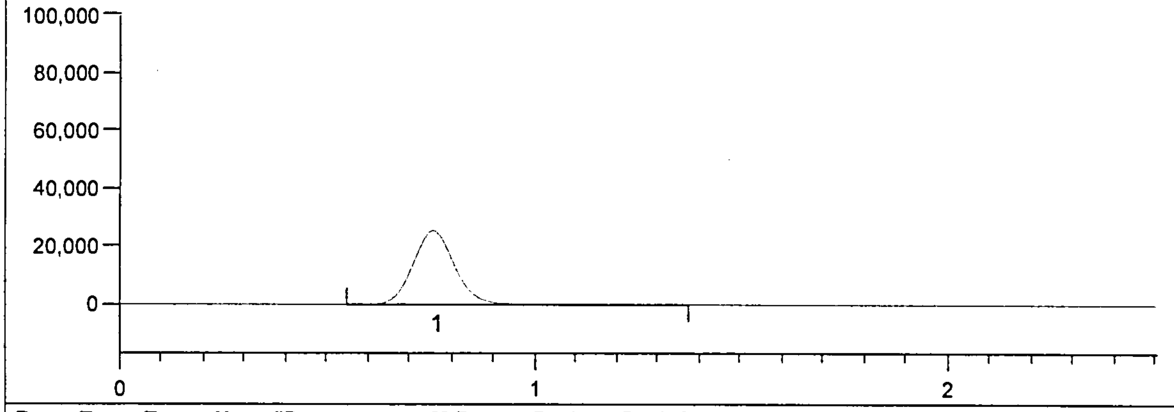
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
14	Y	STD	10000 pg		1	128,469,450	9,960		99.6	75-125	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

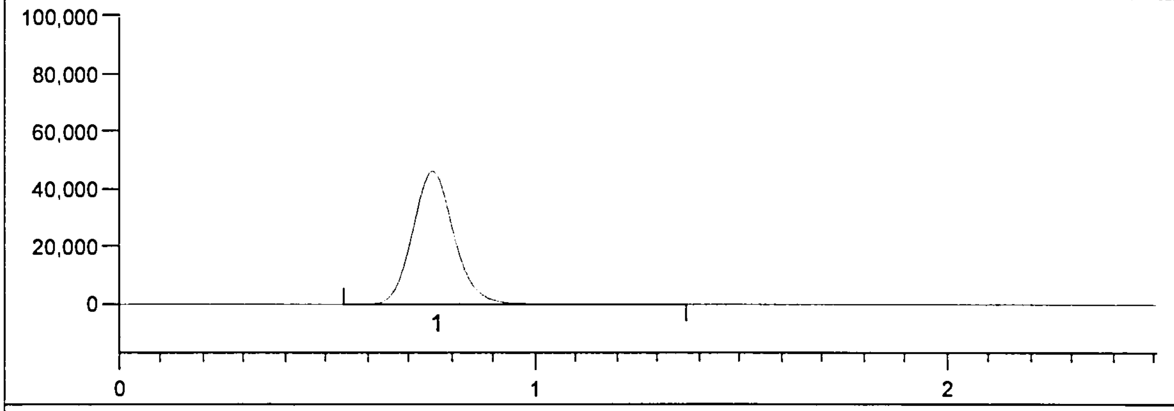
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 12:44 PM

Peak	rt	Area
1	0.75	1,801,943

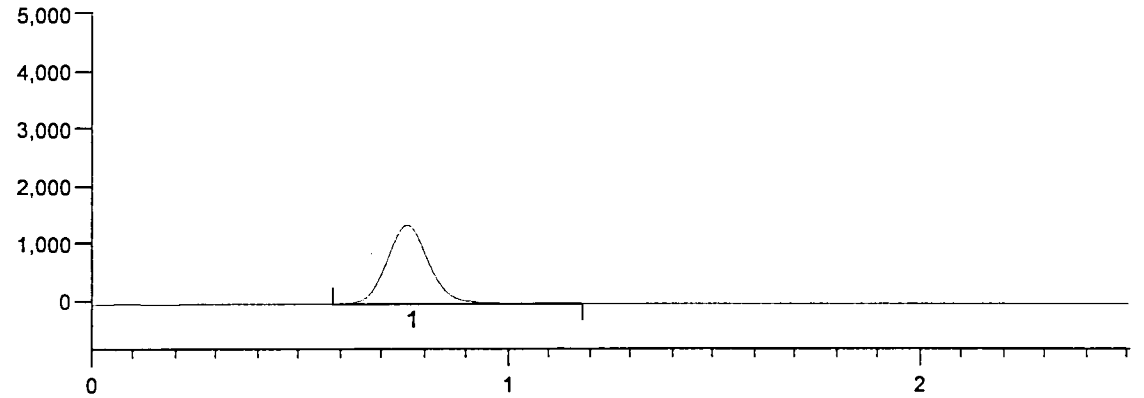
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
72	Y	OPR	OPR-3		1	1,801,943	135	5.40	108	77-123	accept
Notes											



Date: 9/7/16
Time: 12:49 PM

Peak	rt	Area
1	0.75	3,235,575

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
73	X	OPR	OPR-1(SOIL)		1	3,235,575	246	4.93	98.5	77-123	accept
Notes											



Date: 9/7/16
Time: 12:54 PM

Peak	rt	Area
1	0.76	96,882

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
74	Y	MBA	MB-1		1	96,882	2.76	0.0552	0.0552	< 0.5	accept
Notes											

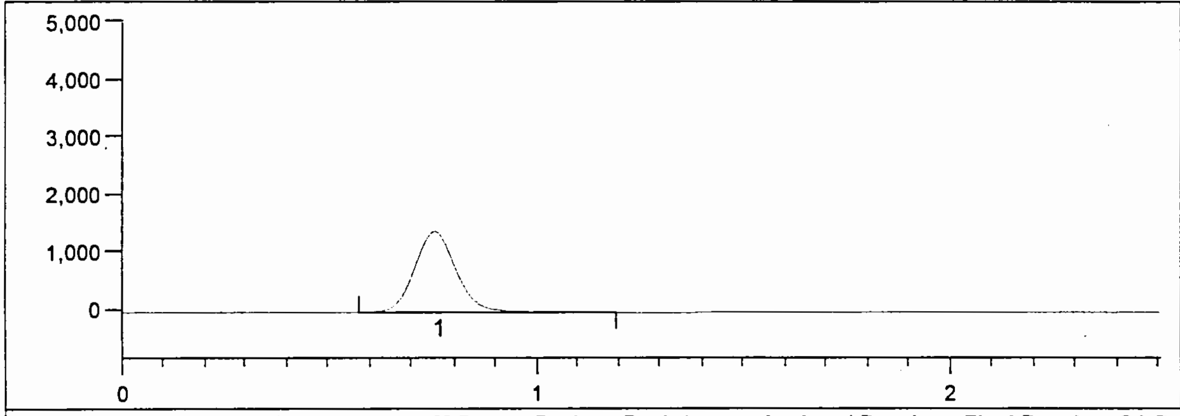
Peak Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

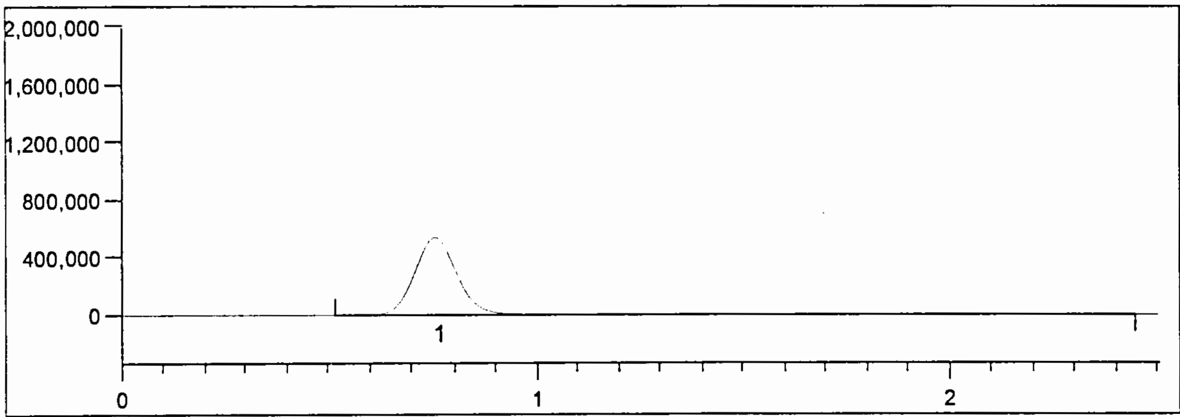
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 12:59 PM

Peak	rt	Area
1	0.75	98,846

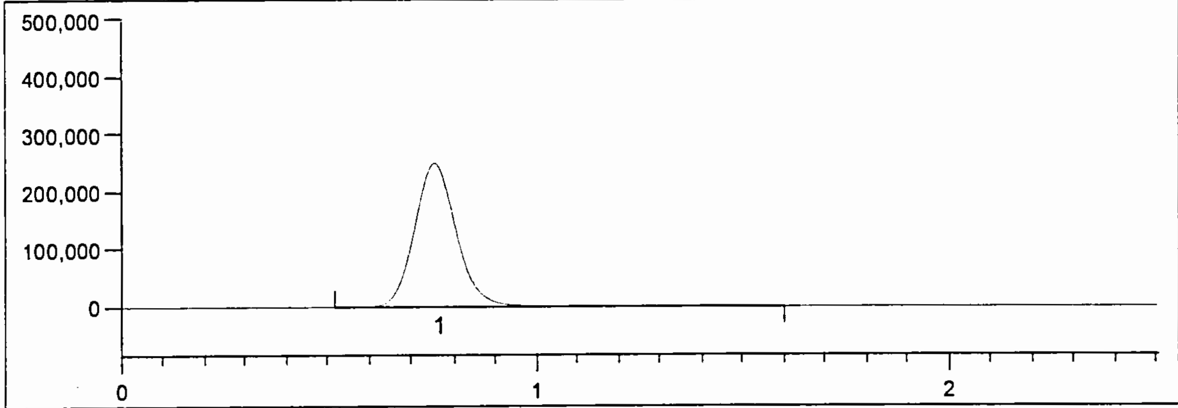
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
75	X	MBA	MB-2		1	98,846	2.91	0.0582	0.0582	< 0.5	accept
Notes											



Date: 9/7/16
Time: 1:04 PM

Peak	rt	Area
1	0.75	38,266,832

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
76	Y	QCS	TORT-2		1	38,266,832	2,960	298	102	77-123	accept
Notes											



Date: 9/7/16
Time: 1:09 PM

Peak	rt	Area
1	0.75	17,384,396

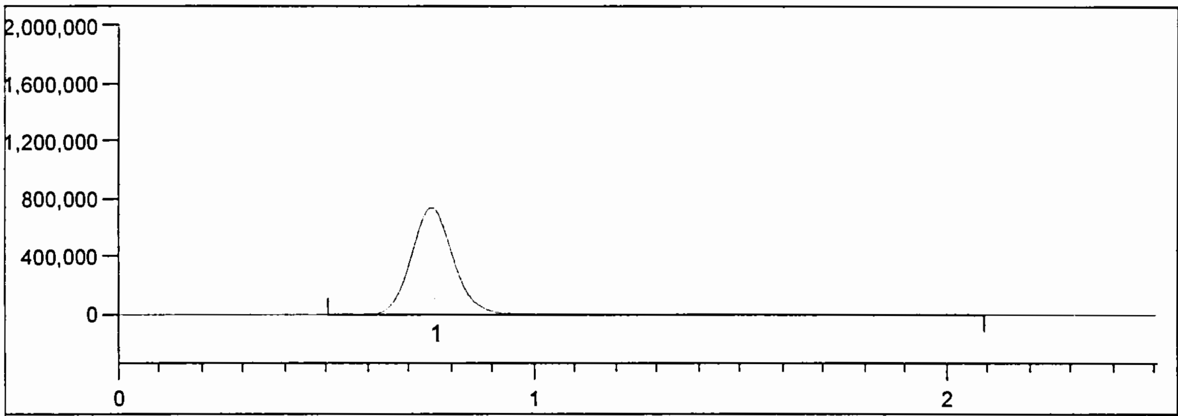
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
77	X	S	K1607170-002		1	17,384,396	1,340	132		< HS	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

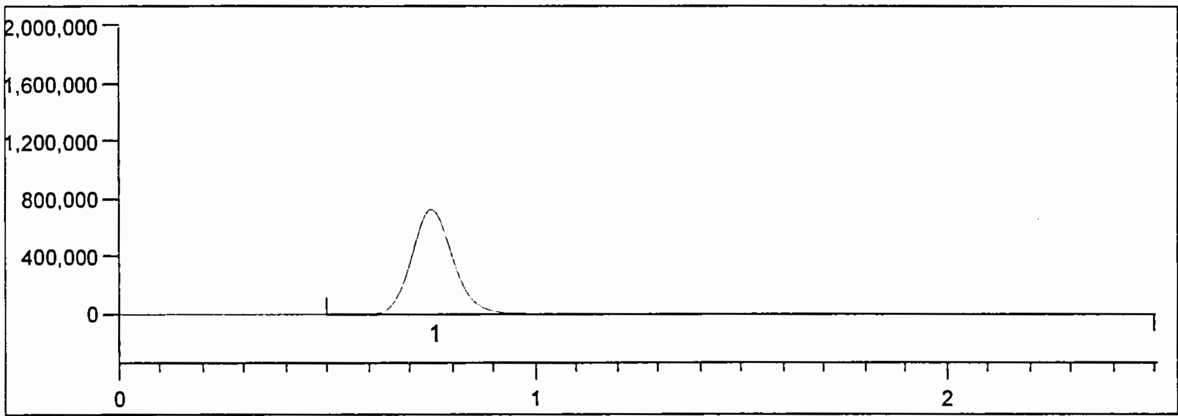
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 1:14 PM

Peak	rt	Area
1	0.75	52,783,216

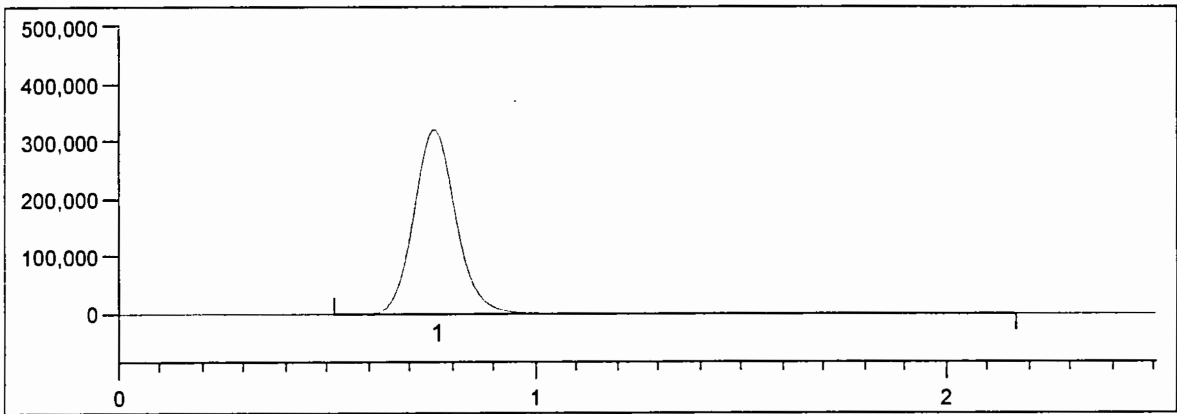
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
78	Y	MS	K1607170-002		1	52,783,216	4,090	406	110.	71-125	accept
Notes											



Date: 9/7/16
Time: 1:19 PM

Peak	rt	Area
1	0.75	51,183,687

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
79	X	MSD	K1607170-002		1	51,183,687	3,970	392	105	71-125	accept
Notes											



Date: 9/7/16
Time: 1:24 PM

Peak	rt	Area
1	0.75	22,718,692

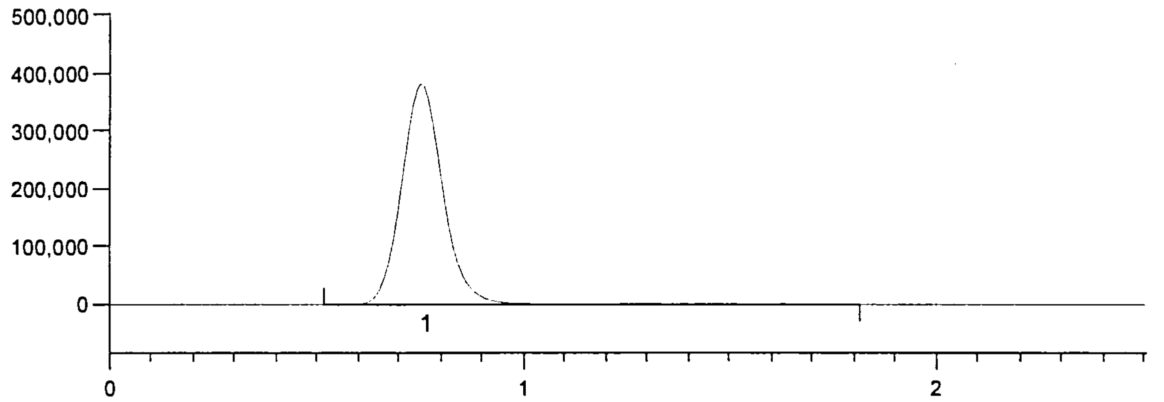
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
80	Y	S	K1609659-001		1	22,718,692	1,760	177		< HS	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

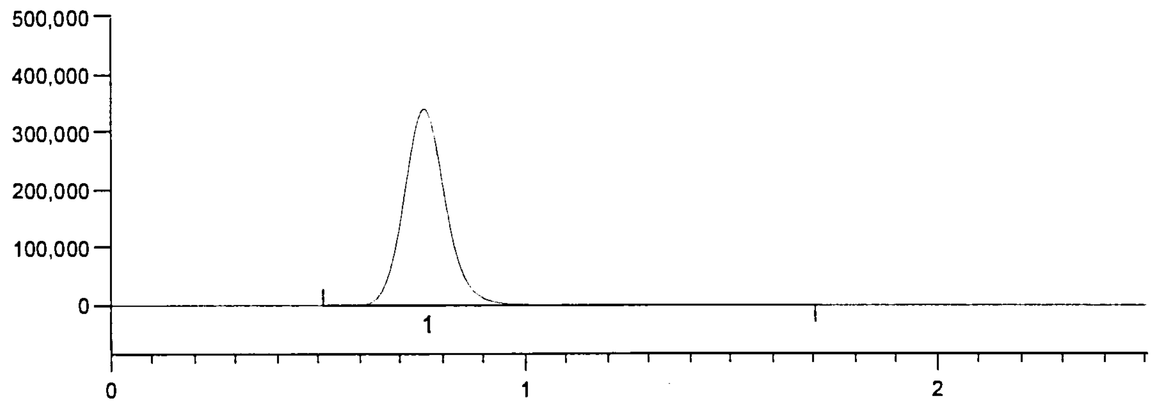
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 1:29 PM

Peak	rt	Area
1	0.75	26,730,867

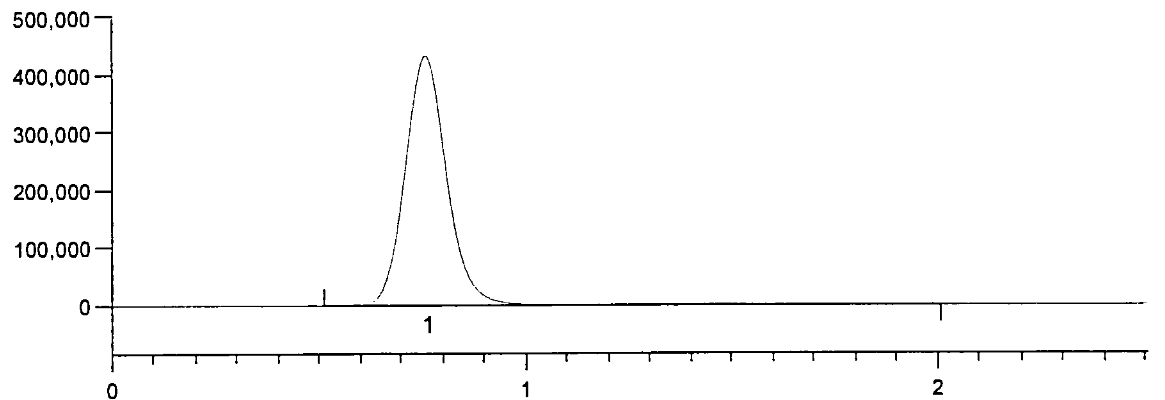
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
81	X	S	K1609659-002		1	26,730,867	2,070	427		< HS	accept
Notes											



Date: 9/7/16
Time: 1:34 PM

Peak	rt	Area
1	0.75	24,103,345

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
82	Y	S	K1609659-003		1	24,103,345	1,870	185		< HS	accept
Notes											



Date: 9/7/16
Time: 1:39 PM

Peak	rt	Area
1	0.75	30,420,865

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
83	X	S	K1609659-004		1	30,420,865	2,360	232		< HS	accept
Notes											

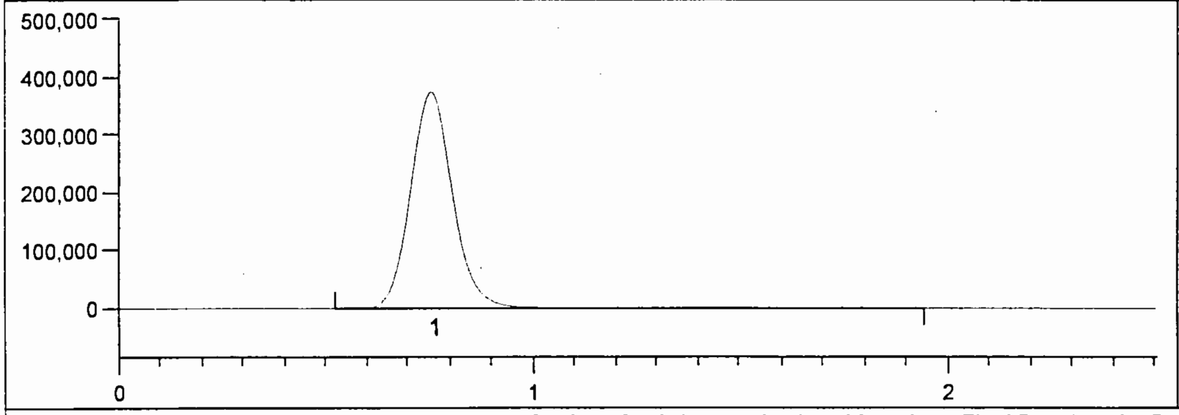
Peak Report

Batch Number:

Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

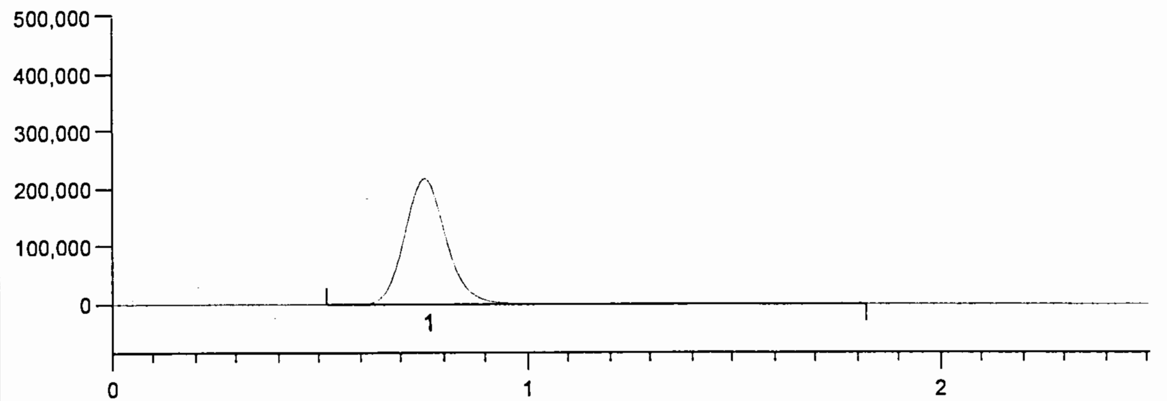
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date:	9/7/16
Time:	1:44 PM

Peak	rt	Area
1	0.75	26,522,756

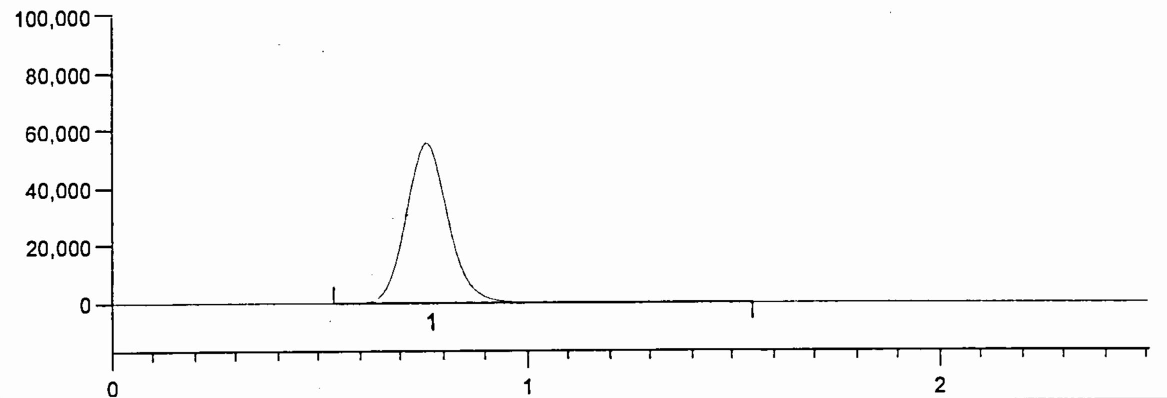
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
84	Y	S	K1609659-005		1	26,522,756	2,050	204		< HS	accept
Notes											



Date:	9/7/16
Time:	1:49 PM

Peak	rt	Area
1	0.75	15,248,290

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
85	X	S	K1609659-006		1	15,248,290	1,180	115		< HS	accept
Notes											



Date:	9/7/16
Time:	1:54 PM

Peak	rt	Area
1	0.76	3,932,512

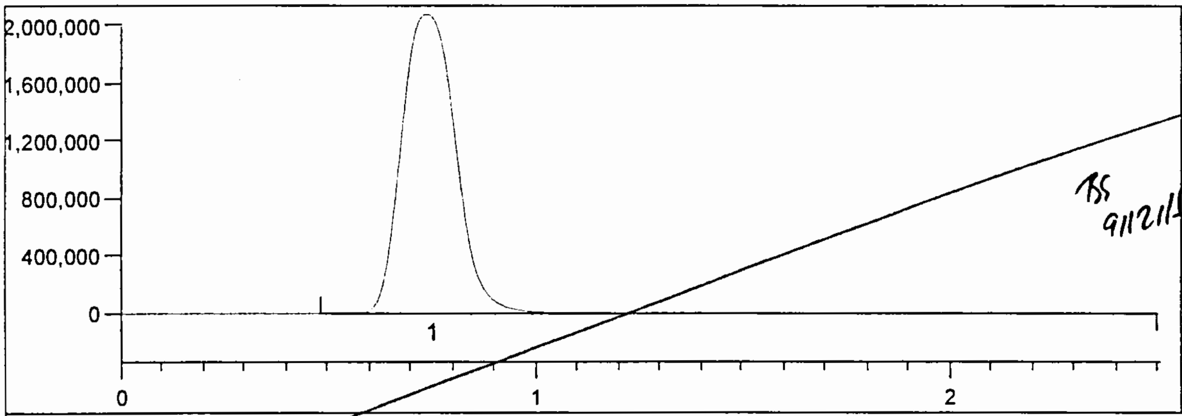
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
86	Y	S	K1609659-007		1	3,932,512	300.	29.8		< HS	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon

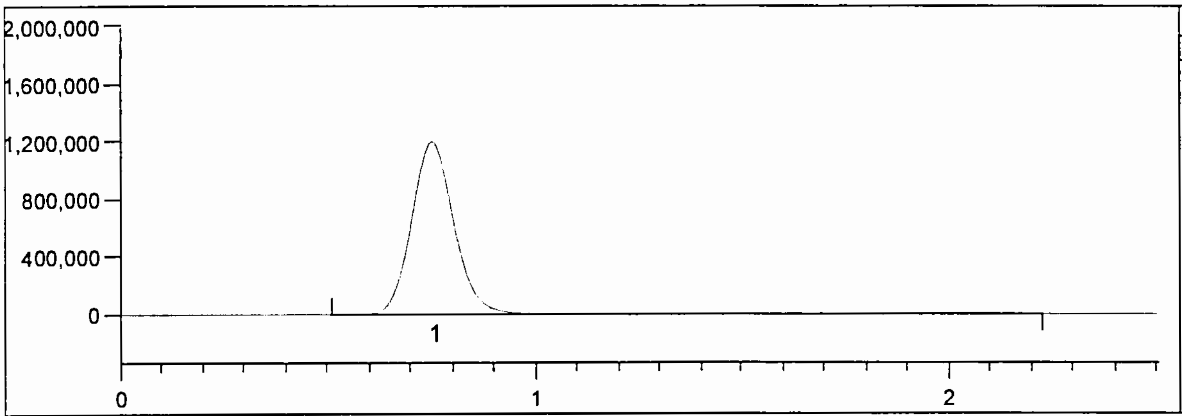


BS
9/12/16

Date: 9/7/16
Time: 1:59 PM

Peak	rt	Area
1	0.74	>188,623,406

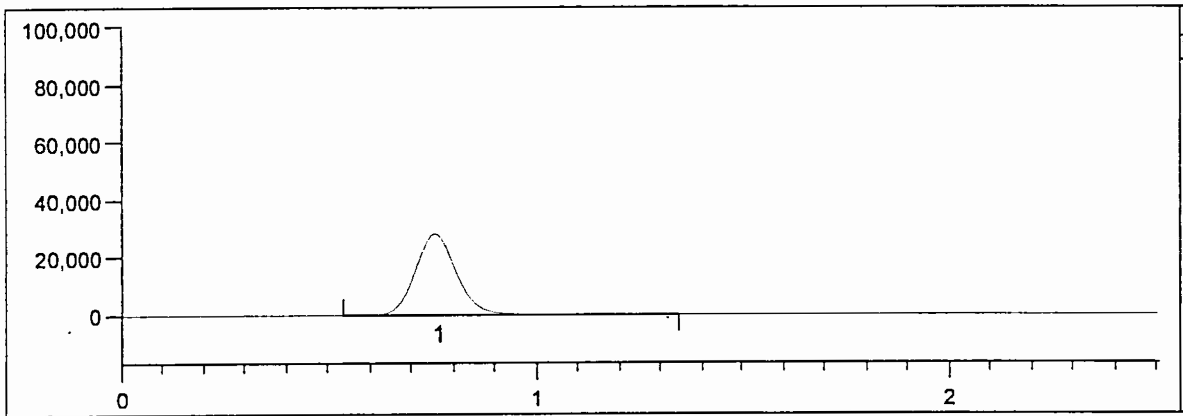
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
87	X	S	K1609659-008		1	>188,623,406	14,600	1,430		< HS	reject
Notes											



Date: 9/7/16
Time: 2:04 PM

Peak	rt	Area
1	0.75	85,687,412

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
88	Y	S	K1609659-009		1	85,687,412	6,640	656		< HS	accept
Notes											



Date: 9/7/16
Time: 2:09 PM

Peak	rt	Area
1	0.75	1,982,641

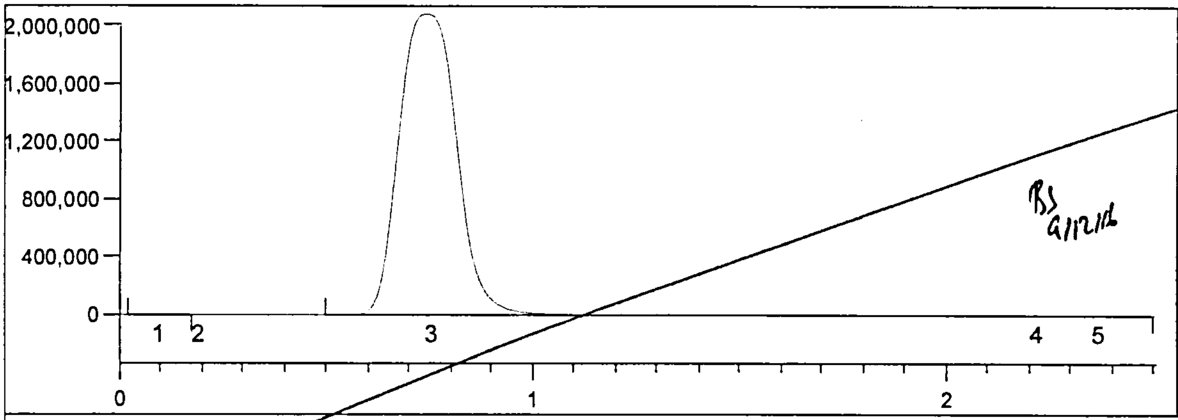
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
89	X	OPR	OPR-4		1	1,982,641	149	5.96	119	77-123	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

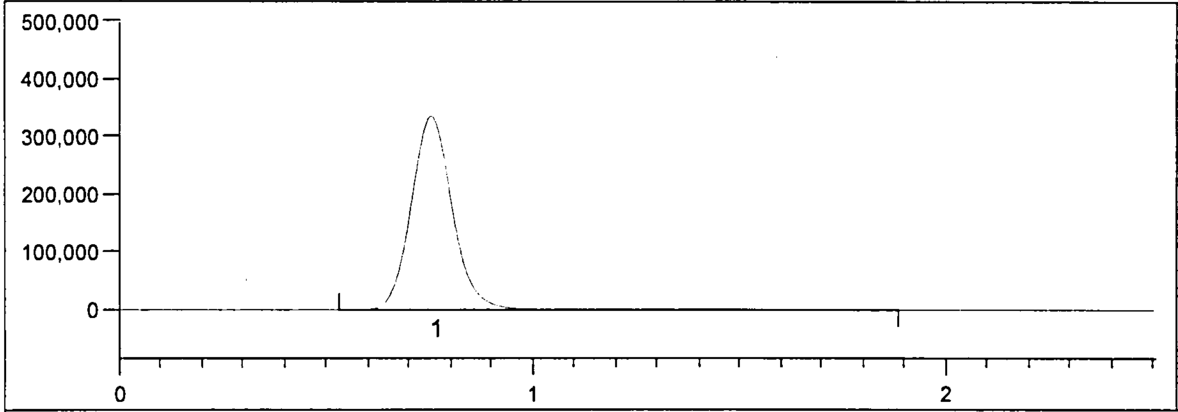
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



BS 9/12/16

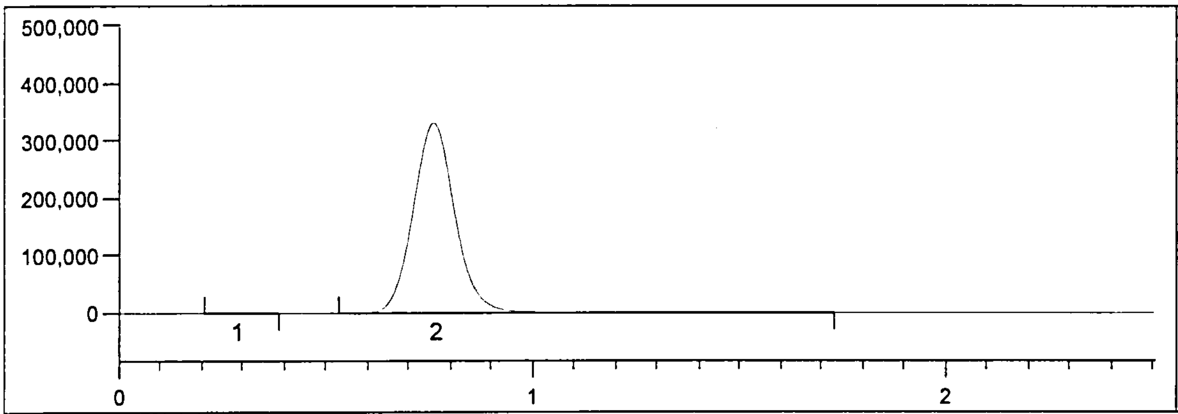
Date:	9/7/16	
Time:	2:14 PM	
Peak	**rt**	**Area**
1	0.08	866
2	0.18	18
3	0.74	>204,186,094
4	2.20	7,008
5	2.35	2,259

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
90	Y	S	K1609659-010		3	>204,186,094	15,800	1,800		< HS	reject
Notes											



Date:	9/7/16	
Time:	2:19 PM	
Peak	**rt**	**Area**
1	0.75	23,482,517

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
91	X	S	K1609659-011		1	23,482,517	1,820	174		< HS	accept
Notes											



Date:	9/7/16	
Time:	2:24 PM	
Peak	**rt**	**Area**
1	0.27	334
2	0.75	23,512,403

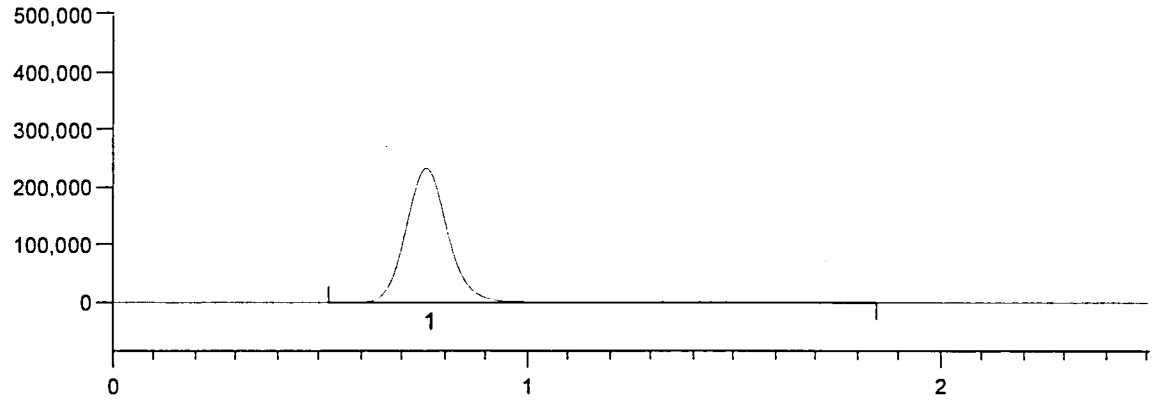
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
92	Y	S	K1609659-012		2	23,512,403	1,820	177		< HS	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

Project Number(s):
Instrument ID: K-AFS-04

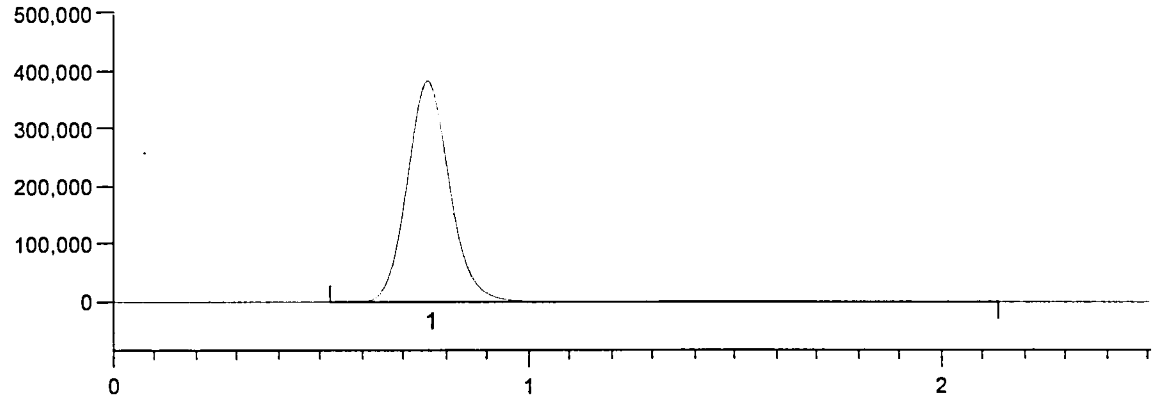
Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



Date: 9/7/16
Time: 2:29 PM

Peak	rt	Area
1	0.75	16,408,396

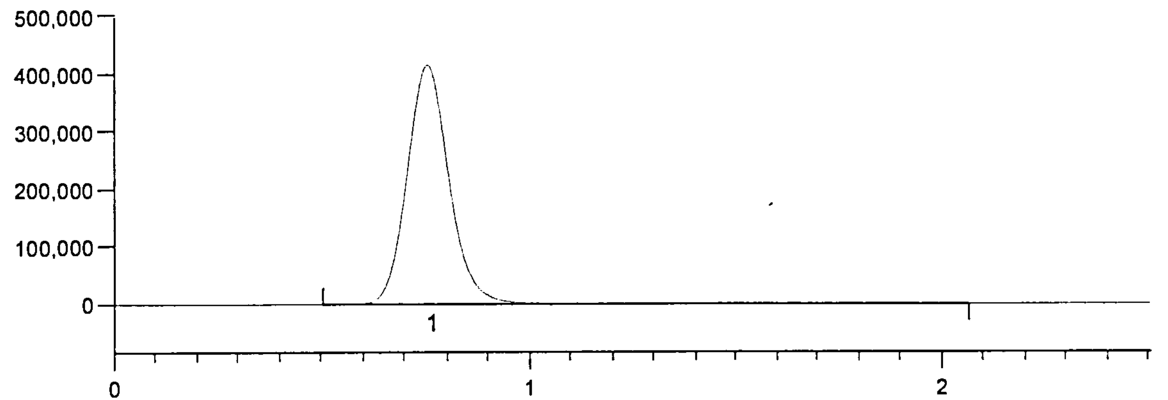
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
93	X	S	K1609659-013		1	16,408,396	1,270	252		< HS	accept
Notes											



Date: 9/7/16
Time: 2:34 PM

Peak	rt	Area
1	0.75	27,285,938

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
94	Y	S	K1609659-008		1	27,285,938	2,110	2,060		< HS	accept
Notes											



Date: 9/7/16
Time: 2:39 PM

Peak	rt	Area
1	0.75	29,139,839

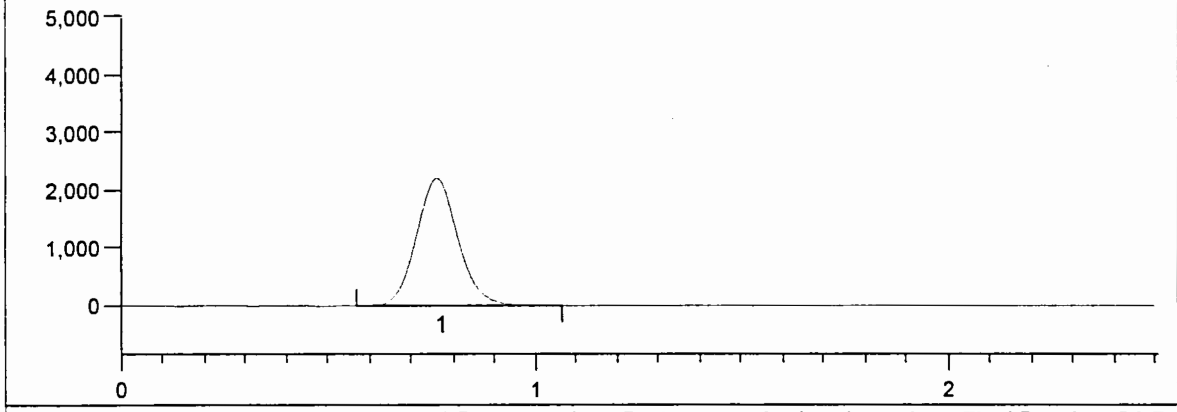
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
95	X	S	K1609659-010		1	29,139,839	2,260	2,560		< HS	accept
Notes											

Peak Report

Batch Number:
Method Number: EPA 1631E

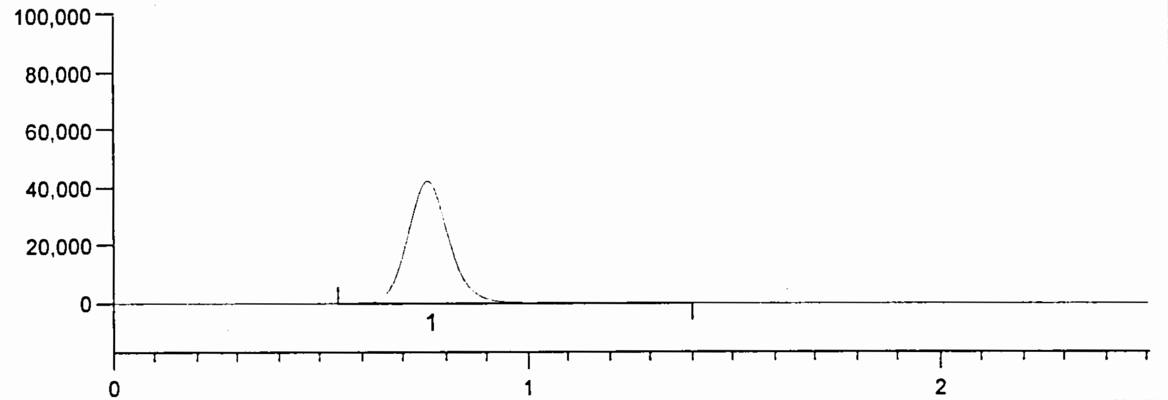
Project Number(s):
Instrument ID: K-AFS-04

Date Analyzed: 9/7/16
Analyst Name: Brian Sheldon



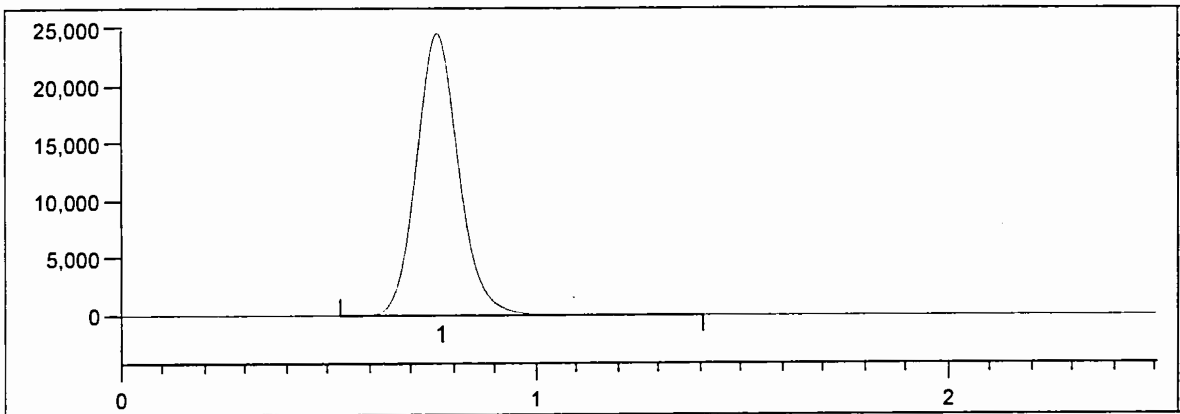
Date:	9/7/16	
Time:	2:44 PM	
Peak	**rt**	**Area**
1	0.76	156,845

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
96	Y	MBA	MB-3		1	156,845	7.41	0.148	0.148	< 0.5	accept
Notes											



Date:	9/7/16	
Time:	2:49 PM	
Peak	**rt**	**Area**
1	0.75	2,966,109

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
97	X	OPR	OPR-2(SOIL)		1	2,966,109	225	4.51	90.2	77-123	accept
Notes											



Date:	9/7/16	
Time:	2:54 PM	
Peak	**rt**	**Area**
1	0.76	1,743,475

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
98	Y	OPR	OPR/VER-5		1	1,743,475	131	5.22	104	77-123	accept
Notes											

Preparation Information Benchsheet

Prep Run: 269829
Team: Metals
Analyst: Keith Linn
Prep Workflow: MetDigTissMS
Prep Method: PSEP Metals
Rush/NPDES: N/A
Status: Prepped
Current Step: Digestion
Prep Date: 09/01/2016 15:00
Due Date: 09/10/2016
Hold Date: 02/05/2017

Lab Code	Client ID	Bottle #	Initial Amt	Initial Basis	Final Volume	Spike Amt	Spike ID	Comments
KQ1610520-01	Method Blank		0.200 g		20 mL			15% HNO3 Ultrex
KQ1610520-02	Lab Control Sample		0.200 g		20 mL	0.05 mL 0.05 mL 0.05 mL 0.2 mL	174221 174614 175121 175169	15% HNO3 Ultrex
KQ1610520-03	Standard Reference Material SRM1 DORM		0.203 g		20 mL	0.2 g	65838	15% HNO3 Ultrex
KQ1610520-04	Standard Reference Material SRM2 TORT		0.210 g		20 mL	0.2 g	65841	15% HNO3 Ultrex
K1609659-001	MWH-007	.01	0.205 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-002	MWH-009	.01	0.206 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-003	MWH-011	.01	0.200 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-003: KQ1610520-05	Duplicate	.01	0.200 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-003: KQ1610520-06	Matrix Spike	.01	0.201 g	Dried & Ground	20 mL	0.05 mL 0.05 mL 0.05 mL 0.2 mL	174221 174614 175121 175169	15% HNO3 Ultrex
K1609659-004	MWH-012	.01	0.206 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-005	MWH-014	.01	0.202 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-006	MWH-016	.01	0.215 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-007	MWH-017	.01	0.201 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-008	MWH-029	.01	0.205 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-009	MWH-030	.01	0.204 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-010	MWH-069	.01	0.203 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-011	MWH-074	.01	0.204 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-012	MWH-075	.01	0.203 g	Dried & Ground	20 mL			15% HNO3 Ultrex
K1609659-013	MWH-013	.01	0.203 g	Dried & Ground	20 mL			15% HNO3 Ultrex

19 Total Samples consisting of 13 Client Samples, 2 Client QC Samples, 4 Batch QC Samples associated with the current Prep Run.

Spiking Solutions

Name	Type	ID	Expires	Name	Type	ID	Expires
K-MET DORM-4	Spike	65838	1/6/2018	K-MET SS4	Spike	174221	10/14/2016
K-MET SS1	Spike	175169	2/19/2017	K-MET SS5	Spike	175121	4/8/2017

K-MET SS3	Spike	174614	3/18/2017	K-MET TORT-3	Spike	65841	1/6/2018

Preparation Materials

Step	Name	ID	Step	Name	ID
Digestion	K-MET 50ml Centrifuge Tube	173969	Digestion	K-MET HNO3 ULTREX	175090

Preparation Hardware / Equipment

Step	Name	Property	Value		Step	Name	Property	Value	
Digestion	K-Balance-45	Date Checked	9/1/16		Digestion	K-Metals-Oven-01	Observed Temperature Out	105	deg C
Digestion	K-Metals-Oven-01	Observed Temperature In	105	deg C					

Preparation Steps

Step	Started	Finished	By	Assisted By	Training?	Comments
Digestion	01-SEP-16 15:00	02-SEP-16 07:50	Keith Linn		N	

Comments

Review

Reviewed by: ____________ Date: 9/2/16

METALS SPIKING SOLUTIONS CONCENTRATIONS FORM

Solution Name	Element	mLs of 1000ppm Solution	Final Volume	Solution Conc. mg/L	Enter mls Added
	HNO3	50.0	1000ml	-	
	Al	100*	1000ml	200	
	Ag	100*	1000ml	5	
	Ba	100*	1000ml	100	
	Be	100*	1000ml	5	
	Cd	100*	1000ml	5	
	Co	100*	1000ml	50	
K-MET SS1	Cr	100*	1000ml	20	
	Cu	100*	1000ml	25	
	Fe	100*	1000ml	100	
	Pb	100*	1000ml	50	
*** Add after HNO3	Mn	100*	1000ml	50	
and before ALS-89	Ni	100*	1000ml	50	
when making the	Sb***	50	1000ml	50	
solution	V	100*	1000ml	50	
	Zn	100*	1000ml	50	
	HNO3	25.0	500ml	-	
K-MET SS2	As	2.0	500ml	4	
	Cd	2.0	500ml	4	
	Pb	2.0	500ml	4	
	Se	2.0	500ml	4	
	Tl	2.0	500ml	4	
	Cu	2.0	500ml	4	
K-MET SS3	HNO3	25.0	500ml	-	
	As	50.0	500ml	100	
	Se	50.0	500ml	100	
	Tl	10.0	500ml	20	
	Hg	6	500	12	
	HNO3	25	500ml	-	
K-MET SS4	B	50	500ml	100	
	Mo	50	500ml	100	
K-MET SS5	HNO3	10.0	200ml	-	
	K**	20	200ml	1000	
	Na**	20	200ml	1000	
	Mg**	20	200ml	1000	
	Ca**	20	200ml	1000	

K-MET GFLCSW	HNO3	10.0	1000ml	-	
	As, Pb, Se, Tl	5.0	1000ml	2.5	
	Cd	-	-	1.25	
	Cu	2.5	1000ml	2.5	
K-MET QCP-CICV-1	Ca, Mg, Na, K	no dilution	-	2500	
	Al, Ba	no dilution	-	1000	
	Fe	no dilution	-	500	
	Co, Mn, Ni, V, Zn	no dilution	-	250	
	Cu, Ag	no dilution	-	125	
	Cr	no dilution	-	100	
	Be	no dilution	-	25	
K-MET QCP-CICV-3	As, Pb, Se, Tl	no dilution	-	500	
	Cd	no dilution	-	250	

* Denotes volume of mixed stock standard.

** Denotes 10,000 ppm individual stock standards.

Standard	mls of standard	ppm	Logbook #	Exp. Date

Conversion from dry weight to wet weight:

ICP/ICPMS
9/1/2016
#269829

Sample I.D.	Dry Weight	Percent Solids	Wet Weight
K1609659-001	0.2050	17.6	1.1648
K1609659-002	0.2060	6.57	3.1355
K1609659-003	0.2000	17.0	1.1765
K1609659-003D	0.2000	17.0	1.1765
K1609659-003S	0.2010	17.0	1.1824
K1609659-004	0.2060	16.5	1.2485
K1609659-005	0.2020	14.1	1.4326
K1609659-006	0.2150	14.4	1.4931
K1609659-007	0.2010	15.8	1.2722
K1609659-008	0.2050	16.4	1.2500
K1609659-009	0.2040	19.3	1.0570
K1609659-010	0.2030	18.0	1.1278
K1609659-011	0.2040	10.7	1.9065
K1609659-012	0.2030	15.7	1.2930
K1609659-013	0.2030	15.3	1.3268

SP 9/21/16

Service Request # K1609659
Instrument ID# K-ICP-AES-04

ICP-OES 6010 Data Review Form

	Yes	No
1. Standardization completed	X	
2. ICV within 10 % of true value	X	
3. ICB below MRL	X	
4. CRI/LLICV standard analyzed.	X	
5. ICS standards within 20% of true value	X	
6. All preceding CCVs within 10 % of true value	X	
7. Following CCV within 10 % of true value	X	
8. Bracketing CCBs below MRL	X	
9. Method Blank below MRL		X①
10. MS (75-125), Dup (20) and LCS (80-120) within control limits		X②
11. All analytes within instrument linear range	X	
12. Adequate rinse out time allowed between samples to eliminate memory effect	X	
13. Run terminated early		X

Comments: Tissue Calibration
StarLIMS Run # 515975 Saved under 092716AICP04
6010: NR Ag. MRL=2X for Al, S.
①MB: Ca=0.0919, Mg=0.0154, samples>20X
②RPD: Fe=23%, particulate in digest/non-homogeneous sample

Primary Review by Date 9/27/16

Secondary Review by Date 9/28/16

Data Review Form

Service Request #: **K1609659**
Instrument ID#: **K-ICP-AES-04**
DataFile Name: **R:\ICP\WIP\DATA\K-ICP-AES-04\092716AICP04.txt**
RUNNO: **515975**

KQ1610520-01MB - Metals T

MB Evaluation

6010C/Metals T - Ca3933 - Result: 9.19 MRL: 2
6010C/Metals T - Mg2795 - Result: 1.54 MRL: 0.5 samples > 20x

K1609659-003DUP - Metals T

DUP RPD

6010C/Metals T - Fe2599 - RPD: 23 Limit: 20 particulate in digest/non-homogeneous samples

Analytical Method 6010C

Primary Approver: 9/27/16
Secondary Approver: JC 9/28/16

```
Sample Name: BLK      Acquired: 9/27/2016 8:21:31      Type: Cal
Method: 2016B-ICP04(v18)      Mode: IR      Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:           Sample Type:
Comment: INT. STD. ICP15-100-C

Elem          Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496
Units          Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg            .0055    -36.54     .1644    -.6866     .0091   -2.0688    -.9222
Stddev         .0002      4.58     .3834     .4714     .0011    2.5732     3.913
%RSD           4.108     12.54     233.2     68.65     11.75    124.38     424.3

#1             .0057    -39.78    -.1067    -.3533     .0084   -.24925    -3.689
#2             .0054    -33.30     .4355    -1.020     .0099   -3.8883     1.844

Elem          Cd2144    Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247
Units          Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg           -.0002    -.0006     .0012     .0168     .0001    -.0003     .0005
Stddev         .0003     .0003     .0000     .0007     .0000     .0000     .0005
%RSD           156.3     48.03     3.735     4.447     27.53     5.113     88.45

#1             .0000    -.0008     .0011     .0162     .0001    -.0003     .0008
#2            -.0004    -.0004     .0012     .0173     .0002    -.0003     .0002

Elem          Cu3273    Fe2599    Pb2203    Li6707    Mg2790    Mg2795    Mg2852
Units          Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg            17.30     .0009     .0000    -27.38    -.0001    -.0001     4.325
Stddev           .28     .0006     .0000      6.32     .0004     .0006     3.076
%RSD           1.630     70.49     7.602     23.08     418.3     490.4     71.12

#1             17.50     .0004     .0000    -22.91    -.0003     .0003     2.150
#2             17.10     .0013     .0000    -31.85     .0002    -.0006     6.500

Elem          Mn2576    Mn2605    Mo2020    Ni2216    P_1782    K_7664    Se1960
Units          Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg           .00003     .0000     .0001    -.0007     .0007    -43.64    -.1833
Stddev        .00007     .0001     .0005     .0006     .0005     11.92     .4007
%RSD          241.18     1048.     629.1     83.50     65.49     27.31     218.6

#1           -.00002     .0000    -.0003    -.0003     .0010    -35.21     .1000
#2            .00007     .0001     .0004    -.0011     .0004    -52.06    -.4666
```

```
Sample Name: BLK      Acquired: 9/27/2016 8:21:31      Type: Cal
Method: 2016B-ICP04(v18)      Mode: IR      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:          Sample Type:
Comment: INT. STD. ICP15-100-C

Elem             Si2516     Ag3280     Na5895     Sr4077     Tl1908     Sn1899     Ti3361
Units             Cts/S      Cts/S      Cts/S      Cts/S      Cts/S      Cts/S      Cts/S
Avg               2.158     -8.500     -50.88    -.01185     -.0005     -.0003      .0017
Stddev            2.893      2.855       5.41     .00038      .0003      .0004      .0000
%RSD              134.0      33.59      10.63     3.2289      60.59      126.9      1.901

#1                .1125     -6.481     -47.05    -.01158     -.0003      .0000      .0016
#2                4.204     -10.52     -54.70    -.01212     -.0007     -.0005      .0017

Elem             V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units             Cts/S      Cts/S      Cts/S      Cts/S      Cts/S
Avg               .0000      .0000      1.465      .0009      9.610
Stddev            .0001      .0000       .312      .0000       .402
%RSD              193.1      127.9      21.32      .5761      4.177

#1                .0001      .0000      1.685      .0009      9.894
#2                .0000      .0001      1.244      .0009      9.327

Int. Std.        Y_2243     Y_3600   Y_3600-2
Units             Cts/S      Cts/S      Cts/S
Avg              1885.9     38258.     3722.9
Stddev               .5        76.       16.6
%RSD             .02583     .19787     .44627

#1               1885.5     38204.     3734.6
#2               1886.2     38311.     3711.1
```

am
9/27/16

```
Sample Name: STD A      Acquired: 9/27/2016 8:24:00      Type: Cal
Method: 2016B-ICP04(v18)      Mode: IR      Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:          Sample Type:
Comment: ICP15-68-F

Elem          Al1670    Sb2068    Be2348    B_2496    Cd2144    Cd2265    Ca3933    Cr2677
Units          Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg            .0515     72.41    6754.5     778.9     1.027     .8101     19.00     .0555
Stddev         .0002       .69      32.5       3.1      .002     .0055       .03     .0003
%RSD           .3412     .9548    .48116     .3988     .1434     .6770     .1490     .4746

#1             .0513     72.90    6731.6     776.7     1.026     .8062     19.02     .0553
#2             .0516     71.92    6777.5     781.1     1.028     .8140     18.98     .0557

Elem          Co2307    Cu2247    Cu3273    Pb2203    Mg2795    Mn2576    Mo2020    Ni2216
Units          Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg            .3374     .1933     2754.     .0668     1.650    .31377     .2850     .3683
Stddev         .0001     .0005        8.     .0004      .001    .00004     .0000     .0015
%RSD           .0384     .2832     .2867     .6216     .0634    .01194     .0173     .4019

#1             .3375     .1929     2760.     .0665     1.649    .31379     .2849     .3672
#2             .3373     .1937     2749.     .0670     1.650    .31374     .2850     .3693

Elem          Se1960    Ag3280    Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138
Units          Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg            41.80     257.5     .0395     .1022     .3054     .0843     .3989     1104.
Stddev           .23       3.2     .0002     .0001     .0003     .0001     .0021        4.
%RSD           .5454     1.251     .4668     .0503     .1070     .0794     .5190     .3346

#1             41.96     255.2     .0396     .1022     .3051     .0843     .3974     1101.
#2             41.64     259.7     .0393     .1022     .3056     .0844     .4004     1107.

Int. Std.     Y_2243    Y_3600  Y_3600-2
Units          Cts/S     Cts/S     Cts/S
Avg           1902.3    38682.    3794.0
Stddev           1.3       53.       4.6
%RSD          .06682    .13739    .12121

#1            1903.2    38644.    3797.2
#2            1901.4    38719.    3790.7
```

```
Sample Name: STD B     Acquired: 9/27/2016 8:26:16     Type: Cal
Method: 2016B-ICP04(v18)     Mode: IR     Corr. Factor: 1.000000
User: admin     Dilution: 1      Test Type:        Sample Type:
Comment: ICP15-98-B

Elem            Al3944    As1890    Ba4554    Ca3158    Fe2599    Li6707    Mg2790    Mg2852
Units            Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg             66110.     274.4     170.9     1.199     1.826    20530.     .2189    25040.
Stddev            214.        .6       1.5      .000      .009        7.     .0000       13.
%RSD             .3229     .2044     .8500     .0248     .5151     .0350     .0019     .0511

#1              65960.     274.0     169.9     1.200     1.833    20530.     .2189    25050.
#2              66260.     274.8     171.9     1.199     1.820    20540.     .2189    25030.

Elem            Mn2605    P_1782    K_7664    Si2516    Na5895    Sr4077    Bi2230    S_1820
Units            Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S     Cts/S
Avg              .0763     .9419     8029.     2628.    29650.    24.457     .2410     148.8
Stddev           .0001     .0005       40.        2.       97.      .085     .0005       1.5
%RSD             .0706     .0563     .4956     .0609     .3283    .34777     .2150     1.019

#1               .0762     .9423     8001.     2626.    29580.    24.517     .2414     147.7
#2               .0763     .9415     8058.     2629.    29710.    24.396     .2407     149.8

Int. Std.       Y_2243    Y_3600  Y_3600-2
Units            Cts/S     Cts/S     Cts/S
Avg             1850.0    37255.    3728.8
Stddev             6.0       59.      24.3
%RSD            .32384    .15720    .65180

#1              1845.8    37296.    3711.7
#2              1854.2    37213.    3746.0
```

```
Sample Name: ICVB     Acquired: 9/27/2016 8:31:11     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: AIR

Elem             Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496
Units               ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           F -.0377     -.0076      .0021      .0007     -.0002     .00027    F .0006
Stddev            .0016      .0003      .0033      .0020      .0001     .00007      .0011
%RSD              4.165      3.568      156.2      308.3      33.66     23.842      186.7

#1               -.0389     -.0078      .0044     -.0008     -.0002     .00023     -.0002
#2               -.0366     -.0074     -.0002      .0021     -.0001     .00032      .0013

Check ?        Chk Fail       None       None       None       None       None   Chk Fail
Value             1.000                                                             2.000
Range           -5.440%                                                           -5.440%

Elem             Cd2144     Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247
Units               ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg               .0002      .0004     -.0109   F -.0002     -.0003      .0000     -.0010
Stddev            .0000      .0000      .0017      .0000      .0002      .0004      .0003
%RSD              11.52      4.313      15.28      7.258      65.76     31340.      25.99

#1                .0002      .0004     -.0097     -.0002     -.0004      .0003     -.0012
#2                .0002      .0004     -.0121     -.0003     -.0002     -.0003     -.0008

Check ?            None       None       None   Chk Fail       None       None       None
Value                                              5.000
Range                                            -5.440%

Elem             Cu3273     Fe2599     Pb2203     Li6707     Mg2790     Mg2795     Mg2852
Units               ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg               .0040     -.0062     -.0010    F .0009     -.0216    F .0001     -.0025
Stddev            .0005      .0048      .0003      .0008      .0219      .0000      .0002
%RSD              13.13      76.36      29.75      90.35      101.4      17.33      9.041

#1                .0044     -.0096     -.0008      .0003     -.0061      .0001     -.0027
#2                .0037     -.0029     -.0012      .0014     -.0370      .0001     -.0023

Check ?            None       None       None   Chk Fail       None   Chk Fail       None
Value                                              2.000                 5.000
Range                                            -5.440%               -5.440%
```

NR-see rerun
am 9/27/16

```
Sample Name: ICVB      Acquired: 9/27/2016 8:31:11      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: AIR

Elem            Mn2576      Mn2605      Mo2020      Ni2216      P_1782      K_7664      Se1960
Units              ppm         ppm         ppm         ppm         ppm         ppm         ppm
Avg            -.00005    F .0002      -.0004       .0005    F -.0128      -.0797      -.0077
Stddev          .00001       .0003       .0001       .0001       .0001       .0234       .0028
%RSD            17.846       120.0       27.62       20.26       1.126       29.36       36.37

#1             -.00004       .0000      -.0003       .0006      -.0127      -.0631      -.0057
#2             -.00006       .0004      -.0005       .0005      -.0129      -.0962      -.0097

Check ?           None    Chk Fail        None        None    Chk Fail        None        None
Value                        10.00                               5.000
Range                      -5.440%                             -5.440%

Elem            Si2516      Ag3280      Na5895      Sr4077      Tl1908      Sn1899      Ti3361
Units              ppm         ppm         ppm         ppm         ppm         ppm         ppm
Avg           F -.0151      -.0293      -.0032   F -.00003       .0027    F .0015       .0001
Stddev           .0231       .0109       .0029      .00006       .0002       .0007       .0001
%RSD             152.4       37.30       89.40      229.37       7.840       49.31       118.7

#1              -.0314      -.0370      -.0053     -.00007       .0026       .0010       .0001
#2               .0012      -.0216      -.0012      .00002       .0029       .0020       .0000

Check ?       Chk Fail        None        None    Chk Fail        None    Chk Fail        None
Value            5.000                              2.0000                   5.000
Range          -5.440%                            -5.4400%                 -5.440%

Elem            V_2924      Zn2062      Zn2138      Bi2230      S_1820
Units              ppm         ppm         ppm         ppm         ppm
Avg             -.0003       .0002       .0000      -.0048       .0253
Stddev           .0005       .0001        .000       .0014       .0059
%RSD             202.2       47.31       58.34       28.68       23.39

#1               .0001       .0003       .0000      -.0039       .0212
#2              -.0006       .0002      -.0001      -.0058       .0295

Check ?           None        None        None        None        None
Value
Range
```

NR-see rerun
am 9/27/16

```
Sample Name: ICVB      Acquired: 9/27/2016 8:31:11      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: AIR

Int. Std.          Y_2243     Y_3600   Y_3600-2
Units               Cts/S      Cts/S      Cts/S
Avg                4296.5     76758.     6224.3
Stddev                8.7       361.       39.5
%RSD               .20164     .47064     .63481

#1                 4290.4     76503.     6196.4
#2                 4302.6     77014.     6252.3
```

NR
am 9/27/16

```
Sample Name: ICVB     Acquired: 9/27/2016 8:33:54     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:     Sample Type:
Comment: ICP15-99-B

Elem          Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .9525     .9913     .0018    -.0002    -.0001   -.00019     1.967    -.0002
Stddev         .0024     .0080     .0029     .0018     .0002    .00016      .005     .0000
%RSD           .2556     .8098     164.6     903.8     183.7    83.992     .2418     6.182

#1             .9507     .9857     .0038    -.0015    -.0002   -.00008     1.964    -.0002
#2             .9542     .9970    -.0003     .0011     .0000   -.00030     1.971    -.0002

Check ?     Chk Pass      None      None      None      None      None  Chk Pass      None
Value
Range

Elem          Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0000     4.999     4.932     .0007    -.0003     .0016     .0001     10.08
Stddev         .0001      .013      .021     .0001     .0003     .0004     .0005       .05
%RSD           234.3     .2618     .4333     16.48     130.0     25.22     643.2     .4503

#1             .0001     4.990     4.947     .0008     .0000     .0018    -.0003     10.05
#2             .0000     5.008     4.917     .0006    -.0005     .0013     .0005     10.11

Check ?         None      None  Chk Pass      None      None      None      None      None
Value
Range

Elem          Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           -.0004     1.955     5.188     4.870     5.108    9.5713     9.813    -.0002
Stddev         .0020      .005      .009      .011      .007     .0535      .067     .0003
%RSD           508.6     .2644     .1764     .2328     .1431    .55875     .6863     136.9

#1            -.0018     1.958     5.182     4.862     5.103    9.6091     9.861     .0000
#2             .0010     1.951     5.195     4.878     5.113    9.5335     9.765    -.0004

Check ?         None  Chk Pass      None  Chk Pass      None      None  Chk Pass      None
Value
Range
```

```
Sample Name: ICVB      Acquired: 9/27/2016 8:33:54     Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC     Corr. Factor: 1.000000
User: admin      Dilution: 1        Test Type:          Sample Type:
Comment: ICP15-99-B

Elem            Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              .0001      4.944     -.0344      .0103      5.012     -.0066      13.31     1.9876
Stddev           .0004       .003      .0115      .0024       .057      .0054        .03      .0005
%RSD             722.9      .0636      33.54      23.22      1.140      82.16      .1926     .02413

#1               .0003      4.942     -.0426      .0086      5.052     -.0027      13.33     1.9879
#2              -.0002      4.946     -.0263      .0119      4.972     -.0104      13.29     1.9873

Check ?           None   Chk Pass       None       None   Chk Pass       None       None   Chk Pass
Value
Range

Elem            Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              .0022      4.928      .0000     -.0002      .0001      .0005      5.038      4.960
Stddev           .0035       .001      .0001      .0000      .0002      .0001       .020       .006
%RSD             155.3      .0266      246.5      15.40      225.0      27.70      .3914      .1227

#1               .0047      4.927      .0001     -.0002     -.0001      .0005      5.024      4.965
#2              -.0002      4.929      .0000     -.0002      .0003      .0004      5.052      4.956

Check ?           None   Chk Pass       None       None       None       None       None       None
Value
Range

Int. Std.       Y_2243     Y_3600   Y_3600-2
Units            Cts/S      Cts/S      Cts/S
Avg             1884.8     38001.     3782.3
Stddev             1.9       185.       15.3
%RSD            .10304     .48775     .40475

#1              1886.2     37870.     3793.1
#2              1883.4     38132.     3771.4
```

```
Sample Name: ICV      Acquired: 9/27/2016 8:36:21      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:         Sample Type:
Comment: ICP15-99-A

Elem          Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            4.273     4.937     2.445     2.455     4.975    .12116     .0022     1.204
Stddev          .008      .032      .015      .011      .004    .00018     .0017      .001
%RSD           .1823     .6535     .6022     .4436     .0777    .15002     74.03     .0949

#1             4.267     4.914     2.434     2.447     4.973    .12103     .0011     1.204
#2             4.278     4.959     2.455     2.463     4.978    .12129     .0034     1.203

Check ?         None  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass      None  Chk Pass
Value
Range

Elem          Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            1.201     12.28     11.91     .4869     1.204     .6029     .5925     2.484
Stddev          .000       .05       .09     .0011      .001     .0003     .0000      .003
%RSD           .0113     .4241     .7504     .2222     .0951     .0550     .0038     .1360

#1             1.201     12.25     11.98     .4876     1.204     .6027     .5925     2.482
#2             1.201     12.32     11.85     .4861     1.203     .6031     .5925     2.487

Check ?     Chk Pass  Chk Pass      None  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem          Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            2.376     .0022     12.74     11.80     12.36    1.1936     1.188     1.002
Stddev          .000     .0017       .17       .02       .03     .0032      .000      .004
%RSD           .0176     77.96     1.344     .1600     .2443    .26957     .0222     .3618

#1             2.377     .0010     12.62     11.79     12.34    1.1959     1.187     1.005
#2             2.376     .0034     12.86     11.81     12.39    1.1913     1.188     .9996

Check ?     Chk Pass      None  Chk Pass      None  Chk Pass  Chk Pass      None  Chk Pass
Value
Range
```

```
Sample Name: ICV      Acquired: 9/27/2016 8:36:21      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1        Test Type:        Sample Type:
Comment: ICP15-99-A

Elem          Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            1.193     -.0040      12.07      2.369     -.0119    F 6.885      12.08     .00047
Stddev          .001      .0088        .02       .015      .0100       .014        .03     .00024
%RSD           .0949      222.9      .1771      .6149      83.86      .2063      .2305     50.664

#1             1.192      .0023      12.08      2.359     -.0048      6.875      12.06     .00064
#2             1.194     -.0102      12.05      2.380     -.0190      6.895      12.10     .00030

Check ?     Chk Pass       None   Chk Pass   Chk Pass       None   Chk Fail   Chk Pass       None
Value                                                                 .6250
Range                                                                10.44%

Elem          Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            2.373      .0077      1.941      1.238      1.210      1.187      .0098     -.0127
Stddev          .000      .0004       .007       .005       .001       .005      .0027      .0014
%RSD           .0084      5.614      .3422      .4090      .0869      .4326      27.85      10.68

#1             2.373      .0080      1.946      1.242      1.211      1.184      .0079     -.0117
#2             2.373      .0074      1.936      1.235      1.210      1.191      .0117     -.0137

Check ?     Chk Pass       None   Chk Pass   Chk Pass   Chk Pass   Chk Pass       None       None
Value
Range

Int. Std.     Y_2243     Y_3600   Y_3600-2
Units          Cts/S      Cts/S      Cts/S
Avg           1864.9     37746.     3735.3
Stddev           7.1        97.        4.6
%RSD          .37993     .25675     .12313

#1            1859.9     37677.     3738.6
#2            1869.9     37814.     3732.1
```

Sample Name: ICB Acquired: 9/27/2016 8:38:38 Type: QC
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment:

Elem	Al1670	Al3944	Sb2068	As1890	Ba4554	Be2348	B_2496
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.0032	-.0015	.0179	.0035	.0009	-.00004	.0008
Stddev	.0033	.0008	.0000	.0068	.0013	.00009	.0021
%RSD	102.4	49.90	.2153	196.9	143.6	214.46	267.4
#1	-.0056	-.0021	.0178	.0083	.0000	.00002	-.0007
#2	-.0009	-.0010	.0179	-.0014	.0019	-.00010	.0023
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	Cd2144	Cd2265	Ca3158	Ca3933	Cr2677	Co2307	Cu2247
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	.0000	-.0183	.0027	.0007	.0000	.0002
Stddev	.0001	.0002	.0002	.0033	.0004	.000	.0011
%RSD	341.0	4157.	.8410	124.8	50.89	751.1	668.5
#1	.0000	-.0001	-.0182	.0003	.0005	-.0003	.0010
#2	.0001	.0001	-.0184	.0050	.0010	.0002	-.0006
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	Cu3273	Fe2599	Pb2203	Li6707	Mg2790	Mg2795	Mg2852
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.0003	-.0129	-.0015	.0001	.0068	.0028	.0015
Stddev	.0012	.0071	.0023	.0001	.0395	.0033	.0037
%RSD	400.1	55.04	153.1	196.3	582.8	119.7	243.8
#1	-.0011	-.0079	.0001	.0002	.0347	.0004	-.0011
#2	.0005	-.0180	-.0031	.0000	-.0212	.0052	.0041
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	None	Chk Pass	Chk Pass
High Limit							
Low Limit							

```
Sample Name: ICB      Acquired: 9/27/2016 8:38:38      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem            Mn2576     Mn2605     Mo2020     Ni2216     P_1782     K_7664     Se1960
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            -.00002      .0007      .0013     -.0004      .0019     -.0261      .0032
Stddev          .00006      .0002      .0002      .0005      .0050      .0021      .0036
%RSD            391.62      31.21      18.78      133.9      265.5      8.152      113.7

#1             -.00006      .0009      .0011     -.0008      .0055     -.0246      .0006
#2              .00003      .0005      .0015      .0000     -.0017     -.0276      .0057

Check ?       Chk Pass       None   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem            Si2516     Ag3280     Na5895     Sr4077     Tl1908     Sn1899     Ti3361
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0153   F -.0097      .0110    -.00008     -.0003      .0018      .0003
Stddev           .0288      .0006      .0042     .00001      .0057      .0027      .0003
%RSD             188.3      6.448      38.16     12.315      1855.      155.8      106.9

#1               .0051     -.0093      .0140    -.00009      .0037     -.0002      .0001
#2              -.0357     -.0102      .0081    -.00007     -.0044      .0037      .0005

Check ?       Chk Pass   Chk Fail   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit                  .0040
Low Limit                  -.0040

Elem            V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units              ppm        ppm        ppm        ppm        ppm
Avg             -.0005     -.0001      .0001      .0010     -.0120
Stddev           .0008      .0002      .0000      .0008      .0004
%RSD             159.8      225.2      64.72      82.52      3.048

#1              -.0010     -.0003      .0001      .0004     -.0123
#2               .0001      .0001      .0000      .0016     -.0118

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: ICB       Acquired: 9/27/2016 8:38:38      Type: QC
Method: 2016B-ICP04(v18)       Mode: CONC       Corr. Factor: 1.000000
User: admin        Dilution: 1          Test Type:          Sample Type:
Comment:

Int. Std.          Y_2243     Y_3600   Y_3600-2
Units               Cts/S      Cts/S      Cts/S
Avg                1892.1     38459.     3758.2
Stddev                1.3        67.       10.3
%RSD               .06627     .17337     .27533

#1                 1891.2     38412.     3765.5
#2                 1893.0     38506.     3750.9
```

```
Sample Name: LLICV     Acquired: 9/27/2016 8:41:06     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: ICP16-1-A 0.5/50mL

Elem          Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496     Cd2144
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0088      .0099      .0248      .0107      .0037     .00108      .0218      .0009
Stddev         .0025      .0027      .0008      .0009      .0002     .00008      .0014      .0001
%RSD           28.94      26.94      3.324      8.022      6.226     7.8432      6.404      8.846

#1             .0070      .0118      .0242      .0113      .0039     .00114      .0228      .0010
#2             .0106      .0080      .0254      .0101      .0035     .00102      .0208      .0009

Check ?     Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem          Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247     Cu3273     Fe2599
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0011      .0239      .0201      .0031      .0017      .0028      .0031      .0192
Stddev         .0001      .0101      .0001      .0005      .0006      .0004      .0001      .0074
%RSD           12.45      42.12      .4090      15.33      32.69      14.00      4.091      38.33

#1             .0012      .0310      .0201      .0035      .0021      .0026      .0032      .0140
#2             .0010      .0168      .0202      .0028      .0013      .0031      .0030      .0244

Check ?     Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem          Pb2203     Li6707     Mg2790     Mg2795     Mg2852     Mn2576     Mn2605     Mo2020
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0083      .0202      .0572      .0051    F .0012     .00097      .0011      .0037
Stddev         .0001      .0001      .0947      .0000      .0001     .00006      .0017      .0003
%RSD           1.637      .5811      165.6      .2130      9.288     6.3458      154.8      7.201

#1             .0084      .0203     -.0098      .0050      .0013     .00093      .0023      .0036
#2             .0082      .0201      .1241      .0051      .0011     .00101     -.0001      .0039

Check ?     Chk Pass   Chk Pass       None   Chk Pass   Chk Fail   Chk Pass       None   Chk Pass
Value                                                      .0050
Range                                                    -30.00%
```

```
Sample Name: LLICV      Acquired: 9/27/2016 8:41:06      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: ICP16-1-A 0.5/50mL

Elem          Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0038      .0341      .1914      .0195      .1963   F .0378      .1946     .00102
Stddev         .0002      .0086      .0366      .0079      .0019      .0047      .0005     .00023
%RSD           5.691      25.29      19.10      40.57      .9481      12.38      .2447     22.319

#1             .0040      .0280      .2172      .0139      .1950      .0411      .1949     .00086
#2             .0037      .0402      .1655      .0251      .1976      .0345      .1943     .00118

Check ?     Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Fail   Chk Pass   Chk Pass
Value                                                                 .0040
Range                                                                30.00%

Elem          Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0088      .0193      .0017      .0030      .0035      .0037      .0209      .0327
Stddev         .0016      .0001      .0001      .0000      .0000      .0001      .0062      .0073
%RSD           18.00      .2782      3.196      1.024      .7264      1.551      29.62      22.23

#1             .0077      .0193      .0016      .0030      .0035      .0037      .0252      .0275
#2             .0099      .0193      .0017      .0030      .0035      .0038      .0165      .0378

Check ?     Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Int. Std.     Y_2243     Y_3600   Y_3600-2
Units          Cts/S      Cts/S      Cts/S
Avg           1885.0     38604.     3717.2
Stddev           8.0       373.       21.2
%RSD          .42285     .96573     .57036

#1            1879.4     38340.     3732.2
#2            1890.7     38868.     3702.2
```

```
Sample Name: LLICV      Acquired: 9/27/2016 8:43:34      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:          Sample Type:
Comment: ICP16-1-A 0.5/50mL RERUN

Elem          Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0084     .0112     .0249   F .0067     .0039    .00093     .0195     .0008
Stddev         .0031     .0002     .0030     .0000     .0000    .00015     .0003     .0000
%RSD           37.20     2.095     12.19     .0089     .6730    16.086     1.599     1.698

#1             .0106     .0113     .0228     .0067     .0039    .00083     .0197     .0008
#2             .0062     .0110     .0270     .0067     .0039    .00104     .0193     .0008

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Fail  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value                                        .0100
Range                                      -30.00%

Elem          Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0008   F .0263     .0204     .0032     .0020     .0029     .0039     .0190
Stddev         .0002     .0281     .0004     .0005     .0007     .0002     .0007     .0006
%RSD           24.53     106.7     1.821     15.97     35.19     6.954     17.84     3.096

#1             .0007     .0462     .0207     .0036     .0025     .0028     .0034     .0186
#2             .0009     .0065     .0201     .0028     .0015     .0030     .0044     .0194

Check ?     Chk Pass  Chk Fail  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value                    .0200
Range                   30.00%

Elem          Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          F .0067     .0199     .0022     .0053     .0050    .00103     .0021     .0040
Stddev         .0000     .0006     .0264     .0003     .0023    .00008     .0014     .0002
%RSD           .3757     2.968     1200.     4.992     47.33    7.6606     64.49     4.423

#1             .0067     .0203     .0208     .0054     .0033    .00098     .0012     .0041
#2             .0067     .0195    -.0164     .0051     .0066    .00109     .0031     .0039

Check ?     Chk Fail  Chk Pass      None  Chk Pass  Chk Pass  Chk Pass      None  Chk Pass
Value          .0100
Range        -30.00%
```

NR
am 9/27/16

```
Sample Name: LLICV      Acquired: 9/27/2016 8:43:34      Type: QC
Method: 2016B-ICP04(v18)       Mode: CONC       Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:          Sample Type:
Comment: ICP16-1-A 0.5/50mL RERUN

Elem         Ni2216     P_1782     K_7664    Se1960     Si2516     Ag3280     Na5895     Sr4077
Units           ppm        ppm        ppm       ppm        ppm        ppm        ppm        ppm
Avg           .0044      .0376      .1688     .0158      .1932    F .0399      .1939     .00099
Stddev        .0006      .0026      .0087     .0015      .0250      .0022      .0052     .00004
%RSD          14.01      6.877      5.128     9.219      12.94      5.577      2.689     4.4094

#1            .0040      .0395      .1627     .0148      .1756      .0383      .1902     .00102
#2            .0049      .0358      .1749     .0169      .2109      .0414      .1976     .00095

Check ?    Chk Pass   Chk Pass   Chk Pass  Chk Pass   Chk Pass   Chk Fail   Chk Pass   Chk Pass
Value                                                              .0040
Range                                                             30.00%

Elem         Tl1908     Sn1899     Ti3361    V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units           ppm        ppm        ppm       ppm        ppm        ppm        ppm        ppm
Avg           .0077      .0218      .0017     .0033      .0037      .0040      .0187      .0290
Stddev        .0002      .0012      .0000     .0005      .0002      .0001      .0014      .0027
%RSD          2.452      5.398      2.670     16.80      5.206      2.236      7.639      9.327

#1            .0078      .0226      .0016     .0029      .0035      .0040      .0177      .0309
#2            .0075      .0210      .0017     .0036      .0038      .0039      .0197      .0271

Check ?    Chk Pass   Chk Pass   Chk Pass  Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Int. Std.    Y_2243     Y_3600  Y_3600-2
Units         Cts/S      Cts/S     Cts/S
Avg          1892.9     38751.    3725.4
Stddev          1.7         5.       4.6
%RSD         .09081     .01406    .12258

#1           1891.6     38747.    3722.2
#2           1894.1     38755.    3728.6
```

NR
am 9/27/16

```
Sample Name: LLICV,0.5      Acquired: 9/27/2016 8:46:01      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: ICP16-1-A 1/50mL

Elem          Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496     Cd2144
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0162      .0194      .0391      .0182      .0075     .00175      .0351      .0019
Stddev         .0020      .0014      .0002      .0020      .0002     .00004      .0006      .0001
%RSD           12.05      7.380      .5249      10.92      2.687     2.5336      1.807      7.958

#1             .0148      .0184      .0393      .0196      .0074     .00172      .0346      .0020
#2             .0176      .0204      .0390      .0168      .0077     .00178      .0355      .0018

Check ?     Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem          Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247     Cu3273     Fe2599
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0021      .0384      .0413      .0081      .0043      .0070      .0065      .0302
Stddev         .0002      .0076      .0001      .0005      .0003      .0005      .0003      .0034
%RSD           8.262      19.92      .2195      5.574      6.938      7.539      4.535      11.35

#1             .0022      .0329      .0414      .0078      .0041      .0066      .0068      .0326
#2             .0020      .0438      .0412      .0084      .0045      .0074      .0063      .0278

Check ?     Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem          Pb2203     Li6707     Mg2790     Mg2795     Mg2852     Mn2576     Mn2605     Mo2020
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0191      .0396      .0068      .0099    F .0067     .00187    F .0005      .0074
Stddev         .0017      .0002      .0490      .0001      .0032     .00009      .0008      .0002
%RSD           8.868      .5901      724.8      1.077      47.55     4.7326      161.6      2.693

#1             .0203      .0394     -.0279      .0100      .0090     .00180     -.0001      .0075
#2             .0179      .0398      .0414      .0098      .0045     .00193      .0010      .0073

Check ?     Chk Pass   Chk Pass       None   Chk Pass   Chk Fail   Chk Pass   Chk Fail   Chk Pass
Value                                                      .0100                 .0020
Range                                                   -30.00%               -30.00%
```

NR
Gm 9/27/16

```
Sample Name: LLICV,0.5      Acquired: 9/27/2016 8:46:01      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: ICP16-1-A 1/50mL

Elem          Ni2216    P_1782    K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0072     .0750     .3366     .0368     .3853  F .0820     .3808    .00197
Stddev         .0002     .0012     .0300     .0002     .0069     .0066     .0054    .00010
%RSD           3.357     1.635     8.915     .5715     1.789     8.013     1.413    5.1858

#1             .0074     .0759     .3154     .0369     .3805     .0774     .3770    .00205
#2             .0070     .0742     .3578     .0366     .3902     .0867     .3846    .00190

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Fail  Chk Pass  Chk Pass
Value                                                          .0080
Range                                                         30.00%

Elem          Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0161     .0398     .0035     .0078     .0077     .0077     .0417     .0670
Stddev         .0040     .0010     .0003     .0009     .0002     .0000     .0008     .0048
%RSD           24.95     2.508     8.298     11.05     2.719     .1551     2.031     7.148

#1             .0133     .0391     .0037     .0072     .0079     .0077     .0411     .0636
#2             .0190     .0405     .0033     .0084     .0076     .0077     .0423     .0703

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Int. Std.     Y_2243    Y_3600  Y_3600-2
Units          Cts/S     Cts/S     Cts/S
Avg           1896.7    38667.    3720.6
Stddev           2.5       45.      18.8
%RSD          .13188    .11757    .50403

#1            1894.9    38635.    3707.4
#2            1898.5    38700.    3733.9
```

NR
am 9/27/16

```
Sample Name: CCVB1      Acquired: 9/27/2016 8:48:28      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:       Sample Type:
Comment:

Elem         Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           7.677     9.623     .0105     1.007     10.05    .00006     .0009     .0001
Stddev         .001      .037     .0019      .005       .01    .00004     .0001     .0001
%RSD          .0147     .3842     18.22     .5105     .0661    67.432     11.46     88.02

#1            7.678     9.597     .0119     1.003     10.05    .00003     .0009     .0002
#2            7.677     9.649     .0091     1.010     10.04    .00010     .0008     .0000

Check ?        None  Chk Pass      None  Chk Pass  Chk Pass      None      None      None
Value
Range

Elem         Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          -.0001     10.22     9.786    -.0003    -.0006     .0020    -.0013     10.14
Stddev        .0004       .04      .006     .0009     .0009     .0003     .0006       .03
%RSD          301.0     .4182     .0571     301.5     147.0     12.83     46.34     .2997

#1           -.0004     10.19     9.782    -.0010     .0000     .0022    -.0009     10.12
#2            .0001     10.25     9.790     .0003    -.0012     .0019    -.0018     10.16

Check ?        None  Chk Pass      None      None      None      None      None  Chk Pass
Value
Range

Elem         Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0002     .9686     10.71     9.730     10.00    1.0028     .9855    -.0004
Stddev        .0036     .0035       .06      .014       .00     .0018     .0008     .0000
%RSD          1791.     .3587     .5969     .1393     .0481    .17807     .0770     1.971

#1           -.0024     .9711     10.66     9.721     9.997    1.0041     .9849    -.0004
#2            .0028     .9662     10.75     9.740     10.00    1.0015     .9860    -.0004

Check ?        None  Chk Pass  Chk Pass      None  Chk Pass      None  Chk Pass      None
Value
Range
```

```
Sample Name: CCVB1      Acquired: 9/27/2016 8:48:28      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1        Test Type:          Sample Type:
Comment:

Elem          Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           -.0007      9.898      9.762      .0050      9.941     -.0065      9.729     1.0001
Stddev         .0000       .023       .052      .0057       .025      .0047       .017      .0001
%RSD           2.963      .2335      .5331      114.3      .2512      72.64      .1758     .00614

#1            -.0006      9.914      9.798      .0010      9.959     -.0031      9.741     1.0000
#2            -.0007      9.881      9.725      .0091      9.923     -.0098      9.717     1.0001

Check ?         None   Chk Pass   Chk Pass       None   Chk Pass       None   Chk Pass   Chk Pass
Value
Range

Elem          Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0001      .0008      .0000      .0002     -.0003      .0003      .9955      .9829
Stddev         .0001      .0022      .0004      .0001      .0001      .0003      .0002      .0046
%RSD           255.3      281.9      939.9      87.18      59.36      90.80      .0164      .4728

#1             .0002     -.0008      .0003      .0001     -.0001      .0001      .9957      .9796
#2             .0000      .0024     -.0003      .0003     -.0004      .0005      .9954      .9862

Check ?         None       None       None       None       None       None   Chk Pass   Chk Pass
Value
Range

Int. Std.     Y_2243     Y_3600   Y_3600-2
Units          Cts/S      Cts/S      Cts/S
Avg           1874.9     37684.     3691.2
Stddev           4.9        31.        4.0
%RSD          .26223     .08185     .10949

#1            1871.4     37662.     3694.0
#2            1878.4     37706.     3688.3
```

```
Sample Name: CCVA1      Acquired: 9/27/2016 8:51:02      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem         Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2531     .2556     .2481     .2584     .2577    .24994     .2522     .2521
Stddev        .0012     .0035     .0012     .0038     .0000    .00099     .0016     .0002
%RSD          .4722     1.386     .4990     1.485     .0194    .39697     .6341     .0879

#1            .2522     .2581     .2472     .2611     .2577    .25064     .2511     .2523
#2            .2539     .2531     .2490     .2556     .2577    .24924     .2534     .2520

Check ?    Chk Pass      None  Chk Pass      None      None  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem         Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2521     .5224     .5014     .2529     .2510     .2505     .2501     .2649
Stddev        .0009     .0217     .0019     .0001     .0005     .0003     .0013     .0064
%RSD          .3664     4.153     .3824     .0288     .2006     .1184     .5037     2.417

#1            .2515     .5377     .5027     .2530     .2506     .2503     .2510     .2604
#2            .2528     .5070     .5000     .2529     .2513     .2508     .2492     .2694

Check ?    Chk Pass      None  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass      None
Value
Range

Elem         Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2545     .0010     .2597     .2534     .2559    .25462     .2405     .2535
Stddev        .0017     .0010     .0103     .0000     .0010    .00016     .0034     .0004
%RSD          .6560     102.9     3.966     .0100     .3714    .06340     1.406     .1517

#1            .2557     .0018     .2525     .2534     .2552    .25473     .2429     .2538
#2            .2533     .0003     .2670     .2534     .2566    .25451     .2381     .2533

Check ?    Chk Pass      None      None  Chk Pass      None  Chk Pass      None  Chk Pass
Value
Range
```

```
Sample Name: CCVA1      Acquired: 9/27/2016 8:51:02      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem         Ni2216    P_1782    K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2515     .0027     2.428     .2521     .1340   F .5333     .2458    .00008
Stddev        .0005     .0059      .037     .0001     .0136     .0123     .0034    .00002
%RSD          .1943     220.9     1.538     .0396     10.15     2.299     1.374    26.466

#1            .2518    -.0015     2.455     .2522     .1244     .5419     .2435    .00007
#2            .2511     .0069     2.402     .2520     .1436     .5246     .2482    .00010

Check ?    Chk Pass      None      None  Chk Pass      None  Chk Fail      None      None
Value                                                           .2500
Range                                                          10.44%

Elem         Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2480     .2534     .2532     .2530     .2546     .2512     .0013    -.0027
Stddev        .0069     .0009     .0006     .0013     .0003     .0000     .0023     .0020
%RSD          2.781     .3637     .2429     .4978     .1160     .0143     172.2     72.59

#1            .2431     .2527     .2528     .2521     .2548     .2512    -.0003    -.0041
#2            .2529     .2540     .2536     .2539     .2544     .2512     .0029    -.0013

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass      None      None
Value
Range

Int. Std.    Y_2243    Y_3600  Y_3600-2
Units         Cts/S     Cts/S     Cts/S
Avg          1904.4    38755.    3723.1
Stddev          3.0         .      11.0
%RSD         .15627    .00003    .29442

#1           1902.2    38755.    3730.9
#2           1906.5    38755.    3715.4
```

```
Sample Name: CCB      Acquired: 9/27/2016 8:53:24      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1        Test Type:        Sample Type:
Comment:

Elem            Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0031     -.0013      .0110      .0032      .0001     .00002      .0004
Stddev           .0017      .0040      .0040      .0004      .0004     .00001      .0013
%RSD             55.44      305.8      36.06      14.02      680.7     30.250      319.8

#1              -.0043     -.0042      .0082      .0029     -.0002     .00002     -.0005
#2              -.0019      .0015      .0139      .0035      .0003     .00001      .0013

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem            Cd2144     Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              .0001     -.0001     -.0014      .0002     -.0004      .0002     -.0006
Stddev           .0002      .0003      .0089      .0000      .0002      .0006      .0003
%RSD             159.4      359.8      631.9      13.85      42.24      307.3      54.17

#1               .0002      .0001     -.0077      .0002     -.0003      .0006     -.0004
#2               .0000     -.0003      .0049      .0002     -.0006     -.0002     -.0008

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem            Cu3273     Fe2599     Pb2203     Li6707     Mg2790     Mg2795     Mg2852
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0017     -.0092     -.0002      .0004      .0028      .0002     -.0016
Stddev           .0002      .0040      .0007      .0009      .0343      .0002      .0010
%RSD             12.40      43.41      339.6      213.3      1244.      103.4      64.42

#1              -.0019     -.0064      .0003      .0010      .0270      .0003     -.0009
#2              -.0016     -.0120     -.0007     -.0002     -.0215      .0000     -.0023

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass       None   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: CCB      Acquired: 9/27/2016 8:53:24      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem            Mn2576     Mn2605     Mo2020     Ni2216     P_1782     K_7664     Se1960
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             .00024     -.0008      .0001     -.0004      .0007      .0070      .0025
Stddev          .00020      .0011      .0002      .0006      .0026      .0088      .0035
%RSD            82.838      135.4      206.1      159.2      367.4      125.7      143.5

#1              .00038     -.0016      .0000     -.0008      .0026      .0133      .0049
#2              .00010      .0000      .0002      .0000     -.0011      .0008      .0000

Check ?       Chk Pass       None   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem            Si2516     Ag3280     Na5895     Sr4077     Tl1908     Sn1899     Ti3361
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              .0064   F -.0084      .0013     .00004     -.0001      .0012      .0000
Stddev           .0055      .0003      .0063     .00006      .0042      .0002      .0004
%RSD             85.30      3.850      493.1     134.68      7074.      18.44      2291.

#1               .0103     -.0087      .0057     .00000     -.0030      .0010      .0003
#2               .0025     -.0082     -.0032     .00008      .0029      .0014     -.0002

Check ?       Chk Pass   Chk Fail   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit                  .0040
Low Limit                  -.0040

Elem            V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units              ppm        ppm        ppm        ppm        ppm
Avg             -.0007     -.0001      .0001      .0004     -.0008
Stddev           .0014      .0005      .0001      .0024      .0062
%RSD             214.0      374.0      127.4      633.5      791.4

#1              -.0017     -.0005      .0002      .0020      .0036
#2               .0003      .0002      .0000     -.0013     -.0052

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: CCB      Acquired: 9/27/2016 8:53:24      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:          Sample Type:
Comment:

Int. Std.           Y_2243      Y_3600   Y_3600-2
Units                Cts/S       Cts/S      Cts/S
Avg                 1894.5      38552.     3685.3
Stddev                 1.8        127.       14.5
%RSD                .09272      .32879     .39446

#1                  1895.7      38462.     3675.0
#2                  1893.3      38641.     3695.6
```

```
Sample Name: ICSA      Acquired: 9/27/2016 8:55:52      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: ICP15-99-C

Elem           Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496     Cd2144
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             25.66      461.6      .0178     -.0016      .0005    -.00076      .0082     -.0004
Stddev            .04         .5      .0043      .0025      .0001     .00029      .0002      .0003
%RSD            .1637      .1001      24.00      155.4      19.96     38.398      1.993      66.25

#1              25.69      461.9      .0148      .0002      .0006    -.00096      .0083     -.0002
#2              25.63      461.2      .0208     -.0034      .0004    -.00055      .0080     -.0006

Check ?          None       None       None       None       None       None       None       None
Value
Range

Elem           Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247     Cu3273     Fe2599
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            -.0006      494.9      *****      .0016     -.0020      .0213      .0000      192.2
Stddev          .0004        3.6      -----      .0002      .0010      .0012      .0002         .6
%RSD            60.41      .7175      -----      14.73      53.22      5.670      5839.      .2882

#1             -.0009      492.4      -----      .0018     -.0012      .0222     -.0002      191.8
#2             -.0004      497.4      -----      .0015     -.0027      .0205      .0002      192.6

Check ?          None   Chk Pass       None       None       None       None       None   Chk Pass
Value
Range

Elem           Pb2203     Li6707     Mg2790     Mg2795     Mg2852     Mn2576     Mn2605     Mo2020
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            -.0062      .0056      576.7      208.3      438.4     .00029      .0030     -.0009
Stddev          .0005      .0020        3.7         .7        1.0     .00003      .0012      .0008
%RSD            8.547      36.29      .6405      .3410      .2280     9.8497      38.44      87.69

#1             -.0059      .0070      574.1      207.8      437.7     .00027      .0039     -.0015
#2             -.0066      .0041      579.3      208.8      439.1     .00031      .0022     -.0003

Check ?          None       None   Chk Pass       None       None       None       None       None
Value
Range
```

```
Sample Name: ICSA      Acquired: 9/27/2016 8:55:52      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: ICP15-99-C

Elem            Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              .0014      .0121     -.0220      .0166      .0039     -.0455      .0187     .00437
Stddev           .0001      .0034      .0431      .0005      .0062      .0111      .0093     .00003
%RSD             8.694      27.92      195.4      2.877      157.2      24.38      49.68     .62920

#1               .0013      .0097     -.0525      .0162     -.0004     -.0377      .0252     .00435
#2               .0015      .0145      .0084      .0169      .0083     -.0533      .0121     .00439

Check ?           None       None       None       None       None       None       None       None
Value
Range

Elem            Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0043      .0035     -.0106      .0024      .0012     -.0005      .0123      .0352
Stddev           .0027      .0029      .0001      .0003      .0001      .0001      .0019      .0001
%RSD             62.46      81.39      .7145      14.18      8.488      28.93      15.72      .3887

#1              -.0062      .0056     -.0106      .0022      .0012     -.0006      .0109      .0353
#2              -.0024      .0015     -.0107      .0027      .0011     -.0004      .0136      .0351

Check ?           None       None       None       None       None       None       None       None
Value
Range

Int. Std.       Y_2243     Y_3600   Y_3600-2
Units            Cts/S      Cts/S      Cts/S
Avg             1651.1     32826.     3512.5
Stddev             2.2        87.       10.9
%RSD            .13379     .26355     .31046

#1              1649.6     32764.     3520.2
#2              1652.7     32887.     3504.8
```

```
Sample Name: ICSAB      Acquired: 9/27/2016 8:58:35      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: ICP15-99-D

Elem        Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496     Cd2144
Units          ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg          25.81      452.7      .9144     -.0051      .5118     .48881      .0001      .9354
Stddev         .06        1.9      .0001      .0029      .0048     .00023      .0052      .0019
%RSD         .2447      .4226      .0121      56.92      .9291     .04718      5270.      .2009

#1           25.85      451.4      .9143     -.0030      .5152     .48898      .0038      .9367
#2           25.76      454.1      .9145     -.0071      .5085     .48865     -.0036      .9341

Check ?       None       None   Chk Pass       None   Chk Pass   Chk Pass       None   Chk Pass
Value
Range

Elem        Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247     Cu3273     Fe2599
Units          ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg          .9250      491.2      *****      .4880      .4480      .4872      .4523      191.5
Stddev       .0012        3.0      -----      .0028      .0002      .0007      .0003        1.1
%RSD         .1303      .6113      -----      .5666      .0434      .1464      .0722      .5580

#1           .9241      493.3      -----      .4899      .4479      .4877      .4521      192.2
#2           .9258      489.1      -----      .4860      .4482      .4867      .4525      190.7

Check ?   Chk Pass   Chk Pass       None   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem        Pb2203     Li6707     Mg2790     Mg2795     Mg2852     Mn2576     Mn2605     Mo2020
Units          ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg          .8871      .0057      573.5      208.7      434.5     .47481      .5172     -.0021
Stddev       .0080      .0013        3.1         .9        2.8     .00141      .0020      .0003
%RSD         .8988      23.42      .5468      .4407      .6430     .29626      .3860      12.61

#1           .8815      .0048      575.8      209.4      436.5     .47382      .5158     -.0019
#2           .8928      .0067      571.3      208.1      432.5     .47581      .5186     -.0022

Check ?   Chk Pass       None   Chk Pass       None       None   Chk Pass   Chk Pass       None
Value
Range
```

```
Sample Name: ICSAB     Acquired: 9/27/2016 8:58:35     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: ICP15-99-D

Elem         Ni2216    P_1782    K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .8796     .0164    -.0323     .0235    -.0069  F 23.44      .0174    .00443
Stddev        .0016     .0001     .0227     .0042     .0138       .04     .0012    .00015
%RSD          .1771     .8470     70.10     17.84     200.8     .1549     7.084    3.3171

#1            .8785     .0165    -.0484     .0205     .0029     23.42     .0166    .00453
#2            .8807     .0163    -.0163     .0265    -.0166     23.47     .0183    .00432

Check ?    Chk Pass      None      None      None      None  Chk Fail      None      None
Value                                                           1.000
Range                                                          20.00%

Elem         Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0001     .0053    -.0115     .5046     .9317     .8872     .0087     .0450
Stddev        .0002     .0025     .0002     .0056     .0015     .0008     .0023     .0041
%RSD          196.1     47.45     1.903     1.105     .1636     .0948     27.10     9.163

#1            .0000     .0070    -.0113     .5085     .9328     .8866     .0103     .0479
#2            .0002     .0035    -.0116     .5007     .9306     .8878     .0070     .0421

Check ?        None      None      None  Chk Pass  Chk Pass  Chk Pass      None      None
Value
Range

Int. Std.    Y_2243    Y_3600  Y_3600-2
Units         Cts/S     Cts/S     Cts/S
Avg          1645.5    32647.    3490.1
Stddev           .6       79.      29.1
%RSD         .03604    .24274    .83333

#1           1645.1    32591.    3469.6
#2           1645.9    32703.    3510.7
```

Sample Name: KQ1610520-01 Acquired: 9/27/2016 9:19:54 Type: Unk
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment: EM 092716A K1609659-MB

Elem	Al1670	Sb2068	As1890	Ba4554	Be2348	B_2496	Cd2144
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0021	F .0260	-.0015	.0000	.00001	.0002	.0000
#1	.0025	.0240	-.0029	.0001	.00000	-.0007	.0000
#2	.0017	.0279	-.0001	-.0002	.00002	.0011	-.0001

Elem	Cd2265	Ca3933	Cr2677	Co2307	Cu2247	Cu3273	* ~~Fe2599~~
Units	ppm	ppm	ppm	ppm	ppm	ppm	~~ppm~~
Avg	.0001	F .0919	-.0004	.0002	.0020	.0019	~~F .0294~~
#1	.0000	.0915	-.0010	.0002	.0026	.0016	~~.0269~~
#2	.0002	.0923	.0002	.0001	.0014	.0021	~~.0318~~

Elem	Pb2203	Li6707	Mg2795	Mn2576	Mo2020	Ni2216	P_1782
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.0022	-.0009	F .0154	-.00013	-.0003	.0000	.0044
#1	.0005	-.0021	.0156	-.00015	-.0006	.0006	.0074
#2	-.0049	.0003	.0153	-.00011	.0000	-.0006	.0014

Elem	K_7664	Se1960	Si2516	Ag3280	Na5895	Sr4077	Tl1908
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0010	-.0009	-.0096	F -.0111	.0026	.00037	.0021
#1	.0196	-.0039	-.0023	-.0180	.0093	.00029	.0027
#2	-.0177	.0022	-.0169	-.0043	-.0041	.00044	.0016

Elem	Sn1899	Ti3361	V_2924	Zn2062	Zn2138	Bi2230	S_1820
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0006	-.0002	-.0005	.0003	.0004	.0020	-.0101
#1	-.0002	-.0002	-.0005	.0003	.0003	.0024	-.0078
#2	.0014	-.0002	-.0004	.0002	.0005	.0015	-.0124

*rerun
am 9/27/16

```
Sample Name: KQ1610520-01      Acquired: 9/27/2016 9:19:54      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:         Sample Type:
Comment: EM 092716A K1609659-MB

Int. Std.        Y_2243      Y_3600   Y_3600-2
Units             Cts/S       Cts/S      Cts/S
Avg              1907.4      39299.     3845.6

#1               1902.7      39181.     3849.1
#2               1912.2      39417.     3842.1
```

```
Sample Name: KQ1610520-01      Acquired: 9/27/2016 9:24:01      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:        Sample Type:
Comment: EM 092716A K1609659-MB REPOUR

Elem         Al1670    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          -.0025     .0119     .0039     .0006   -.00005     .0009     .0000

#1           -.0045     .0149     .0004     .0004   -.00006    -.0031    -.0001
#2           -.0004     .0089     .0074     .0008   -.00005     .0049     .0002

Elem         Cd2265    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0000   F .0921    -.0007    -.0004    -.0001     .0005     .0028

#1            .0003     .0921    -.0002    -.0005     .0011     .0008     .0018
#2           -.0002     .0922    -.0012    -.0002    -.0013     .0002     .0038

Elem         Pb2203    Li6707    Mg2795    Mn2576    Mo2020    Ni2216    P_1782
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          -.0014     .0020   F .0155   -.00009    -.0006     .0003    -.0031

#1            .0003     .0030     .0153   -.00006    -.0003     .0006    -.0036
#2           -.0030     .0010     .0156   -.00013    -.0009     .0000    -.0026

Elem         K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077    Tl1908
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          -.0273    -.0028     .0034  F -.0041     .0006    .00031     .0018

#1           -.0317    -.0078    -.0122    -.0036     .0035    .00025    -.0006
#2           -.0229     .0022     .0189    -.0047    -.0022    .00037     .0042

Elem         Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0014    -.0001    -.0001     .0001     .0003     .0001    -.0167

#1            .0008     .0001    -.0003    -.0001     .0003     .0000    -.0192
#2            .0020    -.0003     .0002     .0003     .0004     .0003    -.0141
```

```
Sample Name: KQ1610520-01      Acquired: 9/27/2016 9:24:01      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:       Sample Type:
Comment: EM 092716A K1609659-MB REPOUR

Int. Std.        Y_2243     Y_3600   Y_3600-2
Units             Cts/S      Cts/S      Cts/S
Avg              1907.7     39134.     3785.9

#1               1903.5     39062.     3790.4
#2               1912.0     39206.     3781.4
```

```
Sample Name: KQ1610520-02      Acquired: 9/27/2016 9:26:30      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:           Sample Type:
Comment: EM 092716A K1609659-LCSW

Elem            Al1670    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144    Cd2265
Units              ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg              1.835     .5010     .2441     .9696    .04784     .2426     .0472     .0468

#1               1.835     .5031     .2350     .9680    .04806     .2405     .0471     .0469
#2               1.835     .4988     .2532     .9712    .04762     .2446     .0473     .0466

Elem            Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599    Pb2203    Li6707
Units              ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg              2.428     .1873     .4756     .2373     .2417     .9617     .4711     .0013

#1               2.427     .1880     .4754     .2368     .2419     .9620     .4702     .0015
#2               2.430     .1866     .4758     .2378     .2414     .9615     .4720     .0010

Elem            Mg2795    Mn2576    Mo2020    Ni2216    P_1782    K_7664    Se1960    Si2516
Units              ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg              2.345    .45884     .2483     .4674     .0049     2.357     .2422     .0098

#1               2.344    .45916     .2488     .4658     .0060     2.308     .2437     .0161
#2               2.346    .45852     .2477     .4691     .0038     2.406     .2407     .0034

Elem            Ag3280    Na5895    Sr4077    Tl1908    Sn1899    Ti3361    V_2924    Zn2062
Units              ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg              .5521     2.403    .00026     .0505     .0004    -.0003     .4746     .4663

#1               .5594     2.380    .00031     .0498     .0024    -.0003     .4784     .4671
#2               .5449     2.426    .00020     .0511    -.0016    -.0002     .4708     .4654

Elem            Zn2138    Bi2230    S_1820
Units              ppm       ppm       ppm
Avg              .4696     .0035    -.0147

#1               .4695     .0054    -.0100
#2               .4697     .0015    -.0194
```

```
Sample Name: KQ1610520-02      Acquired: 9/27/2016 9:26:30      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:          Sample Type:
Comment: EM 092716A K1609659-LCSW

Int. Std.        Y_2243    Y_3600  Y_3600-2
Units             Cts/S     Cts/S     Cts/S
Avg              1912.3    39190.    3844.5

#1               1911.5    39119.    3835.5
#2               1913.1    39261.    3853.4
```

```
Sample Name: KQ1610520-03      Acquired: 9/27/2016 9:28:50      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:        Sample Type:
Comment: EM 092716A K1609659-SRM1 DORM-4

Elem       Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         13.54    .0072    .0801    .0478   .00011    .0850    .0028    .0028

#1          13.55    .0055    .0779    .0479   .00014    .0866    .0030    .0028
#2          13.54    .0090    .0822    .0478   .00008    .0835    .0027    .0027

Elem       Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         21.37    .0168    .0021    .1496    .1498    3.085    .0019    .0131

#1          21.39    .0162    .0022    .1492    .1504    3.077    .0016    .0146
#2          21.35    .0174    .0020    .1499    .1492    3.093    .0022    .0116

Elem       Mg2795   Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         8.175    9.011   .02737    .0033    .0116    76.80    137.9    .0445

#1          8.164    8.999   .02748    .0033    .0114    76.79    137.7    .0434
#2          8.186    9.022   .02726    .0032    .0119    76.81    138.0    .0456

Elem       Si2516   Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         6.624   -.0065    147.1   .08962   -.0085    .0049    .0477    .0150

#1          6.618   -.0073    147.1   .08965   -.0083    .0058    .0476    .0145
#2          6.630   -.0056    147.1   .08959   -.0087    .0040    .0478    .0155

Elem       Zn2062   Zn2138   Bi2230   S_1820
Units         ppm      ppm      ppm      ppm
Avg         .4909    .4794    .0005    90.84

#1          .4897    .4799   -.0011    90.72
#2          .4920    .4790    .0022    90.97
```

```
Sample Name: KQ1610520-03      Acquired: 9/27/2016 9:28:50      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:           Sample Type:
Comment: EM 092716A K1609659-SRM1 DORM-4

Int. Std.        Y_2243    Y_3600  Y_3600-2
Units             Cts/S     Cts/S     Cts/S
Avg              1820.2    37242.    3883.1

#1               1819.4    37285.    3881.8
#2               1821.1    37199.    3884.4
```

```
Sample Name: KQ1610520-04     Acquired: 9/27/2016 9:31:14     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: EM 092716A K1609659-SRM2 TORT-3

Elem       Al1670   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         .0779    .0084    .6902    .0027   .00015    .0292    .4153    .4113

#1          .0816    .0099    .6896    .0026   .00017    .0269    .4147    .4102
#2          .0743    .0069    .6909    .0028   .00013    .0316    .4159    .4124

Elem       Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         24.61    .0192    .0097    4.612    4.492    1.702   -.0034    .0046

#1          24.42    .0188    .0090    4.605    4.485    1.683   -.0033    .0053
#2          24.79    .0195    .0104    4.619    4.499    1.722   -.0036    .0040

Elem       Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         11.75   .14555    .0334    .0501   >90.00    152.2    .1180    .2447

#1          11.73   .14576    .0330    .0500    112.6    151.9    .1187    .2452
#2          11.76   .14535    .0339    .0501    113.1    152.6    .1173    .2441

Elem       Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         .3319    208.3   .34810   -.0036    .0044    .0061    .0882    1.383

#1          .3278    207.1   .34744   -.0018    .0040    .0058    .0878    1.379
#2          .3360    209.4   .34875   -.0054    .0049    .0064    .0885    1.388

Elem       Zn2138   Bi2230   S_1820
Units         ppm      ppm      ppm
Avg         1.323    .0006    147.9

#1          1.324   -.0006    147.6
#2          1.323    .0019    148.2
```

```
Sample Name: KQ1610520-04     Acquired: 9/27/2016 9:31:14     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:          Sample Type:
Comment: EM 092716A K1609659-SRM2 TORT-3

Int. Std.      Y_2243    Y_3600  Y_3600-2
Units           Cts/S     Cts/S     Cts/S
Avg            1799.4    36675.    3894.8

#1             1801.0    36634.    3898.4
#2             1797.8    36715.    3891.2
```

```
Sample Name: K1609659-003     Acquired: 9/27/2016 9:34:37     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: EM 092716A

Elem        Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          9.581    .0733    .6008    .2322   .00045    .0125    .0033    .0034

#1           9.559    .0694    .5973    .2325   .00042    .0124    .0034    .0036
#2           9.602    .0773    .6043    .2318   .00048    .0126    .0032    .0032

Elem        Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          18.13    .0164    .0219    .1544    .1521    21.25    .0041    .0166

#1           18.07    .0160    .0219    .1563    .1501    21.26    .0064    .0165
#2           18.19    .0167    .0219    .1526    .1540    21.23    .0018    .0167

Elem        Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          15.08   3.0613    .0071    .0143    83.67    82.63    .0450    3.230

#1           15.11   3.0631    .0065    .0144    83.65    82.81    .0438    3.233
#2           15.06   3.0595    .0076    .0142    83.69    82.45    .0461    3.226

Elem        Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         -.0050    45.77   .08728   -.0021    .0032    .6340    .0179    1.556

#1           .0042    45.92   .08783   -.0026    .0033    .6346    .0181    1.554
#2          -.0141    45.61   .08673   -.0016    .0032    .6334    .0177    1.558

Elem        Zn2138   Bi2230   S_1820
Units          ppm      ppm      ppm
Avg          1.544   -.0013    62.02

#1           1.543   -.0030    61.99
#2           1.545    .0004    62.05
```

Sample Name: K1609659-003 Acquired: 9/27/2016 9:34:37 Type: Unk
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment: EM 092716A

Int. Std.	Y_2243	Y_3600	Y_3600-2
Units	Cts/S	Cts/S	Cts/S
Avg	1863.3	37960.	3907.4
#1	1862.9	37814.	3910.0
#2	1863.7	38105.	3904.7

```
Sample Name: K1609659-003L    Acquired: 9/27/2016 9:36:59    Type: Unk
Method: 2016B-ICP04(v18)    Mode: CONC    Corr. Factor: 1.000000
User: admin    Dilution: 5    Test Type:    Sample Type:
Comment: EM 092716A 1/5

Elem       Al1670   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         1.720    .0187    .1105    .0465  -.00006    .0015    .0007    .0007

#1          1.724    .0199    .1083    .0461  -.00005    .0015    .0007    .0007
#2          1.717    .0175    .1126    .0468  -.00007    .0015    .0006    .0007

Elem       Ca3933   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         3.669    .0024    .0041    .0304    .0308    4.262    .0000    .0041

#1          3.665    .0019    .0042    .0310    .0313    4.238    .0016    .0045
#2          3.674    .0030    .0039    .0297    .0304    4.287   -.0016    .0038

Elem       Mg2795   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         2.829   .62449    .0012    .0026    16.64    15.52    .0066    .6180

#1          2.825   .62429    .0013    .0028    16.65    15.45    .0095    .6403
#2          2.832   .62469    .0011    .0024    16.62    15.59    .0037    .5957

Elem       Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units         ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg        -.0034    8.610   .01743    .0004    .0012    .1271    .0037    .3071

#1          .0009    8.574   .01732    .0034    .0006    .1270    .0040    .3082
#2         -.0078    8.646   .01754   -.0025    .0018    .1271    .0035    .3060

Elem       Zn2138   Bi2230   S_1820
Units         ppm      ppm      ppm
Avg         .3035    .0013    12.02

#1          .3037    .0014    11.95
#2          .3032    .0012    12.08
```

Sample Name: K1609659-003L Acquired: 9/27/2016 9:36:59 Type: Unk
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 5 Test Type: Sample Type:
Comment: EM 092716A 1/5

Int. Std.	Y_2243	Y_3600	Y_3600-2
Units	Cts/S	Cts/S	Cts/S
Avg	1876.1	38390.	3782.1
#1	1869.2	38318.	3776.3
#2	1883.0	38462.	3788.0

```
Sample Name: K1609659-003D     Acquired: 9/27/2016 9:39:25     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: EM 092716A

Elem          Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            8.669    .0789    .5824    .2219   .00057    .0099    .0036    .0034

#1             8.639    .0791    .5770    .2227   .00057    .0102    .0036    .0031
#2             8.699    .0786    .5879    .2212   .00058    .0095    .0036    .0037

Elem          Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            16.88    .0157    .0224    .1530    .1553    16.92    .0104    .0128

#1             16.89    .0161    .0223    .1530    .1542    16.91    .0113    .0146
#2             16.87    .0154    .0226    .1530    .1563    16.92    .0096    .0110

Elem          Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            14.30   3.1300    .0059    .0136    86.56    86.25    .0394    3.154

#1             14.29   3.1386    .0059    .0140    86.52    86.29    .0376    3.156
#2             14.30   3.1213    .0059    .0132    86.61    86.21    .0413    3.151

Elem          Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            .0073    48.10   .08979   -.0022    .0047    .5131    .0143    1.561

#1             .0061    48.08   .08971   -.0012    .0049    .5145    .0139    1.558
#2             .0084    48.12   .08988   -.0031    .0044    .5118    .0148    1.563

Elem          Zn2138   Bi2230   S_1820
Units            ppm      ppm      ppm
Avg            1.548   -.0017    63.01

#1             1.546   -.0032    62.96
#2             1.550   -.0001    63.06
```

```
Sample Name: K1609659-003D      Acquired: 9/27/2016 9:39:25      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:          Sample Type:
Comment: EM 092716A

Int. Std.        Y_2243     Y_3600  Y_3600-2
Units             Cts/S      Cts/S     Cts/S
Avg              1873.1     38336.    3925.2

#1               1872.1     38276.    3922.2
#2               1874.2     38395.    3928.3
```

```
Sample Name: K1609659-003S     Acquired: 9/27/2016 9:41:48     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:        Sample Type:
Comment: EM 092716A

Elem        Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          14.37    .4548    .8780    1.239   .05062    .2599    .0515    .0510

#1           14.40    .4538    .8824    1.241   .05038    .2596    .0517    .0513
#2           14.35    .4558    .8737    1.237   .05087    .2602    .0514    .0507

Elem        Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          19.97    .2071    .5020    .4003    .4023    23.46    .4711    .0193

#1           19.97    .2055    .5027    .4004    .4029    23.49    .4687    .0207
#2           19.96    .2088    .5013    .4002    .4017    23.43    .4735    .0178

Elem        Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          18.05   3.5889    .2539    .4858    84.03    87.53    .3017    3.646

#1           17.98   3.5949    .2555    .4858    84.20    87.32    .3031    3.624
#2           18.13   3.5830    .2524    .4858    83.86    87.75    .3003    3.669

Elem        Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          .5609    48.50   .09049    .0482    .0047    1.022    .5117    2.029

#1           .5584    48.35   .09064    .0463    .0045    1.022    .5119    2.034
#2           .5634    48.66   .09034    .0500    .0048    1.021    .5115    2.025

Elem        Zn2138   Bi2230   S_1820
Units          ppm      ppm      ppm
Avg          1.992   -.0050    60.32

#1           1.992   -.0049    60.33
#2           1.992   -.0050    60.30
```

```
Sample Name: K1609659-003S     Acquired: 9/27/2016 9:41:48     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: EM 092716A

Int. Std.        Y_2243    Y_3600  Y_3600-2
Units             Cts/S     Cts/S     Cts/S
Avg              1857.0    38075.    3903.4

#1               1853.4    38075.    3886.4
#2               1860.5    38076.    3920.3
```

```
Sample Name: K1609659-001      Acquired: 9/27/2016 9:44:08      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:          Sample Type:
Comment: EM 092716A

Elem          Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            6.128    .2895    3.395    .3521   .00069    .0037    .0012    .0012

#1             6.146    .2866    3.401    .3496   .00088    .0039    .0012    .0013
#2             6.109    .2924    3.389    .3545   .00049    .0034    .0013    .0011

Elem          Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            9.081    .0104    .0177    .3155    .3136    35.79    .0109    .0077

#1             9.027    .0104    .0173    .3148    .3134    35.70    .0121    .0073
#2             9.135    .0105    .0180    .3161    .3138    35.87    .0097    .0081

Elem          Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            11.29   7.2510    .0201    .0131    84.75    106.3    .0513    3.024

#1             11.23   7.2539    .0204    .0134    84.82    105.5    .0525    2.989
#2             11.36   7.2481    .0199    .0128    84.68    107.0    .0501    3.058

Elem          Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            .0036    39.50   .08051   -.0005    .0045    .2593    .0198    1.581

#1             .0065    39.34   .08001    .0011    .0044    .2587    .0192    1.583
#2             .0006    39.66   .08101   -.0021    .0046    .2598    .0203    1.578

Elem          Zn2138   Bi2230   S_1820
Units            ppm      ppm      ppm
Avg            1.551    .0042    59.54

#1             1.550    .0022    59.54
#2             1.552    .0062    59.54
```

Sample Name: K1609659-001 Acquired: 9/27/2016 9:44:08 Type: Unk
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment: EM 092716A

Int. Std.	Y_2243	Y_3600	Y_3600-2
Units	Cts/S	Cts/S	Cts/S
Avg	1853.6	37932.	3884.4
#1	1852.5	37855.	3878.1
#2	1854.7	38009.	3890.7

```
Sample Name: CCVB      Acquired: 9/27/2016 9:46:31      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem          Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496     Cd2144
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            7.723      9.519      .0055      1.001      10.16    -.00002      .0000      .0001
Stddev          .028       .005      .0023       .013        .00     .00009      .0008      .0000
%RSD           .3559      .0578      41.40      1.263      .0477     375.34      4944.      35.91

#1             7.742      9.515      .0072      .9921      10.16    -.00008      .0006      .0001
#2             7.703      9.523      .0039      1.010      10.16     .00004     -.0005      .0001

Check ?         None   Chk Pass       None   Chk Pass   Chk Pass       None       None       None
Value
Range

Elem          Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247     Cu3273     Fe2599
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0000      10.07      9.683     -.0001      .0000      .0012      .0001      10.08
Stddev         .0001        .07       .055      .0005       .000      .0003      .0002        .01
%RSD           529.3      .6675      .5656      730.0      139.4      25.01      175.9      .1349

#1             .0001      10.02      9.644      .0003     -.0001      .0010      .0003      10.09
#2            -.0001      10.12      9.722     -.0004      .0000      .0014      .0000      10.07

Check ?         None   Chk Pass       None       None       None       None       None   Chk Pass
Value
Range

Elem          Pb2203     Li6707     Mg2790     Mg2795     Mg2852     Mn2576     Mn2605     Mo2020
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .0004      .9753      10.53      9.650      9.908     .99369      .9774      .0000
Stddev         .0017      .0045        .01       .018       .003     .00117      .0015       .000
%RSD           373.8      .4635      .1013      .1907      .0323     .11764      .1557      432.6

#1             .0016      .9785      10.52      9.637      9.905     .99452      .9785     -.0001
#2            -.0007      .9721      10.54      9.663      9.910     .99286      .9764      .0001

Check ?         None   Chk Pass   Chk Pass       None   Chk Pass       None   Chk Pass       None
Value
Range
```

```
Sample Name: CCVB     Acquired: 9/27/2016 9:46:31     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:     Sample Type:
Comment:

Elem          Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           -.0006      9.975      9.733      .0030      9.778     -.0106      9.708     .99914
Stddev         .0000       .017       .005      .0011       .022      .0221       .017     .00291
%RSD           7.431      .1737      .0546      37.49      .2262      207.7      .1751     .29079

#1            -.0006      9.987      9.729      .0022      9.793      .0050      9.720     1.0012
#2            -.0006      9.962      9.736      .0038      9.762     -.0263      9.696     .99708

Check ?         None   Chk Pass   Chk Pass       None   Chk Pass       None   Chk Pass   Chk Pass
Value
Range

Elem          Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           -.0011      .0002      .0000      .0000     -.0004      .0002      1.001      .9858
Stddev         .0016      .0018      .0000      .0010      .0002      .0003       .008      .0084
%RSD           143.3      1107.      122.4      2219.      39.57      162.5      .8035      .8539

#1            -.0022      .0014      .0000     -.0007     -.0003      .0000      1.006      .9918
#2             .0000     -.0011      .0001      .0007     -.0005      .0003      .9950      .9799

Check ?         None       None       None       None       None       None   Chk Pass   Chk Pass
Value
Range

Int. Std.     Y_2243     Y_3600   Y_3600-2
Units          Cts/S      Cts/S      Cts/S
Avg           1845.8     37379.     3667.2
Stddev            .6        34.        2.4
%RSD          .03388     .08989     .06644

#1            1845.4     37355.     3665.5
#2            1846.3     37403.     3668.9
```

Sample Name: CCVA Acquired: 9/27/2016 9:49:05 Type: QC
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment:

Elem	Al1670	Al3944	Sb2068	As1890	Ba4554	Be2348	B_2496	Cd2144
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2560	.2553	.2446	.2562	.2562	.24779	.2494	.2514
Stddev	.0061	.0003	.0038	.0006	.0001	.00046	.0055	.0000
%RSD	2.370	.1284	1.572	.2272	.0524	.18704	2.221	.0085
#1	.2603	.2550	.2474	.2558	.2561	.24812	.2534	.2514
#2	.2517	.2555	.2419	.2566	.2563	.24746	.2455	.2514
Check ?	Chk Pass	None	Chk Pass	None	None	Chk Pass	Chk Pass	Chk Pass
Value								
Range								

Elem	Cd2265	Ca3158	Ca3933	Cr2677	Co2307	Cu2247	Cu3273	Fe2599
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2508	.5214	.5012	.2526	.2510	.2518	.2495	.2605
Stddev	.0001	.0178	.0016	.0015	.0003	.0004	.0011	.0009
%RSD	.0596	3.412	.3150	.6092	.1270	.1525	.4538	.3439
#1	.2507	.5088	.5001	.2515	.2512	.2515	.2503	.2611
#2	.2509	.5339	.5023	.2537	.2508	.2521	.2487	.2599
Check ?	Chk Pass	None	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	None
Value								
Range								

Elem	Pb2203	Li6707	Mg2790	Mg2795	Mg2852	Mn2576	Mn2605	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2516	.0014	.3001	.2531	.2536	.25255	.2419	.2528
Stddev	.0004	.0013	.0124	.0009	.0003	.00014	.0018	.0013
%RSD	.1716	95.90	4.122	.3717	.1045	.05674	.7548	.5056
#1	.2513	.0023	.2914	.2524	.2538	.25245	.2432	.2537
#2	.2519	.0004	.3089	.2538	.2534	.25265	.2406	.2519
Check ?	Chk Pass	None	None	Chk Pass	None	Chk Pass	None	Chk Pass
Value								
Range								

```
Sample Name: CCVA     Acquired: 9/27/2016 9:49:05     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:     Sample Type:
Comment:

Elem          Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .2508      .0066      2.433      .2478      .1329    F .6160      .2593     .00002
Stddev         .0002      .0021       .040      .0026      .0158      .0101      .0095     .00015
%RSD           .0822      31.11      1.631      1.054      11.91      1.644      3.664     723.98

#1             .2507      .0052      2.405      .2460      .1440      .6231      .2526    -.00008
#2             .2510      .0081      2.461      .2497      .1217      .6088      .2660     .00012

Check ?     Chk Pass       None       None   Chk Pass       None   Chk Fail       None       None
Value                                                                 .2500
Range                                                                10.44%

Elem          Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units            ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            .2489      .2529      .2540      .2508      .2534      .2484     -.0013     -.0125
Stddev         .0040      .0011      .0004      .0010      .0005      .0005      .0053      .0003
%RSD           1.622      .4314      .1479      .4065      .2147      .2205      410.7      2.426

#1             .2460      .2536      .2537      .2501      .2531      .2480      .0024     -.0127
#2             .2517      .2521      .2542      .2515      .2538      .2487     -.0050     -.0123

Check ?     Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass       None       None
Value
Range

Int. Std.     Y_2243     Y_3600   Y_3600-2
Units          Cts/S      Cts/S      Cts/S
Avg           1890.9     38802.     3723.7
Stddev            .4       151.       18.7
%RSD          .01978     .38867     .50325

#1            1890.6     38908.     3736.9
#2            1891.2     38695.     3710.4
```

```
Sample Name: CCB     Acquired: 9/27/2016 9:51:26     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:     Sample Type:
Comment:

Elem           Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            -.0032      .0010      .0103     -.0014      .0003    -.00021      .0029
Stddev          .0013      .0025      .0008      .0023      .0007     .00021      .0011
%RSD            39.61      252.4      8.180      166.1      190.1     102.62      37.16

#1             -.0023     -.0008      .0097      .0002      .0008    -.00006      .0037
#2             -.0041      .0028      .0109     -.0030     -.0001    -.00036      .0022

Check ?      Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem           Cd2144     Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            -.0001      .0000     -.0060      .0004      .0001     -.0001     -.0004
Stddev          .0003      .0002      .0026      .0000      .0001      .0001      .0005
%RSD            279.3      646.3      43.17      11.97      48.33      71.26      113.9

#1             -.0003      .0002     -.0042      .0004      .0002     -.0001     -.0008
#2              .0001     -.0001     -.0079      .0003      .0001      .0000     -.0001

Check ?      Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem           Cu3273     Fe2599     Pb2203     Li6707     Mg2790     Mg2795     Mg2852
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg            -.0009      .0033     -.0025      .0001     -.0238      .0001      .0002
Stddev          .0007      .0020      .0006      .0008      .0031      .0001      .0019
%RSD            75.41      60.24      25.28      775.6      12.92      214.4      948.4

#1             -.0014      .0019     -.0029     -.0004     -.0260      .0000      .0015
#2             -.0004      .0047     -.0020      .0006     -.0217      .0002     -.0011

Check ?      Chk Pass   Chk Pass   Chk Pass   Chk Pass       None   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: CCB      Acquired: 9/27/2016 9:51:26      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:         Sample Type:
Comment:

Elem           Mn2576     Mn2605     Mo2020     Ni2216     P_1782     K_7664     Se1960
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg          -.00007      .0008      .0007      .0008     -.0002      .0398     -.0048
Stddev        .00002      .0008      .0007      .0003      .0037      .0282      .0007
%RSD          24.986      105.2      100.2      39.61      2400.      70.77      15.26

#1           -.00008      .0002      .0011      .0006     -.0027      .0597     -.0043
#2           -.00006      .0014      .0002      .0010      .0024      .0199     -.0053

Check ?     Chk Pass       None   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem           Si2516     Ag3280     Na5895     Sr4077     Tl1908     Sn1899     Ti3361
Units             ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             .0077   F -.0054      .0190     .00002     -.0062      .0012      .0001
Stddev          .0160      .0079      .0003     .00009      .0039      .0018      .0003
%RSD            207.4      146.8      1.630     554.62      62.85      149.8      318.0

#1             -.0036      .0002      .0192    -.00005     -.0089      .0024      .0004
#2              .0190     -.0109      .0188     .00008     -.0034     -.0001     -.0001

Check ?      Chk Pass   Chk Fail   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit                 .0040
Low Limit                 -.0040

Elem           V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units             ppm        ppm        ppm        ppm        ppm
Avg            -.0006      .0002      .0001      .0045     -.0095
Stddev          .0009      .0002      .0000      .0009      .0040
%RSD            169.0      71.99      23.75      20.73      41.87

#1             -.0012      .0001      .0001      .0051     -.0123
#2              .0001      .0004      .0001      .0038     -.0067

Check ?      Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: CCB      Acquired: 9/27/2016 9:51:26      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Int. Std.       Y_2243    Y_3600  Y_3600-2
Units            Cts/S     Cts/S     Cts/S
Avg             1876.1    38286.    3656.8
Stddev             1.5       84.       7.2
%RSD            .08233    .21846    .19635

#1              1875.0    38345.    3651.7
#2              1877.2    38226.    3661.8
```

```
Sample Name: K1609659-002     Acquired: 9/27/2016 9:53:55     Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:        Sample Type:
Comment: EM 092716A

Elem        Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144    Cd2265
Units          ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          6.259     .0935     1.060     .1903    .00096     .0167     .0031     .0030

#1           6.290     .0914     1.056     .1905    .00086     .0180     .0030     .0029
#2           6.229     .0957     1.063     .1900    .00106     .0155     .0031     .0031

Elem        Ca3158    Cr2677    Co2307    Cu2247    Cu3273    Fe2599    Pb2203    Li6707
Units          ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          15.76     .0169     .0265     .2119     .2130     16.49     .0086     .0082

#1           15.84     .0170     .0269     .2115     .2137     16.50     .0090     .0084
#2           15.69     .0168     .0261     .2122     .2123     16.47     .0083     .0080

Elem        Mg2852    Mn2576    Mo2020    Ni2216    P_1782    K_7664    Se1960    Si2516
Units          ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          13.97    3.8345     .0068     .0165     80.82     66.01     .0355     2.639

#1           13.94    3.8292     .0072     .0165     80.87     65.86     .0337     2.645
#2           13.99    3.8399     .0064     .0165     80.78     66.16     .0372     2.633

Elem        Ag3280    Na5895    Sr4077    Tl1908    Sn1899    Ti3361    V_2924    Zn2062
Units          ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          .0089     31.96    .08205    -.0007     .0054     .2274     .0110     2.344

#1           .0109     31.92    .08226    -.0021     .0062     .2276     .0115     2.343
#2           .0069     32.01    .08184     .0006     .0045     .2271     .0105     2.345

Elem        Zn2138    Bi2230    S_1820
Units          ppm       ppm       ppm
Avg          2.308    -.0014     60.57

#1           2.311     .0017     60.60
#2           2.305    -.0045     60.54
```

```
Sample Name: K1609659-002      Acquired: 9/27/2016 9:53:55      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:           Sample Type:
Comment: EM 092716A

Int. Std.        Y_2243    Y_3600  Y_3600-2
Units             Cts/S     Cts/S     Cts/S
Avg              1883.6    38391.    3890.2

#1               1881.5    38526.    3866.9
#2               1885.7    38257.    3913.6
```

```
Sample Name: K1609659-004     Acquired: 9/27/2016 9:56:19     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Dilution: 1        Test Type:          Sample Type:
Comment: EM 092716A

Elem          Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            7.424    .1551    .4079    .3968   .00047    .0044    .0029    .0030

#1             7.440    .1535    .4089    .3964   .00053    .0035    .0030    .0029
#2             7.408    .1568    .4069    .3973   .00041    .0053    .0028    .0031

Elem          Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            12.26    .0110    .0178    .1535    .1551    17.70    .0054    .0107

#1             12.26    .0108    .0175    .1533    .1551    17.66    .0049    .0102
#2             12.25    .0112    .0181    .1537    .1551    17.74    .0059    .0112

Elem          Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            12.73   3.4526    .0062    .0110    85.90    88.42    .0322    3.078

#1             12.72   3.4597    .0056    .0108    85.98    88.34    .0315    3.062
#2             12.75   3.4455    .0068    .0112    85.82    88.51    .0328    3.093

Elem          Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            .0112    43.17   .07126   -.0016    .0038    .5079    .0148    1.849

#1             .0105    43.20   .07141   -.0039    .0047    .5088    .0149    1.843
#2             .0119    43.14   .07111    .0007    .0029    .5071    .0147    1.856

Elem          Zn2138   Bi2230   S_1820
Units            ppm      ppm      ppm
Avg            1.817   -.0005    61.17

#1             1.814    .0021    61.27
#2             1.820   -.0031    61.07
```

```
Sample Name: K1609659-004      Acquired: 9/27/2016 9:56:19      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:          Sample Type:
Comment: EM 092716A

Int. Std.      Y_2243    Y_3600  Y_3600-2
Units           Cts/S     Cts/S     Cts/S
Avg            1879.5    38222.    3865.6

#1             1880.6    38179.    3864.9
#2             1878.5    38265.    3866.2
```

```
Sample Name: K1609659-005      Acquired: 9/27/2016 9:58:42      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: EM 092716A

Elem       Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144    Cd2265
Units         ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg         8.878     .0215     .7485     .2296    .00058     .0164     .0019     .0019

#1          8.859     .0198     .7493     .2308    .00057     .0174     .0018     .0020
#2          8.898     .0232     .7477     .2284    .00059     .0155     .0021     .0017

Elem       Ca3158    Cr2677    Co2307    Cu2247    Cu3273    Fe2599    Pb2203    Li6707
Units         ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg         11.97     .0138     .0203     .1580     .1565     24.90     .0075     .0100

#1          11.95     .0133     .0203     .1578     .1561     24.96     .0075     .0097
#2          12.00     .0143     .0202     .1582     .1569     24.84     .0075     .0103

Elem       Mg2852    Mn2576    Mo2020    Ni2216    P_1782    K_7664    Se1960    Si2516
Units         ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg         12.03    3.9072     .0079     .0146     85.07     90.28     .0425     3.735

#1          11.99    3.9147     .0079     .0145     85.03     90.02     .0359     3.718
#2          12.08    3.8998     .0079     .0148     85.11     90.55     .0491     3.753

Elem       Ag3280    Na5895    Sr4077    Tl1908    Sn1899    Ti3361    V_2924    Zn2062
Units         ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg        -.0105     49.25    .06445    -.0009     .0030     .4541     .0171     1.310

#1         -.0227     49.12    .06460    -.0014     .0024     .4549     .0172     1.310
#2          .0017     49.38    .06430    -.0004     .0036     .4533     .0170     1.310

Elem       Zn2138    Bi2230    S_1820
Units         ppm       ppm       ppm
Avg         1.288    -.0040     60.33

#1          1.287    -.0062     60.22
#2          1.288    -.0019     60.43
```

```
Sample Name: K1609659-005      Acquired: 9/27/2016 9:58:42      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:          Sample Type:
Comment: EM 092716A

Int. Std.       Y_2243    Y_3600  Y_3600-2
Units            Cts/S     Cts/S     Cts/S
Avg             1864.0    38067.    3876.1

#1              1862.4    38010.    3855.3
#2              1865.5    38124.    3896.8
```

```
Sample Name: K1609659-006     Acquired: 9/27/2016 10:01:04     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: EM 092716A

Elem        Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          8.825    .0056    .0778    .7413   .00057    .0092    .0044    .0041

#1           8.849    .0065    .0823    .7408   .00065    .0080    .0044    .0040
#2           8.802    .0047    .0734    .7419   .00048    .0103    .0044    .0043

Elem        Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          15.44    .0113    .0204    .1227    .1235    9.531    .0021    .0109

#1           15.36    .0117    .0207    .1220    .1223    9.535    .0004    .0106
#2           15.51    .0109    .0200    .1235    .1246    9.528    .0039    .0112

Elem        Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          12.95   1.4636    .0062    .0124   >90.00    95.51    .0292    3.538

#1           12.94   1.4662    .0059    .0128    93.38    95.66    .0273    3.531
#2           12.95   1.4609    .0064    .0120    93.32    95.36    .0312    3.545

Elem        Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         -.0031    53.68   .07816   -.0013    .0040    .4604    .0136    1.823

#1          -.0064    53.78   .07808   -.0048    .0038    .4606    .0134    1.817
#2           .0001    53.58   .07825    .0021    .0042    .4601    .0137    1.829

Elem        Zn2138   Bi2230   S_1820
Units          ppm      ppm      ppm
Avg          1.782   -.0001    65.17

#1           1.784   -.0055    65.27
#2           1.781    .0053    65.07
```

```
Sample Name: K1609659-006     Acquired: 9/27/2016 10:01:04     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:        Sample Type:
Comment: EM 092716A

Int. Std.      Y_2243   Y_3600  Y_3600-2
Units           Cts/S    Cts/S     Cts/S
Avg            1864.7   37930.    3897.1

#1             1867.6   37868.    3906.8
#2             1861.7   37992.    3887.3
```

```
Sample Name: K1609659-007      Acquired: 9/27/2016 10:03:27      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:          Sample Type:
Comment: EM 092716A

Elem         Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144    Cd2265
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           7.940     .0075     .0483     .0725    .00055     .0189     .0100     .0101

#1            7.960     .0064     .0475     .0726    .00044     .0181     .0101     .0101
#2            7.921     .0086     .0490     .0724    .00067     .0196     .0100     .0100

Elem         Ca3158    Cr2677    Co2307    Cu2247    Cu3273    Fe2599    Pb2203    Li6707
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           32.91     .0282     .0092     .2118     .2103     9.273     .0008     .0120

#1            32.80     .0275     .0095     .2122     .2109     9.307    -.0014     .0129
#2            33.02     .0290     .0090     .2115     .2096     9.238     .0030     .0110

Elem         Mg2852    Mn2576    Mo2020    Ni2216    P_1782    K_7664    Se1960    Si2516
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           17.24    .51334     .0050     .0139    >90.00     82.26     .0234     2.498

#1            17.25    .51453     .0045     .0140     93.19     82.37     .0249     2.505
#2            17.24    .51215     .0055     .0137     93.43     82.15     .0218     2.490

Elem         Ag3280    Na5895    Sr4077    Tl1908    Sn1899    Ti3361    V_2924    Zn2062
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0243     44.21    .08548     .0003     .0034     .3943     .0145     1.530

#1            .0318     44.37    .08515     .0032     .0038     .3946     .0139     1.528
#2            .0168     44.04    .08581    -.0025     .0029     .3939     .0152     1.531

Elem         Zn2138    Bi2230    S_1820
Units           ppm       ppm       ppm
Avg           1.501     .0023     65.79

#1            1.501     .0037     65.76
#2            1.501     .0008     65.82
```

```
Sample Name: K1609659-007      Acquired: 9/27/2016 10:03:27      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1        Test Type:           Sample Type:
Comment: EM 092716A

Int. Std.        Y_2243    Y_3600  Y_3600-2
Units              Cts/S     Cts/S     Cts/S
Avg               1857.6    37735.    3858.2

#1                1858.8    37699.    3862.0
#2                1856.3    37770.    3854.3
```

```
Sample Name: K1609659-008     Acquired: 9/27/2016 10:05:50     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin      Dilution: 1       Test Type:        Sample Type:
Comment: EM 092716A

Elem          Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            5.950    .0083    .1020    .0884   .00098    .0068    .0040    .0042

#1             5.949    .0089    .1026    .0883   .00098    .0069    .0040    .0042
#2             5.951    .0077    .1015    .0886   .00098    .0067    .0040    .0042

Elem          Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            14.82    .0129    .0222    .1363    .1352    5.991    .0036    .0056

#1             14.81    .0126    .0223    .1377    .1351    5.952    .0052    .0044
#2             14.83    .0133    .0220    .1348    .1354    6.030    .0020    .0069

Elem          Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            13.47   .60854    .0046    .0220    85.07    79.89    .0276    2.235

#1             13.49   .60906    .0044    .0219    85.07    80.13    .0314    2.248
#2             13.46   .60801    .0048    .0222    85.08    79.64    .0238    2.222

Elem          Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            .0009    38.01   .06196   -.0038    .0040    .1871    .0067    1.517

#1             .0040    38.19   .06199   -.0052    .0053    .1870    .0074    1.519
#2            -.0023    37.84   .06194   -.0025    .0028    .1871    .0061    1.515

Elem          Zn2138   Bi2230   S_1820
Units            ppm      ppm      ppm
Avg            1.484   -.0011    62.91

#1             1.484   -.0050    62.86
#2             1.484    .0028    62.95
```

```
Sample Name: K1609659-008      Acquired: 9/27/2016 10:05:50      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:          Sample Type:
Comment: EM 092716A

Int. Std.         Y_2243    Y_3600  Y_3600-2
Units              Cts/S     Cts/S     Cts/S
Avg               1865.2    37998.    3828.6

#1                1864.1    38036.    3839.4
#2                1866.3    37959.    3817.8
```

```
Sample Name: K1609659-009     Acquired: 9/27/2016 10:08:13     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:          Sample Type:
Comment: EM 092716A

Elem      Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144    Cd2265
Units        ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg        8.314     .2315     5.775     .6237    .00096     .0068     .0010     .0011

#1         8.378     .2285     5.787     .6211    .00114     .0046     .0009     .0011
#2         8.249     .2344     5.763     .6262    .00078     .0091     .0011     .0011

Elem      Ca3158    Cr2677    Co2307    Cu2247    Cu3273    Fe2599    Pb2203    Li6707
Units        ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg        16.35     .0113     .0214     .2418     .2387     41.57     .0072     .0100

#1         16.31     .0120     .0208     .2427     .2396     41.45     .0085     .0084
#2         16.40     .0107     .0220     .2409     .2378     41.69     .0060     .0116

Elem      Mg2852    Mn2605    Mo2020    Ni2216    P_1782    K_7664    Se1960    Si2516
Units        ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg        12.98     10.72     .0151     .0121     80.91     87.28     .0392     2.897

#1         12.97     10.69     .0151     .0116     81.08     87.24     .0357     2.905
#2         12.99     10.75     .0151     .0125     80.74     87.31     .0427     2.890

Elem      Ag3280    Na5895    Sr4077    Tl1908    Sn1899    Ti3361    V_2924    Zn2062
Units        ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg        .0091     44.17    .17460    -.0003     .0045     .3219     .0198     1.442

#1         .0209     44.13    .17422    -.0044     .0050     .3226     .0198     1.441
#2        -.0027     44.20    .17498     .0039     .0040     .3213     .0199     1.444

Elem      Zn2138    Bi2230    S_1820
Units        ppm       ppm       ppm
Avg        1.421    -.0011     60.40

#1         1.421     .0000     60.36
#2         1.421    -.0022     60.44
```

Sample Name: K1609659-009 Acquired: 9/27/2016 10:08:13 Type: Unk
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment: EM 092716A

Int. Std.	Y_2243	Y_3600	Y_3600-2
Units	Cts/S	Cts/S	Cts/S
Avg	1847.6	37998.	3925.3
#1	1846.4	38107.	3932.4
#2	1848.7	37890.	3918.3

```
Sample Name: K1609659-010     Acquired: 9/27/2016 10:10:40     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:       Sample Type:
Comment: EM 092716A

Elem        Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          8.609    .0183    .2529    .1175   .00101    .0113    .0048    .0049

#1           8.610    .0202    .2470    .1174   .00097    .0106    .0049    .0049
#2           8.609    .0165    .2587    .1176   .00104    .0119    .0047    .0050

Elem        Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          14.32    .0140    .0319    .1677    .1688    9.126    .0041    .0121

#1           14.32    .0143    .0323    .1669    .1669    9.164    .0035    .0111
#2           14.32    .0136    .0314    .1684    .1706    9.087    .0046    .0132

Elem        Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          14.74   1.0027    .0045    .0274    83.82    84.52    .0238    2.982

#1           14.69   1.0022    .0048    .0275    83.73    84.18    .0218    2.949
#2           14.80   1.0033    .0042    .0274    83.91    84.86    .0258    3.014

Elem        Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg         -.0025    36.74   .06501   -.0066    .0046    .2527    .0087    1.552

#1          -.0097    36.67   .06519   -.0055    .0039    .2519    .0089    1.548
#2           .0047    36.80   .06483   -.0077    .0053    .2535    .0086    1.556

Elem        Zn2138   Bi2230   S_1820
Units          ppm      ppm      ppm
Avg          1.537   -.0006    60.60

#1           1.537   -.0008    60.41
#2           1.537   -.0003    60.80
```

```
Sample Name: K1609659-010      Acquired: 9/27/2016 10:10:40      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: EM 092716A

Int. Std.      Y_2243    Y_3600  Y_3600-2
Units           Cts/S     Cts/S     Cts/S
Avg            1865.5    38286.    3944.0

#1             1866.2    38288.    3928.1
#2             1864.7    38283.    3959.9
```

```
Sample Name: K1609659-011     Acquired: 9/27/2016 10:13:00     Type: Unk
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:       Sample Type:
Comment: EM 092716A

Elem         Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units           ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg           4.275    .0786    .3077    .0947   .00063    .0170    .0033    .0032

#1            4.275    .0784    .3113    .0948   .00070    .0167    .0034    .0034
#2            4.275    .0787    .3041    .0945   .00055    .0173    .0033    .0029

Elem         Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units           ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg           14.11    .0073    .0327    .1859    .1842    8.937    .0027    .0068

#1            14.16    .0080    .0324    .1863    .1836    8.884    .0043    .0083
#2            14.06    .0066    .0331    .1854    .1848    8.991    .0012    .0053

Elem         Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units           ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg           13.83   2.2855    .0055    .0136    82.87    75.00    .0484    2.195

#1            13.86   2.2900    .0055    .0132    82.89    75.13    .0468    2.206
#2            13.80   2.2810    .0054    .0139    82.85    74.86    .0500    2.185

Elem         Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units           ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg           .0086    33.23   .06274   -.0054    .0036    .1868    .0062    1.572

#1            .0081    33.32   .06276   -.0037    .0036    .1864    .0054    1.569
#2            .0091    33.15   .06271   -.0071    .0035    .1871    .0069    1.574

Elem         Zn2138   Bi2230   S_1820
Units           ppm      ppm      ppm
Avg           1.539   -.0027    60.68

#1            1.537   -.0059    60.76
#2            1.540    .0005    60.61
```

```
Sample Name: K1609659-011      Acquired: 9/27/2016 10:13:00      Type: Unk
Method: 2016B-ICP04(v18)       Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:          Sample Type:
Comment: EM 092716A

Int. Std.      Y_2243    Y_3600  Y_3600-2
Units           Cts/S     Cts/S     Cts/S
Avg            1847.6    37960.    3907.9

#1             1846.1    37808.    3926.9
#2             1849.1    38113.    3888.9
```

```
Sample Name: K1609659-012      Acquired: 9/27/2016 10:15:20      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:          Sample Type:
Comment: EM 092716A

Elem          Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            5.619    .0198    .5827    .1709   .00035    .0056    .0023    .0022

#1             5.600    .0219    .5829    .1704   .00038    .0056    .0023    .0022
#2             5.638    .0177    .5825    .1714   .00033    .0056    .0023    .0022

Elem          Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            11.20    .0153    .0116    .1243    .1242    19.57    .0024    .0064

#1             11.14    .0152    .0114    .1251    .1249    19.51    .0003    .0057
#2             11.25    .0154    .0118    .1234    .1236    19.64    .0044    .0070

Elem          Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            10.57   3.5978    .0068    .0115    82.43    81.73    .0368    2.765

#1             10.56   3.6059    .0067    .0121    82.51    81.53    .0372    2.741
#2             10.57   3.5897    .0069    .0108    82.36    81.93    .0364    2.788

Elem          Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units            ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg            .0079    42.25   .05706   -.0019    .0042    .2813    .0121    1.316

#1             .0171    42.21   .05683   -.0052    .0055    .2811    .0116    1.316
#2            -.0014    42.28   .05729    .0014    .0029    .2815    .0126    1.316

Elem          Zn2138   Bi2230   S_1820
Units            ppm      ppm      ppm
Avg            1.303   -.0029    56.99

#1             1.300   -.0028    56.93
#2             1.306   -.0031    57.05
```

```
Sample Name: K1609659-012      Acquired: 9/27/2016 10:15:20      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:          Sample Type:
Comment: EM 092716A

Int. Std.         Y_2243    Y_3600  Y_3600-2
Units              Cts/S     Cts/S     Cts/S
Avg               1856.9    38210.    3899.9

#1                1853.0    38135.    3903.9
#2                1860.9    38285.    3895.9
```

```
Sample Name: CCVB      Acquired: 9/27/2016 10:17:40      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1          Test Type:          Sample Type:
Comment:

Elem            Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496     Cd2144
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              7.659      9.643      .0081      1.007      10.15    -.00018      .0005     -.0001
Stddev            .011       .009      .0037       .002        .01     .00011      .0008      .0003
%RSD             .1387      .0928      45.29      .1841      .0814     61.215      147.3      447.2

#1               7.667      9.650      .0055      1.008      10.15    -.00026      .0000     -.0002
#2               7.652      9.637      .0107      1.006      10.16    -.00010      .0011      .0001

Check ?           None   Chk Pass       None   Chk Pass   Chk Pass       None       None       None
Value
Range

Elem            Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247     Cu3273     Fe2599
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0002      10.01      9.786     -.0010     -.0001      .0018     -.0005      10.07
Stddev           .0003        .06       .023      .0003      .0008      .0013      .0006        .13
%RSD             146.0      .5910      .2372      30.22      1035.      68.79      126.3      1.291

#1              -.0005      10.05      9.803     -.0008     -.0007      .0009     -.0001      10.17
#2               .0000      9.965      9.770     -.0012      .0005      .0027     -.0009      9.983

Check ?           None   Chk Pass       None       None       None       None       None   Chk Pass
Value
Range

Elem            Pb2203     Li6707     Mg2790     Mg2795     Mg2852     Mn2576     Mn2605     Mo2020
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0004      .9993      10.65      9.703      10.07     .99668      .9884     -.0002
Stddev           .0017      .0043        .08       .052        .05     .00078      .0059      .0001
%RSD             426.3      .4296      .7216      .5405      .4723     .07827      .5976      33.45

#1              -.0016      .9962      10.71      9.740      10.04     .99613      .9926     -.0003
#2               .0008      1.002      10.60      9.666      10.11     .99724      .9842     -.0002

Check ?           None   Chk Pass   Chk Pass       None   Chk Pass       None   Chk Pass       None
Value
Range
```

```
Sample Name: CCVB      Acquired: 9/27/2016 10:17:40      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem          Ni2216     P_1782     K_7664    Se1960     Si2516     Ag3280     Na5895     Sr4077
Units            ppm        ppm        ppm       ppm        ppm        ppm        ppm        ppm
Avg           -.0001      10.03      9.933     .0059      10.05     -.0133      9.969     1.0113
Stddev         .0002        .02       .062     .0031        .08      .0037       .043      .0085
%RSD           122.0      .2271      .6198     52.16      .7820      28.01      .4354     .84466

#1             .0000      10.01      9.977     .0037      9.992     -.0160      9.938     1.0173
#2            -.0003      10.05      9.890     .0080      10.10     -.0107     10.000     1.0052

Check ?         None   Chk Pass   Chk Pass      None   Chk Pass       None   Chk Pass   Chk Pass
Value
Range

Elem          Tl1908     Sn1899     Ti3361    V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units            ppm        ppm        ppm       ppm        ppm        ppm        ppm        ppm
Avg           -.0025      .0002      .0005     .0006     -.0003      .0002      1.007      .9952
Stddev         .0030      .0019      .0002     .0003      .0004      .0000       .003      .0005
%RSD           120.1      846.1      41.17     47.12      132.9      4.611      .2668      .0507

#1            -.0004      .0016      .0003     .0008      .0000      .0002      1.009      .9949
#2            -.0045     -.0011      .0006     .0004     -.0006      .0002      1.005      .9956

Check ?         None       None       None      None       None       None   Chk Pass   Chk Pass
Value
Range

Int. Std.     Y_2243     Y_3600   Y_3600-2
Units          Cts/S      Cts/S      Cts/S
Avg           1855.1     37693.     3716.6
Stddev           7.2       242.       46.9
%RSD          .38605     .64253     1.2628

#1            1850.1     37521.     3683.4
#2            1860.2     37864.     3749.8
```

```
Sample Name: CCVA      Acquired: 9/27/2016 10:20:10      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1        Test Type:        Sample Type:
Comment:

Elem         Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2567     .2537     .2458     .2567     .2573    .24977     .2542     .2510
Stddev        .0044     .0011     .0033     .0013     .0003    .00039     .0015     .0002
%RSD          1.700     .4229     1.348     .5199     .1106    .15579     .5987     .0626

#1            .2598     .2544     .2435     .2577     .2571    .24949     .2552     .2509
#2            .2536     .2529     .2482     .2558     .2575    .25004     .2531     .2512

Check ?    Chk Pass      None  Chk Pass      None      None  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem         Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2517     .5163     .5040     .2511     .2509     .2507     .2514     .2588
Stddev        .0000     .0111     .0003     .0013     .0018     .0023     .0003     .0064
%RSD          .0124     2.142     .0682     .5355     .7077     .9115     .1050     2.460

#1            .2517     .5241     .5037     .2520     .2496     .2491     .2516     .2633
#2            .2517     .5084     .5042     .2501     .2521     .2524     .2512     .2543

Check ?    Chk Pass      None  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass      None
Value
Range

Elem         Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .2519     .0012     .2801     .2518     .2579    .25431     .2480     .2546
Stddev        .0027     .0015     .0281     .0009     .0008    .00027     .0005     .0006
%RSD          1.085     120.6     10.02     .3394     .3102    .10717     .1825     .2218

#1            .2538     .0002     .3000     .2524     .2585    .25451     .2484     .2550
#2            .2499     .0023     .2603     .2512     .2574    .25412     .2477     .2542

Check ?    Chk Pass      None      None  Chk Pass      None  Chk Pass      None  Chk Pass
Value
Range
```

```
Sample Name: CCVA     Acquired: 9/27/2016 10:20:10     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:     Sample Type:
Comment:

Elem         Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units           ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           .2514      .0033      2.484      .2530      .1400    F .6481      .2756     .00003
Stddev        .0009      .0016       .050      .0061      .0154      .0002      .0066     .00000
%RSD          .3466      48.35      2.028      2.400      11.03      .0276      2.389     2.5984

#1            .2507      .0044      2.520      .2573      .1509      .6479      .2709     .00003
#2            .2520      .0022      2.449      .2487      .1291      .6482      .2802     .00003

Check ?    Chk Pass       None       None   Chk Pass       None   Chk Fail       None       None
Value                                                                .2500
Range                                                               10.44%

Elem         Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units           ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           .2510      .2520      .2536      .2509      .2520      .2518      .0013     -.0120
Stddev        .0002      .0006      .0007      .0013      .0001      .0009      .0036      .0016
%RSD          .0968      .2283      .2906      .5195      .0410      .3535      267.8      12.93

#1            .2508      .2516      .2541      .2518      .2519      .2511      .0039     -.0131
#2            .2512      .2524      .2530      .2500      .2521      .2524     -.0012     -.0109

Check ?    Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass       None       None
Value
Range

Int. Std.    Y_2243     Y_3600   Y_3600-2
Units         Cts/S      Cts/S      Cts/S
Avg          1907.4     39020.     3812.6
Stddev          1.5        93.        2.5
%RSD         .07694     .23728     .06444

#1           1906.4     38955.     3810.8
#2           1908.4     39086.     3814.3
```

```
Sample Name: CCB      Acquired: 9/27/2016 10:22:27      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem            Al1670      Al3944      Sb2068      As1890      Ba4554      Be2348      B_2496
Units              ppm         ppm         ppm         ppm         ppm         ppm         ppm
Avg             -.0005       .0061       .0072       .0044       .0005      .00011      -.0002
Stddev           .0004       .0090       .0021       .0033       .0003      .00001       .0004
%RSD             90.42       147.9       29.38       74.61       50.92      4.9669       192.6

#1              -.0008      -.0003       .0088       .0021       .0003      .00012       .0001
#2              -.0002       .0124       .0057       .0067       .0007      .00011      -.0005

Check ?       Chk Pass    Chk Pass    Chk Pass    Chk Pass    Chk Pass    Chk Pass    Chk Pass
High Limit
Low Limit

Elem            Cd2144      Cd2265      Ca3158      Ca3933      Cr2677      Co2307      Cu2247
Units              ppm         ppm         ppm         ppm         ppm         ppm         ppm
Avg              .0000      -.0001      -.0046       .0009       .0000       .0001      -.0001
Stddev            .000       .0001       .0104       .0003       .0006       .0000       .0011
%RSD             699.1       72.50       223.7       31.45       1172.       8.323       811.5

#1              -.0001      -.0001       .0027       .0007      -.0003       .0001       .0007
#2               .0001       .0000      -.0120       .0012       .0004       .0001      -.0009

Check ?       Chk Pass    Chk Pass    Chk Pass    Chk Pass    Chk Pass    Chk Pass    Chk Pass
High Limit
Low Limit

Elem            Cu3273      Fe2599      Pb2203      Li6707      Mg2790      Mg2795      Mg2852
Units              ppm         ppm         ppm         ppm         ppm         ppm         ppm
Avg             -.0004      -.0033      -.0010       .0012      -.0008       .0007       .0011
Stddev           .0003       .0059       .0002       .0016       .0734       .0006       .0005
%RSD             78.56       181.8       17.93       130.0       9250.       89.99       42.68

#1              -.0007      -.0075      -.0009       .0001       .0511       .0002       .0007
#2              -.0002       .0009      -.0011       .0024      -.0527       .0011       .0014

Check ?       Chk Pass    Chk Pass    Chk Pass    Chk Pass        None    Chk Pass    Chk Pass
High Limit
Low Limit
```

```
Sample Name: CCB      Acquired: 9/27/2016 10:22:27      Type: QC
Method: 2016B-ICP04(v18)       Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1          Test Type:          Sample Type:
Comment:

Elem            Mn2576     Mn2605     Mo2020     Ni2216     P_1782     K_7664     Se1960
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg          F .00155      -.0008     -.0002      .0009      .0004      .0821      .0027
Stddev          .00199      .0004      .0009      .0006      .0030      .0253      .0061
%RSD            128.80      47.40      399.0      61.21      838.0      30.86      224.0

#1              .00014     -.0011      .0004      .0014      .0025      .0642      .0071
#2              .00295     -.0005     -.0009      .0005     -.0018      .1000     -.0016

Check ?       Chk Fail       None   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit      .00100
Low Limit      -.00100

Elem            Si2516     Ag3280     Na5895     Sr4077     Tl1908     Sn1899     Ti3361
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0145   F -.0092      .0197     .00004     -.0026      .0018      .0002
Stddev           .0291      .0035      .0118     .00012      .0014      .0010      .0002
%RSD             200.5      37.80      59.83     308.25      54.47      52.95      85.47

#1               .0061     -.0067      .0280    -.00005     -.0016      .0025      .0001
#2              -.0351     -.0117      .0114     .00013     -.0036      .0011      .0004

Check ?       Chk Pass   Chk Fail   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit                  .0040
Low Limit                  -.0040

Elem            V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units              ppm        ppm        ppm        ppm        ppm
Avg             -.0001     -.0002      .0000     -.0020     -.0035
Stddev           .0001      .0002      .0000      .0001      .0034
%RSD             49.86      111.6      71.06      7.271      98.21

#1              -.0001     -.0003      .0001     -.0021     -.0011
#2              -.0001      .0000      .0000     -.0019     -.0059

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: CCB      Acquired: 9/27/2016 10:22:27      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1        Test Type:          Sample Type:
Comment:

Int. Std.          Y_2243     Y_3600   Y_3600-2
Units               Cts/S      Cts/S      Cts/S
Avg                1897.2     38808.     3769.0
Stddev                 .0       186.       14.7
%RSD               .00141     .47977     .39008

#1                 1897.2     38677.     3758.6
#2                 1897.2     38940.     3779.4
```

```
Sample Name: K1609659-013      Acquired: 9/27/2016 10:24:51      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:        Sample Type:
Comment: EM 092716A

Elem        Al3944   Sb2068   As1890   Ba4554   Be2348   B_2496   Cd2144   Cd2265
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          8.416    .0091    .1006    .5407   .00092    .0149    .0080    .0081

#1           8.430    .0103    .0994    .5400   .00083    .0164    .0081    .0083
#2           8.402    .0079    .1017    .5414   .00100    .0134    .0079    .0078

Elem        Ca3158   Cr2677   Co2307   Cu2247   Cu3273   Fe2599   Pb2203   Li6707
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          16.39    .0142    .0257    .1374    .1393    10.16    .0033    .0129

#1           16.46    .0145    .0256    .1362    .1386    10.19   -.0005    .0124
#2           16.32    .0139    .0258    .1385    .1401    10.13    .0072    .0134

Elem        Mg2852   Mn2576   Mo2020   Ni2216   P_1782   K_7664   Se1960   Si2516
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          14.91   1.3804    .0060    .0090    87.58    89.40    .0156    3.046

#1           14.87   1.3795    .0057    .0093    87.44    88.98    .0232    3.023
#2           14.95   1.3814    .0062    .0087    87.73    89.82    .0080    3.069

Elem        Ag3280   Na5895   Sr4077   Tl1908   Sn1899   Ti3361   V_2924   Zn2062
Units          ppm      ppm      ppm      ppm      ppm      ppm      ppm      ppm
Avg          .0008    49.53   .10824   -.0037    .0047    .6234    .0152    3.856

#1           .0069    49.35   .10800   -.0024    .0053    .6259    .0162    3.848
#2          -.0053    49.71   .10848   -.0049    .0040    .6208    .0142    3.865

Elem        Zn2138   Bi2230   S_1820
Units          ppm      ppm      ppm
Avg          3.812    .0014    65.56

#1           3.806    .0020    65.52
#2           3.819    .0007    65.59
```

```
Sample Name: K1609659-013      Acquired: 9/27/2016 10:24:51      Type: Unk
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1        Test Type:        Sample Type:
Comment: EM 092716A

Int. Std.       Y_2243    Y_3600  Y_3600-2
Units            Cts/S     Cts/S     Cts/S
Avg             1874.0    38352.    3986.6

#1              1875.0    38278.    3967.5
#2              1872.9    38425.    4005.7
```

```
Sample Name: CCVB      Acquired: 9/27/2016 10:28:04      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem         Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496     Cd2144
Units           ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           7.675      9.590      .0044      .9998      9.994    -.00006     -.0004      .0000
Stddev         .035       .023      .0046      .0025       .153     .00012      .0010      .0001
%RSD          .4606      .2425      105.3      .2501      1.530     199.46      241.7      382.1

#1            7.650      9.607      .0011      .9980      9.885    -.00014     -.0011      .0000
#2            7.700      9.574      .0076      1.002      10.10     .00002      .0003      .0001

Check ?        None   Chk Pass       None   Chk Pass   Chk Pass       None       None       None
Value
Range

Elem         Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247     Cu3273     Fe2599
Units           ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           .0002      9.946      9.645      .0005     -.0005      .0011     -.0008      10.03
Stddev        .0000       .028       .025      .0003      .0002      .0011      .0004        .02
%RSD          10.04      .2761      .2563      51.28      31.79      105.1      46.00      .1780

#1            .0002      9.966      9.628      .0003     -.0006      .0019     -.0011      10.01
#2            .0002      9.927      9.663      .0007     -.0004      .0003     -.0006      10.04

Check ?        None   Chk Pass       None       None       None       None       None   Chk Pass
Value
Range

Elem         Pb2203     Li6707     Mg2790     Mg2795     Mg2852     Mn2576     Mn2605     Mo2020
Units           ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg           .0011      1.005      10.45      9.568      10.14     .98954      .9948     -.0004
Stddev        .0030       .001        .04       .005        .01     .00278      .0045      .0001
%RSD          271.8      .0995      .3819      .0521      .0866     .28121      .4491      20.72

#1            .0032      1.006      10.48      9.564      10.13     .99150      .9979     -.0003
#2           -.0010      1.004      10.42      9.571      10.15     .98757      .9916     -.0004

Check ?        None   Chk Pass   Chk Pass       None   Chk Pass       None   Chk Pass       None
Value
Range
```

```
Sample Name: CCVB      Acquired: 9/27/2016 10:28:04      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment:

Elem         Ni2216     P_1782     K_7664     Se1960     Si2516     Ag3280     Na5895     Sr4077
Units           ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg          -.0004      10.04      10.04      .0074      10.04     -.0182      10.02     1.0025
Stddev        .0003        .02        .05      .0037        .06      .0025        .00      .0023
%RSD          65.76      .2263      .4761      50.36      .5671      13.82      .0034     .22987

#1           -.0002      10.05      10.08      .0048      10.00     -.0200      10.02     1.0041
#2           -.0006      10.02      10.01      .0101      10.08     -.0164      10.02     1.0008

Check ?        None   Chk Pass   Chk Pass       None   Chk Pass       None   Chk Pass   Chk Pass
Value
Range

Elem         Tl1908     Sn1899     Ti3361     V_2924     Zn2062     Zn2138     Bi2230     S_1820
Units           ppm        ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg          -.0001      .0011      .0004      .0004     -.0001      .0007      1.006      .9807
Stddev        .0001      .0010      .0000      .0003      .0003      .0002       .006      .0025
%RSD          125.6      95.86      9.727      77.43      192.4      25.46      .5666      .2574

#1           -.0002      .0003      .0005      .0007      .0000      .0008      1.002      .9789
#2            .0000      .0018      .0004      .0002     -.0003      .0006      1.010      .9825

Check ?        None       None       None       None       None       None   Chk Pass   Chk Pass
Value
Range

Int. Std.    Y_2243     Y_3600   Y_3600-2
Units         Cts/S      Cts/S      Cts/S
Avg          1848.1     37737.     3778.3
Stddev          4.2       200.        7.6
%RSD         .22972     .52886     .20177

#1           1845.1     37596.     3772.9
#2           1851.1     37878.     3783.6
```

```
Sample Name: CCVA     Acquired: 9/27/2016 10:30:33     Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1       Test Type:         Sample Type:
Comment:

Elem          Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .2559     .2524     .2479     .2580     .2579    .24907     .2494     .2525
Stddev         .0012     .0001     .0057     .0003     .0006    .00013     .0006     .0007
%RSD           .4561     .0481     2.292     .1192     .2326    .05368     .2484     .2931

#1             .2551     .2524     .2439     .2582     .2575    .24898     .2499     .2530
#2             .2567     .2525     .2519     .2578     .2584    .24916     .2490     .2520

Check ?     Chk Pass      None  Chk Pass      None      None  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem          Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .2511     .4989     .4999     .2506     .2516     .2531     .2513     .2633
Stddev         .0013     .0062     .0005     .0003     .0016     .0007     .0003     .0019
%RSD           .5357     1.250     .0970     .1388     .6409     .2632     .1081     .7203

#1             .2521     .4945     .5002     .2509     .2527     .2535     .2515     .2647
#2             .2502     .5033     .4995     .2504     .2504     .2526     .2511     .2620

Check ?     Chk Pass      None  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass      None
Value
Range

Elem          Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .2553     .0005     .2631     .2509     .2531    .25053     .2401     .2518
Stddev         .0008     .0013     .0610     .0008     .0013    .00077     .0031     .0015
%RSD           .3294     259.4     23.17     .3089     .5318    .30910     1.308     .5888

#1             .2547     .0014     .3063     .2515     .2522    .24998     .2424     .2528
#2             .2559    -.0004     .2200     .2504     .2541    .25108     .2379     .2507

Check ?     Chk Pass      None      None  Chk Pass      None  Chk Pass      None  Chk Pass
Value
Range
```

```
Sample Name: CCVA      Acquired: 9/27/2016 10:30:33      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:        Sample Type:
Comment:

Elem           Ni2216    P_1782    K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077
Units             ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg             .2516     .0035     2.467     .2479     .1374  F .6675     .2795    .00004
Stddev          .0011     .0008      .008     .0055     .0101     .0129     .0048    .00011
%RSD            .4338     21.68     .3275     2.226     7.331     1.931     1.714    268.19

#1              .2524     .0030     2.473     .2440     .1445     .6767     .2761   -.00004
#2              .2508     .0040     2.461     .2518     .1303     .6584     .2829    .00012

Check ?      Chk Pass      None      None  Chk Pass      None  Chk Fail      None      None
Value                                                            .2500
Range                                                           10.44%

Elem           Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units             ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg             .2490     .2533     .2523     .2500     .2519     .2480     .0029    -.0139
Stddev          .0023     .0021     .0004     .0018     .0003     .0013     .0044     .0115
%RSD            .9376     .8428     .1621     .7176     .1206     .5054     153.7     83.05

#1              .2506     .2549     .2520     .2487     .2516     .2471     .0060    -.0057
#2              .2473     .2518     .2526     .2512     .2521     .2488    -.0002    -.0221

Check ?      Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass      None      None
Value
Range

Int. Std.      Y_2243    Y_3600  Y_3600-2
Units           Cts/S     Cts/S     Cts/S
Avg            1893.0    38851.    3769.8
Stddev            9.2       25.       3.0
%RSD           .48682    .06322    .07914

#1             1886.4    38833.    3767.6
#2             1899.5    38868.    3771.9
```

Sample Name: CCB Acquired: 9/27/2016 10:32:51 Type: QC
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment:

Elem	Al1670	Al3944	Sb2068	As1890	Ba4554	Be2348	B_2496
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.0008	-.0003	.0042	.0035	-.0001	-.00005	.0007
Stddev	.0004	.0051	.0016	.0017	.0001	.00013	.0011
%RSD	50.87	1672.	37.20	48.47	89.61	247.85	157.9
#1	-.0005	-.0039	.0031	.0023	.0000	-.00014	.0015
#2	-.0011	.0033	.0053	.0047	-.0002	.00004	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	Cd2144	Cd2265	Ca3158	Ca3933	Cr2677	Co2307	Cu2247
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.0001	.0000	-.0109	.0005	.0004	-.0004	-.0003
Stddev	.0001	.000	.0049	.0000	.0005	.0001	.0002
%RSD	175.3	512.7	45.53	4.759	125.4	20.92	69.78
#1	.0000	.0001	-.0144	.0005	.0000	-.0004	-.0005
#2	-.0002	-.0002	-.0074	.0005	.0008	-.0003	-.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	Cu3273	Fe2599	Pb2203	Li6707	Mg2790	Mg2795	Mg2852
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	-.0047	-.0032	.0001	.0021	.0001	.0001
Stddev	.0003	.0024	.0042	.0017	.0301	.0001	.0003
%RSD	282.5	51.09	132.3	1338.	1411.	96.35	212.0
#1	-.0001	-.0064	-.0062	.0013	.0234	.0002	-.0001
#2	.0003	-.0030	-.0002	-.0011	-.0191	.0000	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	None	Chk Pass	Chk Pass
High Limit							
Low Limit							

Sample Name: CCB Acquired: 9/27/2016 10:32:51 Type: QC
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment:

Elem	Mn2576	Mn2605	Mo2020	Ni2216	P_1782	K_7664	Se1960
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.00002	-.0005	.0001	.0000	.0039	-.0127	-.0048
Stddev	.00002	.0006	.0002	.0006	.0019	.0101	.0074
%RSD	80.788	105.1	183.9	1160.	48.97	79.26	154.0
#1	.00003	-.0009	.0002	.0005	.0026	-.0198	.0004
#2	.00001	-.0001	.0000	-.0004	.0053	-.0056	-.0100
Check ?	Chk Pass	None	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	Si2516	Ag3280	Na5895	Sr4077	Tl1908	Sn1899	Ti3361
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.0047	F -.0139	.0121	.00002	.0008	.0001	-.0002
Stddev	.0093	.0030	.0030	.00006	.0010	.0001	.0001
%RSD	197.9	21.90	25.08	278.86	123.3	103.7	65.60
#1	.0019	-.0118	.0099	.00007	.0001	.0000	-.0002
#2	-.0112	-.0161	.0142	-.00002	.0015	.0002	-.0001
Check ?	Chk Pass	Chk Fail	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit		.0040					
Low Limit		-.0040					

Elem	V_2924	Zn2062	Zn2138	Bi2230	S_1820
Units	ppm	ppm	ppm	ppm	ppm
Avg	-.0004	-.0004	-.0001	-.0006	-.0178
Stddev	.0002	.0004	.0003	.0009	.0078
%RSD	47.47	114.7	249.8	148.1	44.20
#1	-.0003	-.0001	.0001	.0000	-.0122
#2	-.0005	-.0007	-.0003	-.0013	-.0233
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit					
Low Limit					

```
Sample Name: CCB     Acquired: 9/27/2016 10:32:51     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin      Dilution: 1       Test Type:       Sample Type:
Comment:

Int. Std.        Y_2243     Y_3600   Y_3600-2
Units             Cts/S      Cts/S      Cts/S
Avg              1880.6     38536.     3718.4
Stddev             14.5        76.       10.4
%RSD             .76892     .19756     .27938

#1               1870.4     38482.     3725.8
#2               1890.8     38589.     3711.1
```

```
Sample Name: CCB      Acquired: 9/27/2016 10:35:16      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Dilution: 1      Test Type:      Sample Type:
Comment: RERUN

Elem            Al1670     Al3944     Sb2068     As1890     Ba4554     Be2348     B_2496
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg             -.0009     -.0017      .0009      .0005     -.0001    -.00003      .0000
Stddev           .0025      .0011      .0095      .0012      .0005     .00011       .001
%RSD             261.5      66.07      1051.      231.2      325.5     395.41     76170.

#1               .0008     -.0009      .0076     -.0003     -.0005     .00005      .0008
#2              -.0027     -.0025     -.0058      .0014      .0002    -.00011     -.0008

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem            Cd2144     Cd2265     Ca3158     Ca3933     Cr2677     Co2307     Cu2247
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              .0000     -.0001   F -.0250      .0003      .0004     -.0002     -.0005
Stddev           .0000      .0001      .0052      .0001      .0007      .0000      .0001
%RSD             2.643      83.72      20.92      26.27      175.5      19.64      20.24

#1               .0000     -.0001     -.0287      .0003     -.0001     -.0003     -.0005
#2               .0000      .0000     -.0213      .0004      .0009     -.0002     -.0006

Check ?       Chk Pass   Chk Pass   Chk Fail   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit                           .0200
Low Limit                           -.0200

Elem            Cu3273     Fe2599     Pb2203     Li6707     Mg2790     Mg2795     Mg2852
Units              ppm        ppm        ppm        ppm        ppm        ppm        ppm
Avg              .0002     -.0022     -.0007      .0007      .0417     -.0001     -.0007
Stddev           .0001      .0003      .0017      .0010      .0232      .0000      .0003
%RSD             54.97      13.81      249.5      133.1      55.62      40.01      45.75

#1               .0001     -.0024      .0005      .0014      .0581     -.0001     -.0009
#2               .0002     -.0020     -.0019      .0000      .0253     -.0001     -.0005

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass       None   Chk Pass   Chk Pass
High Limit
Low Limit
```

NR

am 9/27/16

Sample Name: CCB Acquired: 9/27/2016 10:35:16 Type: QC
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment: RERUN

Elem	Mn2576	Mn2605	Mo2020	Ni2216	P_1782	K_7664	Se1960
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.00004	.0012	-.0004	-.0003	.0007	-.0021	.0068
Stddev	.00001	.0001	.0004	.0002	.0010	.0069	.0059
%RSD	17.013	12.88	105.4	63.09	152.5	337.9	86.44
#1	-.00005	.0013	-.0001	-.0002	-.0001	-.0070	.0110
#2	-.00004	.0011	-.0007	-.0005	.0014	.0029	.0027
Check ?	Chk Pass	None	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	Si2516	Ag3280	Na5895	Sr4077	Tl1908	Sn1899	Ti3361
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	-.0114	.0011	.0154	-.00009	-.0001	.0011	.0000
Stddev	.0166	.0007	.0098	.00005	.0001	.0006	.000
%RSD	145.4	61.49	64.04	62.779	63.63	60.85	156.3
#1	-.0231	.0006	.0084	-.00005	.0000	.0006	.0000
#2	.0003	.0015	.0223	-.00012	-.0001	.0015	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	V_2924	Zn2062	Zn2138	Bi2230	S_1820
Units	ppm	ppm	ppm	ppm	ppm
Avg	-.0011	-.0002	-.0001	-.0010	-.0123
Stddev	.0002	.0005	.0002	.0032	.0081
%RSD	15.51	191.8	217.7	322.8	65.48
#1	-.0012	-.0006	.0000	.0013	-.0180
#2	-.0010	.0001	-.0002	-.0033	-.0066
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit					
Low Limit					

NR
am 9/27/16

Sample Name: CCB Acquired: 9/27/2016 10:35:16 Type: QC
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment: RERUN

Int. Std.	Y_2243	Y_3600	Y_3600-2
Units	Cts/S	Cts/S	Cts/S
Avg	1879.3	38506.	3726.3
Stddev	2.1	136.	1.9
%RSD	.11062	.35286	.05187
#1	1877.8	38410.	3725.0
#2	1880.7	38602.	3727.7

NR
am 9/27/16

Sample Name: LLCCV Acquired: 9/27/2016 10:37:40 Type: QC
Method: 2016B-ICP04(v18) Mode: CONC Corr. Factor: 1.000000
User: admin Dilution: 1 Test Type: Sample Type:
Comment:

```
                 ②
Elem          Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          F .0062     .0080     .0205     .0090     .0046    .00077     .0192     .0009
Stddev         .0008     .0001     .0062     .0027     .0000    .00012     .0000     .0003
%RSD           12.67     1.862     30.15     30.58     1.022    15.612     .2238     37.81

#1             .0057     .0079     .0161     .0109     .0045    .00086     .0192     .0011
#2             .0068     .0081     .0249     .0070     .0046    .00069     .0192     .0006

Check ?     Chk Fail  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value          .0100
Range        -30.00%
                                                     ①
Elem          Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0011   F .0116     .0201     .0035   F .0014     .0041     .0034     .0147
Stddev         .0002     .0089     .0001     .0015     .0003     .0001     .0001     .0040
%RSD           14.31     76.88     .5248     42.41     23.18     3.157     2.482     27.51

#1             .0010     .0053     .0201     .0046     .0016     .0042     .0034     .0119
#2             .0012     .0179     .0202     .0025     .0011     .0040     .0033     .0176

Check ?     Chk Pass  Chk Fail  Chk Pass  Chk Pass  Chk Fail  Chk Pass  Chk Pass  Chk Pass
Value                    .0200                         .0020
Range                  -30.00%                       -30.00%

Elem          Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0102     .0198    -.0139     .0048   F .0033    .00091     .0024     .0032
Stddev         .0001     .0015     .0001     .0000     .0009    .00011     .0012     .0004
%RSD           1.345     7.346     1.003     .8700     27.42    11.856     50.24     12.29

#1             .0101     .0188    -.0140     .0048     .0027    .00099     .0015     .0035
#2             .0103     .0208    -.0138     .0048     .0039    .00084     .0033     .0029

Check ?     Chk Pass  Chk Pass      None  Chk Pass  Chk Fail  Chk Pass      None  Chk Pass
Value                                                  .0050
Range                                                -30.00%
```

① rerun
② 2x
amn 9/27/16

```
Sample Name: LLCCV     Acquired: 9/27/2016 10:37:40     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Dilution: 1     Test Type:     Sample Type:
Comment:

Elem         Ni2216    P_1782    K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0043     .0413     .2220     .0181     .1875   F .0337     .1963    .00089
Stddev        .0000     .0019     .0240     .0025     .0046     .0046     .0080    .00015
%RSD          .9906     4.653     10.80     13.62     2.465     13.60     4.100    16.529

#1            .0043     .0400     .2389     .0164     .1907     .0304     .1906    .00099
#2            .0042     .0427     .2050     .0198     .1842     .0369     .2020    .00078

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Fail  Chk Pass  Chk Pass
Value                                                         .0040
Range                                                        30.00%

Elem         Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0092     .0205     .0019     .0033     .0037     .0037     .0192   F .0240
Stddev        .0031     .0019     .0001     .0002     .0000     .0002     .0042     .0008
%RSD          33.55     9.210     3.279     7.570     1.266     6.073     21.94     3.523

#1            .0114     .0218     .0019     .0031     .0036     .0036     .0162     .0234
#2            .0070     .0191     .0020     .0035     .0037     .0039     .0221     .0246

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Fail
Value                                                                             .0400
Range                                                                            30.00%

Int. Std.    Y_2243    Y_3600  Y_3600-2
Units         Cts/S     Cts/S     Cts/S
Avg          1889.4    38249.    3683.9
Stddev          6.7       88.      23.9
%RSD         .35369    .23037    .64781

#1           1884.6    38187.    3667.1
#2           1894.1    38311.    3700.8
```

②

@2x
am
9/27/16

```
Sample Name: LLCCV      Acquired: 9/27/2016 10:40:04      Type: QC
Method: 2016B-ICP04(v18)       Mode: CONC      Corr. Factor: 1.000000
User: admin        Dilution: 1         Test Type:          Sample Type:
Comment: RERUN

Elem          Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg          F .0064     .0094     .0229   F .0133     .0040    .00099     .0186     .0009
Stddev         .0001     .0020     .0047     .0002     .0003    .00018     .0004     .0001
%RSD           1.116     21.23     20.50     1.795     7.022    18.085     1.975     8.141

#1             .0063     .0080     .0263     .0135     .0042    .00086     .0183     .0009
#2             .0064     .0108     .0196     .0131     .0038    .00111     .0188     .0010

Check ?     Chk Fail  Chk Pass  Chk Pass  Chk Fail  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value          .0100                         .0100
Range        -30.00%                        30.00%

Elem          Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0009     .0206     .0200     .0045     .0016     .0041     .0035     .0144
Stddev         .0000     .0156     .0003     .0002     .0001     .0004     .0013     .0058
%RSD           5.231     75.75     1.257     3.835     9.137     9.587     38.79     40.08

#1             .0010     .0096     .0202     .0046     .0015     .0038     .0044     .0103
#2             .0009     .0316     .0198     .0044     .0017     .0044     .0025     .0185

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem          Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0101     .0214    -.0668     .0049     .0038    .00098     .0021     .0041
Stddev         .0020     .0004     .0007     .0001     .0036    .00007     .0006     .0010
%RSD           19.60     1.750     1.030     1.205     94.28    7.3856     29.60     24.60

#1             .0087     .0217    -.0673     .0049     .0063    .00103     .0025     .0048
#2             .0115     .0211    -.0663     .0048     .0013    .00093     .0017     .0033

Check ?     Chk Pass  Chk Pass      None  Chk Pass  Chk Pass  Chk Pass      None  Chk Pass
Value
Range
```

```
Sample Name: LLCCV      Acquired: 9/27/2016 10:40:04      Type: QC
Method: 2016B-ICP04(v18)      Mode: CONC      Corr. Factor: 1.000000
User: admin       Dilution: 1       Test Type:       Sample Type:
Comment: RERUN

Elem          Ni2216    P_1782    K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0037     .0382     .1902     .0212     .1917   F .0433     .2089    .00092
Stddev         .0002     .0007     .0377     .0017     .0268     .0039     .0029    .00000
%RSD           4.183     1.752     19.81     7.984     13.96     8.945     1.402    .19467

#1             .0035     .0387     .1636     .0224     .1728     .0461     .2068    .00093
#2             .0038     .0377     .2169     .0200     .2106     .0406     .2110    .00092

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Fail  Chk Pass  Chk Pass
Value                                                            .0040
Range                                                           30.00%

Elem          Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units            ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg            .0079     .0208     .0018     .0032     .0034     .0039     .0194   F .0259
Stddev         .0038     .0004     .0001     .0004     .0006     .0002     .0018     .0026
%RSD           47.55     1.788     6.458     13.88     17.13     4.997     9.261     9.856

#1             .0106     .0210     .0019     .0036     .0038     .0040     .0182     .0241
#2             .0052     .0205     .0017     .0029     .0030     .0038     .0207     .0277

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Fail
Value                                                                                .0400
Range                                                                              -30.00%

Int. Std.     Y_2243    Y_3600  Y_3600-2
Units          Cts/S     Cts/S     Cts/S
Avg           1901.2    38563.    3708.1
Stddev           7.0       16.      45.1
%RSD          .36868    .04080    1.2166

#1            1896.3    38575.    3676.2
#2            1906.2    38552.    3740.0
```

```
Sample Name: LLCCV,0.5     Acquired: 9/27/2016 10:42:28     Type: QC
Method: 2016B-ICP04(v18)    Mode: CONC     Corr. Factor: 1.000000
User: admin      Dilution: 1       Test Type:        Sample Type:
Comment:

Elem           Al1670    Al3944    Sb2068    As1890    Ba4554    Be2348    B_2496    Cd2144
Units             ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg             .0174     .0188     .0424     .0214     .0080    .00174     .0377     .0020
Stddev          .0020     .0014     .0015     .0008     .0002    .00008     .0015     .0000
%RSD            11.27     7.312     3.580     3.530     2.005    4.7895     3.847     2.383

#1              .0160     .0198     .0435     .0208     .0081    .00168     .0387     .0020
#2              .0188     .0178     .0414     .0219     .0079    .00180     .0367     .0019

Check ?      Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem           Cd2265    Ca3158    Ca3933    Cr2677    Co2307    Cu2247    Cu3273    Fe2599
Units             ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg             .0020     .0411     .0419     .0069     .0035     .0075     .0074     .0324
Stddev          .0001     .0037     .0003     .0003     .0007     .0006     .0025     .0066
%RSD            4.948     9.000     .7752     4.751     19.58     8.626     33.37     20.42

#1              .0019     .0385     .0421     .0071     .0040     .0071     .0057     .0371
#2              .0020     .0437     .0417     .0067     .0030     .0080     .0092     .0277

Check ?      Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem           Pb2203    Li6707    Mg2790    Mg2795    Mg2852    Mn2576    Mn2605    Mo2020
Units             ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg             .0194     .0405     .0279     .0100     .0080    .00196   F .0036     .0065
Stddev          .0013     .0000     .0323     .0001     .0013    .00008     .0014     .0004
%RSD            6.627     .0007     115.7     .9520     16.62    4.2702     38.29     6.399

#1              .0203     .0405     .0508     .0101     .0071    .00190     .0045     .0068
#2              .0185     .0405     .0051     .0099     .0089    .00202     .0026     .0063

Check ?      Chk Pass  Chk Pass      None  Chk Pass  Chk Pass  Chk Pass  Chk Fail  Chk Pass
Value                                                                       .0020
Range                                                                      30.00%
```

```
Sample Name: LLCCV,0.5     Acquired: 9/27/2016 10:42:28     Type: QC
Method: 2016B-ICP04(v18)     Mode: CONC     Corr. Factor: 1.000000
User: admin      Dilution: 1       Test Type:        Sample Type:
Comment:

Elem         Ni2216    P_1782    K_7664    Se1960    Si2516    Ag3280    Na5895    Sr4077
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0073     .0735     .3998     .0426     .3808   F .0830     .3987    .00210
Stddev        .0005     .0082     .0008     .0003     .0055     .0058     .0011    .00006
%RSD          6.410     11.17     .2081     .6169     1.451     7.027     .2748    3.0080

#1            .0076     .0677     .3992     .0424     .3769     .0789     .3979    .00205
#2            .0070     .0793     .4004     .0428     .3847     .0871     .3994    .00214

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Fail  Chk Pass  Chk Pass
Value                                                          .0080
Range                                                         30.00%

Elem         Tl1908    Sn1899    Ti3361    V_2924    Zn2062    Zn2138    Bi2230    S_1820
Units           ppm       ppm       ppm       ppm       ppm       ppm       ppm       ppm
Avg           .0177     .0408     .0035     .0074     .0074     .0076     .0419     .0726
Stddev        .0039     .0004     .0003     .0004     .0002     .0001     .0009     .0129
%RSD          21.81     1.014     7.842     4.920     2.379     1.029     2.131     17.79

#1            .0149     .0411     .0037     .0071     .0073     .0076     .0425     .0818
#2            .0204     .0405     .0033     .0077     .0076     .0075     .0413     .0635

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Int. Std.    Y_2243    Y_3600  Y_3600-2
Units         Cts/S     Cts/S     Cts/S
Avg          1914.8    38748.    3688.1
Stddev          4.5       33.      28.0
%RSD         .23625    .08543    .75965

#1           1911.6    38724.    3668.2
#2           1918.0    38771.    3707.9
```

✓

Service Request # K1609659
Calibration 090716AMS04
QC in calibration 090716AMS04
QC Service Request # K1609659
STARLIMS run # 513189

CAL STD	MS20-89-K	ICSA STD	MS20-90-C
ICV STD	MS20-90-A	ICSAB STD	MS20-90-D
LLICV STD	MS20-90-B		
Internal STD	MS20-58-A		

6020A ICP-MS Data Review Form

	Yes	No	NA
1. Appropriate standardization completed	X		
2. ICV within 10 % of true value	X		
3. CCV's within 10 % of true value	X		
4. CCB's and/or ICB's below MRL	X		
5. Method blank below MRL	X		
6. LCS in control	X		
7. Spike within 75-125%, Duplicate within 20%	X		
8. All analytes within instrument linear range	X		
9. Adequate rinse out time allowed	X		
10. Internal standards in control (70-125%)	X		
11. Interferences checked	X		
12. Se over MRL	X		
13. LLICV run (70-130%)	X		
14. Cd Correction Applied			X
15. ICSA and ICSAB in control	X		
16. Serial dilution run	X		
17. Post spike in control (80-120%)	X		
18. Was run stop prematurely, If so why?		X	

Comments: Report Mn by 6010.
MB = Cu - 0,3ppb, samples 10x.

Primary Review By: JDB Date: 9/8/16
Secondary Review By: Date: 9/9/16

Data Review Form

Service Request #:	**K1609659**
Instrument ID#:	**K-ICP-MS-04**
DataFile Name:	**R:\ICP\WIP\DATA\K-ICP-MS-04 (NexION)\090716a1.txt**
RUNNO:	**513189**

KQ1610520-01MB - Metals T

MB Evaluation

6020A/Metals T - Cu-KED3 - Result: 0.1541205 MRL: 0.1 — Samples 10x.

K1609659-003SDL - Metals T

Serial Dillution

6020A/Metals T - As-KED2 - Recovery: 11 Limit: 90 — Post-Spike passes.

K1609659-003MS - Metals T

MS Recovery

6020A/Metals T - Sb-KED1 - Recovery: 71 Limits: 75 - 125 - LCSW, SRMs, P.S, Spike passes.

Analytical Method 6020A

Primary Approver: JDB 9/8/16

Secondary Approver: 9 10/16

Dataset Report

User Name: ALKLS.ALKLSXP373
Computer Name: ALKLSXP373
Dataset File Path: C:\NexIONData\DataSet\090716A\
Report Date/Time: Thursday, September 08, 2016 14:41:14

The Dataset

Sample ID	Date and Time	Read Type	Description	Batch ID	Samp. File Name
PRIMER	13:27:29 Wed 07-Sep-16	Sample			C:\NexIONData\DataSet\090716A\PRIMER.0
RINSE	13:32:37 Wed 07-Sep-16	Sample			C:\NexIONData\DataSet\090716A\RINSE.002
Blank	13:37:34 Wed 07-Sep-16	Blank			C:\NexIONData\DataSet\090716A\Blank.003
Standard 1	13:42:26 Wed 07-Sep-16	Standard #1			C:\NexIONData\DataSet\090716A\Standard 1
ICV	13:47:16 Wed 07-Sep-16	QC Std #1			C:\NexIONData\DataSet\090716A\ICV.005
CCV	13:52:08 Wed 07-Sep-16	QC Std #2			C:\NexIONData\DataSet\090716A\CCV.006
ICB	13:56:59 Wed 07-Sep-16	QC Std #3			C:\NexIONData\DataSet\090716A\ICB.007
CCB	14:01:49 Wed 07-Sep-16	QC Std #4			C:\NexIONData\DataSet\090716A\CCB.008
LLICVT	14:06:40 Wed 07-Sep-16	QC Std #5			C:\NexIONData\DataSet\090716A\LLICVT.00
ICSA	14:11:31 Wed 07-Sep-16	QC Std #7			C:\NexIONData\DataSet\090716A\ICSA.010
ICSAB	14:16:21 Wed 07-Sep-16	QC Std #8			C:\NexIONData\DataSet\090716A\ICSAB.011
MO STD	14:21:11 Wed 07-Sep-16	Sample			C:\NexIONData\DataSet\090716A\MO STD.0
KQ1610171-01	14:26:03 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161017
KQ1610171-03	14:30:54 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161017
KQ1610171-04	14:35:44 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161017
K1608059-001	14:40:34 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-002	14:45:25 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-003	14:50:15 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-004	14:55:06 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
CCV	14:59:59 Wed 07-Sep-16	QC Std #2			C:\NexIONData\DataSet\090716A\CCV.020
CCB	15:04:49 Wed 07-Sep-16	QC Std #4			C:\NexIONData\DataSet\090716A\CCB.021
K1608059-005	15:09:42 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-005D	15:14:33 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-005L	15:19:23 Wed 07-Sep-16	Sample	25		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-005A	15:24:14 Wed 07-Sep-16	Sample	5 +50ppb +10ppb Ag		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-005S	15:29:03 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
KQ1610171-02	15:33:53 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161017
MO STD	15:38:45 Wed 07-Sep-16	Sample			C:\NexIONData\DataSet\090716A\MO STD.0
K1608059-006	15:43:37 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-007	15:48:27 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
K1608059-008	15:53:17 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608059-
CCV	15:58:09 Wed 07-Sep-16	QC Std #2			C:\NexIONData\DataSet\090716A\CCV.032
CCV	16:02:39 Wed 07-Sep-16	QC Std #2			C:\NexIONData\DataSet\090716A\CCV.033
CCB	16:07:30 Wed 07-Sep-16	QC Std #4			C:\NexIONData\DataSet\090716A\CCB.034
LLCCVT	16:12:21 Wed 07-Sep-16	QC Std #6			C:\NexIONData\DataSet\090716A\LLCCVT.0
LLCCVT	16:16:52 Wed 07-Sep-16	QC Std #6			C:\NexIONData\DataSet\090716A\LLCCVT.0
KQ1610557-01	16:32:26 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161055
KQ1610557-02	16:37:16 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161055
T1601476-001	16:42:06 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\T1601476-
T1601476-001D	16:46:56 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\T1601476-
T1601476-001L	16:51:47 Wed 07-Sep-16	Sample	25		C:\NexIONData\DataSet\090716A\T1601476-
T1601476-001A	16:56:37 Wed 07-Sep-16	Sample	5 +50ppb +10ppb Ag		C:\NexIONData\DataSet\090716A\T1601476-
T1601476-001S	17:01:28 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\T1601476-
KQ1610485-01	17:06:18 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161048
KQ1610485-02	17:11:08 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161048
KQ1610485-03	17:15:58 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161048
CCV	17:20:50 Wed 07-Sep-16	QC Std #2			C:\NexIONData\DataSet\090716A\CCV.047
CCB	17:25:41 Wed 07-Sep-16	QC Std #4			C:\NexIONData\DataSet\090716A\CCB.048
KQ1610485-04	17:30:33 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\KQ161048
K1608469-001	17:35:23 Wed 07-Sep-16	Sample	5		C:\NexIONData\DataSet\090716A\K1608469-

K1608469-002	17:40:14 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1608469-
K1609288-001	17:45:04 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-002	17:49:54 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-003	17:54:44 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-004	17:59:35 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-005	18:04:25 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-005D	18:09:15 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-005L	18:14:05 Wed 07-Sep-16	Sample	25	C:\NexIONData\DataSet\090716A\K1609288-
CCV	18:18:57 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.059
CCB	18:23:48 Wed 07-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.060
LLCCVT	18:28:39 Wed 07-Sep-16	QC Std #6		C:\NexIONData\DataSet\090716A\LLCCVT.0
K1609288-005A	18:33:30 Wed 07-Sep-16	Sample	5 +50ppb +10ppb Ag	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-005S	18:38:20 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-006	18:43:10 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-007	18:48:01 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-008	18:52:51 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-009	18:57:41 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
K1609288-010	19:02:32 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609288-
KQ1610520-01	19:07:22 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161052
KQ1610520-03	19:12:13 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161052
KQ1610520-04	19:17:03 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161052
CCV	19:21:56 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.072
CCB	19:26:47 Wed 07-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.073
K1609659-001	19:31:40 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-002	19:36:30 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-003	19:41:20 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-003D	19:46:11 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-003L	19:51:01 Wed 07-Sep-16	Sample	25	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-003A	19:55:52 Wed 07-Sep-16	Sample	5 +50ppb +10ppb Ag	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-003S	20:00:41 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
KQ1610520-02	20:05:31 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161052
MO STD	20:10:23 Wed 07-Sep-16	Sample		C:\NexIONData\DataSet\090716A\MO STD.0
K1609659-004	20:15:15 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
CCV	20:20:07 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.084
CCV	20:24:38 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.085
CCB	20:29:29 Wed 07-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.086
LLCCVT	20:34:20 Wed 07-Sep-16	QC Std #6		C:\NexIONData\DataSet\090716A\LLCCVT.0
K1609659-005	20:39:11 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-006	20:44:02 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-007	20:48:52 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-008	20:53:42 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-009	20:58:33 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-010	21:03:25 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-011	21:08:16 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-012	21:13:06 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
K1609659-013	21:17:57 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609659-
KQ1610643-01	21:22:48 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161064
CCV	21:27:40 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.098
CCV	21:32:10 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.099
CCB	21:37:01 Wed 07-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.100
ICSA	21:41:52 Wed 07-Sep-16	Sample		C:\NexIONData\DataSet\090716A\ICSA.101
ICSAB	21:46:42 Wed 07-Sep-16	Sample		C:\NexIONData\DataSet\090716A\ICSAB.102
MO STD	21:51:32 Wed 07-Sep-16	Sample		C:\NexIONData\DataSet\090716A\MO STD.1
KQ1610643-02	21:56:24 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161064
KQ1610643-03	22:01:15 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161064
KQ1610643-04	22:06:05 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\KQ161064
K1609289-001	22:10:56 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-001D	22:15:46 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-001L	22:20:36 Wed 07-Sep-16	Sample	25	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-001A	22:25:27 Wed 07-Sep-16	Sample	5 +50ppb +10ppb Ag	C:\NexIONData\DataSet\090716A\K1609289-

CCV	22:30:18 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.111
CCV	22:34:48 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.112
CCB	22:39:39 Wed 07-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.113
LLCCVT	22:44:30 Wed 07-Sep-16	QC Std #6		C:\NexIONData\DataSet\090716A\LLCCVT.1
K1609289-001S	22:49:21 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-002	22:54:12 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-003	22:59:02 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-004	23:03:52 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-005	23:08:43 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-006	23:13:33 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-007	23:18:24 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-008	23:23:15 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-009	23:28:05 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-010	23:32:55 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
CCV	23:37:49 Wed 07-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.125
CCB	23:42:39 Wed 07-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.126
K1609289-011	23:47:32 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-012	23:52:23 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-013	23:57:13 Wed 07-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-014	00:02:04 Thu 08-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-015	00:06:55 Thu 08-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-016	00:11:45 Thu 08-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-017	00:16:35 Thu 08-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-018	00:21:26 Thu 08-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-019	00:26:16 Thu 08-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
K1609289-020	00:31:07 Thu 08-Sep-16	Sample	5	C:\NexIONData\DataSet\090716A\K1609289-
CCV	00:35:59 Thu 08-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.137
CCV	00:40:29 Thu 08-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.138
CCB	00:45:20 Thu 08-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.139
LLCCVT	00:50:11 Thu 08-Sep-16	QC Std #6		C:\NexIONData\DataSet\090716A\LLCCVT.1
LLCCVT	00:54:41 Thu 08-Sep-16	QC Std #6		C:\NexIONData\DataSet\090716A\LLCCVT.1
K1608469-001	08:35:07 Thu 08-Sep-16	Sample	500	C:\NexIONData\DataSet\090716A\K1608469-
K1608469-002	08:39:38 Thu 08-Sep-16	Sample	500	C:\NexIONData\DataSet\090716A\K1608469-
CCV	08:44:12 Thu 08-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.144
CCV	08:48:18 Thu 08-Sep-16	QC Std #2		C:\NexIONData\DataSet\090716A\CCV.145
CCB	08:52:50 Thu 08-Sep-16	QC Std #4		C:\NexIONData\DataSet\090716A\CCB.146
LLCCVT	08:57:22 Thu 08-Sep-16	QC Std #6		C:\NexIONData\DataSet\090716A\LLCCVT.1
LLCCVT	09:01:28 Thu 08-Sep-16	QC Std #6		C:\NexIONData\DataSet\090716A\LLCCVT.1

SmartTune Wizard - Details

```
Optimization Details

SmartTune file: C:\NexIONData\Wizard\SmartTune\CAS SmartTune Full FAST.swz

Optimization Status

Start Time: 9/7/2016 9:21:00 AM

Mass Calibration and Resolution
        Optimization Settings:
                Method: C:\NexIONData\Method\CAS Tuning.mth.
                MassCal File: C:\NexIONData\MassCal\Default.tun
                Iterations: 6
                Target accuracy (+/- amu): 0.1 for Mass Cal. and 0.1 for Resolution
                Peak height (%) for Res. Opt.: 5

        Optimization Results:
        Initial Try
                Target/Obtained mass (7.016/7.025), Target/Obtained resolution (0.7/0.699)
                Target/Obtained mass (9.0122/9.025), Target/Obtained resolution (0.7/0.690)
                Target/Obtained mass (23.985/24.075), Target/Obtained resolution (0.7/0.696)
                Target/Obtained mass (58.9332/58.975), Target/Obtained resolution (0.7/0.687)
                Target/Obtained mass (114.904/114.925), Target/Obtained resolution (0.7/0.689)
                Target/Obtained mass (139.905/139.925), Target/Obtained resolution (0.7/0.699)
                Target/Obtained mass (207.977/207.975), Target/Obtained resolution (0.7/0.683)
                Target/Obtained mass (208.98/208.975), Target/Obtained resolution (0.7/0.705)
                Target/Obtained mass (238.05/238.025), Target/Obtained resolution (0.7/0.690)
[Passed]  Optimum value(s): N/A
```

Daily Performance Report

Sample ID: Daily Performance Check

Sample Date/Time: Wednesday, September 07, 2016 09:25:33
Sample Description:
Method File: C:\NexIONData\Method\CAS Daily Performance.mth
Dataset File: C:\NexIONData\Dataset\Default\Daily Performance Check.3639
MassCal File: C:\NexIONData\MassCal\Default.tun
Conditions File: C:\NexIONData\Conditions\Default.dac
Dual Detector Mode: Pulse
Acq. Dead Time (ns): 35
Current Dead Time (ns): 35
Torch Z position (mm): 0.00

Summary

Analyte	Mass	Meas. Intens. Mean	Net Intens. Mean	Net Intens. SD	Net Intens. RSD	Mode
Li	7.0	71522.7	71522.747	802.259	1.1	Standard
Be	9.0	20422.9	20422.857	293.256	1.4	Standard
Mg	24.0	67791.8	67791.833	1037.710	1.5	Standard
Co	58.9	59364.5	59364.460	1156.874	1.9	Standard
In	114.9	111079.7	111079.749	1902.080	1.7	Standard
Pb	208.0	103697.1	103697.098	900.557	0.9	Standard
Bi	209.0	84291.7	84291.692	671.728	0.8	Standard
U	238.1	73943.5	73943.545	419.251	0.6	Standard
CeO	155.9	2434.6	0.025	0.001	3.7	Standard
Ce	139.9	97913.1	97913.094	1029.537	1.1	Standard
Ce++	70.0	2532.5	0.026	0.001	2.0	Standard
Bkgd	220.0	0.1	0.133	0.298	223.6	Standard

Replicates

Repeat 1

Analyte	Mass	Meas. Intensity
Li	7	70420.473
Be	9	20640.901
Mg	24	66890.235
Co	59	57872.319
In	115	112542.901
Pb	208	102602.646
Bi	209	83394.705
U	238	73978.387
CeO	156	2370.197
Ce	140	97724.446
Ce++	70	2445.543
Bkgd	220	0.000

Repeat 2

Analyte	Mass	Meas. Intensity
Li	7	71285.414
Be	9	20349.817
Mg	24	68047.012
Co	59	59118.071
In	115	109960.238
Pb	208	102879.351
Bi	209	83813.143
U	238	73787.403
CeO	156	2518.889
Ce	140	96963.286
Ce++	70	2554.228
Bkgd	220	0.000

Repeat 3

Analyte	Mass	Meas. Intensity
Li	7	72077.373
Be	9	20686.967
Mg	24	68347.776
Co	59	59945.508
In	115	112989.068

Pb	208	104509.389
Bi	209	84896.177
U	238	73852.404
CeO	156	2428.206
Ce	140	99444.253
Ce++	70	2586.901
Bkgd	220	0.667

Repeat 4

Analyte	Mass	Meas. Intensity
Li	7	71328.964
Be	9	19955.929
Mg	24	66588.832
Co	59	58928.624
In	115	111517.574
Pb	208	104009.610
Bi	209	84444.177
U	238	73481.164
CeO	156	2528.890
Ce	140	98380.258
Ce++	70	2573.565
Bkgd	220	0.000

Repeat 5

Analyte	Mass	Meas. Intensity
Li	7	72501.511
Be	9	20480.671
Mg	24	69085.311
Co	59	60957.778
In	115	108388.965
Pb	208	104484.496
Bi	209	84910.260
U	238	74618.369
CeO	156	2326.856
Ce	140	97053.227
Ce++	70	2502.219
Bkgd	220	0.000

Current Conditions File Data

Current Value	Description
0.87	Nebulizer Gas Flow STD/KED [NEB]
1.20	Auxiliary Gas Flow
16.00	Plasma Gas Flow
-9.50	Deflector Voltage
1600.00	ICP RF Power
-1712.00	Analog Stage Voltage
1200.00	Pulse Stage Voltage
0.00	Quadrupole Rod Offset STD [QRO]
-14.50	Cell Rod Offset STD [CRO]
8.00	Discriminator Threshold
-5.00	Cell Entrance/Exit Voltage STD
0.00	RPa
0.45	RPq
0.87	DRC Mode NEB
-6.50	DRC Mode QRO
-1.50	DRC Mode CRO
-10.00	DRC Mode Cell Entrance/Exit Voltage
3.50	Cell Gas A
0.00	Cell Gas B
280.00	Axial Field Voltage
-15.00	KED Mode CRO
-12.00	KED Mode QRO
-4.00	KED Mode Cell Entrance Voltage
-40.00	KED Mode Cell Exit Voltage
0.00	KED Cell Gas A
5.00	KED Cell Gas B
0.00	KED RPa
0.25	KED RPq
475.00	KED Mode Axial Field Voltage

LABWORKS - Summary Report

Sample ID: Blank
Sample Date/Time: Wednesday, September 07, 2016 13:37:34
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\Blank.003
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1117811.7	4.9			ppb
│	Be-KED1	9	5.7	53.9			ppb
⌊	Al-KED1	27	794.0	1.9			ppb
⌈	V-KED3	51	3.3	45.8			ppb
│	Cr-KED3	52	5.0	60.0			ppb
│	Cr-KED3	53	0.7	173.2			ppb
│	Co-KED3	59	10.3	47.7			ppb
│	Ni-KED3	60	4.7	65.5			ppb
│	Ni-KED3	62	0.7	173.2			ppb
│	Cu-KED3	63	17.3	43.7			ppb
│	Zn-KED3	64	4.5	69.1			ppb
│	Cu-KED3	65	4.0	25.0			ppb
│	Zn-KED3	66	5.0	52.9			ppb
⌊>	Ge-KED3	72	29436.0	2.2			ppb
⌈>	Ge-KED2	72	150532.0	0.5			ppb
│	As-KED2	75	19.7	28.9			ppb
│	Se-KED2	77	2.7	86.6			ppb
│	Se-KED2	78	34.3	18.7			ppb
⌊	Se-KED2	82	-20.9	69.8			ppb
⌈	Mo-KED2	95	3.3	34.6			ppb
│	Mo-KED2	97	4.0	100.0			ppb
│	Mo-KED2	98	3.6	55.1			ppb
│	Cd-KED2	111	5.0	72.1			ppb
│	Cd-KED2	114	3.2	2.1			ppb
⌊>	In-KED2	115	46736.3	1.1			ppb
⌈>	Rh-KED2	103	254432.4	2.0			ppb
│	Ag-KED2	107	10.0	17.3			ppb
⌊	Ag-KED2	109	11.0	32.8			ppb
⌈>	In-KED1	115	561885.0	2.2			ppb
│	Sb-KED1	121	72.0	14.7			ppb
│	Sb-KED1	123	50.8	2.5			ppb
│	Ba-KED1	135	16.0	45.1			ppb
⌊	Ba-KED1	137	12.0	33.3			ppb
⌈>	Lu-KED1	175	633300.0	2.5			ppb
│	Tl-KED1	203	57.3	24.7			ppb
│	Tl-KED1	205	121.3	4.1			ppb
⌊	Pb-KED1	208	44.7	18.1			ppb
⌈	Mn-STD1	55	1470.7	3.3			ppb
⌊>	Ge-STD	72	1736879.0	2.4			ppb

LABWORKS - Summary Report

Sample ID: Standard 1
Sample Date/Time: Wednesday, September 07, 2016 13:42:26
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\Standard 1.004
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1164609.3	0.9			ppb
│	Be-KED1	9	87310.4	1.8	25.00000	1.5	ppb
└	Al-KED1	27	823547.1	2.4	25.00000	2.1	ppb
┌	V-KED3	51	10642.6	1.4	25.00000	0.9	ppb
│	Cr-KED3	52	15114.3	1.2	25.00000	1.5	ppb
│	Cr-KED3	53	1746.8	0.3	25.00000	2.0	ppb
│	Co-KED3	59	34453.8	2.0	25.00000	3.4	ppb
│	Ni-KED3	60	20759.7	1.8	25.00000	2.5	ppb
│	Ni-KED3	62	1736.1	5.3	25.00000	4.1	ppb
│	Cu-KED3	63	32817.0	0.3	25.00000	2.4	ppb
│	Zn-KED3	64	4150.7	2.7	25.00000	3.0	ppb
│	Cu-KED3	65	17156.6	3.2	25.00000	1.3	ppb
│	Zn-KED3	66	2838.3	5.3	25.00000	3.2	ppb
└>	Ge-KED3	72	29343.4	2.2			ppb
┌>	Ge-KED2	72	150805.2	1.4			ppb
│	As-KED2	75	5954.2	1.2	25.00000	2.2	ppb
│	Se-KED2	77	222.0	15.6	25.00000	17.0	ppb
│	Se-KED2	78	721.3	3.7	25.00000	4.8	ppb
└	Se-KED2	82	343.2	10.8	25.00000	9.0	ppb
┌	Mo-KED2	95	36988.5	0.9	25.00000	2.4	ppb
│	Mo-KED2	97	24474.3	1.6	25.00000	2.0	ppb
│	Mo-KED2	98	63380.1	0.4	25.00000	2.1	ppb
│	Cd-KED2	111	16246.6	1.6	25.00000	3.1	ppb
│	Cd-KED2	114	38257.5	1.5	25.00000	2.6	ppb
└>	In-KED2	115	47007.1	1.9			ppb
┌>	Rh-KED2	103	254276.4	1.7			ppb
│	Ag-KED2	107	143375.6	1.4	25.00000	2.9	ppb
└	Ag-KED2	109	138020.5	0.1	25.00000	1.6	ppb
┌>	In-KED1	115	547372.6	2.3			ppb
│	Sb-KED1	121	301427.5	0.2	25.00000	2.2	ppb
│	Sb-KED1	123	229884.3	1.8	25.00000	0.9	ppb
│	Ba-KED1	135	93619.9	2.7	25.00000	1.3	ppb
└	Ba-KED1	137	157408.5	0.7	25.00000	1.7	ppb
┌>	Lu-KED1	175	658277.7	2.5			ppb
│	Tl-KED1	203	260312.5	3.2	25.00000	1.4	ppb
│	Tl-KED1	205	597554.9	2.1	25.00000	2.3	ppb
└	Pb-KED1	208	781824.5	1.0	25.00000	3.5	ppb
┌	Mn-STD1	55	1014116.8	1.1	25.00000	1.8	ppb
└>	Ge-STD	72	1755647.4	0.7			ppb

LABWORKS - Summary Report

Sample ID: ICV
Sample Date/Time: Wednesday, September 07, 2016 13:47:16
Sample Description:
Autosampler Position: 3
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\ICV.005
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1183104.8	4.0			ppb
|	Be-KED1	9	9094.6	1.7	2.56369	2.8	ppb
⌊	Al-KED1	27	3307600.9	0.3	99.02907	4.4	ppb
⌈	V-KED3	51	11084.6	1.0	25.87100	2.6	ppb
|	Cr-KED3	52	6295.7	5.4	10.34678	7.2	ppb
|	Cr-KED3	53	752.7	9.8	10.70772	11.6	ppb
|	Co-KED3	59	36439.8	0.7	26.25938	1.2	ppb
|	Ni-KED3	60	21814.0	2.6	26.10306	4.4	ppb
|	Ni-KED3	62	1841.5	5.3	26.36934	7.0	ppb
|	Cu-KED3	63	16940.7	1.2	12.81028	0.7	ppb
|	Zn-KED3	64	4221.6	1.7	25.25452	0.9	ppb
|	Cu-KED3	65	8799.4	2.0	12.74173	3.8	ppb
|	Zn-KED3	66	2840.9	1.1	24.87516	2.6	ppb
⌊>	Ge-KED3	72	29538.5	1.8			ppb
⌈>	Ge-KED2	72	153143.6	1.3			ppb
|	As-KED2	75	6251.0	2.0	25.84978	3.1	ppb
|	Se-KED2	77	237.3	4.2	26.31106	5.4	ppb
|	Se-KED2	78	752.5	3.6	25.72127	5.1	ppb
⌊	Se-KED2	82	328.5	8.9	23.68753	9.5	ppb
⌈	Mo-KED2	95	38781.9	2.0	26.01346	6.4	ppb
|	Mo-KED2	97	25422.6	2.8	25.77960	7.1	ppb
|	Mo-KED2	98	66119.4	1.6	25.88110	6.0	ppb
|	Cd-KED2	111	8230.0	1.4	12.56118	5.7	ppb
|	Cd-KED2	114	19521.4	0.7	12.65018	4.0	ppb
⌊>	In-KED2	115	47440.2	4.3			ppb
⌈>	Rh-KED2	103	256129.2	3.5			ppb
|	Ag-KED2	107	73621.9	0.9	12.74823	3.0	ppb
⌊	Ag-KED2	109	70542.1	1.0	12.69081	3.1	ppb
⌈>	In-KED1	115	561927.0	3.3			ppb
|	Sb-KED1	121	310170.0	2.1	25.05828	1.6	ppb
|	Sb-KED1	123	238692.9	2.7	25.28816	1.5	ppb
|	Ba-KED1	135	385684.2	2.8	100.35406	1.4	ppb
⌊	Ba-KED1	137	642570.5	2.5	99.41387	1.5	ppb
⌈>	Lu-KED1	175	656008.3	2.8			ppb
|	Tl-KED1	203	266523.9	3.5	25.68360	0.7	ppb
|	Tl-KED1	205	612170.5	3.6	25.69195	1.6	ppb
⌊	Pb-KED1	208	816611.1	0.8	26.19869	2.4	ppb
⌈	Mn-STD1	55	1019512.4	2.1	25.36853	1.0	ppb
⌊>	Ge-STD	72	1739121.7	1.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		106			
│	Be-KED1	9	103				
⌊	Al-KED1	27	99				
⌈	V-KED3	51	103				
│	Cr-KED3	52	103				
│	Cr-KED3	53	107				
│	Co-KED3	59	105				
│	Ni-KED3	60	104				
│	Ni-KED3	62	105				
│	Cu-KED3	63	102				
│	Zn-KED3	64	101				
│	Cu-KED3	65	102				
│	Zn-KED3	66	100				
⌊>	Ge-KED3	72		100			
⌈>	Ge-KED2	72		102			
│	As-KED2	75	103				
│	Se-KED2	77	105				
│	Se-KED2	78	103				
⌊	Se-KED2	82	95				
⌈	Mo-KED2	95	104				
│	Mo-KED2	97	103				
│	Mo-KED2	98	104				
│	Cd-KED2	111	100				
│	Cd-KED2	114	101				
⌊>	In-KED2	115		102			
⌈>	Rh-KED2	103		101			
│	Ag-KED2	107	102				
⌊	Ag-KED2	109	102				
⌈>	In-KED1	115		100			
│	Sb-KED1	121	100				
│	Sb-KED1	123	101				
│	Ba-KED1	135	100				
⌊	Ba-KED1	137	99				
⌈>	Lu-KED1	175		104			
│	Tl-KED1	203	103				
│	Tl-KED1	205	103				
⌊	Pb-KED1	208	105				
⌈	Mn-STD1	55	101				
⌊>	Ge-STD	72		100			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 13:52:08
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.006
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1164001.3	3.0			ppb
|	Be-KED1	9	86483.7	2.1	24.78275	1.7	ppb
⌊	Al-KED1	27	843423.4	1.4	25.62597	1.7	ppb
⌈	V-KED3	51	10507.5	2.1	24.79856	0.6	ppb
|	Cr-KED3	52	15015.2	3.8	24.94587	2.0	ppb
|	Cr-KED3	53	1781.4	3.6	25.60630	1.4	ppb
|	Co-KED3	59	34256.7	1.6	24.96835	0.8	ppb
|	Ni-KED3	60	20391.9	2.1	24.67092	1.8	ppb
|	Ni-KED3	62	1714.8	7.9	24.80369	6.5	ppb
|	Cu-KED3	63	32859.1	1.4	25.14675	1.0	ppb
|	Zn-KED3	64	4105.0	2.6	24.84129	2.4	ppb
|	Cu-KED3	65	16808.2	2.4	24.61647	2.3	ppb
|	Zn-KED3	66	2723.6	0.6	24.12170	2.5	ppb
⌊>	Ge-KED3	72	29203.2	2.2			ppb
⌈>	Ge-KED2	72	153445.0	0.3			ppb
|	As-KED2	75	5944.9	0.7	24.52569	0.8	ppb
|	Se-KED2	77	227.3	5.2	25.12641	5.0	ppb
|	Se-KED2	78	704.2	1.6	23.93013	1.5	ppb
⌊	Se-KED2	82	323.2	4.4	23.26616	4.3	ppb
⌈	Mo-KED2	95	36473.8	1.7	24.85009	2.3	ppb
|	Mo-KED2	97	23781.1	2.1	24.48933	2.6	ppb
|	Mo-KED2	98	61921.6	2.2	24.61898	2.0	ppb
|	Cd-KED2	111	15786.4	1.1	24.48418	1.5	ppb
|	Cd-KED2	114	37454.3	0.6	24.67049	1.0	ppb
⌊>	In-KED2	115	46623.7	0.6			ppb
⌈>	Rh-KED2	103	256307.6	2.2			ppb
|	Ag-KED2	107	142759.5	1.1	24.69168	1.1	ppb
⌊	Ag-KED2	109	137160.3	0.6	24.64928	1.7	ppb
⌈>	In-KED1	115	556717.0	2.8			ppb
|	Sb-KED1	121	302696.8	0.9	24.68965	3.2	ppb
|	Sb-KED1	123	233635.1	0.7	24.99277	3.1	ppb
|	Ba-KED1	135	93838.0	2.9	24.63692	0.6	ppb
⌊	Ba-KED1	137	158399.1	2.9	24.72793	0.5	ppb
⌈>	Lu-KED1	175	648618.3	1.1			ppb
|	Tl-KED1	203	261923.4	0.7	25.53323	1.4	ppb
|	Tl-KED1	205	597239.7	0.6	25.35569	1.7	ppb
⌊	Pb-KED1	208	784884.6	0.2	25.45884	1.2	ppb
⌈	Mn-STD1	55	1041294.4	1.2	24.85995	3.6	ppb
⌊>	Ge-STD	72	1813855.3	2.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
|	Be-KED1	9	99				
⌊	Al-KED1	27	103				
⌈	V-KED3	51	99				
|	Cr-KED3	52	100				
|	Cr-KED3	53	102				
|	Co-KED3	59	100				
|	Ni-KED3	60	99				
|	Ni-KED3	62	99				
|	Cu-KED3	63	101				
|	Zn-KED3	64	99				
|	Cu-KED3	65	98				
|	Zn-KED3	66	96				
⌊>	Ge-KED3	72		99			
⌈>	Ge-KED2	72		102			
|	As-KED2	75	98				
|	Se-KED2	77	101				
|	Se-KED2	78	96				
⌊	Se-KED2	82	93				
⌈	Mo-KED2	95	99				
|	Mo-KED2	97	98				
|	Mo-KED2	98	98				
|	Cd-KED2	111	98				
|	Cd-KED2	114	99				
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		101			
|	Ag-KED2	107	99				
⌊	Ag-KED2	109	99				
⌈>	In-KED1	115		99			
|	Sb-KED1	121	99				
|	Sb-KED1	123	100				
|	Ba-KED1	135	99				
⌊	Ba-KED1	137	99				
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203	102				
|	Tl-KED1	205	101				
⌊	Pb-KED1	208	102				
⌈	Mn-STD1	55	99				
⌊>	Ge-STD	72		104			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: ICB
Sample Date/Time: Wednesday, September 07, 2016 13:56:59
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\ICB.007
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⎡>	Li-KED1	6	1140367.3	2.6			ppb
⎢	Be-KED1	9	30.3	122.2	0.00722	150.7	ppb
⎣	Al-KED1	27	1430.1	77.4	0.01930	179.0	ppb
⎡	V-KED3	51	2.3	49.5	-0.00212	135.2	ppb
⎢	Cr-KED3	52	4.7	24.7	-0.00029	666.3	ppb
⎢	Cr-KED3	53	0.7	173.2	0.00055	3147.4	ppb
⎢	Co-KED3	59	7.3	70.0	-0.00198	193.4	ppb
⎢	Ni-KED3	60	6.0	33.3	0.00187	139.9	ppb
⎢	Ni-KED3	62	4.7	99.0	0.05961	114.6	ppb
⎢	Cu-KED3	63	12.0	60.1	-0.00382	142.2	ppb
⎢	Zn-KED3	64	3.1	131.2	-0.00736	354.8	ppb
⎢	Cu-KED3	65	8.3	45.4	0.00662	82.7	ppb
⎢	Zn-KED3	66	3.0	57.7	-0.01668	94.8	ppb
⎣>	Ge-KED3	72	28484.4	2.2			ppb
⎡>	Ge-KED2	72	151766.0	1.3			ppb
⎢	As-KED2	75	25.7	30.3	0.02469	135.6	ppb
⎢	Se-KED2	77	2.7	114.6	-0.00277	12536.4	ppb
⎢	Se-KED2	78	37.7	11.5	0.11311	143.5	ppb
⎣	Se-KED2	82	-17.5	70.2	0.23943	353.7	ppb
⎡	Mo-KED2	95	6.7	45.8	0.00229	92.4	ppb
⎢	Mo-KED2	97	8.7	35.3	0.00483	65.0	ppb
⎢	Mo-KED2	98	10.4	67.5	0.00268	103.0	ppb
⎢	Cd-KED2	111	2.7	43.3	-0.00359	49.9	ppb
⎢	Cd-KED2	114	3.7	34.1	0.00030	273.2	ppb
⎣>	In-KED2	115	46544.7	0.8			ppb
⎡>	Rh-KED2	103	251762.8	1.6			ppb
⎢	Ag-KED2	107	48.7	11.3	0.00683	15.3	ppb
⎣	Ag-KED2	109	43.3	10.9	0.00595	16.4	ppb
⎡>	In-KED1	115	549831.9	3.7			ppb
⎢	Sb-KED1	121	414.0	34.2	0.02812	36.5	ppb
⎢	Sb-KED1	123	253.7	29.5	0.02194	32.4	ppb
⎢	Ba-KED1	135	65.3	120.3	0.01272	156.2	ppb
⎣	Ba-KED1	137	66.0	126.0	0.00827	151.2	ppb
⎡>	Lu-KED1	175	656055.4	0.8			ppb
⎢	Tl-KED1	203	118.0	43.3	0.00563	85.9	ppb
⎢	Tl-KED1	205	228.0	56.3	0.00427	124.3	ppb
⎣	Pb-KED1	208	235.3	111.4	0.00603	138.2	ppb
⎡	Mn-STD1	55	1486.1	5.6	0.00037	900.7	ppb
⎣>	Ge-STD	72	1741040.9	3.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		102			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		101			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		99			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		100			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 14:01:49
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.008
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1149147.3	1.0			ppb
|	Be-KED1	9	6.3	63.8	0.00014	819.7	ppb
⌊	Al-KED1	27	790.0	6.6	-0.00081	204.4	ppb
⌈	V-KED3	51	3.7	15.7	0.00054	256.0	ppb
|	Cr-KED3	52	3.0	57.7	-0.00345	79.8	ppb
|	Cr-KED3	53	2.0	100.0	0.01806	151.8	ppb
|	Co-KED3	59	4.3	13.3	-0.00443	9.4	ppb
|	Ni-KED3	60	9.3	49.5	0.00526	101.6	ppb
|	Ni-KED3	62	0.0		-0.00958	0.0	ppb
|	Cu-KED3	63	12.7	9.1	-0.00383	19.8	ppb
|	Zn-KED3	64	2.3	91.8	-0.01346	92.8	ppb
|	Cu-KED3	65	5.7	62.0	0.00216	226.4	ppb
|	Zn-KED3	66	3.0	88.2	-0.01825	125.1	ppb
⌊>	Ge-KED3	72	30313.1	1.0			ppb
⌈>	Ge-KED2	72	150654.6	2.7			ppb
|	As-KED2	75	26.3	7.9	0.02812	34.1	ppb
|	Se-KED2	77	1.3	86.6	-0.15059	88.3	ppb
|	Se-KED2	78	36.0	6.7	0.06203	159.2	ppb
⌊	Se-KED2	82	-18.8	22.2	0.13466	234.8	ppb
⌈	Mo-KED2	95	4.0	50.0	0.00043	309.0	ppb
|	Mo-KED2	97	3.3	124.9	-0.00071	603.6	ppb
|	Mo-KED2	98	2.4	44.3	-0.00050	83.6	ppb
|	Cd-KED2	111	1.7	124.9	-0.00518	62.2	ppb
|	Cd-KED2	114	6.3	31.9	0.00201	66.7	ppb
⌊>	In-KED2	115	46911.4	2.2			ppb
⌈>	Rh-KED2	103	257934.5	1.0			ppb
|	Ag-KED2	107	18.7	13.5	0.00147	30.9	ppb
⌊	Ag-KED2	109	20.3	10.2	0.00164	24.3	ppb
⌈>	In-KED1	115	547671.1	1.2			ppb
|	Sb-KED1	121	102.7	20.5	0.00270	67.1	ppb
|	Sb-KED1	123	68.0	19.2	0.00201	70.9	ppb
|	Ba-KED1	135	16.7	38.6	0.00029	598.0	ppb
⌊	Ba-KED1	137	16.7	42.1	0.00078	138.5	ppb
⌈>	Lu-KED1	175	646134.3	1.7			ppb
|	Tl-KED1	203	60.0	8.8	0.00015	332.6	ppb
|	Tl-KED1	205	150.0	10.9	0.00112	70.0	ppb
⌊	Pb-KED1	208	51.3	21.5	0.00019	203.7	ppb
⌈	Mn-STD1	55	1490.7	3.3	-0.00208	87.9	ppb
⌊>	Ge-STD	72	1868396.2	3.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		103			
⎢	Be-KED1	9					
⎣	Al-KED1	27					
⎡	V-KED3	51					
⎢	Cr-KED3	52					
⎢	Cr-KED3	53					
⎢	Co-KED3	59					
⎢	Ni-KED3	60					
⎢	Ni-KED3	62					
⎢	Cu-KED3	63					
⎢	Zn-KED3	64					
⎢	Cu-KED3	65					
⎢	Zn-KED3	66					
⎣>	Ge-KED3	72		103			
⎡>	Ge-KED2	72		100			
⎢	As-KED2	75					
⎢	Se-KED2	77					
⎢	Se-KED2	78					
⎣	Se-KED2	82					
⎡	Mo-KED2	95					
⎢	Mo-KED2	97					
⎢	Mo-KED2	98					
⎢	Cd-KED2	111					
⎢	Cd-KED2	114					
⎣>	In-KED2	115		100			
⎡>	Rh-KED2	103		101			
⎢	Ag-KED2	107					
⎣	Ag-KED2	109					
⎡>	In-KED1	115		97			
⎢	Sb-KED1	121					
⎢	Sb-KED1	123					
⎢	Ba-KED1	135					
⎣	Ba-KED1	137					
⎡>	Lu-KED1	175		102			
⎢	Tl-KED1	203					
⎢	Tl-KED1	205					
⎣	Pb-KED1	208					
⎡	Mn-STD1	55					
⎣>	Ge-STD	72		108			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: LLICVT
Sample Date/Time: Wednesday, September 07, 2016 14:06:40
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLICVT.009
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1144094.4	3.2			ppb
│	Be-KED1	9	144.3	5.6	0.04037	3.6	ppb
⌊	Al-KED1	27	138715.8	2.3	4.26649	1.0	ppb
⌈	V-KED3	51	185.7	3.7	0.42937	1.8	ppb
│	Cr-KED3	52	254.3	2.6	0.41370	4.0	ppb
│	Cr-KED3	53	24.0	22.0	0.33597	24.9	ppb
│	Co-KED3	59	62.3	7.9	0.03783	7.5	ppb
│	Ni-KED3	60	358.0	8.2	0.42667	8.6	ppb
│	Ni-KED3	62	30.0	17.6	0.42280	16.2	ppb
│	Cu-KED3	63	288.7	6.4	0.20756	9.0	ppb
│	Zn-KED3	64	161.4	6.3	0.94859	7.5	ppb
│	Cu-KED3	65	139.0	16.9	0.19777	19.4	ppb
│	Zn-KED3	66	110.3	8.7	0.93177	8.0	ppb
⌊>	Ge-KED3	72	29273.6	2.1			ppb
⌈>	Ge-KED2	72	153940.8	1.5			ppb
│	As-KED2	75	262.7	4.2	1.00145	6.2	ppb
│	Se-KED2	77	20.7	40.3	1.99870	46.3	ppb
│	Se-KED2	78	83.3	4.8	1.72088	8.0	ppb
⌊	Se-KED2	82	3.2	132.8	1.65076	17.4	ppb
⌈	Mo-KED2	95	157.3	7.0	0.10268	10.5	ppb
│	Mo-KED2	97	103.3	5.9	0.09985	4.8	ppb
│	Mo-KED2	98	258.5	12.6	0.09931	16.1	ppb
│	Cd-KED2	111	30.3	22.0	0.03848	30.5	ppb
│	Cd-KED2	114	58.8	6.8	0.03582	10.3	ppb
⌊>	In-KED2	115	47723.8	3.2			ppb
⌈>	Rh-KED2	103	255699.0	3.9			ppb
│	Ag-KED2	107	241.7	6.6	0.04026	10.7	ppb
⌊	Ag-KED2	109	225.7	7.5	0.03863	5.1	ppb
⌈>	In-KED1	115	570193.2	2.2			ppb
│	Sb-KED1	121	1275.4	3.6	0.09577	5.2	ppb
│	Sb-KED1	123	930.9	2.1	0.09187	4.3	ppb
│	Ba-KED1	135	427.3	1.2	0.10543	1.8	ppb
⌊	Ba-KED1	137	677.3	7.1	0.10153	9.3	ppb
⌈>	Lu-KED1	175	661171.8	4.6			ppb
│	Tl-KED1	203	525.3	12.6	0.04442	10.0	ppb
│	Tl-KED1	205	1169.4	10.1	0.04341	9.1	ppb
⌊	Pb-KED1	208	1380.0	6.5	0.04257	11.4	ppb
⌈	Mn-STD1	55	5699.8	3.5	0.09770	4.2	ppb
⌊>	Ge-STD	72	1838239.3	2.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		102			
│	Be-KED1	9	101				
⌊	Al-KED1	27	107				
⌈	V-KED3	51	107				
│	Cr-KED3	52	103				
│	Cr-KED3	53	84				
│	Co-KED3	59	95				
│	Ni-KED3	60	107				
│	Ni-KED3	62	106				
│	Cu-KED3	63	104				
│	Zn-KED3	64	95				
│	Cu-KED3	65	99				
│	Zn-KED3	66	93				
⌊>	Ge-KED3	72		99			
⌈>	Ge-KED2	72		102			
│	As-KED2	75	100				
│	Se-KED2	77	100				
│	Se-KED2	78	86				
⌊	Se-KED2	82	83				
⌈	Mo-KED2	95	103				
│	Mo-KED2	97	100				
│	Mo-KED2	98	99				
│	Cd-KED2	111	96				
│	Cd-KED2	114	90				
⌊>	In-KED2	115		102			
⌈>	Rh-KED2	103		100			
│	Ag-KED2	107	101				
⌊	Ag-KED2	109	97				
⌈>	In-KED1	115		101			
│	Sb-KED1	121	96				
│	Sb-KED1	123	92				
│	Ba-KED1	135	105				
⌊	Ba-KED1	137	102				
⌈>	Lu-KED1	175		104			
│	Tl-KED1	203	111				
│	Tl-KED1	205	109				
⌊	Pb-KED1	208	106				
⌈	Mn-STD1	55	98				
⌊>	Ge-STD	72		106			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: ICSA
Sample Date/Time: Wednesday, September 07, 2016 14:11:31
Sample Description:
Autosampler Position: 5
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\ICSA.010
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1138085.0	2.6			ppb
│	Be-KED1	9	9.3	48.3	0.00104	127.4	ppb
└	Al-KED1	27	674655970.9	0.3	20989.05126	2.8	ppb
┌	V-KED3	51	20.3	42.4	0.04357	49.0	ppb
│	Cr-KED3	52	419.7	4.1	0.74090	4.6	ppb
│	Cr-KED3	53	761.4	6.7	11.74552	6.2	ppb
│	Co-KED3	59	859.0	6.8	0.66488	6.6	ppb
│	Ni-KED3	60	384.7	1.6	0.49422	2.4	ppb
│	Ni-KED3	62	42.0	12.6	0.64285	11.8	ppb
│	Cu-KED3	63	778.0	11.6	0.62632	11.6	ppb
│	Zn-KED3	64	84.4	4.7	0.52223	6.0	ppb
│	Cu-KED3	65	389.0	5.2	0.60588	4.9	ppb
│	Zn-KED3	66	36.0	15.5	0.29851	16.6	ppb
└>	Ge-KED3	72	27198.5	1.1			ppb
┌>	Ge-KED2	72	143196.3	2.2			ppb
│	As-KED2	75	40.3	23.0	0.09579	41.9	ppb
│	Se-KED2	77	8.7	35.3	0.74059	52.9	ppb
│	Se-KED2	78	38.0	16.3	0.20419	106.0	ppb
└	Se-KED2	82	-11.5	66.3	0.60819	89.6	ppb
┌	Mo-KED2	95	75060.7	0.4	52.36745	1.4	ppb
│	Mo-KED2	97	49241.4	0.8	51.92344	0.3	ppb
│	Mo-KED2	98	127665.6	0.2	51.97954	1.2	ppb
│	Cd-KED2	111	37.0	10.8	0.05103	12.4	ppb
│	Cd-KED2	114	58.6	20.8	0.03745	22.6	ppb
└>	In-KED2	115	45533.6	1.1			ppb
┌>	Rh-KED2	103	230818.5	1.8			ppb
│	Ag-KED2	107	33.0	25.9	0.00459	35.1	ppb
└	Ag-KED2	109	28.7	11.2	0.00374	19.4	ppb
┌>	In-KED1	115	506224.8	3.0			ppb
│	Sb-KED1	121	298.0	3.7	0.02093	7.7	ppb
│	Sb-KED1	123	233.9	10.8	0.02209	11.3	ppb
│	Ba-KED1	135	3220.4	3.2	0.92624	3.8	ppb
└	Ba-KED1	137	5239.6	4.5	0.89763	2.6	ppb
┌>	Lu-KED1	175	633611.4	4.4			ppb
│	Tl-KED1	203	34.0	21.2	-0.00232	34.1	ppb
│	Tl-KED1	205	83.3	16.3	-0.00166	34.4	ppb
└	Pb-KED1	208	4483.6	16.0	0.14807	19.4	ppb
┌	Mn-STD1	55	32885.1	0.3	0.85837	2.4	ppb
└>	Ge-STD	72	1592987.5	2.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		102			
│	Be-KED1	9					
⌊	Al-KED1	27	105				
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		95			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95	105				
│	Mo-KED2	97	104				
│	Mo-KED2	98	104				
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		91			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		90			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		100			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		92			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: ICSAB
Sample Date/Time: Wednesday, September 07, 2016 14:16:21
Sample Description:
Autosampler Position: 6
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\ICSAB.011
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1157857.9	1.5			ppb
|	Be-KED1	9	9.0	33.3	0.00091	98.1	ppb
⌊	Al-KED1	27	689503803.1	1.1	21077.00873	1.7	ppb
⌈	V-KED3	51	22522.1	0.8	57.69648	1.2	ppb
|	Cr-KED3	52	30555.6	0.3	55.11385	0.7	ppb
|	Cr-KED3	53	4305.3	1.8	67.18901	1.7	ppb
|	Co-KED3	59	69071.9	1.0	54.63881	0.7	ppb
|	Ni-KED3	60	39287.3	1.4	51.58504	1.6	ppb
|	Ni-KED3	62	3195.7	0.5	50.20089	0.2	ppb
|	Cu-KED3	63	58521.0	1.1	48.60881	0.7	ppb
|	Zn-KED3	64	3397.4	2.7	22.30537	2.5	ppb
|	Cu-KED3	65	30185.5	1.4	47.97828	1.9	ppb
|	Zn-KED3	66	2413.5	3.3	23.18956	3.5	ppb
⌊>	Ge-KED3	72	26909.0	0.5			ppb
⌈>	Ge-KED2	72	142374.7	1.0			ppb
|	As-KED2	75	5682.5	1.3	25.27127	2.1	ppb
|	Se-KED2	77	212.7	14.4	25.36293	15.5	ppb
|	Se-KED2	78	641.5	1.4	23.47454	2.0	ppb
⌊	Se-KED2	82	313.9	10.4	24.27353	9.1	ppb
⌈	Mo-KED2	95	77494.3	1.2	54.28466	1.9	ppb
|	Mo-KED2	97	51116.0	1.9	54.12552	2.6	ppb
|	Mo-KED2	98	133215.8	0.9	54.46017	1.7	ppb
|	Cd-KED2	111	14705.9	2.6	23.44921	2.8	ppb
|	Cd-KED2	114	34793.6	1.7	23.56296	2.1	ppb
⌊>	In-KED2	115	45349.3	0.8			ppb
⌈>	Rh-KED2	103	233625.2	0.8			ppb
|	Ag-KED2	107	60524.6	1.0	11.48244	1.4	ppb
⌊	Ag-KED2	109	57962.4	1.3	11.42469	1.8	ppb
⌈>	In-KED1	115	520366.2	3.7			ppb
|	Sb-KED1	121	309.3	9.4	0.02114	8.0	ppb
|	Sb-KED1	123	244.3	15.6	0.02255	18.2	ppb
|	Ba-KED1	135	3439.7	1.3	0.96340	5.0	ppb
⌊	Ba-KED1	137	5606.4	1.1	0.93529	3.1	ppb
⌈>	Lu-KED1	175	635663.0	3.0			ppb
|	Tl-KED1	203	37.3	3.1	-0.00201	1.5	ppb
|	Tl-KED1	205	86.7	9.6	-0.00151	31.0	ppb
⌊	Pb-KED1	208	2774.1	2.4	0.09042	5.3	ppb
⌈	Mn-STD1	55	1939331.8	2.2	50.23780	2.5	ppb
⌊>	Ge-STD	72	1671976.2	1.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		104			
│	Be-KED1	9					
└	Al-KED1	27	105				
┌	V-KED3	51	115				
│	Cr-KED3	52	110				
│	Cr-KED3	53	134				
│	Co-KED3	59	109				
│	Ni-KED3	60	103				
│	Ni-KED3	62	100				
│	Cu-KED3	63	97				
│	Zn-KED3	64	89				
│	Cu-KED3	65	96				
│	Zn-KED3	66	93				
└>	Ge-KED3	72		91			
┌>	Ge-KED2	72		95			
│	As-KED2	75	101				
│	Se-KED2	77	101				
│	Se-KED2	78	94				
└	Se-KED2	82	97				
┌	Mo-KED2	95	109				
│	Mo-KED2	97	108				
│	Mo-KED2	98	109				
│	Cd-KED2	111	94				
│	Cd-KED2	114	94				
└>	In-KED2	115		97			
┌>	Rh-KED2	103		92			
│	Ag-KED2	107	92				
└	Ag-KED2	109	91				
┌>	In-KED1	115		93			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		100			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55	100				
└>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 8	Cr-KED3	53	Out of Control

LABWORKS - Summary Report

Sample ID: MO STD
Sample Date/Time: Wednesday, September 07, 2016 14:21:11
Sample Description:
Autosampler Position: 7
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\MO STD.012
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1049539.0	3.7			ppb
|	Be-KED1	9	10.7	14.3	0.00169	23.9	ppb
⌊	Al-KED1	27	24845.6	3.3	0.81290	2.8	ppb
⌈	V-KED3	51	6.3	24.1	0.00752	49.3	ppb
|	Cr-KED3	52	4.7	32.7	-0.00030	868.7	ppb
|	Cr-KED3	53	2.0	100.0	0.01998	147.8	ppb
|	Co-KED3	59	4.7	12.4	-0.00399	10.8	ppb
|	Ni-KED3	60	20.7	39.1	0.02003	50.2	ppb
|	Ni-KED3	62	0.0		-0.00958	0.0	ppb
|	Cu-KED3	63	26.0	35.3	0.00724	99.9	ppb
|	Zn-KED3	64	42.6	13.7	0.23743	15.5	ppb
|	Cu-KED3	65	11.3	18.4	0.01120	28.0	ppb
|	Zn-KED3	66	23.7	17.6	0.17116	22.3	ppb
⌊>	Ge-KED3	72	28498.4	0.3			ppb
⌈>	Ge-KED2	72	150250.8	1.5			ppb
|	As-KED2	75	33.3	12.1	0.05778	25.7	ppb
|	Se-KED2	77	4.0	0.0	0.15297	4.4	ppb
|	Se-KED2	78	42.8	7.4	0.31421	32.3	ppb
⌊	Se-KED2	82	-12.8	77.6	0.54852	126.9	ppb
⌈	Mo-KED2	95	84799.1	3.0	58.93897	4.2	ppb
|	Mo-KED2	97	56369.7	1.3	59.21339	2.5	ppb
|	Mo-KED2	98	146316.3	0.6	59.33780	1.7	ppb
|	Cd-KED2	111	25.7	22.8	0.03291	28.7	ppb
|	Cd-KED2	114	47.7	8.0	0.02995	9.2	ppb
⌊>	In-KED2	115	45716.4	1.2			ppb
⌈>	Rh-KED2	103	237955.2	0.9			ppb
|	Ag-KED2	107	206.0	22.9	0.03660	23.3	ppb
⌊	Ag-KED2	109	206.3	27.4	0.03790	28.1	ppb
⌈>	In-KED1	115	518325.1	2.1			ppb
|	Sb-KED1	121	1426.7	2.8	0.11912	0.9	ppb
|	Sb-KED1	123	1052.5	2.4	0.11558	4.8	ppb
|	Ba-KED1	135	33.3	6.9	0.00525	16.3	ppb
⌊	Ba-KED1	137	33.3	19.3	0.00374	30.4	ppb
⌈>	Lu-KED1	175	611984.3	1.9			ppb
|	Tl-KED1	203	1980.8	1.0	0.19899	1.4	ppb
|	Tl-KED1	205	4496.0	2.4	0.19709	3.1	ppb
⌊	Pb-KED1	208	954.7	8.5	0.03134	9.1	ppb
⌈	Mn-STD1	55	1175.4	1.6	-0.00608	9.3	ppb
⌊>	Ge-STD	72	1663980.0	2.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		94			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		100			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		92			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		97			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610171-01
Sample Date/Time: Wednesday, September 07, 2016 14:26:03
Sample Description: 5
Autosampler Position: 301
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610171-01.013
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1151038.0	0.9			ppb
|	Be-KED1	9	5.7	10.2	-0.00005	308.7	ppb
⌊	Al-KED1	27	19658.2	3.4	0.57933	4.0	ppb
⌈	V-KED3	51	2.3	24.7	-0.00238	50.5	ppb
|	Cr-KED3	52	6.7	31.2	0.00274	130.8	ppb
|	Cr-KED3	53	0.7	173.2	-0.00029	5534.3	ppb
|	Co-KED3	59	3.3	34.6	-0.00508	16.0	ppb
|	Ni-KED3	60	10.7	54.1	0.00726	97.9	ppb
|	Ni-KED3	62	0.7	173.2	0.00010	16016.4	ppb
|	Cu-KED3	63	46.7	9.9	0.02218	18.1	ppb
|	Zn-KED3	64	7.6	102.6	0.01923	247.0	ppb
|	Cu-KED3	65	30.0	0.0	0.03762	2.7	ppb
|	Zn-KED3	66	7.3	20.8	0.02045	70.7	ppb
⌊>	Ge-KED3	72	29554.6	2.4			ppb
⌈>	Ge-KED2	72	148429.3	3.1			ppb
|	As-KED2	75	21.0	25.2	0.00681	328.7	ppb
|	Se-KED2	77	1.3	86.6	-0.14712	92.4	ppb
|	Se-KED2	78	35.6	24.4	0.06307	479.3	ppb
⌊	Se-KED2	82	-12.1	59.9	0.58676	89.0	ppb
⌈	Mo-KED2	95	16.7	18.3	0.00924	21.2	ppb
|	Mo-KED2	97	10.7	39.0	0.00707	63.6	ppb
|	Mo-KED2	98	24.6	16.6	0.00846	17.2	ppb
|	Cd-KED2	111	3.0	33.3	-0.00304	49.2	ppb
|	Cd-KED2	114	5.9	32.4	0.00180	68.0	ppb
⌊>	In-KED2	115	45963.1	2.1			ppb
⌈>	Rh-KED2	103	251054.2	0.9			ppb
|	Ag-KED2	107	50.7	16.4	0.00720	19.7	ppb
⌊	Ag-KED2	109	50.3	6.4	0.00725	9.2	ppb
⌈>	In-KED1	115	560593.0	0.8			ppb
|	Sb-KED1	121	28.0	31.1	-0.00355	19.6	ppb
|	Sb-KED1	123	21.3	23.5	-0.00312	16.7	ppb
|	Ba-KED1	135	34.7	12.0	0.00487	21.0	ppb
⌊	Ba-KED1	137	48.7	17.1	0.00568	21.8	ppb
⌈>	Lu-KED1	175	646069.8	2.6			ppb
|	Tl-KED1	203	122.0	18.9	0.00618	31.6	ppb
|	Tl-KED1	205	284.0	19.3	0.00687	38.6	ppb
⌊	Pb-KED1	208	134.0	5.2	0.00288	4.4	ppb
⌈	Mn-STD1	55	1606.8	4.2	0.00173	71.4	ppb
⌊>	Ge-STD	72	1811961.9	2.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		100			
⌈>	Ge-KED2	72		99			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		99			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		100			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		104			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610171-03
Sample Date/Time: Wednesday, September 07, 2016 14:30:54
Sample Description: 5
Autosampler Position: 302
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610171-03.014
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1145790.0	0.1			ppb
|	Be-KED1	9	134.0	14.2	0.03731	14.7	ppb
⌊	Al-KED1	27	94564721.4	2.5	2920.79040	2.6	ppb
⌈	V-KED3	51	1430.4	3.0	3.45854	5.7	ppb
|	Cr-KED3	52	2241.2	1.0	3.81391	3.1	ppb
|	Cr-KED3	53	264.0	14.2	3.88485	14.0	ppb
|	Co-KED3	59	753.0	4.9	0.55543	4.0	ppb
|	Ni-KED3	60	2269.5	2.6	2.81232	4.6	ppb
|	Ni-KED3	62	197.3	7.2	2.91836	5.3	ppb
|	Cu-KED3	63	41792.4	1.3	32.80556	1.5	ppb
|	Zn-KED3	64	18924.5	1.8	117.60959	4.4	ppb
|	Cu-KED3	65	21500.8	1.0	32.30877	3.7	ppb
|	Zn-KED3	66	12443.4	1.6	113.15574	1.2	ppb
⌊>	Ge-KED3	72	28478.4	2.7			ppb
⌈>	Ge-KED2	72	150247.0	0.8			ppb
|	As-KED2	75	3676.8	2.8	15.45945	2.2	ppb
|	Se-KED2	77	86.7	7.1	9.59454	6.5	ppb
|	Se-KED2	78	289.7	2.1	9.32988	1.5	ppb
⌊	Se-KED2	82	109.1	6.4	8.96192	4.7	ppb
⌈	Mo-KED2	95	839.4	9.7	0.57422	9.9	ppb
|	Mo-KED2	97	568.7	4.9	0.58608	4.2	ppb
|	Mo-KED2	98	1458.1	8.9	0.58316	9.5	ppb
|	Cd-KED2	111	439.0	5.4	0.67901	6.4	ppb
|	Cd-KED2	114	1009.0	1.1	0.66792	2.6	ppb
⌊>	In-KED2	115	46258.8	1.5			ppb
⌈>	Rh-KED2	103	241920.9	0.3			ppb
|	Ag-KED2	107	322.3	5.8	0.05731	5.7	ppb
⌊	Ag-KED2	109	286.7	7.4	0.05257	7.4	ppb
⌈>	In-KED1	115	530198.4	2.9			ppb
|	Sb-KED1	121	102.7	15.6	0.00300	54.0	ppb
|	Sb-KED1	123	80.3	7.3	0.00363	11.2	ppb
|	Ba-KED1	135	38583.4	3.3	10.63390	1.0	ppb
⌊	Ba-KED1	137	64114.3	2.1	10.51099	1.5	ppb
⌈>	Lu-KED1	175	659489.6	2.5			ppb
|	Tl-KED1	203	222.0	3.6	0.01556	3.1	ppb
|	Tl-KED1	205	544.0	4.4	0.01747	8.9	ppb
⌊	Pb-KED1	208	23508.8	2.1	0.74876	3.1	ppb
⌈	Mn-STD1	55	231100.2	2.2	5.90648	4.4	ppb
⌊>	Ge-STD	72	1686309.3	2.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		100			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		99			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		94			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		97			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610171-04
Sample Date/Time: Wednesday, September 07, 2016 14:35:44
Sample Description: 5
Autosampler Position: 303
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610171-04.015
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1164931.6	2.9			ppb
	Be-KED1	9	79.3	3.2	0.02103	3.4	ppb
	Al-KED1	27	725474.6	1.5	22.02128	2.0	ppb
	V-KED3	51	7622.0	2.6	18.83415	4.0	ppb
	Cr-KED3	52	2185.5	2.9	3.79479	3.2	ppb
	Cr-KED3	53	268.0	12.4	4.01835	10.0	ppb
	Co-KED3	59	2980.6	1.6	2.26749	2.8	ppb
	Ni-KED3	60	8303.1	1.7	10.51572	4.0	ppb
	Ni-KED3	62	889.4	7.4	13.48117	9.2	ppb
	Cu-KED3	63	1195958.8	1.7	958.66338	3.2	ppb
	Zn-KED3	64	47545.6	0.5	301.49437	2.4	ppb
	Cu-KED3	65	610457.2	1.7	936.14459	3.0	ppb
	Zn-KED3	66	30644.8	1.2	284.61161	3.9	ppb
>	Ge-KED3	72	27904.9	2.8			ppb
>	Ge-KED2	72	146469.4	0.6			ppb
	As-KED2	75	33452.1	0.8	144.99177	1.4	ppb
	Se-KED2	77	205.3	14.9	23.75333	14.8	ppb
	Se-KED2	78	687.2	1.5	24.49136	1.6	ppb
	Se-KED2	82	335.1	9.0	25.13894	8.0	ppb
	Mo-KED2	95	9814.0	1.1	6.90416	1.7	ppb
	Mo-KED2	97	6518.2	1.2	6.92947	1.7	ppb
	Mo-KED2	98	17059.7	0.9	7.00470	1.4	ppb
	Cd-KED2	111	53330.4	1.1	85.44524	1.2	ppb
	Cd-KED2	114	126075.5	1.5	85.76798	0.7	ppb
>	In-KED2	115	45143.1	1.1			ppb
>	Rh-KED2	103	239821.9	0.4			ppb
	Ag-KED2	107	39469.5	1.7	7.29337	1.5	ppb
	Ag-KED2	109	38004.5	0.9	7.29617	1.1	ppb
>	In-KED1	115	538308.6	2.1			ppb
	Sb-KED1	121	1411.4	7.3	0.11322	7.7	ppb
	Sb-KED1	123	1073.0	3.6	0.11326	1.6	ppb
	Ba-KED1	135	1793.4	2.8	0.48286	0.7	ppb
	Ba-KED1	137	2933.6	1.1	0.47201	3.0	ppb
>	Lu-KED1	175	661785.0	1.7			ppb
	Tl-KED1	203	249.3	2.6	0.01811	5.5	ppb
	Tl-KED1	205	521.3	6.7	0.01642	9.2	ppb
	Pb-KED1	208	12620.8	1.6	0.39987	3.1	ppb
	Mn-STD1	55	1198392.0	2.8	28.89159	4.5	ppb
>	Ge-STD	72	1796534.6	2.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		95			
⌈>	Ge-KED2	72		97			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		94			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		96			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-001
Sample Date/Time: Wednesday, September 07, 2016 14:40:34
Sample Description: 5
Autosampler Position: 304
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-001.016
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1164604.0	3.0			ppb
|	Be-KED1	9	16.0	16.5	0.00289	24.7	ppb
⌊	Al-KED1	27	2441023.7	2.1	74.17068	1.8	ppb
⌈	V-KED3	51	1715.4	2.8	4.24034	2.7	ppb
|	Cr-KED3	52	594.7	2.6	1.02852	1.2	ppb
|	Cr-KED3	53	78.0	12.8	1.16778	13.3	ppb
|	Co-KED3	59	245.0	7.2	0.17986	7.1	ppb
|	Ni-KED3	60	582.7	3.8	0.73386	3.0	ppb
|	Ni-KED3	62	69.3	6.0	1.04347	6.2	ppb
|	Cu-KED3	63	97603.7	2.3	78.36360	1.2	ppb
|	Zn-KED3	64	168175.5	2.4	1068.39067	0.8	ppb
|	Cu-KED3	65	50387.0	0.8	77.41540	1.4	ppb
|	Zn-KED3	66	107166.1	0.4	997.19315	2.0	ppb
⌊>	Ge-KED3	72	27841.1	1.6			ppb
⌈>	Ge-KED2	72	144064.5	0.9			ppb
|	As-KED2	75	1342.1	1.4	5.83404	0.9	ppb
|	Se-KED2	77	312.0	2.8	36.87006	2.2	ppb
|	Se-KED2	78	1053.1	1.4	38.85570	0.9	ppb
⌊	Se-KED2	82	479.1	9.2	35.92385	9.7	ppb
⌈	Mo-KED2	95	20986.7	1.4	15.02282	1.8	ppb
|	Mo-KED2	97	13587.8	2.9	14.69950	2.8	ppb
|	Mo-KED2	98	35714.2	0.1	14.91982	0.5	ppb
|	Cd-KED2	111	45.3	13.5	0.06617	15.3	ppb
|	Cd-KED2	114	95.1	14.7	0.06372	15.5	ppb
⌊>	In-KED2	115	44371.8	0.5			ppb
⌈>	Rh-KED2	103	237502.0	0.7			ppb
|	Ag-KED2	107	25136.4	0.4	4.68973	0.4	ppb
⌊	Ag-KED2	109	24433.5	0.8	4.73607	1.2	ppb
⌈>	In-KED1	115	540031.1	4.0			ppb
|	Sb-KED1	121	5333.0	1.9	0.44285	3.8	ppb
|	Sb-KED1	123	4137.3	3.4	0.45157	7.2	ppb
|	Ba-KED1	135	103335.1	1.6	27.98701	2.3	ppb
⌊	Ba-KED1	137	170949.3	2.8	27.52339	2.1	ppb
⌈>	Lu-KED1	175	652026.6	1.2			ppb
|	Tl-KED1	203	32.7	28.9	-0.00256	35.3	ppb
|	Tl-KED1	205	49.3	26.4	-0.00320	16.6	ppb
⌊	Pb-KED1	208	5255.0	2.1	0.16806	1.2	ppb
⌈	Mn-STD1	55	694790.7	1.8	17.61302	2.0	ppb
⌊>	Ge-STD	72	1706209.9	1.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		95			
⌈>	Ge-KED2	72		96			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		96			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-002
Sample Date/Time: Wednesday, September 07, 2016 14:45:25
Sample Description: 5
Autosampler Position: 305
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-002.017
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1211489.4	6.5			ppb
|	Be-KED1	9	12.0	62.9	0.00170	134.9	ppb
⌊	Al-KED1	27	1685999.9	2.4	49.41388	8.9	ppb
⌈	V-KED3	51	77.0	6.9	0.16859	6.8	ppb
|	Cr-KED3	52	725.7	3.3	1.16245	3.4	ppb
|	Cr-KED3	53	89.3	2.6	1.23734	2.3	ppb
|	Co-KED3	59	102.7	10.2	0.06516	11.4	ppb
|	Ni-KED3	60	757.4	4.2	0.88384	4.6	ppb
|	Ni-KED3	62	62.7	6.6	0.87106	7.0	ppb
|	Cu-KED3	63	20217.6	3.2	15.00784	2.8	ppb
|	Zn-KED3	64	15736.6	0.8	92.48022	0.5	ppb
|	Cu-KED3	65	10331.1	1.1	14.67995	1.4	ppb
|	Zn-KED3	66	9936.5	2.2	85.48554	1.9	ppb
⌊>	Ge-KED3	72	30090.7	0.3			ppb
⌈>	Ge-KED2	72	155800.4	1.1			ppb
|	As-KED2	75	74.0	17.7	0.21862	24.1	ppb
|	Se-KED2	77	48.0	25.3	4.98813	27.4	ppb
|	Se-KED2	78	183.2	8.5	5.19916	9.9	ppb
⌊	Se-KED2	82	52.5	24.8	4.93044	17.6	ppb
⌈	Mo-KED2	95	861.4	4.7	0.56361	2.9	ppb
|	Mo-KED2	97	597.3	1.7	0.58951	3.4	ppb
|	Mo-KED2	98	1560.4	6.8	0.59703	6.8	ppb
|	Cd-KED2	111	231.3	10.7	0.33872	12.0	ppb
|	Cd-KED2	114	541.9	6.5	0.34206	5.5	ppb
⌊>	In-KED2	115	48337.1	1.9			ppb
⌈>	Rh-KED2	103	263214.0	1.9			ppb
|	Ag-KED2	107	552.0	7.6	0.09117	6.1	ppb
⌊	Ag-KED2	109	522.0	4.2	0.08932	2.6	ppb
⌈>	In-KED1	115	575359.4	1.6			ppb
|	Sb-KED1	121	415.3	12.7	0.02698	16.6	ppb
|	Sb-KED1	123	334.2	9.3	0.02922	12.3	ppb
|	Ba-KED1	135	6052.6	1.3	1.53420	2.9	ppb
⌊	Ba-KED1	137	10122.3	0.6	1.52763	2.2	ppb
⌈>	Lu-KED1	175	662697.1	5.7			ppb
|	Tl-KED1	203	41.3	23.9	-0.00176	58.8	ppb
|	Tl-KED1	205	83.3	24.0	-0.00183	39.4	ppb
⌊	Pb-KED1	208	3592.8	0.6	0.11285	6.6	ppb
⌈	Mn-STD1	55	1108913.8	3.2	24.67462	4.5	ppb
⌊>	Ge-STD	72	1945634.6	1.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		108			
⎢	Be-KED1	9					
⎣	Al-KED1	27					
⎡	V-KED3	51					
⎢	Cr-KED3	52					
⎢	Cr-KED3	53					
⎢	Co-KED3	59					
⎢	Ni-KED3	60					
⎢	Ni-KED3	62					
⎢	Cu-KED3	63					
⎢	Zn-KED3	64					
⎢	Cu-KED3	65					
⎢	Zn-KED3	66					
⎣>	Ge-KED3	72		102			
⎡>	Ge-KED2	72		103			
⎢	As-KED2	75					
⎢	Se-KED2	77					
⎢	Se-KED2	78					
⎣	Se-KED2	82					
⎡	Mo-KED2	95					
⎢	Mo-KED2	97					
⎢	Mo-KED2	98					
⎢	Cd-KED2	111					
⎢	Cd-KED2	114					
⎣>	In-KED2	115		103			
⎡>	Rh-KED2	103		103			
⎢	Ag-KED2	107					
⎣	Ag-KED2	109					
⎡>	In-KED1	115		102			
⎢	Sb-KED1	121					
⎢	Sb-KED1	123					
⎢	Ba-KED1	135					
⎣	Ba-KED1	137					
⎡>	Lu-KED1	175		105			
⎢	Tl-KED1	203					
⎢	Tl-KED1	205					
⎣	Pb-KED1	208					
⎡	Mn-STD1	55					
⎣>	Ge-STD	72		112			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-003
Sample Date/Time: Wednesday, September 07, 2016 14:50:15
Sample Description: 5
Autosampler Position: 306
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-003.018
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1170191.9	6.0			ppb
	Be-KED1	9	11.7	9.9	0.00163	10.7	ppb
	Al-KED1	27	1114018.5	3.7	33.70236	3.2	ppb
	V-KED3	51	524.3	7.7	1.22264	8.9	ppb
	Cr-KED3	52	743.4	4.3	1.21947	4.8	ppb
	Cr-KED3	53	92.7	11.1	1.31447	11.2	ppb
	Co-KED3	59	196.0	6.3	0.13449	6.9	ppb
	Ni-KED3	60	721.4	6.0	0.86130	5.5	ppb
	Ni-KED3	62	72.7	20.7	1.03767	22.2	ppb
	Cu-KED3	63	25192.2	4.1	19.15022	4.7	ppb
	Zn-KED3	64	81355.1	2.6	489.47292	2.0	ppb
	Cu-KED3	65	13021.3	1.2	18.94129	1.4	ppb
	Zn-KED3	66	51934.6	1.6	457.65388	2.8	ppb
>	Ge-KED3	72	29398.2	1.5			ppb
>	Ge-KED2	72	153722.0	0.7			ppb
	As-KED2	75	345.3	7.6	1.34433	8.7	ppb
	Se-KED2	77	418.0	5.3	46.38086	5.6	ppb
	Se-KED2	78	1447.4	3.0	50.41636	3.6	ppb
	Se-KED2	82	681.2	6.6	47.37473	6.9	ppb
	Mo-KED2	95	9842.7	2.0	6.61000	1.9	ppb
	Mo-KED2	97	6470.1	0.9	6.56775	2.7	ppb
	Mo-KED2	98	16668.2	1.5	6.53634	3.9	ppb
	Cd-KED2	111	17.3	23.3	0.01886	35.8	ppb
	Cd-KED2	114	37.3	5.8	0.02211	4.6	ppb
>	In-KED2	115	47293.0	2.4			ppb
>	Rh-KED2	103	251615.4	2.5			ppb
	Ag-KED2	107	2234.2	3.1	0.39189	2.6	ppb
	Ag-KED2	109	2179.8	2.1	0.39703	1.3	ppb
>	In-KED1	115	544114.8	1.5			ppb
	Sb-KED1	121	1573.4	2.1	0.12546	2.4	ppb
	Sb-KED1	123	1244.3	5.5	0.13072	4.7	ppb
	Ba-KED1	135	19089.4	0.8	5.12599	2.3	ppb
	Ba-KED1	137	32635.9	3.5	5.21158	3.1	ppb
>	Lu-KED1	175	661746.3	4.0			ppb
	Tl-KED1	203	16.0	12.5	-0.00420	4.3	ppb
	Tl-KED1	205	29.3	14.2	-0.00405	5.4	ppb
	Pb-KED1	208	2344.7	0.9	0.07313	3.8	ppb
	Mn-STD1	55	745052.4	1.9	17.65286	2.4	ppb
>	Ge-STD	72	1826519.7	4.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		105			
⎢	Be-KED1	9					
⎣	Al-KED1	27					
⎡	V-KED3	51					
⎢	Cr-KED3	52					
⎢	Cr-KED3	53					
⎢	Co-KED3	59					
⎢	Ni-KED3	60					
⎢	Ni-KED3	62					
⎢	Cu-KED3	63					
⎢	Zn-KED3	64					
⎢	Cu-KED3	65					
⎢	Zn-KED3	66					
⎣>	Ge-KED3	72		100			
⎡>	Ge-KED2	72		102			
⎢	As-KED2	75					
⎢	Se-KED2	77					
⎢	Se-KED2	78					
⎣	Se-KED2	82					
⎡	Mo-KED2	95					
⎢	Mo-KED2	97					
⎢	Mo-KED2	98					
⎢	Cd-KED2	111					
⎢	Cd-KED2	114					
⎣>	In-KED2	115		101			
⎡>	Rh-KED2	103		99			
⎢	Ag-KED2	107					
⎣	Ag-KED2	109					
⎡>	In-KED1	115		97			
⎢	Sb-KED1	121					
⎢	Sb-KED1	123					
⎢	Ba-KED1	135					
⎣	Ba-KED1	137					
⎡>	Lu-KED1	175		104			
⎢	Tl-KED1	203					
⎢	Tl-KED1	205					
⎣	Pb-KED1	208					
⎡	Mn-STD1	55					
⎣>	Ge-STD	72		105			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-004
Sample Date/Time: Wednesday, September 07, 2016 14:55:06
Sample Description: 5
Autosampler Position: 307
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-004.019
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1226771.6	2.5			ppb
│	Be-KED1	9	56.3	14.9	0.01359	13.9	ppb
└	Al-KED1	27	14710304.7	1.7	424.61264	4.1	ppb
┌	V-KED3	51	669.3	5.9	1.56591	5.8	ppb
│	Cr-KED3	52	1002.7	3.0	1.65201	3.6	ppb
│	Cr-KED3	53	124.7	10.7	1.77612	10.6	ppb
│	Co-KED3	59	322.0	9.6	0.22644	10.7	ppb
│	Ni-KED3	60	1044.7	5.1	1.25351	5.5	ppb
│	Ni-KED3	62	114.0	12.7	1.63323	12.0	ppb
│	Cu-KED3	63	88593.2	1.0	67.54058	1.1	ppb
│	Zn-KED3	64	59823.6	2.0	360.90931	2.6	ppb
│	Cu-KED3	65	46002.3	1.0	67.10540	1.6	ppb
│	Zn-KED3	66	38372.1	1.3	338.91545	0.5	ppb
└>	Ge-KED3	72	29321.7	0.7			ppb
┌>	Ge-KED2	72	154170.9	1.6			ppb
│	As-KED2	75	302.0	2.8	1.16131	2.8	ppb
│	Se-KED2	77	405.3	7.5	44.86924	9.1	ppb
│	Se-KED2	78	1263.3	2.5	43.70211	1.1	ppb
└	Se-KED2	82	625.2	4.5	43.46058	3.8	ppb
┌	Mo-KED2	95	2833.6	2.8	1.90804	3.3	ppb
│	Mo-KED2	97	1918.8	6.2	1.95132	6.5	ppb
│	Mo-KED2	98	4884.8	2.0	1.92042	2.5	ppb
│	Cd-KED2	111	2334.5	3.8	3.57542	3.5	ppb
│	Cd-KED2	114	5377.9	2.1	3.50264	1.5	ppb
└>	In-KED2	115	47123.3	0.6			ppb
┌>	Rh-KED2	103	247977.6	1.1			ppb
│	Ag-KED2	107	4801.5	1.9	0.85672	3.0	ppb
└	Ag-KED2	109	4622.4	1.6	0.85650	1.6	ppb
┌>	In-KED1	115	567362.4	1.9			ppb
│	Sb-KED1	121	1254.7	2.8	0.09461	4.4	ppb
│	Sb-KED1	123	957.9	4.7	0.09518	6.3	ppb
│	Ba-KED1	135	30111.7	2.1	7.75607	2.4	ppb
└	Ba-KED1	137	50106.4	2.8	7.67617	3.4	ppb
┌>	Lu-KED1	175	686010.7	0.9			ppb
│	Tl-KED1	203	96.0	7.5	0.00312	18.6	ppb
│	Tl-KED1	205	198.7	6.5	0.00270	21.4	ppb
└	Pb-KED1	208	38024.8	1.6	1.16476	2.2	ppb
┌	Mn-STD1	55	1855714.5	2.1	44.93434	8.0	ppb
└>	Ge-STD	72	1794760.7	6.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		110			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		100			
⌈>	Ge-KED2	72		102			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		101			
⌈>	Rh-KED2	103		97			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		108			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 14:59:59
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.020
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1218306.1	0.4			ppb
│	Be-KED1	9	88918.2	0.8	24.33817	0.4	ppb
⌊	Al-KED1	27	864838.0	2.3	25.09663	2.3	ppb
⌈	V-KED3	51	10636.0	0.9	25.51296	2.5	ppb
│	Cr-KED3	52	15214.8	1.2	25.69729	2.7	ppb
│	Cr-KED3	53	1820.8	3.5	26.60547	4.0	ppb
│	Co-KED3	59	35005.2	1.2	25.92722	1.9	ppb
│	Ni-KED3	60	20863.2	1.6	25.64573	0.1	ppb
│	Ni-KED3	62	1772.1	4.9	26.05937	4.5	ppb
│	Cu-KED3	63	33333.5	1.9	25.92135	2.1	ppb
│	Zn-KED3	64	3965.0	4.8	24.37230	3.9	ppb
│	Cu-KED3	65	17107.2	0.9	25.45722	1.0	ppb
│	Zn-KED3	66	2664.2	2.0	23.96939	1.8	ppb
⌊>	Ge-KED3	72	28739.6	1.6			ppb
⌈>	Ge-KED2	72	153055.4	1.9			ppb
│	As-KED2	75	6035.3	1.0	24.96755	1.6	ppb
│	Se-KED2	77	218.7	12.5	24.19244	11.1	ppb
│	Se-KED2	78	707.8	2.2	24.11996	0.4	ppb
⌊	Se-KED2	82	331.1	4.4	23.85639	3.1	ppb
⌈	Mo-KED2	95	37052.0	1.2	25.00986	1.7	ppb
│	Mo-KED2	97	24571.8	1.8	25.06553	0.3	ppb
│	Mo-KED2	98	63195.3	1.6	24.89192	0.5	ppb
│	Cd-KED2	111	15923.5	0.4	24.46943	1.5	ppb
│	Cd-KED2	114	38100.0	0.6	24.86617	1.9	ppb
⌊>	In-KED2	115	47063.5	1.9			ppb
⌈>	Rh-KED2	103	256333.5	1.3			ppb
│	Ag-KED2	107	141036.8	0.8	24.39104	1.9	ppb
⌊	Ag-KED2	109	136001.5	2.0	24.43937	3.3	ppb
⌈>	In-KED1	115	577230.3	1.4			ppb
│	Sb-KED1	121	312325.4	0.9	24.55902	1.7	ppb
│	Sb-KED1	123	236223.9	2.1	24.36137	2.5	ppb
│	Ba-KED1	135	96726.4	0.2	24.49674	1.5	ppb
⌊	Ba-KED1	137	161495.7	0.8	24.31815	1.2	ppb
⌈>	Lu-KED1	175	668617.8	1.9			ppb
│	Tl-KED1	203	265405.6	1.2	25.10143	1.9	ppb
│	Tl-KED1	205	611652.7	1.4	25.19416	2.5	ppb
⌊	Pb-KED1	208	792675.5	0.4	24.94629	2.0	ppb
⌈	Mn-STD1	55	1063543.4	0.2	26.44808	1.1	ppb
⌊>	Ge-STD	72	1740570.8	1.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
|	Be-KED1	9	97				
⌊	Al-KED1	27	100				
⌈	V-KED3	51	102				
|	Cr-KED3	52	103				
|	Cr-KED3	53	106				
|	Co-KED3	59	104				
|	Ni-KED3	60	103				
|	Ni-KED3	62	104				
|	Cu-KED3	63	104				
|	Zn-KED3	64	97				
|	Cu-KED3	65	102				
|	Zn-KED3	66	96				
⌊>	Ge-KED3	72		98			
⌈>	Ge-KED2	72		102			
|	As-KED2	75	100				
|	Se-KED2	77	97				
|	Se-KED2	78	96				
⌊	Se-KED2	82	95				
⌈	Mo-KED2	95	100				
|	Mo-KED2	97	100				
|	Mo-KED2	98	100				
|	Cd-KED2	111	98				
|	Cd-KED2	114	99				
⌊>	In-KED2	115		101			
⌈>	Rh-KED2	103		101			
|	Ag-KED2	107	98				
⌊	Ag-KED2	109	98				
⌈>	In-KED1	115		103			
|	Sb-KED1	121	98				
|	Sb-KED1	123	97				
|	Ba-KED1	135	98				
⌊	Ba-KED1	137	97				
⌈>	Lu-KED1	175		106			
|	Tl-KED1	203	100				
|	Tl-KED1	205	101				
⌊	Pb-KED1	208	100				
⌈	Mn-STD1	55	106				
⌊>	Ge-STD	72		100			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 15:04:49
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.021
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1209320.8	2.4			ppb
│	Be-KED1	9	6.3	77.9	0.00006	2222.3	ppb
└	Al-KED1	27	1647.4	4.6	0.02309	10.7	ppb
┌	V-KED3	51	4.7	32.7	0.00357	108.6	ppb
│	Cr-KED3	52	4.7	53.9	-0.00028	1513.1	ppb
│	Cr-KED3	53	1.3	173.2	0.00976	341.9	ppb
│	Co-KED3	59	3.7	56.8	-0.00472	33.2	ppb
│	Ni-KED3	60	4.0	50.0	-0.00057	457.4	ppb
│	Ni-KED3	62	0.0		-0.00958	0.0	ppb
│	Cu-KED3	63	16.0	33.1	-0.00053	814.9	ppb
│	Zn-KED3	64	5.9	32.9	0.00971	133.7	ppb
│	Cu-KED3	65	5.0	40.0	0.00178	180.2	ppb
│	Zn-KED3	66	2.7	57.3	-0.01949	72.5	ppb
└>	Ge-KED3	72	28358.5	2.5			ppb
┌>	Ge-KED2	72	152142.2	0.5			ppb
│	As-KED2	75	21.3	21.1	0.00607	307.8	ppb
│	Se-KED2	77	2.0	100.0	-0.07857	286.1	ppb
│	Se-KED2	78	35.0	19.0	0.01431	1667.6	ppb
└	Se-KED2	82	-12.8	86.3	0.56050	134.7	ppb
┌	Mo-KED2	95	9.3	86.6	0.00411	136.8	ppb
│	Mo-KED2	97	4.0	86.6	-0.00005	6857.9	ppb
│	Mo-KED2	98	7.6	77.2	0.00156	145.8	ppb
│	Cd-KED2	111	2.3	24.7	-0.00413	23.3	ppb
│	Cd-KED2	114	5.7	51.8	0.00163	122.3	ppb
└>	In-KED2	115	46883.8	1.9			ppb
┌>	Rh-KED2	103	255363.2	3.1			ppb
│	Ag-KED2	107	45.0	14.6	0.00608	20.0	ppb
└	Ag-KED2	109	45.3	7.7	0.00620	14.1	ppb
┌>	In-KED1	115	564021.9	4.3			ppb
│	Sb-KED1	121	274.7	16.0	0.01625	19.1	ppb
│	Sb-KED1	123	201.5	14.1	0.01599	23.8	ppb
│	Ba-KED1	135	18.0	0.0	0.00051	38.3	ppb
└	Ba-KED1	137	16.7	66.1	0.00076	231.6	ppb
┌>	Lu-KED1	175	656066.0	2.9			ppb
│	Tl-KED1	203	31.3	31.5	-0.00272	32.2	ppb
│	Tl-KED1	205	82.0	14.6	-0.00183	27.2	ppb
└	Pb-KED1	208	42.0	8.2	-0.00014	72.3	ppb
┌	Mn-STD1	55	1770.1	4.1	0.00625	9.8	ppb
└>	Ge-STD	72	1785811.1	3.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		96			
⌈>	Ge-KED2	72		101			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		100			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		100			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-005
Sample Date/Time: Wednesday, September 07, 2016 15:09:42
Sample Description: 5
Autosampler Position: 308
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-005.022
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1178504.9	2.2			ppb
|	Be-KED1	9	8.0	12.5	0.00057	45.5	ppb
⌊	Al-KED1	27	2339654.3	0.6	70.25264	2.1	ppb
⌈	V-KED3	51	501.3	2.1	1.18778	1.5	ppb
|	Cr-KED3	52	1138.4	5.3	1.90370	5.7	ppb
|	Cr-KED3	53	132.0	12.0	1.91088	13.7	ppb
|	Co-KED3	59	93.0	6.0	0.06106	8.4	ppb
|	Ni-KED3	60	648.0	11.1	0.78737	12.7	ppb
|	Ni-KED3	62	64.7	18.1	0.93565	17.7	ppb
|	Cu-KED3	63	44288.6	2.0	34.23842	1.3	ppb
|	Zn-KED3	64	59965.5	1.0	366.91612	1.1	ppb
|	Cu-KED3	65	22867.0	1.7	33.83723	3.1	ppb
|	Zn-KED3	66	38778.2	1.5	347.41547	1.3	ppb
⌊>	Ge-KED3	72	28909.6	1.5			ppb
⌈>	Ge-KED2	72	151675.1	1.6			ppb
|	As-KED2	75	314.3	4.9	1.23346	5.1	ppb
|	Se-KED2	77	662.0	1.5	74.62227	0.8	ppb
|	Se-KED2	78	2015.3	3.6	71.63309	2.3	ppb
⌊	Se-KED2	82	989.9	6.8	69.06380	6.1	ppb
⌈	Mo-KED2	95	9549.2	1.2	6.50160	0.6	ppb
|	Mo-KED2	97	6068.0	2.0	6.24285	1.4	ppb
|	Mo-KED2	98	16207.3	1.5	6.44058	0.9	ppb
|	Cd-KED2	111	15.3	46.3	0.01605	68.9	ppb
|	Cd-KED2	114	27.0	22.8	0.01563	25.3	ppb
⌊>	In-KED2	115	46638.0	0.7			ppb
⌈>	Rh-KED2	103	251546.2	2.0			ppb
|	Ag-KED2	107	2478.2	1.1	0.43502	1.0	ppb
⌊	Ag-KED2	109	2430.9	2.6	0.44331	4.5	ppb
⌈>	In-KED1	115	552521.4	3.4			ppb
|	Sb-KED1	121	812.0	7.7	0.06088	7.0	ppb
|	Sb-KED1	123	621.2	7.7	0.06171	11.8	ppb
|	Ba-KED1	135	14752.3	0.9	3.90231	3.7	ppb
⌊	Ba-KED1	137	24615.2	3.5	3.87318	4.8	ppb
⌈>	Lu-KED1	175	655582.8	4.7			ppb
|	Tl-KED1	203	22.0	24.1	-0.00360	15.0	ppb
|	Tl-KED1	205	61.3	13.6	-0.00270	12.4	ppb
⌊	Pb-KED1	208	1377.4	1.8	0.04278	5.0	ppb
⌈	Mn-STD1	55	723907.0	4.2	18.13383	3.0	ppb
⌊>	Ge-STD	72	1726565.3	2.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		105			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		98			
⌈>	Ge-KED2	72		101			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		99			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		99			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-005D
Sample Date/Time: Wednesday, September 07, 2016 15:14:33
Sample Description: 5
Autosampler Position: 309
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-005D.023
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1216360.1	3.3			ppb
|	Be-KED1	9	14.7	10.4	0.00234	22.2	ppb
⌊	Al-KED1	27	2206016.2	0.7	64.20400	3.4	ppb
⌈	V-KED3	51	479.7	1.0	1.15999	2.0	ppb
|	Cr-KED3	52	1415.7	2.1	2.41924	3.9	ppb
|	Cr-KED3	53	188.7	16.2	2.78047	13.6	ppb
|	Co-KED3	59	97.3	3.3	0.06576	6.8	ppb
|	Ni-KED3	60	767.4	1.6	0.95240	4.6	ppb
|	Ni-KED3	62	84.0	17.2	1.24744	19.0	ppb
|	Cu-KED3	63	45858.8	1.5	36.20996	4.3	ppb
|	Zn-KED3	64	60852.4	1.6	380.09993	2.5	ppb
|	Cu-KED3	65	23874.6	1.1	36.05681	2.2	ppb
|	Zn-KED3	66	39492.5	1.4	361.33275	4.1	ppb
⌊>	Ge-KED3	72	28329.1	3.0			ppb
⌈>	Ge-KED2	72	152535.1	1.2			ppb
|	As-KED2	75	348.0	5.8	1.36611	5.9	ppb
|	Se-KED2	77	641.3	7.7	71.85158	7.0	ppb
|	Se-KED2	78	2032.2	1.3	71.85082	1.7	ppb
⌊	Se-KED2	82	1039.2	4.4	72.06592	5.1	ppb
⌈	Mo-KED2	95	9647.9	1.8	6.57464	0.8	ppb
|	Mo-KED2	97	6351.4	2.5	6.54148	2.8	ppb
|	Mo-KED2	98	16728.5	1.5	6.65379	0.4	ppb
|	Cd-KED2	111	15.0	13.3	0.01553	18.5	ppb
|	Cd-KED2	114	29.5	7.0	0.01734	7.0	ppb
⌊>	In-KED2	115	46595.6	1.0			ppb
⌈>	Rh-KED2	103	248816.5	0.5			ppb
|	Ag-KED2	107	2626.2	0.6	0.46614	1.1	ppb
⌊	Ag-KED2	109	2407.5	1.1	0.44361	0.6	ppb
⌈>	In-KED1	115	568261.3	5.2			ppb
|	Sb-KED1	121	806.7	3.4	0.05880	8.9	ppb
|	Sb-KED1	123	596.3	10.0	0.05700	6.1	ppb
|	Ba-KED1	135	14089.6	3.4	3.62298	2.1	ppb
⌊	Ba-KED1	137	23104.7	4.4	3.53347	1.9	ppb
⌈>	Lu-KED1	175	667936.6	2.1			ppb
|	Tl-KED1	203	27.3	22.4	-0.00314	18.3	ppb
|	Tl-KED1	205	67.3	9.5	-0.00250	11.0	ppb
⌊	Pb-KED1	208	1458.7	4.4	0.04445	3.1	ppb
⌈	Mn-STD1	55	826455.8	2.1	19.88156	5.4	ppb
⌊>	Ge-STD	72	1800495.5	3.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		96			
⌈>	Ge-KED2	72		101			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		98			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		105			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		104			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-005L
Sample Date/Time: Wednesday, September 07, 2016 15:19:23
Sample Description: 25
Autosampler Position: 310
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-005L.024
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1232144.9	1.1			ppb
|	Be-KED1	9	6.7	75.5	0.00011	1217.4	ppb
⌊	Al-KED1	27	474449.2	2.8	13.60181	2.6	ppb
⌈	V-KED3	51	92.7	2.7	0.21220	3.3	ppb
|	Cr-KED3	52	242.7	11.7	0.39668	9.6	ppb
|	Cr-KED3	53	24.7	30.7	0.34898	33.5	ppb
|	Co-KED3	59	19.3	24.4	0.00665	48.5	ppb
|	Ni-KED3	60	144.0	9.6	0.16941	7.8	ppb
|	Ni-KED3	62	9.3	81.1	0.12797	89.8	ppb
|	Cu-KED3	63	8876.8	1.0	6.82226	2.8	ppb
|	Zn-KED3	64	11163.9	2.3	67.96152	1.0	ppb
|	Cu-KED3	65	4457.7	2.3	6.55864	0.7	ppb
|	Zn-KED3	66	7123.1	2.3	63.48519	2.0	ppb
⌊>	Ge-KED3	72	29047.8	2.6			ppb
⌈>	Ge-KED2	72	154159.7	0.5			ppb
|	As-KED2	75	75.3	13.0	0.22754	18.4	ppb
|	Se-KED2	77	107.3	15.5	11.65159	16.3	ppb
|	Se-KED2	78	382.6	2.6	12.36747	3.1	ppb
⌊	Se-KED2	82	161.1	19.3	12.26263	16.6	ppb
⌈	Mo-KED2	95	1754.8	3.1	1.18696	3.4	ppb
|	Mo-KED2	97	1153.4	3.2	1.17733	3.0	ppb
|	Mo-KED2	98	3076.7	3.8	1.21540	4.0	ppb
|	Cd-KED2	111	4.7	65.5	-0.00054	862.3	ppb
|	Cd-KED2	114	11.9	24.4	0.00570	33.2	ppb
⌊>	In-KED2	115	46874.6	0.3			ppb
⌈>	Rh-KED2	103	255396.2	1.1			ppb
|	Ag-KED2	107	535.0	5.3	0.09111	5.1	ppb
⌊	Ag-KED2	109	513.3	3.0	0.09060	4.0	ppb
⌈>	In-KED1	115	572205.3	0.4			ppb
|	Sb-KED1	121	202.7	19.7	0.01026	30.9	ppb
|	Sb-KED1	123	127.0	17.0	0.00783	29.3	ppb
|	Ba-KED1	135	2937.6	2.9	0.74644	3.3	ppb
⌊	Ba-KED1	137	5116.9	3.4	0.77534	3.0	ppb
⌈>	Lu-KED1	175	669286.5	1.4			ppb
|	Tl-KED1	203	11.3	56.7	-0.00465	13.3	ppb
|	Tl-KED1	205	23.3	38.7	-0.00432	8.4	ppb
⌊	Pb-KED1	208	339.3	4.5	0.00918	4.5	ppb
⌈	Mn-STD1	55	161232.1	4.7	3.77623	4.5	ppb
⌊>	Ge-STD	72	1832834.3	2.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		110			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		99			
⌈>	Ge-KED2	72		102			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		100			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		102			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		106			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		106			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-005A
Sample Date/Time: Wednesday, September 07, 2016 15:24:14
Sample Description: 5 +50ppb +10ppb Ag
Autosampler Position: 311
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-005A.025
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1191054.2	1.7			ppb
│	Be-KED1	9	197354.0	1.1	55.26896	2.2	ppb
└	Al-KED1	27	4147497.4	0.9	123.22684	1.7	ppb
┌	V-KED3	51	22837.9	1.6	54.91168	1.1	ppb
│	Cr-KED3	52	32180.9	1.1	54.48312	1.1	ppb
│	Cr-KED3	53	3825.8	2.4	56.04920	3.1	ppb
│	Co-KED3	59	70585.6	1.3	52.40845	0.4	ppb
│	Ni-KED3	60	43166.5	0.8	53.20432	1.6	ppb
│	Ni-KED3	62	3626.5	2.1	53.47889	2.8	ppb
│	Cu-KED3	63	111641.9	0.4	87.05667	0.7	ppb
│	Zn-KED3	64	68397.7	1.1	421.99252	0.3	ppb
│	Cu-KED3	65	57066.1	0.6	85.14412	1.5	ppb
│	Zn-KED3	66	43844.9	1.5	396.13317	2.1	ppb
└>	Ge-KED3	72	28668.4	0.9			ppb
┌>	Ge-KED2	72	152992.2	0.7			ppb
│	As-KED2	75	13598.8	0.4	56.37614	0.7	ppb
│	Se-KED2	77	1150.0	3.1	128.72307	2.7	ppb
│	Se-KED2	78	3670.9	1.2	130.39528	1.5	ppb
└	Se-KED2	82	1790.6	3.8	122.71889	3.1	ppb
┌	Mo-KED2	95	85416.6	0.9	57.61941	2.1	ppb
│	Mo-KED2	97	56472.8	2.2	57.58778	3.4	ppb
│	Mo-KED2	98	145752.2	0.5	57.37973	2.0	ppb
│	Cd-KED2	111	34625.2	0.6	53.17392	0.9	ppb
│	Cd-KED2	114	81643.9	0.7	53.24454	1.5	ppb
└>	In-KED2	115	47097.1	1.5			ppb
┌>	Rh-KED2	103	250245.9	0.9			ppb
│	Ag-KED2	107	57390.7	0.8	10.16482	1.5	ppb
└	Ag-KED2	109	55323.6	0.6	10.17954	0.4	ppb
┌>	In-KED1	115	569316.4	4.5			ppb
│	Sb-KED1	121	677322.3	1.6	54.07176	4.7	ppb
│	Sb-KED1	123	514665.4	1.2	53.87560	4.0	ppb
│	Ba-KED1	135	208578.8	2.2	53.59243	2.3	ppb
└	Ba-KED1	137	348724.2	1.4	53.28971	3.3	ppb
┌>	Lu-KED1	175	668596.2	0.5			ppb
│	Tl-KED1	203	514982.9	1.3	48.70524	1.7	ppb
│	Tl-KED1	205	1171144.6	2.4	48.23538	2.5	ppb
└	Pb-KED1	208	1561821.2	1.1	49.14216	0.7	ppb
┌	Mn-STD1	55	2842245.3	2.9	66.76169	0.6	ppb
└>	Ge-STD	72	1844333.5	3.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		102			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		101			
⌈>	Rh-KED2	103		98			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		106			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		106			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-005S
Sample Date/Time: Wednesday, September 07, 2016 15:29:03
Sample Description: 5
Autosampler Position: 312
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-005S.026
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1208497.7	4.5			ppb
	Be-KED1	9	37134.9	0.2	10.25993	4.5	ppb
	Al-KED1	27	16031720.2	3.3	470.11265	5.7	ppb
	V-KED3	51	42798.4	1.0	103.07749	1.2	ppb
	Cr-KED3	52	24476.0	1.0	41.50176	1.3	ppb
	Cr-KED3	53	3011.7	3.4	44.18249	3.5	ppb
	Co-KED3	59	136691.3	2.0	101.65600	1.6	ppb
	Ni-KED3	60	81906.9	1.9	101.10851	1.9	ppb
	Ni-KED3	62	6905.0	2.7	101.99039	3.0	ppb
	Cu-KED3	63	109431.0	2.2	85.46266	2.1	ppb
	Zn-KED3	64	77231.7	2.2	477.24078	2.0	ppb
	Cu-KED3	65	55741.6	1.6	83.28895	1.3	ppb
	Zn-KED3	66	50446.3	1.6	456.47756	1.9	ppb
>	Ge-KED3	72	28623.3	0.3			ppb
>	Ge-KED2	72	149888.3	1.5			ppb
	As-KED2	75	8810.0	0.5	37.25860	2.1	ppb
	Se-KED2	77	983.4	2.6	112.32813	2.7	ppb
	Se-KED2	78	3118.5	2.4	112.91864	3.1	ppb
	Se-KED2	82	1512.6	4.0	106.05144	4.6	ppb
	Mo-KED2	95	59978.3	1.1	41.55275	2.8	ppb
	Mo-KED2	97	39479.8	0.9	41.33735	1.8	ppb
	Mo-KED2	98	101923.9	1.1	41.20215	1.4	ppb
	Cd-KED2	111	6515.5	0.8	10.27063	2.3	ppb
	Cd-KED2	114	15636.5	2.1	10.47264	3.6	ppb
>	In-KED2	115	45864.8	2.1			ppb
>	Rh-KED2	103	249571.3	2.4			ppb
	Ag-KED2	107	56588.9	0.3	10.05282	2.3	ppb
	Ag-KED2	109	54725.3	1.0	10.10178	3.3	ppb
>	In-KED1	115	571082.0	4.7			ppb
	Sb-KED1	121	1257311.3	0.7	100.08014	4.7	ppb
	Sb-KED1	123	948630.0	2.3	98.98826	3.7	ppb
	Ba-KED1	135	750172.1	3.3	192.12053	1.6	ppb
	Ba-KED1	137	1257008.2	2.4	191.46246	2.6	ppb
>	Lu-KED1	175	673630.0	4.1			ppb
	Tl-KED1	203	64998.2	0.4	6.10296	4.1	ppb
	Tl-KED1	205	149443.8	2.0	6.10962	3.6	ppb
	Pb-KED1	208	2958929.8	1.5	92.47727	2.7	ppb
	Mn-STD1	55	4757575.2	3.0	116.54555	11.7	ppb
>	Ge-STD	72	1781615.3	9.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		100			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		98			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		102			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		106			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610171-02
Sample Date/Time: Wednesday, September 07, 2016 15:33:53
Sample Description: 5
Autosampler Position: 313
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610171-02.027
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1202212.3	2.6			ppb
|	Be-KED1	9	35221.7	3.9	9.76878	2.9	ppb
⌊	Al-KED1	27	13488776.6	3.1	397.04556	1.9	ppb
⌈	V-KED3	51	41615.2	2.2	99.24061	2.7	ppb
|	Cr-KED3	52	23895.3	1.8	40.12987	3.9	ppb
|	Cr-KED3	53	2888.3	5.4	41.95844	5.8	ppb
|	Co-KED3	59	136531.3	0.6	100.54379	1.7	ppb
|	Ni-KED3	60	81696.3	1.6	99.87046	3.0	ppb
|	Ni-KED3	62	6921.0	1.6	101.21023	1.9	ppb
|	Cu-KED3	63	65915.1	2.0	50.95662	0.6	ppb
|	Zn-KED3	64	15842.6	3.0	96.88424	1.1	ppb
|	Cu-KED3	65	33498.6	1.1	49.57320	3.3	ppb
|	Zn-KED3	66	10616.3	1.0	95.08111	1.8	ppb
⌊>	Ge-KED3	72	28914.9	2.3			ppb
⌈>	Ge-KED2	72	150925.7	0.3			ppb
|	As-KED2	75	7942.9	2.2	33.34603	2.4	ppb
|	Se-KED2	77	268.7	0.4	30.25389	0.4	ppb
|	Se-KED2	78	930.4	0.6	32.57346	0.4	ppb
⌊	Se-KED2	82	450.5	4.0	32.36879	3.6	ppb
⌈	Mo-KED2	95	49219.3	0.9	33.66075	1.9	ppb
|	Mo-KED2	97	31914.3	1.2	32.99039	2.1	ppb
|	Mo-KED2	98	84008.9	1.5	33.52447	0.4	ppb
|	Cd-KED2	111	6353.4	2.0	9.88457	0.1	ppb
|	Cd-KED2	114	14930.5	0.6	9.87030	1.4	ppb
⌊>	In-KED2	115	46454.5	1.8			ppb
⌈>	Rh-KED2	103	258000.6	0.6			ppb
|	Ag-KED2	107	56258.2	1.8	9.66465	2.2	ppb
⌊	Ag-KED2	109	54186.9	0.9	9.67036	0.5	ppb
⌈>	In-KED1	115	582432.4	2.8			ppb
|	Sb-KED1	121	1230131.3	2.8	95.86793	0.2	ppb
|	Sb-KED1	123	938071.1	1.2	95.90896	1.6	ppb
|	Ba-KED1	135	740562.9	1.1	185.93934	1.7	ppb
⌊	Ba-KED1	137	1232641.6	2.4	183.98011	1.7	ppb
⌈>	Lu-KED1	175	662245.7	2.1			ppb
|	Tl-KED1	203	67484.4	1.2	6.43938	1.3	ppb
|	Tl-KED1	205	154077.8	0.2	6.40401	2.2	ppb
⌊	Pb-KED1	208	3038480.0	2.0	96.56799	3.6	ppb
⌈	Mn-STD1	55	4225398.0	1.4	104.50951	1.5	ppb
⌊>	Ge-STD	72	1752133.9	2.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		98			
⌈>	Ge-KED2	72		100			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		99			
⌈>	Rh-KED2	103		101			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		104			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		105			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: MO STD
Sample Date/Time: Wednesday, September 07, 2016 15:38:45
Sample Description:
Autosampler Position: 7
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\MO STD.028
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1112753.7	4.6			ppb
	Be-KED1	9	9.3	34.4	0.00114	97.1	ppb
	Al-KED1	27	11897.0	2.6	0.35352	3.4	ppb
	V-KED3	51	6.0	50.0	0.00633	107.0	ppb
	Cr-KED3	52	4.3	35.3	-0.00099	250.1	ppb
	Cr-KED3	53	2.7	43.3	0.02898	55.0	ppb
	Co-KED3	59	8.0	12.5	-0.00158	59.0	ppb
	Ni-KED3	60	15.3	65.7	0.01288	91.9	ppb
	Ni-KED3	62	0.7	173.2	-0.00004	46970.1	ppb
	Cu-KED3	63	27.3	15.2	0.00789	34.5	ppb
	Zn-KED3	64	27.5	7.9	0.14100	13.6	ppb
	Cu-KED3	65	12.7	25.4	0.01297	40.0	ppb
	Zn-KED3	66	16.0	43.8	0.10060	68.5	ppb
>	Ge-KED3	72	28977.4	3.5			ppb
>	Ge-KED2	72	153088.3	1.4			ppb
	As-KED2	75	35.3	8.2	0.06354	16.3	ppb
	Se-KED2	77	3.3	34.6	0.07079	188.2	ppb
	Se-KED2	78	37.5	9.6	0.09431	151.1	ppb
	Se-KED2	82	-12.1	59.9	0.61254	81.2	ppb
	Mo-KED2	95	89985.2	0.8	62.10522	1.2	ppb
	Mo-KED2	97	58982.8	0.5	61.53628	1.7	ppb
	Mo-KED2	98	152254.8	1.6	61.31910	0.2	ppb
	Cd-KED2	111	22.0	32.8	0.02686	42.9	ppb
	Cd-KED2	114	41.8	19.7	0.02581	22.6	ppb
>	In-KED2	115	46029.4	1.7			ppb
>	Rh-KED2	103	253904.6	3.2			ppb
	Ag-KED2	107	75.0	12.7	0.01133	11.8	ppb
	Ag-KED2	109	76.0	16.0	0.01183	20.9	ppb
>	In-KED1	115	554905.5	2.8			ppb
	Sb-KED1	121	1449.4	4.5	0.11281	5.5	ppb
	Sb-KED1	123	1167.0	3.6	0.11982	2.6	ppb
	Ba-KED1	135	40.7	19.9	0.00654	30.9	ppb
	Ba-KED1	137	76.7	8.4	0.01018	13.3	ppb
>	Lu-KED1	175	622843.6	0.6			ppb
	Tl-KED1	203	1847.5	3.9	0.18183	3.5	ppb
	Tl-KED1	205	4278.6	0.9	0.18390	0.3	ppb
	Pb-KED1	208	284.0	3.2	0.00811	3.3	ppb
	Mn-STD1	55	1480.7	3.7	0.00125	149.7	ppb
>	Ge-STD	72	1692108.3	2.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		100			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		98			
┌>	Ge-KED2	72		102			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		98			
┌>	Rh-KED2	103		100			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		99			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		98			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		97			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-006
Sample Date/Time: Wednesday, September 07, 2016 15:43:37
Sample Description: 5
Autosampler Position: 314
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-006.029
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1171124.3	2.5			ppb
	Be-KED1	9	30.7	22.9	0.00707	31.1	ppb
	Al-KED1	27	6275252.0	3.4	189.73840	5.2	ppb
	V-KED3	51	7665.7	2.0	18.73487	2.4	ppb
	Cr-KED3	52	704.7	2.5	1.20497	3.1	ppb
	Cr-KED3	53	98.7	17.2	1.46067	17.8	ppb
	Co-KED3	59	167.7	3.3	0.11911	3.3	ppb
	Ni-KED3	60	401.3	5.9	0.49743	6.6	ppb
	Ni-KED3	62	27.3	8.4	0.40004	7.6	ppb
	Cu-KED3	63	37737.8	3.5	29.91230	4.0	ppb
	Zn-KED3	64	55351.6	0.6	347.20132	1.1	ppb
	Cu-KED3	65	19280.3	0.5	29.24164	1.5	ppb
	Zn-KED3	66	35676.2	1.2	327.69360	2.1	ppb
>	Ge-KED3	72	28199.5	1.0			ppb
>	Ge-KED2	72	150031.5	1.2			ppb
	As-KED2	75	549.0	1.8	2.24184	3.1	ppb
	Se-KED2	77	686.0	1.3	78.18881	1.0	ppb
	Se-KED2	78	2102.9	3.2	75.67032	4.2	ppb
	Se-KED2	82	991.8	2.5	69.96832	3.6	ppb
	Mo-KED2	95	3741.8	4.2	2.60662	5.1	ppb
	Mo-KED2	97	2430.9	4.4	2.55756	5.1	ppb
	Mo-KED2	98	6401.7	0.8	2.60259	0.8	ppb
	Cd-KED2	111	2970.6	0.8	4.70728	1.4	ppb
	Cd-KED2	114	6977.0	0.2	4.69997	1.4	ppb
>	In-KED2	115	45575.5	1.2			ppb
>	Rh-KED2	103	244485.5	1.2			ppb
	Ag-KED2	107	4474.7	1.2	0.80955	0.4	ppb
	Ag-KED2	109	4389.7	1.6	0.82486	0.4	ppb
>	In-KED1	115	550918.8	4.7			ppb
	Sb-KED1	121	734.0	7.9	0.05461	3.6	ppb
	Sb-KED1	123	583.7	5.3	0.05768	1.1	ppb
	Ba-KED1	135	65479.1	2.4	17.38553	2.9	ppb
	Ba-KED1	137	110633.0	2.9	17.48933	7.0	ppb
>	Lu-KED1	175	641417.0	1.6			ppb
	Tl-KED1	203	76.7	6.6	0.00183	20.4	ppb
	Tl-KED1	205	172.0	12.3	0.00212	47.5	ppb
	Pb-KED1	208	18846.1	1.4	0.61682	2.7	ppb
	Mn-STD1	55	1740901.6	1.3	43.16700	1.4	ppb
>	Ge-STD	72	1746476.8	1.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		105			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		96			
⌈>	Ge-KED2	72		100			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		96			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		101			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-007
Sample Date/Time: Wednesday, September 07, 2016 15:48:27
Sample Description: 5
Autosampler Position: 315
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-007.030
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1173971.2	2.4			ppb
	Be-KED1	9	43.7	9.3	0.01072	12.1	ppb
	Al-KED1	27	7810506.0	2.7	235.41672	0.8	ppb
	V-KED3	51	1572.8	1.1	3.80139	0.8	ppb
	Cr-KED3	52	1242.1	3.1	2.10977	2.8	ppb
	Cr-KED3	53	152.0	18.6	2.23269	18.4	ppb
	Co-KED3	59	206.3	2.0	0.14684	1.7	ppb
	Ni-KED3	60	654.7	3.7	0.80714	3.9	ppb
	Ni-KED3	62	62.7	9.2	0.92147	9.7	ppb
	Cu-KED3	63	16524.2	1.2	12.96556	0.8	ppb
	Zn-KED3	64	21246.0	1.0	132.00102	0.6	ppb
	Cu-KED3	65	8402.8	3.3	12.62195	3.6	ppb
	Zn-KED3	66	13718.3	1.9	124.79422	2.2	ppb
>	Ge-KED3	72	28464.7	0.4			ppb
>	Ge-KED2	72	146879.4	1.9			ppb
	As-KED2	75	362.0	9.6	1.48451	11.8	ppb
	Se-KED2	77	547.3	1.5	63.69241	3.4	ppb
	Se-KED2	78	1691.1	1.5	61.92581	1.3	ppb
	Se-KED2	82	791.9	5.7	57.28907	4.0	ppb
	Mo-KED2	95	6303.4	2.8	4.54359	5.4	ppb
	Mo-KED2	97	4019.9	2.2	4.37773	4.8	ppb
	Mo-KED2	98	10908.1	0.6	4.58734	2.6	ppb
	Cd-KED2	111	189.7	2.4	0.30365	4.5	ppb
	Cd-KED2	114	437.5	3.9	0.30293	6.2	ppb
>	In-KED2	115	44090.7	3.1			ppb
>	Rh-KED2	103	240699.3	0.9			ppb
	Ag-KED2	107	671.7	5.2	0.12199	6.0	ppb
	Ag-KED2	109	613.0	6.3	0.11530	6.5	ppb
>	In-KED1	115	534428.7	0.8			ppb
	Sb-KED1	121	2212.2	0.5	0.18209	0.3	ppb
	Sb-KED1	123	1760.8	4.3	0.19073	3.6	ppb
	Ba-KED1	135	99643.8	2.9	27.25114	2.3	ppb
	Ba-KED1	137	167231.3	1.5	27.19554	0.9	ppb
>	Lu-KED1	175	648512.5	2.4			ppb
	Tl-KED1	203	40.0	10.0	-0.00182	26.6	ppb
	Tl-KED1	205	87.3	33.2	-0.00158	74.7	ppb
	Pb-KED1	208	5610.4	1.8	0.18054	1.1	ppb
	Mn-STD1	55	1169509.0	5.4	33.00466	1.8	ppb
>	Ge-STD	72	1534696.3	6.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		105			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		98			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		95			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		88			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608059-008
Sample Date/Time: Wednesday, September 07, 2016 15:53:17
Sample Description: 5
Autosampler Position: 316
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608059-008.031
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1176862.6	1.4			ppb
│	Be-KED1	9	44.0	8.2	0.01078	9.1	ppb
└	Al-KED1	27	9944803.4	3.1	298.98002	1.8	ppb
┌	V-KED3	51	805.4	4.5	1.93679	5.1	ppb
│	Cr-KED3	52	1358.7	1.9	2.30162	2.6	ppb
│	Cr-KED3	53	169.3	18.1	2.48346	19.0	ppb
│	Co-KED3	59	414.0	6.5	0.30128	7.4	ppb
│	Ni-KED3	60	1626.8	4.2	2.00683	3.4	ppb
│	Ni-KED3	62	154.7	7.9	2.28138	8.8	ppb
│	Cu-KED3	63	28759.6	0.7	22.50280	0.4	ppb
│	Zn-KED3	64	35691.9	0.5	221.06625	1.3	ppb
│	Cu-KED3	65	14896.4	3.0	22.30596	2.9	ppb
│	Zn-KED3	66	23251.6	1.6	210.87340	2.3	ppb
└>	Ge-KED3	72	28557.9	0.9			ppb
┌>	Ge-KED2	72	149503.0	1.2			ppb
│	As-KED2	75	207.0	4.0	0.79629	3.1	ppb
│	Se-KED2	77	485.3	7.4	55.43996	7.9	ppb
│	Se-KED2	78	1595.6	1.3	57.31551	2.4	ppb
└	Se-KED2	82	784.5	5.0	55.80899	4.1	ppb
┌	Mo-KED2	95	3819.8	0.2	2.65695	1.6	ppb
│	Mo-KED2	97	2518.2	6.6	2.64790	8.3	ppb
│	Mo-KED2	98	6541.2	3.3	2.65510	1.6	ppb
│	Cd-KED2	111	583.0	5.7	0.91706	7.4	ppb
│	Cd-KED2	114	1333.0	3.7	0.89524	4.8	ppb
└>	In-KED2	115	45638.1	1.8			ppb
┌>	Rh-KED2	103	249712.0	1.8			ppb
│	Ag-KED2	107	1345.7	2.9	0.23725	4.3	ppb
└	Ag-KED2	109	1323.1	1.0	0.24205	1.4	ppb
┌>	In-KED1	115	558261.7	3.2			ppb
│	Sb-KED1	121	929.4	5.6	0.06978	6.3	ppb
│	Sb-KED1	123	741.7	6.4	0.07385	9.8	ppb
│	Ba-KED1	135	51801.8	1.5	13.57267	4.2	ppb
└	Ba-KED1	137	86912.7	5.0	13.53328	4.8	ppb
┌>	Lu-KED1	175	652937.4	2.8			ppb
│	Tl-KED1	203	55.3	4.2	-0.00037	53.1	ppb
│	Tl-KED1	205	108.7	17.0	-0.00070	102.4	ppb
└	Pb-KED1	208	11974.6	3.4	0.38441	2.9	ppb
┌	Mn-STD1	55	1221275.0	3.6	29.97783	3.4	ppb
└>	Ge-STD	72	1763402.1	0.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		105			
⎢	Be-KED1	9					
⎣	Al-KED1	27					
⎡	V-KED3	51					
⎢	Cr-KED3	52					
⎢	Cr-KED3	53					
⎢	Co-KED3	59					
⎢	Ni-KED3	60					
⎢	Ni-KED3	62					
⎢	Cu-KED3	63					
⎢	Zn-KED3	64					
⎢	Cu-KED3	65					
⎢	Zn-KED3	66					
⎣>	Ge-KED3	72		97			
⎡>	Ge-KED2	72		99			
⎢	As-KED2	75					
⎢	Se-KED2	77					
⎢	Se-KED2	78					
⎣	Se-KED2	82					
⎡	Mo-KED2	95					
⎢	Mo-KED2	97					
⎢	Mo-KED2	98					
⎢	Cd-KED2	111					
⎢	Cd-KED2	114					
⎣>	In-KED2	115		98			
⎡>	Rh-KED2	103		98			
⎢	Ag-KED2	107					
⎣	Ag-KED2	109					
⎡>	In-KED1	115		99			
⎢	Sb-KED1	121					
⎢	Sb-KED1	123					
⎢	Ba-KED1	135					
⎣	Ba-KED1	137					
⎡>	Lu-KED1	175		103			
⎢	Tl-KED1	203					
⎢	Tl-KED1	205					
⎣	Pb-KED1	208					
⎡	Mn-STD1	55					
⎣>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 15:58:09
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.032
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1200782.8	2.1			ppb
	Be-KED1	9	86959.9	2.0	24.15369	2.1	ppb
	Al-KED1	27	844189.5	3.5	24.85679	3.3	ppb
	V-KED3	51	10217.3	1.6	25.24957	1.0	ppb
	Cr-KED3	52	14504.0	2.0	25.24825	4.0	ppb
	Cr-KED3	53	1672.1	2.0	25.17784	3.1	ppb
	Co-KED3	59	33399.7	2.7	25.48373	0.6	ppb
	Ni-KED3	60	19896.5	1.9	25.20173	0.7	ppb
	Ni-KED3	62	1648.1	2.5	24.97701	2.6	ppb
	Cu-KED3	63	31824.8	2.1	25.50401	2.8	ppb
	Zn-KED3	64	3999.8	1.0	25.34510	1.7	ppb
	Cu-KED3	65	16549.6	0.9	25.38264	2.6	ppb
	Zn-KED3	66	2678.6	2.6	24.82962	0.9	ppb
>	Ge-KED3	72	27893.2	2.4			ppb
>	Ge-KED2	72	145194.9	1.3			ppb
	As-KED2	75	5790.5	0.6	25.25050	1.1	ppb
	Se-KED2	77	226.0	2.3	26.41368	1.3	ppb
	Se-KED2	78	696.6	3.8	25.06840	2.7	ppb
	Se-KED2	82	318.5	13.1	24.15102	11.3	ppb
	Mo-KED2	95	35048.9	1.4	24.94248	0.8	ppb
	Mo-KED2	97	23100.0	1.4	24.84832	1.4	ppb
	Mo-KED2	98	60719.9	2.1	25.21773	1.4	ppb
	Cd-KED2	111	15290.2	2.0	24.77099	1.5	ppb
	Cd-KED2	114	36387.7	1.2	25.03693	0.8	ppb
>	In-KED2	115	44631.2	0.7			ppb
>	Rh-KED2	103	244315.5	0.5			ppb
	Ag-KED2	107	135321.0	1.3	24.55044	1.4	ppb
	Ag-KED2	109	130498.6	2.4	24.59855	2.7	ppb
>	In-KED1	115	566766.5	3.2			ppb
	Sb-KED1	121	302700.5	1.6	24.25003	2.6	ppb
	Sb-KED1	123	231978.1	1.1	24.37295	2.1	ppb
	Ba-KED1	135	92437.0	3.3	23.83905	0.6	ppb
	Ba-KED1	137	155581.9	3.4	23.86364	2.8	ppb
>	Lu-KED1	175	657304.6	2.3			ppb
	Tl-KED1	203	257172.5	2.6	24.73868	2.1	ppb
	Tl-KED1	205	591144.1	2.6	24.76158	0.9	ppb
	Pb-KED1	208	761724.9	1.5	24.38335	1.6	ppb
	Mn-STD1	55	1058290.4	2.1	27.79030	1.7	ppb
>	Ge-STD	72	1648211.9	0.8			ppb

JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		107			
|	Be-KED1	9	97				
⎣	Al-KED1	27	99				
⎡	V-KED3	51	101				
|	Cr-KED3	52	101				
|	Cr-KED3	53	101				
|	Co-KED3	59	102				
|	Ni-KED3	60	101				
|	Ni-KED3	62	100				
|	Cu-KED3	63	102				
|	Zn-KED3	64	101				
|	Cu-KED3	65	102				
|	Zn-KED3	66	99				
⎣>	Ge-KED3	72		95			
⎡>	Ge-KED2	72		96			
|	As-KED2	75	101				
|	Se-KED2	77	106				
|	Se-KED2	78	100				
⎣	Se-KED2	82	97				
⎡	Mo-KED2	95	100				
|	Mo-KED2	97	99				
|	Mo-KED2	98	101				
|	Cd-KED2	111	99				
|	Cd-KED2	114	100				
⎣>	In-KED2	115		95			
⎡>	Rh-KED2	103		96			
|	Ag-KED2	107	98				
⎣	Ag-KED2	109	98				
⎡>	In-KED1	115		101			
|	Sb-KED1	121	97				
|	Sb-KED1	123	97				
|	Ba-KED1	135	95				
⎣	Ba-KED1	137	95				
⎡>	Lu-KED1	175		104			
|	Tl-KED1	203	99				
|	Tl-KED1	205	99				
⎣	Pb-KED1	208	98				
⎡	Mn-STD1	55	111				
⎣>	Ge-STD	72		95			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 16:02:39
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.033
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1185958.7	5.8			ppb
|	Be-KED1	9	86392.3	5.5	24.29449	0.4	ppb
⌊	Al-KED1	27	823291.9	6.4	24.53824	1.7	ppb
⌈	V-KED3	51	9962.8	0.5	24.70144	0.8	ppb
|	Cr-KED3	52	14104.6	1.6	24.62190	1.4	ppb
|	Cr-KED3	53	1698.8	5.3	25.66143	5.7	ppb
|	Co-KED3	59	32770.2	0.5	25.08976	0.0	ppb
|	Ni-KED3	60	19949.9	1.8	25.35259	1.3	ppb
|	Ni-KED3	62	1738.1	6.2	26.42311	5.9	ppb
|	Cu-KED3	63	31231.4	1.2	25.10655	1.4	ppb
|	Zn-KED3	64	3858.6	3.3	24.52843	3.6	ppb
|	Cu-KED3	65	16412.8	1.7	25.24796	1.3	ppb
|	Zn-KED3	66	2630.6	2.0	24.46732	1.9	ppb
⌊>	Ge-KED3	72	27798.0	0.5			ppb
⌈>	Ge-KED2	72	144426.2	1.6			ppb
|	As-KED2	75	5642.8	2.3	24.73333	1.7	ppb
|	Se-KED2	77	187.3	9.9	21.98817	11.7	ppb
|	Se-KED2	78	651.6	3.0	23.50475	2.7	ppb
⌊	Se-KED2	82	285.8	9.3	21.96913	10.1	ppb
⌈	Mo-KED2	95	34973.4	2.1	25.53104	0.8	ppb
|	Mo-KED2	97	22532.4	1.0	24.86642	1.5	ppb
|	Mo-KED2	98	59235.5	1.4	25.23875	0.6	ppb
|	Cd-KED2	111	15059.9	0.7	25.03173	1.1	ppb
|	Cd-KED2	114	35530.6	0.4	25.08217	1.4	ppb
⌊>	In-KED2	115	43508.3	1.6			ppb
⌈>	Rh-KED2	103	239029.5	3.2			ppb
|	Ag-KED2	107	132645.0	3.1	24.59692	0.2	ppb
⌊	Ag-KED2	109	127834.3	2.6	24.63125	0.9	ppb
⌈>	In-KED1	115	553275.7	3.6			ppb
|	Sb-KED1	121	297666.2	3.4	24.42761	3.5	ppb
|	Sb-KED1	123	228819.6	3.3	24.62194	2.1	ppb
|	Ba-KED1	135	90485.4	4.5	23.90007	0.8	ppb
⌊	Ba-KED1	137	149759.1	4.2	23.52293	1.4	ppb
⌈>	Lu-KED1	175	627626.4	5.4			ppb
|	Tl-KED1	203	248507.8	3.4	25.05323	2.5	ppb
|	Tl-KED1	205	575798.7	3.7	25.27979	2.8	ppb
⌊	Pb-KED1	208	754631.1	4.3	25.30542	1.9	ppb
⌈	Mn-STD1	55	1035213.1	1.8	26.25832	3.9	ppb
⌊>	Ge-STD	72	1707233.9	2.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		106			
⎢	Be-KED1	9	97				
⎣	Al-KED1	27	98				
⎡	V-KED3	51	99				
⎢	Cr-KED3	52	98				
⎢	Cr-KED3	53	103				
⎢	Co-KED3	59	100				
⎢	Ni-KED3	60	101				
⎢	Ni-KED3	62	106				
⎢	Cu-KED3	63	100				
⎢	Zn-KED3	64	98				
⎢	Cu-KED3	65	101				
⎢	Zn-KED3	66	98				
⎣>	Ge-KED3	72		94			
⎡>	Ge-KED2	72		96			
⎢	As-KED2	75	99				
⎢	Se-KED2	77	88				
⎢	Se-KED2	78	94				
⎣	Se-KED2	82	88				
⎡	Mo-KED2	95	102				
⎢	Mo-KED2	97	99				
⎢	Mo-KED2	98	101				
⎢	Cd-KED2	111	100				
⎢	Cd-KED2	114	100				
⎣>	In-KED2	115		93			
⎡>	Rh-KED2	103		94			
⎢	Ag-KED2	107	98				
⎣	Ag-KED2	109	99				
⎡>	In-KED1	115		98			
⎢	Sb-KED1	121	98				
⎢	Sb-KED1	123	98				
⎢	Ba-KED1	135	96				
⎣	Ba-KED1	137	94				
⎡>	Lu-KED1	175		99			
⎢	Tl-KED1	203	100				
⎢	Tl-KED1	205	101				
⎣	Pb-KED1	208	101				
⎡	Mn-STD1	55	105				
⎣>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Se-KED2	77	Out of Control
QC Std 2	Se-KED2	82	Out of Control

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 16:07:30
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.034
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1152178.8	1.1			ppb
	Be-KED1	9	16.0	70.4	0.00292	109.9	ppb
	Al-KED1	27	1022.0	17.1	0.00622	81.6	ppb
	V-KED3	51	1.7	34.6	-0.00360	40.6	ppb
	Cr-KED3	52	2.0	100.0	-0.00469	75.8	ppb
	Cr-KED3	53	1.3	86.6	0.01101	161.4	ppb
	Co-KED3	59	7.3	41.7	-0.00175	136.1	ppb
	Ni-KED3	60	7.3	31.5	0.00389	76.6	ppb
	Ni-KED3	62	0.7	173.2	0.00075	2388.1	ppb
	Cu-KED3	63	14.0	49.5	-0.00170	333.6	ppb
	Zn-KED3	64	3.1	137.3	-0.00710	385.7	ppb
	Cu-KED3	65	6.7	34.6	0.00463	77.9	ppb
	Zn-KED3	66	3.0	33.3	-0.01552	61.2	ppb
>	Ge-KED3	72	27288.7	0.1			ppb
>	Ge-KED2	72	144230.1	2.6			ppb
	As-KED2	75	22.0	18.2	0.01367	113.2	ppb
	Se-KED2	77	2.7	173.2	0.02305	2458.1	ppb
	Se-KED2	78	34.5	10.0	0.06722	240.0	ppb
	Se-KED2	82	-16.8	25.0	0.22493	136.3	ppb
	Mo-KED2	95	7.3	150.2	0.00310	261.1	ppb
	Mo-KED2	97	5.3	21.7	0.00169	77.4	ppb
	Mo-KED2	98	11.5	47.1	0.00338	67.6	ppb
	Cd-KED2	111	3.3	34.6	-0.00227	85.1	ppb
	Cd-KED2	114	4.9	50.1	0.00127	131.4	ppb
>	In-KED2	115	44236.2	1.8			ppb
>	Rh-KED2	103	241811.7	3.5			ppb
	Ag-KED2	107	40.7	6.2	0.00571	4.8	ppb
	Ag-KED2	109	36.7	31.5	0.00498	42.1	ppb
>	In-KED1	115	547801.0	1.8			ppb
	Sb-KED1	121	329.3	26.1	0.02148	33.5	ppb
	Sb-KED1	123	260.7	15.7	0.02295	19.4	ppb
	Ba-KED1	135	15.3	27.2	-0.00006	1908.7	ppb
	Ba-KED1	137	34.7	31.8	0.00365	48.6	ppb
>	Lu-KED1	175	608390.8	2.6			ppb
	Tl-KED1	203	42.7	51.4	-0.00128	179.8	ppb
	Tl-KED1	205	112.0	50.3	-0.00019	1361.7	ppb
	Pb-KED1	208	96.7	94.5	0.00187	169.9	ppb
	Mn-STD1	55	1682.8	1.3	0.00883	29.3	ppb
>	Ge-STD	72	1604487.4	4.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		96			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		97			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		96			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		92			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: LLCCVT
Sample Date/Time: Wednesday, September 07, 2016 16:12:21
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLCCVT.035
User Name: JDB
Batch ID:

Concentration Results

Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
> Li-KED1	6	1085076.5	1.6			ppb
Be-KED1	9	157.3	31.8	0.04679	34.2	ppb
Al-KED1	27	132191.9	3.4	4.28558	2.1	ppb
V-KED3	51	171.3	8.4	0.42259	10.1	ppb
Cr-KED3	52	249.7	9.0	0.43281	8.6	ppb
Cr-KED3	53	28.0	32.7	0.42014	35.1	ppb
Co-KED3	59	61.0	12.8	0.03987	17.1	ppb
Ni-KED3	60	333.3	9.6	0.42361	11.2	ppb
Ni-KED3	62	28.7	35.8	0.43297	38.1	ppb
Cu-KED3	63	254.7	3.2	0.19420	5.1	ppb
Zn-KED3	64	184.2	14.0	1.16101	15.7	ppb
Cu-KED3	65	137.0	5.1	0.20742	3.6	ppb
Zn-KED3	66	102.0	13.7	0.91929	16.0	ppb
> Ge-KED3	72	27471.7	1.6			ppb
> Ge-KED2	72	144422.8	1.4			ppb
As-KED2	75	256.7	3.9	1.04569	3.2	ppb
Se-KED2	77	12.7	32.9	1.20356	41.6	ppb
Se-KED2	78	91.1	5.4	2.21248	10.7	ppb
Se-KED2	82	5.1	21.5	1.80486	4.6	ppb
Mo-KED2	95	142.7	14.2	0.10056	14.0	ppb
Mo-KED2	97	108.7	14.9	0.11440	16.0	ppb
Mo-KED2	98	235.4	16.3	0.09750	15.5	ppb
Cd-KED2	111	30.3	6.9	0.04204	6.7	ppb
Cd-KED2	114	71.7	12.0	0.04786	11.7	ppb
> In-KED2	115	44058.7	1.3			ppb
> Rh-KED2	103	241411.0	1.6			ppb
Ag-KED2	107	226.7	9.2	0.03985	8.4	ppb
Ag-KED2	109	225.7	7.2	0.04105	6.8	ppb
> In-KED1	115	524864.2	1.5			ppb
Sb-KED1	121	1287.4	5.4	0.10550	4.7	ppb
Sb-KED1	123	1025.5	5.4	0.11102	7.3	ppb
Ba-KED1	135	407.3	5.8	0.10928	5.3	ppb
Ba-KED1	137	672.0	10.8	0.10939	10.3	ppb
> Lu-KED1	175	598356.2	4.7			ppb
Tl-KED1	203	460.7	4.7	0.04310	10.4	ppb
Tl-KED1	205	1071.4	21.8	0.04437	29.1	ppb
Pb-KED1	208	1536.7	31.0	0.05306	36.4	ppb
Mn-STD1	55	6045.9	1.7	0.11794	2.3	ppb
> Ge-STD	72	1695171.5	3.4			ppb

JB 9/8/16

Sample ID: LLCCVT
Report Date/Time: Thursday, September 08, 2016 09:08:33
Page 1

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		97			
│	Be-KED1	9	117				
⌊	Al-KED1	27	107				
⌈	V-KED3	51	106				
│	Cr-KED3	52	108				
│	Cr-KED3	53	105				
│	Co-KED3	59	100				
│	Ni-KED3	60	106				
│	Ni-KED3	62	108				
│	Cu-KED3	63	97				
│	Zn-KED3	64	116				
│	Cu-KED3	65	104				
│	Zn-KED3	66	92				
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		96			
│	As-KED2	75	105				
│	Se-KED2	77	60				
│	Se-KED2	78	111				
⌊	Se-KED2	82	90				
⌈	Mo-KED2	95	101				
│	Mo-KED2	97	114				
│	Mo-KED2	98	97				
│	Cd-KED2	111	105				
│	Cd-KED2	114	120				
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		95			
│	Ag-KED2	107	100				
⌊	Ag-KED2	109	103				
⌈>	In-KED1	115		93			
│	Sb-KED1	121	106				
│	Sb-KED1	123	111				
│	Ba-KED1	135	109				
⌊	Ba-KED1	137	109				
⌈>	Lu-KED1	175		94			
│	Tl-KED1	203	108				
│	Tl-KED1	205	111				
⌊	Pb-KED1	208	133				
⌈	Mn-STD1	55	118				
⌊>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 6	Se-KED2	77	Out of Control
QC Std 6	Pb-KED1	208	Out of Control

LABWORKS - Summary Report

Sample ID: LLCCVT
Sample Date/Time: Wednesday, September 07, 2016 16:16:52
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLCCVT.036
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1158922.0	4.7			ppb
│	Be-KED1	9	149.3	14.4	0.04119	11.4	ppb
⌊	Al-KED1	27	135328.0	4.0	4.10958	3.2	ppb
⌈	V-KED3	51	167.0	8.6	0.41268	8.8	ppb
│	Cr-KED3	52	250.0	5.4	0.43501	5.8	ppb
│	Cr-KED3	53	26.7	33.8	0.40028	35.5	ppb
│	Co-KED3	59	59.3	9.3	0.03868	11.9	ppb
│	Ni-KED3	60	340.0	4.2	0.43323	4.8	ppb
│	Ni-KED3	62	32.7	24.7	0.49477	25.1	ppb
│	Cu-KED3	63	260.7	11.7	0.19975	13.0	ppb
│	Zn-KED3	64	156.0	13.1	0.98101	13.8	ppb
│	Cu-KED3	65	150.3	9.3	0.22906	9.8	ppb
│	Zn-KED3	66	109.7	10.4	0.99283	10.0	ppb
⌊>	Ge-KED3	72	27382.6	0.8			ppb
⌈>	Ge-KED2	72	142125.2	0.8			ppb
│	As-KED2	75	249.7	9.4	1.03343	11.1	ppb
│	Se-KED2	77	18.0	33.3	1.86716	38.2	ppb
│	Se-KED2	78	88.8	8.3	2.17630	11.9	ppb
⌊	Se-KED2	82	1.8	292.2	1.56607	24.7	ppb
⌈	Mo-KED2	95	145.3	2.9	0.10592	2.8	ppb
│	Mo-KED2	97	83.3	28.6	0.09002	31.7	ppb
│	Mo-KED2	98	224.3	7.8	0.09595	6.8	ppb
│	Cd-KED2	111	25.0	24.3	0.03452	27.5	ppb
│	Cd-KED2	114	59.0	8.2	0.04036	7.9	ppb
⌊>	In-KED2	115	42679.6	2.5			ppb
⌈>	Rh-KED2	103	236896.2	3.4			ppb
│	Ag-KED2	107	232.3	6.2	0.04173	5.1	ppb
⌊	Ag-KED2	109	221.7	7.5	0.04106	4.5	ppb
⌈>	In-KED1	115	554257.9	3.8			ppb
│	Sb-KED1	121	1210.7	7.4	0.09334	6.8	ppb
│	Sb-KED1	123	938.9	1.3	0.09557	4.8	ppb
│	Ba-KED1	135	434.0	2.4	0.11037	2.8	ppb
⌊	Ba-KED1	137	685.3	4.4	0.10572	5.8	ppb
⌈>	Lu-KED1	175	628935.6	3.8			ppb
│	Tl-KED1	203	444.7	3.8	0.03906	8.2	ppb
│	Tl-KED1	205	1042.0	3.1	0.04038	4.7	ppb
⌊	Pb-KED1	208	1320.0	4.5	0.04268	3.1	ppb
⌈	Mn-STD1	55	5795.8	2.3	0.12055	3.7	ppb
⌊>	Ge-STD	72	1598025.0	2.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
│	Be-KED1	9	103				
⌊	Al-KED1	27	103				
⌈	V-KED3	51	103				
│	Cr-KED3	52	109				
│	Cr-KED3	53	100				
│	Co-KED3	59	97				
│	Ni-KED3	60	108				
│	Ni-KED3	62	124				
│	Cu-KED3	63	100				
│	Zn-KED3	64	98				
│	Cu-KED3	65	115				
│	Zn-KED3	66	99				
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		94			
│	As-KED2	75	103				
│	Se-KED2	77	93				
│	Se-KED2	78	109				
⌊	Se-KED2	82	78				
⌈	Mo-KED2	95	106				
│	Mo-KED2	97	90				
│	Mo-KED2	98	96				
│	Cd-KED2	111	86				
│	Cd-KED2	114	101				
⌊>	In-KED2	115		91			
⌈>	Rh-KED2	103		93			
│	Ag-KED2	107	104				
⌊	Ag-KED2	109	103				
⌈>	In-KED1	115		99			
│	Sb-KED1	121	93				
│	Sb-KED1	123	96				
│	Ba-KED1	135	110				
⌊	Ba-KED1	137	106				
⌈>	Lu-KED1	175		99			
│	Tl-KED1	203	98				
│	Tl-KED1	205	101				
⌊	Pb-KED1	208	107				
⌈	Mn-STD1	55	121				
⌊>	Ge-STD	72		92			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610557-01
Sample Date/Time: Wednesday, September 07, 2016 16:32:26
Sample Description: 5
Autosampler Position: 317
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610557-01.037
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1113950.2	4.7			ppb
|	Be-KED1	9	8.0	12.5	0.00071	45.3	ppb
⌊	Al-KED1	27	190120.5	2.3	6.02069	3.6	ppb
⌈	V-KED3	51	5.3	28.6	0.00536	72.8	ppb
|	Cr-KED3	52	156.0	5.1	0.26234	5.3	ppb
|	Cr-KED3	53	18.0	22.2	0.26051	23.0	ppb
|	Co-KED3	59	7.7	27.2	-0.00166	88.6	ppb
|	Ni-KED3	60	26.0	15.4	0.02717	16.4	ppb
|	Ni-KED3	62	0.7	173.2	0.00028	6002.4	ppb
|	Cu-KED3	63	28.0	24.7	0.00925	63.3	ppb
|	Zn-KED3	64	37.1	21.2	0.20677	22.0	ppb
|	Cu-KED3	65	14.7	41.7	0.01653	54.8	ppb
|	Zn-KED3	66	25.3	27.7	0.19115	35.6	ppb
⌊>	Ge-KED3	72	27989.7	1.9			ppb
⌈>	Ge-KED2	72	145366.8	4.4			ppb
|	As-KED2	75	20.7	24.4	0.00684	269.8	ppb
|	Se-KED2	77	3.3	91.7	0.08054	439.6	ppb
|	Se-KED2	78	36.9	16.2	0.14093	143.1	ppb
⌊	Se-KED2	82	-19.5	15.9	0.03652	735.4	ppb
⌈	Mo-KED2	95	6.7	45.8	0.00241	82.7	ppb
|	Mo-KED2	97	6.0	57.7	0.00235	163.6	ppb
|	Mo-KED2	98	6.4	62.4	0.00119	139.8	ppb
|	Cd-KED2	111	1.3	43.3	-0.00558	17.5	ppb
|	Cd-KED2	114	5.1	57.1	0.00134	148.6	ppb
⌊>	In-KED2	115	44882.9	3.1			ppb
⌈>	Rh-KED2	103	244259.9	1.7			ppb
|	Ag-KED2	107	12.0	52.0	0.00044	262.0	ppb
⌊	Ag-KED2	109	6.7	43.3	-0.00073	75.5	ppb
⌈>	In-KED1	115	535423.5	3.0			ppb
|	Sb-KED1	121	32.0	0.0	-0.00310	2.7	ppb
|	Sb-KED1	123	26.9	45.5	-0.00242	53.2	ppb
|	Ba-KED1	135	256.0	5.4	0.06583	8.2	ppb
⌊	Ba-KED1	137	444.0	9.4	0.07027	10.0	ppb
⌈>	Lu-KED1	175	614515.9	2.8			ppb
|	Tl-KED1	203	28.0	18.9	-0.00285	16.3	ppb
|	Tl-KED1	205	61.3	5.0	-0.00252	8.4	ppb
⌊	Pb-KED1	208	194.7	6.7	0.00519	10.3	ppb
⌈	Mn-STD1	55	3319.1	2.4	0.04833	9.4	ppb
⌊>	Ge-STD	72	1693947.7	4.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		100			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		95			
⌈>	Ge-KED2	72		97			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		96			
⌈>	Rh-KED2	103		96			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		95			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		97			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610557-02
Sample Date/Time: Wednesday, September 07, 2016 16:37:16
Sample Description: 5
Autosampler Position: 318
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610557-02.038
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1162503.2	2.5			ppb
│	Be-KED1	9	66349.1	1.2	19.03990	2.7	ppb
└	Al-KED1	27	25454962.9	2.3	775.02208	2.2	ppb
┌	V-KED3	51	80894.1	0.7	195.56456	1.7	ppb
│	Cr-KED3	52	45187.4	0.2	76.92205	2.5	ppb
│	Cr-KED3	53	5537.1	0.3	81.54913	2.1	ppb
│	Co-KED3	59	261645.0	2.1	195.37700	3.8	ppb
│	Ni-KED3	60	154536.7	0.7	191.51009	2.6	ppb
│	Ni-KED3	62	13129.4	2.2	194.72479	4.3	ppb
│	Cu-KED3	63	122301.4	1.5	95.86237	0.9	ppb
│	Zn-KED3	64	29846.2	1.2	185.10108	1.5	ppb
│	Cu-KED3	65	62695.0	1.8	94.06949	4.2	ppb
│	Zn-KED3	66	20461.3	0.8	185.82554	2.4	ppb
└>	Ge-KED3	72	28523.8	2.3			ppb
┌>	Ge-KED2	72	147352.5	1.4			ppb
│	As-KED2	75	89756.1	1.4	386.91151	2.7	ppb
│	Se-KED2	77	3177.7	2.4	369.96488	3.2	ppb
│	Se-KED2	78	10238.6	1.4	380.03801	2.5	ppb
└	Se-KED2	82	5154.1	1.9	364.06587	3.3	ppb
┌	Mo-KED2	95	580136.4	0.9	411.58976	1.9	ppb
│	Mo-KED2	97	379364.0	0.9	406.91308	3.0	ppb
│	Mo-KED2	98	985391.1	0.7	408.04680	2.7	ppb
│	Cd-KED2	111	12092.8	1.5	19.53131	3.2	ppb
│	Cd-KED2	114	28672.3	0.9	19.66893	3.0	ppb
└>	In-KED2	115	44784.4	2.1			ppb
┌>	Rh-KED2	103	244648.0	2.1			ppb
│	Ag-KED2	107	102640.5	1.6	18.60398	3.5	ppb
└	Ag-KED2	109	98694.4	1.1	18.57930	1.1	ppb
┌>	In-KED1	115	549281.2	3.1			ppb
│	Sb-KED1	121	2445847.5	0.8	202.28386	3.8	ppb
│	Sb-KED1	123	1776506.3	1.5	192.69609	4.0	ppb
│	Ba-KED1	135	1363798.2	3.2	363.02397	2.2	ppb
└	Ba-KED1	137	2395852.1	2.0	379.27140	2.5	ppb
┌>	Lu-KED1	175	630158.3	3.0			ppb
│	Tl-KED1	203	729344.1	1.4	73.21708	2.4	ppb
│	Tl-KED1	205	1663692.1	1.7	72.75103	3.7	ppb
└	Pb-KED1	208	5731294.1	0.4	191.46978	3.4	ppb
┌	Mn-STD1	55	8027713.9	5.6	199.00749	3.3	ppb
└>	Ge-STD	72	1747089.4	2.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		98			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		96			
⌈>	Rh-KED2	103		96			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		100			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: T1601476-001
Sample Date/Time: Wednesday, September 07, 2016 16:42:06
Sample Description: 5
Autosampler Position: 319
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\T1601476-001.039
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1206043.1	3.9			ppb
|	Be-KED1	9	6.3	24.1	0.00005	676.1	ppb
⌊	Al-KED1	27	62094.1	3.8	1.79703	1.1	ppb
⌈	V-KED3	51	6.7	52.7	0.00775	104.1	ppb
|	Cr-KED3	52	154.3	10.3	0.24559	13.1	ppb
|	Cr-KED3	53	21.3	30.1	0.29145	28.2	ppb
|	Co-KED3	59	10.0	36.1	-0.00031	768.8	ppb
|	Ni-KED3	60	11.3	27.0	0.00801	50.6	ppb
|	Ni-KED3	62	0.7	173.2	-0.00023	7034.0	ppb
|	Cu-KED3	63	82.0	8.8	0.04900	15.9	ppb
|	Zn-KED3	64	34.9	28.0	0.18256	33.5	ppb
|	Cu-KED3	65	39.0	16.8	0.05042	15.4	ppb
|	Zn-KED3	66	21.0	9.5	0.14041	16.9	ppb
⌊>	Ge-KED3	72	29581.3	3.6			ppb
⌈>	Ge-KED2	72	155668.6	0.8			ppb
|	As-KED2	75	23.7	31.7	0.01360	224.6	ppb
|	Se-KED2	77	5.3	21.7	0.28336	43.5	ppb
|	Se-KED2	78	36.2	5.8	0.02722	291.9	ppb
⌊	Se-KED2	82	-16.2	24.9	0.35975	74.3	ppb
⌈	Mo-KED2	95	23.3	47.2	0.01368	54.4	ppb
|	Mo-KED2	97	14.0	37.8	0.01039	53.6	ppb
|	Mo-KED2	98	48.2	26.5	0.01782	28.9	ppb
|	Cd-KED2	111	5.0	60.0	0.00009	5414.4	ppb
|	Cd-KED2	114	6.4	26.9	0.00210	53.1	ppb
⌊>	In-KED2	115	46451.9	1.3			ppb
⌈>	Rh-KED2	103	258878.0	2.7			ppb
|	Ag-KED2	107	32.7	19.7	0.00385	28.9	ppb
⌊	Ag-KED2	109	32.7	13.8	0.00381	17.0	ppb
⌈>	In-KED1	115	565748.5	3.2			ppb
|	Sb-KED1	121	182.0	45.7	0.00870	72.4	ppb
|	Sb-KED1	123	140.6	30.4	0.00935	44.2	ppb
|	Ba-KED1	135	432.0	10.9	0.10729	8.2	ppb
⌊	Ba-KED1	137	716.7	4.3	0.10830	4.5	ppb
⌈>	Lu-KED1	175	643075.8	2.9			ppb
|	Tl-KED1	203	38.7	52.1	-0.00196	95.0	ppb
|	Tl-KED1	205	79.3	53.3	-0.00191	89.0	ppb
⌊	Pb-KED1	208	314.0	33.2	0.00873	35.4	ppb
⌈	Mn-STD1	55	1843.5	4.6	0.00743	32.0	ppb
⌊>	Ge-STD	72	1810822.5	0.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		100			
⌈>	Ge-KED2	72		103			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		99			
⌈>	Rh-KED2	103		102			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		104			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: T1601476-001D
Sample Date/Time: Wednesday, September 07, 2016 16:46:56
Sample Description: 5
Autosampler Position: 320
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\T1601476-001D.040
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1210390.3	1.9			ppb
│	Be-KED1	9	9.3	40.6	0.00088	117.0	ppb
└	Al-KED1	27	38665.6	2.6	1.10536	1.9	ppb
┌	V-KED3	51	7.0	37.8	0.00847	71.3	ppb
│	Cr-KED3	52	156.3	4.1	0.24841	4.9	ppb
│	Cr-KED3	53	21.3	14.3	0.29367	15.5	ppb
│	Co-KED3	59	3.7	41.7	-0.00484	22.3	ppb
│	Ni-KED3	60	20.0	43.6	0.01832	57.1	ppb
│	Ni-KED3	62	4.7	49.5	0.05726	58.1	ppb
│	Cu-KED3	63	91.3	14.1	0.05587	17.0	ppb
│	Zn-KED3	64	30.6	26.2	0.15589	29.8	ppb
│	Cu-KED3	65	47.7	9.7	0.06311	10.0	ppb
│	Zn-KED3	66	17.7	23.6	0.11051	31.8	ppb
└>	Ge-KED3	72	29574.6	1.0			ppb
┌>	Ge-KED2	72	155389.5	0.4			ppb
│	As-KED2	75	28.0	15.6	0.03142	55.2	ppb
│	Se-KED2	77	2.7	114.6	-0.00963	3508.4	ppb
│	Se-KED2	78	36.1	10.5	0.02677	518.3	ppb
└	Se-KED2	82	-18.2	33.3	0.22273	182.7	ppb
┌	Mo-KED2	95	14.0	28.6	0.00715	37.7	ppb
│	Mo-KED2	97	5.3	21.7	0.00131	90.7	ppb
│	Mo-KED2	98	16.9	26.6	0.00518	33.4	ppb
│	Cd-KED2	111	4.0	43.3	-0.00161	165.7	ppb
│	Cd-KED2	114	4.0	63.4	0.00049	336.3	ppb
└>	In-KED2	115	47255.7	1.0			ppb
┌>	Rh-KED2	103	260791.4	1.1			ppb
│	Ag-KED2	107	13.3	51.1	0.00053	222.1	ppb
└	Ag-KED2	109	13.3	35.4	0.00036	230.0	ppb
┌>	In-KED1	115	570852.7	2.8			ppb
│	Sb-KED1	121	84.7	45.1	0.00094	329.4	ppb
│	Sb-KED1	123	63.1	57.4	0.00122	312.5	ppb
│	Ba-KED1	135	206.7	15.7	0.04880	17.5	ppb
└	Ba-KED1	137	336.0	15.4	0.04930	15.7	ppb
┌>	Lu-KED1	175	653635.4	2.0			ppb
│	Tl-KED1	203	32.0	75.8	-0.00263	88.5	ppb
│	Tl-KED1	205	71.3	90.7	-0.00228	119.1	ppb
└	Pb-KED1	208	350.0	76.2	0.00977	87.4	ppb
┌	Mn-STD1	55	2604.2	3.0	0.02517	3.2	ppb
└>	Ge-STD	72	1824172.8	1.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		100			
⌈>	Ge-KED2	72		103			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		101			
⌈>	Rh-KED2	103		102			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		102			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		105			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: T1601476-001L
Sample Date/Time: Wednesday, September 07, 2016 16:51:47
Sample Description: 25
Autosampler Position: 321
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\T1601476-001L.041
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1254086.7	4.1			ppb
│	Be-KED1	9	6.3	36.5	-0.00002	2539.9	ppb
└	Al-KED1	27	19101.4	1.9	0.51428	3.1	ppb
┌	V-KED3	51	4.0	43.3	0.00136	281.7	ppb
│	Cr-KED3	52	31.0	37.2	0.04213	45.7	ppb
│	Cr-KED3	53	7.3	41.7	0.09362	46.8	ppb
│	Co-KED3	59	3.3	45.8	-0.00510	21.8	ppb
│	Ni-KED3	60	5.3	86.6	0.00067	815.0	ppb
│	Ni-KED3	62	1.3	86.6	0.00917	177.0	ppb
│	Cu-KED3	63	23.3	32.5	0.00419	128.2	ppb
│	Zn-KED3	64	13.8	64.3	0.05463	97.1	ppb
│	Cu-KED3	65	9.3	16.4	0.00752	30.0	ppb
│	Zn-KED3	66	5.0	0.0	-0.00078	74.6	ppb
└>	Ge-KED3	72	29970.1	1.4			ppb
┌>	Ge-KED2	72	157499.1	2.4			ppb
│	As-KED2	75	21.3	19.5	0.00332	568.3	ppb
│	Se-KED2	77	2.7	114.6	-0.00900	3814.1	ppb
│	Se-KED2	78	34.5	5.1	-0.04629	83.3	ppb
└	Se-KED2	82	-12.8	32.8	0.58748	50.0	ppb
┌	Mo-KED2	95	11.3	27.0	0.00523	40.3	ppb
│	Mo-KED2	97	3.3	91.7	-0.00080	375.9	ppb
│	Mo-KED2	98	14.2	77.6	0.00407	106.0	ppb
│	Cd-KED2	111	2.3	24.7	-0.00424	19.2	ppb
│	Cd-KED2	114	6.1	19.9	0.00176	40.6	ppb
└>	In-KED2	115	48151.7	1.4			ppb
┌>	Rh-KED2	103	265990.9	0.7			ppb
│	Ag-KED2	107	12.7	37.3	0.00037	213.4	ppb
└	Ag-KED2	109	19.0	32.0	0.00130	82.1	ppb
┌>	In-KED1	115	581458.1	0.7			ppb
│	Sb-KED1	121	44.0	7.9	-0.00238	10.6	ppb
│	Sb-KED1	123	33.6	26.3	-0.00194	47.6	ppb
│	Ba-KED1	135	110.0	11.1	0.02350	13.1	ppb
└	Ba-KED1	137	178.0	1.1	0.02475	1.7	ppb
┌>	Lu-KED1	175	669318.4	3.2			ppb
│	Tl-KED1	203	16.0	45.1	-0.00420	17.6	ppb
│	Tl-KED1	205	35.3	26.1	-0.00381	11.4	ppb
└	Pb-KED1	208	116.7	11.7	0.00218	18.1	ppb
┌	Mn-STD1	55	1796.1	4.9	0.00295	149.0	ppb
└>	Ge-STD	72	1972274.3	6.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		112			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		102			
⌈>	Ge-KED2	72		105			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		103			
⌈>	Rh-KED2	103		105			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		103			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		106			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		114			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: T1601476-001A
Sample Date/Time: Wednesday, September 07, 2016 16:56:37
Sample Description: 5 +50ppb +10ppb Ag
Autosampler Position: 322
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\T1601476-001A.042
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1192285.7	5.4			ppb
│	Be-KED1	9	201771.5	1.5	56.53783	5.2	ppb
⌊	Al-KED1	27	1783646.0	2.7	52.97175	3.1	ppb
⌈	V-KED3	51	21927.5	1.1	50.58205	1.6	ppb
│	Cr-KED3	52	31203.7	1.2	50.67761	0.5	ppb
│	Cr-KED3	53	3741.2	0.9	52.57403	1.4	ppb
│	Co-KED3	59	71382.6	0.3	50.84691	0.5	ppb
│	Ni-KED3	60	43637.2	1.3	51.59487	1.7	ppb
│	Ni-KED3	62	3721.8	3.2	52.64163	2.7	ppb
│	Cu-KED3	63	70738.7	1.4	52.91129	1.4	ppb
│	Zn-KED3	64	10628.3	1.8	62.89079	2.4	ppb
│	Cu-KED3	65	36923.0	1.4	52.84570	1.8	ppb
│	Zn-KED3	66	7023.4	1.9	60.82888	1.3	ppb
⌊>	Ge-KED3	72	29883.6	0.6			ppb
⌈>	Ge-KED2	72	154364.2	0.7			ppb
│	As-KED2	75	14482.7	1.5	59.51551	2.1	ppb
│	Se-KED2	77	618.0	3.7	68.42362	3.8	ppb
│	Se-KED2	78	1930.0	1.4	67.34567	0.9	ppb
⌊	Se-KED2	82	941.2	2.4	64.62929	2.5	ppb
⌈	Mo-KED2	95	74897.8	0.2	50.83069	2.9	ppb
│	Mo-KED2	97	48930.3	1.2	50.18688	2.4	ppb
│	Mo-KED2	98	128313.3	0.3	50.82515	3.3	ppb
│	Cd-KED2	111	36501.6	2.3	56.40282	3.8	ppb
│	Cd-KED2	114	85326.1	1.0	55.98730	3.1	ppb
⌊>	In-KED2	115	46832.3	3.1			ppb
⌈>	Rh-KED2	103	255403.5	2.1			ppb
│	Ag-KED2	107	55501.6	0.9	9.63294	1.7	ppb
⌊	Ag-KED2	109	54442.9	0.8	9.81823	2.5	ppb
⌈>	In-KED1	115	567698.1	1.9			ppb
│	Sb-KED1	121	677788.1	2.7	54.19325	2.2	ppb
│	Sb-KED1	123	521159.4	1.2	54.65311	0.8	ppb
│	Ba-KED1	135	187747.8	3.2	48.36312	4.3	ppb
⌊	Ba-KED1	137	311783.0	4.7	47.75098	5.3	ppb
⌈>	Lu-KED1	175	632733.0	6.6			ppb
│	Tl-KED1	203	505595.0	3.8	50.59002	3.0	ppb
│	Tl-KED1	205	1163921.1	2.0	50.77276	5.5	ppb
⌊	Pb-KED1	208	1565010.2	2.3	52.13605	4.5	ppb
⌈	Mn-STD1	55	2212961.0	1.8	51.62751	3.1	ppb
⌊>	Ge-STD	72	1857610.3	3.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		102			
⌈>	Ge-KED2	72		103			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		100			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		100			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		107			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: T1601476-001S
Sample Date/Time: Wednesday, September 07, 2016 17:01:28
Sample Description: 5
Autosampler Position: 323
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\T1601476-001S.043
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1203235.1	4.6			ppb
|	Be-KED1	9	71851.3	1.1	19.93829	4.3	ppb
⌊	Al-KED1	27	25692360.2	4.7	756.69053	6.6	ppb
⌈	V-KED3	51	80774.1	1.7	193.10077	2.6	ppb
|	Cr-KED3	52	45372.6	1.9	76.38753	3.9	ppb
|	Cr-KED3	53	5451.0	3.0	79.35610	1.6	ppb
|	Co-KED3	59	265789.0	1.9	196.22010	2.9	ppb
|	Ni-KED3	60	157906.9	4.1	193.56463	5.8	ppb
|	Ni-KED3	62	13330.2	2.3	195.48425	4.2	ppb
|	Cu-KED3	63	123842.5	0.6	95.99512	1.3	ppb
|	Zn-KED3	64	33297.9	2.2	204.19657	2.2	ppb
|	Cu-KED3	65	64496.3	2.0	95.67859	3.7	ppb
|	Zn-KED3	66	22597.2	1.1	202.89986	1.0	ppb
⌊>	Ge-KED3	72	28844.4	1.9			ppb
⌈>	Ge-KED2	72	152257.1	4.4			ppb
|	As-KED2	75	102172.8	1.0	426.58251	3.5	ppb
|	Se-KED2	77	4077.9	1.5	460.19305	5.5	ppb
|	Se-KED2	78	13180.3	0.7	474.18339	3.6	ppb
⌊	Se-KED2	82	6568.0	1.3	448.96115	3.5	ppb
⌈	Mo-KED2	95	578197.1	1.5	392.18846	3.8	ppb
|	Mo-KED2	97	379311.7	1.4	388.84386	3.0	ppb
|	Mo-KED2	98	991157.4	1.7	392.39339	4.3	ppb
|	Cd-KED2	111	12759.0	4.4	19.68205	2.4	ppb
|	Cd-KED2	114	30212.0	3.2	19.79842	1.9	ppb
⌊>	In-KED2	115	46880.7	4.4			ppb
⌈>	Rh-KED2	103	256095.2	2.8			ppb
|	Ag-KED2	107	104707.1	1.8	18.12750	2.2	ppb
⌊	Ag-KED2	109	101258.0	2.1	18.21272	2.4	ppb
⌈>	In-KED1	115	557493.3	3.8			ppb
|	Sb-KED1	121	2569986.7	2.7	209.53215	5.7	ppb
|	Sb-KED1	123	1859009.7	4.1	198.74875	6.0	ppb
|	Ba-KED1	135	1366556.5	3.4	358.44435	2.1	ppb
⌊	Ba-KED1	137	2415793.7	2.7	376.80438	2.3	ppb
⌈>	Lu-KED1	175	649877.5	4.9			ppb
|	Tl-KED1	203	746630.1	3.2	72.68873	2.1	ppb
|	Tl-KED1	205	1714877.1	0.6	72.76409	4.2	ppb
⌊	Pb-KED1	208	5914303.7	2.5	191.60622	2.5	ppb
⌈	Mn-STD1	55	7670532.4	1.6	184.42711	4.5	ppb
⌊>	Ge-STD	72	1804114.4	3.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		98			
⌈>	Ge-KED2	72		101			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		100			
⌈>	Rh-KED2	103		101			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		99			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		104			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610485-01
Sample Date/Time: Wednesday, September 07, 2016 17:06:18
Sample Description: 5
Autosampler Position: 324
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610485-01.044
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1206200.9	3.4			ppb
|	Be-KED1	9	10.0	26.5	0.00107	66.8	ppb
⌊	Al-KED1	27	11894.3	4.3	0.32382	2.8	ppb
⌈	V-KED3	51	3.3	34.6	0.00030	959.0	ppb
|	Cr-KED3	52	6.0	0.0	0.00201	6.8	ppb
|	Cr-KED3	53	1.3	173.2	0.01001	337.9	ppb
|	Co-KED3	59	12.3	44.7	0.00178	233.1	ppb
|	Ni-KED3	60	9.3	12.4	0.00601	24.9	ppb
|	Ni-KED3	62	2.0	0.0	0.02019	2.0	ppb
|	Cu-KED3	63	124.0	8.5	0.08439	9.1	ppb
|	Zn-KED3	64	13.0	17.6	0.05383	25.1	ppb
|	Cu-KED3	65	67.0	16.8	0.09497	16.9	ppb
|	Zn-KED3	66	16.0	12.5	0.10173	16.2	ppb
⌊>	Ge-KED3	72	28412.6	1.3			ppb
⌈>	Ge-KED2	72	147142.2	0.6			ppb
|	As-KED2	75	23.3	30.4	0.01775	172.3	ppb
|	Se-KED2	77	2.0	100.0	-0.07058	330.0	ppb
|	Se-KED2	78	32.4	19.7	-0.04348	532.9	ppb
⌊	Se-KED2	82	-20.9	36.6	-0.03573	1516.3	ppb
⌈	Mo-KED2	95	40.7	28.0	0.02631	30.2	ppb
|	Mo-KED2	97	21.3	28.6	0.01853	34.5	ppb
|	Mo-KED2	98	59.6	32.0	0.02296	33.0	ppb
|	Cd-KED2	111	1.7	124.9	-0.00509	64.8	ppb
|	Cd-KED2	114	4.7	72.3	0.00111	212.3	ppb
⌊>	In-KED2	115	45205.3	1.1			ppb
⌈>	Rh-KED2	103	247333.3	1.5			ppb
|	Ag-KED2	107	183.7	24.7	0.03110	24.5	ppb
⌊	Ag-KED2	109	170.3	15.1	0.02968	14.5	ppb
⌈>	In-KED1	115	557401.9	2.9			ppb
|	Sb-KED1	121	202.7	29.6	0.01073	48.2	ppb
|	Sb-KED1	123	173.3	25.2	0.01318	38.2	ppb
|	Ba-KED1	135	56.7	57.1	0.01084	82.5	ppb
⌊	Ba-KED1	137	100.7	26.2	0.01387	31.1	ppb
⌈>	Lu-KED1	175	643977.9	3.7			ppb
|	Tl-KED1	203	29.3	32.2	-0.00283	34.9	ppb
|	Tl-KED1	205	70.7	40.9	-0.00224	57.4	ppb
⌊	Pb-KED1	208	260.0	30.6	0.00701	37.8	ppb
⌈	Mn-STD1	55	1854.1	6.1	0.01008	38.3	ppb
⌊>	Ge-STD	72	1719903.2	2.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		98			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		97			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		99			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		99			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610485-02
Sample Date/Time: Wednesday, September 07, 2016 17:11:08
Sample Description: 5
Autosampler Position: 325
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610485-02.045
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1172128.8	1.3			ppb
│	Be-KED1	9	34055.2	1.4	9.68979	2.6	ppb
⌊	Al-KED1	27	13152628.2	1.8	397.06811	0.6	ppb
⌈	V-KED3	51	39929.1	1.5	98.78884	1.6	ppb
│	Cr-KED3	52	22701.4	1.5	39.54124	1.5	ppb
│	Cr-KED3	53	2716.3	5.1	40.93442	5.1	ppb
│	Co-KED3	59	132246.3	3.1	101.03749	3.1	ppb
│	Ni-KED3	60	79069.7	3.0	100.27135	3.2	ppb
│	Ni-KED3	62	6600.2	1.3	100.14229	1.6	ppb
│	Cu-KED3	63	63214.9	1.2	50.71025	1.1	ppb
│	Zn-KED3	64	15153.0	1.5	96.17058	1.5	ppb
│	Cu-KED3	65	32345.9	1.9	49.64985	2.1	ppb
│	Zn-KED3	66	10295.7	1.5	95.66365	1.4	ppb
⌊>	Ge-KED3	72	27863.5	0.3			ppb
⌈>	Ge-KED2	72	149062.9	3.3			ppb
│	As-KED2	75	7572.3	3.3	32.18359	0.0	ppb
│	Se-KED2	77	268.0	8.6	30.57283	8.9	ppb
│	Se-KED2	78	891.9	1.9	31.60142	3.9	ppb
⌊	Se-KED2	82	424.5	2.6	30.96272	2.5	ppb
⌈	Mo-KED2	95	47464.1	1.3	32.87427	1.4	ppb
│	Mo-KED2	97	31044.4	1.6	32.49892	1.3	ppb
│	Mo-KED2	98	81853.8	1.2	33.08538	0.8	ppb
│	Cd-KED2	111	6141.0	2.8	9.67686	2.1	ppb
│	Cd-KED2	114	14513.3	1.1	9.71721	1.2	ppb
⌊>	In-KED2	115	45861.8	1.0			ppb
⌈>	Rh-KED2	103	251851.3	3.1			ppb
│	Ag-KED2	107	54197.0	2.2	9.53907	1.1	ppb
⌊	Ag-KED2	109	51593.3	0.8	9.43750	2.7	ppb
⌈>	In-KED1	115	569433.6	1.4			ppb
│	Sb-KED1	121	1193484.4	1.1	95.15737	2.5	ppb
│	Sb-KED1	123	911943.5	1.5	95.35075	2.1	ppb
│	Ba-KED1	135	720878.9	1.2	185.10958	2.4	ppb
⌊	Ba-KED1	137	1207217.5	1.1	184.30935	2.4	ppb
⌈>	Lu-KED1	175	666907.1	3.0			ppb
│	Tl-KED1	203	66649.8	1.4	6.31908	4.0	ppb
│	Tl-KED1	205	152708.2	2.6	6.30747	5.5	ppb
⌊	Pb-KED1	208	2974561.4	0.2	93.89521	3.3	ppb
⌈	Mn-STD1	55	4149397.6	2.6	104.76713	2.1	ppb
⌊>	Ge-STD	72	1715912.1	1.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		105			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		95			
⌈>	Ge-KED2	72		99			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		99			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		105			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		99			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610485-03
Sample Date/Time: Wednesday, September 07, 2016 17:15:58
Sample Description: 5
Autosampler Position: 326
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610485-03.046
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1195087.7	2.7			ppb
|	Be-KED1	9	119.0	12.4	0.03154	13.7	ppb
⌊	Al-KED1	27	85006587.0	2.7	2517.53239	2.1	ppb
⌈	V-KED3	51	1234.1	2.6	3.03705	0.7	ppb
|	Cr-KED3	52	1853.1	1.2	3.21294	3.4	ppb
|	Cr-KED3	53	252.7	3.7	3.79212	5.9	ppb
|	Co-KED3	59	663.3	5.1	0.49822	6.1	ppb
|	Ni-KED3	60	1957.5	2.3	2.47113	3.8	ppb
|	Ni-KED3	62	168.7	9.0	2.54008	6.6	ppb
|	Cu-KED3	63	38063.3	2.2	30.45140	2.5	ppb
|	Zn-KED3	64	16833.6	3.1	106.53277	0.8	ppb
|	Cu-KED3	65	19680.9	0.8	30.13086	1.8	ppb
|	Zn-KED3	66	10779.4	0.3	99.92143	2.4	ppb
⌊>	Ge-KED3	72	27941.3	2.5			ppb
⌈>	Ge-KED2	72	148647.1	1.1			ppb
|	As-KED2	75	3211.4	2.0	13.63883	1.3	ppb
|	Se-KED2	77	63.3	3.6	7.00841	2.6	ppb
|	Se-KED2	78	260.1	3.5	8.35515	5.3	ppb
⌊	Se-KED2	82	103.2	17.6	8.61983	13.8	ppb
⌈	Mo-KED2	95	754.7	3.1	0.52694	1.2	ppb
|	Mo-KED2	97	519.3	5.8	0.54728	8.7	ppb
|	Mo-KED2	98	1304.0	0.9	0.53241	2.3	ppb
|	Cd-KED2	111	375.7	4.1	0.59215	3.3	ppb
|	Cd-KED2	114	883.9	5.1	0.59693	2.6	ppb
⌊>	In-KED2	115	45299.5	2.8			ppb
⌈>	Rh-KED2	103	244009.5	2.0			ppb
|	Ag-KED2	107	287.3	7.4	0.05042	5.9	ppb
⌊	Ag-KED2	109	253.0	6.6	0.04573	4.8	ppb
⌈>	In-KED1	115	559760.3	2.7			ppb
|	Sb-KED1	121	201.3	13.5	0.01048	16.9	ppb
|	Sb-KED1	123	140.0	15.0	0.00948	20.3	ppb
|	Ba-KED1	135	34437.5	0.9	8.99290	1.9	ppb
⌊	Ba-KED1	137	57095.9	1.4	8.86699	2.3	ppb
⌈>	Lu-KED1	175	667380.8	4.4			ppb
|	Tl-KED1	203	204.7	11.3	0.01363	10.8	ppb
|	Tl-KED1	205	504.0	1.4	0.01554	5.3	ppb
⌊	Pb-KED1	208	17851.6	1.6	0.56182	3.5	ppb
⌈	Mn-STD1	55	231687.0	2.3	5.65835	7.7	ppb
⌊>	Ge-STD	72	1768199.9	5.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		95			
⌈>	Ge-KED2	72		99			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		96			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		100			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		105			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 17:20:50
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.047
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1195736.7	1.0			ppb
│	Be-KED1	9	86069.9	2.0	24.00762	2.9	ppb
⌊	Al-KED1	27	849404.6	3.2	25.11565	3.3	ppb
⌈	V-KED3	51	10214.0	0.9	24.35546	1.6	ppb
│	Cr-KED3	52	14599.5	0.8	24.51165	1.6	ppb
│	Cr-KED3	53	1667.4	4.8	24.22012	4.9	ppb
│	Co-KED3	59	33305.1	1.9	24.52548	2.6	ppb
│	Ni-KED3	60	19786.4	0.3	24.18351	1.0	ppb
│	Ni-KED3	62	1776.1	4.4	25.96594	3.9	ppb
│	Cu-KED3	63	31508.1	3.8	24.36185	4.3	ppb
│	Zn-KED3	64	3971.7	2.6	24.27890	2.6	ppb
│	Cu-KED3	65	16566.9	1.9	24.51090	2.2	ppb
│	Zn-KED3	66	2665.2	0.4	23.84067	1.1	ppb
⌊>	Ge-KED3	72	28905.5	1.0			ppb
⌈>	Ge-KED2	72	146493.1	1.5			ppb
│	As-KED2	75	5840.5	2.6	25.24894	3.8	ppb
│	Se-KED2	77	188.0	14.6	21.73039	15.1	ppb
│	Se-KED2	78	695.9	2.6	24.81308	1.9	ppb
⌊	Se-KED2	82	303.9	3.9	22.93747	4.2	ppb
⌈	Mo-KED2	95	35864.3	1.7	25.46109	3.4	ppb
│	Mo-KED2	97	23552.1	1.3	25.27239	3.2	ppb
│	Mo-KED2	98	61240.6	0.4	25.37192	2.6	ppb
│	Cd-KED2	111	15698.6	1.0	25.37251	3.2	ppb
│	Cd-KED2	114	36807.3	1.1	25.26007	2.3	ppb
⌊>	In-KED2	115	44761.1	2.3			ppb
⌈>	Rh-KED2	103	252237.4	1.7			ppb
│	Ag-KED2	107	140334.9	0.4	24.66431	1.6	ppb
⌊	Ag-KED2	109	134036.3	1.2	24.47351	1.6	ppb
⌈>	In-KED1	115	565886.7	3.5			ppb
│	Sb-KED1	121	305477.6	1.8	24.51328	2.9	ppb
│	Sb-KED1	123	233104.5	2.0	24.53217	2.9	ppb
│	Ba-KED1	135	92401.9	0.6	23.88374	2.9	ppb
⌊	Ba-KED1	137	153452.5	1.3	23.58032	2.2	ppb
⌈>	Lu-KED1	175	651601.0	2.8			ppb
│	Tl-KED1	203	256616.4	2.2	24.90193	0.7	ppb
│	Tl-KED1	205	585016.0	1.6	24.72655	1.6	ppb
⌊	Pb-KED1	208	765141.4	1.5	24.71011	1.9	ppb
⌈	Mn-STD1	55	996269.9	4.1	24.10884	3.0	ppb
⌊>	Ge-STD	72	1787889.8	1.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
|	Be-KED1	9	96				
⌊	Al-KED1	27	100				
⌈	V-KED3	51	97				
|	Cr-KED3	52	98				
|	Cr-KED3	53	97				
|	Co-KED3	59	98				
|	Ni-KED3	60	97				
|	Ni-KED3	62	104				
|	Cu-KED3	63	97				
|	Zn-KED3	64	97				
|	Cu-KED3	65	98				
|	Zn-KED3	66	95				
⌊>	Ge-KED3	72		98			
⌈>	Ge-KED2	72		97			
|	As-KED2	75	101				
|	Se-KED2	77	87				
|	Se-KED2	78	99				
⌊	Se-KED2	82	92				
⌈	Mo-KED2	95	102				
|	Mo-KED2	97	101				
|	Mo-KED2	98	101				
|	Cd-KED2	111	101				
|	Cd-KED2	114	101				
⌊>	In-KED2	115		96			
⌈>	Rh-KED2	103		99			
|	Ag-KED2	107	99				
⌊	Ag-KED2	109	98				
⌈>	In-KED1	115		101			
|	Sb-KED1	121	98				
|	Sb-KED1	123	98				
|	Ba-KED1	135	96				
⌊	Ba-KED1	137	94				
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203	100				
|	Tl-KED1	205	99				
⌊	Pb-KED1	208	99				
⌈	Mn-STD1	55	96				
⌊>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Se-KED2	77	Out of Control

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 17:25:41
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.048
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1141889.4	1.7			ppb
	Be-KED1	9	9.3	22.3	0.00103	56.0	ppb
	Al-KED1	27	2524.9	31.6	0.05341	49.1	ppb
	V-KED3	51	5.7	36.7	0.00576	81.7	ppb
	Cr-KED3	52	5.3	28.6	0.00077	324.1	ppb
	Cr-KED3	53	2.7	86.6	0.02998	114.1	ppb
	Co-KED3	59	6.3	45.6	-0.00276	78.5	ppb
	Ni-KED3	60	8.0	66.1	0.00420	150.0	ppb
	Ni-KED3	62	2.0	100.0	0.01949	148.4	ppb
	Cu-KED3	63	19.3	41.8	0.00200	333.2	ppb
	Zn-KED3	64	3.1	100.3	-0.00844	222.8	ppb
	Cu-KED3	65	8.3	34.6	0.00668	67.2	ppb
	Zn-KED3	66	2.0	50.0	-0.02605	33.2	ppb
>	Ge-KED3	72	28656.7	2.3			ppb
>	Ge-KED2	72	144622.7	0.8			ppb
	As-KED2	75	22.3	9.3	0.01506	55.7	ppb
	Se-KED2	77	5.3	86.6	0.32603	167.4	ppb
	Se-KED2	78	35.1	8.6	0.08427	133.9	ppb
	Se-KED2	82	-21.6	46.2	-0.10491	670.8	ppb
	Mo-KED2	95	11.3	40.8	0.00593	55.8	ppb
	Mo-KED2	97	5.3	78.1	0.00174	264.6	ppb
	Mo-KED2	98	13.3	17.9	0.00416	22.2	ppb
	Cd-KED2	111	4.0	75.0	-0.00110	453.9	ppb
	Cd-KED2	114	2.4	109.6	-0.00044	417.7	ppb
>	In-KED2	115	43847.4	1.3			ppb
>	Rh-KED2	103	240869.0	0.4			ppb
	Ag-KED2	107	44.3	3.4	0.00642	4.7	ppb
	Ag-KED2	109	39.0	11.2	0.00547	15.2	ppb
>	In-KED1	115	557736.1	1.8			ppb
	Sb-KED1	121	320.0	9.2	0.02025	13.2	ppb
	Sb-KED1	123	234.6	18.2	0.01971	25.2	ppb
	Ba-KED1	135	40.7	33.5	0.00654	57.8	ppb
	Ba-KED1	137	40.0	47.7	0.00441	70.4	ppb
>	Lu-KED1	175	621731.0	6.1			ppb
	Tl-KED1	203	19.3	60.6	-0.00371	34.6	ppb
	Tl-KED1	205	58.0	13.8	-0.00271	11.6	ppb
	Pb-KED1	208	93.3	34.8	0.00171	69.9	ppb
	Mn-STD1	55	1792.8	2.4	0.00791	9.8	ppb
>	Ge-STD	72	1741714.2	1.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		102			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		96			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		99			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		98			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		100			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610485-04
Sample Date/Time: Wednesday, September 07, 2016 17:30:33
Sample Description: 5
Autosampler Position: 327
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610485-04.049
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1188579.7	4.2			ppb
|	Be-KED1	9	85.7	22.8	0.02231	23.5	ppb
⌊	Al-KED1	27	600274.9	3.2	17.86371	4.4	ppb
⌈	V-KED3	51	7287.2	0.4	18.08918	0.7	ppb
|	Cr-KED3	52	2112.5	2.6	3.68559	2.7	ppb
|	Cr-KED3	53	272.7	5.4	4.11612	5.7	ppb
|	Co-KED3	59	2886.0	3.9	2.20588	4.3	ppb
|	Ni-KED3	60	8030.3	1.7	10.21506	1.3	ppb
|	Ni-KED3	62	863.4	3.5	13.13790	3.1	ppb
|	Cu-KED3	63	1137819.1	2.3	916.38178	2.6	ppb
|	Zn-KED3	64	44464.5	1.9	283.28985	1.9	ppb
|	Cu-KED3	65	588109.1	1.7	906.08582	1.3	ppb
|	Zn-KED3	66	28606.3	1.5	266.86497	1.8	ppb
⌊>	Ge-KED3	72	27761.6	0.4			ppb
⌈>	Ge-KED2	72	146462.0	0.8			ppb
|	As-KED2	75	31373.1	0.8	135.98573	1.5	ppb
|	Se-KED2	77	212.0	7.4	24.55261	8.2	ppb
|	Se-KED2	78	663.2	1.5	23.59466	2.4	ppb
⌊	Se-KED2	82	320.4	12.4	24.11696	12.2	ppb
⌈	Mo-KED2	95	9518.5	1.4	6.83903	1.8	ppb
|	Mo-KED2	97	6432.1	3.0	6.98447	3.5	ppb
|	Mo-KED2	98	16462.4	0.3	6.90364	0.9	ppb
|	Cd-KED2	111	50452.6	0.4	82.56197	1.0	ppb
|	Cd-KED2	114	119922.3	1.2	83.33248	1.7	ppb
⌊>	In-KED2	115	44198.4	0.6			ppb
⌈>	Rh-KED2	103	238421.1	1.5			ppb
|	Ag-KED2	107	32703.1	1.1	6.07997	2.6	ppb
⌊	Ag-KED2	109	31172.3	1.7	6.02123	3.2	ppb
⌈>	In-KED1	115	541322.0	2.5			ppb
|	Sb-KED1	121	1463.4	4.6	0.11704	7.4	ppb
|	Sb-KED1	123	1095.3	7.4	0.11510	7.6	ppb
|	Ba-KED1	135	1671.4	4.9	0.44730	4.7	ppb
⌊	Ba-KED1	137	2807.6	5.7	0.44922	6.5	ppb
⌈>	Lu-KED1	175	639013.2	3.1			ppb
|	Tl-KED1	203	231.3	7.7	0.01722	14.6	ppb
|	Tl-KED1	205	504.7	10.0	0.01653	16.7	ppb
⌊	Pb-KED1	208	11571.1	2.0	0.37959	1.9	ppb
⌈	Mn-STD1	55	1139526.5	1.2	27.33593	2.9	ppb
⌊>	Ge-STD	72	1805070.3	2.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		106			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		94			
⌈>	Ge-KED2	72		97			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		96			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		101			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		104			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608469-001
Sample Date/Time: Wednesday, September 07, 2016 17:35:23
Sample Description: 5
Autosampler Position: 328
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608469-001.050
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1205405.7	2.6			ppb
|	Be-KED1	9	21.0	21.8	0.00413	32.4	ppb
⌊	Al-KED1	27	1651328.6	2.3	48.47585	3.3	ppb
⌈	V-KED3	51	469.7	6.1	1.17350	5.9	ppb
|	Cr-KED3	52	1050.0	1.2	1.85155	1.4	ppb
|	Cr-KED3	53	138.7	8.3	2.11573	8.6	ppb
|	Co-KED3	59	646.7	2.6	0.49483	2.5	ppb
|	Ni-KED3	60	542.0	5.4	0.69318	5.4	ppb
|	Ni-KED3	62	73.3	12.3	1.12139	12.1	ppb
|	Cu-KED3	63	112407.3	1.9	91.68330	1.9	ppb
|	~~Zn-KED3~~	~~64~~	~~3533571.5~~	~~0.8~~	~~22805.51667~~	~~0.6~~	~~ppb~~
|	Cu-KED3	65	57833.2	0.7	90.25004	0.4	ppb
|	~~Zn-KED3~~	~~66~~	~~2246392.1~~	~~2.1~~	~~21229.92302~~	~~2.1~~	~~ppb~~
⌊>	Ge-KED3	72	27407.6	0.4			ppb
⌈>	Ge-KED2	72	142819.6	2.1			ppb
|	As-KED2	75	10227.3	1.6	45.40512	0.5	ppb
|	Se-KED2	77	106.0	8.2	12.44441	9.3	ppb
|	Se-KED2	78	344.2	2.1	11.97928	3.8	ppb
⌊	Se-KED2	82	155.0	19.5	12.68100	17.1	ppb
⌈	Mo-KED2	95	1548.8	7.9	1.13206	6.7	ppb
|	Mo-KED2	97	1058.7	2.8	1.16863	2.7	ppb
|	Mo-KED2	98	2739.3	2.8	1.16990	1.6	ppb
|	Cd-KED2	111	823.4	3.2	1.36582	1.5	ppb
|	Cd-KED2	114	1943.2	4.4	1.37452	3.8	ppb
⌊>	In-KED2	115	43350.7	1.8			ppb
⌈>	Rh-KED2	103	232400.7	1.4			ppb
|	Ag-KED2	107	401.0	5.6	0.07475	5.9	ppb
⌊	Ag-KED2	109	396.0	8.2	0.07654	9.6	ppb
⌈>	In-KED1	115	537335.3	2.5			ppb
|	Sb-KED1	121	378.0	5.6	0.02614	7.8	ppb
|	Sb-KED1	123	326.0	14.2	0.03070	15.1	ppb
|	Ba-KED1	135	3561.8	3.1	0.96535	4.2	ppb
⌊	Ba-KED1	137	5901.2	1.9	0.95333	4.1	ppb
⌈>	Lu-KED1	175	654712.1	5.5			ppb
|	Tl-KED1	203	57.3	8.8	-0.00017	382.9	ppb
|	Tl-KED1	205	126.7	4.8	0.00006	506.1	ppb
⌊	Pb-KED1	208	198770.8	0.8	6.39670	4.7	ppb
⌈	Mn-STD1	55	1846922.2	1.9	45.06914	6.6	ppb
⌊>	Ge-STD	72	1778717.6	5.4			ppb

JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		95			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		91			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		96			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1608469-002
Sample Date/Time: Wednesday, September 07, 2016 17:40:14
Sample Description: 5
Autosampler Position: 329
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1608469-002.051
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1243314.0	2.9			ppb
	Be-KED1	9	36.7	10.3	0.00817	16.0	ppb
	Al-KED1	27	3969588.5	3.9	112.94225	1.0	ppb
	V-KED3	51	482.7	4.3	1.16990	5.1	ppb
	Cr-KED3	52	3071.7	2.4	5.26866	3.4	ppb
	Cr-KED3	53	386.0	10.9	5.72524	10.6	ppb
	Co-KED3	59	487.7	7.0	0.35975	6.2	ppb
	Ni-KED3	60	1295.4	1.4	1.61439	3.0	ppb
	Ni-KED3	62	160.7	9.5	2.39270	8.8	ppb
	Cu-KED3	63	267542.8	0.9	211.67274	2.4	ppb
	~~Zn-KED3~~	~~64~~	~~2786690.5~~	~~1.0~~	~~17442.43990~~	~~1.5~~	~~ppb~~
	Cu-KED3	65	138750.1	2.1	210.01962	3.0	ppb
	~~Zn-KED3~~	~~66~~	~~1676519.2~~	~~1.0~~	~~15367.31672~~	~~2.2~~	~~ppb~~
>	Ge-KED3	72	28264.9	1.8			ppb
>	Ge-KED2	72	143703.2	0.6			ppb
	As-KED2	75	7833.8	1.6	34.54324	1.7	ppb
	Se-KED2	77	91.3	12.8	10.60794	13.3	ppb
	Se-KED2	78	339.4	3.4	11.70935	4.1	ppb
	Se-KED2	82	143.7	3.7	11.79856	3.5	ppb
	Mo-KED2	95	1598.1	2.3	1.14273	2.3	ppb
	Mo-KED2	97	1054.0	6.1	1.13828	7.7	ppb
	Mo-KED2	98	2703.7	1.7	1.12947	3.6	ppb
	Cd-KED2	111	549.0	1.5	0.88816	3.0	ppb
	Cd-KED2	114	1284.1	2.6	0.88775	4.3	ppb
>	In-KED2	115	44341.0	2.0			ppb
>	Rh-KED2	103	236610.8	1.9			ppb
	Ag-KED2	107	665.3	2.1	0.12290	0.3	ppb
	Ag-KED2	109	632.3	4.0	0.12114	5.2	ppb
>	In-KED1	115	546798.5	1.9			ppb
	Sb-KED1	121	343.3	3.2	0.02270	5.7	ppb
	Sb-KED1	123	268.2	5.4	0.02384	8.7	ppb
	Ba-KED1	135	2334.9	1.7	0.62012	1.0	ppb
	Ba-KED1	137	3885.9	4.4	0.61566	2.7	ppb
>	Lu-KED1	175	653301.0	3.4			ppb
	Tl-KED1	203	80.7	12.2	0.00208	42.4	ppb
	Tl-KED1	205	185.3	3.8	0.00254	5.6	ppb
	Pb-KED1	208	285983.6	2.0	9.21127	1.6	ppb
	Mn-STD1	55	1400722.0	2.3	33.75267	2.9	ppb
>	Ge-STD	72	1797251.7	2.7			ppb

VCB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		111			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		96			
⌈>	Ge-KED2	72		95			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		97			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-001
Sample Date/Time: Wednesday, September 07, 2016 17:45:04
Sample Description: 5
Autosampler Position: 330
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-001.052
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
[>	Li-KED1	6	1174640.7	5.2			ppb
|	Be-KED1	9	7.7	19.9	0.00050	104.7	ppb
L	Al-KED1	27	1357423.1	6.8	40.89428	5.9	ppb
[	V-KED3	51	156.0	12.6	0.38432	13.8	ppb
|	Cr-KED3	52	344.7	3.2	0.60137	3.7	ppb
|	Cr-KED3	53	48.0	34.1	0.72649	35.5	ppb
|	Co-KED3	59	1132.7	3.0	0.87100	2.7	ppb
|	Ni-KED3	60	430.7	6.2	0.54884	6.3	ppb
|	Ni-KED3	62	42.7	14.3	0.64789	14.9	ppb
|	Cu-KED3	63	4704.8	3.9	3.81993	4.7	ppb
|	Zn-KED3	64	45196.9	2.1	291.27190	2.7	ppb
|	Cu-KED3	65	2576.9	1.3	4.01008	1.9	ppb
|	Zn-KED3	66	29205.8	0.4	275.56889	1.0	ppb
L>	Ge-KED3	72	27449.0	0.9			ppb
[>	Ge-KED2	72	147496.8	2.2			ppb
|	As-KED2	75	1997.5	3.0	8.51993	2.9	ppb
|	Se-KED2	77	122.7	3.4	13.97319	3.1	ppb
|	Se-KED2	78	377.7	1.8	12.80543	3.4	ppb
L	Se-KED2	82	157.8	2.5	12.52628	0.7	ppb
[	Mo-KED2	95	210.0	7.4	0.14300	8.2	ppb
|	Mo-KED2	97	136.0	5.1	0.13803	4.8	ppb
|	Mo-KED2	98	359.3	10.7	0.14362	11.5	ppb
|	Cd-KED2	111	442.3	5.6	0.68884	5.9	ppb
|	Cd-KED2	114	1044.6	2.1	0.69619	1.1	ppb
L>	In-KED2	115	45937.3	1.1			ppb
[>	Rh-KED2	103	240475.4	2.2			ppb
|	Ag-KED2	107	630.7	5.7	0.11446	3.8	ppb
L	Ag-KED2	109	599.3	4.9	0.11277	3.8	ppb
[>	In-KED1	115	536538.6	3.2			ppb
|	Sb-KED1	121	413.3	10.2	0.02914	10.8	ppb
|	Sb-KED1	123	349.1	10.8	0.03333	11.0	ppb
|	Ba-KED1	135	55413.4	3.9	15.09230	0.8	ppb
L	Ba-KED1	137	92145.8	3.5	14.92480	0.9	ppb
[>	Lu-KED1	175	643739.9	4.9			ppb
|	Tl-KED1	203	2266.2	4.8	0.21704	4.3	ppb
|	Tl-KED1	205	5322.3	5.3	0.22250	3.9	ppb
L	Pb-KED1	208	13747.9	3.2	0.44816	3.0	ppb
[	Mn-STD1	55	2584072.5	1.8	65.38908	1.3	ppb
L>	Ge-STD	72	1711850.4	1.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		105			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		98			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		95			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		99			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-002
Sample Date/Time: Wednesday, September 07, 2016 17:49:54
Sample Description: 5
Autosampler Position: 331
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-002.053
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1225190.2	2.5			ppb
|	Be-KED1	9	23.3	25.1	0.00464	30.7	ppb
⌊	Al-KED1	27	11885921.4	1.8	343.32943	0.6	ppb
⌈	V-KED3	51	710.4	5.0	1.78915	3.5	ppb
|	Cr-KED3	52	615.7	8.5	1.08805	7.2	ppb
|	Cr-KED3	53	81.3	31.1	1.24756	32.7	ppb
|	Co-KED3	59	1275.7	3.7	0.98921	2.2	ppb
|	Ni-KED3	60	772.0	7.5	0.99529	6.5	ppb
|	Ni-KED3	62	74.7	11.2	1.15031	12.5	ppb
|	Cu-KED3	63	7037.1	1.3	5.76361	2.9	ppb
|	Zn-KED3	64	38141.0	0.6	247.64361	1.1	ppb
|	Cu-KED3	65	3487.8	1.0	5.47094	1.8	ppb
|	Zn-KED3	66	24571.8	1.1	233.63129	2.5	ppb
⌊>	Ge-KED3	72	27243.6	1.6			ppb
⌈>	Ge-KED2	72	147147.7	0.9			ppb
|	As-KED2	75	1792.8	4.4	7.65447	3.8	ppb
|	Se-KED2	77	94.7	18.2	10.74099	18.9	ppb
|	Se-KED2	78	340.7	2.7	11.45272	2.1	ppb
⌊	Se-KED2	82	157.8	22.9	12.54397	19.8	ppb
⌈	Mo-KED2	95	240.7	4.6	0.16703	4.2	ppb
|	Mo-KED2	97	170.7	13.3	0.17734	13.3	ppb
|	Mo-KED2	98	418.3	1.2	0.17031	1.1	ppb
|	Cd-KED2	111	1148.0	4.4	1.83131	4.2	ppb
|	Cd-KED2	114	2729.0	1.8	1.85429	2.2	ppb
⌊>	In-KED2	115	45151.3	0.5			ppb
⌈>	Rh-KED2	103	239691.7	1.4			ppb
|	Ag-KED2	107	758.7	2.0	0.13856	1.0	ppb
⌊	Ag-KED2	109	725.4	8.5	0.13733	7.8	ppb
⌈>	In-KED1	115	544050.0	1.1			ppb
|	Sb-KED1	121	481.3	3.7	0.03436	5.4	ppb
|	Sb-KED1	123	363.7	5.4	0.03442	6.1	ppb
|	Ba-KED1	135	95823.1	2.6	25.74449	2.4	ppb
⌊	Ba-KED1	137	158971.9	2.0	25.39815	2.4	ppb
⌈>	Lu-KED1	175	658395.2	3.2			ppb
|	Tl-KED1	203	2346.2	5.1	0.21953	1.9	ppb
|	Tl-KED1	205	5332.3	1.9	0.21792	3.8	ppb
⌊	Pb-KED1	208	31519.5	1.4	1.00621	2.7	ppb
⌈	Mn-STD1	55	4107305.1	2.4	102.22254	3.0	ppb
⌊>	Ge-STD	72	1741915.3	4.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		110			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		98			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		97			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		100			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-003
Sample Date/Time: Wednesday, September 07, 2016 17:54:44
Sample Description: 5
Autosampler Position: 332
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-003.054
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1218968.9	5.9			ppb
|	Be-KED1	9	11.3	20.4	0.00143	54.2	ppb
⌊	Al-KED1	27	1056800.1	1.5	30.70767	4.3	ppb
⌈	V-KED3	51	183.7	22.1	0.45560	20.2	ppb
|	Cr-KED3	52	263.0	5.3	0.46080	7.1	ppb
|	Cr-KED3	53	36.0	11.1	0.54474	8.8	ppb
|	Co-KED3	59	1022.0	4.5	0.79171	5.8	ppb
|	Ni-KED3	60	419.3	14.3	0.53918	16.0	ppb
|	Ni-KED3	62	42.7	2.7	0.65309	4.9	ppb
|	Cu-KED3	63	5618.4	3.9	4.60192	6.0	ppb
|	Zn-KED3	64	41101.6	1.8	266.95598	3.0	ppb
|	Cu-KED3	65	2884.3	0.5	4.52457	2.4	ppb
|	Zn-KED3	66	26497.6	3.2	252.14301	5.8	ppb
⌊>	Ge-KED3	72	27244.6	2.9			ppb
⌈>	Ge-KED2	72	146538.4	0.9			ppb
|	As-KED2	75	2750.3	1.2	11.83815	0.9	ppb
|	Se-KED2	77	122.7	18.2	14.05786	18.0	ppb
|	Se-KED2	78	439.6	3.5	15.21198	4.0	ppb
⌊	Se-KED2	82	183.1	12.1	14.39252	11.3	ppb
⌈	Mo-KED2	95	150.7	5.5	0.10331	6.6	ppb
|	Mo-KED2	97	90.0	2.2	0.09117	1.4	ppb
|	Mo-KED2	98	257.0	13.1	0.10359	13.2	ppb
|	Cd-KED2	111	563.0	5.8	0.89009	5.5	ppb
|	Cd-KED2	114	1347.6	2.4	0.91085	4.0	ppb
⌊>	In-KED2	115	45355.4	1.8			ppb
⌈>	Rh-KED2	103	238342.5	1,6			ppb
|	Ag-KED2	107	1528.4	1.1	0.28259	2.6	ppb
⌊	Ag-KED2	109	1480.7	1.2	0.28417	2.1	ppb
⌈>	In-KED1	115	545522.5	4.6			ppb
|	Sb-KED1	121	382.0	1.4	0.02602	6.4	ppb
|	Sb-KED1	123	270.3	12.9	0.02419	17.8	ppb
|	Ba-KED1	135	48763.2	3.6	13.06956	2.3	ppb
⌊	Ba-KED1	137	81160.2	4.5	12.93090	1.6	ppb
⌈>	Lu-KED1	175	639650.7	5.5			ppb
|	Tl-KED1	203	2750.9	1.0	0.26675	5.2	ppb
|	Tl-KED1	205	6471.5	1.3	0.27388	5.5	ppb
⌊	Pb-KED1	208	20618.4	2.0	0.67757	3.7	ppb
⌈	Mn-STD1	55	2525375.5	1.6	64.82370	1.3	ppb
⌊>	Ge-STD	72	1687636.3	1.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		97			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		94			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		101			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		97			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-004
Sample Date/Time: Wednesday, September 07, 2016 17:59:35
Sample Description: 5
Autosampler Position: 333
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-004.055
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1194329.7	2.2			ppb
|	Be-KED1	9	35.3	7.1	0.00819	10.5	ppb
⌊	Al-KED1	27	16018810.3	2.5	474.77428	3.3	ppb
⌈	V-KED3	51	977.4	3.1	2.50759	3.5	ppb
|	Cr-KED3	52	1227.1	1.6	2.21529	2.1	ppb
|	Cr-KED3	53	173.3	5.9	2.70839	6.3	ppb
|	Co-KED3	59	2485.5	3.5	1.96794	3.9	ppb
|	Ni-KED3	60	1313.4	8.1	1.72726	8.6	ppb
|	Ni-KED3	62	118.7	5.1	1.86337	5.4	ppb
|	Cu-KED3	63	7272.5	0.9	6.05642	1.4	ppb
|	Zn-KED3	64	45468.0	1.4	300.19003	1.4	ppb
|	Cu-KED3	65	3669.8	1.4	5.85336	1.1	ppb
|	Zn-KED3	66	29465.7	0.1	284.85163	0.6	ppb
⌊>	Ge-KED3	72	26790.1	0.6			ppb
⌈>	Ge-KED2	72	139971.0	0.1			ppb
|	As-KED2	75	1950.1	1.8	8.76640	1.7	ppb
|	Se-KED2	77	122.0	14.3	14.65796	14.6	ppb
|	Se-KED2	78	417.2	2.2	15.10309	2.2	ppb
⌊	Se-KED2	82	164.5	8.6	13.61301	7.7	ppb
⌈	Mo-KED2	95	396.7	8.1	0.28569	7.9	ppb
|	Mo-KED2	97	230.0	6.3	0.24832	6.5	ppb
|	Mo-KED2	98	635.4	3.4	0.26774	3.0	ppb
|	Cd-KED2	111	1674.4	2.0	2.76026	1.7	ppb
|	Cd-KED2	114	4040.5	0.9	2.83414	1.2	ppb
⌊>	In-KED2	115	43754.2	0.9			ppb
⌈>	Rh-KED2	103	234732.5	0.5			ppb
|	Ag-KED2	107	1516.1	2.2	0.28456	2.3	ppb
⌊	Ag-KED2	109	1431.7	2.0	0.27893	2.4	ppb
⌈>	In-KED1	115	556440.3	2.4			ppb
|	Sb-KED1	121	922.0	3.2	0.06939	1.3	ppb
|	Sb-KED1	123	725.3	1.2	0.07223	1.7	ppb
|	Ba-KED1	135	108846.0	2.8	28.59122	0.7	ppb
⌊	Ba-KED1	137	182746.9	1.3	28.55428	2.6	ppb
⌈>	Lu-KED1	175	650444.9	2.1			ppb
|	Tl-KED1	203	2227.5	1.2	0.21092	2.9	ppb
|	Tl-KED1	205	5351.7	2.1	0.22140	3.5	ppb
⌊	Pb-KED1	208	64377.1	0.8	2.08158	2.9	ppb
⌈	Mn-STD1	55	8425825.4	1.1	215.11797	2.7	ppb
⌊>	Ge-STD	72	1697784.7	1.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		91			
⌈>	Ge-KED2	72		93			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		92			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		99			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-005
Sample Date/Time: Wednesday, September 07, 2016 18:04:25
Sample Description: 5
Autosampler Position: 334
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-005.056
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1230688.4	3.6			ppb
|	Be-KED1	9	7.0	24.7	0.00020	202.4	ppb
⌊	Al-KED1	27	777930.8	4.7	22.36413	5.9	ppb
⌈	V-KED3	51	111.3	14.0	0.27545	12.5	ppb
|	Cr-KED3	52	237.0	6.0	0.41755	8.5	ppb
|	Cr-KED3	53	32.7	21.5	0.49705	20.7	ppb
|	Co-KED3	59	736.0	6.4	0.57160	5.6	ppb
|	Ni-KED3	60	296.0	8.9	0.38114	9.3	ppb
|	Ni-KED3	62	34.0	38.6	0.51938	38.1	ppb
|	Cu-KED3	63	5729.8	3.0	4.72186	2.1	ppb
|	Zn-KED3	64	40868.0	1.3	267.24574	2.2	ppb
|	Cu-KED3	65	2970.0	4.3	4.69463	6.7	ppb
|	Zn-KED3	66	26121.9	2.4	250.15777	3.9	ppb
⌊>	Ge-KED3	72	27056.3	2.5			ppb
⌈>	Ge-KED2	72	143561.8	1.1			ppb
|	As-KED2	75	1738.1	3.2	7.60888	4.0	ppb
|	Se-KED2	77	113.3	4.4	13.25063	5.2	ppb
|	Se-KED2	78	382.5	4.3	13.36364	3.6	ppb
⌊	Se-KED2	82	153.2	2.0	12.49157	0.9	ppb
⌈	Mo-KED2	95	140.0	5.2	0.09857	5.2	ppb
|	Mo-KED2	97	91.3	15.8	0.09544	17.7	ppb
|	Mo-KED2	98	270.4	4.9	0.11219	4.4	ppb
|	Cd-KED2	111	968.0	0.7	1.57997	1.4	ppb
|	Cd-KED2	114	2198.2	2.5	1.52866	2.7	ppb
⌊>	In-KED2	115	44104.8	1.1			ppb
⌈>	Rh-KED2	103	238632.7	0.9			ppb
|	Ag-KED2	107	844.0	5.2	0.15506	5.5	ppb
⌊	Ag-KED2	109	794.7	2.8	0.15140	3.6	ppb
⌈>	In-KED1	115	552472.5	2.2			ppb
|	Sb-KED1	121	357.3	6.2	0.02356	8.8	ppb
|	Sb-KED1	123	269.1	2.7	0.02362	4.5	ppb
|	Ba-KED1	135	38102.1	1.5	10.07980	1.4	ppb
⌊	Ba-KED1	137	62901.5	0.3	9.89714	2.0	ppb
⌈>	Lu-KED1	175	653606.2	1.4			ppb
|	Tl-KED1	203	2301.5	6.8	0.21711	8.3	ppb
|	Tl-KED1	205	5371.0	0.4	0.22106	1.7	ppb
⌊	Pb-KED1	208	11325.7	0.9	0.36311	1.6	ppb
⌈	Mn-STD1	55	1261394.4	1.8	32.81154	2.5	ppb
⌊>	Ge-STD	72	1664778.5	2.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		110			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		95			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-005D
Sample Date/Time: Wednesday, September 07, 2016 18:09:15
Sample Description: 5
Autosampler Position: 335
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-005D.057
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1215466.9	5.4			ppb
|	Be-KED1	9	11.3	5.1	0.00143	21.2	ppb
⌊	Al-KED1	27	1268872.7	1.4	36.98398	5.0	ppb
⌈	V-KED3	51	136.7	10.0	0.33933	9.2	ppb
|	Cr-KED3	52	200.0	15.3	0.34984	16.0	ppb
|	Cr-KED3	53	29.3	21.9	0.44534	23.3	ppb
|	Co-KED3	59	783.7	5.5	0.60745	4.5	ppb
|	Ni-KED3	60	314.0	12.9	0.40359	13.3	ppb
|	Ni-KED3	62	25.3	9.1	0.38521	8.9	ppb
|	Cu-KED3	63	5945.2	1.2	4.88740	1.1	ppb
|	Zn-KED3	64	41709.1	2.3	271.96767	2.0	ppb
|	Cu-KED3	65	3061.3	2.0	4.82131	1.0	ppb
|	Zn-KED3	66	26957.1	1.5	257.38642	1.5	ppb
⌊>	Ge-KED3	72	27125.1	1.3			ppb
⌈>	Ge-KED2	72	143755.7	2.8			ppb
|	As-KED2	75	1787.8	0.8	7.82089	3.3	ppb
|	Se-KED2	77	119.3	21.2	13.92628	20.4	ppb
|	Se-KED2	78	385.5	4.3	13.47242	5.7	ppb
⌊	Se-KED2	82	171.2	4.1	13.77350	1.4	ppb
⌈	Mo-KED2	95	134.7	8.6	0.09363	7.1	ppb
|	Mo-KED2	97	100.0	0.0	0.10364	3.1	ppb
|	Mo-KED2	98	275.0	11.7	0.11292	11.4	ppb
|	Cd-KED2	111	985.4	0.4	1.59157	2.8	ppb
|	Cd-KED2	114	2329.2	0.9	1.60286	2.2	ppb
⌊>	In-KED2	115	44588.7	2.9			ppb
⌈>	Rh-KED2	103	240219.4	1.4			ppb
|	Ag-KED2	107	872.7	1.0	0.15930	0.9	ppb
⌊	Ag-KED2	109	846.4	3.3	0.16026	2.9	ppb
⌈>	In-KED1	115	542968.7	2.9			ppb
|	Sb-KED1	121	312.0	7.1	0.02027	8.1	ppb
|	Sb-KED1	123	207.7	10.7	0.01741	15.9	ppb
|	Ba-KED1	135	38598.8	2.2	10.39185	2.4	ppb
⌊	Ba-KED1	137	63170.8	2.8	10.11449	3.2	ppb
⌈>	Lu-KED1	175	645354.2	2.3			ppb
|	Tl-KED1	203	2318.9	3.3	0.22158	4.0	ppb
|	Tl-KED1	205	5374.3	1.7	0.22417	3.4	ppb
⌊	Pb-KED1	208	12407.4	3.0	0.40296	1.2	ppb
⌈	Mn-STD1	55	1275702.0	3.5	32.82223	3.0	ppb
⌊>	Ge-STD	72	1684303.0	5.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		95			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		97			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		97			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-005L
Sample Date/Time: Wednesday, September 07, 2016 18:14:05
Sample Description: 25
Autosampler Position: 336
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-005L.058
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1285173.8	2.5			ppb
|	Be-KED1	9	8.0	45.1	0.00040	245.4	ppb
⌊	Al-KED1	27	163865.9	3.5	4.48641	1.1	ppb
⌈	V-KED3	51	22.3	15.7	0.04748	19.7	ppb
|	Cr-KED3	52	48.0	18.5	0.07514	18.1	ppb
|	Cr-KED3	53	2.7	114.6	0.03101	151.9	ppb
|	Co-KED3	59	151.0	9.1	0.10801	12.1	ppb
|	Ni-KED3	60	78.0	10.3	0.09323	10.5	ppb
|	Ni-KED3	62	8.7	26.6	0.12241	30.7	ppb
|	Cu-KED3	63	1180.0	1.7	0.93359	3.9	ppb
|	Zn-KED3	64	7786.0	5.2	49.34593	3.1	ppb
|	Cu-KED3	65	611.7	1.9	0.93289	3.2	ppb
|	Zn-KED3	66	5091.2	0.9	47.26721	2.5	ppb
⌊>	Ge-KED3	72	27883.5	2.4			ppb
⌈>	Ge-KED2	72	148387.8	1.7			ppb
|	As-KED2	75	326.3	5.5	1.31337	4.3	ppb
|	Se-KED2	77	24.7	41.6	2.54618	45.7	ppb
|	Se-KED2	78	97.6	12.7	2.36553	22.2	ppb
⌊	Se-KED2	82	19.2	15.7	2.77682	7.8	ppb
⌈	Mo-KED2	95	30.0	48.1	0.01854	55.8	ppb
|	Mo-KED2	97	22.0	65.6	0.01910	81.7	ppb
|	Mo-KED2	98	51.9	21.2	0.01947	22.8	ppb
|	Cd-KED2	111	203.0	5.7	0.31140	2.9	ppb
|	Cd-KED2	114	430.4	4.7	0.28564	6.9	ppb
⌊>	In-KED2	115	45984.8	2.8			ppb
⌈>	Rh-KED2	103	252648.2	0.5			ppb
|	Ag-KED2	107	207.0	6.3	0.03457	6.2	ppb
⌊	Ag-KED2	109	175.7	3.1	0.03003	3.4	ppb
⌈>	In-KED1	115	598235.7	1.1			ppb
|	Sb-KED1	121	68.0	10.6	-0.00066	83.4	ppb
|	Sb-KED1	123	60.3	3.4	0.00062	28.9	ppb
|	Ba-KED1	135	7771.4	2.4	1.89514	2.7	ppb
⌊	Ba-KED1	137	12795.1	2.1	1.85737	2.6	ppb
⌈>	Lu-KED1	175	687072.4	4.0			ppb
|	Tl-KED1	203	473.3	7.4	0.03784	7.2	ppb
|	Tl-KED1	205	1136.0	3.7	0.04029	4.7	ppb
⌊	Pb-KED1	208	2366.1	2.6	0.07100	2.2	ppb
⌈	Mn-STD1	55	269430.9	3.9	6.64657	3.2	ppb
⌊>	Ge-STD	72	1747080.7	1.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		115			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		95			
⌈>	Ge-KED2	72		99			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		99			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		106			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		108			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 18:18:57
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.059
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1206488.4	3.2			ppb
|	Be-KED1	9	89376.8	2.4	24.70756	0.8	ppb
⌊	Al-KED1	27	875839.1	2.7	25.67069	1.9	ppb
⌈	V-KED3	51	10303.0	2.1	24.96482	1.8	ppb
|	Cr-KED3	52	14432.3	1.4	24.62502	2.1	ppb
|	Cr-KED3	53	1696.1	0.9	25.04154	2.7	ppb
|	Co-KED3	59	32726.1	3.3	24.48873	3.4	ppb
|	Ni-KED3	60	19933.9	0.9	24.76536	2.9	ppb
|	Ni-KED3	62	1718.1	3.1	25.52593	2.2	ppb
|	Cu-KED3	63	31715.2	2.4	24.92594	4.1	ppb
|	Zn-KED3	64	3909.8	3.8	24.28504	3.1	ppb
|	Cu-KED3	65	16642.7	1.1	25.03011	3.3	ppb
|	Zn-KED3	66	2634.6	6.0	23.95258	6.4	ppb
⌊>	Ge-KED3	72	28450.0	2.8			ppb
⌈>	Ge-KED2	72	146871.3	1.6			ppb
|	As-KED2	75	5748.8	0.3	24.78355	1.8	ppb
|	Se-KED2	77	201.3	11.6	23.22670	11.5	ppb
|	Se-KED2	78	683.7	3.2	24.30340	5.0	ppb
⌊	Se-KED2	82	303.9	2.9	22.88284	3.0	ppb
⌈	Mo-KED2	95	35595.0	1.0	24.99201	1.2	ppb
|	Mo-KED2	97	23305.0	0.9	24.73178	0.8	ppb
|	Mo-KED2	98	60180.6	1.0	24.65966	1.0	ppb
|	Cd-KED2	111	15591.2	0.6	24.92045	0.4	ppb
|	Cd-KED2	114	36480.6	0.5	24.76385	0.3	ppb
⌊>	In-KED2	115	45238.8	0.3			ppb
⌈>	Rh-KED2	103	250578.5	1.5			ppb
|	Ag-KED2	107	137010.9	0.6	24.23919	1.8	ppb
⌊	Ag-KED2	109	132725.7	0.4	24.39596	1.9	ppb
⌈>	In-KED1	115	555301.3	4.6			ppb
|	Sb-KED1	121	306424.1	1.7	25.07996	5.1	ppb
|	Sb-KED1	123	234811.2	2.8	25.20527	5.5	ppb
|	Ba-KED1	135	91303.8	3.7	24.04860	3.5	ppb
⌊	Ba-KED1	137	153387.8	3.6	24.04171	6.0	ppb
⌈>	Lu-KED1	175	632193.6	3.1			ppb
|	Tl-KED1	203	249565.3	2.5	24.96217	1.2	ppb
|	Tl-KED1	205	575630.5	2.4	25.07939	2.7	ppb
⌊	Pb-KED1	208	752834.3	2.9	25.05303	0.8	ppb
⌈	Mn-STD1	55	1096371.3	0.8	27.08706	2.0	ppb
⌊>	Ge-STD	72	1752282.3	2.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
|	Be-KED1	9	99				
⌊	Al-KED1	27	103				
⌈	V-KED3	51	100				
|	Cr-KED3	52	99				
|	Cr-KED3	53	100				
|	Co-KED3	59	98				
|	Ni-KED3	60	99				
|	Ni-KED3	62	102				
|	Cu-KED3	63	100				
|	Zn-KED3	64	97				
|	Cu-KED3	65	100				
|	Zn-KED3	66	96				
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		98			
|	As-KED2	75	99				
|	Se-KED2	77	93				
|	Se-KED2	78	97				
⌊	Se-KED2	82	92				
⌈	Mo-KED2	95	100				
|	Mo-KED2	97	99				
|	Mo-KED2	98	99				
|	Cd-KED2	111	100				
|	Cd-KED2	114	99				
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		98			
|	Ag-KED2	107	97				
⌊	Ag-KED2	109	98				
⌈>	In-KED1	115		99			
|	Sb-KED1	121	100				
|	Sb-KED1	123	101				
|	Ba-KED1	135	96				
⌊	Ba-KED1	137	96				
⌈>	Lu-KED1	175		100			
|	Tl-KED1	203	100				
|	Tl-KED1	205	100				
⌊	Pb-KED1	208	100				
⌈	Mn-STD1	55	108				
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 18:23:48
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.060
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1197980.5	5.4			ppb
│	Be-KED1	9	8.3	30.2	0.00066	126.8	ppb
⌊	Al-KED1	27	1023.4	2.4	0.00514	30.0	ppb
⌈	V-KED3	51	4.7	24.7	0.00411	73.2	ppb
│	Cr-KED3	52	5.0	20.0	0.00075	255.9	ppb
│	Cr-KED3	53	1.3	86.6	0.01117	160.5	ppb
│	Co-KED3	59	5.7	40.8	-0.00298	63.9	ppb
│	Ni-KED3	60	8.0	25.0	0.00489	56.4	ppb
│	Ni-KED3	62	4.0	50.0	0.05357	61.3	ppb
│	Cu-KED3	63	13.3	108.5	-0.00233	496.3	ppb
│	Zn-KED3	64	11.1	52.2	0.04582	86.7	ppb
│	Cu-KED3	65	5.7	10.2	0.00316	29.0	ppb
│	Zn-KED3	66	6.0	50.0	0.01384	212.1	ppb
⌊>	Ge-KED3	72	27025.2	2.6			ppb
⌈>	Ge-KED2	72	145182.9	2.1			ppb
│	As-KED2	75	19.0	18.2	0.00037	4555.2	ppb
│	Se-KED2	77	2.0	0.0	-0.06756	7.1	ppb
│	Se-KED2	78	35.0	2.7	0.07356	12.4	ppb
⌊	Se-KED2	82	-24.2	30.0	-0.29022	175.9	ppb
⌈	Mo-KED2	95	6.7	91.7	0.00241	175.8	ppb
│	Mo-KED2	97	4.0	0.0	0.00019	60.4	ppb
│	Mo-KED2	98	4.2	29.4	0.00029	185.2	ppb
│	Cd-KED2	111	3.0	33.3	-0.00285	60.6	ppb
│	Cd-KED2	114	5.8	57.6	0.00185	122.9	ppb
⌊>	In-KED2	115	44681.5	2.7			ppb
⌈>	Rh-KED2	103	241973.8	4.8			ppb
│	Ag-KED2	107	38.7	10.5	0.00536	16.9	ppb
⌊	Ag-KED2	109	29.7	8.5	0.00365	6.1	ppb
⌈>	In-KED1	115	549797.2	3.2			ppb
│	Sb-KED1	121	261.3	4.2	0.01579	9.1	ppb
│	Sb-KED1	123	196.0	12.5	0.01580	12.4	ppb
│	Ba-KED1	135	11.3	36.7	-0.00114	99.9	ppb
⌊	Ba-KED1	137	16.7	6.9	0.00078	26.8	ppb
⌈>	Lu-KED1	175	633086.1	3.5			ppb
│	Tl-KED1	203	21.3	46.2	-0.00362	25.7	ppb
│	Tl-KED1	205	52.7	18.7	-0.00299	12.4	ppb
⌊	Pb-KED1	208	38.0	15.8	-0.00022	110.9	ppb
⌈	Mn-STD1	55	1749.4	3.3	0.00930	17.1	ppb
⌊>	Ge-STD	72	1648448.0	1.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		96			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		96			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		100			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		95			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: LLCCVT
Sample Date/Time: Wednesday, September 07, 2016 18:28:39
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLCCVT.061
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1194441.8	4.0			ppb
│	Be-KED1	9	143.0	2.1	0.03829	5.9	ppb
└	Al-KED1	27	136025.8	5.4	4.00530	3.9	ppb
┌	V-KED3	51	173.3	11.8	0.42701	13.7	ppb
│	Cr-KED3	52	240.3	5.3	0.41555	4.1	ppb
│	Cr-KED3	53	30.0	23.1	0.44734	22.3	ppb
│	Co-KED3	59	65.3	11.9	0.04314	15.8	ppb
│	Ni-KED3	60	331.3	15.2	0.41930	14.1	ppb
│	Ni-KED3	62	25.3	43.5	0.38141	46.3	ppb
│	Cu-KED3	63	268.7	10.8	0.20517	11.8	ppb
│	Zn-KED3	64	161.0	6.7	1.00711	5.5	ppb
│	Cu-KED3	65	136.3	7.2	0.20620	8.4	ppb
│	Zn-KED3	66	114.7	8.4	1.03480	7.8	ppb
└>	Ge-KED3	72	27520.2	1.5			ppb
┌>	Ge-KED2	72	141132.1	0.9			ppb
│	As-KED2	75	236.0	0.4	0.97923	1.3	ppb
│	Se-KED2	77	21.3	5.4	2.29084	6.2	ppb
│	Se-KED2	78	89.8	4.9	2.24159	6.6	ppb
└	Se-KED2	82	3.2	366.2	1.66751	50.9	ppb
┌	Mo-KED2	95	122.7	19.0	0.08755	21.4	ppb
│	Mo-KED2	97	94.7	9.8	0.10048	10.9	ppb
│	Mo-KED2	98	261.5	10.0	0.11001	9.6	ppb
│	Cd-KED2	111	26.7	33.6	0.03680	43.0	ppb
│	Cd-KED2	114	57.1	13.6	0.03830	16.3	ppb
└>	In-KED2	115	43488.1	1.7			ppb
┌>	Rh-KED2	103	241480.5	2.2			ppb
│	Ag-KED2	107	230.3	2.4	0.04054	0.7	ppb
└	Ag-KED2	109	203.7	3.9	0.03688	6.1	ppb
┌>	In-KED1	115	547887.0	4.8			ppb
│	Sb-KED1	121	1215.4	1.6	0.09507	6.2	ppb
│	Sb-KED1	123	974.2	2.1	0.10059	4.0	ppb
│	Ba-KED1	135	380.7	13.9	0.09720	11.2	ppb
└	Ba-KED1	137	650.7	4.1	0.10164	8.7	ppb
┌>	Lu-KED1	175	624793.6	3.0			ppb
│	Tl-KED1	203	412.7	3.0	0.03607	5.4	ppb
│	Tl-KED1	205	1008.7	6.3	0.03918	5.9	ppb
└	Pb-KED1	208	1229.4	2.3	0.03995	5.1	ppb
┌	Mn-STD1	55	6158.7	4.0	0.11920	2.3	ppb
└>	Ge-STD	72	1711667.3	2.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
│	Be-KED1	9	96				
⌊	Al-KED1	27	100				
⌈	V-KED3	51	107				
│	Cr-KED3	52	104				
│	Cr-KED3	53	112				
│	Co-KED3	59	108				
│	Ni-KED3	60	105				
│	Ni-KED3	62	95				
│	Cu-KED3	63	103				
│	Zn-KED3	64	101				
│	Cu-KED3	65	103				
│	Zn-KED3	66	103				
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		94			
│	As-KED2	75	98				
│	Se-KED2	77	115				
│	Se-KED2	78	112				
⌊	Se-KED2	82	83				
⌈	Mo-KED2	95	88				
│	Mo-KED2	97	100				
│	Mo-KED2	98	110				
│	Cd-KED2	111	92				
│	Cd-KED2	114	96				
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		95			
│	Ag-KED2	107	101				
⌊	Ag-KED2	109	92				
⌈>	In-KED1	115		98			
│	Sb-KED1	121	95				
│	Sb-KED1	123	101				
│	Ba-KED1	135	97				
⌊	Ba-KED1	137	102				
⌈>	Lu-KED1	175		99			
│	Tl-KED1	203	90				
│	Tl-KED1	205	98				
⌊	Pb-KED1	208	100				
⌈	Mn-STD1	55	119				
⌊>	Ge-STD	72		99			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-005A
Sample Date/Time: Wednesday, September 07, 2016 18:33:30
Sample Description: 5 +50ppb +10ppb Ag
Autosampler Position: 337
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-005A.062
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1162028.3	0.7			ppb
│	Be-KED1	9	184399.7	1.5	52.92302	1.9	ppb
⌊	Al-KED1	27	2470674.2	2.6	75.22352	2.9	ppb
⌈	V-KED3	51	20973.1	1.7	54.15366	3.4	ppb
│	Cr-KED3	52	28971.0	1.4	52.66762	3.0	ppb
│	Cr-KED3	53	3551.8	2.3	55.87463	4.1	ppb
│	Co-KED3	59	67093.9	2.1	53.48648	2.6	ppb
│	Ni-KED3	60	39653.6	1.9	52.48844	4.1	ppb
│	Ni-KED3	62	3297.0	3.1	52.19755	3.6	ppb
│	Cu-KED3	63	66794.5	1.9	55.92694	3.6	ppb
│	Zn-KED3	64	47607.6	0.3	315.38735	2.4	ppb
│	Cu-KED3	65	34647.0	0.2	55.49766	2.1	ppb
│	Zn-KED3	66	30769.4	1.4	298.52236	3.7	ppb
⌊>	Ge-KED3	72	26708.6	2.3			ppb
⌈>	Ge-KED2	72	141944.4	1.2			ppb
│	As-KED2	75	14058.6	2.5	62.82521	2.1	ppb
│	Se-KED2	77	560.0	6.0	67.39460	4.9	ppb
│	Se-KED2	78	1845.1	3.0	70.05974	2.4	ppb
⌊	Se-KED2	82	890.5	0.5	66.46314	1.3	ppb
⌈	Mo-KED2	95	72375.7	3.4	51.67366	2.8	ppb
│	Mo-KED2	97	47781.1	2.7	51.56597	2.1	ppb
│	Mo-KED2	98	124509.6	2.6	51.88137	1.9	ppb
│	Cd-KED2	111	33202.9	1.8	53.97754	1.3	ppb
│	Cd-KED2	114	78602.5	2.4	54.26178	1.9	ppb
⌊>	In-KED2	115	44484.5	0.7			ppb
⌈>	Rh-KED2	103	237653.9	0.8			ppb
│	Ag-KED2	107	50393.4	1.9	9.39699	1.1	ppb
⌊	Ag-KED2	109	48683.2	2.7	9.43107	1.9	ppb
⌈>	In-KED1	115	550920.7	1.6			ppb
│	Sb-KED1	121	628845.9	2.2	51.81780	2.7	ppb
│	Sb-KED1	123	481956.3	1.3	52.08530	2.1	ppb
│	Ba-KED1	135	218832.1	0.8	58.07460	1.7	ppb
⌊	Ba-KED1	137	367588.5	2.6	58.00682	3.4	ppb
⌈>	Lu-KED1	175	641510.7	1.2			ppb
│	Tl-KED1	203	485822.5	1.4	47.89079	2.0	ppb
│	Tl-KED1	205	1114357.6	1.5	47.83972	2.2	ppb
⌊	Pb-KED1	208	1453436.3	1.6	47.66218	0.4	ppb
⌈	Mn-STD1	55	3731093.3	1.5	95.74746	1.7	ppb
⌊>	Ge-STD	72	1688277.5	0.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		104			
│	Be-KED1	9					
⎣	Al-KED1	27					
⎡	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⎣>	Ge-KED3	72		91			
⎡>	Ge-KED2	72		94			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⎣	Se-KED2	82					
⎡	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⎣>	In-KED2	115		95			
⎡>	Rh-KED2	103		93			
│	Ag-KED2	107					
⎣	Ag-KED2	109					
⎡>	In-KED1	115		98			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⎣	Ba-KED1	137					
⎡>	Lu-KED1	175		101			
│	Tl-KED1	203					
│	Tl-KED1	205					
⎣	Pb-KED1	208					
⎡	Mn-STD1	55					
⎣>	Ge-STD	72		97			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-005S
Sample Date/Time: Wednesday, September 07, 2016 18:38:20
Sample Description: 5
Autosampler Position: 338
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-005S.063
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1215310.1	2.3			ppb
│	Be-KED1	9	34983.1	1.3	9.60319	3.6	ppb
└	Al-KED1	27	14011385.7	2.5	408.27856	4.9	ppb
┌	V-KED3	51	40236.9	0.5	105.15941	0.5	ppb
│	Cr-KED3	52	22233.6	1.6	40.91043	2.0	ppb
│	Cr-KED3	53	2653.6	3.3	42.23693	2.4	ppb
│	Co-KED3	59	126629.8	0.4	102.20105	1.2	ppb
│	Ni-KED3	60	74566.1	1.5	99.89479	2.3	ppb
│	Ni-KED3	62	6310.7	1.6	101.13659	0.7	ppb
│	Cu-KED3	63	62248.7	1.8	52.74528	0.9	ppb
│	Zn-KED3	64	55504.1	0.5	372.20111	1.0	ppb
│	Cu-KED3	65	32180.9	1.6	52.18371	2.3	ppb
│	Zn-KED3	66	36360.9	1.5	357.04451	2.2	ppb
└>	Ge-KED3	72	26378.0	1.0			ppb
┌>	Ge-KED2	72	140352.8	1.2			ppb
│	As-KED2	75	9417.4	0.7	42.53823	0.7	ppb
│	Se-KED2	77	383.3	4.4	46.56829	3.3	ppb
│	Se-KED2	78	1305.4	2.3	49.77777	2.1	ppb
└	Se-KED2	82	663.2	4.6	50.39618	3.3	ppb
┌	Mo-KED2	95	47805.2	0.9	34.60639	2.2	ppb
│	Mo-KED2	97	31465.3	0.2	34.43282	2.7	ppb
│	Mo-KED2	98	82995.4	1.1	35.06045	1.6	ppb
│	Cd-KED2	111	6946.4	0.6	11.44371	2.5	ppb
│	Cd-KED2	114	16420.7	1.4	11.49103	2.2	ppb
└>	In-KED2	115	43893.3	2.6			ppb
┌>	Rh-KED2	103	234126.4	1.0			ppb
│	Ag-KED2	107	50020.1	0.9	9.46924	1.5	ppb
└	Ag-KED2	109	47862.7	1.3	9.41304	1.3	ppb
┌>	In-KED1	115	567712.2	1.4			ppb
│	Sb-KED1	121	1195590.6	0.4	95.60632	1.6	ppb
│	Sb-KED1	123	903559.2	1.8	94.77270	3.0	ppb
│	Ba-KED1	135	736794.7	3.0	189.77317	3.8	ppb
└	Ba-KED1	137	1232423.1	3.2	188.72874	3.9	ppb
┌>	Lu-KED1	175	658637.2	2.8			ppb
│	Tl-KED1	203	63233.0	1.4	6.06725	1.6	ppb
│	Tl-KED1	205	146862.4	0.1	6.13877	2.9	ppb
└	Pb-KED1	208	2735833.0	0.6	87.42574	2.4	ppb
┌	Mn-STD1	55	5154907.2	2.9	138.46115	0.4	ppb
└>	Ge-STD	72	1613184.0	3.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		90			
⌈>	Ge-KED2	72		93			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		92			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		93			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-006
Sample Date/Time: Wednesday, September 07, 2016 18:43:10
Sample Description: 5
Autosampler Position: 339
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-006.064
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1245635.0	6.2			ppb
│	Be-KED1	9	12.3	41.6	0.00166	91.5	ppb
└	Al-KED1	27	1554707.6	0.7	44.26663	6.6	ppb
┌	V-KED3	51	215.0	7.7	0.54767	6.3	ppb
│	Cr-KED3	52	405.7	1.4	0.73036	3.1	ppb
│	Cr-KED3	53	56.7	33.4	0.89023	37.6	ppb
│	Co-KED3	59	1009.0	5.6	0.79738	2.7	ppb
│	Ni-KED3	60	485.3	3.2	0.63728	1.1	ppb
│	Ni-KED3	62	33.3	6.9	0.51864	5.8	ppb
│	Cu-KED3	63	5327.7	1.4	4.45606	4.5	ppb
│	Zn-KED3	64	42290.1	0.7	280.57461	3.2	ppb
│	Cu-KED3	65	2764.3	1.5	4.42954	3.7	ppb
│	Zn-KED3	66	27206.9	0.7	264.35946	4.2	ppb
└>	Ge-KED3	72	26679.2	3.5			ppb
┌>	Ge-KED2	72	140071.7	0.5			ppb
│	As-KED2	75	2038.5	4.1	9.15999	3.8	ppb
│	Se-KED2	77	98.7	10.0	11.78470	9.8	ppb
│	Se-KED2	78	332.6	0.7	11.78048	1.2	ppb
└	Se-KED2	82	127.8	9.4	10.89240	7.9	ppb
┌	Mo-KED2	95	237.3	3.5	0.17261	5.7	ppb
│	Mo-KED2	97	131.3	20.6	0.14254	23.2	ppb
│	Mo-KED2	98	382.2	4.3	0.16280	4.0	ppb
│	Cd-KED2	111	1245.1	1.6	2.07975	1.0	ppb
│	Cd-KED2	114	2957.9	0.8	2.10385	1.5	ppb
└>	In-KED2	115	43146.4	2.3			ppb
┌>	Rh-KED2	103	233680.8	1.8			ppb
│	Ag-KED2	107	1170.4	3.6	0.22023	2.2	ppb
└	Ag-KED2	109	1106.0	3.4	0.21598	2.8	ppb
┌>	In-KED1	115	558068.1	5.1			ppb
│	Sb-KED1	121	758.0	4.3	0.05597	8.3	ppb
│	Sb-KED1	123	554.9	4.5	0.05391	7.6	ppb
│	Ba-KED1	135	50637.7	3.4	13.27075	2.8	ppb
└	Ba-KED1	137	83439.7	2.5	13.00843	3.8	ppb
┌>	Lu-KED1	175	649634.8	3.8			ppb
│	Tl-KED1	203	2730.3	5.1	0.25999	2.4	ppb
│	Tl-KED1	205	6284.7	3.9	0.26118	2.4	ppb
└	Pb-KED1	208	17831.0	1.2	0.57635	2.7	ppb
┌	Mn-STD1	55	2325926.7	3.4	61.77850	4.7	ppb
└>	Ge-STD	72	1631505.0	1.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		111			
⎢	Be-KED1	9					
⎣	Al-KED1	27					
⎡	V-KED3	51					
⎢	Cr-KED3	52					
⎢	Cr-KED3	53					
⎢	Co-KED3	59					
⎢	Ni-KED3	60					
⎢	Ni-KED3	62					
⎢	Cu-KED3	63					
⎢	Zn-KED3	64					
⎢	Cu-KED3	65					
⎢	Zn-KED3	66					
⎣>	Ge-KED3	72		91			
⎡>	Ge-KED2	72		93			
⎢	As-KED2	75					
⎢	Se-KED2	77					
⎢	Se-KED2	78					
⎣	Se-KED2	82					
⎡	Mo-KED2	95					
⎢	Mo-KED2	97					
⎢	Mo-KED2	98					
⎢	Cd-KED2	111					
⎢	Cd-KED2	114					
⎣>	In-KED2	115		92			
⎡>	Rh-KED2	103		92			
⎢	Ag-KED2	107					
⎣	Ag-KED2	109					
⎡>	In-KED1	115		99			
⎢	Sb-KED1	121					
⎢	Sb-KED1	123					
⎢	Ba-KED1	135					
⎣	Ba-KED1	137					
⎡>	Lu-KED1	175		103			
⎢	Tl-KED1	203					
⎢	Tl-KED1	205					
⎣	Pb-KED1	208					
⎡	Mn-STD1	55					
⎣>	Ge-STD	72		94			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-007
Sample Date/Time: Wednesday, September 07, 2016 18:48:01
Sample Description: 5
Autosampler Position: 340
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-007.065
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1220645.4	1.7			ppb
│	Be-KED1	9	11.0	15.7	0.00131	32.8	ppb
└	Al-KED1	27	447576.0	0.6	12.95455	2.3	ppb
┌	V-KED3	51	176.0	11.3	0.44252	12.7	ppb
│	Cr-KED3	52	274.3	5.9	0.48571	6.8	ppb
│	Cr-KED3	53	36.7	41.3	0.56090	41.3	ppb
│	Co-KED3	59	1216.1	5.6	0.95239	5.4	ppb
│	Ni-KED3	60	316.7	8.4	0.40996	11.1	ppb
│	Ni-KED3	62	21.3	32.9	0.32619	35.9	ppb
│	Cu-KED3	63	5295.0	3.2	4.37637	3.2	ppb
│	Zn-KED3	64	33492.1	2.9	219.62615	2.5	ppb
│	Cu-KED3	65	2707.3	1.8	4.28755	1.1	ppb
│	Zn-KED3	66	21603.7	2.9	207.43742	2.7	ppb
└>	Ge-KED3	72	26975.1	2.5			ppb
┌>	Ge-KED2	72	141155.7	1.0			ppb
│	As-KED2	75	2608.6	1.4	11.65687	2.4	ppb
│	Se-KED2	77	86.7	25.5	10.24962	27.2	ppb
│	Se-KED2	78	295.5	4.6	10.23661	5.7	ppb
└	Se-KED2	82	129.9	27.1	10.96458	23.3	ppb
┌	Mo-KED2	95	172.0	5.1	0.12077	5.7	ppb
│	Mo-KED2	97	118.7	3.5	0.12415	2.8	ppb
│	Mo-KED2	98	294.5	3.2	0.12146	3.6	ppb
│	Cd-KED2	111	628.0	0.7	1.01499	1.0	ppb
│	Cd-KED2	114	1494.2	1.1	1.03103	0.4	ppb
└>	In-KED2	115	44417.2	0.8			ppb
┌>	Rh-KED2	103	236266.7	1.5			ppb
│	Ag-KED2	107	569.0	2.8	0.10506	4.4	ppb
└	Ag-KED2	109	547.0	0.7	0.10465	1.9	ppb
┌>	In-KED1	115	554153.2	2.5			ppb
│	Sb-KED1	121	222.0	15.0	0.01241	24.6	ppb
│	Sb-KED1	123	190.8	1.1	0.01512	2.9	ppb
│	Ba-KED1	135	49527.0	0.5	13.06681	2.4	ppb
└	Ba-KED1	137	82406.4	1.8	12.92503	0.8	ppb
┌>	Lu-KED1	175	650182.8	0.5			ppb
│	Tl-KED1	203	2224.8	3.1	0.21069	3.6	ppb
│	Tl-KED1	205	5286.3	1.1	0.21864	1.6	ppb
└	Pb-KED1	208	12084.0	1.5	0.38953	1.6	ppb
┌	Mn-STD1	55	2006205.4	4.4	52.70614	4.7	ppb
└>	Ge-STD	72	1648698.4	0.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		94			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		99			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		95			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-008
Sample Date/Time: Wednesday, September 07, 2016 18:52:51
Sample Description: 5
Autosampler Position: 341
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-008.066
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1217695.1	1.6			ppb
|	Be-KED1	9	7.3	28.4	0.00031	173.5	ppb
⌊	Al-KED1	27	538940.6	1.5	15.63864	1.1	ppb
⌈	V-KED3	51	135.7	3.3	0.35310	1.5	ppb
|	Cr-KED3	52	238.3	7.7	0.43855	8.8	ppb
|	Cr-KED3	53	34.7	33.8	0.55587	37.3	ppb
|	Co-KED3	59	799.7	6.0	0.65043	8.6	ppb
|	Ni-KED3	60	390.7	2.8	0.52750	4.9	ppb
|	Ni-KED3	62	36.7	3.1	0.58876	2.9	ppb
|	Cu-KED3	63	5076.2	1.7	4.36831	2.9	ppb
|	Zn-KED3	64	42554.9	1.1	290.57815	2.6	ppb
|	Cu-KED3	65	2642.9	2.8	4.36069	5.5	ppb
|	Zn-KED3	66	27719.5	1.1	277.18546	3.4	ppb
⌊>	Ge-KED3	72	25913.5	2.6			ppb
⌈>	Ge-KED2	72	138081.7	2.5			ppb
|	As-KED2	75	1669.1	0.7	7.59732	2.0	ppb
|	Se-KED2	77	87.3	8.7	10.57290	11.5	ppb
|	Se-KED2	78	316.1	7.0	11.30279	5.4	ppb
⌊	Se-KED2	82	145.2	24.1	12.34768	21.6	ppb
⌈	Mo-KED2	95	150.0	1.3	0.10681	2.6	ppb
|	Mo-KED2	97	93.3	7.5	0.09852	8.8	ppb
|	Mo-KED2	98	270.9	4.2	0.11346	2.9	ppb
|	Cd-KED2	111	706.4	1.4	1.16155	1.1	ppb
|	Cd-KED2	114	1668.6	4.3	1.17114	5.3	ppb
⌊>	In-KED2	115	43697.0	1.7			ppb
⌈>	Rh-KED2	103	234543.4	2.4			ppb
|	Ag-KED2	107	368.3	5.2	0.06791	6.4	ppb
⌊	Ag-KED2	109	355.3	2.5	0.06783	5.0	ppb
⌈>	In-KED1	115	550210.3	1.1			ppb
|	Sb-KED1	121	416.7	6.4	0.02856	7.8	ppb
|	Sb-KED1	123	311.9	7.9	0.02836	9.3	ppb
|	Ba-KED1	135	47625.3	1.5	12.65190	2.3	ppb
⌊	Ba-KED1	137	77926.0	1.0	12.30860	0.5	ppb
⌈>	Lu-KED1	175	639463.7	2.5			ppb
|	Tl-KED1	203	2472.9	3.0	0.23890	3.6	ppb
|	Tl-KED1	205	5669.1	2.3	0.23889	1.0	ppb
⌊	Pb-KED1	208	12126.7	0.9	0.39760	1.9	ppb
⌈	Mn-STD1	55	1864802.5	1.5	51.84109	0.5	ppb
⌊>	Ge-STD	72	1557867.7	1.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		88			
⌈>	Ge-KED2	72		92			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		92			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		101			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		90			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-009
Sample Date/Time: Wednesday, September 07, 2016 18:57:41
Sample Description: 5
Autosampler Position: 342
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-009.067
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1196544.8	3.0			ppb
|	Be-KED1	9	34.0	5.9	0.00778	4.4	ppb
⌊	Al-KED1	27	15853881.6	3.1	469.20542	4.7	ppb
⌈	V-KED3	51	639.7	2.9	1.67804	2.6	ppb
|	Cr-KED3	52	1072.7	6.3	1.98171	5.4	ppb
|	Cr-KED3	53	138.0	7.7	2.20604	7.5	ppb
|	Co-KED3	59	2627.9	3.0	2.13127	2.9	ppb
|	Ni-KED3	60	1378.7	3.9	1.85680	3.8	ppb
|	Ni-KED3	62	124.7	10.7	2.00679	11.6	ppb
|	Cu-KED3	63	7776.8	3.6	6.63407	3.8	ppb
|	Zn-KED3	64	39705.9	2.5	268.48400	2.7	ppb
|	Cu-KED3	65	4033.6	2.1	6.58962	1.9	ppb
|	Zn-KED3	66	25699.4	1.3	254.42071	0.4	ppb
⌊>	Ge-KED3	72	26158.9	0.9			ppb
⌈>	Ge-KED2	72	139470.3	1.9			ppb
|	As-KED2	75	2034.8	2.6	9.18851	4.3	ppb
|	Se-KED2	77	82.7	13.8	9.87204	14.3	ppb
|	Se-KED2	78	304.6	8.5	10.72599	7.6	ppb
⌊	Se-KED2	82	117.8	1.7	10.19205	1.1	ppb
⌈	Mo-KED2	95	212.0	4.3	0.15219	3.3	ppb
|	Mo-KED2	97	145.3	11.1	0.15596	11.3	ppb
|	Mo-KED2	98	405.1	6.6	0.17076	5.4	ppb
|	Cd-KED2	111	1079.4	1.1	1.78355	2.0	ppb
|	Cd-KED2	114	2641.4	1.1	1.85908	1.7	ppb
⌊>	In-KED2	115	43592.0	1.5			ppb
⌈>	Rh-KED2	103	231603.6	1.4			ppb
|	Ag-KED2	107	1634.1	1.3	0.31103	1.5	ppb
⌊	Ag-KED2	109	1580.4	1.1	0.31234	2.5	ppb
⌈>	In-KED1	115	547630.2	4.2			ppb
|	Sb-KED1	121	534.7	5.1	0.03857	8.5	ppb
|	Sb-KED1	123	406.6	12.4	0.03892	16.2	ppb
|	Ba-KED1	135	63086.4	2.9	16.84769	3.1	ppb
⌊	Ba-KED1	137	104992.7	3.1	16.67706	4.3	ppb
⌈>	Lu-KED1	175	643480.7	2.6			ppb
|	Tl-KED1	203	2219.5	4.5	0.21235	2.7	ppb
|	Tl-KED1	205	5072.9	1.5	0.21188	1.5	ppb
⌊	Pb-KED1	208	22522.2	2.3	0.73518	3.3	ppb
⌈	Mn-STD1	55	3806831.6	2.4	101.09909	1.8	ppb
⌊>	Ge-STD	72	1631842.0	3.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		107			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		89			
┌>	Ge-KED2	72		93			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		93			
┌>	Rh-KED2	103		91			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		102			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		94			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609288-010
Sample Date/Time: Wednesday, September 07, 2016 19:02:32
Sample Description: 5
Autosampler Position: 343
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609288-010.068
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1195098.9	2.3			ppb
|	Be-KED1	9	9.7	26.0	0.00102	74.3	ppb
⌊	Al-KED1	27	1100870.3	1.6	32.59229	3.8	ppb
⌈	V-KED3	51	165.0	4.4	0.42564	2.6	ppb
|	Cr-KED3	52	246.3	7.5	0.44789	8.9	ppb
|	Cr-KED3	53	38.0	24.1	0.59872	24.5	ppb
|	Co-KED3	59	1144.7	1.7	0.92158	2.4	ppb
|	Ni-KED3	60	338.0	5.6	0.44967	5.8	ppb
|	Ni-KED3	62	26.0	7.7	0.40938	7.6	ppb
|	Cu-KED3	63	5412.4	0.9	4.60052	2.7	ppb
|	Zn-KED3	64	39414.4	1.3	265.77882	2.5	ppb
|	Cu-KED3	65	2812.3	2.7	4.58089	4.0	ppb
|	Zn-KED3	66	25609.3	1.2	252.81843	1.5	ppb
⌊>	Ge-KED3	72	26236.4	1.8			ppb
⌈>	Ge-KED2	72	140390.9	1.6			ppb
|	As-KED2	75	2398.5	1.3	10.77169	2.7	ppb
|	Se-KED2	77	126.7	4.0	15.18181	3.1	ppb
|	Se-KED2	78	463.1	3.5	16.85353	4.5	ppb
⌊	Se-KED2	82	209.1	12.3	16.88283	11.6	ppb
⌈	Mo-KED2	95	310.7	17.0	0.22316	18.6	ppb
|	Mo-KED2	97	210.7	10.4	0.22606	7.7	ppb
|	Mo-KED2	98	486.2	7.7	0.20383	5.6	ppb
|	Cd-KED2	111	1663.1	2.2	2.73605	4.9	ppb
|	Cd-KED2	114	3891.9	3.9	2.72537	6.9	ppb
⌊>	In-KED2	115	43883.7	3.0			ppb
⌈>	Rh-KED2	103	235500.6	1.6			ppb
|	Ag-KED2	107	643.0	2.3	0.11928	1.0	ppb
⌊	Ag-KED2	109	612.0	4.4	0.11766	3.1	ppb
⌈>	In-KED1	115	548795.4	2.5			ppb
|	Sb-KED1	121	230.7	5.6	0.01325	5.0	ppb
|	Sb-KED1	123	184.8	13.1	0.01464	15.7	ppb
|	Ba-KED1	135	43392.5	2.0	11.55752	2.1	ppb
⌊	Ba-KED1	137	70917.7	2.7	11.22982	0.4	ppb
⌈>	Lu-KED1	175	651378.6	1.9			ppb
|	Tl-KED1	203	2276.2	2.7	0.21533	3.8	ppb
|	Tl-KED1	205	5255.6	3.1	0.21703	4.6	ppb
⌊	Pb-KED1	208	11242.4	0.8	0.36174	2.6	ppb
⌈	Mn-STD1	55	1801290.4	0.9	47.03125	1.7	ppb
⌊>	Ge-STD	72	1658822.9	1.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		89			
⌈>	Ge-KED2	72		93			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610520-01
Sample Date/Time: Wednesday, September 07, 2016 19:07:22
Sample Description: 5
Autosampler Position: 344
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610520-01.069
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1266384.4	7.2			ppb
	Be-KED1	9	5.3	21.7	-0.00029	88.5	ppb
	Al-KED1	27	12634.9	6.3	0.32828	4.7	ppb
	V-KED3	51	3.3	45.8	0.00067	570.6	ppb
	Cr-KED3	52	3.3	34.6	-0.00228	87.6	ppb
	Cr-KED3	53	2.7	43.3	0.03177	54.4	ppb
	Co-KED3	59	3.0	88.2	-0.00511	40.6	ppb
	Ni-KED3	60	8.0	86.6	0.00495	187.9	ppb
	Ni-KED3	62	1.3	86.6	0.01132	159.9	ppb
	Cu-KED3	63	372.0	1.4	0.29457	2.7	ppb
	Zn-KED3	64	17.1	17.7	0.08463	24.2	ppb
	Cu-KED3	65	198.3	5.3	0.30824	7.1	ppb
	Zn-KED3	66	11.0	31.5	0.06149	54.5	ppb
>	Ge-KED3	72	27033.6	1.7			ppb
>	Ge-KED2	72	143800.9	1.4			ppb
	As-KED2	75	22.0	9.1	0.01425	66.9	ppb
	Se-KED2	77	1.3	173.2	-0.14490	190.3	ppb
	Se-KED2	78	31.2	6.0	-0.05782	116.3	ppb
	Se-KED2	82	-18.8	27.0	0.07764	478.6	ppb
	Mo-KED2	95	4.0	100.0	0.00063	453.7	ppb
	Mo-KED2	97	4.7	49.5	0.00103	249.2	ppb
	Mo-KED2	98	4.4	28.0	0.00041	124.6	ppb
	Cd-KED2	111	1.3	43.3	-0.00553	17.8	ppb
	Cd-KED2	114	5.2	71.6	0.00151	170.9	ppb
>	In-KED2	115	43720.5	1.2			ppb
>	Rh-KED2	103	247140.1	0.6			ppb
	Ag-KED2	107	18.3	19.2	0.00155	41.0	ppb
	Ag-KED2	109	19.3	16.6	0.00161	38.0	ppb
>	In-KED1	115	576954.7	3.6			ppb
	Sb-KED1	121	25.3	36.5	-0.00381	20.1	ppb
	Sb-KED1	123	17.4	37.3	-0.00360	16.6	ppb
	Ba-KED1	135	52.0	30.8	0.00894	40.4	ppb
	Ba-KED1	137	102.7	3.0	0.01363	6.8	ppb
>	Lu-KED1	175	639620.7	3.1			ppb
	Tl-KED1	203	7.3	15.7	-0.00500	2.7	ppb
	Tl-KED1	205	15.3	39.8	-0.00462	5.8	ppb
	Pb-KED1	208	118.7	12.6	0.00243	24.1	ppb
	Mn-STD1	55	1904.8	1.3	0.01781	48.3	ppb
>	Ge-STD	72	1538413.2	14.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		113			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		96			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		97			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		103			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		101			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		89			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610520-03 Semi Dorm
Sample Date/Time: Wednesday, September 07, 2016 19:12:13
Sample Description: 5
Autosampler Position: 345
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610520-03.070
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1233138.8	1.6			ppb
│	Be-KED1	9	126.0	4.8	0.03238	3.6	ppb
└	Al-KED1	27	89468946.8	2.7	2568.46220	3.9	ppb
┌	V-KED3	51	1118.4	3.6	2.90126	3.1	ppb
│	Cr-KED3	52	1798.8	4.4	3.28604	3.9	ppb
│	Cr-KED3	53	224.7	3.4	3.55201	4.3	ppb
│	Co-KED3	59	628.0	5.3	0.49721	6.3	ppb
│	Ni-KED3	60	1922.8	1.1	2.55822	1.4	ppb
│	Ni-KED3	62	168.0	14.6	2.67019	14.5	ppb
│	Cu-KED3	63	36522.6	1.8	30.79746	1.3	ppb
│	Zn-KED3	64	16090.6	1.3	107.36963	0.8	ppb
│	Cu-KED3	65	19013.0	0.9	30.68368	1.8	ppb
│	Zn-KED3	66	10277.0	2.1	100.39101	1.1	ppb
└>	Ge-KED3	72	26502.2	1.0			ppb
┌>	Ge-KED2	72	142122.8	0.8			ppb
│	As-KED2	75	3124.3	1.9	13.88083	2.0	ppb
│	Se-KED2	77	69.3	25.9	8.05954	26.0	ppb
│	Se-KED2	78	235.7	4.2	7.85008	5.5	ppb
└	Se-KED2	82	98.5	3.1	8.61935	2.9	ppb
┌	Mo-KED2	95	753.4	9.7	0.54281	10.4	ppb
│	Mo-KED2	97	498.7	4.4	0.54098	4.0	ppb
│	Mo-KED2	98	1355.1	2.6	0.57046	2.1	ppb
│	Cd-KED2	111	356.0	9.5	0.57852	9.6	ppb
│	Cd-KED2	114	871.7	2.7	0.60750	3.4	ppb
└>	In-KED2	115	43922.5	0.6			ppb
┌>	Rh-KED2	103	238401.4	2.2			ppb
│	Ag-KED2	107	256.0	7.1	0.04584	6.4	ppb
└	Ag-KED2	109	254.0	9.9	0.04710	10.6	ppb
┌>	In-KED1	115	565114.5	2.1			ppb
│	Sb-KED1	121	82.0	29.7	0.00080	264.7	ppb
│	Sb-KED1	123	88.5	20.7	0.00394	48.3	ppb
│	Ba-KED1	135	34048.6	3.0	8.80384	2.0	ppb
└	Ba-KED1	137	55882.4	1.0	8.59575	2.3	ppb
┌>	Lu-KED1	175	663561.6	3.8			ppb
│	Tl-KED1	203	202.7	11.4	0.01366	21.4	ppb
│	Tl-KED1	205	464.0	10.9	0.01405	20.3	ppb
└	Pb-KED1	208	18679.4	0.7	0.59122	3.2	ppb
┌	Mn-STD1	55	231663.6	2.9	5.81022	3.4	ppb
└>	Ge-STD	72	1717435.8	0.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		110			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		90			
⌈>	Ge-KED2	72		94			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		105			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		99			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610520-04 Sum2 Tot.
Sample Date/Time: Wednesday, September 07, 2016 19:17:03
Sample Description: 5
Autosampler Position: 346
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610520-04.071
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1219623.9	0.8			ppb
|	Be-KED1	9	84.7	4.1	0.02146	4.6	ppb
⌊	Al-KED1	27	672445.6	2.0	19.48691	1.8	ppb
⌈	V-KED3	51	7137.5	5.2	18.59586	0.8	ppb
|	Cr-KED3	52	2086.2	5.0	3.82062	0.7	ppb
|	Cr-KED3	53	243.3	6.4	3.86604	10.3	ppb
|	Co-KED3	59	2845.3	0.3	2.28603	4.2	ppb
|	Ni-KED3	60	7886.2	3.9	10.53399	0.6	ppb
|	Ni-KED3	62	884.7	3.5	14.15458	5.8	ppb
|	Cu-KED3	63	1124452.3	1.5	951.55866	3.2	ppb
|	Zn-KED3	64	43703.3	2.2	292.61482	4.0	ppb
|	Cu-KED3	65	574011.2	2.9	928.92128	1.8	ppb
|	Zn-KED3	66	27806.1	3.7	272.37980	0.8	ppb
⌊>	Ge-KED3	72	26443.8	4.4			ppb
⌈>	Ge-KED2	72	141913.8	1.4			ppb
|	As-KED2	75	30352.2	1.3	135.79784	2.6	ppb
|	Se-KED2	77	188.7	6.2	22.50914	5.1	ppb
|	Se-KED2	78	642.2	1.4	23.58063	1.4	ppb
⌊	Se-KED2	82	321.1	16.3	24.92190	16.6	ppb
⌈	Mo-KED2	95	9408.4	1.7	6.93598	0.9	ppb
|	Mo-KED2	97	6171.3	1.0	6.87720	2.7	ppb
|	Mo-KED2	98	16247.4	0.5	6.99250	2.2	ppb
|	Cd-KED2	111	49727.4	1.7	83.50861	2.4	ppb
|	Cd-KED2	114	117825.0	2.1	84.00586	1.6	ppb
⌊>	In-KED2	115	43076.3	1.8			ppb
⌈>	Rh-KED2	103	232264.4	2.0			ppb
|	Ag-KED2	107	44181.6	2.2	8.42997	0.3	ppb
⌊	Ag-KED2	109	42488.8	0.9	8.42425	1.5	ppb
⌈>	In-KED1	115	558606.2	3.5			ppb
|	Sb-KED1	121	1492.7	1.9	0.11557	3.6	ppb
|	Sb-KED1	123	1136.2	4.1	0.11589	7.4	ppb
|	Ba-KED1	135	2140.2	5.4	0.55664	7.5	ppb
⌊	Ba-KED1	137	3685.8	3.4	0.57193	3.7	ppb
⌈>	Lu-KED1	175	650730.7	2.9			ppb
|	Tl-KED1	203	202.7	7.7	0.01396	8.8	ppb
|	Tl-KED1	205	469.3	7.0	0.01457	5.6	ppb
⌊	Pb-KED1	208	16746.4	0.8	0.54016	2.2	ppb
⌈	Mn-STD1	55	1150760.9	3.7	29.35605	3.3	ppb
⌊>	Ge-STD	72	1696952.6	2.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		109			
|	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
└>	Ge-KED3	72		90			
┌>	Ge-KED2	72		94			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
└>	In-KED2	115		92			
┌>	Rh-KED2	103		91			
|	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		99			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 19:21:56
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.072
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1226896.4	3.8			ppb
	Be-KED1	9	87634.4	2.8	23.82605	1.4	ppb
	Al-KED1	27	859185.5	4.1	24.75910	2.0	ppb
	V-KED3	51	9983.5	2.2	25.26480	2.8	ppb
	Cr-KED3	52	14400.3	2.3	25.65560	2.0	ppb
	Cr-KED3	53	1701.4	6.5	26.23132	6.8	ppb
	Co-KED3	59	33572.1	0.9	26.23313	0.4	ppb
	Ni-KED3	60	20001.3	2.7	25.93854	1.5	ppb
	Ni-KED3	62	1724.1	3.9	26.74652	2.8	ppb
	Cu-KED3	63	31954.4	1.4	26.21528	0.2	ppb
	Zn-KED3	64	3788.7	2.4	24.57726	2.0	ppb
	Cu-KED3	65	16500.5	2.3	25.90436	1.5	ppb
	Zn-KED3	66	2667.9	2.7	25.32458	1.9	ppb
>	Ge-KED3	72	27238.3	1.3			ppb
>	Ge-KED2	72	143255.5	3.2			ppb
	As-KED2	75	5631.4	5.0	24.87729	2.1	ppb
	Se-KED2	77	195.3	10.3	23.08317	8.5	ppb
	Se-KED2	78	686.2	6.6	25.02762	5.9	ppb
	Se-KED2	82	325.9	4.4	25.01498	3.4	ppb
	Mo-KED2	95	35442.0	5.6	25.30390	3.2	ppb
	Mo-KED2	97	23254.9	3.5	25.10347	1.3	ppb
	Mo-KED2	98	60563.4	5.6	25.23529	3.3	ppb
	Cd-KED2	111	15412.7	4.5	25.05504	2.2	ppb
	Cd-KED2	114	36572.4	4.8	25.24871	2.6	ppb
>	In-KED2	115	44466.1	2.4			ppb
>	Rh-KED2	103	244639.1	3.3			ppb
	Ag-KED2	107	136366.1	4.9	24.69810	1.6	ppb
	Ag-KED2	109	133515.9	5.5	25.12072	2.2	ppb
>	In-KED1	115	579414.0	1.2			ppb
	Sb-KED1	121	311746.3	2.6	24.41595	1.9	ppb
	Sb-KED1	123	236127.6	3.1	24.25537	2.7	ppb
	Ba-KED1	135	91235.9	2.5	23.01366	1.5	ppb
	Ba-KED1	137	152171.2	2.6	22.82336	1.7	ppb
>	Lu-KED1	175	649101.0	5.0			ppb
	Tl-KED1	203	252174.6	2.7	24.58115	2.3	ppb
	Tl-KED1	205	582979.5	3.2	24.75158	3.5	ppb
	Pb-KED1	208	752624.8	3.7	24.40275	1.3	ppb
	Mn-STD1	55	1104469.1	2.8	26.97463	5.3	ppb
>	Ge-STD	72	1773820.9	2.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		110			
│	Be-KED1	9	95				
└	Al-KED1	27	99				
┌	V-KED3	51	101				
│	Cr-KED3	52	103				
│	Cr-KED3	53	105				
│	Co-KED3	59	105				
│	Ni-KED3	60	104				
│	Ni-KED3	62	107				
│	Cu-KED3	63	105				
│	Zn-KED3	64	98				
│	Cu-KED3	65	104				
│	Zn-KED3	66	101				
└>	Ge-KED3	72		93			
┌>	Ge-KED2	72		95			
│	As-KED2	75	100				
│	Se-KED2	77	92				
│	Se-KED2	78	100				
└	Se-KED2	82	100				
┌	Mo-KED2	95	101				
│	Mo-KED2	97	100				
│	Mo-KED2	98	101				
│	Cd-KED2	111	100				
│	Cd-KED2	114	101				
└>	In-KED2	115		95			
┌>	Rh-KED2	103		96			
│	Ag-KED2	107	99				
└	Ag-KED2	109	100				
┌>	In-KED1	115		103			
│	Sb-KED1	121	98				
│	Sb-KED1	123	97				
│	Ba-KED1	135	92				
└	Ba-KED1	137	91				
┌>	Lu-KED1	175		102			
│	Tl-KED1	203	98				
│	Tl-KED1	205	99				
└	Pb-KED1	208	98				
┌	Mn-STD1	55	108				
└>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 19:26:47
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.073
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1234250.4	5.3			ppb
│	Be-KED1	9	7.0	42.9	0.00021	409.7	ppb
└	Al-KED1	27	1141.4	4.0	0.00761	12.2	ppb
┌	V-KED3	51	3.0	100.0	-0.00007	11901.8	ppb
│	Cr-KED3	52	2.0	132.3	-0.00458	106.7	ppb
│	Cr-KED3	53	2.0	100.0	0.02128	145.3	ppb
│	Co-KED3	59	6.0	16.7	-0.00273	32.8	ppb
│	Ni-KED3	60	10.7	75.8	0.00820	126.1	ppb
│	Ni-KED3	62	0.7	173.2	0.00080	2251.8	ppb
│	Cu-KED3	63	17.3	24.0	0.00124	306.4	ppb
│	Zn-KED3	64	4.3	90.5	0.00068	3699.7	ppb
│	Cu-KED3	65	6.3	18.2	0.00424	46.7	ppb
│	Zn-KED3	66	5.0	40.0	0.00390	479.6	ppb
└>	Ge-KED3	72	27006.2	2.2			ppb
┌>	Ge-KED2	72	142294.6	1.1			ppb
│	As-KED2	75	18.0	5.6	-0.00260	202.9	ppb
│	Se-KED2	77	1.3	173.2	-0.14416	192.2	ppb
│	Se-KED2	78	30.4	6.5	-0.07826	92.6	ppb
└	Se-KED2	82	-13.5	31.1	0.45364	70.0	ppb
┌	Mo-KED2	95	7.3	56.8	0.00307	98.0	ppb
│	Mo-KED2	97	3.3	124.9	-0.00040	1166.5	ppb
│	Mo-KED2	98	6.8	37.7	0.00145	73.2	ppb
│	Cd-KED2	111	3.3	17.3	-0.00221	41.1	ppb
│	Cd-KED2	114	3.2	32.3	0.00013	556.0	ppb
└>	In-KED2	115	43575.4	1.2			ppb
┌>	Rh-KED2	103	241625.1	1.2			ppb
│	Ag-KED2	107	52.0	6.9	0.00780	10.0	ppb
└	Ag-KED2	109	45.3	13.5	0.00665	17.9	ppb
┌>	In-KED1	115	577287.9	3.7			ppb
│	Sb-KED1	121	256.7	2.0	0.01439	6.6	ppb
│	Sb-KED1	123	216.4	13.8	0.01690	14.7	ppb
│	Ba-KED1	135	12.0	28.9	-0.00114	67.8	ppb
└	Ba-KED1	137	12.7	24.1	0.00005	898.9	ppb
┌>	Lu-KED1	175	644215.4	3.5			ppb
│	Tl-KED1	203	21.3	27.1	-0.00363	16.1	ppb
│	Tl-KED1	205	35.3	14.2	-0.00376	7.1	ppb
└	Pb-KED1	208	36.7	22.0	-0.00029	77.7	ppb
┌	Mn-STD1	55	1837.5	6.0	0.01075	26.2	ppb
└>	Ge-STD	72	1678500.8	2.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		110			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		95			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		103			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		97			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-001
Sample Date/Time: Wednesday, September 07, 2016 19:31:40
Sample Description: 5
Autosampler Position: 347
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-001.074
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1187437.2	4.6			ppb
	Be-KED1	9	674.3	2.6	0.18798	5.6	ppb
	Al-KED1	27	40041762.9	4.3	1193.43989	0.4	ppb
	V-KED3	51	1453.1	1.1	3.68379	1.6	ppb
	Cr-KED3	52	1091.0	2.1	1.94384	3.5	ppb
	Cr-KED3	53	228.7	8.9	3.53322	10.7	ppb
	Co-KED3	59	4915.5	2.0	3.84972	3.5	ppb
	Ni-KED3	60	2115.5	2.6	2.74975	4.0	ppb
	Ni-KED3	62	174.0	4.0	2.70270	5.7	ppb
	Cu-KED3	63	77773.9	2.2	64.07817	3.6	ppb
	Zn-KED3	64	51753.8	0.5	337.34746	1.9	ppb
	Cu-KED3	65	40201.8	0.9	63.36786	2.4	ppb
	Zn-KED3	66	33716.8	1.9	321.83621	3.2	ppb
>	Ge-KED3	72	27140.4	1.7			ppb
>	Ge-KED2	72	145601.6	1.2			ppb
	As-KED2	75	155764.3	0.3	679.49983	1.4	ppb
	Se-KED2	77	72.7	7.9	8.26201	7.9	ppb
	Se-KED2	78	218.1	1.1	6.97084	2.7	ppb
	Se-KED2	82	85.8	19.1	7.54118	15.5	ppb
	Mo-KED2	95	6156.0	1.6	4.32795	3.3	ppb
	Mo-KED2	97	3918.5	2.0	4.16075	0.9	ppb
	Mo-KED2	98	10211.4	2.5	4.18842	0.8	ppb
	Cd-KED2	111	184.3	2.6	0.28741	2.2	ppb
	Cd-KED2	114	451.1	3.5	0.30471	5.0	ppb
>	In-KED2	115	45176.7	1.8			ppb
>	Rh-KED2	103	244296.1	2.2			ppb
	Ag-KED2	107	1227.7	2.9	0.22100	0.9	ppb
	Ag-KED2	109	1200.1	1.8	0.22428	2.2	ppb
>	In-KED1	115	556887.0	1.2			ppb
	Sb-KED1	121	685546.6	1.5	55.87806	1.5	ppb
	Sb-KED1	123	521050.4	2.3	55.69811	2.1	ppb
	Ba-KED1	135	252206.7	3.6	66.20850	3.7	ppb
	Ba-KED1	137	420773.6	3.0	65.67686	3.1	ppb
>	Lu-KED1	175	663597.8	3.5			ppb
	Tl-KED1	203	410.7	3.4	0.03344	6.0	ppb
	Tl-KED1	205	858.0	4.0	0.03033	2.1	ppb
	Pb-KED1	208	65469.4	1.4	2.07554	3.3	ppb
	Mn-STD1	55	62385519.6	5.2	1610.04590	7.7	ppb
>	Ge-STD	72	1681395.1	2.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		106			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		97			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		96			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		99			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		105			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		97			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-002
Sample Date/Time: Wednesday, September 07, 2016 19:36:30
Sample Description: 5
Autosampler Position: 348
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-002.075
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1207825.3	2.9			ppb
|	Be-KED1	9	697.7	8.9	0.19078	6.8	ppb
⌊	Al-KED1	27	41680149.4	2.0	1221.54473	2.1	ppb
⌈	V-KED3	51	874.0	1.8	2.21737	1.6	ppb
|	Cr-KED3	52	1757.1	2.7	3.14145	2.4	ppb
|	Cr-KED3	53	242.0	5.2	3.74374	4.9	ppb
|	Co-KED3	59	7465.6	0.6	5.86202	0.9	ppb
|	Ni-KED3	60	2516.9	2.5	3.27863	2.4	ppb
|	Ni-KED3	62	225.3	5.9	3.50902	6.2	ppb
|	Cu-KED3	63	53402.3	0.3	44.07876	0.5	ppb
|	Zn-KED3	64	78323.8	1.1	511.61062	1.1	ppb
|	Cu-KED3	65	27636.4	2.1	43.64970	2.4	ppb
|	Zn-KED3	66	50446.9	0.7	482.49606	0.6	ppb
⌊>	Ge-KED3	72	27079.0	0.3			ppb
⌈>	Ge-KED2	72	146391.3	0.8			ppb
|	As-KED2	75	47700.2	1.1	206.87927	0.5	ppb
|	Se-KED2	77	69.3	8.3	7.82967	9.5	ppb
|	Se-KED2	78	219.2	4.8	6.96493	5.7	ppb
⌊	Se-KED2	82	87.2	21.8	7.60998	17.9	ppb
⌈	Mo-KED2	95	2058.8	5.0	1.44058	5.2	ppb
|	Mo-KED2	97	1399.4	6.4	1.47766	5.4	ppb
|	Mo-KED2	98	3550.1	2.8	1.45074	3.8	ppb
|	Cd-KED2	111	421.3	4.7	0.66447	4.1	ppb
|	Cd-KED2	114	982.4	1.1	0.66346	0.6	ppb
⌊>	In-KED2	115	45331.1	1.0			ppb
⌈>	Rh-KED2	103	246104.2	0.9			ppb
|	Ag-KED2	107	1408.7	5.0	0.25204	5.5	ppb
⌊	Ag-KED2	109	1357.1	6.7	0.25198	6.9	ppb
⌈>	In-KED1	115	588832.0	1.6			ppb
|	Sb-KED1	121	215949.1	2.1	16.64112	0.6	ppb
|	Sb-KED1	123	164193.0	0.6	16.59709	1.1	ppb
|	Ba-KED1	135	139035.8	3.3	34.50905	1.8	ppb
⌊	Ba-KED1	137	229663.9	4.0	33.89075	2.4	ppb
⌈>	Lu-KED1	175	669817.6	1.3			ppb
|	Tl-KED1	203	1404.1	4.9	0.12690	6.4	ppb
|	Tl-KED1	205	3378.4	3.1	0.13367	4.4	ppb
⌊	Pb-KED1	208	52099.9	1.2	1.63509	1.7	ppb
⌈	Mn-STD1	55	33783790.6	0.4	833.96034	3.7	ppb
⌊>	Ge-STD	72	1757433.8	4.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		108			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		92			
┌>	Ge-KED2	72		97			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		97			
┌>	Rh-KED2	103		97			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		105			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		106			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-003
Sample Date/Time: Wednesday, September 07, 2016 19:41:20
Sample Description: 5
Autosampler Position: 349
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-003.076
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1245471.2	0.5			ppb
│	Be-KED1	9	498.0	7.3	0.13163	6.9	ppb
└	Al-KED1	27	62012838.5	4.0	1761.91411	3.7	ppb
┌	V-KED3	51	1410.7	0.5	3.57383	0.8	ppb
│	Cr-KED3	52	1735.1	1.3	3.09338	1.2	ppb
│	Cr-KED3	53	272.7	8.1	4.20716	7.8	ppb
│	Co-KED3	59	5906.2	2.4	4.62275	2.2	ppb
│	Ni-KED3	60	2369.5	2.2	3.07761	2.0	ppb
│	Ni-KED3	62	210.7	2.9	3.27065	3.3	ppb
│	Cu-KED3	63	37923.6	1.4	31.20931	1.0	ppb
│	Zn-KED3	64	51003.6	1.4	332.21424	1.5	ppb
│	Cu-KED3	65	19464.3	1.2	30.65415	1.6	ppb
│	Zn-KED3	66	32915.2	1.7	313.91114	1.5	ppb
└>	Ge-KED3	72	27155.5	0.4			ppb
┌>	Ge-KED2	72	145261.7	2.1			ppb
│	As-KED2	75	26444.1	1.2	115.56202	1.0	ppb
│	Se-KED2	77	63.3	7.9	7.17804	7.3	ppb
│	Se-KED2	78	204.9	4.7	6.48747	4.7	ppb
└	Se-KED2	82	56.4	13.5	5.46953	11.3	ppb
┌	Mo-KED2	95	1936.1	2.5	1.37089	3.9	ppb
│	Mo-KED2	97	1241.4	1.0	1.32633	0.4	ppb
│	Mo-KED2	98	3291.6	1.4	1.36052	0.5	ppb
│	Cd-KED2	111	424.0	9.3	0.67631	8.1	ppb
│	Cd-KED2	114	999.1	4.0	0.68260	3.0	ppb
└>	In-KED2	115	44803.6	1.3			ppb
┌>	Rh-KED2	103	243199.9	3.4			ppb
│	Ag-KED2	107	1023.7	3.4	0.18487	2.0	ppb
└	Ag-KED2	109	990.4	5.7	0.18545	2.3	ppb
┌>	In-KED1	115	580060.4	1.3			ppb
│	Sb-KED1	121	161989.3	1.1	12.67160	0.9	ppb
│	Sb-KED1	123	123476.8	1.6	12.66769	1.2	ppb
│	Ba-KED1	135	166881.1	1.1	42.05594	0.4	ppb
└	Ba-KED1	137	278026.7	1.9	41.66153	2.0	ppb
┌>	Lu-KED1	175	681106.6	1.4			ppb
│	Tl-KED1	203	620.7	3.8	0.05191	4.6	ppb
│	Tl-KED1	205	1372.7	4.5	0.05026	6.3	ppb
└	Pb-KED1	208	30812.2	0.7	0.95036	1.5	ppb
┌	Mn-STD1	55	27077864.7	2.2	665.66933	7.7	ppb
└>	Ge-STD	72	1769683.1	7.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		111			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		92			
┌>	Ge-KED2	72		96			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		96			
┌>	Rh-KED2	103		96			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		103			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		108			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-003D
Sample Date/Time: Wednesday, September 07, 2016 19:46:11
Sample Description: 5
Autosampler Position: 350
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-003D.077
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1247588.1	2.7			ppb
│	Be-KED1	9	426.3	4.5	0.11241	7.0	ppb
└	Al-KED1	27	56460245.8	4.9	1601.64566	4.4	ppb
┌	V-KED3	51	1189.0	3.7	2.95189	4.4	ppb
│	Cr-KED3	52	1630.1	1.0	2.84815	0.8	ppb
│	Cr-KED3	53	257.3	0.4	3.89224	1.1	ppb
│	Co-KED3	59	6241.4	1.8	4.78987	2.8	ppb
│	Ni-KED3	60	2149.5	4.8	2.73529	3.6	ppb
│	Ni-KED3	62	192.7	15.1	2.93196	15.6	ppb
│	Cu-KED3	63	38030.6	2.7	30.68686	3.6	ppb
│	Zn-KED3	64	51665.0	1.0	329.91768	2.1	ppb
│	Cu-KED3	65	19846.1	1.9	30.63576	1.3	ppb
│	Zn-KED3	66	33812.0	0.5	316.12239	1.3	ppb
└>	Ge-KED3	72	27703.2	1.2			ppb
┌>	Ge-KED2	72	145590.5	1.0			ppb
│	As-KED2	75	26320.9	0.3	114.75447	0.9	ppb
│	Se-KED2	77	76.0	27.3	8.64795	27.7	ppb
│	Se-KED2	78	216.6	4.0	6.91486	5.2	ppb
└	Se-KED2	82	66.4	12.5	6.16640	10.4	ppb
┌	Mo-KED2	95	1938.1	1.4	1.35190	1.5	ppb
│	Mo-KED2	97	1296.1	3.6	1.36500	4.4	ppb
│	Mo-KED2	98	3322.2	4.2	1.35364	5.2	ppb
│	Cd-KED2	111	486.3	3.8	0.76597	3.7	ppb
│	Cd-KED2	114	1082.5	2.4	0.72924	3.2	ppb
└>	In-KED2	115	45465.8	1.1			ppb
┌>	Rh-KED2	103	250365.5	1.5			ppb
│	Ag-KED2	107	1021.7	2.9	0.17917	3.2	ppb
└	Ag-KED2	109	1008.7	5.7	0.18352	5.0	ppb
┌>	In-KED1	115	585952.1	0.2			ppb
│	Sb-KED1	121	170640.5	1.3	13.21382	1.3	ppb
│	Sb-KED1	123	129693.1	2.4	13.17199	2.5	ppb
│	Ba-KED1	135	163928.2	2.5	40.89532	2.5	ppb
└	Ba-KED1	137	272281.7	0.7	40.38750	0.6	ppb
┌>	Lu-KED1	175	691824.2	1.9			ppb
│	Tl-KED1	203	670.7	8.7	0.05564	11.1	ppb
│	Tl-KED1	205	1503.4	2.4	0.05460	4.5	ppb
└	Pb-KED1	208	31907.7	1.7	0.96885	0.2	ppb
┌	Mn-STD1	55	27858887.6	4.5	693.90697	3.0	ppb
└>	Ge-STD	72	1739952.4	3.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		112			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		94			
⌈>	Ge-KED2	72		97			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		98			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		104			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		109			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		100			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-003L
Sample Date/Time: Wednesday, September 07, 2016 19:51:01
Sample Description: 25
Autosampler Position: 351
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-003L.078
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1244537.7	2.9			ppb
|	Be-KED1	9	89.0	10.3	0.02222	14.0	ppb
⌊	Al-KED1	27	11961722.9	2.9	340.13157	1.2	ppb
⌈	V-KED3	51	265.0	5.4	0.63458	5.1	ppb
|	Cr-KED3	52	335.7	0.3	0.56477	1.0	ppb
|	Cr-KED3	53	61.3	12.3	0.89579	11.6	ppb
|	Co-KED3	59	1156.4	1.4	0.85826	1.5	ppb
|	Ni-KED3	60	502.7	10.6	0.61905	10.8	ppb
|	Ni-KED3	62	39.3	10.6	0.57553	11.5	ppb
|	Cu-KED3	63	7487.3	2.4	5.87349	2.3	ppb
|	Zn-KED3	64	9653.5	0.5	60.02369	1.0	ppb
|	Cu-KED3	65	3897.2	2.5	5.85553	1.7	ppb
|	Zn-KED3	66	6295.1	2.1	57.30279	2.9	ppb
⌊>	Ge-KED3	72	28437.3	0.8			ppb
⌈>	Ge-KED2	72	148504.7	1.5			ppb
|	As-KED2	75	4841.5	2.1	20.62420	1.3	ppb
|	Se-KED2	77	15.3	41.9	1.47197	51.0	ppb
|	Se-KED2	78	60.9	2.9	0.99900	5.2	ppb
⌊	Se-KED2	82	1.8	474.7	1.56081	38.6	ppb
⌈	Mo-KED2	95	382.7	4.2	0.26053	4.7	ppb
|	Mo-KED2	97	242.7	7.7	0.24769	7.2	ppb
|	Mo-KED2	98	622.9	2.5	0.24817	2.4	ppb
|	Cd-KED2	111	78.0	14.4	0.11421	15.3	ppb
|	Cd-KED2	114	207.3	4.2	0.13548	4.2	ppb
⌊>	In-KED2	115	46261.7	0.6			ppb
⌈>	Rh-KED2	103	254169.2	0.4			ppb
|	Ag-KED2	107	209.0	1.9	0.03471	1.6	ppb
⌊	Ag-KED2	109	210.0	6.8	0.03605	6.8	ppb
⌈>	In-KED1	115	599157.2	2.9			ppb
|	Sb-KED1	121	30801.8	2.1	2.32951	4.2	ppb
|	Sb-KED1	123	23629.9	2.3	2.34482	5.1	ppb
|	Ba-KED1	135	32505.6	1.6	7.92936	1.7	ppb
⌊	Ba-KED1	137	54106.9	1.2	7.85342	4.0	ppb
⌈>	Lu-KED1	175	683938.5	2.7			ppb
|	Tl-KED1	203	134.0	6.5	0.00669	17.2	ppb
|	Tl-KED1	205	255.3	2.4	0.00501	4.5	ppb
⌊	Pb-KED1	208	5995.2	4.9	0.18286	2.7	ppb
⌈	Mn-STD1	55	5628038.0	3.6	137.48422	2.6	ppb
⌊>	Ge-STD	72	1773406.3	1.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		111			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		97			
⌈>	Ge-KED2	72		99			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		99			
⌈>	Rh-KED2	103		100			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		107			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		108			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-003A
Sample Date/Time: Wednesday, September 07, 2016 19:55:52
Sample Description: 5 +50ppb +10ppb Ag
Autosampler Position: 352
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-003A.079
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1230659.5	1.3			ppb
│	Be-KED1	9	189196.3	2.2	51.27667	2.9	ppb
└	Al-KED1	27	62835168.4	3.9	1807.18081	4.3	ppb
┌	V-KED3	51	22051.7	0.9	56.19465	1.4	ppb
│	Cr-KED3	52	30374.9	1.1	54.50244	1.8	ppb
│	Cr-KED3	53	3748.5	0.9	58.18905	0.2	ppb
│	Co-KED3	59	72946.4	0.4	57.40336	1.1	ppb
│	Ni-KED3	60	42443.6	0.9	55.43808	1.4	ppb
│	Ni-KED3	62	3693.8	1.9	57.71821	1.2	ppb
│	Cu-KED3	63	101962.6	0.3	84.25938	0.6	ppb
│	Zn-KED3	64	59738.9	1.9	390.62308	2.2	ppb
│	Cu-KED3	65	52213.6	0.8	82.55812	1.5	ppb
│	Zn-KED3	66	38882.5	2.1	372.23455	1.5	ppb
└>	Ge-KED3	72	27051.6	0.7			ppb
┌>	Ge-KED2	72	145386.2	1.9			ppb
│	As-KED2	75	38843.4	2.5	169.61021	1.0	ppb
│	Se-KED2	77	501.3	7.1	58.85618	5.5	ppb
│	Se-KED2	78	1665.1	2.9	61.59569	3.3	ppb
└	Se-KED2	82	813.1	9.0	59.43154	9.5	ppb
┌	Mo-KED2	95	74358.4	1.7	52.51839	1.4	ppb
│	Mo-KED2	97	49187.9	1.5	52.51356	1.4	ppb
│	Mo-KED2	98	127939.6	2.1	52.73103	0.8	ppb
│	Cd-KED2	111	32989.4	1.3	53.05364	1.8	ppb
│	Cd-KED2	114	77659.6	1.5	53.03401	1.8	ppb
└>	In-KED2	115	44984.1	2.8			ppb
┌>	Rh-KED2	103	242925.5	3.6			ppb
│	Ag-KED2	107	53300.6	1.9	9.72892	2.3	ppb
└	Ag-KED2	109	51222.0	1.5	9.71356	2.1	ppb
┌>	In-KED1	115	588440.8	2.6			ppb
│	Sb-KED1	121	819144.6	1.2	63.20370	1.8	ppb
│	Sb-KED1	123	629920.4	1.3	63.74090	1.5	ppb
│	Ba-KED1	135	362267.7	1.4	90.06110	4.0	ppb
└	Ba-KED1	137	601713.2	2.0	88.92533	3.6	ppb
┌>	Lu-KED1	175	684296.6	0.3			ppb
│	Tl-KED1	203	507339.6	2.4	46.87848	2.3	ppb
│	Tl-KED1	205	1160612.4	2.2	46.70352	2.2	ppb
└	Pb-KED1	208	1556558.6	1.5	47.85447	1.6	ppb
┌	Mn-STD1	55	28934423.7	1.3	712.79538	1.0	ppb
└>	Ge-STD	72	1759476.7	2.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		110			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		97			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		96			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		105			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		108			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-003S
Sample Date/Time: Wednesday, September 07, 2016 20:00:41
Sample Description: 5
Autosampler Position: 353
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-003S.080
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1313243.0	3.1			ppb
│	Be-KED1	9	38238.1	2.2	9.71074	1.1	ppb
⌊	Al-KED1	27	100549167.6	2.7	2710.22573	2.3	ppb
⌈	V-KED3	51	40949.9	1.0	104.36992	1.0	ppb
│	Cr-KED3	52	23723.0	1.5	42.56583	1.0	ppb
│	Cr-KED3	53	2997.6	2.8	46.54196	3.2	ppb
│	Co-KED3	59	134727.4	0.9	106.04459	1.7	ppb
│	Ni-KED3	60	77230.9	0.5	100.89976	1.8	ppb
│	Ni-KED3	62	6598.2	3.4	103.15240	4.3	ppb
│	Cu-KED3	63	98217.8	1.0	81.19300	2.8	ppb
│	Zn-KED3	64	65520.6	0.1	428.51910	1.8	ppb
│	Cu-KED3	65	50850.7	1.2	80.40714	0.7	ppb
│	Zn-KED3	66	43075.5	0.6	412.49622	1.6	ppb
⌊>	Ge-KED3	72	27050.6	1.8			ppb
⌈>	Ge-KED2	72	145382.7	2.8			ppb
│	As-KED2	75	39874.6	0.5	174.20849	2.6	ppb
│	Se-KED2	77	516.7	3.3	60.75689	5.5	ppb
│	Se-KED2	78	1646.9	2.3	60.95704	5.1	ppb
⌊	Se-KED2	82	799.7	4.3	58.45648	4.0	ppb
⌈	Mo-KED2	95	74726.9	0.3	52.00600	2.9	ppb
│	Mo-KED2	97	49375.9	0.8	51.94503	3.3	ppb
│	Mo-KED2	98	128412.9	1.5	52.16388	3.9	ppb
│	Cd-KED2	111	6792.6	2.7	10.75353	2.4	ppb
│	Cd-KED2	114	16138.5	1.1	10.85540	2.0	ppb
⌊>	In-KED2	115	45663.8	2.6			ppb
⌈>	Rh-KED2	103	244318.7	1.3			ppb
│	Ag-KED2	107	53771.0	1.0	9.75532	1.8	ppb
⌊	Ag-KED2	109	51272.5	0.5	9.66364	1.2	ppb
⌈>	In-KED1	115	623664.4	2.9			ppb
│	Sb-KED1	121	1163828.9	2.8	84.73437	3.2	ppb
│	Sb-KED1	123	879922.6	2.5	84.03115	3.6	ppb
│	Ba-KED1	135	949362.1	2.3	222.55829	0.6	ppb
⌊	Ba-KED1	137	1583019.2	1.8	220.66464	1.2	ppb
⌈>	Lu-KED1	175	709648.5	2.9			ppb
│	Tl-KED1	203	101580.0	2.0	9.04910	2.3	ppb
│	Tl-KED1	205	235371.2	2.5	9.13210	2.9	ppb
⌊	Pb-KED1	208	3041703.3	2.4	90.18444	1.2	ppb
⌈	Mn-STD1	55	31540584.1	2.0	771.55487	3.2	ppb
⌊>	Ge-STD	72	1772495.2	2.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		117			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		97			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		98			
⌈>	Rh-KED2	103		96			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		111			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		112			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610520-02
Sample Date/Time: Wednesday, September 07, 2016 20:05:31
Sample Description: 5
Autosampler Position: 354
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610520-02.081
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1280205.5	6.0			ppb
	Be-KED1	9	35354.4	3.0	9.21891	2.9	ppb
	Al-KED1	27	13905681.9	2.8	384.91236	3.8	ppb
	V-KED3	51	39483.5	0.4	97.03993	1.5	ppb
	Cr-KED3	52	22259.7	1.0	38.51184	0.3	ppb
	Cr-KED3	53	2668.2	4.9	39.93561	4.3	ppb
	Co-KED3	59	130421.4	1.2	98.98100	1.6	ppb
	Ni-KED3	60	78012.4	0.5	98.26683	0.5	ppb
	Ni-KED3	62	6572.8	1.7	99.05591	1.4	ppb
	Cu-KED3	63	62507.1	0.8	49.80825	0.8	ppb
	Zn-KED3	64	15114.2	2.0	95.29411	2.7	ppb
	Cu-KED3	65	32118.4	0.9	48.96921	0.3	ppb
	Zn-KED3	66	10283.0	2.6	94.89964	1.9	ppb
>	Ge-KED3	72	28051.5	1.0			ppb
>	Ge-KED2	72	150137.2	1.0			ppb
	As-KED2	75	11310.1	0.9	47.77121	1.8	ppb
	Se-KED2	77	378.0	10.1	42.89243	9.2	ppb
	Se-KED2	78	1368.9	1.1	48.77835	1.9	ppb
	Se-KED2	82	667.2	6.0	47.48481	5.4	ppb
	Mo-KED2	95	72220.8	0.5	49.66023	2.1	ppb
	Mo-KED2	97	47494.8	2.3	49.35433	1.9	ppb
	Mo-KED2	98	123887.9	0.6	49.71002	1.0	ppb
	Cd-KED2	111	6199.3	2.2	9.69665	0.9	ppb
	Cd-KED2	114	14656.4	0.8	9.74242	2.4	ppb
>	In-KED2	115	46204.7	1.6			ppb
>	Rh-KED2	103	254385.4	0.9			ppb
	Ag-KED2	107	53827.9	1.9	9.37742	1.2	ppb
	Ag-KED2	109	52050.7	2.2	9.42047	1.4	ppb
>	In-KED1	115	612530.5	4.5			ppb
	Sb-KED1	121	1265069.2	3.2	93.79263	2.1	ppb
	Sb-KED1	123	957209.8	3.7	93.05794	1.7	ppb
	Ba-KED1	135	730668.7	4.5	174.38885	0.5	ppb
	Ba-KED1	137	1220594.6	3.4	173.26938	1.8	ppb
>	Lu-KED1	175	684020.1	3.8			ppb
	Tl-KED1	203	100377.2	4.5	9.27283	1.1	ppb
	Tl-KED1	205	231001.2	3.9	9.29497	0.2	ppb
	Pb-KED1	208	3007765.1	3.2	92.52476	1.0	ppb
	Mn-STD1	55	4387814.3	6.6	108.17272	6.4	ppb
>	Ge-STD	72	1757421.6	1.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		115			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		95			
⌈>	Ge-KED2	72		100			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		99			
⌈>	Rh-KED2	103		100			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		109			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		108			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: MO STD
Sample Date/Time: Wednesday, September 07, 2016 20:10:23
Sample Description:
Autosampler Position: 7
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\MO STD.082
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1195366.4	3.3			ppb
│	Be-KED1	9	9.7	39.2	0.00102	109.7	ppb
⌊	Al-KED1	27	13924.1	3.2	0.38764	6.6	ppb
⌈	V-KED3	51	4.0	43.3	0.00232	179.9	ppb
│	Cr-KED3	52	7.0	65.5	0.00423	190.0	ppb
│	Cr-KED3	53	0.7	173.2	0.00060	2899.8	ppb
│	Co-KED3	59	6.0	76.4	-0.00280	124.7	ppb
│	Ni-KED3	60	22.7	13.5	0.02400	18.3	ppb
│	Ni-KED3	62	2.0	0.0	0.02164	2.7	ppb
│	Cu-KED3	63	22.0	31.5	0.00503	118.0	ppb
│	Zn-KED3	64	38.5	15.6	0.22494	18.9	ppb
│	Cu-KED3	65	9.3	24.7	0.00895	42.4	ppb
│	Zn-KED3	66	26.0	7.7	0.20463	9.6	ppb
⌊>	Ge-KED3	72	27092.3	1.9			ppb
⌈>	Ge-KED2	72	146558.7	1.3			ppb
│	As-KED2	75	30.7	5.0	0.04997	15.7	ppb
│	Se-KED2	77	3.3	69.3	0.08875	312.9	ppb
│	Se-KED2	78	36.1	9.9	0.10368	132.9	ppb
⌊	Se-KED2	82	-15.5	41.7	0.33528	139.7	ppb
⌈	Mo-KED2	95	85831.1	0.6	62.67721	1.8	ppb
│	Mo-KED2	97	55893.1	0.8	61.69319	1.7	ppb
│	Mo-KED2	98	147159.3	1.2	62.71636	2.2	ppb
│	Cd-KED2	111	20.7	7.4	0.02659	6.8	ppb
│	Cd-KED2	114	34.7	28.7	0.02249	33.9	ppb
⌊>	In-KED2	115	43511.0	2.4			ppb
⌈>	Rh-KED2	103	243661.2	2.4			ppb
│	Ag-KED2	107	77.3	9.7	0.01233	11.0	ppb
⌊	Ag-KED2	109	65.3	14.2	0.01039	19.8	ppb
⌈>	In-KED1	115	576052.5	3.6			ppb
│	Sb-KED1	121	1495.4	3.2	0.11204	0.6	ppb
│	Sb-KED1	123	1150.9	4.0	0.11364	5.3	ppb
│	Ba-KED1	135	44.7	25.5	0.00717	40.6	ppb
⌊	Ba-KED1	137	56.0	31.7	0.00666	43.8	ppb
⌈>	Lu-KED1	175	639330.2	2.1			ppb
│	Tl-KED1	203	1864.1	1.9	0.17867	0.3	ppb
│	Tl-KED1	205	4384.7	1.5	0.18363	1.9	ppb
⌊	Pb-KED1	208	267.3	6.8	0.00732	10.2	ppb
⌈	Mn-STD1	55	1988.1	5.2	0.01523	10.6	ppb
⌊>	Ge-STD	72	1659021.7	3.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		97			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		96			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		103			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		101			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-004
Sample Date/Time: Wednesday, September 07, 2016 20:15:15
Sample Description: 5
Autosampler Position: 355
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-004.083
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1256693.7	4.1			ppb
|	Be-KED1	9	434.0	3.4	0.11353	2.8	ppb
⌊	Al-KED1	27	50326481.0	0.7	1418.57852	3.6	ppb
⌈	V-KED3	51	1181.7	3.1	2.94566	5.6	ppb
|	Cr-KED3	52	1097.4	2.8	1.92184	3.5	ppb
|	Cr-KED3	53	187.3	17.4	2.84782	19.6	ppb
|	Co-KED3	59	4809.5	3.4	3.70103	2.2	ppb
|	Ni-KED3	60	1676.8	1.7	2.14189	4.3	ppb
|	Ni-KED3	62	142.0	7.5	2.16798	9.7	ppb
|	Cu-KED3	63	39177.7	0.9	31.72191	1.9	ppb
|	Zn-KED3	64	61740.2	2.0	395.56600	0.6	ppb
|	Cu-KED3	65	20358.8	1.0	31.54681	2.5	ppb
|	Zn-KED3	66	39813.7	1.1	373.70000	3.6	ppb
⌊>	Ge-KED3	72	27609.7	2.6			ppb
⌈>	Ge-KED2	72	146579.8	2.5			ppb
|	As-KED2	75	18159.2	0.6	78.64733	3.1	ppb
|	Se-KED2	77	58.7	2.0	6.57037	4.0	ppb
|	Se-KED2	78	178.7	1.7	5.44251	1.5	ppb
⌊	Se-KED2	82	49.1	8.3	4.91324	6.7	ppb
⌈	Mo-KED2	95	1960.8	3.0	1.36731	5.6	ppb
|	Mo-KED2	97	1297.4	1.2	1.36492	2.5	ppb
|	Mo-KED2	98	3197.4	3.1	1.30243	6.5	ppb
|	Cd-KED2	111	397.0	3.2	0.62357	5.2	ppb
|	Cd-KED2	114	954.4	2.6	0.64200	3.0	ppb
⌊>	In-KED2	115	45530.7	3.6			ppb
⌈>	Rh-KED2	103	248859.9	1.5			ppb
|	Ag-KED2	107	1467.4	3.4	0.25965	3.5	ppb
⌊	Ag-KED2	109	1451.4	2.4	0.26658	0.9	ppb
⌈>	In-KED1	115	598590.2	3.8			ppb
|	Sb-KED1	121	363551.0	1.3	27.59606	4.7	ppb
|	Sb-KED1	123	274789.8	0.7	27.35150	4.0	ppb
|	Ba-KED1	135	294812.8	2.4	72.02367	1.6	ppb
⌊	Ba-KED1	137	491032.9	2.9	71.31561	1.1	ppb
⌈>	Lu-KED1	175	693331.2	1.3			ppb
|	Tl-KED1	203	581.3	10.1	0.04730	11.3	ppb
|	Tl-KED1	205	1330.7	8.0	0.04755	7.7	ppb
⌊	Pb-KED1	208	37623.2	0.3	1.14025	1.2	ppb
⌈	Mn-STD1	55	30100111.9	3.2	739.02589	2.3	ppb
⌊>	Ge-STD	72	1765368.4	3.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		112			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		94			
⌈>	Ge-KED2	72		97			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		98			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		107			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		109			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 20:20:07
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.084
User Name: JDB
Batch ID:

Concentration Results

Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
> Li-KED1	6	1248506.3	5.3			ppb
Be-KED1	9	89824.2	1.0	24.02752	4.3	ppb
Al-KED1	27	901318.8	4.0	25.53441	1.4	ppb
V-KED3	51	10130.9	1.5	25.57282	0.9	ppb
Cr-KED3	52	14671.2	1.3	26.07566	0.8	ppb
Cr-KED3	53	1738.1	1.3	26.72926	1.6	ppb
Co-KED3	59	34007.4	2.4	26.50774	1.7	ppb
Ni-KED3	60	20580.8	0.9	26.63068	1.0	ppb
Ni-KED3	62	1790.8	2.1	27.72042	1.8	ppb
Cu-KED3	63	32225.6	1.6	26.37536	1.2	ppb
Zn-KED3	64	3913.6	4.8	25.32852	4.8	ppb
Cu-KED3	65	16902.0	0.2	26.47432	0.9	ppb
Zn-KED3	66	2705.6	0.6	25.62433	0.7	ppb
> Ge-KED3	72	27302.7	0.7			ppb
> Ge-KED2	72	146432.1	1.7			ppb
As-KED2	75	5735.2	1.4	24.80146	2.8	ppb
Se-KED2	77	195.3	7.8	22.59522	7.7	ppb
Se-KED2	78	686.0	2.5	24.46294	4.4	ppb
Se-KED2	82	305.1	9.6	23.05298	10.0	ppb
Mo-KED2	95	36209.8	0.9	25.39087	1.8	ppb
Mo-KED2	97	23881.9	0.7	25.30989	0.6	ppb
Mo-KED2	98	61802.4	1.4	25.29337	2.4	ppb
Cd-KED2	111	15633.2	1.5	24.95790	2.6	ppb
Cd-KED2	114	37267.0	0.5	25.26398	0.8	ppb
> In-KED2	115	45302.4	1.3			ppb
> Rh-KED2	103	254178.7	0.7			ppb
Ag-KED2	107	139775.2	1.2	24.37387	0.8	ppb
Ag-KED2	109	134666.5	1.5	24.39687	0.9	ppb
> In-KED1	115	603516.8	0.7			ppb
Sb-KED1	121	321734.5	2.3	24.19674	2.9	ppb
Sb-KED1	123	241765.3	2.3	23.84612	2.8	ppb
Ba-KED1	135	95212.3	1.2	23.06169	1.9	ppb
Ba-KED1	137	160561.5	1.9	23.12530	2.7	ppb
> Lu-KED1	175	667842.2	4.4			ppb
Tl-KED1	203	260572.0	3.3	24.67702	1.6	ppb
Tl-KED1	205	605251.0	2.1	24.97472	3.3	ppb
Pb-KED1	208	787185.5	1.8	24.81494	2.6	ppb
~~Mn-STD1~~	~~55~~	~~1168275.6~~	~~2.7~~	~~28.33000~~	~~0.5~~	~~ppb~~
> Ge-STD	72	1784847.1	2.3			ppb

NR Mn rest of run.
JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		112			
|	Be-KED1	9	96				
⌊	Al-KED1	27	102				
⌈	V-KED3	51	102				
|	Cr-KED3	52	104				
|	Cr-KED3	53	107				
|	Co-KED3	59	106				
|	Ni-KED3	60	107				
|	Ni-KED3	62	111				
|	Cu-KED3	63	106				
|	Zn-KED3	64	101				
|	Cu-KED3	65	106				
|	Zn-KED3	66	102				
⌊>	Ge-KED3	72		93			
⌈>	Ge-KED2	72		97			
|	As-KED2	75	99				
|	Se-KED2	77	90				
|	Se-KED2	78	98				
⌊	Se-KED2	82	92				
⌈	Mo-KED2	95	102				
|	Mo-KED2	97	101				
|	Mo-KED2	98	101				
|	Cd-KED2	111	100				
|	Cd-KED2	114	101				
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		100			
|	Ag-KED2	107	97				
⌊	Ag-KED2	109	98				
⌈>	In-KED1	115		107			
|	Sb-KED1	121	97				
|	Sb-KED1	123	95				
|	Ba-KED1	135	92				
⌊	Ba-KED1	137	93				
⌈>	Lu-KED1	175		105			
|	Tl-KED1	203	99				
|	Tl-KED1	205	100				
⌊	Pb-KED1	208	99				
⌈	Mn-STD1	55	113				
⌊>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Ni-KED3	62	Out of Control
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 20:24:38
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.085
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1301422.6	3.7			ppb
│	Be-KED1	9	89929.5	4.0	23.04288	1.5	ppb
└	Al-KED1	27	902741.5	5.2	24.51472	1.7	ppb
┌	V-KED3	51	10074.9	0.8	26.00389	4.5	ppb
│	Cr-KED3	52	14339.9	0.6	26.06296	4.8	ppb
│	Cr-KED3	53	1670.1	4.9	26.26575	7.0	ppb
│	Co-KED3	59	32628.2	1.7	26.00677	4.8	ppb
│	Ni-KED3	60	19566.1	1.2	25.89313	5.4	ppb
│	Ni-KED3	62	1654.1	3.1	26.15876	2.1	ppb
│	Cu-KED3	63	31145.9	1.9	26.06799	5.2	ppb
│	Zn-KED3	64	3806.1	3.0	25.18766	5.6	ppb
│	Cu-KED3	65	16220.5	0.8	25.97107	3.7	ppb
│	Zn-KED3	66	2555.9	0.7	24.74701	4.3	ppb
└>	Ge-KED3	72	26735.7	4.2			ppb
┌>	Ge-KED2	72	144821.8	1.3			ppb
│	As-KED2	75	5691.1	3.6	24.87405	2.6	ppb
│	Se-KED2	77	199.3	10.5	23.31357	10.0	ppb
│	Se-KED2	78	702.5	3.4	25.36906	4.1	ppb
└	Se-KED2	82	296.5	7.1	22.66486	7.5	ppb
┌	Mo-KED2	95	35718.6	1.1	25.49554	1.0	ppb
│	Mo-KED2	97	23814.5	1.1	25.69288	0.9	ppb
│	Mo-KED2	98	61160.1	1.1	25.47776	0.9	ppb
│	Cd-KED2	111	15658.2	1.6	25.44381	1.3	ppb
│	Cd-KED2	114	36737.5	1.5	25.35273	1.3	ppb
└>	In-KED2	115	44498.4	0.3			ppb
┌>	Rh-KED2	103	248981.1	1.8			ppb
│	Ag-KED2	107	138300.6	1.1	24.62406	1.7	ppb
└	Ag-KED2	109	132295.1	0.4	24.47345	1.8	ppb
┌>	In-KED1	115	608198.4	6.5			ppb
│	Sb-KED1	121	324169.7	4.6	24.20861	2.0	ppb
│	Sb-KED1	123	245660.6	4.0	24.06747	2.8	ppb
│	Ba-KED1	135	94025.4	7.1	22.59096	0.6	ppb
└	Ba-KED1	137	155850.3	6.2	22.27348	0.6	ppb
┌>	Lu-KED1	175	666602.6	4.8			ppb
│	Tl-KED1	203	259367.6	3.9	24.60860	1.5	ppb
│	Tl-KED1	205	604078.3	5.5	24.95280	2.9	ppb
└	Pb-KED1	208	775745.3	3.0	24.49746	2.3	ppb
┌	Mn-STD1	55	1105422.5	5.3	28.02506	2.3	ppb
└>	Ge-STD	72	1706505.6	3.0			ppb

JDB 9/8/16

Sample ID: CCV
Report Date/Time: Thursday, September 08, 2016 09:09:53
Page 1

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		116			
⎢	Be-KED1	9	92				
⎣	Al-KED1	27	98				
⎡	V-KED3	51	104				
⎢	Cr-KED3	52	104				
⎢	Cr-KED3	53	105				
⎢	Co-KED3	59	104				
⎢	Ni-KED3	60	104				
⎢	Ni-KED3	62	105				
⎢	Cu-KED3	63	104				
⎢	Zn-KED3	64	101				
⎢	Cu-KED3	65	104				
⎢	Zn-KED3	66	99				
⎣>	Ge-KED3	72		91			
⎡>	Ge-KED2	72		96			
⎢	As-KED2	75	99				
⎢	Se-KED2	77	93				
⎢	Se-KED2	78	101				
⎣	Se-KED2	82	91				
⎡	Mo-KED2	95	102				
⎢	Mo-KED2	97	103				
⎢	Mo-KED2	98	102				
⎢	Cd-KED2	111	102				
⎢	Cd-KED2	114	101				
⎣>	In-KED2	115		95			
⎡>	Rh-KED2	103		98			
⎢	Ag-KED2	107	98				
⎣	Ag-KED2	109	98				
⎡>	In-KED1	115		108			
⎢	Sb-KED1	121	97				
⎢	Sb-KED1	123	96				
⎢	Ba-KED1	135	90				
⎣	Ba-KED1	137	89				
⎡>	Lu-KED1	175		105			
⎢	Tl-KED1	203	98				
⎢	Tl-KED1	205	100				
⎣	Pb-KED1	208	98				
⎡	Mn-STD1	55	112				
⎣>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Ba-KED1	137	Out of Control
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 20:29:29
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.086
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1213351.8	0.6			ppb
│	Be-KED1	9	8.7	37.1	0.00069	128.8	ppb
└	Al-KED1	27	1290.1	5.0	0.01248	13.8	ppb
┌	V-KED3	51	4.0	25.0	0.00216	118.5	ppb
│	Cr-KED3	52	4.3	13.3	-0.00066	143.3	ppb
│	Cr-KED3	53	1.3	173.2	0.01050	330.1	ppb
│	Co-KED3	59	5.7	36.7	-0.00312	51.8	ppb
│	Ni-KED3	60	8.0	25.0	0.00460	55.6	ppb
│	Ni-KED3	62	0.7	173.2	0.00066	2681.3	ppb
│	Cu-KED3	63	12.0	16.7	-0.00348	47.0	ppb
│	Zn-KED3	64	9.1	34.3	0.03068	63.4	ppb
│	Cu-KED3	65	8.0	37.5	0.00656	71.7	ppb
│	Zn-KED3	66	4.0	25.0	-0.00663	136.6	ppb
└>	Ge-KED3	72	27697.2	0.9			ppb
┌>	Ge-KED2	72	143539.4	2.0			ppb
│	As-KED2	75	21.0	28.6	0.00968	260.7	ppb
│	Se-KED2	77	2.0	100.0	-0.06747	351.2	ppb
│	Se-KED2	78	32.7	20.5	0.00352	7970.7	ppb
└	Se-KED2	82	-18.2	50.9	0.11757	585.6	ppb
┌	Mo-KED2	95	10.7	10.8	0.00546	16.1	ppb
│	Mo-KED2	97	5.3	94.4	0.00171	321.6	ppb
│	Mo-KED2	98	7.9	51.0	0.00188	90.2	ppb
│	Cd-KED2	111	2.3	65.5	-0.00388	65.5	ppb
│	Cd-KED2	114	4.7	70.2	0.00121	194.2	ppb
└>	In-KED2	115	43891.8	0.6			ppb
┌>	Rh-KED2	103	241153.2	2.5			ppb
│	Ag-KED2	107	43.0	12.9	0.00615	13.8	ppb
└	Ag-KED2	109	37.3	14.8	0.00515	22.0	ppb
┌>	In-KED1	115	583779.4	2.9			ppb
│	Sb-KED1	121	335.3	12.7	0.02022	13.9	ppb
│	Sb-KED1	123	258.3	20.0	0.02087	21.4	ppb
│	Ba-KED1	135	21.3	14.3	0.00120	76.5	ppb
└	Ba-KED1	137	14.7	34.3	0.00034	236.9	ppb
┌>	Lu-KED1	175	653813.4	3.6			ppb
│	Tl-KED1	203	32.0	22.5	-0.00264	23.0	ppb
│	Tl-KED1	205	66.7	14.8	-0.00247	15.0	ppb
└	Pb-KED1	208	54.0	12.8	0.00025	75.4	ppb
┌	Mn-STD1	55	2066.1	5.3	0.01372	26.7	ppb
└>	Ge-STD	72	1778667.2	4.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		94			
⌈>	Ge-KED2	72		95			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		95			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		104			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		102			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: LLCCVT
Sample Date/Time: Wednesday, September 07, 2016 20:34:20
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLCCVT.087
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1235888.6	5.4			ppb
|	Be-KED1	9	148.3	6.9	0.03851	12.7	ppb
⌊	Al-KED1	27	142486.9	3.4	4.05795	2.2	ppb
⌈	V-KED3	51	155.0	7.8	0.37922	6.7	ppb
|	Cr-KED3	52	235.7	1.3	0.40639	2.6	ppb
|	Cr-KED3	53	30.0	40.6	0.44620	41.0	ppb
|	Co-KED3	59	66.3	19.1	0.04361	20.6	ppb
|	Ni-KED3	60	321.3	2.6	0.40587	2.5	ppb
|	Ni-KED3	62	38.0	45.9	0.57140	46.3	ppb
|	Cu-KED3	63	256.0	7.5	0.19412	6.4	ppb
|	Zn-KED3	64	164.0	7.2	1.02387	6.8	ppb
|	Cu-KED3	65	141.3	8.7	0.21334	9.6	ppb
|	Zn-KED3	66	105.0	4.4	0.94127	3.1	ppb
⌊>	Ge-KED3	72	27596.3	1.5			ppb
⌈>	Ge-KED2	72	145422.4	0.7			ppb
|	As-KED2	75	255.7	4.7	1.03353	4.4	ppb
|	Se-KED2	77	22.7	18.4	2.37287	21.1	ppb
|	Se-KED2	78	81.3	1.6	1.81712	1.9	ppb
⌊	Se-KED2	82	4.4	321.1	1.75592	58.2	ppb
⌈	Mo-KED2	95	154.7	2.0	0.10834	4.0	ppb
|	Mo-KED2	97	84.0	10.4	0.08669	11.4	ppb
|	Mo-KED2	98	233.8	6.5	0.09602	4.6	ppb
|	Cd-KED2	111	28.0	9.4	0.03779	9.2	ppb
|	Cd-KED2	114	60.3	14.0	0.03948	13.1	ppb
⌊>	In-KED2	115	44442.6	1.9			ppb
⌈>	Rh-KED2	103	248315.2	2.2			ppb
|	Ag-KED2	107	242.3	5.8	0.04149	3.7	ppb
⌊	Ag-KED2	109	231.0	6.4	0.04088	7.7	ppb
⌈>	In-KED1	115	575979.5	5.7			ppb
|	Sb-KED1	121	1358.1	4.1	0.10149	8.3	ppb
|	Sb-KED1	123	1043.9	4.4	0.10266	5.6	ppb
|	Ba-KED1	135	402.0	6.7	0.09831	12.6	ppb
⌊	Ba-KED1	137	674.7	13.6	0.09973	9.2	ppb
⌈>	Lu-KED1	175	649095.0	3.4			ppb
|	Tl-KED1	203	412.0	14.3	0.03448	18.2	ppb
|	Tl-KED1	205	1042.7	3.8	0.03896	1.7	ppb
⌊	Pb-KED1	208	1338.7	2.7	0.04196	5.7	ppb
⌈	Mn-STD1	55	6580.8	2.6	0.12817	3.7	ppb
⌊>	Ge-STD	72	1730217.6	1.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		111			
|	Be-KED1	9	96				
⌊	Al-KED1	27	101				
⌈	V-KED3	51	95				
|	Cr-KED3	52	102				
|	Cr-KED3	53	112				
|	Co-KED3	59	109				
|	Ni-KED3	60	101				
|	Ni-KED3	62	143				
|	Cu-KED3	63	97				
|	Zn-KED3	64	102				
|	Cu-KED3	65	107				
|	Zn-KED3	66	94				
⌊>	Ge-KED3	72		94			
⌈>	Ge-KED2	72		97			
|	As-KED2	75	103				
|	Se-KED2	77	119				
|	Se-KED2	78	91				
⌊	Se-KED2	82	88				
⌈	Mo-KED2	95	108				
|	Mo-KED2	97	87				
|	Mo-KED2	98	96				
|	Cd-KED2	111	94				
|	Cd-KED2	114	99				
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		98			
|	Ag-KED2	107	104				
⌊	Ag-KED2	109	102				
⌈>	In-KED1	115		103			
|	Sb-KED1	121	101				
|	Sb-KED1	123	103				
|	Ba-KED1	135	98				
⌊	Ba-KED1	137	100				
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203	86				
|	Tl-KED1	205	97				
⌊	Pb-KED1	208	105				
⌈	Mn-STD1	55	128				
⌊>	Ge-STD	72		100			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 6	Ni-KED3	62	Out of Control

LABWORKS - Summary Report

Sample ID: K1609659-005
Sample Date/Time: Wednesday, September 07, 2016 20:39:11
Sample Description: 5
Autosampler Position: 356
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-005.088
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1244792.2	4.3			ppb
|	Be-KED1	9	444.7	8.3	0.11770	11.2	ppb
⌊	Al-KED1	27	60549689.8	3.6	1722.37851	3.5	ppb
⌈	V-KED3	51	1419.7	3.6	3.59337	2.3	ppb
|	Cr-KED3	52	1473.4	6.6	2.62112	3.4	ppb
|	Cr-KED3	53	246.0	3.7	3.79569	6.0	ppb
|	Co-KED3	59	5626.8	5.8	4.39865	4.3	ppb
|	Ni-KED3	60	2464.9	4.8	3.19746	1.1	ppb
|	Ni-KED3	62	208.0	6.7	3.23300	10.2	ppb
|	Cu-KED3	63	39186.3	1.3	32.23589	2.7	ppb
|	Zn-KED3	64	43659.9	2.4	284.21369	2.8	ppb
|	Cu-KED3	65	20652.6	5.2	32.47897	1.8	ppb
|	Zn-KED3	66	28138.7	2.4	268.17411	2.0	ppb
⌊>	Ge-KED3	72	27186.2	3.9			ppb
⌈>	Ge-KED2	72	147743.7	0.2			ppb
|	As-KED2	75	33793.9	0.5	145.20231	0.5	ppb
|	Se-KED2	77	79.3	7.3	8.91302	7.4	ppb
|	Se-KED2	78	229.0	7.8	7.25276	9.0	ppb
⌊	Se-KED2	82	83.7	6.3	7.30996	5.1	ppb
⌈	Mo-KED2	95	2478.2	1.6	1.72687	2.6	ppb
|	Mo-KED2	97	1558.8	3.4	1.63977	3.7	ppb
|	Mo-KED2	98	4256.9	2.5	1.73145	1.5	ppb
|	Cd-KED2	111	315.0	1.1	0.49266	1.3	ppb
|	Cd-KED2	114	666.6	5.4	0.44759	5.9	ppb
⌊>	In-KED2	115	45535.1	1.1			ppb
⌈>	Rh-KED2	103	245066.6	1.0			ppb
|	Ag-KED2	107	804.0	8.0	0.14364	7.3	ppb
⌊	Ag-KED2	109	790.7	2.4	0.14663	3.4	ppb
⌈>	In-KED1	115	591760.1	1.2			ppb
|	Sb-KED1	121	49117.0	2.9	3.76145	1.7	ppb
|	Sb-KED1	123	37063.6	4.0	3.72259	2.9	ppb
|	Ba-KED1	135	167969.4	2.4	41.48820	1.3	ppb
⌊	Ba-KED1	137	279296.6	2.2	41.01931	1.3	ppb
⌈>	Lu-KED1	175	668970.9	2.9			ppb
|	Tl-KED1	203	498.7	8.0	0.04138	6.6	ppb
|	Tl-KED1	205	1164.0	8.2	0.04263	7.7	ppb
⌊	Pb-KED1	208	30134.2	1.8	0.94644	1.7	ppb
⌈	Mn-STD1	55	33575082.0	1.6	827.98726	2.6	ppb
⌊>	Ge-STD	72	1758662.8	4.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		111			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		98			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		97			
⌈>	Rh-KED2	103		96			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		105			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		106			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		101			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-006
Sample Date/Time: Wednesday, September 07, 2016 20:44:02
Sample Description: 5
Autosampler Position: 357
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-006.089
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1255015.7	3.8			ppb
│	Be-KED1	9	443.3	7.0	0.11631	9.1	ppb
└	Al-KED1	27	59788318.6	2.5	1687.86070	5.1	ppb
┌	V-KED3	51	1055.0	0.3	2.67048	1.4	ppb
│	Cr-KED3	52	1150.4	3.0	2.04809	3.5	ppb
│	Cr-KED3	53	164.0	2.1	2.52723	3.4	ppb
│	Co-KED3	59	5400.7	3.5	4.22496	2.3	ppb
│	Ni-KED3	60	1987.5	5.4	2.57916	4.2	ppb
│	Ni-KED3	62	176.7	6.2	2.73986	5.6	ppb
│	Cu-KED3	63	30431.7	1.3	25.04210	2.5	ppb
│	Zn-KED3	64	59601.6	2.8	388.09225	1.7	ppb
│	Cu-KED3	65	15693.3	2.4	24.70716	1.7	ppb
│	Zn-KED3	66	38581.4	1.7	367.99169	3.1	ppb
└>	Ge-KED3	72	27161.8	1.6			ppb
┌>	Ge-KED2	72	144300.9	1.7			ppb
│	As-KED2	75	3189.0	1.6	13.95907	3.2	ppb
│	Se-KED2	77	50.0	17.4	5.63343	16.5	ppb
│	Se-KED2	78	170.5	7.3	5.24058	10.8	ppb
└	Se-KED2	82	51.7	23.6	5.16061	18.0	ppb
┌	Mo-KED2	95	1982.1	1.1	1.41925	1.7	ppb
│	Mo-KED2	97	1330.1	6.4	1.43805	7.1	ppb
│	Mo-KED2	98	3439.2	2.2	1.43798	2.6	ppb
│	Cd-KED2	111	568.3	2.7	0.92045	3.4	ppb
│	Cd-KED2	114	1339.7	0.5	0.92675	0.2	ppb
└>	In-KED2	115	44296.4	0.7			ppb
┌>	Rh-KED2	103	240399.9	1.7			ppb
│	Ag-KED2	107	963.4	6.5	0.17600	7.7	ppb
└	Ag-KED2	109	944.4	4.2	0.17897	4.8	ppb
┌>	In-KED1	115	578298.4	0.9			ppb
│	Sb-KED1	121	6520.2	3.0	0.50602	3.3	ppb
│	Sb-KED1	123	5014.9	0.7	0.51088	0.2	ppb
│	Ba-KED1	135	536256.6	1.6	135.55663	1.0	ppb
└	Ba-KED1	137	899275.8	1.3	135.15898	0.9	ppb
┌>	Lu-KED1	175	677259.6	2.7			ppb
│	Tl-KED1	203	330.7	10.2	0.02521	15.0	ppb
│	Tl-KED1	205	834.0	1.7	0.02866	4.8	ppb
└	Pb-KED1	208	20930.6	2.4	0.64886	2.4	ppb
┌	Mn-STD1	55	12256760.7	2.8	310.58640	2.5	ppb
└>	Ge-STD	72	1710598.0	3.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		112			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		92			
⌈>	Ge-KED2	72		96			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		95			
⌈>	Rh-KED2	103		94			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		103			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		107			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		98			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-007
Sample Date/Time: Wednesday, September 07, 2016 20:48:52
Sample Description: 5
Autosampler Position: 358
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-007.090
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1219077.9	2.2			ppb
│	Be-KED1	9	414.3	5.9	0.11160	3.8	ppb
└	Al-KED1	27	52475176.0	1.1	1523.90163	2.9	ppb
┌	V-KED3	51	1209.4	2.9	3.12524	2.3	ppb
│	Cr-KED3	52	3069.3	3.0	5.59255	4.2	ppb
│	Cr-KED3	53	382.0	2.4	6.01984	2.2	ppb
│	Co-KED3	59	2598.6	2.7	2.07168	3.1	ppb
│	Ni-KED3	60	2103.5	5.7	2.78846	6.6	ppb
│	Ni-KED3	62	191.3	13.2	3.03886	15.9	ppb
│	Cu-KED3	63	51567.0	4.2	43.30116	2.9	ppb
│	Zn-KED3	64	49626.1	2.9	329.80145	1.5	ppb
│	Cu-KED3	65	26723.3	1.4	42.95440	2.2	ppb
│	Zn-KED3	66	32156.8	2.4	313.03869	3.5	ppb
└>	Ge-KED3	72	26617.1	2.9			ppb
┌>	Ge-KED2	72	141325.4	1.4			ppb
│	As-KED2	75	1974.8	1.8	8.79428	2.6	ppb
│	Se-KED2	77	48.7	15.6	5.61177	17.0	ppb
│	Se-KED2	78	146.3	2.1	4.43205	4.3	ppb
└	Se-KED2	82	25.7	81.1	3.31659	45.5	ppb
┌	Mo-KED2	95	1679.4	4.7	1.21602	5.4	ppb
│	Mo-KED2	97	1110.7	0.7	1.21373	2.1	ppb
│	Mo-KED2	98	2808.8	3.1	1.18721	2.1	ppb
│	Cd-KED2	111	1260.1	3.2	2.07274	1.9	ppb
│	Cd-KED2	114	2951.0	0.3	2.06753	2.5	ppb
└>	In-KED2	115	43804.9	2.1			ppb
┌>	Rh-KED2	103	238949.3	1.9			ppb
│	Ag-KED2	107	2867.6	3.6	0.53011	1.8	ppb
└	Ag-KED2	109	2769.9	6.8	0.53177	6.1	ppb
┌>	In-KED1	115	579295.0	3.4			ppb
│	Sb-KED1	121	1703.4	1.7	0.12782	5.2	ppb
│	Sb-KED1	123	1329.4	2.8	0.13126	0.8	ppb
│	Ba-KED1	135	53026.9	2.1	13.38217	1.5	ppb
└	Ba-KED1	137	88815.2	0.6	13.33338	3.0	ppb
┌>	Lu-KED1	175	682081.7	2.2			ppb
│	Tl-KED1	203	280.7	8.4	0.02030	10.6	ppb
│	Tl-KED1	205	614.0	6.1	0.01950	5.0	ppb
└	Pb-KED1	208	14082.7	1.9	0.43307	3.4	ppb
┌	Mn-STD1	55	4255569.6	1.0	106.81378	3.6	ppb
└>	Ge-STD	72	1727184.8	2.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		90			
⌈>	Ge-KED2	72		94			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		103			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		108			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		99			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-008
Sample Date/Time: Wednesday, September 07, 2016 20:53:42
Sample Description: 5
Autosampler Position: 359
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-008.091
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1201496.6	4.8			ppb
|	Be-KED1	9	603.0	5.9	0.16604	8.7	ppb
⌊	Al-KED1	27	39605117.9	2.5	1168.49518	5.8	ppb
⌈	V-KED3	51	554.3	1.8	1.41804	1.6	ppb
|	Cr-KED3	52	1236.7	5.0	2.23144	4.9	ppb
|	Cr-KED3	53	155.3	9.7	2.42598	10.7	ppb
|	Co-KED3	59	5798.5	2.4	4.59733	0.3	ppb
|	Ni-KED3	60	3471.8	2.8	4.57023	0.6	ppb
|	Ni-KED3	62	300.7	4.1	4.73536	5.4	ppb
|	Cu-KED3	63	33512.6	3.4	27.93218	1.2	ppb
|	Zn-KED3	64	49153.7	2.4	324.32722	1.4	ppb
|	Cu-KED3	65	17376.9	1.2	27.72475	1.1	ppb
|	Zn-KED3	66	31939.4	5.1	308.45121	3.2	ppb
⌊>	Ge-KED3	72	26807.1	2.2			ppb
⌈>	Ge-KED2	72	138583.2	3.5			ppb
|	As-KED2	75	4195.3	1.0	19.15853	3.0	ppb
|	Se-KED2	77	51.3	16.2	6.07836	20.0	ppb
|	Se-KED2	78	164.6	4.1	5.27258	7.1	ppb
⌊	Se-KED2	82	33.0	64.8	3.91663	40.8	ppb
⌈	Mo-KED2	95	1364.1	1.7	1.02261	3.4	ppb
|	Mo-KED2	97	868.7	5.2	0.98383	8.8	ppb
|	Mo-KED2	98	2401.7	3.3	1.05122	2.8	ppb
|	Cd-KED2	111	523.0	5.9	0.88852	9.8	ppb
|	Cd-KED2	114	1177.3	2.9	0.85336	5.1	ppb
⌊>	In-KED2	115	42310.7	3.7			ppb
⌈>	Rh-KED2	103	233354.3	3.8			ppb
|	Ag-KED2	107	767.4	5.9	0.14413	6.5	ppb
⌊	Ag-KED2	109	752.4	4.7	0.14650	3.1	ppb
⌈>	In-KED1	115	568939.0	3.1			ppb
|	Sb-KED1	121	9885.4	2.4	0.78317	2.4	ppb
|	Sb-KED1	123	7716.5	1.4	0.80237	1.8	ppb
|	Ba-KED1	135	63959.5	0.9	16.43988	2.8	ppb
⌊	Ba-KED1	137	105770.9	2.1	16.16069	1.2	ppb
⌈>	Lu-KED1	175	667677.1	3.0			ppb
|	Tl-KED1	203	4130.6	0.8	0.38571	2.9	ppb
|	Tl-KED1	205	9508.5	4.1	0.38684	1.2	ppb
⌊	Pb-KED1	208	20160.2	2.7	0.63380	0.7	ppb
⌈	Mn-STD1	55	5051107.2	1.2	131.11935	2.1	ppb
⌊>	Ge-STD	72	1669494.1	1.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		91			
⌈>	Ge-KED2	72		92			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		91			
⌈>	Rh-KED2	103		92			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		105			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-009
Sample Date/Time: Wednesday, September 07, 2016 20:58:33
Sample Description: 5
Autosampler Position: 360
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-009.092
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1170162.5	1.4			ppb
│	Be-KED1	9	719.4	4.9	0.20338	5.5	ppb
⌊	Al-KED1	27	54668030.4	2.7	1653.24336	2.1	ppb
⌈	V-KED3	51	1463.7	1.0	3.92664	1.4	ppb
│	Cr-KED3	52	1081.0	3.3	2.03787	3.8	ppb
│	Cr-KED3	53	240.0	3.8	3.92111	4.5	ppb
│	Co-KED3	59	5400.0	0.7	4.47464	1.0	ppb
│	Ni-KED3	60	1714.8	2.2	2.35743	3.7	ppb
│	Ni-KED3	62	163.3	4.6	2.68348	5.5	ppb
│	Cu-KED3	63	57450.6	0.9	50.06409	0.8	ppb
│	Zn-KED3	64	45833.1	2.2	316.04153	1.9	ppb
│	Cu-KED3	65	29472.7	1.0	49.15215	2.6	ppb
│	Zn-KED3	66	29601.3	0.2	298.91385	1.8	ppb
⌊>	Ge-KED3	72	25651.7	1.6			ppb
⌈>	Ge-KED2	72	140017.2	1.4			ppb
│	As-KED2	75	257350.4	1.6	1167.34105	0.4	ppb
│	Se-KED2	77	64.7	12.5	7.61632	11.7	ppb
│	Se-KED2	78	200.8	7.0	6.61680	7.7	ppb
⌊	Se-KED2	82	57.7	17.4	5.71008	13.0	ppb
⌈	Mo-KED2	95	4432.0	4.1	3.25066	1.9	ppb
│	Mo-KED2	97	2813.6	5.1	3.11690	2.8	ppb
│	Mo-KED2	98	7385.1	3.0	3.16235	0.7	ppb
│	Cd-KED2	111	148.0	8.6	0.23945	6.7	ppb
│	Cd-KED2	114	351.4	3.3	0.24730	1.3	ppb
⌊>	In-KED2	115	43268.3	2.3			ppb
⌈>	Rh-KED2	103	237043.1	2.3			ppb
│	Ag-KED2	107	2651.9	2.9	0.49449	4.8	ppb
⌊	Ag-KED2	109	2553.6	0.7	0.49433	2.7	ppb
⌈>	In-KED1	115	568634.0	1.6			ppb
│	Sb-KED1	121	547675.1	1.9	43.71678	1.6	ppb
│	Sb-KED1	123	415723.0	1.2	43.52430	1.6	ppb
│	Ba-KED1	135	442111.4	2.1	113.65460	0.5	ppb
⌊	Ba-KED1	137	732747.5	1.5	112.00425	0.5	ppb
⌈>	Lu-KED1	175	650678.5	2.7			ppb
│	Tl-KED1	203	829.4	4.9	0.07485	3.0	ppb
│	Tl-KED1	205	1824.8	4.3	0.07196	3.7	ppb
⌊	Pb-KED1	208	53430.4	1.0	1.72660	1.7	ppb
⌈	Mn-STD1	55	89038568.5	2.1	2327.08948	4.0	ppb
⌊>	Ge-STD	72	1659176.0	2.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		105			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		87			
⌈>	Ge-KED2	72		93			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-010
Sample Date/Time: Wednesday, September 07, 2016 21:03:25
Sample Description: 5
Autosampler Position: 101
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-010.093
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1181256.4	3.4			ppb
|	Be-KED1	9	739.7	2.9	0.20740	5.9	ppb
⌊	Al-KED1	27	56553180.4	1.8	1695.73517	4.2	ppb
⌈	V-KED3	51	742.4	4.1	1.92075	5.0	ppb
|	Cr-KED3	52	1438.1	2.0	2.62175	2.6	ppb
|	Cr-KED3	53	190.7	8.1	3.00577	7.2	ppb
|	Co-KED3	59	8336.1	2.7	6.67929	3.6	ppb
|	Ni-KED3	60	4261.3	4.0	5.66575	3.2	ppb
|	Ni-KED3	62	377.3	8.6	5.99722	7.6	ppb
|	Cu-KED3	63	40906.5	1.4	34.44369	2.2	ppb
|	Zn-KED3	64	49871.0	1.9	332.35133	2.9	ppb
|	Cu-KED3	65	20795.1	1.3	33.50109	0.8	ppb
|	Zn-KED3	66	32316.2	1.3	315.30775	1.9	ppb
⌊>	Ge-KED3	72	26546.0	1.0			ppb
⌈>	Ge-KED2	72	140579.5	2.0			ppb
|	As-KED2	75	10821.8	1.2	48.81961	1.4	ppb
|	Se-KED2	77	48.7	30.8	5.62215	30.8	ppb
|	Se-KED2	78	138.4	3.6	4.15448	4.2	ppb
⌊	Se-KED2	82	30.4	71.3	3.65767	42.9	ppb
⌈	Mo-KED2	95	1390.7	2.3	1.01692	0.6	ppb
|	Mo-KED2	97	931.4	6.2	1.02732	5.1	ppb
|	Mo-KED2	98	2365.9	3.6	1.01026	1.7	ppb
|	Cd-KED2	111	637.3	3.5	1.05579	2.6	ppb
|	Cd-KED2	114	1447.4	3.5	1.02359	3.5	ppb
⌊>	In-KED2	115	43345.3	2.2			ppb
⌈>	Rh-KED2	103	238284.2	3.2			ppb
|	Ag-KED2	107	756.0	2.8	0.13891	1.0	ppb
⌊	Ag-KED2	109	783.0	8.3	0.14939	8.4	ppb
⌈>	In-KED1	115	560807.9	2.7			ppb
|	Sb-KED1	121	27938.0	0.7	2.25652	2.4	ppb
|	Sb-KED1	123	21214.2	1.3	2.24732	1.8	ppb
|	Ba-KED1	135	82170.4	1.8	21.42179	2.0	ppb
⌊	Ba-KED1	137	136963.1	2.7	21.23484	3.6	ppb
⌈>	Lu-KED1	175	647311.2	1.9			ppb
|	Tl-KED1	203	4753.5	1.8	0.45888	3.8	ppb
|	Tl-KED1	205	10798.7	1.9	0.45432	3.4	ppb
⌊	Pb-KED1	208	30181.1	0.8	0.97958	1.2	ppb
⌈	Mn-STD1	55	8703902.0	1.8	228.18237	2.0	ppb
⌊>	Ge-STD	72	1653066.5	1.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		106			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		90			
⌈>	Ge-KED2	72		93			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		94			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		100			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		102			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		95			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-011
Sample Date/Time: Wednesday, September 07, 2016 21:08:16
Sample Description: 5
Autosampler Position: 102
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-011.094
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1197496.6	1.6			ppb
	Be-KED1	9	415.3	0.6	0.11401	2.3	ppb
	Al-KED1	27	28323827.7	3.7	837.22914	4.3	ppb
	V-KED3	51	523.0	2.5	1.33203	4.2	ppb
	Cr-KED3	52	833.0	4.7	1.49361	4.4	ppb
	Cr-KED3	53	128.0	14.3	1.98587	13.5	ppb
	Co-KED3	59	8655.0	3.4	6.83812	4.2	ppb
	Ni-KED3	60	2035.5	0.8	2.66646	2.4	ppb
	Ni-KED3	62	170.7	4.7	2.67205	6.1	ppb
	Cu-KED3	63	46742.4	1.6	38.81360	3.0	ppb
	Zn-KED3	64	51404.1	1.1	337.73762	1.5	ppb
	Cu-KED3	65	24070.3	2.6	38.23011	1.1	ppb
	Zn-KED3	66	33269.4	1.3	320.05237	1.3	ppb
>	Ge-KED3	72	26924.0	1.7			ppb
>	Ge-KED2	72	141201.1	0.5			ppb
	As-KED2	75	13237.1	0.4	59.46276	0.3	ppb
	Se-KED2	77	86.0	12.9	10.15314	13.6	ppb
	Se-KED2	78	259.8	1.2	8.84499	1.9	ppb
	Se-KED2	82	83.1	8.4	7.53707	7.1	ppb
	Mo-KED2	95	1582.1	1.4	1.13818	3.0	ppb
	Mo-KED2	97	1036.7	1.2	1.12551	2.9	ppb
	Mo-KED2	98	2740.6	5.8	1.15176	7.0	ppb
	Cd-KED2	111	398.0	6.0	0.64491	3.8	ppb
	Cd-KED2	114	990.3	3.8	0.68827	5.4	ppb
>	In-KED2	115	44084.7	2.3			ppb
>	Rh-KED2	103	242792.8	1.4			ppb
	Ag-KED2	107	1058.4	4.4	0.19159	5.9	ppb
	Ag-KED2	109	1014.7	3.3	0.19052	4.0	ppb
>	In-KED1	115	570980.3	2.1			ppb
	Sb-KED1	121	171667.5	1.9	13.64482	2.3	ppb
	Sb-KED1	123	130596.8	1.9	13.61566	2.9	ppb
	Ba-KED1	135	67434.8	0.9	17.26476	1.2	ppb
	Ba-KED1	137	112849.4	1.3	17.17884	0.8	ppb
>	Lu-KED1	175	653770.6	2.3			ppb
	Tl-KED1	203	698.7	8.0	0.06196	11.2	ppb
	Tl-KED1	205	1676.8	6.2	0.06539	7.7	ppb
	Pb-KED1	208	24364.7	2.2	0.78266	1.8	ppb
	Mn-STD1	55	20054477.7	0.9	528.66409	2.2	ppb
>	Ge-STD	72	1644302.7	1.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		91			
⌈>	Ge-KED2	72		94			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		94			
⌈>	Rh-KED2	103		95			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		102			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		95			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-012
Sample Date/Time: Wednesday, September 07, 2016 21:13:06
Sample Description: 5
Autosampler Position: 103
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-012.095
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1204605.1	0.7			ppb
	Be-KED1	9	292.3	0.5	0.07925	1.2	ppb
	Al-KED1	27	35723532.0	3.6	1049.56153	3.9	ppb
	V-KED3	51	933.4	3.3	2.39834	1.7	ppb
	Cr-KED3	52	1560.8	1.2	2.82605	2.7	ppb
	Cr-KED3	53	240.7	10.6	3.76854	9.4	ppb
	Co-KED3	59	3107.3	2.8	2.46770	4.3	ppb
	Ni-KED3	60	1809.4	2.2	2.38555	1.0	ppb
	Ni-KED3	62	143.3	9.0	2.26102	11.7	ppb
	Cu-KED3	63	29618.7	4.4	24.76028	5.0	ppb
	Zn-KED3	64	42076.2	2.4	278.37766	2.9	ppb
	Cu-KED3	65	15353.9	1.1	24.56122	2.2	ppb
	Zn-KED3	66	27015.9	3.3	261.75348	4.3	ppb
>	Ge-KED3	72	26741.7	2.5			ppb
>	Ge-KED2	72	141448.9	1.1			ppb
	As-KED2	75	25101.4	1.3	112.63463	0.7	ppb
	Se-KED2	77	65.3	21.5	7.63715	23.4	ppb
	Se-KED2	78	189.6	5.3	6.10448	6.1	ppb
	Se-KED2	82	71.2	25.5	6.65622	20.4	ppb
	Mo-KED2	95	1964.8	3.0	1.43693	3.4	ppb
	Mo-KED2	97	1250.1	2.6	1.37986	2.5	ppb
	Mo-KED2	98	3265.3	4.4	1.39430	4.5	ppb
	Cd-KED2	111	312.0	5.0	0.51259	4.9	ppb
	Cd-KED2	114	689.9	5.5	0.48641	5.5	ppb
>	In-KED2	115	43370.0	0.4			ppb
>	Rh-KED2	103	236853.5	0.9			ppb
	Ag-KED2	107	777.7	2.7	0.14379	1.8	ppb
	Ag-KED2	109	730.0	7.3	0.13990	6.6	ppb
>	In-KED1	115	580832.9	1.4			ppb
	Sb-KED1	121	26377.7	3.4	2.05637	4.4	ppb
	Sb-KED1	123	19832.2	2.0	2.02769	2.6	ppb
	Ba-KED1	135	119883.2	3.1	30.16558	1.9	ppb
	Ba-KED1	137	199469.7	3.0	29.84380	1.7	ppb
>	Lu-KED1	175	649362.9	3.0			ppb
	Tl-KED1	203	449.3	4.9	0.03806	6.2	ppb
	Tl-KED1	205	1042.0	4.7	0.03896	7.4	ppb
	Pb-KED1	208	26598.9	1.0	0.86067	2.4	ppb
	Mn-STD1	55	30270471.0	2.2	808.85656	1.8	ppb
>	Ge-STD	72	1622636.1	3.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		108			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		91			
⌈>	Ge-KED2	72		94			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		93			
⌈>	Rh-KED2	103		93			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		103			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		93			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609659-013
Sample Date/Time: Wednesday, September 07, 2016 21:17:57
Sample Description: 5
Autosampler Position: 104
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609659-013.096
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1181370.5	4.0			ppb
|	Be-KED1	9	578.7	1.3	0.16189	5.2	ppb
⌊	Al-KED1	27	52822108.0	2.7	1582.90873	1.5	ppb
⌈	V-KED3	51	1151.0	2.1	3.02922	1.9	ppb
|	Cr-KED3	52	1424.7	2.7	2.63864	2.6	ppb
|	Cr-KED3	53	208.7	7.2	3.34506	7.4	ppb
|	Co-KED3	59	6715.6	2.3	5.46454	2.7	ppb
|	Ni-KED3	60	1314.1	1.3	1.77145	1.2	ppb
|	Ni-KED3	62	117.3	21.7	1.89009	22.2	ppb
|	Cu-KED3	63	33042.8	1.5	28.26217	2.0	ppb
|	Zn-KED3	64	122944.1	0.8	832.31421	1.2	ppb
|	Cu-KED3	65	17194.3	2.3	28.14034	1.9	ppb
|	Zn-KED3	66	79479.2	1.9	787.84859	1.9	ppb
⌊>	Ge-KED3	72	26128.9	0.4			ppb
⌈>	Ge-KED2	72	139669.8	0.8			ppb
|	As-KED2	75	4209.6	1.8	19.06358	2.6	ppb
|	Se-KED2	77	38.0	39.7	4.37562	43.2	ppb
|	Se-KED2	78	80.8	1.4	1.92568	1.0	ppb
⌊	Se-KED2	82	-12.3	145.2	0.52869	249.3	ppb
⌈	Mo-KED2	95	1922.1	1.6	1.42739	2.1	ppb
|	Mo-KED2	97	1228.1	0.4	1.37650	0.4	ppb
|	Mo-KED2	98	3246.9	3.5	1.40796	3.9	ppb
|	Cd-KED2	111	1041.0	1.5	1.75528	1.5	ppb
|	Cd-KED2	114	2400.1	2.7	1.72354	2.1	ppb
⌊>	In-KED2	115	42711.0	0.6			ppb
⌈>	Rh-KED2	103	235727.6	0.4			ppb
|	Ag-KED2	107	1128.4	2.0	0.21045	2.3	ppb
⌊	Ag-KED2	109	1133.0	1.7	0.21938	2.0	ppb
⌈>	In-KED1	115	560955.0	4.1			ppb
|	Sb-KED1	121	14409.3	2.9	1.16201	6.1	ppb
|	Sb-KED1	123	11107.4	2.4	1.17496	5.3	ppb
|	Ba-KED1	135	381421.5	4.0	99.40605	1.3	ppb
⌊	Ba-KED1	137	641755.2	5.1	99.41070	1.0	ppb
⌈>	Lu-KED1	175	658478.5	2.0			ppb
|	Tl-KED1	203	824.7	8.9	0.07348	9.3	ppb
|	Tl-KED1	205	1809.4	3.6	0.07039	2.7	ppb
⌊	Pb-KED1	208	32619.7	2.0	1.04077	1.4	ppb
⌈	Mn-STD1	55	12923964.5	2.6	336.16258	1.3	ppb
⌊>	Ge-STD	72	1666077.5	2.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		106			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		89			
⌈>	Ge-KED2	72		93			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		91			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		100			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		104			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		96			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610643-01
Sample Date/Time: Wednesday, September 07, 2016 21:22:48
Sample Description: 5
Autosampler Position: 105
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610643-01.097
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1166794.2	4.3			ppb
	Be-KED1	9	5.7	44.4	-0.00009	768.1	ppb
	Al-KED1	27	11587.4	3.2	0.32648	2.7	ppb
	V-KED3	51	2.3	65.5	-0.00163	245.3	ppb
	Cr-KED3	52	3.0	0.0	-0.00264	1.9	ppb
	Cr-KED3	53	0.7	173.2	0.00136	1385.2	ppb
	Co-KED3	59	5.0	40.0	-0.00338	47.4	ppb
	Ni-KED3	60	9.3	32.7	0.00708	57.3	ppb
	Ni-KED3	62	2.0	0.0	0.02299	1.2	ppb
	Cu-KED3	63	82.7	11.4	0.05805	14.8	ppb
	Zn-KED3	64	9.7	53.6	0.03863	90.3	ppb
	Cu-KED3	65	37.0	16.9	0.05509	17.8	ppb
	Zn-KED3	66	5.3	39.0	0.00912	225.5	ppb
>	Ge-KED3	72	25968.6	0.9			ppb
>	Ge-KED2	72	137394.6	1.5			ppb
	As-KED2	75	18.7	3.1	0.00333	96.0	ppb
	Se-KED2	77	2.0	100.0	-0.05583	446.0	ppb
	Se-KED2	78	32.5	5.2	0.04929	167.1	ppb
	Se-KED2	82	-20.2	29.9	-0.09042	528.5	ppb
	Mo-KED2	95	4.0	100.0	0.00081	379.3	ppb
	Mo-KED2	97	5.3	57.3	0.00200	175.7	ppb
	Mo-KED2	98	8.4	27.3	0.00230	43.4	ppb
	Cd-KED2	111	3.0	0.0	-0.00255	4.3	ppb
	Cd-KED2	114	2.3	24.8	-0.00039	117.0	ppb
>	In-KED2	115	41817.0	2.1			ppb
>	Rh-KED2	103	235954.3	0.3			ppb
	Ag-KED2	107	19.7	2.9	0.00195	4.9	ppb
	Ag-KED2	109	14.0	18.9	0.00074	69.9	ppb
>	In-KED1	115	565967.3	5.5			ppb
	Sb-KED1	121	28.0	25.8	-0.00358	13.9	ppb
	Sb-KED1	123	17.6	38.0	-0.00354	18.9	ppb
	Ba-KED1	135	29.3	56.8	0.00339	121.0	ppb
	Ba-KED1	137	36.0	14.7	0.00365	14.5	ppb
>	Lu-KED1	175	625563.2	2.8			ppb
	Tl-KED1	203	14.0	62.3	-0.00432	20.0	ppb
	Tl-KED1	205	28.0	31.1	-0.00404	10.0	ppb
	Pb-KED1	208	54.7	37.0	0.00034	180.4	ppb
	Mn-STD1	55	2706.9	4.0	0.03687	8.4	ppb
>	Ge-STD	72	1594898.0	1.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		88			
⌈>	Ge-KED2	72		91			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		89			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		101			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		99			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		92			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 21:27:40
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.098
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1159351.5	4.1			ppb
|	Be-KED1	9	83598.7	3.2	24.07082	5.0	ppb
⌊	Al-KED1	27	841637.8	4.0	25.68468	4.7	ppb
⌈	V-KED3	51	9605.2	4.0	24.87334	3.6	ppb
|	Cr-KED3	52	13791.3	0.2	25.15000	1.6	ppb
|	Cr-KED3	53	1655.4	0.9	26.12205	2.6	ppb
|	Co-KED3	59	32288.8	2.0	25.81928	0.3	ppb
|	Ni-KED3	60	19403.8	2.0	25.75876	2.1	ppb
|	Ni-KED3	62	1624.1	5.8	25.80484	6.9	ppb
|	Cu-KED3	63	30592.1	0.8	25.69074	1.9	ppb
|	Zn-KED3	64	3718.4	2.9	24.69107	3.3	ppb
|	Cu-KED3	65	15993.6	1.1	25.69979	0.8	ppb
|	Zn-KED3	66	2532.9	1.9	24.61531	3.4	ppb
⌊>	Ge-KED3	72	26615.1	1.8			ppb
⌈>	Ge-KED2	72	138721.6	2.7			ppb
|	As-KED2	75	5487.7	1.0	25.05338	2.2	ppb
|	Se-KED2	77	197.3	5.2	24.13835	7.1	ppb
|	Se-KED2	78	641.7	4.3	24.15248	6.4	ppb
⌊	Se-KED2	82	272.5	10.0	21.82704	10.9	ppb
⌈	Mo-KED2	95	34342.6	1.8	25.77613	2.6	ppb
|	Mo-KED2	97	22658.6	1.9	25.70437	2.5	ppb
|	Mo-KED2	98	59255.8	1.8	25.95571	2.5	ppb
|	Cd-KED2	111	14896.8	1.2	25.45348	2.1	ppb
|	Cd-KED2	114	35527.0	0.2	25.78131	2.0	ppb
⌊>	In-KED2	115	42330.6	2.2			ppb
⌈>	Rh-KED2	103	237778.8	2.2			ppb
|	Ag-KED2	107	132835.4	1.1	24.77112	2.9	ppb
⌊	Ag-KED2	109	127621.6	1.9	24.72112	2.2	ppb
⌈>	In-KED1	115	547217.5	4.3			ppb
|	Sb-KED1	121	307114.1	1.8	25.49328	3.4	ppb
|	Sb-KED1	123	232916.9	0.5	25.36244	3.9	ppb
|	Ba-KED1	135	87830.7	3.3	23.48045	4.2	ppb
⌊	Ba-KED1	137	147941.5	3.7	23.50685	2.9	ppb
⌈>	Lu-KED1	175	628833.0	5.9			ppb
|	Tl-KED1	203	244818.3	1.7	24.66001	4.9	ppb
|	Tl-KED1	205	558195.9	2.0	24.50414	6.9	ppb
⌊	Pb-KED1	208	728706.3	1.7	24.43011	5.7	ppb
~~⌈~~	~~Mn-STD1~~	~~55~~	~~1074997.2~~	~~2.0~~	~~28.88706~~	~~4.6~~	~~ppb~~
⌊>	Ge-STD	72	1612775.6	4.3			ppb

JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
|	Be-KED1	9	96				
⌊	Al-KED1	27	103				
⌈	V-KED3	51	99				
|	Cr-KED3	52	101				
|	Cr-KED3	53	104				
|	Co-KED3	59	103				
|	Ni-KED3	60	103				
|	Ni-KED3	62	103				
|	Cu-KED3	63	103				
|	Zn-KED3	64	99				
|	Cu-KED3	65	103				
|	Zn-KED3	66	98				
⌊>	Ge-KED3	72		90			
⌈>	Ge-KED2	72		92			
|	As-KED2	75	100				
|	Se-KED2	77	97				
|	Se-KED2	78	97				
⌊	Se-KED2	82	87				
⌈	Mo-KED2	95	103				
|	Mo-KED2	97	103				
|	Mo-KED2	98	104				
|	Cd-KED2	111	102				
|	Cd-KED2	114	103				
⌊>	In-KED2	115		91			
⌈>	Rh-KED2	103		93			
|	Ag-KED2	107	99				
⌊	Ag-KED2	109	99				
⌈>	In-KED1	115		97			
|	Sb-KED1	121	102				
|	Sb-KED1	123	101				
|	Ba-KED1	135	94				
⌊	Ba-KED1	137	94				
⌈>	Lu-KED1	175		99			
|	Tl-KED1	203	99				
|	Tl-KED1	205	98				
⌊	Pb-KED1	208	98				
⌈	Mn-STD1	55	116				
⌊>	Ge-STD	72		93			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Se-KED2	82	Out of Control
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 21:32:10
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.099
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1218381.5	6.0			ppb
	Be-KED1	9	85669.7	3.7	23.46917	2.4	ppb
	Al-KED1	27	858882.2	3.9	24.94270	2.2	ppb
	V-KED3	51	9690.6	2.7	25.37063	2.3	ppb
	Cr-KED3	52	13737.6	1.9	25.32775	2.7	ppb
	Cr-KED3	53	1703.4	3.0	27.16771	2.6	ppb
	Co-KED3	59	32131.1	2.3	25.98054	2.7	ppb
	Ni-KED3	60	18759.7	3.6	25.18129	4.4	ppb
	Ni-KED3	62	1619.4	2.4	26.00415	3.1	ppb
	Cu-KED3	63	30123.7	0.6	25.57273	0.9	ppb
	Zn-KED3	64	3655.8	3.4	24.54347	4.1	ppb
	Cu-KED3	65	15591.5	1.5	25.33097	2.2	ppb
	Zn-KED3	66	2432.2	2.1	23.89151	2.8	ppb
>	Ge-KED3	72	26323.9	0.7			ppb
>	Ge-KED2	72	137667.6	1.7			ppb
	As-KED2	75	5457.4	3.0	25.09292	1.3	ppb
	Se-KED2	77	189.3	6.4	23.29428	5.0	ppb
	Se-KED2	78	634.4	1.5	24.03529	1.0	ppb
	Se-KED2	82	285.2	14.4	22.87822	12.0	ppb
	Mo-KED2	95	34311.2	0.9	25.62486	1.4	ppb
	Mo-KED2	97	22694.7	1.9	25.61532	1.1	ppb
	Mo-KED2	98	58249.0	2.0	25.38517	1.2	ppb
	Cd-KED2	111	14826.7	1.1	25.20714	1.0	ppb
	Cd-KED2	114	35030.0	1.4	25.29164	0.6	ppb
>	In-KED2	115	42536.6	1.9			ppb
>	Rh-KED2	103	237796.3	1.2			ppb
	Ag-KED2	107	131098.3	2.1	24.43479	1.3	ppb
	Ag-KED2	109	126148.9	1.2	24.42926	0.6	ppb
>	In-KED1	115	574726.0	6.3			ppb
	Sb-KED1	121	312750.3	2.9	24.73233	3.5	ppb
	Sb-KED1	123	239596.9	3.4	24.85480	4.6	ppb
	Ba-KED1	135	91469.0	4.7	23.27992	2.0	ppb
	Ba-KED1	137	151017.6	4.2	22.85839	2.2	ppb
>	Lu-KED1	175	635945.0	5.8			ppb
	Tl-KED1	203	248291.9	3.9	24.70802	3.2	ppb
	Tl-KED1	205	568182.1	2.9	24.62778	3.0	ppb
	Pb-KED1	208	744198.9	3.0	24.64476	2.8	ppb
	Mn-STD1	55	1043205.9	1.1	27.87234	3.2	ppb
>	Ge-STD	72	1620737.2	2.2			ppb

JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		109			
│	Be-KED1	9	94				
⌊	Al-KED1	27	100				
⌈	V-KED3	51	101				
│	Cr-KED3	52	101				
│	Cr-KED3	53	109				
│	Co-KED3	59	104				
│	Ni-KED3	60	101				
│	Ni-KED3	62	104				
│	Cu-KED3	63	102				
│	Zn-KED3	64	98				
│	Cu-KED3	65	101				
│	Zn-KED3	66	96				
⌊>	Ge-KED3	72		89			
⌈>	Ge-KED2	72		91			
│	As-KED2	75	100				
│	Se-KED2	77	93				
│	Se-KED2	78	96				
⌊	Se-KED2	82	92				
⌈	Mo-KED2	95	102				
│	Mo-KED2	97	102				
│	Mo-KED2	98	102				
│	Cd-KED2	111	101				
│	Cd-KED2	114	101				
⌊>	In-KED2	115		91			
⌈>	Rh-KED2	103		93			
│	Ag-KED2	107	98				
⌊	Ag-KED2	109	98				
⌈>	In-KED1	115		102			
│	Sb-KED1	121	99				
│	Sb-KED1	123	99				
│	Ba-KED1	135	93				
⌊	Ba-KED1	137	91				
⌈>	Lu-KED1	175		100			
│	Tl-KED1	203	99				
│	Tl-KED1	205	99				
⌊	Pb-KED1	208	99				
⌈	Mn-STD1	55	111				
⌊>	Ge-STD	72		93			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 21:37:01
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.100
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1164773.3	3.5			ppb
│	Be-KED1	9	8.3	38.6	0.00072	141.1	ppb
└	Al-KED1	27	1213.4	8.3	0.01172	23.3	ppb
┌	V-KED3	51	2.3	89.2	-0.00168	329.4	ppb
│	Cr-KED3	52	4.7	32.7	0.00034	863.5	ppb
│	Cr-KED3	53	0.0		-0.00951	0.0	ppb
│	Co-KED3	59	6.0	44.1	-0.00268	76.0	ppb
│	Ni-KED3	60	8.0	66.1	0.00502	138.5	ppb
│	Ni-KED3	62	0.0		-0.00958	0.0	ppb
│	Cu-KED3	63	11.3	10.2	-0.00359	30.0	ppb
│	Zn-KED3	64	7.7	47.3	0.02465	100.3	ppb
│	Cu-KED3	65	6.3	79.5	0.00430	186.5	ppb
│	Zn-KED3	66	2.3	89.2	-0.02116	95.3	ppb
└>	Ge-KED3	72	26480.2	2.9			ppb
┌>	Ge-KED2	72	139260.1	2.6			ppb
│	As-KED2	75	19.7	20.5	0.00700	293.4	ppb
│	Se-KED2	77	0.7	173.2	-0.22372	62.2	ppb
│	Se-KED2	78	30.9	7.1	-0.03120	202.7	ppb
└	Se-KED2	82	-8.8	108.3	0.77780	92.2	ppb
┌	Mo-KED2	95	6.0	33.3	0.00216	65.0	ppb
│	Mo-KED2	97	4.0	50.0	0.00040	586.2	ppb
│	Mo-KED2	98	6.7	99.0	0.00151	193.8	ppb
│	Cd-KED2	111	2.3	49.5	-0.00383	49.6	ppb
│	Cd-KED2	114	3.4	84.4	0.00030	666.7	ppb
└>	In-KED2	115	42888.1	1.9			ppb
┌>	Rh-KED2	103	236227.8	3.6			ppb
│	Ag-KED2	107	26.0	13.9	0.00316	27.4	ppb
└	Ag-KED2	109	30.3	21.4	0.00395	37.2	ppb
┌>	In-KED1	115	554522.7	3.6			ppb
│	Sb-KED1	121	298.7	8.4	0.01863	9.6	ppb
│	Sb-KED1	123	244.2	6.6	0.02086	10.3	ppb
│	Ba-KED1	135	14.0	37.8	-0.00048	289.1	ppb
└	Ba-KED1	137	18.0	50.9	0.00095	142.4	ppb
┌>	Lu-KED1	175	640488.1	3.6			ppb
│	Tl-KED1	203	38.7	28.5	-0.00190	58.7	ppb
│	Tl-KED1	205	80.0	10.0	-0.00184	12.1	ppb
└	Pb-KED1	208	50.7	22.4	0.00018	204.3	ppb
┌	Mn-STD1	55	2120.2	4.5	0.02018	6.7	ppb
└>	Ge-STD	72	1615029.7	2.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		90			
⌈>	Ge-KED2	72		93			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		92			
⌈>	Rh-KED2	103		93			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		99			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		101			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		93			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: ICSA
Sample Date/Time: Wednesday, September 07, 2016 21:41:52
Sample Description:
Autosampler Position: 5
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\ICSA.101
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1105961.8	1.7			ppb
│	Be-KED1	9	11.7	42.3	0.00184	82.1	ppb
⌊	Al-KED1	27	658425987.2	1.1	21073.29648	2.2	ppb
⌈	V-KED3	51	23.3	9.9	0.05866	9.8	ppb
│	Cr-KED3	52	334.0	6.5	0.66187	5.3	ppb
│	Cr-KED3	53	665.3	2.5	11.54403	1.2	ppb
│	Co-KED3	59	742.7	2.4	0.64623	1.1	ppb
│	Ni-KED3	60	301.3	3.7	0.43458	2.5	ppb
│	Ni-KED3	62	33.3	25.0	0.57328	25.6	ppb
│	Cu-KED3	63	660.7	4.8	0.59742	3.7	ppb
│	Zn-KED3	64	74.7	11.1	0.51915	11.2	ppb
│	Cu-KED3	65	317.7	9.1	0.55565	8.0	ppb
│	Zn-KED3	66	32.3	7.8	0.30246	9.8	ppb
⌊>	Ge-KED3	72	24184.8	1.3			ppb
⌈>	Ge-KED2	72	125830.4	0.4			ppb
│	As-KED2	75	35.0	4.9	0.09370	9.6	ppb
│	Se-KED2	77	7.3	56.8	0.69507	81.1	ppb
│	Se-KED2	78	30.6	17.9	0.08395	281.7	ppb
⌊	Se-KED2	82	-12.8	36.2	0.38099	99.0	ppb
⌈	Mo-KED2	95	67115.3	1.4	53.62966	2.6	ppb
│	Mo-KED2	97	44232.4	0.1	53.41919	1.2	ppb
│	Mo-KED2	98	116153.5	1.1	54.16139	1.7	ppb
│	Cd-KED2	111	25.7	27.4	0.03904	34.0	ppb
│	Cd-KED2	114	49.9	15.5	0.03644	16.8	ppb
⌊>	In-KED2	115	39759.5	1.2			ppb
⌈>	Rh-KED2	103	209417.1	0.2			ppb
│	Ag-KED2	107	24.0	20.8	0.00334	31.8	ppb
⌊	Ag-KED2	109	24.0	7.2	0.00329	11.3	ppb
⌈>	In-KED1	115	500531.7	2.0			ppb
│	Sb-KED1	121	409.3	5.0	0.03132	6.8	ppb
│	Sb-KED1	123	322.6	12.9	0.03303	16.6	ppb
│	Ba-KED1	135	3058.3	2.0	0.88918	1.7	ppb
⌊	Ba-KED1	137	5068.9	2.3	0.87881	4.0	ppb
⌈>	Lu-KED1	175	611608.2	0.7			ppb
│	Tl-KED1	203	32.7	15.4	-0.00235	23.0	ppb
│	Tl-KED1	205	66.0	31.9	-0.00231	40.7	ppb
⌊	Pb-KED1	208	4286.3	17.8	0.14588	17.6	ppb
⌈	Mn-STD1	55	33017.5	1.7	0.91059	2.3	ppb
⌊>	Ge-STD	72	1510710.4	0.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		99			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		82			
⌈>	Ge-KED2	72		84			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		85			
⌈>	Rh-KED2	103		82			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		89			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		97			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		87			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: ICSAB
Sample Date/Time: Wednesday, September 07, 2016 21:46:42
Sample Description:
Autosampler Position: 6
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\ICSAB.102
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1095920.8	0.4			ppb
|	Be-KED1	9	16.0	27.2	0.00318	42.0	ppb
⌊	Al-KED1	27	658498514.3	0.9	21263.98100	0.7	ppb
⌈	V-KED3	51	18897.8	1.6	55.66308	1.0	ppb
|	Cr-KED3	52	26200.0	0.6	54.34701	2.2	ppb
|	Cr-KED3	53	3801.2	2.5	68.20202	1.3	ppb
|	Co-KED3	59	59421.3	1.3	54.04877	0.9	ppb
|	Ni-KED3	60	33868.8	1.8	51.15107	3.6	ppb
|	Ni-KED3	62	2825.6	5.0	51.01352	3.1	ppb
|	Cu-KED3	63	50443.6	0.8	48.18145	1.2	ppb
|	Zn-KED3	64	2869.8	2.5	21.66287	1.7	ppb
|	Cu-KED3	65	26175.6	0.4	47.84342	1.9	ppb
|	Zn-KED3	66	2094.2	1.4	23.13584	1.8	ppb
⌊>	Ge-KED3	72	23404.5	1.9			ppb
⌈>	Ge-KED2	72	124594.9	2.8			ppb
|	As-KED2	75	4914.2	1.9	24.97315	0.9	ppb
|	Se-KED2	77	180.7	12.2	24.56323	10.6	ppb
|	Se-KED2	78	575.1	4.7	24.06390	2.3	ppb
⌊	Se-KED2	82	239.1	3.2	21.33433	3.3	ppb
⌈	Mo-KED2	95	69086.0	2.4	55.92159	0.2	ppb
|	Mo-KED2	97	45941.8	1.8	56.21675	0.8	ppb
|	Mo-KED2	98	119228.5	2.0	56.32729	0.6	ppb
|	Cd-KED2	111	13217.1	2.4	24.35612	1.5	ppb
|	Cd-KED2	114	31211.1	1.4	24.42918	1.2	ppb
⌊>	In-KED2	115	39242.5	2.6			ppb
⌈>	Rh-KED2	103	206344.0	2.8			ppb
|	Ag-KED2	107	53319.7	1.4	11.45598	1.9	ppb
⌊	Ag-KED2	109	51318.7	2.0	11.45343	0.8	ppb
⌈>	In-KED1	115	502946.6	3.4			ppb
|	Sb-KED1	121	359.3	6.9	0.02666	10.8	ppb
|	Sb-KED1	123	288.1	7.1	0.02876	10.7	ppb
|	Ba-KED1	135	3092.3	2.6	0.89485	0.8	ppb
⌊	Ba-KED1	137	5119.6	5.1	0.88258	1.8	ppb
⌈>	Lu-KED1	175	593973.0	1.7			ppb
|	Tl-KED1	203	30.0	29.1	-0.00254	34.0	ppb
|	Tl-KED1	205	75.3	17.3	-0.00179	30.9	ppb
⌊	Pb-KED1	208	2426.1	1.6	0.08445	1.3	ppb
⌈	Mn-STD1	55	1901015.4	3.2	55.88593	2.7	ppb
⌊>	Ge-STD	72	1474709.8	5.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		98			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		80			
⌈>	Ge-KED2	72		83			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		81			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		90			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		94			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		85			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: MO STD
Sample Date/Time: Wednesday, September 07, 2016 21:51:32
Sample Description:
Autosampler Position: 7
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\MO STD.103
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1107763.9	2.9			ppb
│	Be-KED1	9	15.3	26.4	0.00293	42.3	ppb
└	Al-KED1	27	17761.7	5.7	0.54213	4.0	ppb
┌	V-KED3	51	5.7	44.4	0.00755	89.4	ppb
│	Cr-KED3	52	2.7	21.7	-0.00316	34.1	ppb
│	Cr-KED3	53	2.7	43.3	0.03457	55.4	ppb
│	Co-KED3	59	5.0	72.1	-0.00330	90.3	ppb
│	Ni-KED3	60	14.0	37.8	0.01386	53.2	ppb
│	Ni-KED3	62	1.3	173.2	0.01263	304.5	ppb
│	Cu-KED3	63	24.0	14.4	0.00793	36.3	ppb
│	Zn-KED3	64	37.5	18.3	0.23422	21.1	ppb
│	Cu-KED3	65	15.3	15.1	0.02000	19.6	ppb
│	Zn-KED3	66	20.3	19.9	0.16326	25.4	ppb
└>	Ge-KED3	72	25416.3	0.8			ppb
┌>	Ge-KED2	72	134744.6	1.5			ppb
│	As-KED2	75	28.0	6.2	0.04911	20.8	ppb
│	Se-KED2	77	4.0	50.0	0.20362	123.0	ppb
│	Se-KED2	78	35.0	9.1	0.17663	85.8	ppb
└	Se-KED2	82	-18.2	33.2	0.04186	1065.5	ppb
┌	Mo-KED2	95	80421.1	1.0	63.98121	1.7	ppb
│	Mo-KED2	97	52631.4	0.8	63.29237	1.7	ppb
│	Mo-KED2	98	137090.9	0.9	63.65451	2.1	ppb
│	Cd-KED2	111	14.0	18.9	0.01767	29.2	ppb
│	Cd-KED2	114	35.5	14.7	0.02515	15.3	ppb
└>	In-KED2	115	39931.1	1.3			ppb
┌>	Rh-KED2	103	223887.7	2.3			ppb
│	Ag-KED2	107	167.7	6.9	0.03145	6.5	ppb
└	Ag-KED2	109	163.3	20.2	0.03154	19.7	ppb
┌>	In-KED1	115	543753.5	4.9			ppb
│	Sb-KED1	121	1348.1	3.1	0.10698	7.9	ppb
│	Sb-KED1	123	1078.5	3.5	0.11298	8.1	ppb
│	Ba-KED1	135	24.0	14.4	0.00228	32.1	ppb
└	Ba-KED1	137	36.7	69.5	0.00404	102.3	ppb
┌>	Lu-KED1	175	599560.5	3.6			ppb
│	Tl-KED1	203	1822.8	4.9	0.18660	4.7	ppb
│	Tl-KED1	205	4254.6	2.7	0.19040	5.9	ppb
└	Pb-KED1	208	436.0	11.7	0.01383	13.2	ppb
┌	Mn-STD1	55	1540.1	2.4	0.00485	40.8	ppb
└>	Ge-STD	72	1607567.6	2.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		99			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		86			
┌>	Ge-KED2	72		90			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		85			
┌>	Rh-KED2	103		88			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		95			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		93			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610643-02
Sample Date/Time: Wednesday, September 07, 2016 21:56:24
Sample Description: 5
Autosampler Position: 106
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610643-02.104
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1180081.0	4.4			ppb
│	Be-KED1	9	32927.6	2.6	9.31156	3.6	ppb
⌊	Al-KED1	27	13118895.0	3.7	393.50102	1.5	ppb
⌈	V-KED3	51	37367.5	1.1	96.35756	3.0	ppb
│	Cr-KED3	52	21714.8	0.3	39.41778	2.3	ppb
│	Cr-KED3	53	2542.2	4.7	39.94644	6.4	ppb
│	Co-KED3	59	124864.0	0.9	99.43217	3.2	ppb
│	Ni-KED3	60	75062.0	0.2	99.19901	2.3	ppb
│	Ni-KED3	62	6342.1	1.7	100.27397	2.5	ppb
│	Cu-KED3	63	59537.8	2.1	49.79064	4.4	ppb
│	Zn-KED3	64	14713.1	1.5	97.33500	3.6	ppb
│	Cu-KED3	65	30963.2	0.7	49.53424	2.9	ppb
│	Zn-KED3	66	9830.4	1.9	95.22039	4.1	ppb
⌊>	Ge-KED3	72	26745.7	2.3			ppb
⌈>	Ge-KED2	72	138240.0	3.0			ppb
│	As-KED2	75	7088.8	1.3	32.49939	1.8	ppb
│	Se-KED2	77	234.7	7.7	28.89486	10.8	ppb
│	Se-KED2	78	856.4	1.1	32.76173	3.9	ppb
⌊	Se-KED2	82	423.2	9.9	33.18265	9.7	ppb
⌈	Mo-KED2	95	44186.9	0.6	33.24850	2.9	ppb
│	Mo-KED2	97	29032.8	0.4	33.02737	3.9	ppb
│	Mo-KED2	98	75759.6	0.6	33.27719	4.0	ppb
│	Cd-KED2	111	5828.5	0.1	9.98065	3.5	ppb
│	Cd-KED2	114	13708.8	1.2	9.97037	2.4	ppb
⌊>	In-KED2	115	42241.2	3.5			ppb
⌈>	Rh-KED2	103	235637.0	3.1			ppb
│	Ag-KED2	107	49673.9	1.3	9.34608	1.8	ppb
⌊	Ag-KED2	109	47973.1	1.5	9.37783	2.2	ppb
⌈>	In-KED1	115	580245.7	2.6			ppb
│	Sb-KED1	121	1202412.1	1.8	94.08601	2.1	ppb
│	Sb-KED1	123	912107.6	2.4	93.62193	3.7	ppb
│	Ba-KED1	135	698818.9	2.8	176.15852	4.2	ppb
⌊	Ba-KED1	137	1161400.9	3.9	174.03303	4.4	ppb
⌈>	Lu-KED1	175	655197.0	1.5			ppb
│	Tl-KED1	203	64480.7	3.7	6.21652	2.2	ppb
│	Tl-KED1	205	147579.9	4.2	6.19613	2.7	ppb
⌊	Pb-KED1	208	2853592.1	3.3	91.61024	1.8	ppb
⌈	Mn-STD1	55	4613127.5	1.1	111.72897	3.8	ppb
⌊>	Ge-STD	72	1790444.9	3.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		106			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		91			
┌>	Ge-KED2	72		92			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		90			
┌>	Rh-KED2	103		93			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		103			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		103			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		103			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

Sample ID: KQ1610643-02
Report Date/Time: Thursday, September 08, 2016 09:10:25

LABWORKS - Summary Report

Sample ID: KQ1610643-03
Sample Date/Time: Wednesday, September 07, 2016 22:01:15
Sample Description: 5
Autosampler Position: 107
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610643-03.105
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1109649.2	5.2			ppb
|	Be-KED1	9	129.7	8.9	0.03725	5.3	ppb
⌊	Al-KED1	27	93989166.6	4.0	2999.29404	2.8	ppb
⌈	V-KED3	51	1259.7	1.7	3.40977	1.8	ppb
|	Cr-KED3	52	2256.2	2.2	4.30235	3.3	ppb
|	Cr-KED3	53	284.7	12.4	4.69488	12.3	ppb
|	Co-KED3	59	629.7	8.9	0.51977	8.1	ppb
|	Ni-KED3	60	1890.1	3.4	2.62287	3.9	ppb
|	Ni-KED3	62	153.3	5.9	2.54183	6.3	ppb
|	Cu-KED3	63	35495.4	0.7	31.21683	1.2	ppb
|	Zn-KED3	64	16364.1	1.6	113.87112	0.6	ppb
|	Cu-KED3	65	18272.0	1.1	30.74942	1.3	ppb
|	Zn-KED3	66	10399.8	1.8	105.97389	2.8	ppb
⌊>	Ge-KED3	72	25413.3	1.1			ppb
⌈>	Ge-KED2	72	136052.5	0.8			ppb
|	As-KED2	75	3106.7	1.6	14.42017	0.8	ppb
|	Se-KED2	77	70.7	6.5	8.61085	6.4	ppb
|	Se-KED2	78	223.7	0.2	7.77339	1.1	ppb
⌊	Se-KED2	82	100.5	16.3	9.08279	13.1	ppb
⌈	Mo-KED2	95	814.7	4.3	0.62284	2.4	ppb
|	Mo-KED2	97	582.7	5.9	0.67186	5.5	ppb
|	Mo-KED2	98	1376.6	5.2	0.61528	5.4	ppb
|	Cd-KED2	111	361.3	9.9	0.62496	12.3	ppb
|	Cd-KED2	114	880.3	4.2	0.65125	4.3	ppb
⌊>	In-KED2	115	41389.8	2.5			ppb
⌈>	Rh-KED2	103	225733.3	1.0			ppb
|	Ag-KED2	107	301.7	11.7	0.05750	12.2	ppb
⌊	Ag-KED2	109	292.0	9.2	0.05762	10.5	ppb
⌈>	In-KED1	115	527839.4	4.3			ppb
|	Sb-KED1	121	200.0	3.5	0.01142	11.8	ppb
|	Sb-KED1	123	133.2	10.2	0.00962	12.2	ppb
|	Ba-KED1	135	35196.7	3.8	9.74659	1.9	ppb
⌊	Ba-KED1	137	58461.5	3.7	9.62791	2.0	ppb
⌈>	Lu-KED1	175	617060.2	3.8			ppb
|	Tl-KED1	203	200.7	0.6	0.01486	5.1	ppb
|	Tl-KED1	205	442.7	4.8	0.01452	11.9	ppb
⌊	Pb-KED1	208	22751.0	1.7	0.77470	2.8	ppb
⌈	Mn-STD1	55	226849.1	2.7	6.01986	3.9	ppb
⌊>	Ge-STD	72	1624039.5	2.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		99			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		86			
⌈>	Ge-KED2	72		90			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		89			
⌈>	Rh-KED2	103		89			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		94			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		97			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		94			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: KQ1610643-04
Sample Date/Time: Wednesday, September 07, 2016 22:06:05
Sample Description: 5
Autosampler Position: 108
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\KQ1610643-04.106
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1166636.1	4.3			ppb
│	Be-KED1	9	82.0	8.5	0.02174	6.7	ppb
└	Al-KED1	27	793559.1	4.0	24.07682	6.0	ppb
┌	V-KED3	51	6623.2	1.6	17.98236	1.2	ppb
│	Cr-KED3	52	1988.1	3.1	3.79423	3.1	ppb
│	Cr-KED3	53	228.7	17.1	3.77675	17.7	ppb
│	Co-KED3	59	2580.9	2.3	2.15746	2.5	ppb
│	Ni-KED3	60	7211.8	1.1	10.03462	0.8	ppb
│	Ni-KED3	62	790.0	4.4	13.14947	4.1	ppb
│	Cu-KED3	63	1035249.8	1.7	911.92544	1.6	ppb
│	Zn-KED3	64	41109.9	2.4	286.47269	2.0	ppb
│	Cu-KED3	65	533236.4	0.9	898.62796	0.5	ppb
│	Zn-KED3	66	26269.1	1.5	268.05474	1.8	ppb
└>	Ge-KED3	72	25380.9	0.6			ppb
┌>	Ge-KED2	72	134003.5	2.8			ppb
│	As-KED2	75	28868.5	0.5	136.81408	2.4	ppb
│	Se-KED2	77	180.7	15.3	22.79658	13.1	ppb
│	Se-KED2	78	579.0	4.5	22.44698	1.9	ppb
└	Se-KED2	82	286.4	5.2	23.58585	3.5	ppb
┌	Mo-KED2	95	9009.5	1.0	7.05233	2.8	ppb
│	Mo-KED2	97	5899.9	1.8	6.97748	1.8	ppb
│	Mo-KED2	98	15185.1	2.1	6.93772	3.4	ppb
│	Cd-KED2	111	47370.4	0.4	84.46295	3.3	ppb
│	Cd-KED2	114	112548.9	0.8	85.21967	3.7	ppb
└>	In-KED2	115	40591.9	3.3			ppb
┌>	Rh-KED2	103	222209.9	3.9			ppb
│	Ag-KED2	107	16876.3	2.6	3.36654	2.6	ppb
└	Ag-KED2	109	16306.3	2.4	3.37934	2.6	ppb
┌>	In-KED1	115	530601.0	5.0			ppb
│	Sb-KED1	121	1360.1	3.5	0.11065	4.3	ppb
│	Sb-KED1	123	1026.3	5.8	0.11009	10.1	ppb
│	Ba-KED1	135	1723.4	6.8	0.47053	3.5	ppb
└	Ba-KED1	137	2879.0	2.4	0.47031	4.0	ppb
┌>	Lu-KED1	175	632509.9	2.3			ppb
│	Tl-KED1	203	224.0	1.8	0.01668	5.1	ppb
│	Tl-KED1	205	512.7	1.8	0.01705	1.7	ppb
└	Pb-KED1	208	10813.6	1.3	0.35827	1.8	ppb
┌	Mn-STD1	55	1106223.3	2.8	30.22041	2.9	ppb
└>	Ge-STD	72	1584634.6	1.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		104			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		86			
⌈>	Ge-KED2	72		89			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		87			
⌈>	Rh-KED2	103		87			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		94			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		100			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		91			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-001
Sample Date/Time: Wednesday, September 07, 2016 22:10:56
Sample Description: 5
Autosampler Position: 109
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-001.107
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1161234.0	2.2			ppb
	Be-KED1	9	22.3	5.2	0.00472	4.6	ppb
	Al-KED1	27	3090839.5	1.7	94.20994	3.3	ppb
	V-KED3	51	169.0	4.3	0.45152	4.7	ppb
	Cr-KED3	52	344.0	6.5	0.65019	7.2	ppb
	Cr-KED3	53	54.7	30.5	0.89382	30.0	ppb
	Co-KED3	59	929.7	0.5	0.77275	1.3	ppb
	Ni-KED3	60	564.0	1.4	0.78007	2.3	ppb
	Ni-KED3	62	49.3	27.0	0.81337	27.7	ppb
	Cu-KED3	63	6606.2	0.4	5.80907	0.9	ppb
	Zn-KED3	64	34864.6	1.5	243.10331	2.4	ppb
	Cu-KED3	65	3396.7	1.2	5.72157	1.7	ppb
	Zn-KED3	66	22493.4	2.1	229.65626	3.1	ppb
>	Ge-KED3	72	25369.5	1.0			ppb
>	Ge-KED2	72	137004.9	1.6			ppb
	As-KED2	75	130.7	4.9	0.52314	7.1	ppb
	Se-KED2	77	70.7	11.4	8.54683	11.3	ppb
	Se-KED2	78	241.3	6.0	8.42309	8.6	ppb
	Se-KED2	82	101.2	21.7	9.08985	18.1	ppb
	Mo-KED2	95	241.3	3.1	0.17932	1.5	ppb
	Mo-KED2	97	136.0	16.7	0.15063	17.4	ppb
	Mo-KED2	98	362.1	8.3	0.15784	10.8	ppb
	Cd-KED2	111	1059.4	2.5	1.80831	4.0	ppb
	Cd-KED2	114	2476.4	0.8	1.80022	2.7	ppb
>	In-KED2	115	42215.4	2.5			ppb
>	Rh-KED2	103	226856.8	2.6			ppb
	Ag-KED2	107	203.3	3.6	0.03803	6.3	ppb
	Ag-KED2	109	171.3	6.7	0.03284	9.5	ppb
>	In-KED1	115	545812.9	1.7			ppb
	Sb-KED1	121	346.7	11.3	0.02301	13.7	ppb
	Sb-KED1	123	257.7	16.4	0.02275	21.4	ppb
	Ba-KED1	135	32237.7	2.5	8.63316	3.5	ppb
	Ba-KED1	137	53985.9	3.5	8.59876	4.6	ppb
>	Lu-KED1	175	641226.1	2.2			ppb
	Tl-KED1	203	804.7	1.2	0.07367	3.1	ppb
	Tl-KED1	205	1695.4	7.2	0.06763	9.8	ppb
	Pb-KED1	208	10744.2	3.0	0.35125	4.8	ppb
	Mn-STD1	55	522187.7	3.3	14.47522	2.1	ppb
>	Ge-STD	72	1559272.6	1.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		104			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		86			
┌>	Ge-KED2	72		91			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		90			
┌>	Rh-KED2	103		89			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		101			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		90			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-001D
Sample Date/Time: Wednesday, September 07, 2016 22:15:46
Sample Description: 5
Autosampler Position: 110
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-001D.108
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1139062.6	1.6			ppb
|	Be-KED1	9	25.0	34.6	0.00561	43.3	ppb
⌊	Al-KED1	27	4756480.8	2.3	147.75360	1.8	ppb
⌈	V-KED3	51	243.3	3.9	0.66132	2.3	ppb
|	Cr-KED3	52	436.7	3.0	0.83731	1.4	ppb
|	Cr-KED3	53	44.7	2.6	0.73898	2.3	ppb
|	Co-KED3	59	1018.7	1.2	0.85808	3.1	ppb
|	Ni-KED3	60	608.0	9.7	0.85230	10.9	ppb
|	Ni-KED3	62	38.7	6.0	0.64303	7.2	ppb
|	Cu-KED3	63	8243.7	0.9	7.34181	2.2	ppb
|	Zn-KED3	64	39084.0	2.1	275.82789	2.2	ppb
|	Cu-KED3	65	4267.0	1.7	7.27872	3.5	ppb
|	Zn-KED3	66	25270.0	1.7	261.18882	3.3	ppb
⌊>	Ge-KED3	72	25065.6	1.9			ppb
⌈>	Ge-KED2	72	133786.1	2.2			ppb
|	As-KED2	75	122.7	10.9	0.50004	14.2	ppb
|	Se-KED2	77	73.3	19.7	9.11755	21.4	ppb
|	Se-KED2	78	244.8	3.4	8.79893	6.2	ppb
⌊	Se-KED2	82	111.8	21.1	10.07623	16.2	ppb
⌈	Mo-KED2	95	277.3	7.9	0.21067	7.5	ppb
|	Mo-KED2	97	171.3	8.2	0.19462	6.8	ppb
|	Mo-KED2	98	462.2	9.5	0.20587	10.7	ppb
|	Cd-KED2	111	1065.7	4.1	1.85685	5.9	ppb
|	Cd-KED2	114	2512.8	1.3	1.86378	2.5	ppb
⌊>	In-KED2	115	41370.9	2.0			ppb
⌈>	Rh-KED2	103	225227.6	2.4			ppb
|	Ag-KED2	107	185.3	7.6	0.03476	9.2	ppb
⌊	Ag-KED2	109	179.3	4.1	0.03468	3.5	ppb
⌈>	In-KED1	115	548471.8	2.9			ppb
|	Sb-KED1	121	447.3	7.5	0.03125	10.5	ppb
|	Sb-KED1	123	352.8	4.3	0.03292	4.7	ppb
|	Ba-KED1	135	38412.9	2.0	10.23683	1.4	ppb
⌊	Ba-KED1	137	63853.7	1.7	10.11988	1.5	ppb
⌈>	Lu-KED1	175	617590.7	2.6			ppb
|	Tl-KED1	203	798.0	6.1	0.07597	4.9	ppb
|	Tl-KED1	205	1896.8	2.2	0.07931	1.0	ppb
⌊	Pb-KED1	208	12629.5	1.1	0.42892	2.8	ppb
⌈	Mn-STD1	55	623218.8	0.6	17.23903	3.6	ppb
⌊>	Ge-STD	72	1564726.3	3.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		102			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		85			
⌈>	Ge-KED2	72		89			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		89			
⌈>	Rh-KED2	103		89			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		98			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		98			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		90			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-001L
Sample Date/Time: Wednesday, September 07, 2016 22:20:36
Sample Description: 25
Autosampler Position: 111
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-001L.109
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1255733.9	3.1			ppb
│	Be-KED1	9	12.3	37.4	0.00157	75.3	ppb
└	Al-KED1	27	631895.1	4.0	17.79066	4.4	ppb
┌	V-KED3	51	31.0	14.8	0.07239	15.6	ppb
│	Cr-KED3	52	71.0	12.5	0.12120	13.7	ppb
│	Cr-KED3	53	10.0	20.0	0.14811	20.9	ppb
│	Co-KED3	59	185.0	1.6	0.14041	1.0	ppb
│	Ni-KED3	60	134.0	12.9	0.17221	13.4	ppb
│	Ni-KED3	62	16.0	12.5	0.24450	13.2	ppb
│	Cu-KED3	63	1372.1	2.1	1.13861	1.4	ppb
│	Zn-KED3	64	6652.8	1.8	44.16294	2.1	ppb
│	Cu-KED3	65	715.7	3.8	1.14367	3.9	ppb
│	Zn-KED3	66	4391.0	1.1	42.66576	1.8	ppb
└>	Ge-KED3	72	26632.1	0.7			ppb
┌>	Ge-KED2	72	139818.6	1.0			ppb
│	As-KED2	75	42.3	10.9	0.10923	17.9	ppb
│	Se-KED2	77	22.0	31.5	2.39234	34.8	ppb
│	Se-KED2	78	71.0	6.3	1.53978	13.1	ppb
└	Se-KED2	82	-1.5	278.0	1.32530	23.3	ppb
┌	Mo-KED2	95	52.0	10.2	0.03632	11.9	ppb
│	Mo-KED2	97	32.7	19.7	0.03245	20.8	ppb
│	Mo-KED2	98	68.4	12.9	0.02812	12.4	ppb
│	Cd-KED2	111	212.0	3.7	0.35019	4.3	ppb
│	Cd-KED2	114	490.7	0.9	0.34959	0.2	ppb
└>	In-KED2	115	42849.7	1.1			ppb
┌>	Rh-KED2	103	237744.9	1.3			ppb
│	Ag-KED2	107	44.0	12.0	0.00646	13.8	ppb
└	Ag-KED2	109	49.0	4.1	0.00751	6.8	ppb
┌>	In-KED1	115	561143.3	2.7			ppb
│	Sb-KED1	121	74.7	21.8	0.00023	591.3	ppb
│	Sb-KED1	123	47.6	23.3	-0.00036	294.6	ppb
│	Ba-KED1	135	6300.1	1.4	1.63761	1.7	ppb
└	Ba-KED1	137	10374.4	3.1	1.60570	3.7	ppb
┌>	Lu-KED1	175	649804.8	3.1			ppb
│	Tl-KED1	203	142.7	7.1	0.00816	9.9	ppb
│	Tl-KED1	205	357.3	8.0	0.00989	15.8	ppb
└	Pb-KED1	208	2233.4	3.6	0.07083	2.8	ppb
┌	Mn-STD1	55	107007.3	0.6	2.84198	4.3	ppb
└>	Ge-STD	72	1612783.4	3.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		112			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		90			
⌈>	Ge-KED2	72		93			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		92			
⌈>	Rh-KED2	103		93			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		100			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		103			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		93			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-001A
Sample Date/Time: Wednesday, September 07, 2016 22:25:27
Sample Description: 5 +50ppb +10ppb Ag
Autosampler Position: 112
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-001A.110
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1149369.2	1.8			ppb
|	Be-KED1	9	181505.8	0.7	52.67302	1.8	ppb
⌊	Al-KED1	27	4651362.7	0.8	143.20901	1.1	ppb
⌈	V-KED3	51	19935.6	1.1	54.47353	0.9	ppb
|	Cr-KED3	52	27641.7	0.4	53.18738	1.8	ppb
|	Cr-KED3	53	3351.1	2.2	55.78059	1.9	ppb
|	Co-KED3	59	63646.8	2.0	53.69803	0.3	ppb
|	Ni-KED3	60	37674.3	1.0	52.76978	1.9	ppb
|	Ni-KED3	62	3221.0	4.0	53.95802	2.7	ppb
|	Cu-KED3	63	65120.8	1.0	57.70448	1.6	ppb
|	Zn-KED3	64	42499.4	1.9	297.95158	1.0	ppb
|	Cu-KED3	65	33527.3	1.0	56.84789	2.1	ppb
|	Zn-KED3	66	27641.1	1.3	283.78727	2.0	ppb
⌊>	Ge-KED3	72	25229.9	2.0			ppb
⌈>	Ge-KED2	72	132799.5	1.7			ppb
|	As-KED2	75	11952.0	0.4	57.09179	1.4	ppb
|	Se-KED2	77	512.7	7.2	65.92472	5.6	ppb
|	Se-KED2	78	1633.4	1.5	66.23670	1.6	ppb
⌊	Se-KED2	82	766.5	7.2	61.22465	5.4	ppb
⌈	Mo-KED2	95	69964.3	1.7	54.08028	3.9	ppb
|	Mo-KED2	97	45913.0	2.0	53.63367	3.3	ppb
|	Mo-KED2	98	118573.0	3.1	53.49195	4.8	ppb
|	Cd-KED2	111	31592.2	1.8	55.58941	3.2	ppb
|	Cd-KED2	114	75422.7	2.8	56.35335	3.7	ppb
⌊>	In-KED2	115	41125.3	3.3			ppb
⌈>	Rh-KED2	103	221692.3	1.9			ppb
|	Ag-KED2	107	48383.8	3.0	9.67364	3.0	ppb
⌊	Ag-KED2	109	46365.8	2.4	9.63130	2.6	ppb
⌈>	In-KED1	115	546021.6	1.6			ppb
|	Sb-KED1	121	635549.0	0.9	52.84130	2.1	ppb
|	Sb-KED1	123	482081.3	2.5	52.57527	3.8	ppb
|	Ba-KED1	135	209014.8	1.5	55.97466	3.0	ppb
⌊	Ba-KED1	137	346644.0	0.5	55.18631	1.4	ppb
⌈>	Lu-KED1	175	633248.8	2.5			ppb
|	Tl-KED1	203	469663.9	2.5	46.90105	1.7	ppb
|	Tl-KED1	205	1073404.0	2.0	46.68338	1.7	ppb
⌊	Pb-KED1	208	1429550.4	2.2	47.49709	1.3	ppb
⌈	Mn-STD1	55	2717513.3	2.2	74.90537	1.7	ppb
⌊>	Ge-STD	72	1571490.4	0.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		86			
⌈>	Ge-KED2	72		88			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		88			
⌈>	Rh-KED2	103		87			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		100			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		90			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 22:30:18
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.111
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1187643.4	0.9			ppb
|	Be-KED1	9	84506.3	1.7	23.72693	0.9	ppb
⌊	Al-KED1	27	841738.7	3.6	25.05446	3.0	ppb
⌈	V-KED3	51	9342.1	1.9	25.15707	2.2	ppb
|	Cr-KED3	52	13397.6	1.1	25.40237	1.5	ppb
|	Cr-KED3	53	1553.4	5.7	25.47812	5.3	ppb
|	Co-KED3	59	31210.7	1.7	25.95187	1.3	ppb
|	Ni-KED3	60	18492.0	1.1	25.52536	1.8	ppb
|	Ni-KED3	62	1635.4	0.5	27.00633	1.1	ppb
|	Cu-KED3	63	29961.4	0.5	26.15881	0.5	ppb
|	Zn-KED3	64	3555.2	3.9	24.54834	4.6	ppb
|	Cu-KED3	65	15463.7	1.9	25.83923	2.6	ppb
|	Zn-KED3	66	2474.2	1.4	24.99667	2.0	ppb
⌊>	Ge-KED3	72	25595.2	0.7			ppb
⌈>	Ge-KED2	72	134771.1	1.3			ppb
|	As-KED2	75	5263.0	1.2	24.72523	2.1	ppb
|	Se-KED2	77	187.3	10.7	23.58174	12.2	ppb
|	Se-KED2	78	632.0	3.1	24.47859	2.7	ppb
⌊	Se-KED2	82	319.2	0.7	25.98638	1.3	ppb
⌈	Mo-KED2	95	33596.8	0.9	26.04122	0.4	ppb
|	Mo-KED2	97	22139.8	0.0	25.93908	0.6	ppb
|	Mo-KED2	98	57409.7	1.5	25.96990	1.3	ppb
|	Cd-KED2	111	14540.7	2.0	25.65824	1.8	ppb
|	Cd-KED2	114	34358.7	1.7	25.74928	1.8	ppb
⌊>	In-KED2	115	40978.0	0.6			ppb
⌈>	Rh-KED2	103	230536.0	1.0			ppb
|	Ag-KED2	107	128000.6	1.1	24.60977	0.2	ppb
⌊	Ag-KED2	109	123904.3	0.3	24.75114	0.8	ppb
⌈>	In-KED1	115	555824.9	1.8			ppb
|	Sb-KED1	121	300323.3	1.8	24.53038	3.3	ppb
|	Sb-KED1	123	230865.7	2.7	24.73428	4.3	ppb
|	Ba-KED1	135	86980.7	1.3	22.87687	1.7	ppb
⌊	Ba-KED1	137	143627.2	1.4	22.46299	2.3	ppb
⌈>	Lu-KED1	175	619729.2	4.1			ppb
|	Tl-KED1	203	239675.4	2.6	24.46105	1.5	ppb
|	Tl-KED1	205	546181.1	2.6	24.27918	2.6	ppb
⌊	Pb-KED1	208	721261.0	1.7	24.49976	2.5	ppb
~~⌈~~	~~Mn-STD1~~	~~55~~	~~1042187.3~~	~~0.4~~	~~28.61055~~	~~2.7~~	~~ppb~~
⌊>	Ge-STD	72	1577601.9	3.1			ppb

JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		106			
|	Be-KED1	9	95				
⌊	Al-KED1	27	100				
⌈	V-KED3	51	101				
|	Cr-KED3	52	102				
|	Cr-KED3	53	102				
|	Co-KED3	59	104				
|	Ni-KED3	60	102				
|	Ni-KED3	62	108				
|	Cu-KED3	63	105				
|	Zn-KED3	64	98				
|	Cu-KED3	65	103				
|	Zn-KED3	66	100				
⌊>	Ge-KED3	72		87			
⌈>	Ge-KED2	72		90			
|	As-KED2	75	99				
|	Se-KED2	77	94				
|	Se-KED2	78	98				
⌊	Se-KED2	82	104				
⌈	Mo-KED2	95	104				
|	Mo-KED2	97	104				
|	Mo-KED2	98	104				
|	Cd-KED2	111	103				
|	Cd-KED2	114	103				
⌊>	In-KED2	115		88			
⌈>	Rh-KED2	103		91			
|	Ag-KED2	107	98				
⌊	Ag-KED2	109	99				
⌈>	In-KED1	115		99			
|	Sb-KED1	121	98				
|	Sb-KED1	123	99				
|	Ba-KED1	135	92				
⌊	Ba-KED1	137	90				
⌈>	Lu-KED1	175		98			
|	Tl-KED1	203	98				
|	Tl-KED1	205	97				
⌊	Pb-KED1	208	98				
⌈	Mn-STD1	55	114				
⌊>	Ge-STD	72		91			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 22:34:48
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.112
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1183030.2	4.8			ppb
|	Be-KED1	9	84584.2	3.2	23.85586	2.1	ppb
⌊	Al-KED1	27	848901.4	4.9	25.36852	0.1	ppb
⌈	V-KED3	51	9217.0	1.1	25.80163	1.7	ppb
|	Cr-KED3	52	13320.5	0.8	26.25513	1.6	ppb
|	Cr-KED3	53	1564.1	2.1	26.66826	1.2	ppb
|	Co-KED3	59	30603.8	1.5	26.45215	0.4	ppb
|	Ni-KED3	60	18184.2	0.3	26.09264	1.4	ppb
|	Ni-KED3	62	1496.7	4.9	25.68403	3.8	ppb
|	Cu-KED3	63	29159.1	1.0	26.46787	2.2	ppb
|	Zn-KED3	64	3486.7	3.1	25.02940	4.2	ppb
|	Cu-KED3	65	14933.8	1.9	25.93493	0.9	ppb
|	Zn-KED3	66	2431.5	0.6	25.53764	1.6	ppb
⌊>	Ge-KED3	72	24622.9	1.2			ppb
⌈>	Ge-KED2	72	135109.0	1.1			ppb
|	As-KED2	75	5239.3	0.7	24.54885	0.6	ppb
|	Se-KED2	77	183.3	9.1	22.98917	9.1	ppb
|	Se-KED2	78	614.9	4.9	23.73073	6.2	ppb
⌊	Se-KED2	82	276.5	6.2	22.65876	6.8	ppb
⌈	Mo-KED2	95	33438.4	2.0	25.31050	1.1	ppb
|	Mo-KED2	97	21727.2	1.3	24.85877	0.6	ppb
|	Mo-KED2	98	56837.2	1.4	25.10864	0.4	ppb
|	Cd-KED2	111	14573.1	0.8	25.11670	1.9	ppb
|	Cd-KED2	114	34364.6	0.3	25.15279	1.4	ppb
⌊>	In-KED2	115	41961.9	1.5			ppb
⌈>	Rh-KED2	103	228567.3	1.7			ppb
|	Ag-KED2	107	126812.8	1.7	24.59279	1.3	ppb
⌊	Ag-KED2	109	123996.9	1.3	24.98279	0.4	ppb
⌈>	In-KED1	115	561939.8	5.3			ppb
|	Sb-KED1	121	306377.5	2.8	24.77131	3.5	ppb
|	Sb-KED1	123	233698.5	4.0	24.76987	2.5	ppb
|	Ba-KED1	135	88100.2	6.2	22.90864	0.9	ppb
⌊	Ba-KED1	137	146810.7	5.5	22.70655	1.3	ppb
⌈>	Lu-KED1	175	633038.2	7.0			ppb
|	Tl-KED1	203	241355.9	6.4	24.11050	0.6	ppb
|	Tl-KED1	205	551040.5	5.2	23.98780	2.3	ppb
⌊	Pb-KED1	208	726471.1	4.9	24.16529	2.3	ppb
⌈	Mn-STD1	55	1057950.6	1.5	28.91335	5.3	ppb
⌊>	Ge-STD	72	1586185.7	4.4			ppb

JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		106			
⎢	Be-KED1	9	95				
⎣	Al-KED1	27	101				
⎡	V-KED3	51	103				
⎢	Cr-KED3	52	105				
⎢	Cr-KED3	53	107				
⎢	Co-KED3	59	106				
⎢	Ni-KED3	60	104				
⎢	Ni-KED3	62	103				
⎢	Cu-KED3	63	106				
⎢	Zn-KED3	64	100				
⎢	Cu-KED3	65	104				
⎢	Zn-KED3	66	102				
⎣>	Ge-KED3	72		84			
⎡>	Ge-KED2	72		90			
⎢	As-KED2	75	98				
⎢	Se-KED2	77	92				
⎢	Se-KED2	78	95				
⎣	Se-KED2	82	91				
⎡	Mo-KED2	95	101				
⎢	Mo-KED2	97	99				
⎢	Mo-KED2	98	100				
⎢	Cd-KED2	111	100				
⎢	Cd-KED2	114	101				
⎣>	In-KED2	115		90			
⎡>	Rh-KED2	103		90			
⎢	Ag-KED2	107	98				
⎣	Ag-KED2	109	100				
⎡>	In-KED1	115		100			
⎢	Sb-KED1	121	99				
⎢	Sb-KED1	123	99				
⎢	Ba-KED1	135	92				
⎣	Ba-KED1	137	91				
⎡>	Lu-KED1	175		100			
⎢	Tl-KED1	203	96				
⎢	Tl-KED1	205	96				
⎣	Pb-KED1	208	97				
⎡	Mn-STD1	55	116				
⎣>	Ge-STD	72		91			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 22:39:39
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.113
User Name: JDB
Batch ID:

Concentration Results

Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
Li-KED1	6	1177174.7	5.5			ppb
Be-KED1	9	16.7	17.3	0.00301	18.8	ppb
Al-KED1	27	1335.4	4.1	0.01515	24.9	ppb
V-KED3	51	1.3	43.3	-0.00427	37.1	ppb
Cr-KED3	52	2.7	78.1	-0.00332	113.5	ppb
Cr-KED3	53	0.0		-0.00951	0.0	ppb
Co-KED3	59	11.0	24.1	0.00151	152.9	ppb
Ni-KED3	60	6.7	91.7	0.00347	238.5	ppb
Ni-KED3	62	2.0	0.0	0.02278	2.4	ppb
Cu-KED3	63	12.0	44.1	-0.00289	158.6	ppb
Zn-KED3	64	5.1	62.1	0.00722	289.9	ppb
Cu-KED3	65	6.0	16.7	0.00400	38.7	ppb
Zn-KED3	66	3.3	75.5	-0.01112	219.4	ppb
Ge-KED3	72	26135.6	1.7			ppb
Ge-KED2	72	134573.0	1.6			ppb
As-KED2	75	22.7	22.2	0.02417	102.1	ppb
Se-KED2	77	2.0	0.0	-0.04893	8.4	ppb
Se-KED2	78	32.0	5.1	0.05332	97.9	ppb
Se-KED2	82	-14.1	51.4	0.35257	153.0	ppb
Mo-KED2	95	4.0	50.0	0.00080	190.7	ppb
Mo-KED2	97	3.3	91.7	-0.00025	1406.7	ppb
Mo-KED2	98	5.6	59.2	0.00104	140.1	ppb
Cd-KED2	111	2.7	86.6	-0.00312	128.5	ppb
Cd-KED2	114	1.9	195.8	-0.00072	383.0	ppb
In-KED2	115	41370.4	1.7			ppb
Rh-KED2	103	225855.1	0.7			ppb
Ag-KED2	107	47.7	7.4	0.00762	9.8	ppb
Ag-KED2	109	42.3	11.7	0.00664	15.5	ppb
In-KED1	115	546101.0	5.1			ppb
Sb-KED1	121	317.3	4.1	0.02057	1.4	ppb
Sb-KED1	123	250.2	8.6	0.02196	14.0	ppb
Ba-KED1	135	15.3	39.8	-0.00010	1373.2	ppb
Ba-KED1	137	18.7	32.7	0.00115	95.1	ppb
Lu-KED1	175	623834.9	1.7			ppb
Tl-KED1	203	42.0	16.5	-0.00146	52.1	ppb
Tl-KED1	205	120.0	3.3	0.00002	1004.4	ppb
Pb-KED1	208	59.3	17.3	0.00052	64.9	ppb
Mn-STD1	55	1761.4	5.5	0.01272	5.6	ppb
Ge-STD	72	1544569.4	4.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		105			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		89			
┌>	Ge-KED2	72		89			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		89			
┌>	Rh-KED2	103		89			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		99			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		89			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: LLCCVT
Sample Date/Time: Wednesday, September 07, 2016 22:44:30
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLCCVT.114
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1205591.9	4.7			ppb
│	Be-KED1	9	151.7	1.7	0.04035	6.7	ppb
└	Al-KED1	27	139725.9	5.4	4.07657	2.6	ppb
┌	V-KED3	51	154.3	11.0	0.40592	10.8	ppb
│	Cr-KED3	52	229.3	6.6	0.42485	7.3	ppb
│	Cr-KED3	53	28.7	31.5	0.45826	31.4	ppb
│	Co-KED3	59	60.3	11.0	0.04245	11.8	ppb
│	Ni-KED3	60	302.7	8.4	0.41059	9.4	ppb
│	Ni-KED3	62	18.0	38.5	0.28562	38.5	ppb
│	Cu-KED3	63	264.0	3.8	0.21639	3.8	ppb
│	Zn-KED3	64	166.7	2.2	1.11932	0.9	ppb
│	Cu-KED3	65	136.7	1.5	0.22154	1.4	ppb
│	Zn-KED3	66	105.3	3.8	1.01759	5.4	ppb
└>	Ge-KED3	72	25712.8	1.4			ppb
┌>	Ge-KED2	72	137344.8	1.2			ppb
│	As-KED2	75	240.3	6.9	1.02921	8.7	ppb
│	Se-KED2	77	18.0	11.1	1.94684	13.5	ppb
│	Se-KED2	78	80.0	12.2	1.94834	21.5	ppb
└	Se-KED2	82	3.2	96.6	1.67905	14.0	ppb
┌	Mo-KED2	95	134.7	14.3	0.09773	13.5	ppb
│	Mo-KED2	97	102.0	10.9	0.11060	12.6	ppb
│	Mo-KED2	98	233.6	7.9	0.09996	9.0	ppb
│	Cd-KED2	111	27.3	37.5	0.03839	44.1	ppb
│	Cd-KED2	114	60.8	5.0	0.04159	6.5	ppb
└>	In-KED2	115	42737.2	1.2			ppb
┌>	Rh-KED2	103	239933.1	0.3			ppb
│	Ag-KED2	107	223.7	8.4	0.03958	8.6	ppb
└	Ag-KED2	109	209.3	12.5	0.03818	12.8	ppb
┌>	In-KED1	115	554095.6	4.0			ppb
│	Sb-KED1	121	1259.4	0.2	0.09748	4.5	ppb
│	Sb-KED1	123	964.4	2.3	0.09839	6.2	ppb
│	Ba-KED1	135	381.3	6.3	0.09665	9.6	ppb
└	Ba-KED1	137	654.0	4.1	0.10094	8.0	ppb
┌>	Lu-KED1	175	618354.1	3.7			ppb
│	Tl-KED1	203	410.0	3.9	0.03623	4.4	ppb
│	Tl-KED1	205	1007.4	6.9	0.03960	7.2	ppb
└	Pb-KED1	208	1298.0	2.9	0.04269	1.5	ppb
┌	Mn-STD1	55	6094.6	1.0	0.12873	0.9	ppb
└>	Ge-STD	72	1596700.2	0.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		108			
│	Be-KED1	9	101				
└	Al-KED1	27	102				
┌	V-KED3	51	101				
│	Cr-KED3	52	106				
│	Cr-KED3	53	115				
│	Co-KED3	59	106				
│	Ni-KED3	60	103				
│	Ni-KED3	62	71				
│	Cu-KED3	63	108				
│	Zn-KED3	64	112				
│	Cu-KED3	65	111				
│	Zn-KED3	66	102				
└>	Ge-KED3	72		87			
┌>	Ge-KED2	72		91			
│	As-KED2	75	103				
│	Se-KED2	77	97				
│	Se-KED2	78	97				
└	Se-KED2	82	84				
┌	Mo-KED2	95	98				
│	Mo-KED2	97	111				
│	Mo-KED2	98	100				
│	Cd-KED2	111	96				
│	Cd-KED2	114	104				
└>	In-KED2	115		91			
┌>	Rh-KED2	103		94			
│	Ag-KED2	107	99				
└	Ag-KED2	109	95				
┌>	In-KED1	115		99			
│	Sb-KED1	121	97				
│	Sb-KED1	123	98				
│	Ba-KED1	135	97				
└	Ba-KED1	137	101				
┌>	Lu-KED1	175		98			
│	Tl-KED1	203	91				
│	Tl-KED1	205	99				
└	Pb-KED1	208	107				
┌	Mn-STD1	55	129				
└>	Ge-STD	72		92			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-001S
Sample Date/Time: Wednesday, September 07, 2016 22:49:21
Sample Description: 5
Autosampler Position: 113
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-001S.115
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1147735.4	3.0			ppb
|	Be-KED1	9	33900.8	0.5	9.85487	3.1	ppb
⌊	Al-KED1	27	16679468.3	2.3	514.37407	1.4	ppb
⌈	V-KED3	51	36429.7	1.3	100.10516	1.6	ppb
|	Cr-KED3	52	20567.1	2.2	39.79247	3.0	ppb
|	Cr-KED3	53	2466.9	4.6	41.30279	5.5	ppb
|	Co-KED3	59	117210.1	2.4	99.46228	2.7	ppb
|	Ni-KED3	60	69322.5	1.3	97.64208	2.1	ppb
|	Ni-KED3	62	5777.8	2.6	97.38088	3.6	ppb
|	Cu-KED3	63	60474.4	2.4	53.88453	2.9	ppb
|	Zn-KED3	64	51413.8	2.2	362.45998	1.8	ppb
|	Cu-KED3	65	31317.3	0.5	53.39191	1.5	ppb
|	Zn-KED3	66	33355.6	2.0	344.38971	2.9	ppb
⌊>	Ge-KED3	72	25088.7	1.0			ppb
⌈>	Ge-KED2	72	135231.1	1.5			ppb
|	As-KED2	75	7407.6	2.4	34.71751	3.2	ppb
|	Se-KED2	77	322.7	2.6	40.66262	3.2	ppb
|	Se-KED2	78	1115.1	3.1	43.98190	1.7	ppb
⌊	Se-KED2	82	553.8	7.5	43.86621	6.4	ppb
⌈	Mo-KED2	95	43822.5	3.0	33.27994	1.9	ppb
|	Mo-KED2	97	28827.7	0.8	33.09906	1.7	ppb
|	Mo-KED2	98	74585.3	0.7	33.06506	1.7	ppb
|	Cd-KED2	111	6760.6	2.9	11.68496	2.5	ppb
|	Cd-KED2	114	15960.9	1.5	11.72167	2.7	ppb
⌊>	In-KED2	115	41819.9	1.2			ppb
⌈>	Rh-KED2	103	227011.7	1.3			ppb
|	Ag-KED2	107	45962.9	2.9	8.97257	2.2	ppb
⌊	Ag-KED2	109	44077.6	1.8	8.94052	1.9	ppb
⌈>	In-KED1	115	543274.6	2.4			ppb
|	Sb-KED1	121	1171912.7	1.6	97.92750	0.8	ppb
|	Sb-KED1	123	887778.7	1.7	97.29219	0.8	ppb
|	Ba-KED1	135	700355.8	0.7	188.52002	2.1	ppb
⌊	Ba-KED1	137	1161779.4	2.1	185.93846	3.0	ppb
⌈>	Lu-KED1	175	621706.9	3.8			ppb
|	Tl-KED1	203	60052.0	1.5	6.10639	2.5	ppb
|	Tl-KED1	205	139800.2	1.7	6.19127	2.7	ppb
⌊	Pb-KED1	208	2667748.2	1.0	90.33897	2.9	ppb
⌈	Mn-STD1	55	4447263.9	3.4	127.60956	4.2	ppb
⌊>	Ge-STD	72	1510399.0	1.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		85			
⌈>	Ge-KED2	72		90			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		89			
⌈>	Rh-KED2	103		89			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		98			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		87			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-002
Sample Date/Time: Wednesday, September 07, 2016 22:54:12
Sample Description: 5
Autosampler Position: 114
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-002.116
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1146966.7	3.2			ppb
|	Be-KED1	9	21.3	31.2	0.00449	40.9	ppb
⌊	Al-KED1	27	3202318.8	2.8	98.86162	4.8	ppb
⌈	V-KED3	51	169.7	11.7	0.46694	11.9	ppb
|	Cr-KED3	52	318.7	2.6	0.61951	1.2	ppb
|	Cr-KED3	53	42.7	15.1	0.71841	16.1	ppb
|	Co-KED3	59	1348.1	2.3	1.15777	3.8	ppb
|	Ni-KED3	60	446.7	6.9	0.63528	7.9	ppb
|	Ni-KED3	62	32.7	14.1	0.55153	15.4	ppb
|	Cu-KED3	63	8201.0	2.5	7.43152	4.0	ppb
|	Zn-KED3	64	47390.8	0.4	340.24337	1.4	ppb
|	Cu-KED3	65	4209.0	2.3	7.30368	3.8	ppb
|	Zn-KED3	66	30647.2	1.2	322.22547	2.8	ppb
⌊>	Ge-KED3	72	24639.6	1.6			ppb
⌈>	Ge-KED2	72	130286.7	2.5			ppb
|	As-KED2	75	210.7	3.7	0.94386	1.3	ppb
|	Se-KED2	77	108.0	8.1	13.93339	8.8	ppb
|	Se-KED2	78	339.1	4.7	13.04270	7.2	ppb
⌊	Se-KED2	82	141.2	3.6	12.67814	5.4	ppb
⌈	Mo-KED2	95	247.3	8.6	0.19163	10.7	ppb
|	Mo-KED2	97	158.0	15.9	0.18326	17.9	ppb
|	Mo-KED2	98	388.8	4.6	0.17610	2.6	ppb
|	Cd-KED2	111	1185.0	1.9	2.10464	0.6	ppb
|	Cd-KED2	114	2832.2	1.4	2.14245	3.5	ppb
⌊>	In-KED2	115	40581.2	2.4			ppb
⌈>	Rh-KED2	103	217758.3	3.4			ppb
|	Ag-KED2	107	259.0	6.8	0.05109	10.1	ppb
⌊	Ag-KED2	109	257.7	1.8	0.05253	2.1	ppb
⌈>	In-KED1	115	527165.3	6.2			ppb
|	Sb-KED1	121	565.3	5.0	0.04289	1.8	ppb
|	Sb-KED1	123	409.9	14.0	0.04130	23.3	ppb
|	Ba-KED1	135	47631.3	1.1	13.24293	7.0	ppb
⌊	Ba-KED1	137	78894.7	3.1	13.05867	9.6	ppb
⌈>	Lu-KED1	175	612719.4	0.1			ppb
|	Tl-KED1	203	2081.5	3.4	0.20911	3.6	ppb
|	Tl-KED1	205	4750.1	0.7	0.20822	0.9	ppb
⌊	Pb-KED1	208	18008.4	2.8	0.61686	3.0	ppb
⌈	Mn-STD1	55	652904.2	2.3	19.10449	1.7	ppb
⌊>	Ge-STD	72	1478293.3	1.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		84			
⌈>	Ge-KED2	72		87			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		87			
⌈>	Rh-KED2	103		86			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		94			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		97			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		85			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-003
Sample Date/Time: Wednesday, September 07, 2016 22:59:02
Sample Description: 5
Autosampler Position: 115
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-003.117
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1137095.2	1.0			ppb
	Be-KED1	9	24.3	16.6	0.00545	21.8	ppb
	Al-KED1	27	4310944.2	2.0	134.14500	2.0	ppb
	V-KED3	51	230.3	8.1	0.64509	7.2	ppb
	Cr-KED3	52	325.3	0.9	0.64149	2.3	ppb
	Cr-KED3	53	51.3	34.0	0.87423	32.9	ppb
	Co-KED3	59	1787.8	2.1	1.55815	2.0	ppb
	Ni-KED3	60	543.3	5.3	0.78499	7.7	ppb
	Ni-KED3	62	51.3	12.5	0.88286	12.3	ppb
	Cu-KED3	63	9687.3	0.5	8.89873	2.9	ppb
	Zn-KED3	64	61941.6	1.1	450.79659	2.9	ppb
	Cu-KED3	65	4913.2	4.0	8.63808	3.7	ppb
	Zn-KED3	66	40280.7	1.8	429.15241	1.9	ppb
>	Ge-KED3	72	24314.7	2.5			ppb
>	Ge-KED2	72	128522.0	1.6			ppb
	As-KED2	75	213.7	1.1	0.97317	2.1	ppb
	Se-KED2	77	121.3	11.6	15.88497	10.2	ppb
	Se-KED2	78	366.0	3.8	14.38334	5.8	ppb
	Se-KED2	82	137.8	21.4	12.52702	17.6	ppb
	Mo-KED2	95	261.3	5.1	0.20569	5.6	ppb
	Mo-KED2	97	156.0	14.4	0.18328	13.6	ppb
	Mo-KED2	98	447.1	7.9	0.20598	6.0	ppb
	Cd-KED2	111	1635.8	3.8	2.95715	5.4	ppb
	Cd-KED2	114	3915.2	1.4	3.01030	3.0	ppb
>	In-KED2	115	39932.1	2.2			ppb
>	Rh-KED2	103	216740.6	2.1			ppb
	Ag-KED2	107	202.0	8.3	0.03953	6.5	ppb
	Ag-KED2	109	178.7	1.7	0.03598	1.0	ppb
>	In-KED1	115	519505.9	4.7			ppb
	Sb-KED1	121	579.3	10.9	0.04504	17.1	ppb
	Sb-KED1	123	418.8	13.3	0.04248	9.7	ppb
	Ba-KED1	135	44393.6	2.5	12.50182	4.1	ppb
	Ba-KED1	137	73739.4	4.3	12.34046	3.0	ppb
>	Lu-KED1	175	603509.4	2.9			ppb
	Tl-KED1	203	1350.7	7.3	0.13588	8.0	ppb
	Tl-KED1	205	3266.4	3.8	0.14375	1.0	ppb
	Pb-KED1	208	13667.8	2.5	0.47504	1.4	ppb
	Mn-STD1	55	977325.3	2.8	28.97219	1.2	ppb
>	Ge-STD	72	1460540.3	3.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		102			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		83			
⌈>	Ge-KED2	72		85			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		85			
⌈>	Rh-KED2	103		85			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		92			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		95			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		84			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-004
Sample Date/Time: Wednesday, September 07, 2016 23:03:52
Sample Description: 5
Autosampler Position: 116
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-004.118
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1147661.3	2.1			ppb
│	Be-KED1	9	22.7	28.7	0.00487	36.4	ppb
└	Al-KED1	27	4130581.0	1.1	127.40112	3.2	ppb
┌	V-KED3	51	214.0	8.1	0.61048	7.7	ppb
│	Cr-KED3	52	457.3	10.4	0.92127	8.7	ppb
│	Cr-KED3	53	54.0	11.1	0.94030	10.0	ppb
│	Co-KED3	59	1381.1	1.0	1.22500	1.4	ppb
│	Ni-KED3	60	345.3	5.2	0.50572	4.2	ppb
│	Ni-KED3	62	24.0	14.4	0.41504	13.0	ppb
│	Cu-KED3	63	7638.0	2.9	7.14318	1.1	ppb
│	Zn-KED3	64	51230.9	2.4	379.77461	1.2	ppb
│	Cu-KED3	65	3948.2	3.4	7.07144	2.2	ppb
│	Zn-KED3	66	33240.0	1.7	360.84644	1.5	ppb
└>	Ge-KED3	72	23859.6	1.9			ppb
┌>	Ge-KED2	72	129490.3	1.1			ppb
│	As-KED2	75	197.3	3.6	0.88508	4.2	ppb
│	Se-KED2	77	86.0	2.3	11.09936	3.5	ppb
│	Se-KED2	78	333.7	4.1	12.89667	5.7	ppb
└	Se-KED2	82	118.5	16.4	10.91236	13.5	ppb
┌	Mo-KED2	95	217.3	6.1	0.17255	6.4	ppb
│	Mo-KED2	97	162.0	11.3	0.19286	11.7	ppb
│	Mo-KED2	98	377.5	18.0	0.17577	18.3	ppb
│	Cd-KED2	111	717.0	8.0	1.30558	8.3	ppb
│	Cd-KED2	114	1676.6	1.2	1.30165	1.3	ppb
└>	In-KED2	115	39495.4	0.3			ppb
┌>	Rh-KED2	103	215046.3	1.2			ppb
│	Ag-KED2	107	140.3	5.3	0.02719	6.5	ppb
└	Ag-KED2	109	136.7	14.0	0.02731	16.3	ppb
┌>	In-KED1	115	522100.2	3.9			ppb
│	Sb-KED1	121	431.3	6.0	0.03167	2.6	ppb
│	Sb-KED1	123	319.2	5.3	0.03110	10.7	ppb
│	Ba-KED1	135	43315.6	2.3	12.13136	2.6	ppb
└	Ba-KED1	137	71621.1	1.7	11.93382	4.4	ppb
┌>	Lu-KED1	175	617802.7	2.7			ppb
│	Tl-KED1	203	1378.1	1.3	0.13541	3.6	ppb
│	Tl-KED1	205	3323.7	2.4	0.14301	5.1	ppb
└	Pb-KED1	208	13513.1	0.8	0.45892	3.1	ppb
┌	Mn-STD1	55	861772.0	0.8	25.12239	5.9	ppb
└>	Ge-STD	72	1488327.8	6.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		103			
|	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
└>	Ge-KED3	72		81			
┌>	Ge-KED2	72		86			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
└>	In-KED2	115		85			
┌>	Rh-KED2	103		85			
|	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		93			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		98			
|	Tl-KED1	203					
|	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		86			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-005
Sample Date/Time: Wednesday, September 07, 2016 23:08:43
Sample Description: 5
Autosampler Position: 117
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-005.119
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1129096.0	6.1			ppb
|	Be-KED1	9	18.3	19.2	0.00370	19.2	ppb
⌊	Al-KED1	27	2750110.5	0.8	86.35439	5.2	ppb
⌈	V-KED3	51	142.0	10.4	0.40633	11.5	ppb
|	Cr-KED3	52	224.7	2.1	0.45293	3.6	ppb
|	Cr-KED3	53	38.7	23.9	0.67787	24.9	ppb
|	Co-KED3	59	2324.9	1.5	2.08481	0.4	ppb
|	Ni-KED3	60	453.3	6.0	0.67188	7.0	ppb
|	Ni-KED3	62	36.7	27.5	0.64603	27.8	ppb
|	Cu-KED3	63	9811.4	2.0	9.26024	1.7	ppb
|	Zn-KED3	64	74443.6	1.4	556.69977	1.8	ppb
|	Cu-KED3	65	5086.2	1.8	9.19355	3.1	ppb
|	Zn-KED3	66	47242.0	1.2	517.31086	1.9	ppb
⌊>	Ge-KED3	72	23655.6	1.4			ppb
⌈>	Ge-KED2	72	127209.6	0.9			ppb
|	As-KED2	75	222.7	13.6	1.02976	15.7	ppb
|	Se-KED2	77	104.0	19.5	13.72511	19.6	ppb
|	Se-KED2	78	340.0	4.1	13.41397	3.7	ppb
⌊	Se-KED2	82	133.2	3.8	12.28773	2.8	ppb
⌈	Mo-KED2	95	186.0	4.7	0.14666	4.4	ppb
|	Mo-KED2	97	124.7	16.7	0.14676	16.9	ppb
|	Mo-KED2	98	278.3	7.0	0.12861	6.9	ppb
|	Cd-KED2	111	1644.8	5.2	2.99191	5.7	ppb
|	Cd-KED2	114	3861.9	1.9	2.98787	1.9	ppb
⌊>	In-KED2	115	39668.4	0.6			ppb
⌈>	Rh-KED2	103	213163.3	0.9			ppb
|	Ag-KED2	107	114.7	8.1	0.02212	9.6	ppb
⌊	Ag-KED2	109	127.7	5.9	0.02558	5.6	ppb
⌈>	In-KED1	115	511038.9	3.1			ppb
|	Sb-KED1	121	509.3	8.2	0.03953	12.9	ppb
|	Sb-KED1	123	340.4	8.4	0.03425	7.8	ppb
|	Ba-KED1	135	41921.5	2.8	11.98959	1.3	ppb
⌊	Ba-KED1	137	70541.1	1.5	12.00008	1.7	ppb
⌈>	Lu-KED1	175	611449.5	1.6			ppb
|	Tl-KED1	203	1474.7	3.3	0.14680	3.3	ppb
|	Tl-KED1	205	3334.4	1.6	0.14495	3.2	ppb
⌊	Pb-KED1	208	17885.0	0.6	0.61396	1.1	ppb
⌈	Mn-STD1	55	925070.3	3.1	26.79737	3.0	ppb
⌊>	Ge-STD	72	1494408.8	2.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		101			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		80			
⌈>	Ge-KED2	72		85			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		85			
⌈>	Rh-KED2	103		84			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		91			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		97			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		86			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-006
Sample Date/Time: Wednesday, September 07, 2016 23:13:33
Sample Description: 5
Autosampler Position: 118
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-006.120
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1149093.7	1.3			ppb
│	Be-KED1	9	35.3	80.1	0.00851	94.6	ppb
⌊	Al-KED1	27	3764026.5	3.2	115.93256	4.2	ppb
⌈	V-KED3	51	181.3	16.7	0.51840	17.3	ppb
│	Cr-KED3	52	363.0	5.4	0.73367	7.8	ppb
│	Cr-KED3	53	44.0	35.5	0.77257	38.8	ppb
│	Co-KED3	59	1453.1	4.9	1.29312	3.3	ppb
│	Ni-KED3	60	451.3	5.9	0.66527	6.0	ppb
│	Ni-KED3	62	40.7	15.8	0.71300	15.0	ppb
│	Cu-KED3	63	7203.1	0.4	6.76178	2.2	ppb
│	Zn-KED3	64	56407.3	1.3	419.71817	2.5	ppb
│	Cu-KED3	65	3674.1	3.3	6.60948	5.9	ppb
│	Zn-KED3	66	36049.1	0.9	392.82409	3.2	ppb
⌊>	Ge-KED3	72	23779.4	2.5			ppb
⌈>	Ge-KED2	72	128265.4	1.9			ppb
│	As-KED2	75	138.0	3.6	0.60052	4.4	ppb
│	Se-KED2	77	69.3	20.5	8.95742	19.6	ppb
│	Se-KED2	78	314.0	1.7	12.18708	3.3	ppb
⌊	Se-KED2	82	131.1	11.6	12.04859	11.7	ppb
⌈	Mo-KED2	95	282.0	7.0	0.22245	8.3	ppb
│	Mo-KED2	97	167.3	0.7	0.19734	1.6	ppb
│	Mo-KED2	98	449.0	1.3	0.20729	2.6	ppb
│	Cd-KED2	111	628.0	4.8	1.13056	3.1	ppb
│	Cd-KED2	114	1507.7	0.7	1.15878	1.3	ppb
⌊>	In-KED2	115	39892.8	2.0			ppb
⌈>	Rh-KED2	103	212248.1	1.9			ppb
│	Ag-KED2	107	119.7	7.8	0.02328	10.5	ppb
⌊	Ag-KED2	109	109.7	4.6	0.02181	4.7	ppb
⌈>	In-KED1	115	538664.4	4.0			ppb
│	Sb-KED1	121	1280.7	71.7	0.10091	73.1	ppb
│	Sb-KED1	123	922.9	55.5	0.09582	55.8	ppb
│	Ba-KED1	135	43156.4	1.4	11.71767	3.1	ppb
⌊	Ba-KED1	137	72568.5	1.5	11.71574	2.6	ppb
⌈>	Lu-KED1	175	619607.2	2.4			ppb
│	Tl-KED1	203	1444.7	11.5	0.14152	9.5	ppb
│	Tl-KED1	205	3241.7	13.7	0.13856	11.8	ppb
⌊	Pb-KED1	208	13525.8	8.6	0.45741	6.6	ppb
⌈	Mn-STD1	55	783193.7	2.3	23.14277	1.9	ppb
⌊>	Ge-STD	72	1464823.6	3.3			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		81			
⌈>	Ge-KED2	72		85			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		85			
⌈>	Rh-KED2	103		83			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		96			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		98			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		84			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-007
Sample Date/Time: Wednesday, September 07, 2016 23:18:24
Sample Description: 5
Autosampler Position: 119
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-007.121
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1097573.5	5.6			ppb
│	Be-KED1	9	119.3	5.1	0.03463	7.2	ppb
⌊	Al-KED1	27	43822647.2	3.4	1414.51203	3.5	ppb
⌈	V-KED3	51	2100.8	0.9	6.01231	2.8	ppb
│	Cr-KED3	52	1510.1	0.7	3.03823	1.8	ppb
│	Cr-KED3	53	182.0	16.0	3.16260	14.8	ppb
│	Co-KED3	59	2834.3	2.9	2.50072	4.1	ppb
│	Ni-KED3	60	1918.8	5.0	2.81368	6.6	ppb
│	Ni-KED3	62	174.0	6.1	3.04642	5.0	ppb
│	Cu-KED3	63	13413.6	1.9	12.44868	1.3	ppb
│	Zn-KED3	64	61365.4	0.3	451.12339	2.1	ppb
│	Cu-KED3	65	6820.0	1.8	12.11535	0.4	ppb
│	Zn-KED3	66	39459.1	1.5	424.66001	0.6	ppb
⌊>	Ge-KED3	72	24067.3	2.1			ppb
⌈>	Ge-KED2	72	127212.7	1.9			ppb
│	As-KED2	75	383.0	7.2	1.83037	8.4	ppb
│	Se-KED2	77	97.3	10.1	12.83151	10.4	ppb
│	Se-KED2	78	380.0	3.5	15.14694	5.2	ppb
⌊	Se-KED2	82	152.5	8.0	13.85461	6.2	ppb
⌈	Mo-KED2	95	770.7	5.5	0.62266	7.4	ppb
│	Mo-KED2	97	492.7	4.4	0.59966	6.2	ppb
│	Mo-KED2	98	1305.0	2.9	0.61541	0.7	ppb
│	Cd-KED2	111	2077.5	1.9	3.82476	1.6	ppb
│	Cd-KED2	114	4872.2	2.5	3.81382	1.3	ppb
⌊>	In-KED2	115	39214.3	2.3			ppb
⌈>	Rh-KED2	103	212906.4	1.6			ppb
│	Ag-KED2	107	285.7	1.7	0.05775	3.0	ppb
⌊	Ag-KED2	109	270.3	3.0	0.05651	4.4	ppb
⌈>	In-KED1	115	496315.7	4.0			ppb
│	Sb-KED1	121	2106.2	3.6	0.18687	2.4	ppb
│	Sb-KED1	123	1637.5	6.4	0.19094	3.4	ppb
│	Ba-KED1	135	175242.8	6.0	51.58960	2.2	ppb
⌊	Ba-KED1	137	289925.6	4.1	50.77134	0.2	ppb
⌈>	Lu-KED1	175	594879.4	6.2			ppb
│	Tl-KED1	203	1650.1	5.8	0.16977	3.1	ppb
│	Tl-KED1	205	3613.1	3.5	0.16230	5.5	ppb
⌊	Pb-KED1	208	46982.4	2.6	1.66258	3.7	ppb
⌈	Mn-STD1	55	2621239.5	2.7	81.11325	2.3	ppb
⌊>	Ge-STD	72	1399862.2	0.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		98			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		82			
⌈>	Ge-KED2	72		85			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		84			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		88			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		94			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		81			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-008
Sample Date/Time: Wednesday, September 07, 2016 23:23:15
Sample Description: 5
Autosampler Position: 120
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-008.122
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1080414.8	1.2			ppb
│	Be-KED1	9	33.7	32.7	0.00871	39.4	ppb
⌊	Al-KED1	27	10660638.7	2.6	349.12662	1.4	ppb
⌈	V-KED3	51	500.3	4.0	1.46855	1.8	ppb
│	Cr-KED3	52	640.7	4.0	1.32350	4.2	ppb
│	Cr-KED3	53	86.7	11.4	1.54815	10.6	ppb
│	Co-KED3	59	2082.8	2.8	1.89234	5.2	ppb
│	Ni-KED3	60	770.0	4.1	1.16046	6.6	ppb
│	Ni-KED3	62	61.3	6.8	1.10030	5.8	ppb
│	Cu-KED3	63	11211.1	0.6	10.72085	2.1	ppb
│	Zn-KED3	64	65185.3	1.1	493.74235	2.1	ppb
│	Cu-KED3	65	5864.5	1.1	10.73883	3.5	ppb
│	Zn-KED3	66	41979.9	0.6	465.65513	2.7	ppb
⌊>	Ge-KED3	72	23359.4	2.5			ppb
⌈>	Ge-KED2	72	128182.9	0.5			ppb
│	As-KED2	75	226.3	8.6	1.03825	8.8	ppb
│	Se-KED2	77	94.7	10.8	12.37832	11.6	ppb
│	Se-KED2	78	341.1	5.5	13.34753	5.5	ppb
⌊	Se-KED2	82	143.1	33.3	12.99739	29.1	ppb
⌈	Mo-KED2	95	352.7	0.3	0.28367	2.3	ppb
│	Mo-KED2	97	218.0	6.4	0.26283	4.3	ppb
│	Mo-KED2	98	574.5	3.2	0.27031	2.9	ppb
│	Cd-KED2	111	1700.1	1.9	3.13017	1.0	ppb
│	Cd-KED2	114	4136.8	3.4	3.23912	1.5	ppb
⌊>	In-KED2	115	39191.3	2.1			ppb
⌈>	Rh-KED2	103	211880.8	1.2			ppb
│	Ag-KED2	107	221.3	2.9	0.04458	4.1	ppb
⌊	Ag-KED2	109	215.7	8.4	0.04491	9.6	ppb
⌈>	In-KED1	115	510603.0	3.2			ppb
│	Sb-KED1	121	929.4	1.4	0.07687	4.0	ppb
│	Sb-KED1	123	735.8	2.4	0.08047	4.6	ppb
│	Ba-KED1	135	79225.8	1.5	22.68802	2.0	ppb
⌊	Ba-KED1	137	130853.1	3.6	22.27133	0.7	ppb
⌈>	Lu-KED1	175	593442.2	4.7			ppb
│	Tl-KED1	203	1500.7	1.8	0.15437	3.7	ppb
│	Tl-KED1	205	3397.7	4.1	0.15250	3.6	ppb
⌊	Pb-KED1	208	20869.9	1.9	0.73904	2.9	ppb
⌈	Mn-STD1	55	1114838.5	4.2	35.70315	3.8	ppb
⌊>	Ge-STD	72	1351786.6	0.7			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		97			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		79			
⌈>	Ge-KED2	72		85			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		83			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		91			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		94			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		78			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-009
Sample Date/Time: Wednesday, September 07, 2016 23:28:05
Sample Description: 5
Autosampler Position: 121
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-009.123
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1114155.5	3.2			ppb
|	Be-KED1	9	24.3	18.5	0.00558	21.3	ppb
⌊	Al-KED1	27	6202308.9	0.5	197.12809	3.5	ppb
⌈	V-KED3	51	297.3	2.7	0.86547	1.3	ppb
|	Cr-KED3	52	298.0	8.1	0.60815	8.2	ppb
|	Cr-KED3	53	36.7	32.0	0.64586	31.6	ppb
|	Co-KED3	59	1466.4	2.3	1.32253	0.8	ppb
|	Ni-KED3	60	447.3	4.7	0.66834	6.5	ppb
|	Ni-KED3	62	37.3	20.3	0.66479	22.7	ppb
|	Cu-KED3	63	7782.1	2.0	7.40146	2.9	ppb
|	Zn-KED3	64	51021.9	1.9	384.48732	0.7	ppb
|	Cu-KED3	65	3983.9	2.9	7.25398	2.1	ppb
|	Zn-KED3	66	33279.4	2.0	367.22572	1.4	ppb
⌊>	Ge-KED3	72	23471.9	1.9			ppb
⌈>	Ge-KED2	72	125818.6	0.1			ppb
|	As-KED2	75	208.7	1.0	0.97044	1.0	ppb
|	Se-KED2	77	100.0	3.5	13.33941	3.5	ppb
|	Se-KED2	78	356.7	6.7	14.30393	7.2	ppb
⌊	Se-KED2	82	151.2	21.4	13.88801	19.2	ppb
⌈	Mo-KED2	95	188.7	3.4	0.15464	3.8	ppb
|	Mo-KED2	97	134.7	10.1	0.16512	9.9	ppb
|	Mo-KED2	98	315.1	1.9	0.15149	2.1	ppb
|	Cd-KED2	111	1049.4	7.2	1.97895	6.8	ppb
|	Cd-KED2	114	2521.4	2.8	2.02525	3.2	ppb
⌊>	In-KED2	115	38199.8	0.5			ppb
⌈>	Rh-KED2	103	207960.7	1.7			ppb
|	Ag-KED2	107	123.0	8.6	0.02449	10.0	ppb
⌊	Ag-KED2	109	133.0	3.9	0.02747	4.9	ppb
⌈>	In-KED1	115	516380.9	2.4			ppb
|	Sb-KED1	121	471.3	3.5	0.03563	4.6	ppb
|	Sb-KED1	123	390.1	4.5	0.03959	4.7	ppb
|	Ba-KED1	135	53945.7	1.0	15.27350	2.3	ppb
⌊	Ba-KED1	137	89331.8	1.9	15.04092	3.2	ppb
⌈>	Lu-KED1	175	597849.9	4.2			ppb
|	Tl-KED1	203	1595.4	3.3	0.16308	1.4	ppb
|	Tl-KED1	205	3681.1	0.7	0.16450	4.5	ppb
⌊	Pb-KED1	208	13703.2	0.9	0.48129	4.2	ppb
⌈	Mn-STD1	55	718992.4	2.0	22.05287	4.5	ppb
⌊>	Ge-STD	72	1411914.3	3.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⎡>	Li-KED1	6		100			
⎢	Be-KED1	9					
⎣	Al-KED1	27					
⎡	V-KED3	51					
⎢	Cr-KED3	52					
⎢	Cr-KED3	53					
⎢	Co-KED3	59					
⎢	Ni-KED3	60					
⎢	Ni-KED3	62					
⎢	Cu-KED3	63					
⎢	Zn-KED3	64					
⎢	Cu-KED3	65					
⎢	Zn-KED3	66					
⎣>	Ge-KED3	72		80			
⎡>	Ge-KED2	72		84			
⎢	As-KED2	75					
⎢	Se-KED2	77					
⎢	Se-KED2	78					
⎣	Se-KED2	82					
⎡	Mo-KED2	95					
⎢	Mo-KED2	97					
⎢	Mo-KED2	98					
⎢	Cd-KED2	111					
⎢	Cd-KED2	114					
⎣>	In-KED2	115		82			
⎡>	Rh-KED2	103		82			
⎢	Ag-KED2	107					
⎣	Ag-KED2	109					
⎡>	In-KED1	115		92			
⎢	Sb-KED1	121					
⎢	Sb-KED1	123					
⎢	Ba-KED1	135					
⎣	Ba-KED1	137					
⎡>	Lu-KED1	175		94			
⎢	Tl-KED1	203					
⎢	Tl-KED1	205					
⎣	Pb-KED1	208					
⎡	Mn-STD1	55					
⎣>	Ge-STD	72		81			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-010
Sample Date/Time: Wednesday, September 07, 2016 23:32:55
Sample Description: 5
Autosampler Position: 122
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-010.124
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1115455.8	3.6			ppb
|	Be-KED1	9	21.0	21.8	0.00460	31.3	ppb
⌊	Al-KED1	27	5871924.3	0.7	186.40236	3.1	ppb
⌈	V-KED3	51	300.3	5.0	0.91551	7.7	ppb
|	Cr-KED3	52	413.0	3.0	0.88555	6.2	ppb
|	Cr-KED3	53	58.7	16.8	1.08589	14.7	ppb
|	Co-KED3	59	2542.6	1.8	2.40776	7.7	ppb
|	Ni-KED3	60	534.0	7.3	0.83498	7.5	ppb
|	Ni-KED3	62	59.3	8.5	1.10563	4.1	ppb
|	Cu-KED3	63	9441.8	1.2	9.39739	5.3	ppb
|	Zn-KED3	64	67698.6	1.9	534.39673	8.0	ppb
|	Cu-KED3	65	4948.5	2.3	9.43812	7.7	ppb
|	Zn-KED3	66	43328.6	0.5	500.40028	5.9	ppb
⌊>	Ge-KED3	72	22478.7	5.9			ppb
⌈>	Ge-KED2	72	126139.5	0.8			ppb
|	As-KED2	75	232.7	7.2	1.08828	7.0	ppb
|	Se-KED2	77	114.0	15.2	15.22289	16.2	ppb
|	Se-KED2	78	355.8	1.3	14.22786	1.8	ppb
⌊	Se-KED2	82	156.4	6.4	14.28792	5.3	ppb
⌈	Mo-KED2	95	235.3	12.9	0.18843	11.6	ppb
|	Mo-KED2	97	161.3	8.0	0.19359	6.7	ppb
|	Mo-KED2	98	392.8	7.5	0.18443	6.4	ppb
|	Cd-KED2	111	1311.7	0.8	2.41556	2.1	ppb
|	Cd-KED2	114	3144.5	2.4	2.46380	1.2	ppb
⌊>	In-KED2	115	39160.4	1.4			ppb
⌈>	Rh-KED2	103	211116.9	0.1			ppb
|	Ag-KED2	107	125.0	15.2	0.02450	16.1	ppb
⌊	Ag-KED2	109	111.3	11.4	0.02230	12.6	ppb
⌈>	In-KED1	115	524400.2	1.1			ppb
|	Sb-KED1	121	487.3	2.1	0.03637	1.3	ppb
|	Sb-KED1	123	375.2	7.3	0.03722	8.5	ppb
|	Ba-KED1	135	56804.8	2.7	15.83125	2.2	ppb
⌊	Ba-KED1	137	93936.8	3.7	15.56566	2.8	ppb
⌈>	Lu-KED1	175	605921.1	0.2			ppb
|	Tl-KED1	203	1792.8	5.6	0.18139	6.0	ppb
|	Tl-KED1	205	4222.0	1.8	0.18661	1.9	ppb
⌊	Pb-KED1	208	12736.9	1.9	0.44075	2.0	ppb
⌈	Mn-STD1	55	935167.5	1.6	28.65514	4.4	ppb
⌊>	Ge-STD	72	1413775.3	2.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		100			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		76			
⌈>	Ge-KED2	72		84			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		83			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		93			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		96			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		81			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Wednesday, September 07, 2016 23:37:49
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.125
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1153552.6	6.3			ppb
	Be-KED1	9	83659.4	3.5	24.21451	3.0	ppb
	Al-KED1	27	830752.4	4.8	25.49753	5.0	ppb
	V-KED3	51	9194.0	4.2	25.64809	5.1	ppb
	Cr-KED3	52	12980.9	1.6	25.49421	2.7	ppb
	Cr-KED3	53	1573.4	1.4	26.73685	2.8	ppb
	Co-KED3	59	30417.1	4.9	26.20755	6.1	ppb
	Ni-KED3	60	17955.3	2.6	25.66939	2.9	ppb
	Ni-KED3	62	1485.4	6.5	25.39903	6.0	ppb
	Cu-KED3	63	28300.7	3.7	25.59301	4.0	ppb
	Zn-KED3	64	3369.5	4.6	24.09445	5.1	ppb
	Cu-KED3	65	14775.0	1.8	25.56657	1.5	ppb
	Zn-KED3	66	2352.2	3.8	24.60440	2.7	ppb
>	Ge-KED3	72	24714.4	1.5			ppb
>	Ge-KED2	72	131070.6	1.4			ppb
	As-KED2	75	5128.6	2.5	24.77077	2.1	ppb
	Se-KED2	77	184.0	14.1	23.77512	13.5	ppb
	Se-KED2	78	604.3	6.0	24.03499	5.0	ppb
	Se-KED2	82	299.2	14.0	25.12339	14.3	ppb
	Mo-KED2	95	32244.4	1.8	25.30797	3.0	ppb
	Mo-KED2	97	21382.0	1.2	25.36667	2.8	ppb
	Mo-KED2	98	55384.1	1.1	25.36811	2.3	ppb
	Cd-KED2	111	14102.3	1.2	25.20140	3.3	ppb
	Cd-KED2	114	33180.4	0.8	25.17690	2.0	ppb
>	In-KED2	115	40482.5	2.2			ppb
>	Rh-KED2	103	221089.4	0.7			ppb
	Ag-KED2	107	124132.3	1.0	24.88749	1.6	ppb
	Ag-KED2	109	119236.2	0.8	24.83616	1.2	ppb
>	In-KED1	115	534442.7	4.0			ppb
	Sb-KED1	121	297280.3	3.4	25.26898	5.0	ppb
	Sb-KED1	123	227078.4	3.7	25.30915	4.5	ppb
	Ba-KED1	135	85459.9	4.5	23.37493	2.7	ppb
	Ba-KED1	137	141575.5	4.1	23.02726	2.6	ppb
>	Lu-KED1	175	605570.1	4.1			ppb
	Tl-KED1	203	232854.0	3.6	24.32475	3.7	ppb
	Tl-KED1	205	538677.0	5.2	24.50185	4.8	ppb
	Pb-KED1	208	708616.4	4.3	24.61881	2.1	ppb
	Mn-STD1	55	942503.7	3.1	26.70690	3.9	ppb
>	Ge-STD	72	1530230.9	7.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
|	Be-KED1	9	97				
⌊	Al-KED1	27	102				
⌈	V-KED3	51	103				
|	Cr-KED3	52	102				
|	Cr-KED3	53	107				
|	Co-KED3	59	105				
|	Ni-KED3	60	103				
|	Ni-KED3	62	102				
|	Cu-KED3	63	102				
|	Zn-KED3	64	96				
|	Cu-KED3	65	102				
|	Zn-KED3	66	98				
⌊>	Ge-KED3	72		84			
⌈>	Ge-KED2	72		87			
|	As-KED2	75	99				
|	Se-KED2	77	95				
|	Se-KED2	78	96				
⌊	Se-KED2	82	100				
⌈	Mo-KED2	95	101				
|	Mo-KED2	97	101				
|	Mo-KED2	98	101				
|	Cd-KED2	111	101				
|	Cd-KED2	114	101				
⌊>	In-KED2	115		87			
⌈>	Rh-KED2	103		87			
|	Ag-KED2	107	100				
⌊	Ag-KED2	109	99				
⌈>	In-KED1	115		95			
|	Sb-KED1	121	101				
|	Sb-KED1	123	101				
|	Ba-KED1	135	93				
⌊	Ba-KED1	137	92				
⌈>	Lu-KED1	175		96			
|	Tl-KED1	203	97				
|	Tl-KED1	205	98				
⌊	Pb-KED1	208	98				
⌈	Mn-STD1	55	107				
⌊>	Ge-STD	72		88			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Wednesday, September 07, 2016 23:42:39
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.126
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1139946.3	1.9			ppb
|	Be-KED1	9	13.0	15.4	0.00211	26.3	ppb
⌊	Al-KED1	27	1106.0	6.6	0.00918	17.7	ppb
⌈	V-KED3	51	2.0	0.0	-0.00210	3.2	ppb
|	Cr-KED3	52	2.7	21.7	-0.00290	39.0	ppb
|	Cr-KED3	53	0.0		-0.00951	0.0	ppb
|	Co-KED3	59	3.0	57.7	-0.00482	32.1	ppb
|	Ni-KED3	60	6.7	17.3	0.00415	42.4	ppb
|	Ni-KED3	62	0.7	173.2	0.00217	936.9	ppb
|	Cu-KED3	63	8.7	66.6	-0.00517	102.8	ppb
|	Zn-KED3	64	6.4	64.6	0.02024	151.8	ppb
|	Cu-KED3	65	4.3	74.2	0.00181	307.0	ppb
|	Zn-KED3	66	3.0	0.0	-0.01185	3.2	ppb
⌊>	Ge-KED3	72	24175.4	1.2			ppb
⌈>	Ge-KED2	72	131261.6	2.7			ppb
|	As-KED2	75	22.7	16.7	0.02699	77.2	ppb
|	Se-KED2	77	4.0	50.0	0.21727	119.5	ppb
|	Se-KED2	78	32.6	5.7	0.11251	55.3	ppb
⌊	Se-KED2	82	-15.5	27.1	0.21358	154.5	ppb
⌈	Mo-KED2	95	6.0	57.7	0.00249	115.0	ppb
|	Mo-KED2	97	4.0	50.0	0.00058	373.3	ppb
|	Mo-KED2	98	6.9	40.3	0.00170	70.2	ppb
|	Cd-KED2	111	4.7	24.7	0.00064	356.1	ppb
|	Cd-KED2	114	5.8	1.8	0.00227	10.7	ppb
⌊>	In-KED2	115	40474.7	4.4			ppb
⌈>	Rh-KED2	103	224232.6	3.2			ppb
|	Ag-KED2	107	32.7	29.7	0.00469	37.9	ppb
⌊	Ag-KED2	109	28.3	14.7	0.00384	24.6	ppb
⌈>	In-KED1	115	539062.0	2.3			ppb
|	Sb-KED1	121	262.0	5.3	0.01626	8.6	ppb
|	Sb-KED1	123	190.0	20.6	0.01566	30.5	ppb
|	Ba-KED1	135	12.0	44.1	-0.00089	171.7	ppb
⌊	Ba-KED1	137	19.3	57.0	0.00125	139.6	ppb
⌈>	Lu-KED1	175	595625.0	0.6			ppb
|	Tl-KED1	203	26.0	38.5	-0.00296	36.3	ppb
|	Tl-KED1	205	66.0	12.1	-0.00222	16.6	ppb
⌊	Pb-KED1	208	44.0	4.5	0.00007	111.4	ppb
⌈	Mn-STD1	55	1684.1	3.1	0.01361	3.3	ppb
⌊>	Ge-STD	72	1450770.9	2.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		102			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		82			
⌈>	Ge-KED2	72		87			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		87			
⌈>	Rh-KED2	103		88			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		96			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		94			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		84			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-011
Sample Date/Time: Wednesday, September 07, 2016 23:47:32
Sample Description: 5
Autosampler Position: 123
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-011.127
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1048326.7	2.1			ppb
	Be-KED1	9	55.0	52.3	0.01571	55.8	ppb
	Al-KED1	27	12276667.3	3.6	414.32043	1.5	ppb
	V-KED3	51	465.7	5.0	1.37828	4.3	ppb
	Cr-KED3	52	536.3	3.0	1.11599	2.6	ppb
	Cr-KED3	53	81.3	24.8	1.46565	25.2	ppb
	Co-KED3	59	2780.6	0.3	2.54917	1.8	ppb
	Ni-KED3	60	669.3	4.5	1.01532	2.6	ppb
	Ni-KED3	62	48.7	10.3	0.87799	8.6	ppb
	Cu-KED3	63	10138.3	1.4	9.77779	3.1	ppb
	Zn-KED3	64	70744.6	1.0	540.39912	1.5	ppb
	Cu-KED3	65	5233.3	1.3	9.66038	0.8	ppb
	Zn-KED3	66	46054.8	1.1	515.21788	2.8	ppb
>	Ge-KED3	72	23159.4	1.9			ppb
>	Ge-KED2	72	125113.2	1.3			ppb
	As-KED2	75	187.7	4.5	0.86960	4.0	ppb
	Se-KED2	77	122.0	4.9	16.43856	5.5	ppb
	Se-KED2	78	384.5	1.3	15.61356	2.7	ppb
	Se-KED2	82	149.8	8.8	13.84897	8.1	ppb
	Mo-KED2	95	224.0	11.4	0.17913	10.5	ppb
	Mo-KED2	97	165.3	6.2	0.19833	5.0	ppb
	Mo-KED2	98	401.0	10.9	0.18840	12.4	ppb
	Cd-KED2	111	1425.1	3.4	2.62223	3.7	ppb
	Cd-KED2	114	3382.3	2.2	2.64886	3.7	ppb
>	In-KED2	115	39198.3	1.5			ppb
>	Rh-KED2	103	209980.4	1.2			ppb
	Ag-KED2	107	189.3	5.0	0.03821	4.0	ppb
	Ag-KED2	109	175.3	15.5	0.03646	16.4	ppb
>	In-KED1	115	507865.7	0.9			ppb
	Sb-KED1	121	419.3	37.5	0.03168	44.7	ppb
	Sb-KED1	123	336.2	21.6	0.03406	25.6	ppb
	Ba-KED1	135	57836.3	4.7	16.64738	5.2	ppb
	Ba-KED1	137	97075.1	4.1	16.61324	4.3	ppb
>	Lu-KED1	175	584321.6	2.4			ppb
	Tl-KED1	203	1220.7	10.5	0.12623	8.6	ppb
	Tl-KED1	205	2905.0	10.2	0.13147	8.1	ppb
	Pb-KED1	208	8977.8	6.7	0.32154	4.3	ppb
	Mn-STD1	55	977632.0	2.3	30.56189	3.9	ppb
>	Ge-STD	72	1385771.2	3.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		94			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		79			
⌈>	Ge-KED2	72		83			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		83			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		90			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		92			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		80			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-012
Sample Date/Time: Wednesday, September 07, 2016 23:52:23
Sample Description: 5
Autosampler Position: 124
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-012.128
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1080645.2	5.2			ppb
|	Be-KED1	9	78.3	11.4	0.02251	12.7	ppb
└	Al-KED1	27	26486217.0	4.0	868.09332	3.8	ppb
┌	V-KED3	51	1137.4	5.1	3.40467	2.0	ppb
|	Cr-KED3	52	851.7	3.9	1.79198	3.4	ppb
|	Cr-KED3	53	116.0	18.6	2.10769	16.9	ppb
|	Co-KED3	59	2613.6	2.0	2.41585	2.5	ppb
|	Ni-KED3	60	944.0	7.0	1.44780	8.0	ppb
|	Ni-KED3	62	93.3	9.7	1.70684	7.5	ppb
|	Cu-KED3	63	10027.5	3.8	9.76421	7.4	ppb
|	Zn-KED3	64	60150.5	0.6	463.66611	4.6	ppb
|	Cu-KED3	65	5190.6	1.8	9.67315	5.8	ppb
|	Zn-KED3	66	39434.0	0.4	445.06549	4.3	ppb
└>	Ge-KED3	72	22975.8	4.3			ppb
┌>	Ge-KED2	72	125440.4	1.3			ppb
|	As-KED2	75	251.0	10.1	1.18737	10.0	ppb
|	Se-KED2	77	80.7	20.0	10.71971	19.6	ppb
|	Se-KED2	78	295.9	4.0	11.69239	4.0	ppb
└	Se-KED2	82	119.2	18.1	11.28650	16.0	ppb
┌	Mo-KED2	95	240.0	11.8	0.19287	12.0	ppb
|	Mo-KED2	97	172.0	16.4	0.20712	15.9	ppb
|	Mo-KED2	98	383.4	6.0	0.18056	6.9	ppb
|	Cd-KED2	111	1002.4	0.8	1.84805	1.2	ppb
|	Cd-KED2	114	2324.8	2.9	1.82563	3.6	ppb
└>	In-KED2	115	39070.3	0.9			ppb
┌>	Rh-KED2	103	209670.5	0.4			ppb
|	Ag-KED2	107	225.7	9.4	0.04598	10.1	ppb
└	Ag-KED2	109	226.0	8.7	0.04765	9.2	ppb
┌>	In-KED1	115	508771.3	3.2			ppb
|	Sb-KED1	121	542.7	5.3	0.04259	3.9	ppb
|	Sb-KED1	123	413.2	13.1	0.04287	11.5	ppb
|	Ba-KED1	135	98050.2	3.2	28.17225	1.6	ppb
└	Ba-KED1	137	162860.7	2.4	27.82739	1.5	ppb
┌>	Lu-KED1	175	588160.1	4.1			ppb
|	Tl-KED1	203	1216.1	2.0	0.12513	3.6	ppb
|	Tl-KED1	205	2775.6	2.2	0.12489	6.3	ppb
└	Pb-KED1	208	8281.6	4.0	0.29476	0.8	ppb
┌	Mn-STD1	55	1401279.4	3.5	41.61182	2.9	ppb
└>	Ge-STD	72	1458186.2	1.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		97			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		78			
⌈>	Ge-KED2	72		83			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		82			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		91			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		93			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		84			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-013
Sample Date/Time: Wednesday, September 07, 2016 23:57:13
Sample Description: 5
Autosampler Position: 125
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-013.129
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1112333.9	3.1			ppb
│	Be-KED1	9	23.3	6.5	0.00530	6.2	ppb
⌊	Al-KED1	27	3826232.9	1.8	121.74560	1.7	ppb
⌈	V-KED3	51	172.3	13.2	0.48787	15.2	ppb
│	Cr-KED3	52	344.0	3.1	0.68721	3.3	ppb
│	Cr-KED3	53	38.0	22.9	0.65336	21.2	ppb
│	Co-KED3	59	1842.5	3.0	1.62574	1.9	ppb
│	Ni-KED3	60	460.0	9.9	0.67099	9.2	ppb
│	Ni-KED3	62	44.0	16.4	0.76539	17.0	ppb
│	Cu-KED3	63	8827.4	1.1	8.20615	1.4	ppb
│	Zn-KED3	64	56139.9	1.4	413.62602	2.9	ppb
│	Cu-KED3	65	4672.8	0.6	8.31870	1.9	ppb
│	Zn-KED3	66	36556.0	0.4	394.35225	2.3	ppb
⌊>	Ge-KED3	72	24015.2	1.9			ppb
⌈>	Ge-KED2	72	125556.1	1.2			ppb
│	As-KED2	75	154.0	6.2	0.69617	7.0	ppb
│	Se-KED2	77	99.3	15.1	13.26353	14.4	ppb
│	Se-KED2	78	329.4	5.6	13.14297	5.7	ppb
⌊	Se-KED2	82	131.8	7.0	12.32149	6.4	ppb
⌈	Mo-KED2	95	216.0	5.8	0.17372	4.2	ppb
│	Mo-KED2	97	135.3	15.1	0.16266	15.6	ppb
│	Mo-KED2	98	405.1	3.2	0.19135	4.4	ppb
│	Cd-KED2	111	1230.1	2.3	2.27521	1.0	ppb
│	Cd-KED2	114	2909.5	1.7	2.29142	2.7	ppb
⌊>	In-KED2	115	38971.6	2.0			ppb
⌈>	Rh-KED2	103	210492.9	2.2			ppb
│	Ag-KED2	107	214.7	4.8	0.04350	6.6	ppb
⌊	Ag-KED2	109	222.3	5.2	0.04668	6.4	ppb
⌈>	In-KED1	115	515899.4	6.1			ppb
│	Sb-KED1	121	548.7	9.4	0.04248	8.5	ppb
│	Sb-KED1	123	425.3	0.9	0.04384	7.9	ppb
│	Ba-KED1	135	39519.3	3.4	11.20727	2.8	ppb
⌊	Ba-KED1	137	66194.5	4.4	11.15989	2.6	ppb
⌈>	Lu-KED1	175	595021.8	3.9			ppb
│	Tl-KED1	203	909.4	9.6	0.09093	9.5	ppb
│	Tl-KED1	205	2143.5	7.5	0.09384	3.8	ppb
⌊	Pb-KED1	208	8914.4	4.6	0.31364	1.0	ppb
⌈	Mn-STD1	55	1180862.9	3.4	37.70872	3.1	ppb
⌊>	Ge-STD	72	1356623.8	4.2			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		100			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		82			
⌈>	Ge-KED2	72		83			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		83			
⌈>	Rh-KED2	103		83			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		92			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		94			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		78			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-014
Sample Date/Time: Thursday, September 08, 2016 00:02:04
Sample Description: 5
Autosampler Position: 126
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-014.130
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1092679.9	3.7			ppb
│	Be-KED1	9	46.3	4.5	0.01246	6.9	ppb
└	Al-KED1	27	15878459.5	1.6	514.60377	3.2	ppb
┌	V-KED3	51	674.0	6.1	1.95033	5.1	ppb
│	Cr-KED3	52	506.7	5.9	1.02948	7.9	ppb
│	Cr-KED3	53	73.3	7.9	1.28804	6.4	ppb
│	Co-KED3	59	1755.1	5.7	1.56692	4.3	ppb
│	Ni-KED3	60	638.7	5.9	0.94663	8.0	ppb
│	Ni-KED3	62	59.3	10.8	1.04652	9.0	ppb
│	Cu-KED3	63	9679.3	3.2	9.10946	3.0	ppb
│	Zn-KED3	64	56620.9	1.1	422.19945	1.3	ppb
│	Cu-KED3	65	4995.2	1.9	9.00499	4.0	ppb
│	Zn-KED3	66	36123.0	1.9	394.41962	2.3	ppb
└>	Ge-KED3	72	23724.7	2.1			ppb
┌>	Ge-KED2	72	126805.0	0.7			ppb
│	As-KED2	75	268.3	8.0	1.26131	8.8	ppb
│	Se-KED2	77	104.0	15.7	13.77174	15.8	ppb
│	Se-KED2	78	343.0	3.4	13.59121	3.6	ppb
└	Se-KED2	82	147.8	5.4	13.51392	4.6	ppb
┌	Mo-KED2	95	328.0	2.4	0.25857	1.2	ppb
│	Mo-KED2	97	202.0	7.1	0.23892	8.7	ppb
│	Mo-KED2	98	548.2	6.9	0.25319	8.3	ppb
│	Cd-KED2	111	1603.1	0.8	2.89569	1.7	ppb
│	Cd-KED2	114	3839.1	1.2	2.95060	2.7	ppb
└>	In-KED2	115	39943.4	1.7			ppb
┌>	Rh-KED2	103	208968.4	4.6			ppb
│	Ag-KED2	107	194.0	4.5	0.03952	9.0	ppb
└	Ag-KED2	109	178.7	7.7	0.03751	12.0	ppb
┌>	In-KED1	115	501143.7	0.2			ppb
│	Sb-KED1	121	846.0	7.0	0.07082	7.8	ppb
│	Sb-KED1	123	676.8	7.9	0.07500	8.3	ppb
│	Ba-KED1	135	83369.2	0.5	24.31609	0.4	ppb
└	Ba-KED1	137	137798.1	1.3	23.89832	1.5	ppb
┌>	Lu-KED1	175	605753.1	3.6			ppb
│	Tl-KED1	203	1406.7	4.5	0.14111	2.0	ppb
│	Tl-KED1	205	3193.0	5.0	0.13996	5.3	ppb
└	Pb-KED1	208	11889.9	2.3	0.41174	3.6	ppb
┌	Mn-STD1	55	1195097.6	2.0	35.32744	3.0	ppb
└>	Ge-STD	72	1464996.5	1.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		98			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		81			
⌈>	Ge-KED2	72		84			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		85			
⌈>	Rh-KED2	103		82			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		89			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		96			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		84			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-015
Sample Date/Time: Thursday, September 08, 2016 00:06:55
Sample Description: 5
Autosampler Position: 127
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-015.131
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1120987.6	6.2			ppb
│	Be-KED1	9	29.0	21.5	0.00695	27.6	ppb
└	Al-KED1	27	7623477.1	6.2	240.83599	5.0	ppb
┌	V-KED3	51	367.7	8.9	1.07170	9.9	ppb
│	Cr-KED3	52	501.0	0.4	1.02695	1.0	ppb
│	Cr-KED3	53	64.7	27.7	1.14632	27.8	ppb
│	Co-KED3	59	1642.1	4.4	1.48045	4.2	ppb
│	Ni-KED3	60	650.0	10.0	0.97261	11.0	ppb
│	Ni-KED3	62	54.7	18.4	0.97289	17.5	ppb
│	Cu-KED3	63	10299.0	4.6	9.78577	3.9	ppb
│	Zn-KED3	64	53596.2	1.9	403.48526	1.5	ppb
│	Cu-KED3	65	5315.0	1.8	9.67212	2.8	ppb
│	Zn-KED3	66	34841.8	1.0	384.07337	0.3	ppb
└>	Ge-KED3	72	23495.0	1.1			ppb
┌>	Ge-KED2	72	126013.8	1.5			ppb
│	As-KED2	75	318.3	7.6	1.52066	6.4	ppb
│	Se-KED2	77	122.0	13.0	16.32186	13.7	ppb
│	Se-KED2	78	392.8	4.1	15.86234	6.0	ppb
└	Se-KED2	82	168.5	12.7	15.31060	12.4	ppb
┌	Mo-KED2	95	291.3	15.2	0.23172	14.6	ppb
│	Mo-KED2	97	193.3	2.6	0.23075	0.5	ppb
│	Mo-KED2	98	546.7	5.6	0.25487	4.0	ppb
│	Cd-KED2	111	1712.1	2.0	3.12712	3.8	ppb
│	Cd-KED2	114	4156.1	2.0	3.23000	4.9	ppb
└>	In-KED2	115	39528.7	2.9			ppb
┌>	Rh-KED2	103	210825.1	3.4			ppb
│	Ag-KED2	107	358.3	6.4	0.07375	9.6	ppb
└	Ag-KED2	109	334.3	4.8	0.07111	6.4	ppb
┌>	In-KED1	115	511385.9	2.5			ppb
│	Sb-KED1	121	764.7	5.4	0.06203	3.3	ppb
│	Sb-KED1	123	594.8	1.9	0.06387	2.7	ppb
│	Ba-KED1	135	66812.7	4.3	19.09125	2.2	ppb
└	Ba-KED1	137	111015.7	4.9	18.86369	3.6	ppb
┌>	Lu-KED1	175	602617.0	3.4			ppb
│	Tl-KED1	203	1947.5	3.5	0.19867	2.0	ppb
│	Tl-KED1	205	4431.4	1.0	0.19736	2.7	ppb
└	Pb-KED1	208	29440.4	3.0	1.02645	0.9	ppb
┌	Mn-STD1	55	1105691.9	4.3	34.95094	2.9	ppb
└>	Ge-STD	72	1371210.2	6.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		100			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		80			
⌈>	Ge-KED2	72		84			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		85			
⌈>	Rh-KED2	103		83			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		91			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		95			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		79			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-016
Sample Date/Time: Thursday, September 08, 2016 00:11:45
Sample Description: 5
Autosampler Position: 128
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-016.132
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1115359.2	2.7			ppb
|	Be-KED1	9	20.7	15.6	0.00449	21.2	ppb
⌊	Al-KED1	27	4483434.9	0.3	142.29719	2.7	ppb
⌈	V-KED3	51	218.0	9.9	0.62461	12.1	ppb
|	Cr-KED3	52	313.7	3.9	0.63187	6.0	ppb
|	Cr-KED3	53	34.7	26.6	0.60146	26.6	ppb
|	Co-KED3	59	1906.8	2.8	1.69859	4.4	ppb
|	Ni-KED3	60	345.3	7.6	0.50661	5.7	ppb
|	Ni-KED3	62	29.3	14.2	0.51241	16.3	ppb
|	Cu-KED3	63	9063.5	2.5	8.50421	4.6	ppb
|	Zn-KED3	64	57536.9	1.7	427.70738	3.8	ppb
|	Cu-KED3	65	4622.4	1.4	8.30181	2.6	ppb
|	Zn-KED3	66	36913.0	0.4	401.71486	2.5	ppb
⌊>	Ge-KED3	72	23807.2	2.2			ppb
⌈>	Ge-KED2	72	125997.6	1.6			ppb
|	As-KED2	75	157.3	5.9	0.70993	5.4	ppb
|	Se-KED2	77	90.0	11.1	11.96028	11.7	ppb
|	Se-KED2	78	325.4	4.2	12.92526	5.3	ppb
⌊	Se-KED2	82	138.5	6.8	12.83686	7.4	ppb
⌈	Mo-KED2	95	173.3	1.8	0.13830	2.4	ppb
|	Mo-KED2	97	111.3	8.9	0.13242	9.8	ppb
|	Mo-KED2	98	278.9	13.4	0.13057	13.8	ppb
|	Cd-KED2	111	747.0	2.9	1.37149	2.4	ppb
|	Cd-KED2	114	1769.7	2.7	1.38517	2.0	ppb
⌊>	In-KED2	115	39173.4	0.7			ppb
⌈>	Rh-KED2	103	211170.1	1.1			ppb
|	Ag-KED2	107	224.3	9.0	0.04538	10.6	ppb
⌊	Ag-KED2	109	215.7	3.7	0.04503	2.9	ppb
⌈>	In-KED1	115	513769.3	2.3			ppb
|	Sb-KED1	121	356.7	7.6	0.02570	9.2	ppb
|	Sb-KED1	123	244.0	2.6	0.02291	5.9	ppb
|	Ba-KED1	135	41624.6	1.6	11.84564	3.4	ppb
⌊	Ba-KED1	137	69320.5	2.0	11.73012	3.2	ppb
⌈>	Lu-KED1	175	615063.1	2.1			ppb
|	Tl-KED1	203	1475.4	3.1	0.14601	3.9	ppb
|	Tl-KED1	205	3435.7	2.4	0.14859	2.9	ppb
⌊	Pb-KED1	208	5203.7	2.3	0.17655	2.9	ppb
⌈	Mn-STD1	55	642888.9	2.2	19.10884	1.9	ppb
⌊>	Ge-STD	72	1455319.7	1.0			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		100			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		81			
⌈>	Ge-KED2	72		84			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		83			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		91			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		97			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		84			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-017
Sample Date/Time: Thursday, September 08, 2016 00:16:35
Sample Description: 5
Autosampler Position: 129
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-017.133
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
┌>	Li-KED1	6	1108575.0	2.1			ppb
│	Be-KED1	9	36.7	19.3	0.00935	23.5	ppb
└	Al-KED1	27	11435505.6	1.9	365.13057	2.7	ppb
┌	V-KED3	51	486.0	5.3	1.47706	4.8	ppb
│	Cr-KED3	52	547.7	4.7	1.16970	3.4	ppb
│	Cr-KED3	53	67.3	9.1	1.24503	10.4	ppb
│	Co-KED3	59	1632.1	3.2	1.53228	1.8	ppb
│	Ni-KED3	60	530.7	6.0	0.82516	4.7	ppb
│	Ni-KED3	62	51.3	9.0	0.95369	11.0	ppb
│	Cu-KED3	63	9880.7	0.9	9.78114	2.9	ppb
│	Zn-KED3	64	53138.0	2.3	416.53620	0.8	ppb
│	Cu-KED3	65	5095.6	0.7	9.65717	2.8	ppb
│	Zn-KED3	66	34807.4	2.1	399.72113	3.9	ppb
└>	Ge-KED3	72	22564.1	2.1			ppb
┌>	Ge-KED2	72	127193.6	2.1			ppb
│	As-KED2	75	170.7	7.0	0.76911	6.9	ppb
│	Se-KED2	77	114.0	6.3	15.07333	4.5	ppb
│	Se-KED2	78	372.4	2.8	14.81897	4.2	ppb
└	Se-KED2	82	163.9	6.4	14.80215	7.3	ppb
┌	Mo-KED2	95	392.0	7.2	0.31493	7.5	ppb
│	Mo-KED2	97	227.3	8.9	0.27388	8.8	ppb
│	Mo-KED2	98	635.6	9.1	0.29899	11.0	ppb
│	Cd-KED2	111	1352.1	3.4	2.48416	5.0	ppb
│	Cd-KED2	114	3072.5	3.7	2.40143	4.0	ppb
└>	In-KED2	115	39268.3	2.0			ppb
┌>	Rh-KED2	103	214162.8	1.2			ppb
│	Ag-KED2	107	654.7	7.6	0.13379	8.0	ppb
└	Ag-KED2	109	680.3	8.9	0.14425	8.2	ppb
┌>	In-KED1	115	516131.8	1.9			ppb
│	Sb-KED1	121	786.0	3.3	0.06333	4.0	ppb
│	Sb-KED1	123	640.0	6.1	0.06846	7.0	ppb
│	Ba-KED1	135	72468.8	3.4	20.52746	3.9	ppb
└	Ba-KED1	137	120864.0	2.3	20.35355	1.9	ppb
┌>	Lu-KED1	175	605268.9	2.2			ppb
│	Tl-KED1	203	1328.7	2.5	0.13310	0.7	ppb
│	Tl-KED1	205	2899.0	3.0	0.12666	3.6	ppb
└	Pb-KED1	208	8490.3	1.5	0.29368	1.6	ppb
┌	Mn-STD1	55	934730.9	2.1	28.85284	2.2	ppb
└>	Ge-STD	72	1402348.9	0.8			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		99			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		77			
┌>	Ge-KED2	72		84			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		84			
┌>	Rh-KED2	103		84			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		92			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		96			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		81			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-018
Sample Date/Time: Thursday, September 08, 2016 00:21:26
Sample Description: 5
Autosampler Position: 130
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-018.134
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1111282.4	2.8			ppb
|	Be-KED1	9	28.3	2.0	0.00681	1.2	ppb
⌊	Al-KED1	27	10805716.5	2.8	344.11846	1.6	ppb
⌈	V-KED3	51	457.3	8.4	1.31701	8.1	ppb
|	Cr-KED3	52	482.0	5.0	0.97490	4.6	ppb
|	Cr-KED3	53	66.0	13.2	1.15509	13.0	ppb
|	Co-KED3	59	1922.1	3.1	1.71212	2.8	ppb
|	Ni-KED3	60	611.3	3.0	0.90232	3.4	ppb
|	Ni-KED3	62	45.3	9.2	0.79575	9.0	ppb
|	Cu-KED3	63	10986.9	1.7	10.30980	1.5	ppb
|	Zn-KED3	64	73694.2	1.6	547.77887	1.2	ppb
|	Cu-KED3	65	5682.8	0.4	10.20937	0.6	ppb
|	Zn-KED3	66	47482.8	0.8	516.82227	0.8	ppb
⌊>	Ge-KED3	72	23795.5	0.5			ppb
⌈>	Ge-KED2	72	127658.3	2.1			ppb
|	As-KED2	75	255.3	2.6	1.18762	2.7	ppb
|	Se-KED2	77	115.3	12.3	15.23022	14.3	ppb
|	Se-KED2	78	377.3	2.3	14.97343	4.2	ppb
⌊	Se-KED2	82	150.5	8.1	13.67337	9.1	ppb
⌈	Mo-KED2	95	234.7	9.4	0.18770	11.3	ppb
|	Mo-KED2	97	174.7	9.9	0.20909	8.0	ppb
|	Mo-KED2	98	417.0	1.2	0.19531	1.8	ppb
|	Cd-KED2	111	2119.2	0.8	3.89473	3.2	ppb
|	Cd-KED2	114	4916.0	1.8	3.84139	3.1	ppb
⌊>	In-KED2	115	39297.7	2.4			ppb
⌈>	Rh-KED2	103	212515.3	1.6			ppb
|	Ag-KED2	107	224.7	8.0	0.04516	9.8	ppb
⌊	Ag-KED2	109	214.0	4.7	0.04441	6.5	ppb
⌈>	In-KED1	115	532685.6	1.5			ppb
|	Sb-KED1	121	578.7	3.2	0.04349	2.7	ppb
|	Sb-KED1	123	403.3	9.5	0.03974	12.6	ppb
|	Ba-KED1	135	73173.7	3.4	20.07639	2.6	ppb
⌊	Ba-KED1	137	123745.0	1.4	20.19244	1.9	ppb
⌈>	Lu-KED1	175	597487.8	1.5			ppb
|	Tl-KED1	203	1368.7	0.7	0.13915	0.9	ppb
|	Tl-KED1	205	3170.4	4.6	0.14088	5.2	ppb
⌊	Pb-KED1	208	17316.1	0.7	0.60835	2.1	ppb
⌈	Mn-STD1	55	1219511.2	0.7	37.06285	2.6	ppb
⌊>	Ge-STD	72	1425148.7	2.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		99			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		81			
⌈>	Ge-KED2	72		85			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		84			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		95			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		94			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		82			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-019
Sample Date/Time: Thursday, September 08, 2016 00:26:16
Sample Description: 5
Autosampler Position: 131
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-019.135
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1121653.0	2.9			ppb
│	Be-KED1	9	57.3	10.7	0.01535	10.4	ppb
⌊	Al-KED1	27	5879445.3	3.2	185.59996	4.7	ppb
⌈	V-KED3	51	315.3	1.6	0.90762	1.9	ppb
│	Cr-KED3	52	633.0	7.9	1.28678	9.5	ppb
│	Cr-KED3	53	88.7	21.9	1.56094	22.9	ppb
│	Co-KED3	59	2184.8	2.0	1.95146	3.2	ppb
│	Ni-KED3	60	613.3	1.9	0.90716	3.2	ppb
│	Ni-KED3	62	51.3	13.7	0.90387	13.5	ppb
│	Cu-KED3	63	10777.4	3.3	10.13552	4.4	ppb
│	Zn-KED3	64	58354.1	1.6	434.73527	3.4	ppb
│	Cu-KED3	65	5389.0	2.2	9.70345	3.9	ppb
│	Zn-KED3	66	37631.2	2.4	410.49496	3.7	ppb
⌊>	Ge-KED3	72	23751.7	1.8			ppb
⌈>	Ge-KED2	72	125997.2	0.6			ppb
│	As-KED2	75	195.0	3.4	0.90001	3.4	ppb
│	Se-KED2	77	86.7	23.6	11.50678	24.3	ppb
│	Se-KED2	78	296.2	1.5	11.64838	2.1	ppb
⌊	Se-KED2	82	132.5	19.0	12.34400	17.1	ppb
⌈	Mo-KED2	95	372.0	16.9	0.29831	17.2	ppb
│	Mo-KED2	97	252.7	4.8	0.30437	3.7	ppb
│	Mo-KED2	98	646.5	6.0	0.30327	4.7	ppb
│	Cd-KED2	111	1343.4	1.4	2.46375	1.5	ppb
│	Cd-KED2	114	3171.9	2.5	2.47605	3.5	ppb
⌊>	In-KED2	115	39319.5	1.4			ppb
⌈>	Rh-KED2	103	209976.8	1.6			ppb
│	Ag-KED2	107	196.7	7.4	0.03977	7.4	ppb
⌊	Ag-KED2	109	192.3	7.1	0.04023	9.0	ppb
⌈>	In-KED1	115	523284.3	3.2			ppb
│	Sb-KED1	121	1540.1	2.0	0.12791	5.1	ppb
│	Sb-KED1	123	1253.0	3.3	0.13720	3.0	ppb
│	Ba-KED1	135	53540.2	2.2	14.96168	3.3	ppb
⌊	Ba-KED1	137	88501.3	1.3	14.70985	3.9	ppb
⌈>	Lu-KED1	175	603272.0	3.6			ppb
│	Tl-KED1	203	1762.8	5.0	0.17900	1.9	ppb
│	Tl-KED1	205	4133.9	2.6	0.18350	1.8	ppb
⌊	Pb-KED1	208	11077.6	2.6	0.38532	5.7	ppb
⌈	Mn-STD1	55	991818.4	2.3	31.55638	1.4	ppb
⌊>	Ge-STD	72	1360813.3	2.9			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		100			
│	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
⌊>	Ge-KED3	72		81			
⌈>	Ge-KED2	72		84			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		83			
│	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		93			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		95			
│	Tl-KED1	203					
│	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		78			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: K1609289-020
Sample Date/Time: Thursday, September 08, 2016 00:31:07
Sample Description: 5
Autosampler Position: 132
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\K1609289-020.136
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1103169.0	0.8			ppb
|	Be-KED1	9	18.0	20.0	0.00375	27.8	ppb
⌊	Al-KED1	27	4636039.5	0.8	148.71065	1.6	ppb
⌈	V-KED3	51	209.0	6.8	0.59635	6.5	ppb
|	Cr-KED3	52	295.0	7.3	0.59198	6.3	ppb
|	Cr-KED3	53	36.7	6.3	0.63650	7.1	ppb
|	Co-KED3	59	2033.8	1.7	1.80859	2.9	ppb
|	Ni-KED3	60	503.3	8.9	0.73973	7.8	ppb
|	Ni-KED3	62	45.3	24.3	0.79267	23.5	ppb
|	Cu-KED3	63	10247.0	3.0	9.59479	3.3	ppb
|	Zn-KED3	64	51395.3	2.4	381.28576	3.4	ppb
|	Cu-KED3	65	5341.0	2.0	9.57491	2.4	ppb
|	Zn-KED3	66	33274.0	1.2	361.39333	1.6	ppb
⌊>	Ge-KED3	72	23847.6	1.3			ppb
⌈>	Ge-KED2	72	127728.2	1.4			ppb
|	As-KED2	75	162.7	4.0	0.72633	6.0	ppb
|	Se-KED2	77	98.7	10.0	12.94772	9.0	ppb
|	Se-KED2	78	325.6	2.3	12.73531	1.1	ppb
⌊	Se-KED2	82	162.6	12.3	14.61805	10.4	ppb
⌈	Mo-KED2	95	220.7	7.8	0.17751	7.4	ppb
|	Mo-KED2	97	136.7	9.5	0.16435	10.9	ppb
|	Mo-KED2	98	370.8	1.6	0.17493	2.5	ppb
|	Cd-KED2	111	1446.4	5.4	2.67520	4.4	ppb
|	Cd-KED2	114	3517.4	2.6	2.76862	1.4	ppb
⌊>	In-KED2	115	38985.3	1.7			ppb
⌈>	Rh-KED2	103	215213.8	1.3			ppb
|	Ag-KED2	107	165.3	11.4	0.03229	11.2	ppb
⌊	Ag-KED2	109	146.7	9.9	0.02941	11.2	ppb
⌈>	In-KED1	115	522900.1	1.1			ppb
|	Sb-KED1	121	419.3	2.4	0.03059	2.1	ppb
|	Sb-KED1	123	320.5	7.9	0.03111	9.7	ppb
|	Ba-KED1	135	46278.2	2.5	12.93464	2.4	ppb
⌊	Ba-KED1	137	76784.0	3.9	12.76189	3.8	ppb
⌈>	Lu-KED1	175	610277.9	3.0			ppb
|	Tl-KED1	203	1239.4	1.4	0.12281	4.5	ppb
|	Tl-KED1	205	2887.6	1.0	0.12512	3.8	ppb
⌊	Pb-KED1	208	7918.2	1.5	0.27172	4.4	ppb
⌈	Mn-STD1	55	938358.1	0.1	28.33290	1.6	ppb
⌊>	Ge-STD	72	1433762.8	1.5			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		99			
|	Be-KED1	9					
⌊	Al-KED1	27					
⌈	V-KED3	51					
|	Cr-KED3	52					
|	Cr-KED3	53					
|	Co-KED3	59					
|	Ni-KED3	60					
|	Ni-KED3	62					
|	Cu-KED3	63					
|	Zn-KED3	64					
|	Cu-KED3	65					
|	Zn-KED3	66					
⌊>	Ge-KED3	72		81			
⌈>	Ge-KED2	72		85			
|	As-KED2	75					
|	Se-KED2	77					
|	Se-KED2	78					
⌊	Se-KED2	82					
⌈	Mo-KED2	95					
|	Mo-KED2	97					
|	Mo-KED2	98					
|	Cd-KED2	111					
|	Cd-KED2	114					
⌊>	In-KED2	115		83			
⌈>	Rh-KED2	103		85			
|	Ag-KED2	107					
⌊	Ag-KED2	109					
⌈>	In-KED1	115		93			
|	Sb-KED1	121					
|	Sb-KED1	123					
|	Ba-KED1	135					
⌊	Ba-KED1	137					
⌈>	Lu-KED1	175		96			
|	Tl-KED1	203					
|	Tl-KED1	205					
⌊	Pb-KED1	208					
⌈	Mn-STD1	55					
⌊>	Ge-STD	72		83			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Thursday, September 08, 2016 00:35:59
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.137
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1194728.9	3.5			ppb
|	Be-KED1	9	85002.2	0.9	23.74239	3.2	ppb
⌊	Al-KED1	27	834479.1	1.0	24.70725	2.5	ppb
⌈	V-KED3	51	8809.0	2.4	25.59690	0.6	ppb
|	Cr-KED3	52	12836.1	0.4	26.27209	2.5	ppb
|	Cr-KED3	53	1542.1	5.6	27.32437	7.4	ppb
|	Co-KED3	59	29684.1	1.9	26.63998	1.6	ppb
|	Ni-KED3	60	17811.8	1.8	26.54395	3.7	ppb
|	Ni-KED3	62	1541.4	1.7	27.48597	4.3	ppb
|	Cu-KED3	63	28178.4	2.3	26.55711	3.1	ppb
|	Zn-KED3	64	3416.5	0.9	25.46204	2.5	ppb
|	Cu-KED3	65	14551.4	0.8	26.24881	3.3	ppb
|	Zn-KED3	66	2304.5	1.6	25.13600	3.6	ppb
⌊>	Ge-KED3	72	23720.0	2.6			ppb
⌈>	Ge-KED2	72	131137.3	2.0			ppb
|	As-KED2	75	5200.9	2.7	25.12303	4.6	ppb
|	Se-KED2	77	196.7	9.4	25.43843	9.2	ppb
|	Se-KED2	78	615.0	5.7	24.46866	3.9	ppb
⌊	Se-KED2	82	271.9	12.2	22.96420	13.4	ppb
⌈	Mo-KED2	95	32468.9	2.2	25.57592	0.8	ppb
|	Mo-KED2	97	21515.5	1.7	25.61778	0.3	ppb
|	Mo-KED2	98	55957.5	0.9	25.72862	1.2	ppb
|	Cd-KED2	111	14126.3	0.6	25.33692	1.4	ppb
|	Cd-KED2	114	33379.2	1.2	25.42387	0.9	ppb
⌊>	In-KED2	115	40321.5	1.8			ppb
⌈>	Rh-KED2	103	226050.0	2.3			ppb
|	Ag-KED2	107	124597.7	1.0	24.43627	1.4	ppb
⌊	Ag-KED2	109	119834.9	1.4	24.41558	1.0	ppb
⌈>	In-KED1	115	558196.9	3.1			ppb
|	Sb-KED1	121	304550.5	1.5	24.76991	1.8	ppb
|	Sb-KED1	123	231673.2	1.8	24.71366	2.4	ppb
|	Ba-KED1	135	86881.6	3.5	22.74960	1.2	ppb
⌊	Ba-KED1	137	143391.5	1.6	22.33372	1.7	ppb
⌈>	Lu-KED1	175	614983.5	1.5			ppb
|	Tl-KED1	203	237968.6	1.5	24.46521	1.0	ppb
|	Tl-KED1	205	549728.4	1.3	24.61636	2.2	ppb
⌊	Pb-KED1	208	722094.0	1.0	24.70339	1.3	ppb
⌈	Mn-STD1	55	990863.2	7.8	29.87609	5.3	ppb
⌊>	Ge-STD	72	1434780.8	3.9			ppb

JB 9/2/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		107			
|	Be-KED1	9	95				
⌊	Al-KED1	27	99				
⌈	V-KED3	51	102				
|	Cr-KED3	52	105				
|	Cr-KED3	53	109				
|	Co-KED3	59	107				
|	Ni-KED3	60	106				
|	Ni-KED3	62	110				
|	Cu-KED3	63	106				
|	Zn-KED3	64	102				
|	Cu-KED3	65	105				
|	Zn-KED3	66	101				
⌊>	Ge-KED3	72		81			
⌈>	Ge-KED2	72		87			
|	As-KED2	75	100				
|	Se-KED2	77	102				
|	Se-KED2	78	98				
⌊	Se-KED2	82	92				
⌈	Mo-KED2	95	102				
|	Mo-KED2	97	102				
|	Mo-KED2	98	103				
|	Cd-KED2	111	101				
|	Cd-KED2	114	102				
⌊>	In-KED2	115		86			
⌈>	Rh-KED2	103		89			
|	Ag-KED2	107	98				
⌊	Ag-KED2	109	98				
⌈>	In-KED1	115		99			
|	Sb-KED1	121	99				
|	Sb-KED1	123	99				
|	Ba-KED1	135	91				
⌊	Ba-KED1	137	89				
⌈>	Lu-KED1	175		97			
|	Tl-KED1	203	98				
|	Tl-KED1	205	98				
⌊	Pb-KED1	208	99				
⌈	Mn-STD1	55	120				
⌊>	Ge-STD	72		83			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Ba-KED1	137	Out of Control
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCV
Sample Date/Time: Thursday, September 08, 2016 00:40:29
Sample Description:
Autosampler Position: 2
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCV.138
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
⌈>	Li-KED1	6	1185535.2	5.8			ppb
|	Be-KED1	9	83201.2	4.2	23.41881	2.2	ppb
⌊	Al-KED1	27	834878.9	5.2	24.90469	1.8	ppb
⌈	V-KED3	51	8637.3	1.7	24.43841	1.5	ppb
|	Cr-KED3	52	12351.7	0.9	24.61474	3.1	ppb
|	Cr-KED3	53	1494.1	5.1	25.73816	3.0	ppb
|	Co-KED3	59	28548.8	2.5	24.94302	2.0	ppb
|	Ni-KED3	60	17122.9	0.4	24.83844	2.3	ppb
|	Ni-KED3	62	1479.4	2.5	25.68243	4.6	ppb
|	Cu-KED3	63	27558.6	2.3	25.28245	2.3	ppb
|	Zn-KED3	64	3434.8	1.1	24.91790	1.4	ppb
|	Cu-KED3	65	14214.7	1.9	24.96114	3.2	ppb
|	Zn-KED3	66	2252.8	1.8	23.91127	1.1	ppb
⌊>	Ge-KED3	72	24362.4	2.4			ppb
⌈>	Ge-KED2	72	128230.7	1.9			ppb
|	As-KED2	75	5084.2	0.8	25.10527	1.4	ppb
|	Se-KED2	77	175.3	4.3	23.18554	6.3	ppb
|	Se-KED2	78	586.4	2.0	23.84821	3.2	ppb
⌊	Se-KED2	82	261.2	18.9	22.59637	19.3	ppb
⌈	Mo-KED2	95	32347.3	1.2	26.20487	4.1	ppb
|	Mo-KED2	97	20788.4	0.7	25.44999	3.2	ppb
|	Mo-KED2	98	55044.9	0.4	26.02065	3.3	ppb
|	Cd-KED2	111	13895.1	0.2	25.61962	2.8	ppb
|	Cd-KED2	114	32542.5	0.5	25.48321	3.0	ppb
⌊>	In-KED2	115	39238.8	2.9			ppb
⌈>	Rh-KED2	103	222768.2	1.8			ppb
|	Ag-KED2	107	122715.5	0.8	24.42087	1.7	ppb
⌊	Ag-KED2	109	117586.4	1.6	24.31585	3.2	ppb
⌈>	In-KED1	115	539657.3	6.5			ppb
|	Sb-KED1	121	297087.9	3.5	25.01568	2.9	ppb
|	Sb-KED1	123	228578.8	4.3	25.23506	2.3	ppb
|	Ba-KED1	135	86349.3	5.3	23.39961	1.2	ppb
⌊	Ba-KED1	137	143148.8	4.9	23.07017	1.8	ppb
⌈>	Lu-KED1	175	615107.8	5.0			ppb
|	Tl-KED1	203	237856.8	5.8	24.44271	1.5	ppb
|	Tl-KED1	205	544846.9	3.3	24.40117	1.6	ppb
⌊	Pb-KED1	208	715746.9	2.7	24.49689	2.3	ppb
⌈	Mn-STD1	55	1011171.8	4.2	28.29962	1.4	ppb
⌊>	Ge-STD	72	1546373.3	3.4			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		106			
│	Be-KED1	9	94				
⌊	Al-KED1	27	100				
⌈	V-KED3	51	98				
│	Cr-KED3	52	98				
│	Cr-KED3	53	103				
│	Co-KED3	59	100				
│	Ni-KED3	60	99				
│	Ni-KED3	62	103				
│	Cu-KED3	63	101				
│	Zn-KED3	64	100				
│	Cu-KED3	65	100				
│	Zn-KED3	66	96				
⌊>	Ge-KED3	72		83			
⌈>	Ge-KED2	72		85			
│	As-KED2	75	100				
│	Se-KED2	77	93				
│	Se-KED2	78	95				
⌊	Se-KED2	82	90				
⌈	Mo-KED2	95	105				
│	Mo-KED2	97	102				
│	Mo-KED2	98	104				
│	Cd-KED2	111	102				
│	Cd-KED2	114	102				
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		88			
│	Ag-KED2	107	98				
⌊	Ag-KED2	109	97				
⌈>	In-KED1	115		96			
│	Sb-KED1	121	100				
│	Sb-KED1	123	101				
│	Ba-KED1	135	94				
⌊	Ba-KED1	137	92				
⌈>	Lu-KED1	175		97			
│	Tl-KED1	203	98				
│	Tl-KED1	205	98				
⌊	Pb-KED1	208	98				
⌈	Mn-STD1	55	113				
⌊>	Ge-STD	72		89			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 2	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: CCB
Sample Date/Time: Thursday, September 08, 2016 00:45:20
Sample Description:
Autosampler Position: 1
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\CCB.139
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1106095.5	3.7			ppb
	Be-KED1	9	12.0	38.2	0.00190	67.7	ppb
	Al-KED1	27	1039.4	5.2	0.00815	27.7	ppb
	V-KED3	51	4.0	86.6	0.00378	265.7	ppb
	Cr-KED3	52	2.7	43.3	-0.00281	83.9	ppb
	Cr-KED3	53	0.7	173.2	0.00225	904.4	ppb
	Co-KED3	59	5.0	34.6	-0.00300	51.7	ppb
	Ni-KED3	60	12.7	24.1	0.01320	34.3	ppb
	Ni-KED3	62	0.7	173.2	0.00229	898.7	ppb
	Cu-KED3	63	6.0	33.3	-0.00753	24.8	ppb
	Zn-KED3	64	6.2	19.0	0.01915	45.3	ppb
	Cu-KED3	65	4.3	26.6	0.00198	105.7	ppb
	Zn-KED3	66	3.0	115.5	-0.01135	332.2	ppb
>	Ge-KED3	72	23808.2	0.2			ppb
>	Ge-KED2	72	127725.9	1.7			ppb
	As-KED2	75	20.0	26.0	0.01670	161.1	ppb
	Se-KED2	77	3.3	69.3	0.14753	217.7	ppb
	Se-KED2	78	30.2	22.5	0.05113	583.3	ppb
	Se-KED2	82	-8.1	99.3	0.77588	83.8	ppb
	Mo-KED2	95	4.0	50.0	0.00092	170.0	ppb
	Mo-KED2	97	6.0	57.7	0.00313	132.3	ppb
	Mo-KED2	98	9.7	20.6	0.00309	30.3	ppb
	Cd-KED2	111	1.0	100.0	-0.00593	30.6	ppb
	Cd-KED2	114	2.8	77.2	0.00003	5192.0	ppb
>	In-KED2	115	39709.3	1.2			ppb
>	Rh-KED2	103	218728.7	1.7			ppb
	Ag-KED2	107	30.7	23.1	0.00447	32.1	ppb
	Ag-KED2	109	28.0	12.9	0.00390	17.5	ppb
>	In-KED1	115	542624.9	3.4			ppb
	Sb-KED1	121	322.0	1.9	0.02114	3.8	ppb
	Sb-KED1	123	219.1	8.5	0.01866	11.3	ppb
	Ba-KED1	135	13.3	17.3	-0.00056	132.7	ppb
	Ba-KED1	137	13.3	37.7	0.00027	281.2	ppb
>	Lu-KED1	175	602819.7	4.2			ppb
	Tl-KED1	203	34.7	48.0	-0.00213	76.5	ppb
	Tl-KED1	205	74.0	15.0	-0.00188	34.3	ppb
	Pb-KED1	208	58.0	39.8	0.00052	139.2	ppb
	Mn-STD1	55	1830.1	2.9	0.01630	4.3	ppb
>	Ge-STD	72	1496635.4	3.1			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		99			
│	Be-KED1	9					
└	Al-KED1	27					
┌	V-KED3	51					
│	Cr-KED3	52					
│	Cr-KED3	53					
│	Co-KED3	59					
│	Ni-KED3	60					
│	Ni-KED3	62					
│	Cu-KED3	63					
│	Zn-KED3	64					
│	Cu-KED3	65					
│	Zn-KED3	66					
└>	Ge-KED3	72		81			
┌>	Ge-KED2	72		85			
│	As-KED2	75					
│	Se-KED2	77					
│	Se-KED2	78					
└	Se-KED2	82					
┌	Mo-KED2	95					
│	Mo-KED2	97					
│	Mo-KED2	98					
│	Cd-KED2	111					
│	Cd-KED2	114					
└>	In-KED2	115		85			
┌>	Rh-KED2	103		86			
│	Ag-KED2	107					
└	Ag-KED2	109					
┌>	In-KED1	115		97			
│	Sb-KED1	121					
│	Sb-KED1	123					
│	Ba-KED1	135					
└	Ba-KED1	137					
┌>	Lu-KED1	175		95			
│	Tl-KED1	203					
│	Tl-KED1	205					
└	Pb-KED1	208					
┌	Mn-STD1	55					
└>	Ge-STD	72		86			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message

LABWORKS - Summary Report

Sample ID: LLCCVT
Sample Date/Time: Thursday, September 08, 2016 00:50:11
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLCCVT.140
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1156105.3	2.9			ppb
	Be-KED1	9	148.0	2.4	0.04104	5.4	ppb
	Al-KED1	27	135474.4	3.0	4.12343	3.6	ppb
	V-KED3	51	153.0	16.5	0.42482	14.2	ppb
	Cr-KED3	52	230.0	4.8	0.45101	5.2	ppb
	Cr-KED3	53	22.7	35.7	0.38462	39.6	ppb
	Co-KED3	59	55.3	19.3	0.04083	20.3	ppb
	Ni-KED3	60	290.0	3.8	0.41621	6.4	ppb
	Ni-KED3	62	26.7	26.3	0.45294	25.7	ppb
	Cu-KED3	63	248.0	5.0	0.21497	6.2	ppb
	Zn-KED3	64	145.8	21.6	1.03294	21.7	ppb
	Cu-KED3	65	134.3	5.6	0.23054	5.9	ppb
	Zn-KED3	66	96.3	9.6	0.98072	7.3	ppb
>	Ge-KED3	72	24319.4	2.8			ppb
>	Ge-KED2	72	126983.0	1.7			ppb
	As-KED2	75	219.3	5.5	1.01491	7.5	ppb
	Se-KED2	77	20.0	43.6	2.40526	49.5	ppb
	Se-KED2	78	74.4	5.1	1.96589	6.5	ppb
	Se-KED2	82	15.2	33.1	2.67960	15.3	ppb
	Mo-KED2	95	138.0	12.9	0.10930	12.0	ppb
	Mo-KED2	97	85.3	17.7	0.10037	19.2	ppb
	Mo-KED2	98	233.0	20.8	0.10842	20.0	ppb
	Cd-KED2	111	27.7	13.7	0.04321	15.3	ppb
	Cd-KED2	114	63.0	9.5	0.04716	8.8	ppb
>	In-KED2	115	39255.0	1.2			ppb
>	Rh-KED2	103	219388.4	2.5			ppb
	Ag-KED2	107	206.0	2.2	0.03991	4.8	ppb
	Ag-KED2	109	197.0	0.9	0.03939	3.5	ppb
>	In-KED1	115	545315.2	5.5			ppb
	Sb-KED1	121	1235.4	4.4	0.09706	1.2	ppb
	Sb-KED1	123	951.2	2.1	0.09868	6.5	ppb
	Ba-KED1	135	396.0	1.3	0.10222	6.2	ppb
	Ba-KED1	137	618.0	2.8	0.09675	2.8	ppb
>	Lu-KED1	175	612677.9	2.9			ppb
	Tl-KED1	203	450.0	19.4	0.04058	19.4	ppb
	Tl-KED1	205	956.0	7.5	0.03766	5.6	ppb
	Pb-KED1	208	1229.4	3.0	0.04075	3.5	ppb
	Mn-STD1	55	6106.0	2.8	0.13921	5.0	ppb
>	Ge-STD	72	1504888.1	1.6			ppb

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
⌈>	Li-KED1	6		103			
|	Be-KED1	9	103				
⌊	Al-KED1	27	103				
⌈	V-KED3	51	106				
|	Cr-KED3	52	113				
|	Cr-KED3	53	96				
|	Co-KED3	59	102				
|	Ni-KED3	60	104				
|	Ni-KED3	62	113				
|	Cu-KED3	63	107				
|	Zn-KED3	64	103				
|	Cu-KED3	65	115				
|	Zn-KED3	66	98				
⌊>	Ge-KED3	72		83			
⌈>	Ge-KED2	72		84			
|	As-KED2	75	101				
|	Se-KED2	77	120				
|	Se-KED2	78	98				
⌊	Se-KED2	82	134				
⌈	Mo-KED2	95	109				
|	Mo-KED2	97	100				
|	Mo-KED2	98	108				
|	Cd-KED2	111	108				
|	Cd-KED2	114	118				
⌊>	In-KED2	115		84			
⌈>	Rh-KED2	103		86			
|	Ag-KED2	107	100				
⌊	Ag-KED2	109	98				
⌈>	In-KED1	115		97			
|	Sb-KED1	121	97				
|	Sb-KED1	123	99				
|	Ba-KED1	135	102				
⌊	Ba-KED1	137	97				
⌈>	Lu-KED1	175		97			
|	Tl-KED1	203	101				
|	Tl-KED1	205	94				
⌊	Pb-KED1	208	102				
⌈	Mn-STD1	55	139				
⌊>	Ge-STD	72		87			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 6	Se-KED2	82	Out of Control
QC Std 6	Mn-STD1	55	Out of Control

LABWORKS - Summary Report

Sample ID: LLCCVT
Sample Date/Time: Thursday, September 08, 2016 00:54:41
Sample Description:
Autosampler Position: 4
Number of Replicates: 3
Dataset File: C:\NexIONData\DataSet\090716A\LLCCVT.141
User Name: JDB
Batch ID:

Concentration Results

	Analyte	Mass	Meas. Intens. Mean	Meas. Intens. RSD	Conc. Mean	Conc. RSD	Sample Unit
>	Li-KED1	6	1168298.6	8.5			ppb
	Be-KED1	9	149.7	6.3	0.04120	10.1	ppb
	Al-KED1	27	137107.8	7.3	4.13375	5.1	ppb
	V-KED3	51	145.7	3.4	0.40031	2.3	ppb
	Cr-KED3	52	193.0	6.5	0.37293	8.6	ppb
	Cr-KED3	53	29.3	15.7	0.49001	13.7	ppb
	Co-KED3	59	51.3	6.3	0.03701	10.9	ppb
	Ni-KED3	60	296.7	8.7	0.42082	9.9	ppb
	Ni-KED3	62	24.0	22.0	0.40274	22.5	ppb
	Cu-KED3	63	242.7	6.9	0.20749	8.4	ppb
	Zn-KED3	64	145.5	2.2	1.02001	5.0	ppb
	Cu-KED3	65	126.7	3.2	0.21456	5.5	ppb
	Zn-KED3	66	103.3	12.6	1.04561	15.1	ppb
>	Ge-KED3	72	24610.2	3.3			ppb
>	Ge-KED2	72	130243.4	0.5			ppb
	As-KED2	75	216.7	4.3	0.97378	5.0	ppb
	Se-KED2	77	17.3	69.6	1.98573	80.6	ppb
	Se-KED2	78	72.7	5.1	1.81528	8.9	ppb
	Se-KED2	82	20.6	78.0	3.06863	41.3	ppb
	Mo-KED2	95	120.0	7.6	0.09417	7.3	ppb
	Mo-KED2	97	95.3	11.6	0.11182	12.8	ppb
	Mo-KED2	98	223.9	8.5	0.10360	9.1	ppb
	Cd-KED2	111	20.7	32.9	0.02998	40.2	ppb
	Cd-KED2	114	60.2	16.1	0.04472	18.0	ppb
>	In-KED2	115	39519.8	1.8			ppb
>	Rh-KED2	103	221020.7	0.8			ppb
	Ag-KED2	107	184.7	12.1	0.03528	12.1	ppb
	Ag-KED2	109	208.0	5.8	0.04136	6.8	ppb
>	In-KED1	115	543322.9	8.6			ppb
	Sb-KED1	121	1255.4	2.5	0.09950	7.9	ppb
	Sb-KED1	123	929.7	2.7	0.09691	8.1	ppb
	Ba-KED1	135	364.0	9.1	0.09377	2.4	ppb
	Ba-KED1	137	654.7	3.4	0.10355	11.4	ppb
>	Lu-KED1	175	605447.7	6.0			ppb
	Tl-KED1	203	405.3	10.9	0.03662	11.2	ppb
	Tl-KED1	205	986.0	6.8	0.03956	1.2	ppb
	Pb-KED1	208	1225.4	8.4	0.04106	2.4	ppb
	Mn-STD1	55	5884.5	2.5	0.13514	3.0	ppb
>	Ge-STD	72	1484303.2	1.8			ppb

JB 9/8/16

QC Calculated Values

IS Symbol	Analyte	Mass	QC Std % Recovery	IS % Recovery	Spike % R	Duplicate Rel. % Difference	Dilution % Difference
┌>	Li-KED1	6		105			
│	Be-KED1	9	103				
└	Al-KED1	27	103				
┌	V-KED3	51	100				
│	Cr-KED3	52	93				
│	Cr-KED3	53	123				
│	Co-KED3	59	93				
│	Ni-KED3	60	105				
│	Ni-KED3	62	101				
│	Cu-KED3	63	104				
│	Zn-KED3	64	102				
│	Cu-KED3	65	107				
│	Zn-KED3	66	105				
└>	Ge-KED3	72		84			
┌>	Ge-KED2	72		87			
│	As-KED2	75	97				
│	Se-KED2	77	99				
│	Se-KED2	78	91				
└	Se-KED2	82	153				
┌	Mo-KED2	95	94				
│	Mo-KED2	97	112				
│	Mo-KED2	98	104				
│	Cd-KED2	111	75				
│	Cd-KED2	114	112				
└>	In-KED2	115		85			
┌>	Rh-KED2	103		87			
│	Ag-KED2	107	88				
└	Ag-KED2	109	103				
┌>	In-KED1	115		97			
│	Sb-KED1	121	100				
│	Sb-KED1	123	97				
│	Ba-KED1	135	94				
└	Ba-KED1	137	104				
┌>	Lu-KED1	175		96			
│	Tl-KED1	203	92				
│	Tl-KED1	205	99				
└	Pb-KED1	208	103				
┌	Mn-STD1	55	135				
└>	Ge-STD	72		85			

QC Out of Limits

Measurement Type	Analyte	Mass	Out of Limits Message
QC Std 6	Se-KED2	82	Out of Control
QC Std 6	Mn-STD1	55	Out of Control

Fish Tissue Metals Concentration Laboratory Report

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
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www.jupiterlabs.com
clientservices@jupiterlabs.com

October 2, 2015

Caleb Zurstadt
USDA Forest Service Region 4 Utah Acquis Support Center
2222 West 2300 South
Salt Lake City, UT 84119

RE: LOG# 1542993
Project ID: Whole Body Fish Tissue
COC# 542993

Dear Caleb Zurstadt:

Enclosed are the analytical results for sample(s) received by the laboratory on Tuesday, August 18, 2015. Results reported herein conform to the most current NELAC standards, where applicable, unless indicated by * in the body of the report. The enclosed Chain of Custody is a component of this package and should be retained with the package and incorporated therein.

Results for all solid matrices are reported in dry weight unless otherwise noted. Results for all liquid matrices are reported as received in the laboratory unless otherwise noted. Results relate only to the samples received. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

Samples are disposed of after 30 days of their receipt by the laboratory unless extended storage is requested in writing. The laboratory maintains the right to charge storage fees for archived samples. This report will be archived for 5 years after which time it will be destroyed without further notice, unless prior arrangements have been made.

Certain analyses are subcontracted to outside NELAC certified laboratories, please see the Project Summary section of this report for NELAC certification numbers of laboratories used. A Statement of Qualifiers is available upon request.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Melissa Mills

Melissa Mills for
Kacia Baldwin
V.P. of Operations

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

SAMPLE ANALYTE COUNT

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID	Sample ID	Method	Analytes Reported
1542993001	1A	EPA 1631E	1
		EPA 6020	16
1542993002	2A	EPA 1631E	1
		EPA 6020	16
1542993003	3A	EPA 1631E	1
		EPA 6020	16
1542993004	4A	EPA 1631E	1
		EPA 6020	16
1542993005	5A	EPA 1631E	1
		EPA 6020	16
1542993006	1B	EPA 1631E	1
		EPA 6020	16
1542993007	2B	EPA 1631E	1
		EPA 6020	16
1542993008	3B	EPA 1631E	1
		EPA 6020	16
1542993009	4B	EPA 1631E	1
		EPA 6020	16
1542993010	5B	EPA 1631E	1
		EPA 6020	16
1542993011	1C	EPA 1631E	1
		EPA 6020	16
1542993012	2C	EPA 1631E	1
		EPA 6020	16
1542993013	3C	EPA 1631E	1
		EPA 6020	16
1542993014	1D	EPA 1631E	1
		EPA 6020	16
1542993015	1E	EPA 1631E	1
		EPA 6020	16
1542993016	2E	EPA 1631E	1
		EPA 6020	16
1542993017	3E	EPA 1631E	1
		EPA 6020	16

SAMPLE ANALYTE COUNT

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID	Sample ID	Method	Analytes Reported
1542993018	4E	EPA 1631E	1
		EPA 6020	16
1542993019	5E	EPA 1631E	1
		EPA 6020	16
1542993020	1F	EPA 1631E	1
		EPA 6020	16
1542993021	2F	EPA 1631E	1
		EPA 6020	16
1542993022	3F	EPA 1631E	1
		EPA 6020	16
1542993023	1G	EPA 1631E	1
		EPA 6020	16
1542993024	2G	EPA 1631E	1
		EPA 6020	16
1542993025	3G	EPA 1631E	1
		EPA 6020	16
1542993026	4G	EPA 1631E	1
		EPA 6020	16
1542993027	5G	EPA 1631E	1
		EPA 6020	16
1542993028	6G	EPA 1631E	1
		EPA 6020	16
1542993029	1H	EPA 1631E	1
		EPA 6020	16
1542993030	2H	EPA 1631E	1
		EPA 6020	16

SAMPLE SUMMARY

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID	Sample ID	Matrix	Date Collected	Date Received
1542993001	1A	Soil/Solid	7/20/2015 15:05	8/18/2015 09:30
1542993002	2A	Soil/Solid	7/20/2015 15:10	8/18/2015 09:30
1542993003	3A	Soil/Solid	7/20/2015 15:15	8/18/2015 09:30
1542993004	4A	Soil/Solid	7/20/2015 00:00	8/18/2015 09:30
1542993005	5A	Soil/Solid	7/20/2015 00:00	8/18/2015 09:30
1542993006	1B	Soil/Solid	7/21/2015 13:10	8/18/2015 09:30
1542993007	2B	Soil/Solid	7/21/2015 13:10	8/18/2015 09:30
1542993008	3B	Soil/Solid	7/21/2015 14:55	8/18/2015 09:30
1542993009	4B	Soil/Solid	7/21/2015 00:00	8/18/2015 09:30
1542993010	5B	Soil/Solid	7/21/2015 00:00	8/18/2015 09:30
1542993011	1C	Soil/Solid	7/22/2015 13:10	8/18/2015 09:30
1542993012	2C	Soil/Solid	7/22/2015 15:30	8/18/2015 09:30
1542993013	3C	Soil/Solid	7/22/2015 17:00	8/18/2015 09:30
1542993014	1D	Soil/Solid	7/23/2015 14:30	8/18/2015 09:30
1542993015	1E	Soil/Solid	7/24/2015 14:30	8/18/2015 09:30
1542993016	2E	Soil/Solid	7/24/2015 14:30	8/18/2015 09:30
1542993017	3E	Soil/Solid	7/24/2015 16:10	8/18/2015 09:30
1542993018	4E	Soil/Solid	7/24/2015 16:40	8/18/2015 09:30
1542993019	5E	Soil/Solid	7/24/2015 17:00	8/18/2015 09:30
1542993020	1F	Soil/Solid	7/25/2015 14:30	8/18/2015 09:30
1542993021	2F	Soil/Solid	7/25/2015 14:47	8/18/2015 09:30
1542993022	3F	Soil/Solid	7/25/2015 14:50	8/18/2015 09:30
1542993023	1G	Soil/Solid	8/10/2015 12:34	8/18/2015 09:30
1542993024	2G	Soil/Solid	8/10/2015 12:53	8/18/2015 09:30
1542993025	3G	Soil/Solid	8/10/2015 13:07	8/18/2015 09:30
1542993026	4G	Soil/Solid	8/10/2015 15:25	8/18/2015 09:30
1542993027	5G	Soil/Solid	8/10/2015 15:45	8/18/2015 09:30
1542993028	6G	Soil/Solid	8/10/2015 16:20	8/18/2015 09:30
1542993029	1H	Soil/Solid	8/11/2015 07:55	8/18/2015 09:30
1542993030	2H	Soil/Solid	8/11/2015 13:15	8/18/2015 09:30

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993001**
Sample ID: **1A**
Date Received: 8/18/2015 09:30
Date Collected: 7/20/2015 15:05
Matrix: Soil/Solid

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.106	mg/Kg	0.0250	0.0125	50	9/22/2015 15:00	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	0.70i	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.38	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.8	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.68	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	15	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.32i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.55	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	280	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	43	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.30	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993002**	Date Received:	8/18/2015 09:30
Matrix:	Soil/Solid		
Sample ID:	**2A**	Date Collected:	7/20/2015 15:10

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.269	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	6.4	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.75	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	6.2	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.92	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	17	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.62	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	1.0	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	310	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	75	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	0.12i	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	1.4	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993003** Date Received: 8/18/2015 09:30 Matrix: Soil/Solid
Sample ID: **3A** Date Collected: 7/20/2015 15:15

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.143	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	0.12i	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.67	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	6.3	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.78	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.6	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	1.2	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	18	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.63	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.65	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	380	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	47	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993004**	Date Received:	8/18/2015 09:30
Sample ID:	**4A**	Date Collected:	7/20/2015 00:00

Matrix: Soil/Solid

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E				
						Analytical Method: EPA 1631E				
Mercury	0.0969i	mg/Kg	0.125	0.0625	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B				
						Analytical Method: EPA 6020				
Chromium	U	mg/Kg	2.7	0.55	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.38i	mg/Kg	1.3	0.21	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	1.3	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	1.3	0.20	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	1.4	0.28	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	12i	mg/Kg	17	3.5	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	1.1i	mg/Kg	1.6	0.32	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.0	mg/Kg	1.3	0.24	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	3.8	0.77	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.69i	mg/Kg	2.1	0.41	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	27	mg/Kg	6.1	1.2	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	2.5	1.2	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	1.3	0.18	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	1.5	mg/Kg	1.3	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	370	mg/Kg	2.9	0.57	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	33i	mg/Kg	44	22	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993005**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**5A**	Date Collected:	7/20/2015 00:00		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.203	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	10	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	1.7	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.2	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.81	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	25	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.38	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	330	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	39	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	0.14i	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.16i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993006**	Date Received: 8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID: **1B**	Date Collected: 7/21/2015 13:10		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.130	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.27	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	5.1	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.60	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.2	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.81	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	17	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.58	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	260	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	23	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993007**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**2B**	Date Collected:	7/21/2015 13:10		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.122	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	2.7i	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.48	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.2	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.91	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	21	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.38	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	330	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	30	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.17i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	0.042i	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993008** Date Received: 8/18/2015 09:30 Matrix: Soil/Solid
Sample ID: **3B** Date Collected: 7/21/2015 14:55

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.105	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	7.2	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.79	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.8	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.81	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	29	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.29	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	360	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	43	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.095i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993009**	Date Received: 8/18/2015 09:30	Matrix: Soil/Solid
Sample ID:	**4B**	Date Collected: 7/21/2015 00:00	

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.323	mg/Kg	0.0500	0.0250	100	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.57	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	U	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.35	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.4	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.48	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	19	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.28	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	340	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	21	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993010**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**5B**	Date Collected:	7/21/2015 00:00		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.205	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	6.5	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.78	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.6	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.96	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	28	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.37i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.27	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	340	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	49	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.21i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993011**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**1C**	Date Collected:	7/22/2015 13:10		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.0651	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	16	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	1.6	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.8	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.43	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	18	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.33	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	280	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	35	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.058i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993012**	Date Received: 8/18/2015 09:30	Matrix: Soil/Solid
Sample ID:	**2C**	Date Collected: 7/22/2015 15:30	

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.0689	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.14i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	8.7	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	1.0	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	3.2	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.68	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	22	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.38i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.28	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	390	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	49	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993013**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**3C**	Date Collected:	7/22/2015 17:00		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E				
						Analytical Method: EPA 1631E				
Mercury	0.0669	mg/Kg	0.0250	0.0125	50	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B				
						Analytical Method: EPA 6020				
Aluminum	5.5	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	1.0	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.9	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.66	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	26	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.41i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.21i	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	390	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	46	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.078i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID: **1542993014**	Date Received: 8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID: **1D**	Date Collected: 7/23/2015 14:30		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.898	mg/Kg	0.0500	0.0250	100	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.22i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	3.5	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.59	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.6	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.50	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	14	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.25	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	330	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	24	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993015**	Date Received: 8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID: **1E**	Date Collected: 7/24/2015 14:30		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.298	mg/Kg	0.0500	0.0250	100	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	2.3i	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.36	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.2	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.73	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	13	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.26i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.21i	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	290	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	21	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.26	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993016**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**2E**	Date Collected:	7/24/2015 14:30		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.410	mg/Kg	0.0500	0.0250	100	9/16/2015 14:55	ZS	9/22/2015 14:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	2.9i	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.58	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.9	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.96	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	17	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.35i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.18i	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	360	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	38	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.23i	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993017**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**3E**	Date Collected:	7/24/2015 16:10		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.204	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.85	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	2.0i	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.71	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	3.6	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.78	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	17	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.30i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.20i	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	370	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	28	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993018**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**4E**	Date Collected:	7/24/2015 16:40		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.134	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	1.0	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	3.2i	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.51	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	2.5	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.98	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	14	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.63	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.21i	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	340	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	31	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993019** Date Received: 8/18/2015 09:30 Matrix: Soil/Solid
Sample ID: **5E** Date Collected: 7/24/2015 17:00

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.170	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.51	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	0.98	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	1.2i	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	0.39	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	1.6	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.59	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	17	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	0.36i	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Antimony	0.18i	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Magnesium	310	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	23	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993020**	Date Received: 8/18/2015 09:30	Matrix: Soil/Solid
Sample ID:	**1F**	Date Collected: 7/25/2015 14:30	

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.141	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	0.50	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Aluminum	8.9	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.90	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	1.9	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.59	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	10	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.56	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.73	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	290	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	27	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID: **1542993021** Date Received: 8/18/2015 09:30 Matrix: Soil/Solid

Sample ID: **2F** Date Collected: 7/25/2015 14:47

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.153	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	0.46	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Aluminum	U	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.33	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	0.79	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.63	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	14	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.55	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.33	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	280	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	20	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993022**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**3F**	Date Collected:	7/25/2015 14:50		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.153	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	5.0	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.63	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	4.2	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.88	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	16	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.52	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.47	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	320	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	39	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	0.82	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993023**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**1G**	Date Collected:	8/10/2015 12:34		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.183	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	1.1i	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.51	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	2.0	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.71	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	20	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.47i	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.23i	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	400	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	20	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	0.39	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID:	**1542993024**	Date Received: 8/18/2015 09:30	Matrix: Soil/Solid
Sample ID:	**2G**	Date Collected: 8/10/2015 12:53	

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.178	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	0.13i	mg/Kg	0.55	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Arsenic	0.62	mg/Kg	0.25	0.041	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Aluminum	72	mg/Kg	3.5	0.70	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Titanium	15	mg/Kg	0.32	0.064	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Manganese	6.2	mg/Kg	0.25	0.048	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Copper	0.63	mg/Kg	0.41	0.082	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Zinc	16	mg/Kg	1.2	0.25	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Selenium	U	mg/Kg	0.50	0.23	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	J4
Antimony	0.11i	mg/Kg	0.25	0.029	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	J4
Magnesium	340	mg/Kg	0.57	0.11	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	
Iron	180	mg/Kg	8.8	4.4	1	9/4/2015 12:07	ZS	9/8/2015 18:03	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993025**	Date Received:	8/18/2015 09:30
Sample ID:	**3G**	Date Collected:	8/10/2015 13:07

Matrix: Soil/Solid

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.101	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Aluminum	5.6	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.83	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	4.3	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.54	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	18	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.38i	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.16i	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	360	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	35	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Chromium	0.67	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	0.94	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993026**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**4G**	Date Collected:	8/10/2015 15:25		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.0733	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Aluminum	6.9	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.57	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	1.3	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.72	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	15	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.25i	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.20i	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	300	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	33	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	0.38	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993027**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**5G**	Date Collected:	8/10/2015 15:45		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.0720	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	1.2	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Aluminum	10	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.98	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	4.1	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.82	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	18	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.68	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.28	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	380	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	51	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID:	**1542993028**	Date Received:	8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID:	**6G**	Date Collected:	8/10/2015 16:20		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.112	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	2.2	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Aluminum	6.0	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.69	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	6.0	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.85	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	19	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.48i	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.27	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	310	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	37	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993029**	Date Received: 8/18/2015 09:30	Matrix:	Soil/Solid
Sample ID: **1H**	Date Collected: 8/11/2015 07:55		

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.0768	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 RCRA-4 Metals by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Chromium	U	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	1.6	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Aluminum	6.8	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.59	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	1.9	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.91	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	17	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.50	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.25	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	310	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	40	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID: **1542993030**
Sample ID: **2H**
Date Received: 8/18/2015 09:30
Date Collected: 8/11/2015 13:15
Matrix: Soil/Solid

Parameters	Results	Units	PQL	MDL	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: EPA 1631 Mercury (S)*						Preparation Method: EPA 1631E Analytical Method: EPA 1631E				
Mercury	0.0836	mg/Kg	0.0250	0.0125	50	9/16/2015 12:49	ZS	9/18/2015 11:59	ZS	
Analysis Desc: EPA 6020 Metals SCAN by ICP/MS (S)						Preparation Method: EPA 3050B Analytical Method: EPA 6020				
Thallium	U	mg/Kg	0.28	0.055	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Chromium	0.13i	mg/Kg	0.55	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Arsenic	0.60	mg/Kg	0.25	0.041	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Cadmium	U	mg/Kg	0.25	0.046	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Lead	U	mg/Kg	0.25	0.039	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Aluminum	2.1i	mg/Kg	3.5	0.70	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Titanium	0.52	mg/Kg	0.32	0.064	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Manganese	1.4	mg/Kg	0.25	0.048	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Nickel	U	mg/Kg	0.77	0.15	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Copper	0.82	mg/Kg	0.41	0.082	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Zinc	15	mg/Kg	1.2	0.25	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Selenium	0.37i	mg/Kg	0.50	0.23	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Silver	U	mg/Kg	0.25	0.035	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Antimony	0.12i	mg/Kg	0.25	0.029	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Magnesium	310	mg/Kg	0.57	0.11	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	
Iron	26	mg/Kg	8.8	4.4	1	9/4/2015 12:23	ZS	9/8/2015 20:40	ZS	

ANALYTICAL RESULTS QUALIFIERS

Workorder: 1542993
Project ID: Whole Body Fish Tissue

PARAMETER QUALIFIERS

J4	MS/MSD recovery exceeded control limits due to matrix interference. LCS/LCSD recovery was within acceptable range.

PROJECT COMMENTS

1542993	A reported value of U indicates that the compound was analyzed for but not detected above the MDL. A value flagged with an "i" flag indicates that the reported value is between the laboratory method detection limit and the practical quantitation limit. All samples are reported "as received" as wet weight.

QUALITY CONTROL DATA

Workorder: 1542993

Project ID: Whole Body Fish Tissue

QC Batch:	MXX/7058	Analysis Method:	EPA 6020
QC Batch Method:	EPA 3050B		

Associated Lab Samples:						
	1542993001	1542993002	1542993003	1542993004	1542993005	1542993006
	1542993007	1542993008	1542993009	1542993010	1542993011	1542993012
	1542993013	1542993014	1542993015	1542993016	1542993017	1542993018
	1542993019	1542993024				

METHOD BLANK: 84770

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Aluminum	mg/Kg	U	0.70	
Titanium	mg/Kg	U	0.064	
Chromium	mg/Kg	U	0.11	
Manganese	mg/Kg	U	0.048	
Nickel	mg/Kg	U	0.15	
Copper	mg/Kg	U	0.082	
Zinc	mg/Kg	U	0.25	
Arsenic	mg/Kg	U	0.041	
Selenium	mg/Kg	U	0.23	
Silver	mg/Kg	U	0.035	
Cadmium	mg/Kg	U	0.046	
Antimony	mg/Kg	U	0.029	
Thallium	mg/Kg	U	0.055	
Lead	mg/Kg	U	0.039	
Magnesium	mg/Kg	U	0.11	
Iron	mg/Kg	U	4.4	

LABORATORY CONTROL SAMPLE & LCSD: 84771 84772

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Aluminum	mg/Kg	10	10	9.9	101	98.7	75-125	1.01	20	
Titanium	mg/Kg	10	10	10	101	103	75-125	0	20	
Chromium	mg/Kg	10	10	10	101	102	75-125	0	20	
Manganese	mg/Kg	10	10	10	101	102	75-125	0	20	
Nickel	mg/Kg	10	10	10	101	102	75-125	0	20	
Copper	mg/Kg	10	10	10	99.9	102	75-125	0	20	
Zinc	mg/Kg	10	9.5	9.8	94.5	97.9	75-125	3.11	20	
Arsenic	mg/Kg	10	10	10	101	102	75-125	0	20	
Selenium	mg/Kg	10	9.8	10	97.8	102	75-125	2.02	20	
Silver	mg/Kg	10	9.5	11	95.1	113	75-125	14.6	20	
Cadmium	mg/Kg	10	9.9	10	98.7	100	75-125	1.01	20	
Antimony	mg/Kg	10	9.1	10	90.5	104	75-125	9.42	20	
Thallium	mg/Kg	10	9.5	9.6	94.9	96.4	75-125	1.05	20	

QUALITY CONTROL DATA

Workorder: 1542993

Project ID: Whole Body Fish Tissue

LABORATORY CONTROL SAMPLE & LCSD: 84771 84772

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Lead	mg/Kg	10	9.5	9.7	94.7	96.6	75-125	2.08	20	
Magnesium	mg/Kg	100	98	97	98	97.4	75-125	1.03	20	
Iron	mg/Kg	100	99	100	99.3	102	75-125	1.01	20	

MATRIX SPIKE SAMPLE: 84774 Original: 1542993024

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Aluminum	mg/Kg	72	10	83	111	75-125	
Titanium	mg/Kg	15	10	26	110	75-125	
Chromium	mg/Kg	0.13	10	11	111	75-125	
Manganese	mg/Kg	6.2	10	17	111	75-125	
Nickel	mg/Kg	0.047	10	12	116	75-125	
Copper	mg/Kg	0.63	10	12	114	75-125	
Zinc	mg/Kg	16	10	27	109	75-125	
Arsenic	mg/Kg	0.62	10	12	111	75-125	
Selenium	mg/Kg	0.18	10	12	115	75-125	
Silver	mg/Kg	0	10	15	151	75-125	J4
Cadmium	mg/Kg	0	10	11	111	75-125	
Antimony	mg/Kg	0.11	10	15	145	75-125	J4
Thallium	mg/Kg						
Lead	mg/Kg	0.00056	10	11	110	75-125	
Magnesium	mg/Kg	340	100	450	107	75-125	
Iron	mg/Kg	180	100	300	117	75-125	

SAMPLE DUPLICATE: 84773 Original: 1542993024

Parameter	Units	Original Result	DUP Result	RPD	Max RPD	Qualifiers
Aluminum	mg/Kg	72	72	0	20	
Titanium	mg/Kg	15	15	0	20	
Chromium	mg/Kg	0.13	0.13i	0	20	
Manganese	mg/Kg	6.2	6.3	1.6	20	
Nickel	mg/Kg	0.047	U	15.7	20	
Copper	mg/Kg	0.63	0.63	0	20	
Zinc	mg/Kg	16	16	0	20	
Arsenic	mg/Kg	0.62	0.61	1.63	20	
Selenium	mg/Kg	0.18	0.26i	36.4	20	P1
Silver	mg/Kg	0	U	0	20	

QUALITY CONTROL DATA

Workorder: 1542993

Project ID: Whole Body Fish Tissue

SAMPLE DUPLICATE: 84773 Original: 1542993024

Parameter	Units	Original Result	DUP Result	RPD	Max RPD	Qualifiers
Cadmium	mg/Kg	0	U	0	20	
Antimony	mg/Kg	0.11	0.10i	9.52	20	J4
Thallium	mg/Kg		U			P1
Lead	mg/Kg	0.00056	U	5.5	20	
Magnesium	mg/Kg	340	340	0	20	
Iron	mg/Kg	180	180	0	20	

QUALITY CONTROL DATA

Workorder: 1542993
Project ID: Whole Body Fish Tissue

QC Batch: MXX/7059 Analysis Method: EPA 6020
QC Batch Method: EPA 3050B

Associated Lab Samples:					
1542993020	1542993021	1542993022	1542993023	1542993025	1542993026
1542993027	1542993028	1542993029	1542993030		

METHOD BLANK: 84778

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Aluminum	mg/Kg	U	0.70	
Titanium	mg/Kg	U	0.064	
Chromium	mg/Kg	U	0.11	
Manganese	mg/Kg	U	0.048	
Nickel	mg/Kg	U	0.15	
Copper	mg/Kg	U	0.082	
Zinc	mg/Kg	U	0.25	
Arsenic	mg/Kg	U	0.041	
Selenium	mg/Kg	U	0.23	
Silver	mg/Kg	U	0.035	
Cadmium	mg/Kg	U	0.046	
Antimony	mg/Kg	U	0.029	
Thallium	mg/Kg	U	0.055	
Lead	mg/Kg	U	0.039	
Magnesium	mg/Kg	U	0.11	
Iron	mg/Kg	U	4.4	

LABORATORY CONTROL SAMPLE & LCSD: 84779 84780

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Aluminum	mg/Kg	10	9.5	9.7	95.3	96.6	75-125	2.08	20	
Titanium	mg/Kg	10	9.4	9.5	94.4	95	75-125	1.06	20	
Chromium	mg/Kg	10	9.8	10	97.9	99.9	75-125	2.02	20	
Manganese	mg/Kg	10	9.6	9.8	96.3	97.6	75-125	2.06	20	
Nickel	mg/Kg	10	9.7	10	96.7	101	75-125	3.05	20	
Copper	mg/Kg	10	9.6	10	96.1	99.9	75-125	4.08	20	
Zinc	mg/Kg	10	9.0	9.3	90.3	92.5	75-125	3.28	20	
Arsenic	mg/Kg	10	9.6	9.7	95.6	96.5	75-125	1.04	20	
Selenium	mg/Kg	10	9.7	10	96.9	99.7	75-125	3.05	20	
Silver	mg/Kg	10	11	12	107	116	75-125	8.7	20	
Cadmium	mg/Kg	10	10	10	101	102	75-125	0	20	
Antimony	mg/Kg	10	8.7	10	87	100	75-125	13.9	20	
Thallium	mg/Kg	10	9.6	9.7	96	96.6	75-125	1.04	20	
Lead	mg/Kg	10	9.6	9.8	95.9	97.6	75-125	2.06	20	
Magnesium	mg/Kg	100	97	98	96.9	98.4	75-125	1.03	20	

QUALITY CONTROL DATA

Workorder: 1542993

Project ID: Whole Body Fish Tissue

LABORATORY CONTROL SAMPLE & LCSD: 84779 84780

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Iron	mg/Kg	100	99	99	98.5	98.6	75-125	0	20	

MATRIX SPIKE SAMPLE: 84782 Original: 1542993030

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Aluminum	mg/Kg	2.1	10	13	109	75-125	
Titanium	mg/Kg	0.52	10	11	109	75-125	
Chromium	mg/Kg	0.13	10	11	111	75-125	
Manganese	mg/Kg	1.4	10	12	110	75-125	
Nickel	mg/Kg	0.036	10	11	114	75-125	
Copper	mg/Kg	0.82	10	12	113	75-125	
Zinc	mg/Kg	15	10	27	115	75-125	
Arsenic	mg/Kg	0.6	10	12	110	75-125	
Selenium	mg/Kg	0.37	10	11	109	75-125	J4
Silver	mg/Kg	0	10	15	152	75-125	J4
Cadmium	mg/Kg	0	10	11	111	75-125	
Antimony	mg/Kg	0.12	10	14	142	75-125	J4
Thallium	mg/Kg						
Lead	mg/Kg	0	10	11	108	75-125	
Magnesium	mg/Kg	310	100	440	126	75-125	
Iron	mg/Kg	26	100	140	113	75-125	

SAMPLE DUPLICATE: 84781 Original: 1542993030

Parameter	Units	Original Result	DUP Result	RPD	Max RPD	Qualifiers
Aluminum	mg/Kg	2.1	2.2i	4.65	20	
Titanium	mg/Kg	0.52	0.55	5.61	20	
Chromium	mg/Kg	0.13	0.14i	7.41	20	
Manganese	mg/Kg	1.4	1.5	6.9	20	
Nickel	mg/Kg	0.036	U	2.82	20	
Copper	mg/Kg	0.82	0.83	1.21	20	
Zinc	mg/Kg	15	16	6.45	20	
Arsenic	mg/Kg	0.6	0.66	9.52	20	
Selenium	mg/Kg	0.37	0.46i	21.7	20	P1
Silver	mg/Kg	0	U	0	20	
Cadmium	mg/Kg	0	U	0	20	
Antimony	mg/Kg	0.12	0.13i	8	20	

QUALITY CONTROL DATA

Workorder: 1542993
Project ID: Whole Body Fish Tissue

SAMPLE DUPLICATE: 84781 Original: 1542993030

Parameter	Units	Original Result	DUP Result	RPD	Max RPD	Qualifiers
Thallium	mg/Kg	0.0042	U	4.65	20	
Lead	mg/Kg	0	U	0	20	
Magnesium	mg/Kg	310	330	6.25	20	
Iron	mg/Kg	26	26	0	20	

QUALITY CONTROL DATA

Workorder: 1542993

Project ID: Whole Body Fish Tissue

QC Batch: MHG/1793 Analysis Method: EPA 1631E

QC Batch Method: EPA 1631E

Associated Lab Samples:					
1542993001	1542993002	1542993003	1542993004	1542993005	1542993006
1542993007	1542993008	1542993009	1542993010	1542993011	1542993012
1542993013	1542993014	1542993015	1542993016		

METHOD BLANK: 85260

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Mercury	mg/Kg	U	0.000250	

LABORATORY CONTROL SAMPLE: 85261

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/Kg	2.5	3.04	122	77-123	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 85263 85264 Original: 1542993006

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Mercury	mg/Kg	0.13	0.0625	0.206	0.201	122	114	71-125	2.46	24	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 85650 85651 Original: 1542993013

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Mercury	mg/Kg	0.0669	0.0625	0.136	0.133	111	105	71-125	2.23	24	

QUALITY CONTROL DATA

Workorder: 1542993
Project ID: Whole Body Fish Tissue

QC Batch: MHG/1795
Analysis Method: EPA 1631E
QC Batch Method: EPA 1631E

Associated Lab Samples:
1542993017 1542993018 1542993019 1542993020 1542993021 1542993022
1542993023 1542993024 1542993025 1542993026 1542993027 1542993028
1542993029 1542993030

METHOD BLANK: 85270

Parameter	Units	Blank Result	Reporting Limit	Qualifiers
Mercury	mg/Kg	U	0.000250	

LABORATORY CONTROL SAMPLE: 85271

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/Kg	2.5	3.02	121	77-123	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 85272 85652 Original: 1542993025

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Mercury	mg/Kg	0.101	0.0625	0.16	0.168	95.2	107	71-125	4.88	24	

QUALITY CONTROL DATA QUALIFIERS

Workorder: 1542993

Project ID: Whole Body Fish Tissue

QUALITY CONTROL PARAMETER QUALIFIERS

J4	MS/MSD recovery exceeded control limits due to matrix interference. LCS/LCSD recovery was within acceptable range.
P1	RPD value not applicable for sample concentrations less than 5 times the PQL.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
1542993001	**1A**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993002	**2A**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993003	**3A**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993004	**4A**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993005	**5A**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993006	**1B**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993007	**2B**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993008	**3B**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993009	**4B**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993010	**5B**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993011	**1C**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993012	**2C**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993013	**3C**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993014	**1D**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993015	**1E**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993016	**2E**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993017	**3E**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993018	**4E**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993019	**5E**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993024	**2G**	EPA 3050B	MXX/7058	EPA 6020	MMS/6327
1542993020	**1F**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993021	**2F**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993022	**3F**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993023	**1G**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993025	**3G**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993026	**4G**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993027	**5G**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993028	**6G**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993029	**1H**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: 1542993
Project ID: Whole Body Fish Tissue

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
1542993030	**2H**	EPA 3050B	MXX/7059	EPA 6020	MMS/6328
1542993001	**1A**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993002	**2A**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993003	**3A**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993004	**4A**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993005	**5A**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993006	**1B**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993007	**2B**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993008	**3B**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993009	**4B**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993010	**5B**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993011	**1C**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993012	**2C**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993013	**3C**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993014	**1D**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993015	**1E**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993016	**2E**	EPA 1631E	MHG/1793	EPA 1631E	MHG/1794
1542993017	**3E**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993018	**4E**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993019	**5E**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993020	**1F**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993021	**2F**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993022	**3F**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993023	**1G**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993024	**2G**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993025	**3G**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993026	**4G**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993027	**5G**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: 1542993

Project ID: Whole Body Fish Tissue

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
1542993028	**6G**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993029	**1H**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796
1542993030	**2H**	EPA 1631E	MHG/1795	EPA 1631E	MHG/1796

Jupiter
Environmental Laboratories, Inc.

www.jupiterlabs.com
150 S. Old Dixie Highway, Jupiter, FL 33458
(561) 575-0030 • (888) 287-3218 • clientservices@jupiterlabs.com

J.E.L. Log # 1512993
P.O. # 9/30/15
Quote #

Company Name USDA Forest Service Region 4 Utah Acquis Support Center
Address 2222 West 2300 South
City Salt Lake City State UT Zip 84119
Sampling Site Address
Attn: Caleb Zurstadt Email czurstadt@fs.fed.us
Project Name Whole Body Fish Tissue Homogenization analysis Project #
Sampler Name/Signature

LAB ANALYSIS

#	Sample Label (Client ID)	Collected Date	Collected Time	Matrix Code*	# of Cont	Parameters	Homogenization	1631E Hg	Al, Sb, As, Cd, Cr	Cu, Fe, Pb, Mg, Mn	Ni, Se, Ag, Zn, Tl								Field Filtered (Y/N)	Comments
1	1A	7/20/15	15:05	S	1		↓	↓	↓	↓	↓									022-1
2	2A	7/20/15	15:10	S	1															022-3
3	3A	↓	15:15	S	1															022-2
4	4A		—	S	1															026-2
5	5A		—	S	1															026-4 (026-001)
6	1B	7/21/15	13:10	S																023-2
7	2B	7/21/15	13:10	S																023-1
8	3B	7/21/15	14:55																	023-3
9	4B	7/21/15	—																	026-3
10	5B	7/21/15	—																	026-4 (026-403)

Requested Turnaround Time
Note: Rush requests subject to acceptance by the laboratory
___ Standard
___ Expedited
Due___/___/___

Matrix Codes*

S	Soil/Solid Sediment	SW	Surface Water
GW	Ground Water	SL	Sludge
WW	Waste Water	O	Other (Please Specify)
DW	Drinking Water		

Pres Codes

A-	none	I-	Ice
B-	HNO_3	O-	Other
C-	H_2SO_4	M-	MeOH
D-	NaOH	N-	$Na_2S_2O_3$
E-	HCl	Z-	ZnAc

Relinquished by	Date	Time	Received by	Date	Time
Caleb Zurstadt			UPS		
UPS	8/18/15	09:30	TG	8/18/15	09:30

QA/QC level with report
None___1___2___3___ See price guide for applicable fees

FDEP Dry Cleaning ☐ FDEP UST Pre-Approval ☐
SFWMD ☐ ADaPT ☐ DOT ☐

Temp Control: on dry ice °C

Page 1 of 3

5112993

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(561) 575-0030 • (888) 287-3218 • clientservices@jupiterlabs.com

J.E.L. Log # 1542993
P.O. #
Quote #

Company Name
Address Same.
City State Zip
Sampling Site Address
Attn: Email
Project Name Project #
Sampler Name/Signature

LAB ANALYSIS

Requested Turnaround Time
Note: Rush requests subject to acceptance by the laboratory
___ Standard
___ Expedited
Due___/___/___

#	Sample Label (Client ID)	Collected Date	Collected Time	Matrix Code*	# of Cont	Pres Codes	Homogenization	1631E Hg	metals	Field Filtered (Y/N)	Comments
11	1C	7/22/15	13:10	S	1		↓	↓	↓		016-1
12	2C	7/22/15	15:30	S	1						016-2
13	3C	7/22/15	17:00	S	1						016-3
14	1D	7/23/15	14.30	↓							018
15	1 E	7/24/15	14:30								018-2
16	2 E	7/24/15	14:30								018-1
17	3 E	7/24/15	16:10								014-1
18	4 E	7/24/15	16:40								014-2
19	5 E	7/24/15	17:00								014-3
20	1F	7/25/15	14 30								011-1

Matrix Codes*

S	Soil/Solid Sediment	SW	Surface Water
GW	Ground Water	SL	Sludge
WW	Waste Water	O	Other (Please Specify)
DW	Drinking Water		

Pres Codes

A-	none	I-	Ice
B-	HNO_3	O-	Other
C-	H_2SO_4	M-	MeOH
D-	NaOH	N -	$Na_2S_2O_3$
E-	HCl	Z-	ZnAc

Relinquished by	Date	Time	Received by	Date	Time
Caleb Zurgot			UPS		
UPS	8/18/15	09:30	TG	8/18/15	09:30

QA/QC level with report
None___1___2___3___ See price guide for applicable fees

FDEP Dry Cleaning ☐ FDEP UST Pre-Approval ☐
SFWMD ☐ ADaPT ☐ DOT ☐

Temp Control: on dry ice °C

Page 2 of 3

1542993

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J.E.L. Log # 1512993
P.O. # ____
Quote # ____

Company Name
Address Same
City State Zip
Sampling Site Address
Attn: Email
Project Name Project #
Sampler Name/Signature

Requested Turnaround Time
Note: Rush requests subject to acceptance by the laboratory
___ Standard
___ Expedited
Due___/___/___

LAB ANALYSIS

#	Sample Label (Client ID)	Collected Date	Collected Time	Matrix Code*	# of Cont	Pres Codes	Homogenization	1631E Hg	metals	Field Filtered (Y/N)	Comments
21	2F	7/23/15	14:47	S	1		↓	↓	↓		011
22	3F	↓	14:50	S	1					10-2-15	~~027-1~~ 011-2
23	1G	8/10/15	12:34	S	1						027-1
24	2G		12:53	S	1						027-2
25	3G		13:07	S	1						027-3
26	4G		15:25	S	1						EFSFSR05
27	5G		15:45	S	1						EFSFSR01-0
28	6G	↓	16:20	S	1						EFSFSR02
29	1H	8/11/15	07:55	S	1		↓	↓	↓		EFSFSR03
30	2H	↓	13:15	S	1						EFSFSR04

Matrix Codes*

S	Soil/Solid Sediment	SW	Surface Water
GW	Ground Water	SL	Sludge
WW	Waste Water	O	Other (Please Specify)
DW	Drinking Water		

Pres Codes

A-	none	I-	Ice
B-	HNO_3	O-	Other
C-	H_2SO_4	M-	MeOH
D-	NaOH	N -	$Na_2S_2O_3$
E-	HCl	Z-	ZnAc

Relinquished by	Date	Time	Received by	Date	Time
Caleb Zurstadt			UPS		
UPS	8/18/15	09:30	TG	8/18/15	09:30

QA/QC level with report
None ___1___2___3___ See price guide for applicable fees

FDEP Dry Cleaning ☐ FDEP UST Pre-Approval ☐
SFWMD ☐ ADaPT ☐ DOT ☐

Temp Control: on dry ice °C

Page 3 of 3

1512993

Login Checklist

Cooler Unpacked/Checked by: TG Date: 8/18/15

JEL LOG#: 1542443

Cooler Check

Cooler ID	Cooler Temp (C)	# of Samples in Cooler	Evidence Tape				Method of Receipt		
			Present?		Intact?				
			Yes	No	Yes	No	**Drop Off**	**Comm. Carrier**	**Pick Up**
	Dry ice	30		✓				✓	

Note: if the temperature of a cooler is above 6C or an evidence seal is damaged then identify the bottles in the affected cooler(s) on the sample discrepancy form.
*Write tracking number only if waybill copy cannot be placed in the folder

Condition of Containers:

Loose Caps: Yes________ [✓ No]
If yes, fill out sample discrepancy form.

Broken Containers: Yes________ [✓ No]
If yes, fill out sample discrepancy form.

Acid Preserved Samples: Are their pHs </=2 ?Yes______ No______ [✓ N/A]
If yes, pH strip lot #:HC412469
If no: Fill out sample discrepancy form
Check unpreserved containers with same Field ID
If acid is added: HCL Lot #: , HNO3 Lot #: , H2SO4 Lot #:

Base Preserved Samples: Are their pHs >/=12 or 9 ?Yes______ No______ [✓ N/A]
(Cyanide >/= 12; Sulfide >/=9)
If yes, pH strip lot #: HC5412469
If no: Fill out sample discrepancy form
Check unpreserved containers with same Field ID
If base is added: NaOH Lot #:

Are all samples in cooler on COC?: [✓ Yes] No________
If no, fill out sample discrepancy form.

Are all samples on COC in cooler?: [✓ Yes] No________
If no, fill out sample discrepancy form.

N/A = not Applicable Temperature Gun ID #: TEMP-GUN-1

ORDER FOR SUPPLIES OR SERVICES
SCHEDULE - CONTINUATION

PAGE NO
2

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

DATE OF ORDER	CONTRACT NO	ORDER NO.
07/29/2015	GS-07F-170BA	AG-84N8-D-15-0093

ITEM NO (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Admin Office: USDA FOREST SERVICE REGION 4 UTAH ACQUIS SUPPORT CENTER 2222 WEST 2300 SOUTH SALT LAKE CITY UT 84119 Client Agency Code: FS00 Budget Yr Start: ZZ SHC: 0412NFMG1215 BOC: 2540 Period of Performance: 07/29/2015 to 09/30/2015 IGF::OT::IGF Whole Body Fish Tissue Homogenization Analysis The Krassel Ranger District, located in McCall, Idaho requires lab testing on fish samples along with a report on testing procedures and analysis results. All testing is required to meet EPA Standardized Guidelines. Analysis and final report are due no later than September 30, 2015. Testing includes: Whole Body Fish Tissue Homogenization - quantity of 30 @ $95 each ($2,850.00) Trace Metal Analysis - quantity of 30 - @ $110.00 each ($3,300.00) Total Hg - quantity of 30 @ $97.00 each ($2,910.00) Total of this award: $9,060.00 (reference E-Buy quote RFQ1006014-ZCC, attached) Government Point of Contact: Caleb Zurstadt Phone: 208-634-0618 e-mail: czurstadt@fs.fed.us contact					
001	Whole Body Fish Tissue Homogenization analysis Project Name				9,060.00	
	The total amount of award: $9,060.00. The obligation for this award is shown in box 17(i).					
	TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H))	⊳			$9,060.00	

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OPTIONAL FORM 348 (Rev. 4/2006)
Prescribed by GSA FAR (48 CFR) 53.213(f)

Sara Ouly

From:	Zurstadt, Caleb F -FS
Sent:	Thursday, August 20, 2015 12:03 AM
To:	Sara Ouly
Cc:	kbaldwin@jupiterlabs.com
Subject:	RE: Award for Whole Body Fish Tissue Analysis (AG-84N8-D-15-0093)

The table below has the analysis that the contract bid was based on (i.e, the analysis we need run). And according the Kacia this is the method you use for trace metal analysis:

A unique 3rd generation collision/reaction cell is utilized in all 7700 Series instruments to remove spectral interferences that might otherwise bias results. Helium (He) mode is already established as the *only* reliable cell method for complex and variable samples, because it filters out *all* polyatomics, even unidentified ones.

ANALYSES

Analyte	Method	Matrix	Comments	Qty
Homogenization	BRL SOP BR-0106	Whole body		30
Al ✓, Sb ✓, As ✓, Cd ✓, Cr ✓, Cu ✓, Fe ✓, Pb ✓, Mg ✓, Mn ✓, Ni ✓, Se ✓, Ag, Zn ✓, Tl ✓	EPA 1638, Modified	Biota	HNO_3 + H_2O_2 Hotplate Digestion	30
Total Hg ✓	EPA 1631E, Appendix	Tissue		30

★ we received these 8·18 @ around
930am via
UPS

Hope this helps gets us moving forward. Sorry about this, I'm pretty tapped with dealing with forest fire priorities.

From: Sara Ouly [mailto:souly@jupiterlabs.com]
Sent: Wednesday, August 19, 2015 6:58 AM
To: Zurstadt, Caleb F -FS
Cc: kbaldwin@jupiterlabs.com
Subject: RE: Award for Whole Body Fish Tissue Analysis (AG-84N8-D-15-0093)

We can't run the samples without the chain of custody. This is because it gives us the information that we currently do not possess, such as what tests you wish to run, what the order and the name of the samples are, and when they were collected. Without this written approval by the client to proceed in the manner specified, we can only hold the samples. I can fill out the COC for you, but you must tell me in writing all of the information needed so that I have documentation of consent and then I can send you a copy so that you may make sure I have everything correct.

ORDER FOR SUPPLIES OR SERVICES

IMPORTANT: Mark all packages and papers with contract and/or order numbers

PAGE OF PAGES: 1 2

1. DATE OF ORDER: 07/29/2015

2. CONTRACT NO. *(If any)*: GS-07F-170BA

3. ORDER NO: AG-84N8-D-15-0093

4. REQUISITION/REFERENCE NO: 757171

5. ISSUING OFFICE *(Address correspondence to)*

USDA FOREST SERVICE
REGION 4 UTAH ACQUIS SUPPORT CENTER
2222 WEST 2300 SOUTH
SALT LAKE CITY UT 84119

6. SHIP TO:

a. NAME OF CONSIGNEE: PAYETTE NATIONAL FOREST

b. STREET ADDRESS: 800 WEST LAKESIDE AVE

c. CITY: MCCALL
d. STATE: ID
e. ZIP CODE: 83638

f. SHIP VIA:

7. TO

a. NAME OF CONTRACTOR: JUPITER ENVIRONMENTAL LABORATORIES INC

b. COMPANY NAME:

c. STREET ADDRESS: 150 S OLD DIXIE HIGHWAY
1100623322

d. CITY: JUPITER
e. STATE: FL
f. ZIP CODE: 33458-7448

8. TYPE OF ORDER

☐ a. PURCHASE
REFERENCE YOUR:

Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated

☒ b. DELIVERY
Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above numbered contract.

9. ACCOUNTING AND APPROPRIATION DATA: FS00.ZZ.......0412NFMG1215.2540...

10. REQUISITIONING OFFICE: IAS

11. BUSINESS CLASSIFICATION *(Check appropriate box(es))*

☒ a. SMALL
☐ b. OTHER THAN SMALL
☐ c. DISADVANTAGED
☒ d. WOMEN OWNED
☐ e. HUBZone
☐ f. SERVICE-DISABLED VETERAN-OWNED
☒ g. WOMEN OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOSB PROGRAM
☐ h. EDWOSB

12. F.O.B. POINT: Destination

13. PLACE OF
a. INSPECTION:
b. ACCEPTANCE:

14. GOVERNMENT B/L NO.:

15. DELIVER TO F.O.B. POINT ON OR BEFORE *(Date)*: 09/30/2015

16. DISCOUNT TERMS:

17. SCHEDULE *(See reverse for Rejections)*

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	IGF::OT::IGF Whole Body Fish Tissue Homogenization analysis Continued ...					

18. SHIPPING POINT:

19. GROSS SHIPPING WEIGHT:

20. INVOICE NO.:

17(h) TOTAL (Cont. pages): $9,060.00

21. MAIL INVOICE TO:

SEE BILLING INSTRUCTIONS ON REVERSE

a. NAME: USDA FOREST SERVICE

b. STREET ADDRESS (or P.O. Box): REGION 4 UTAH ACQUIS SUPPORT CENTER
2222 WEST 2300 SOUTH

c. CITY: SALT LAKE CITY
d. STATE: UT
e. ZIP CODE: 84119

17(i) GRAND TOTAL: $9,060.00

22. UNITED STATES OF AMERICA BY *(Signature)*: Tamara Draper

23. NAME *(Typed)*: TAMMY DRAPER
TITLE: CONTRACTING/ORDERING OFFICER

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OPTIONAL FORM 347 (Rev. 2/2012)
Prescribed by GSA/FAR 48 CFR 53.213(f)

ORDER FOR SUPPLIES OR SERVICES
SCHEDULE - CONTINUATION

PAGE NO 2

IMPORTANT: Mark all packages and papers with contract and/or order numbers

DATE OF ORDER	CONTRACT NO	ORDER NO
07/29/2015	GS-07F-170BA	AG-84N8-D-15-0093

ITEM NO (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Admin Office: USDA FOREST SERVICE REGION 4 UTAH ACQUIS SUPPORT CENTER 2222 WEST 2300 SOUTH SALT LAKE CITY UT 84119 Agency Code: FS00 Budget Yr Start: ZZ SHC: 0412NFMG1215 BOC: 2540 Period of Performance: 07/29/2015 to 09/30/2015 IGF::OT::IGF Whole Body Fish Tissue Homogenization Analysis The Krassel Ranger District, located in McCall, Idaho requires lab testing on fish samples along with a report on testing procedures and analysis results. All testing is required to meet EPA Standardized Guidelines. Analysis and final report are due no later than September 30, 2015. Testing includes: Whole Body Fish Tissue Homogenization - quantity of 30 @ $95 each ($2,850.00) Trace Metal Analysis - quantity of 30 - @ $110.00 each ($3,300.00) Total Hg - quantity of 30 @ $97.00 each ($2,910.00) Total of this award: $9,060.00 (reference E-Buy quote RFQ1006014 ZCC, attached) Government Point of Contact: Caleb Zurstadt Phone: 208-634-0618 e-mail: czurstadt@fs.fed.us					
001	Whole Body Fish Tissue Homogenization analysis				9,060.00	
	The total amount of award: $9,060.00. The obligation for this award is shown in box 17(i).					
	TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H))	▷			$9,060.00	

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OPTIONAL FORM 348 (Rev. 4/2006)
Prescribed by GSA FAR (48 CFR) 53.213(f)

RFQ ID: **RFQ1006014**

Reference #:S-15-0100

RFQ Title:Whole Body Fish Tissue Homogenization Analysis

RFQ Status: Closed

RFQ Close Date: 07/20/2015 07:00:00 PM EDT

Quote ID: RFQ1006014-ZCC

Quote Status: Pending Response

Vendor: JUPITER ENVIRONMENTAL LABORATORIES
Contract Number: GS-07F-170BA **Expires:** 03/25/2019
Schedule/SIN: 66/873 2
Contact: Glynda Russell
(561)575-0030
glyndar@jupiterlabs.com

Total Quote Price:$9,060.00

This quote is good until: 09/18/2015 07:00:00 PM EDT

Prompt Pay: 20 Days 2%
FOB: Destination
Socio-Economic: s/d/w/wo
DUNS: 938340247

Line Items (Specific items added by the vendor to complete this quote are listed below, beneath the RFQ line item)

Mfr. Part/Item #	Manufacturer	Product/Service Name	Qty	Unit	Unit Price	Total Price	Award Line Item
Whole Body Fish Tissue Homogenization			30	EA	$95.00	$2,850.00	○ Yes ○ No
Trace Metal Analysis			30	EA	$110.00	$3,300.00	○ Yes ○ No
Total Hg			30	EA	$97.00	$2,910.00	○ Yes ○ No
					Total Line Items:	**$9,060.00**	

Vendor Comments

Vendor Attached Documents:

Total Dollar Amount in Attached Documents:	**$0.00**
FOB Transportation Cost:	**$0.00**
Total Quote:	**$9,060.00**

Buyer Notes

The Krassel Ranger District, located in McCall, Idaho has a need for Lab Testing on fish samples. All testing must meet EPA Standardized Guidelines. The testing includes:

Analyte	Method	Matrix		Quantity	Unit Price	Extended Price
Homogenization	BRL SOP BR-0106	Whole Body		30	$	$
Al, Sb, As, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, Se, Ag, Zn, Tl	EPA 1638, Modified Samples are hot-block digested with nitric acid (HNO3) and hydrogen peroxide (H2O2), then diluted to volume with DI water. Digests are then analyzed by inductively coupled plasma -mass spectrometry (ICP-MS) using dynamic reaction cell (DRC) technology for the As, Cr, Cu, Fe, and Se analyses to reduce potential polyatomic interferences and to achieve lower detection limits.	Homogenized Tissue	$HNO_3 + H_2O_2$ Hot plate Digestion	30	$	$
Total Hg	EPA 1631E, Appendix Samples are acid digested with heat and further oxidized with BrCl. Samples are analyzed by SnCl2 reduction, followed by gold amalgamation, thermal desorption and atomic fluorescence spectroscopy (CVAFS) using a MERX-T Analyzer.	Homogenized Tissue		30	$	$
					Total	$

Assuming an award is made prior to July 31, 2015; all analysis requirements are due no later than September 30, 2015.
Offerors shall provide descriptive information on Analysis Methods and Report:
EPA 1631, Appendix – Total Mercury in Tissue
EPA 1638, Modified w/DRC – Trace Metals in Tissue
Description of details provided in report on analysis results

The government intends to evaluate all offers to determine overall Best Value to the Government. The government will review technical components of the proposed sampling methods, delivery and price. Technical components and delivery, when combined are of greater value when compared to price.

Appendix 5:
Genetic Studies Results

Appendix 5: Genetic Studies Results

Stibnite Gold Project
Midas Gold Idaho, Inc.

April 2017

Prepared by

MWH Americas, Inc.
727 E. Riverpark Lane, Suite 150
Boise, Idaho 83706

2015 Fish Tissue Collection Genetics Study

Site ID	Waterway	Code (FS)	Field ID Species	Failed markers	Failed alleles	Available alleles	WSCT alleles	%RBT alleles
MWH-011	EFSFSR	011-001	WCT	0	0	78	78	0
MWH-011	EFSFSR	011-002	WCT	0	0	78	78	0
MWH-011	EFSFSR	011-003	WCT	0	0	78	78	0
MWH-011	EFSFSR	011-003D	WCT	0	0	78	78	0
MWH-011	EFSFSR	011-004	WCT	0	0	78	78	0
MWH-011	EFSFSR	011-004D	WCT	0	0	78	78	0
MWH-011	EFSFSR	011-005	RT	0	0	78	61	21.79487
MWH-011	EFSFSR	011-006	WCT	0	0	78	78	0
MWH-011	EFSFSR	011-007	RT	0	0	78	67	14.10256
MWH-011	EFSFSR	011-007D	RT	0	0	78	60	23.07692
MWH-011	EFSFSR	011-009D	WCT	0	0	78	55	29.48718
MWH-011	EFSFSR	011-012D	WCT	0	0	78	78	0
MWH-014	Meadow Creek	014-005	WCT	0	0	78	78	0
MWH-014	Meadow Creek	014-005D	RT	0	0	78	60	23.07692
MWH-014	Meadow Creek	014-006	WCT	0	0	78	78	0
MWH-014	Meadow Creek	014-006D	WCT	0	0	78	64	17.94872
MWH-014	Meadow Creek	014-007	WCT	0	0	78	78	0
MWH-014	Meadow Creek	014-008	WCT	0	0	78	78	0
MWH-014	Meadow Creek	014-008D	WCT	0	0	78	78	0
MWH-014	Meadow Creek	014-009	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-001	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-002	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-004D	WCT	11	22	56	51	8.928571
MWH-016	Meadow Creek	016-005	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-005D	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-006	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-006D	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-007	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-010D	WCT	1	2	76	76	0
MWH-016	Meadow Creek	016-011	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-012	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-013	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-014	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-015	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-016	RT	0	0	78	78	0
MWH-016	Meadow Creek	016-017	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-018	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-018D	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-019	WCT	0	0	78	78	0
MWH-016	Meadow Creek	016-020D	WCT	0	0	78	78	0
MWH-018	Sugar Creek	018-006	RT	0	0	78	0	100
MWH-018	Sugar Creek	018-112	RT	0	0	78	0	100
MWH-018	Sugar Creek	018-113	RT	0	0	78	0	100
MWH-018	Sugar Creek	018-119	RT	0	0	78	1	98.71795
MWH-018	Sugar Creek	018-120	RT	0	0	78	0	100
MWH-018	Sugar Creek	018-202	RT	0	0	78	0	100

2015 Fish Tissue Collection Genetics Study

Site ID	Waterway	Code (FS)	Field ID Species	Failed markers	Failed alleles	Available alleles	WSCT alleles	%RBT alleles
MWH-018	Sugar Creek	018-301	WCT	0	0	78	78	0
MWH-018	Sugar Creek	018-305	RT	0	0	78	0	100
MWH-018	Sugar Creek	018-306	RT	0	0	78	0	100
MWH-018	Sugar Creek	018-401	RT	0	0	78	0	100
MWH-018	Sugar Creek	018-402	RT	0	0	78	0	100
MWH-019	Cinnabar Creek	019-008	RT	0	0	78	0	100
MWH-025	EFSFSR	025-001	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-002	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-003	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-004	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-005	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-006	WCT	0	0	78	77	1.282051
MWH-025	EFSFSR	025-007	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-008	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-009	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-010	**TF**	39	78	0	0	#DIV/0!
MWH-025	EFSFSR	025-011	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-012	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-013	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-014	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-015	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-016	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-017	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-018	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-019	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-020	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-021	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-022	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-023	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-024	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-025	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-026	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-027	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-028	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-029	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-030	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-031	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-032	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-033	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-034	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-035	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-036	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-037	WCT	0	0	78	77	1.282051
MWH-025	EFSFSR	025-038	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-039	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-102	WCT	0	0	78	78	0

2015 Fish Tissue Collection Genetics Study

Site ID	Waterway	Code (FS)	Field ID Species	Failed markers	Failed alleles	Available alleles	WSCT alleles	%RBT alleles
MWH-025	EFSFSR	025-103	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-106	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-107	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-108	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-109	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-110	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-112	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-115	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-116	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-117	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-118	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-119	WCT	0	0	78	77	1.282051
MWH-025	EFSFSR	025-123	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-124	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-201	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-202	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-205	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-206	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-207	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-301	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-302	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-303	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-304	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-308	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-309	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-310	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-314	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-402	WCT	0	0	78	78	0
MWH-025	EFSFSR	025-403	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-001	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-002	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-003	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-004	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-005	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-006	**BT**	4	8	70	26	62.85714
MWH-026	EFSFSR	026-007	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-008	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-009	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-010	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-011	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-012	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-013	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-014	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-016	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-017	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-018	WCT	0	0	78	78	0

2015 Fish Tissue Collection Genetics Study

Site ID	Waterway	Code (FS)	Field ID Species	Failed markers	Failed alleles	Available alleles	WSCT alleles	%RBT alleles
MWH-026	EFSFSR	026-019	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-020	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-022	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-023	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-025	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-108	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-109	WCT	0	0	78	78	0
MWH-026	EFSFSR	026-402	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-001	RT	0	0	78	78	0
MWH-034	Meadow Creek	034-002	RT	0	0	78	78	0
MWH-034	Meadow Creek	034-003	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-004	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-005	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-006	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-007	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-008	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-009	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-009D	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-010	RT	0	0	78	78	0
MWH-034	Meadow Creek	034-010D	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-011	WCT	0	0	78	78	0
MWH-034	Meadow Creek	034-012	WCT	0	0	78	78	0
MWH-047	Meadow Creek	047-001	WCT	0	0	78	78	0
MWH-047	Meadow Creek	047-005	WCT	0	0	78	78	0
MWH-047	Meadow Creek	047-007	WCT	0	0	78	78	0
MWH-047	Meadow Creek	047-008	WCT	0	0	78	78	0
Blowout01	EFMC	Blowout01	WCT	0	0	78	78	0
Blowout02	EFMC	Blowout02	WCT	0	0	78	78	0
Blowout03	EFMC	Blowout03	WCT	0	0	78	78	0
EFSFSR01	EFSFSR	EFSFSR-01	RT	0	0	78	1	98.71795
EFSFSR01	EFSFSR	EFSFSR01-9	WCT	0	0	78	77	1.282051
EFSFSR02	EFSFSR	EFSFSR02	WCT	0	0	78	78	0
EFSFSR03	EFSFSR	EFSFSR03	WCT	0	0	78	78	0
EFSFSR04	EFSFSR	EFSFSR04	WCT	0	0	78	78	0
EFSFSR05	EFSFSR	EFSFSR05	WCT	0	0	78	78	0

2015 Fish Tissue Genetics Study
Project: ID bulltrout
Human: AL

▨ **Not diagnostic**
🟦 **Missing data**
🟨 **ID & genotype disagree**
🟪 **Sfo alleles**

Site ID	Waterway	Sample Name	Missing Data	Non-diagnostic Markers																		Diagnostic Markers														Hybrid Index
				Sco106		Smm22		Sco202		Sco200		Sco220		Sco109		Sco105		Omm1130		Sco212		Sfo18		Sco216		Sco218		Sco215		Omm1128		Sco102		Sco107		
MWH-019	Cinnabar Creek	CIN019_003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-019	Cinnabar Creek	CIN019_004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-019	Cinnabar Creek	CIN019_005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-019	Cinnabar Creek	CIN019_006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-019	Cinnabar Creek	CIN019_007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MWH-019	Cinnabar Creek	CIN019_009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-019	Cinnabar Creek	CIN019_010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-019	Cinnabar Creek	CIN019_011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-019	Cinnabar Creek	CIN019_012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-011	EFSFSR	EFSFSR011_008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MWH-026	EFSFSR	EFSFSR26-006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-016	Meadow Creek	MDW016_003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-016	Meadow Creek	MDW016_004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-016	Meadow Creek	MDW016_009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-016	Meadow Creek	MDW016_010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-047	Meadow Creek	MDW047_002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-018	Sugar Creek	SUGAR018_001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-018	Sugar Creek	SUGAR018_002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-018	Sugar Creek	SUGAR018_003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-018	Sugar Creek	SUGAR018_004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
MWH-018	Sugar Creek	SUGAR018_005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-018	Sugar Creek	SUGAR018_007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
MWH-018	Sugar Creek	SUGAR018_008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Key: EFSFSR = East Fork of the South Fork of the Salmon River																																				

2016 eDNA Results

Stream	Collaborator	Date Collected	Collaborator Site #	NGC_ID Tag	Bull # Wells Positive Detections	Brook # Wells Positive Detections	Rainbow # Wells Positive Detections	Westslope # Wells Positive Detections	Chinook # Wells Positive Detections	Lamprey # Wells Positive Detections	Notes
EFMC	Nez Perce	8/4/2014		ID_080414_BLOW_01_S	0/3	n/a	**4/9**	n/a	0/3	n/a	Note- this samples was analyzed in triplicate three times, with a total of 4 wells of amplifcation across three triplicate analysis (i.e., 9 wells).
EFMC	Nez Perce	7/13/2016		ID_071316_BLW_04	0/3	0/3	0/3	n/a	n/a	n/a	
EFSFSR	USFS	8/6/2016	410-2	101699	**3/3**	0/3	0/3	**3/3**	n/a	0/3	
EFSFSR	USFS	8/7/2016	MWH-065	ID_080716_MWH_065	**3/3**	0/3	0/3	**3/3**	n/a	0/3	
EFSFSR	USFS	8/8/2016	355-1	101689	**3/3**	0/3	0/3	**3/3**	n/a	n/a	
EFSFSR	USFS	8/8/2016	345-1	101687	0/3	0/3	0/3	**3/3**	n/a	n/a	
EFSFSR	USFS	8/8/2016	356-1	101690	**3/3**	0/3	0/3	**3/3**	n/a	n/a	
EFSFSR	USFS	8/8/2016	371-2	101692	**3/3**	0/3	0/3	**3/3**	n/a	n/a	
EFSFSR	USFS	8/8/2016	371-1	101691	**2/3**	0/3	0/3	**3/3**	n/a	n/a	
EFSFSR	USFS	8/10/2016	345-2	101688	0/3	0/3	0/3	**3/3**	n/a	n/a	
EFSFSR	USFS	8/10/2016	MWH-011	ID_081016_MWH_011	**3/3**	0/3	0/3	**3/3**	**3/3**	0/3	
EFSFSR	USFS	8/13/2016	410-1	101698	**3/3**	0/3	0/3	**3/3**	**3/3**	0/3	
EFSFSR	USFS	8/14/2016	439-1	101702	**2/3**	0/3	**3/3**	**3/3**	**3/3**	0/3	This sample is located below the cascades which limit upstream movement of fish from the Glory Hole.
EFMC	USFS	8/14/2016	318-3	101682	0/3	0/3	0/3	**3/3**	0/3	n/a	
EFMC	USFS	8/14/2016	318-2	101681	0/3	0/3	0/3	**3/3**	0/3	n/a	
EFSFSR	USFS	8/15/2016	326-4	101684	0/3	0/3	0/3	0/3	0/3	n/a	
EFSFSR Trib	USFS	8/8/2016	326-1	101683	**3/3**	0/3	0/3	**3/3**	n/a	n/a	
Fern Creek	USFS	8/8/2016	397-1	101697	**1/3**	0/3	0/3	**3/3**	n/a	n/a	
Fiddle Creek	Nez Perce	9/16/2015		ID_091615_FIDD_01	0/3	n/a	0/3	n/a	0/3	n/a	
Fiddle Creek	Nez Perce	7/13/2016		ID_071316_FID_03	**1/3**	n/a	0/3	n/a	n/a	n/a	
Fiddle Creek	USFS	8/13/2016	MWH-078	ID_081316_MWH_078	0/3	0/3	0/3	**3/3**	0/3	n/a	
Fiddle Creek	USFS	8/13/2016	425-1	101700	0/3	0/3	0/3	**3/3**	0/3	n/a	
Fiddle Creek	USFS	8/14/2016	425-3	101701	0/3	0/3	0/3	0/3	0/3	n/a	
Garnet Creek	USFS	9/29/2015		ID_092915_GARN_02	0/3	0/3	0/3	0/3	n/a	n/a	
Garnet Creek	USFS	8/7/2016	395-1	101696	0/3	0/3	0/3	**3/3**	n/a	n/a	
Garnet Creek	USFS	8/10/2016	MWH-066	ID_081016_MWH_066	0/3	0/3	0/3	0/3	0/3	n/a	
Meadow Creek	Nez Perce	7/13/2016		ID_071316_MED_02	**3/3**	n/a	0/3	n/a	n/a	n/a	
Meadow Creek	Nez Perce	7/13/2016		ID_071316_MED_01	**3/3**	n/a	0/3	n/a	n/a	n/a	
Meadow Creek	USFS	8/7/2016	373-1	101693	**3/3**	0/3	0/3	**3/3**	n/a	n/a	
Meadow Creek	USFS	8/7/2016	375-1	101694	**3/3**	0/3	0/3	**3/3**	n/a	n/a	Analyzing for Chinook to confirm consistancy with previous field surveys
Meadow Creek	USFS	8/7/2016	384-1	101695	**2/3**	0/3	0/3	**3/3**	n/a	n/a	
Meadow Creek	USFS	8/17/2016	329-2	101686	**3/3**	0/3	0/3	**3/3**	0/3	n/a	
Meadow Creek	USFS	8/17/2016	329-1	101685	**3/3**	0/3	0/3	**3/3**	0/3	n/a	
Meadow Creek Lake	USFS	8/16/2016	MWH-068	ID_081616_MWH_068	0/3	0/3	**5/9**	**6/6**	0/3	n/a	
Meadow Creek Trib	USFS	8/17/2016	MWH-079	ID_081716_MWH_079	**3/3**	0/3	0/3	**3/3**	0/3	n/a	
Midnight Creek	USFS	9/29/2015		ID_092915_MID_01	0/3	0/3	0/3	0/3	n/a	n/a	
Midnight Creek	USFS	8/12/2016	MWH-063	ID_081216_MWH_063	0/3	0/3	0/3	0/3	0/3	n/a	
Midnight Creek	USFS	8/13/2016	MWH-064	ID_081316_MWH_064	0/3	0/3	0/3	0/3	0/3	n/a	

Appendix 6:

Summary of Fish Counts and Basic Habitat Information from Snorkel Surveys

Appendix 6: Summary of Fish Counts and Basic Habitat Information from Snorkel Surveys

Stibnite Gold Project
Midas Gold Idaho, Inc.

April 2017

Prepared by

MWH Americas, Inc.
727 E. Riverpark Lane, Suite 150
Boise, Idaho 83706

2012	**Tamarack Creek**		**East Fork South Fork Salmon River**														
(downstream to upstream)	**017 Day**	**017 Night**	**033 Day**	**032 Day**	**032 Night**	**009 Day**	**009 Night**	**030 Day**	**030 Night**	**022 Day**	**011 Day**	**011 Night**	**013 Day**	**025 Day**	**044 Day**	**026 Day**	**026 Night**
Date Surveyed	9/8/2012	--	--	--	--	8/3/2012	--	8/2/2012	--	8/6/2012	8/5/2012	--	8/7/2012	8/8/2012	--	8/8/2012	--
Time of Survey	14:00	--	--	--	--	11:00	--	11:50	--	16:00	15:40	--	16:10	11:15	--	12:26	--
Bottom of Reach Easting	627081	--	--	--	--	630943	--	631355	--	631510	631749	--	632524	633225	--	634441	--
Bottom of Reach Northing	4979789	--	--	--	--	4977337	--	4976683	--	4975805	4974329	--	4973022	4972634	--	4971911	--
Water Temperature (°C)	10.1	--	--	--	--	10.5	--	11.3	--	15.0	15.6	--	10.9	8.4	--	8.3	--
Air Temperature (°C)	27.1	--	--	--	--	22.2	--	19.5	--	26.0	30.8	--	25.9	22.4	--	24.3	--
Average Gradient (%)	2.0	--	--	--	--	5.0	--	2.0	--	7.0	4.0	--	3.5	3.5	--	2.0	--
Unit Length (m)	91	--	--	--	--	91	--	91	--	61	91	--	91	91	--	91	--
Average Unit Width (m)	5.5	--	--	--	--	9.0	--	6.5	--	7.5	4.5	--	4.5	4.0	--	3.0	--
Species/Count																	
Chinook (50-80)	3	--	--	--	--	23	--	115	--	692	263	--	0	6	--	0	--
Chinook (81-130)	8	--	--	--	--	1	--	7	--	17	5	--	13	13	--	0	--
Chinook (>130)	0	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Chinook (Adult)	0	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Rainbow Trout (<50)	0	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Rainbow Trout (51-100)	3	--	--	--	--	4	--	10	--	0	0	--	0	0	--	0	--
Rainbow Trout (101-150)	7	--	--	--	--	2	--	11	--	0	0	--	0	0	--	0	--
Rainbow Trout (151-200)	3	--	--	--	--	2	--	11	--	0	0	--	0	0	--	0	--
Rainbow Trout (201-250)	2	--	--	--	--	1	--	3	--	0	0	--	0	0	--	0	--
Rainbow Trout (>250)	1	--	--	--	--	1	--	0	--	0	0	--	0	0	--	0	--
Bull Trout (<50)	1	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Bull Trout (51-100)	0	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Bull Trout (101-150)	0	--	--	--	--	3	--	1	--	0	0	--	0	0	--	0	--
Bull Trout (151-200)	1	--	--	--	--	0	--	4	--	0	0	--	0	0	--	0	--
Bull Trout (201-250)	0	--	--	--	--	1	--	0	--	0	0	--	0	0	--	0	--
Bull Trout (251-300)	0	--	--	--	--	0	--	1	--	0	0	--	0	0	--	0	--
Bull Trout (301-350)	0	--	--	--	--	0	--	1	--	0	0	--	0	0	--	0	--
Bull Trout (351-400)	0	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Bull Trout (>400)	0	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Cutthroat Trout (<50)	0	--	--	--	--	0	--	0	--	0	0	--	0	0	--	0	--
Cutthroat Trout (51-100)	1	--	--	--	--	0	--	0	--	0	2	--	2	6	--	2	--
Cutthroat Trout (101-150)	10	--	--	--	--	3	--	1	--	2	7	--	3	8	--	6	--
Cutthroat Trout (151-200)	0	--	--	--	--	0	--	0	--	1	6	--	4	5	--	3	--
Cutthroat Trout (201-250)	2	--	--	--	--	0	--	1	--	0	0	--	0	0	--	0	--
Cutthroat Trout (>250)	0	--	--	--	--	0	--	0	--	3	0	--	4	3	--	2	--
Total Fish Count	42	--	--	--	--	41	--	166	--	715	283	--	26	41	--	13	--

2012	Sugar Creek					Cinnabar Creek	Cane Creek	Fiddle Creek		Meadow Creek							
(downstream to upstream)	**029 Day**	**029 Night**	**010 Day**	**018 Day**	**020 Day**	**019 Day**	**021 Day**	**023 Day**	**024 Day**	**031 Day**	**014 Day**	**015 Day**	**015 Night**	**047 Day**	**047 Night**	**016 Day**	**034 Day**
Date Surveyed	8/1/2012	--	8/12/2012	8/8/2012	8/11/2012	8/11/2012	8/11/2012	8/3/2012	8/7/2012	8/5/2012	--	8/4/2012	--	--	--	8/2/2012	--
Time of Survey	13:45	--	12:30	15:52	11:55	15:27	13:45	14:50	14:47	14:00	--	15:00	--	--	--	15:00	--
Bottom of Reach Easting	631820	--	632413	633613	634672	634640	634730	631521	631094	#N/A	--	630861	--	--	--	629369	--
Bottom of Reach Northing	4977182	--	4977498	4978380	4979149	4979069	4979169	4975443	4975010	#N/A	--	4972275	--	--	--	4971903	--
Water Temperature (°C)	11.3	--	9.9	13.7	9.0	10.2	11.8	10.2	10.3	14.8	--	10.9	--	--	--	11.6	--
Air Temperature (°C)	24.5	--	20.8	25.5	20.7	25.0	25.9	21.7	21.1	27.5	--	24.7	--	--	--	22.4	--
Average Gradient (%)	2.5	--	2.5	2.5	1.5	4.5	2.5	5.0	13.0	2.5	--	2.0	--	--	--	4.0	--
Unit Length (m)	91	--	91	91	91	76	61	91	22	91	--	91	--	--	--	91	--
Average Unit Width (m)	5.5	--	5.5	4.5	3.0	2.5	3.0	2.0	2.0	4.0	--	5.0	--	--	--	3.7	--
Species/Count																	
Chinook (50-80)	7	--	11	2	0	0	0	0	0	493	--	4	--	--	--	0	--
Chinook (81-130)	1	--	3	3	1	0	0	0	0	6	--	0	--	--	--	0	--
Chinook (>130)	0	--	0	0	0	0	0	0	0	0	--	0	--	--	--	0	--
Chinook (Adult)	0	--	0	0	0	0	0	0	0	0	--	0	--	--	--	0	--
Rainbow Trout (<50)	0	--	0	0	0	0	0	0	0	0	--	0	--	--	--	0	--
Rainbow Trout (51-100)	1	--	1	1	0	0	0	0	0	0	--	0	--	--	--	0	--
Rainbow Trout (101-150)	2	--	0	1	1	0	0	0	0	0	--	0	--	--	--	0	--
Rainbow Trout (151-200)	1	--	1	1	0	0	0	0	0	0	--	0	--	--	--	0	--
Rainbow Trout (201-250)	3	--	0	1	0	0	0	0	0	0	--	0	--	--	--	0	--
Rainbow Trout (>250)	3	--	1	1	1	0	0	0	0	0	--	0	--	--	--	0	--
Bull Trout (<50)	5	--	2	1	3	3	0	0	0	*	--	0	--	--	--	0	--
Bull Trout (51-100)	1	--	6	8	6	6	4	0	0	1	--	0	--	--	--	0	--
Bull Trout (101-150)	2	--	8	10	9	5	6	0	0	0	--	0	--	--	--	1	--
Bull Trout (151-200)	3	--	4	2	3	6	6	0	0	0	--	2	--	--	--	2	--
Bull Trout (201-250)	4	--	1	3	0	1	0	0	0	0	--	4	--	--	--	0	--
Bull Trout (251-300)	1	--	0	0	0	0	0	0	0	0	--	0	--	--	--	0	--
Bull Trout (301-350)	1	--	0	1	0	0	0	0	0	0	--	0	--	--	--	0	--
Bull Trout (351-400)	0	--	0	0	0	0	0	0	0	0	--	0	--	--	--	0	--
Bull Trout (>400)	0	--	1	0	0	0	0	0	0	0	--	0	--	--	--	0	--
Cutthroat Trout (<50)	0	--	0	0	0	0	0	0	0	0	--	0	--	--	--	0	--
Cutthroat Trout (51-100)	0	--	0	0	0	0	0	0	4	1	--	1	--	--	--	5	--
Cutthroat Trout (101-150)	0	--	3	0	0	0	0	4	3	5	--	2	--	--	--	11	--
Cutthroat Trout (151-200)	0	--	0	0	0	0	0	1	0	6	--	1	--	--	--	3	--
Cutthroat Trout (201-250)	0	--	2	0	0	0	0	1	0	0	--	0	--	--	--	0	--
Cutthroat Trout (>250)	1	--	0	0	0	0	0	0	0	6	--	5	--	--	--	0	--
Total Fish Count	36	--	44	35	24	21	16	6	7	518	--	19	--	--	--	22	--

2012	East Fork Meadow Creek		
(downstream to upstream)	028 Day	028 Night	027 Day
Date Surveyed	8/6/2012	--	8/7/2012
Time of Survey	10:50	--	12:00
Bottom of Reach Easting	631143	--	631240
Bottom of Reach Northing	4972643	--	4971212
Water Temperature (°C)	10.4	--	11.1
Air Temperature (°C)	19.3	--	28.3
Average Gradient (%)	2.0	--	1.0
Unit Length (m)	91	--	91
Average Unit Width (m)	2.1	--	1.5
Species/Count			
Chinook (50-80)	338	--	0
Chinook (81-130)	10	--	0
Chinook (>130)	0	--	0
Chinook (Adult)	0	--	0
Rainbow Trout (<50)	0	--	0
Rainbow Trout (51-100)	0	--	0
Rainbow Trout (101-150)	0	--	0
Rainbow Trout (151-200)	0	--	0
Rainbow Trout (201-250)	0	--	0
Rainbow Trout (>250)	0	--	0
Bull Trout (<50)	0	--	0
Bull Trout (51-100)	0	--	0
Bull Trout (101-150)	0	--	0
Bull Trout (151-200)	0	--	0
Bull Trout (201-250)	0	--	0
Bull Trout (251-300)	0	--	0
Bull Trout (301-350)	0	--	0
Bull Trout (351-400)	0	--	0
Bull Trout (>400)	0	--	0
Cutthroat Trout (<50)	0	--	0
Cutthroat Trout (51-100)	0	--	0
Cutthroat Trout (101-150)	2	--	3
Cutthroat Trout (151-200)	0	--	0
Cutthroat Trout (201-250)	1	--	0
Cutthroat Trout (>250)	0	--	0
Total Fish Count	351	--	3

2013	Tamarack Creek		East Fork South Fork Salmon River														
(downstream to upstream)	017 Day	017 Night	033 Day	032 Day	032 Night	009 Day	009 Night	030 Day	030 Night	022 Day	011 Day	011 Night	013 Day	025 Day	044 Day	026 Day	026 Night
Date Surveyed	8/3/2013	--	8/9/2013	7/31/2013	--	--	--	8/3/2013	--	8/2/2013	8/2/2013	--	7/26/2013	7/28/2013	8/5/2013	7/31/2013	--
Time of Survey	12:47	--	12:00	12:00	--	--	--	16:52	--	13:54	17:30	--	12:30	14:56	15:28	17:44	--
Bottom of Reach Easting	627081	--	620813	626699	--	--	--	631355	--	631510	631749	--	632524	633225	634162	634441	--
Bottom of Reach Northing	4979789	--	4979837	4979679	--	--	--	4976683	--	4975805	4974329	--	4973022	4972634	4971918	4971911	--
Water Temperature (°C)	11.1	--	12.0	9.3	--	--	--	13.7	--	12.5	14.0	--	9.6	12.0	11.7	12.0	--
Air Temperature (°C)	18.7	--	22.0	21.0	--	--	--	21.2	--	24.4	22.0	--	22.0	27.2	25.7	20.4	--
Average Gradient (%)	2.0	--	2.5	2.0	--	--	--	2.0	--	7.0	4.0	--	2.5	4.3	3.5	3.0	--
Unit Length (m)	100	--	100	100	--	--	--	100	--	80	100	--	96	100	100	100	--
Average Unit Width (m)	6.0	--	14.1	15.9	--	--	--	6.6	--	6.2	6.2	--	4.1	4.8	3.0	3.2	--
Species/Count																	
Chinook (50-80)	8	--	111	54	--	--	--	64	--	111	298	--	0	0	0	0	--
Chinook (81-130)	0	--	16	0	--	--	--	32	--	9	6	--	0	0	0	0	--
Chinook (>130)	0	--	0	0	--	--	--	0	--	0	0	--	0	0	0	0	--
Chinook (Adult)	0	--	0	0	--	--	--	0	--	0	0	--	0	0	0	0	--
Rainbow Trout (<50)	0	--	0	5	--	--	--	7	--	0	0	--	0	0	0	0	--
Rainbow Trout (51-100)	5	--	10	10	--	--	--	4	--	0	0	--	0	0	0	0	--
Rainbow Trout (101-150)	6	--	30	10	--	--	--	4	--	0	0	--	0	0	0	0	--
Rainbow Trout (151-200)	2	--	20	7	--	--	--	0	--	0	0	--	0	0	0	0	--
Rainbow Trout (201-250)	2	--	14	11	--	--	--	2	--	0	0	--	0	0	0	0	--
Rainbow Trout (>250)	0	--	13	5	--	--	--	8	--	0	0	--	0	0	0	0	--
Bull Trout (<50)	0	--	0	1	--	--	--	0	--	0	0	--	0	0	0	0	--
Bull Trout (51-100)	1	--	0	0	--	--	--	1	--	0	0	--	0	0	0	0	--
Bull Trout (101-150)	0	--	8	3	--	--	--	0	--	0	0	--	0	0	0	0	--
Bull Trout (151-200)	0	--	2	1	--	--	--	0	--	0	0	--	0	0	0	0	--
Bull Trout (201-250)	0	--	1	2	--	--	--	0	--	0	0	--	0	0	0	0	--
Bull Trout (251-300)	1	--	0	0	--	--	--	1	--	0	0	--	0	0	0	0	--
Bull Trout (301-350)	0	--	0	0	--	--	--	2	--	0	0	--	0	0	0	0	--
Bull Trout (351-400)	0	--	0	0	--	--	--	1	--	0	0	--	0	0	0	0	--
Bull Trout (>400)	0	--	0	15	--	--	--	0	--	0	0	--	0	0	0	0	--
Cutthroat Trout (<50)	1	--	0	1	--	--	--	0	--	0	5	--	0	0	4	0	--
Cutthroat Trout (51-100)	4	--	13	11	--	--	--	0	--	0	5	--	0	20	16	1	--
Cutthroat Trout (101-150)	5	--	11	9	--	--	--	5	--	0	1	--	3	14	12	1	--
Cutthroat Trout (151-200)	0	--	6	0	--	--	--	1	--	0	0	--	0	11	5	2	--
Cutthroat Trout (201-250)	2	--	1	2	--	--	--	6	--	1	2	--	1	1	7	0	--
Cutthroat Trout (>250)	1	--	6	0	--	--	--	5	--	2	1	--	1	1	1	0	--
Total Fish Count	38	--	262	147	--	--	--	143	--	123	318	--	5	47	45	4	--

2013	Sugar Creek					Cinnabar Creek	Cane Creek	Fiddle Creek		Meadow Creek							
(downstream to upstream)	029 Day	029 Night	010 Day	018 Day	020 Day	019 Day	021 Day	023 Day	024 Day	031 Day	014 Day	015 Day	015 Night	047 Day	047 Night	016 Day	034 Day
Date Surveyed	8/4/2013	8/4/2013	8/6/2013	8/6/2013	7/25/2013	7/25/2013	7/25/2013	7/28/2013	--	--	7/28/2013	8/3/2013	--	7/28/2013	7/28/2013	--	8/8/2013
Time of Survey	13:45	23:18	15:30	12:45	13:15	15:40	14:15	14:24	--	--	16:02	16:13	--	12:00	22:32	--	14:45
Bottom of Reach Easting	631820	631820	632413	633613	634672	634640	634730	631521	--	--	631644	630861	--	629972	629972	--	628919
Bottom of Reach Northing	4977182	4977182	4977498	4978380	4979149	4979069	4979169	4975443	--	--	4972991	4972275	--	4972027	4972027	--	4971564
Water Temperature (°C)	11.6	10.3	14.2	11.3	9.8	9.1	10.6	10.7	--	--	15.3	15.5	--	10.3	10.3	--	12.6
Air Temperature (°C)	20.0	9.4	26.6	26.0	23.9	19.7	21.1	24.6	--	--	24.3	28.4	--	21.1	11.1	--	27.6
Average Gradient (%)	2.0	2.0	3.0	2.5	2.0	5.0	2.0	5.0	--	--	1.5	2.0	--	0.5	0.5	--	7.0
Unit Length (m)	100	100	100	90	100	96	50	100	--	--	100	100	--	100	100	--	100
Average Unit Width (m)	5.1	5.1	5.5	4.5	4.1	2.3	2.9	2.1	--	--	5.6	4.7	--	4.0	4.0	--	3.0
Species/Count																	
Chinook (50-80)	13	14	7	0	0	0	0	0	--	--	567	0	--	0	1	--	0
Chinook (81-130)	0	0	0	0	0	0	0	0	--	--	0	0	--	0	0	--	0
Chinook (>130)	0	0	0	0	0	0	0	0	--	--	0	0	--	14	25	--	0
Chinook (Adult)	0	0	0	0	0	0	0	0	--	--	0	0	--	0	0	--	0
Rainbow Trout (<50)	3	1	0	1	0	0	0	0	--	--	0	0	--	0	0	--	0
Rainbow Trout (51-100)	1	0	5	6	0	0	0	0	--	--	0	0	--	0	0	--	0
Rainbow Trout (101-150)	0	0	1	1	0	0	0	0	--	--	0	0	--	0	0	--	0
Rainbow Trout (151-200)	0	1	0	1	0	0	0	0	--	--	0	0	--	0	0	--	0
Rainbow Trout (201-250)	0	1	3	0	0	0	0	0	--	--	0	0	--	0	0	--	0
Rainbow Trout (>250)	0	1	3	0	1	0	0	0	--	--	0	0	--	0	0	--	0
Bull Trout (<50)	6	1	2	0	1	2	0	0	--	*	0	0	--	0	0	--	0
Bull Trout (51-100)	1	10	6	5	4	8	1	0	--	--	0	0	--	0	0	--	0
Bull Trout (101-150)	1	4	4	3	2	1	2	0	--	--	0	0	--	0	0	--	2
Bull Trout (151-200)	2	0	4	2	6	0	3	0	--	--	0	0	--	0	0	--	0
Bull Trout (201-250)	0	0	4	1	3	0	4	0	--	--	0	0	--	0	0	--	0
Bull Trout (251-300)	0	1	0	1	1	0	0	0	--	--	0	0	--	0	0	--	0
Bull Trout (301-350)	0	0	0	0	1	0	0	0	--	--	0	0	--	0	0	--	0
Bull Trout (351-400)	0	0	0	0	1	0	0	0	--	--	0	0	--	0	0	--	0
Bull Trout (>400)	0	0	0	0	0	0	0	0	--	--	0	0	--	0	0	--	0
Cutthroat Trout (<50)	0	0	0	0	0	0	0	7	--	--	0	0	--	0	0	--	0
Cutthroat Trout (51-100)	8	4	6	1	0	0	0	11	--	--	0	0	--	0	0	--	7
Cutthroat Trout (101-150)	7	0	3	0	0	0	0	2	--	--	2	0	--	2	2	--	7
Cutthroat Trout (151-200)	3	0	2	0	0	0	0	0	--	--	0	3	--	11	2	--	6
Cutthroat Trout (201-250)	2	1	0	0	0	0	0	0	--	--	5	9	--	5	6	--	4
Cutthroat Trout (>250)	0	0	0	0	0	0	0	0	--	--	3	7	--	0	2	--	2
Total Fish Count	47	39	50	22	20	11	10	20	--	--	577	19	--	32	38	--	28

2013	**East Fork Meadow Creek**		
(downstream to upstream)	**028 Day**	**028 Night**	**027 Day**
Date Surveyed	8/7/2013	--	8/7/2013
Time of Survey	12:45	--	15:40
Bottom of Reach Easting	631143	--	631240
Bottom of Reach Northing	4972643	--	4971212
Water Temperature (°C)	13.4	--	14.9
Air Temperature (°C)	24.4	--	26.9
Average Gradient (%)	2.5	--	1.5
Unit Length (m)	100	--	100
Average Unit Width (m)	2.3	--	1.6
Species/Count			
Chinook (50-80)	637	--	0
Chinook (81-130)	0	--	0
Chinook (>130)	0	--	0
Chinook (Adult)	0	--	0
Rainbow Trout (<50)	0	--	0
Rainbow Trout (51-100)	0	--	0
Rainbow Trout (101-150)	0	--	0
Rainbow Trout (151-200)	0	--	0
Rainbow Trout (201-250)	0	--	0
Rainbow Trout (>250)	0	--	0
Bull Trout (<50)	0	--	0
Bull Trout (51-100)	0	--	0
Bull Trout (101-150)	0	--	0
Bull Trout (151-200)	0	--	0
Bull Trout (201-250)	0	--	0
Bull Trout (251-300)	0	--	0
Bull Trout (301-350)	0	--	0
Bull Trout (351-400)	0	--	0
Bull Trout (>400)	0	--	0
Cutthroat Trout (<50)	1	--	0
Cutthroat Trout (51-100)	1	--	0
Cutthroat Trout (101-150)	6	--	0
Cutthroat Trout (151-200)	1	--	1
Cutthroat Trout (201-250)	0	--	1
Cutthroat Trout (>250)	0	--	1
Total Fish Count	646	--	3

2014	Tamarack Creek		East Fork South Fork Salmon River														
(downstream to upstream)	017 Day	017 Night	033 Day	032 Day	032 Night	009 Day	009 Night	030 Day	030 Night	022 Day	011 Day	011 Night	013 Day	025 Day	044 Day	026 Day	026 Night
Date Surveyed	8/6/2014	8/6/2014	--	7/30/2014	7/31/2014	7/31/2014	7/31/2014	8/3/2014	8/3/2014	8/5/2014	7/29/2014	7/29/2014	8/3/2014	--	--	7/27/2014	7/27/2014
Time of Survey	12:30	22:20	--	13:30	22:15	14:10	22:45	13:35	23:15	13:40	13:05	23:10	15:42	--	--	15:30	23:00
Bottom of Reach Easting	627081	627081	--	626699	626699	630943	630943	631355	631355	631510	631749	631749	632524	--	--	634441	634441
Bottom of Reach Northing	4979789	4979789	--	4979679	4979679	4977337	4977337	4976683	4976683	4975805	4974329	4974329	4973022	--	--	4971911	4971911
Water Temperature (°C)	11.3	11.5	--	13.4	11.0	13.3	11.2	13.5	14.0	13.9	11.4	12.3	12.6	--	--	11.4	9.0
Air Temperature (°C)	23.8	15.3	--	25.6	13.1	28.0	16.5	27.5	15.2	28.5	25.6	14.5	26.5	--	--	26.7	12.5
Average Gradient (%)	2.8	2.8	--	2.5	2.5	2.0	2.0	1.8	1.8	7.8	3.7	3.7	3.5	--	--	2.0	2.0
Unit Length (m)	100	110	--	100	100	100	100	100	100	100	100	100	100	--	--	100	100
Average Unit Width (m)	5.5	5.5	--	15.9	15.9	7.8	7.8	6.0	6.0	9.6	4.9	4.9	4.4	--	--	3.5	3.5
Species/Count																	
Chinook (50-80)	2	3	--	41	36	45	30	18	3	7	37	8	0	--	--	0	0
Chinook (81-130)	0	0	--	3	0	0	0	7	3	1	0	1	0	--	--	0	0
Chinook (>130)	0	1	--	1	0	1	1	0	0	3	3	2	0	--	--	0	0
Chinook (Adult)	0	0	--	1	0	0	0	0	0	0	0	0	0	--	--	0	0
Rainbow Trout (<50)	0	0	--	1	2	11	6	0	0	0	0	0	0	--	--	0	0
Rainbow Trout (51-100)	4	2	--	4	2	5	2	0	0	0	0	0	0	--	--	0	0
Rainbow Trout (101-150)	6	1	--	11	4	16	8	6	1	0	0	0	0	--	--	0	0
Rainbow Trout (151-200)	4	1	--	14	13	6	6	8	1	0	0	0	0	--	--	0	0
Rainbow Trout (201-250)	6	3	--	6	13	7	9	7	4	0	0	0	0	--	--	0	0
Rainbow Trout (>250)	1	0	--	1	3	4	3	4	4	0	0	0	0	--	--	0	0
Bull Trout (<50)	1	3	--	0	0	12	5	0	0	0	0	0	0	--	--	0	0
Bull Trout (51-100)	0	0	--	0	0	2	2	0	0	0	0	0	0	--	--	0	0
Bull Trout (101-150)	0	0	--	0	1	0	0	0	0	0	0	0	0	--	--	0	0
Bull Trout (151-200)	1	0	--	1	0	4	2	0	0	0	0	0	0	--	--	0	0
Bull Trout (201-250)	0	0	--	0	0	1	0	0	2	0	0	0	0	--	--	0	0
Bull Trout (251-300)	1	0	--	0	0	0	0	2	1	0	0	0	0	--	--	0	0
Bull Trout (301-350)	0	0	--	0	0	0	0	3	0	0	0	0	0	--	--	0	0
Bull Trout (351-400)	0	0	--	0	0	0	0	0	2	0	0	0	0	--	--	0	0
Bull Trout (>400)	0	0	--	1	0	3	0	3	1	0	0	0	0	--	--	0	0
Cutthroat Trout (<50)	5	11	--	0	0	0	0	0	2	0	0	0	0	--	--	0	0
Cutthroat Trout (51-100)	5	3	--	2	1	0	0	0	0	0	2	2	13	--	--	4	7
Cutthroat Trout (101-150)	8	2	--	7	8	7	6	2	3	0	1	1	7	--	--	5	9
Cutthroat Trout (151-200)	2	0	--	3	1	3	3	2	1	1	0	3	6	--	--	4	4
Cutthroat Trout (201-250)	0	0	--	1	0	3	0	3	1	1	3	3	7	--	--	2	1
Cutthroat Trout (>250)	1	0	--	1	0	1	1	1	0	2	2	1	5	--	--	0	1
Total Fish Count	47	30	--	99	84	131	84	66	29	15	48	21	38	--	--	15	22

2014	Sugar Creek					Cinnabar Creek	Cane Creek	Fiddle Creek		Meadow Creek							
(downstream to upstream)	**029 Day**	**029 Night**	**010 Day**	**018 Day**	**020 Day**	**019 Day**	**021 Day**	**023 Day**	**024 Day**	**031 Day**	**014 Day**	**015 Day**	**015 Night**	**047 Day**	**047 Night**	**016 Day**	**034 Day**
Date Surveyed	8/6/2014	--	8/8/2014	7/29/2014	--	8/7/2014	--	7/31/2014	--	--	7/26/2014	7/26/2014	7/26/2014	8/4/2014	--	7/27/2014	--
Time of Survey	15:30	--	14:15	16:35	--	14:43	--	15:45	--	--	15:45	12:15	22:35	14:40	--	13:20	--
Bottom of Reach Easting	631820	--	632413	633613	--	634640	--	631521	--	--	631644	630861	630861	629972	--	629369	--
Bottom of Reach Northing	4977182	--	4977498	4978380	--	4979069	--	4975443	--	--	4972991	4972275	4972275	4972027	--	4971903	--
Water Temperature (°C)	13.5	--	11.4	12.8	--	11.0	--	11.7	--	--	16.7	10.2	9.7	12.2	--	11.1	--
Air Temperature (°C)	28.1	--	22.8	28.2	--	25.5	--	20.1	--	--	24.7	22.2	14.4	20.6	--	27.7	--
Average Gradient (%)	2.9	--	2.5	3.0	--	3.6	--	2.0	--	--	1.5	2.0	2.0	1.5	--	5.5	--
Unit Length (m)	100	--	100	100	--	100	--	100	--	--	100	100	100	100	--	100	--
Average Unit Width (m)	6.0	--	5.4	5.4	--	2.3	--	2.0	--	--	5.2	4.6	4.6	4.4	--	4.4	--
Species/Count																	
Chinook (50-80)	1	--	1	0	--	0	--	0	--	--	327	0	0	0	--	0	--
Chinook (81-130)	1	--	0	0	--	0	--	0	--	--	0	0	0	0	--	0	--
Chinook (>130)	1	--	4	0	--	0	--	0	--	--	0	1	1	2	--	0	--
Chinook (Adult)	0	--	1	0	--	0	--	0	--	--	0	0	0	0	--	0	--
Rainbow Trout (<50)	1	--	5	0	--	0	--	0	--	--	0	0	0	0	--	0	--
Rainbow Trout (51-100)	2	--	1	1	--	0	--	0	--	--	0	0	0	0	--	0	--
Rainbow Trout (101-150)	3	--	3	2	--	0	--	0	--	--	0	0	0	0	--	0	--
Rainbow Trout (151-200)	2	--	2	2	--	0	--	0	--	--	0	0	0	0	--	0	--
Rainbow Trout (201-250)	1	--	1	2	--	0	--	0	--	--	0	0	0	0	--	0	--
Rainbow Trout (>250)	0	--	1	2	--	0	--	0	--	--	0	0	0	0	--	0	--
Bull Trout (<50)	2	--	1	0	--	2	--	0	--	*	0	0	0	0	--	0	--
Bull Trout (51-100)	1	--	2	0	--	5	--	0	--	--	0	0	0	1	--	0	--
Bull Trout (101-150)	1	--	3	4	--	5	--	0	--	--	0	0	0	0	--	1	--
Bull Trout (151-200)	0	--	3	4	--	1	--	0	--	--	0	0	0	0	--	0	--
Bull Trout (201-250)	4	--	2	2	--	1	--	0	--	--	0	0	0	1	--	0	--
Bull Trout (251-300)	0	--	0	1	--	0	--	0	--	--	0	0	0	0	--	0	--
Bull Trout (301-350)	0	--	1	0	--	0	--	0	--	--	0	0	0	0	--	0	--
Bull Trout (351-400)	0	--	0	0	--	0	--	0	--	--	0	0	0	0	--	0	--
Bull Trout (>400)	0	--	2	2	--	0	--	0	--	--	0	0	0	0	--	0	--
Cutthroat Trout (<50)	0	--	4	0	--	0	--	0	--	--	0	0	0	0	--	0	--
Cutthroat Trout (51-100)	0	--	3	0	--	1	--	10	--	--	0	0	0	5	--	5	--
Cutthroat Trout (101-150)	0	--	2	2	--	1	--	3	--	--	0	0	1	4	--	4	--
Cutthroat Trout (151-200)	2	--	1	0	--	0	--	0	--	--	0	0	3	3	--	2	--
Cutthroat Trout (201-250)	2	--	0	0	--	1	--	0	--	--	2	3	2	2	--	7	--
Cutthroat Trout (>250)	4	--	0	0	--	0	--	0	--	--	2	7	2	7	--	3	--
Total Fish Count	28	--	43	24	--	17	--	13	--	--	331	11	9	25	--	22	--

2014	East Fork Meadow Creek		
(downstream to upstream)	**028 Day**	**028 Night**	**027 Day**
Date Surveyed	8/4/2014	8/4/2014	7/28/2014
Time of Survey	12:45	22:15	14:57
Bottom of Reach Easting	631143	631143	631240
Bottom of Reach Northing	4972643	4972643	4971212
Water Temperature (°C)	14.2	11.0	12.7
Air Temperature (°C)	31.0	11.3	24.0
Average Gradient (%)	1.4	1.4	1.0
Unit Length (m)	100	100	100
Average Unit Width (m)	2.8	2.8	1.8
Species/Count			
Chinook (50-80)	337	254	0
Chinook (81-130)	7	2	0
Chinook (>130)	2	2	0
Chinook (Adult)	0	0	0
Rainbow Trout (<50)	0	0	0
Rainbow Trout (51-100)	0	0	0
Rainbow Trout (101-150)	0	0	0
Rainbow Trout (151-200)	0	0	0
Rainbow Trout (201-250)	0	0	0
Rainbow Trout (>250)	0	0	0
Bull Trout (<50)	0	0	0
Bull Trout (51-100)	0	0	0
Bull Trout (101-150)	0	0	0
Bull Trout (151-200)	0	0	0
Bull Trout (201-250)	0	0	0
Bull Trout (251-300)	0	0	0
Bull Trout (301-350)	0	0	0
Bull Trout (351-400)	0	0	0
Bull Trout (>400)	0	0	0
Cutthroat Trout (<50)	1	2	0
Cutthroat Trout (51-100)	1	4	7
Cutthroat Trout (101-150)	5	2	5
Cutthroat Trout (151-200)	1	0	0
Cutthroat Trout (201-250)	0	1	0
Cutthroat Trout (>250)	1	0	1
Total Fish Count	355	267	13

2015	East Fork of the South Fork of the Salmon River			Sugar Creek	Cinnabar Creek	Meadow Creek			
MWH Site Number (downstream to upstream)	**011**	**025**	**026**	**018**	**019**	**014**	**047**	**016**	**034**
Date	7/25/2015	7/22/2015	7/21/2015	7/24/2015	7/23/2015	7/24/2015	7/23/2015	7/22/2015	7/21/2015
Bottom of Reach Easting	631749	633225	634441	633613	634640	631644	629972	629369	628919
Bottom of Reach Northing	4974329	4972634	4971911	4978380	4979069	4972991	4972027	4971903	4971564
Water Temperature (°C)	--	--	--	--	--	--	--	--	--
Air Temperature (°C)	--	--	--	--	--	--	--	--	--
Average Gradient (%)	4.3	4.0	5.7	3.0	5.5	2.3	1.0	3.8	7.4
Unit Length (m)	100	100	100	100	100	100	100	100	100
Average Unit Width (m)	5.7	4.5	3.4	5.9	2.8	4.6	4.4	3.6	3.3
Species/Count									
Chinook (50-80)									
Chinook (81-130)									
Chinook (>130)									
Chinook (Adult)									
Rainbow Trout (<50)									
Rainbow Trout (51-100)									
Rainbow Trout (101-150)									
Rainbow Trout (151-200)									
Rainbow Trout (201-250)									
Rainbow Trout (>250)				1					
Bull Trout (<50)				8	12				
Bull Trout (51-100)				2	6				
Bull Trout (101-150)				1	1				
Bull Trout (151-200)				3					
Bull Trout (201-250)				2					
Bull Trout (251-300)									
Bull Trout (301-350)									
Bull Trout (351-400)									
Bull Trout (>400)									
Cutthroat Trout (<50)	2								
Cutthroat Trout (51-100)		3	4	1	1			1	1
Cutthroat Trout (101-150)		10	6	2		1	3	4	7
Cutthroat Trout (151-200)	1	7						1	1
Cutthroat Trout (201-250)	1	1				3		1	
Cutthroat Trout (>250)				1		2			
Total Fish Count	4	21	10	21	20	6	3	7	9

Transactions of the American Fisheries Society 150:147–159, 2021
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ISSN: 0002-8487 print / 1548-8659 online
DOI: 10.1002/tafs.10286

ARTICLE

Effects of Artificial Lighting at Night on Predator Density and Salmonid Predation

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Abstract

Predation of juvenile salmonids within California's Sacramento–San Joaquin Delta (the Delta) has been identified as a contributing factor to low survival during out-migration through the system. Artificial lighting at night (ALAN) may contribute to increased levels of salmonid predation by attracting predators and prey, increasing predator reaction distance, and boosting foraging success. To assess ALAN effects on predator (piscivorous fishes) density and the relative predation risk of Chinook Salmon *Oncorhynchus tshawytscha* smolts in the Delta, we preformed field-based experiments with introduced ALAN. We used adaptive resolution imaging sonar cameras to generate predator density estimates in light and dark treatments throughout nightly experiments at 30-min intervals. We simultaneously deployed predation event recorders to estimate the impact of ALAN intensity (lux) on relative predation risk of Chinook Salmon smolts. Early in the night (1–3 h past sunset), predator density and relative predation risk of smolts were unrelated to ALAN. However, late in the night (3–5 h past sunset), ALAN presence increased predator density, and the relative predation risk of juvenile salmonids increased with increasing lux. Predation risk was also positively related to predator density, and increased late-night predator density under ALAN, coupled with late-night foraging benefits of ALAN, likely contributed to the lux–risk relationship. The exact mechanism behind this discrepancy between early- and late-night trends is unknown and could be a result of our experimental design or the predator community sampled here. However, if these temporal trends prove robust to future investigations, late-night lighting reduction campaigns during out-migration could maximize the human benefits of ALAN while minimizing the negative impacts on salmonids. Overall, our findings align with others and suggest that ALAN increases juvenile salmonid predation. Although many questions remain unanswered, it appears that reducing artificial illumination is a practical management strategy to reduce predation.

The diel light cycle is a driving force behind animal behavior and ecological interactions (Navara and Nelson 2007; Hölker et al. 2010a, 2010b). However, abundant and increasing artificial lighting at night (ALAN) disrupts ecological processes across a wide range of taxa (Gaston et al. 2013, 2014a; Zapata et al. 2019). Artificial lighting at night affects animal migration and orientation, foraging and predation, reproduction, and even human health (Navara and Nelson 2007). Although ALAN impacts in terrestrial ecosystems are apparent, ALAN also affects

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Corrections added on 27 February 2021, after first online publication
Received June 23, 2020; accepted November 23, 2020

aquatic environments, given that many urban areas are near coastlines, estuaries, and freshwater shorelines (Davies et al. 2014; Jechow and Hölker 2019; Zapata et al. 2019). The presence of ALAN in aquatic environments attracts prey species and piscivorous fishes (Becker et al. 2011; Lehman et al. 2019), increases the foraging efficiency and predatory behavior of fishes (Bolton et al. 2017), and increases the reaction distance and prey consumption rate of fishes (Vogel and Beauchamp 1999; Mazur and Beauchamp 2003, 2006). Therefore, ALAN in the aquatic environment may increase piscivorous fish predation rates and negatively impact prey survival.

Juvenile salmonids face a gauntlet of potential predators as they migrate from freshwater to marine environments (Poe et al. 1991; Rieman et al. 1991; Osterback et al. 2013). Predation risk is exacerbated in clear waters (Gregory and Levings 1998) and out-migrating salmonids employ nocturnal migrations as one strategy to minimize this risk (Chapman et al. 2013; Clark et al. 2016; Furey et al. 2016). However, in many ecosystems, salmonid out-migration traverses anthropogenically altered habitat and urban centers (Michel et al. 2013, 2015; Schroeder et al. 2015), likely leading to increased ALAN exposure (Jechow and Hölker 2019; Zapata et al. 2019). Given that ALAN aggregates and slows out-migrating salmon, attracts predators (including fishes, birds, and mammals), and increases piscivore consumption of salmonids (Yurk and Trites 2000; Tabor et al. 2004; Celedonia et al. 2011; Tabor et al. 2017), increased migratory ALAN exposure likely increases juvenile salmonid predation risk and mortality.

The Sacramento–San Joaquin River Delta (the Delta) is a heavily modified tidal freshwater system consisting of large, interconnected waterways that drain the Central Valley of California (Monsen et al. 2007; Lehman et al. 2019). The Delta provides water for irrigation and municipalities across a large portion of the state and habitat for threatened and endangered fish species (Mount and Twiss 2005; Williams 2006). Four runs of Chinook Salmon *Oncorhynchus tshawytscha* (winter, spring, fall, and late fall) and steelhead *O. mykiss* must pass through the Delta during both juvenile and spawning migrations (Williams 2006). Populations of these salmonids have drastically declined over the past century, and poor juvenile survival is a contributing factor (Yoshiyama et al. 1998; Williams 2006; Lindley et al. 2009). Current survival estimates of out-migrating juvenile Chinook Salmon, or smolts, through the Delta are as low as 5% (Buchanan et al. 2013, 2018) and are likely affected by predation from nonnative fishes (Grossman 2016; Buchanan et al. 2018; Michel et al. 2018).

Management strategies that minimize out-migrant mortality are needed to rebuild salmonid populations. Decreasing the interactions of juvenile salmonids and their predators may be a way to lower predation-induced mortality. Removing anthropogenic contact and aggregation points between predators and prey is likely one way to decrease these interactions (Lehman et al. 2019). Major metropolitan areas located throughout the Delta (e.g., Sacramento, Stockton, and Antioch, California), and elsewhere along rivers of the California Central Valley, likely produce an abundance of ALAN, and ALAN has been identified as a prevalent predator–prey contact point (Lehman et al. 2019). Therefore, we investigated whether ALAN affected piscivorous fish (predator) density and the relative predation risk of Chinook Salmon smolts in the Delta. This study was an important first step in determining if ALAN removal or intensity reduction may be a viable management strategy to help lower predation mortality in the Delta and other waterways.

METHODS

Study system.— Prior to ocean entry, all out-migrating Central Valley Chinook Salmon pass through the heavily modified Delta and San Francisco Estuary (Nichols et al. 1986), typically in the spring (Williams 2006). During out-migration, nocturnal movements are preferred in all river reaches except the estuary (Chapman et al. 2013), and migration speed is slowest in the Delta (Michel et al. 2013). Salmon released in the Sacramento River take, on average, 12.4 d to reach the Delta and 13.2 d to migrate from the Delta to the ocean (Michel et al. 2013). Most Delta land is below water level, waterways are channelized and leveed, and riprap covers 73% of mainstream shorelines (Mount and Twiss 2005; Lehman et al. 2019). Invasive fishes and vegetation are prevalent in the Delta (Underwood et al. 2006; Brown et al. 2007) and may contribute to poor survival of out-migrating salmonids (Grossman 2016; Michel et al. 2018; Zeug et al., in press).

Delta piscivores consist of fishes, birds, and mammals. Piscivorous fishes that may consume juvenile salmonids are dominated by invasive species, including Striped Bass *Morone saxatilis*, Largemouth Bass *Micropterus salmoides*, other black basses *Micropterus* spp., sunfish (*Lepomis* spp. and *Pomoxis* spp.), and catfish (Ictaluridae) (Grossman 2016; Michel et al. 2018). The Sacramento Pikeminnow *Ptychocheilus grandis* is the only significant native piscivorous fish in this system (Brown and Moyle 1981). Avian and mammalian piscivory within the Delta is poorly studied (Grossman 2016). However, avian salmonid predation occurs in San Francisco Bay (Evans et al. 2011; Adrean et al. 2012; Riensche et al. 2012), and piscivorous birds that occur in the Delta (e.g., terns, gulls, cormorants, and herons) depredate salmonids elsewhere (Osterback et al. 2013; Evans et al. 2016; Sherker 2020). Mammalian (e.g., river otters *Lutra canadensis*, harbor seals *Phoca vitulina*, and sea lions) depredation of juvenile salmonids also occurs in other ecosystems (Dolloff 1993; Yurk and Trites 2000; Chasco et al. 2017) and is possible in the Delta.

Experimental design.— We conducted our study during spring 2019 (April 22, 2019 to June 7, 2019) at five sites in the western Sacramento–San Joaquin Delta (Figure 1). For each of the first two study weeks, predation experiments occurred on four consecutive nights within a single site (L3, L4; Figure 1). We randomly chose the light location within experimental reaches (upstream or downstream) without replacement to ensure that both locations were equally represented each week. After the first 2 weeks, we found an insignificant effect of light location on relative predation risk with a Cox proportional hazards model ($P = 0.69$; Cox 1972). Therefore, we only visited new experimental sites on two consecutive nights, and we randomly selected the single light location before experiments began. Experiments occurred at three more sites (L6, L7, L8; Figure 1) using this design; however, predation at these sites was almost nonexistent (mean 2% predation). Therefore, we revisited the second site (L4) over two more weeks and employed the two-night experiment once each week.

We delineated our experimental reaches within each site with floating lines, measuring 200 m in length (alongshore) and 25–50 m in width (perpendicular to shore). All reaches had riprapped shorelines, and we defined within-reach treatments as the 100-m upstream and downstream sections of the reach. We mounted the artificial light source on a 4-m pole and placed it at the waterline halfway within the upstream (50 m into reach) or downstream (150 m into reach) portion of the reach, depending on the experimental treatment. The light source was two LED floodlights, which emitted 20,000 lx, and it was oriented parallel with the waterline (Figure 2).

To assess the relationship of ALAN intensity with the relative predation risk of juvenile salmon, we used predation event recorders (PERs; Demetras et al. 2016). Each PER was an independent drifting GPS-enabled platform baited with a tethered hatchery-origin live Chinook Salmon smolt (mean TL = 87 mm; SE = 0.01) at 1 m depth. To tether each smolt, we looped fluorocarbon fishing line through their mouth and operculum. We attached this tether to a magnet that initiated a timer when it was pulled by a predation event (event time). To determine the exact location and time of predation events, we subtracted event time from deployment end time. On average, we had 82 (SE = 3.6) PER deployments each night that typically began 1 h after sunset and continued for 4 h. To ensure that PERs traversed both light and dark treatments, we deployed PERs at the reach end where tidal flow carried them through the entire reach and spread them along the width of this end. When PERS reached the opposite end of the 200-m reach, they were collected and returned to the starting point. Before redeployment, we ensured that each PER had an active tethered smolt in good condition and used smolts two to three times when no predation occurred.

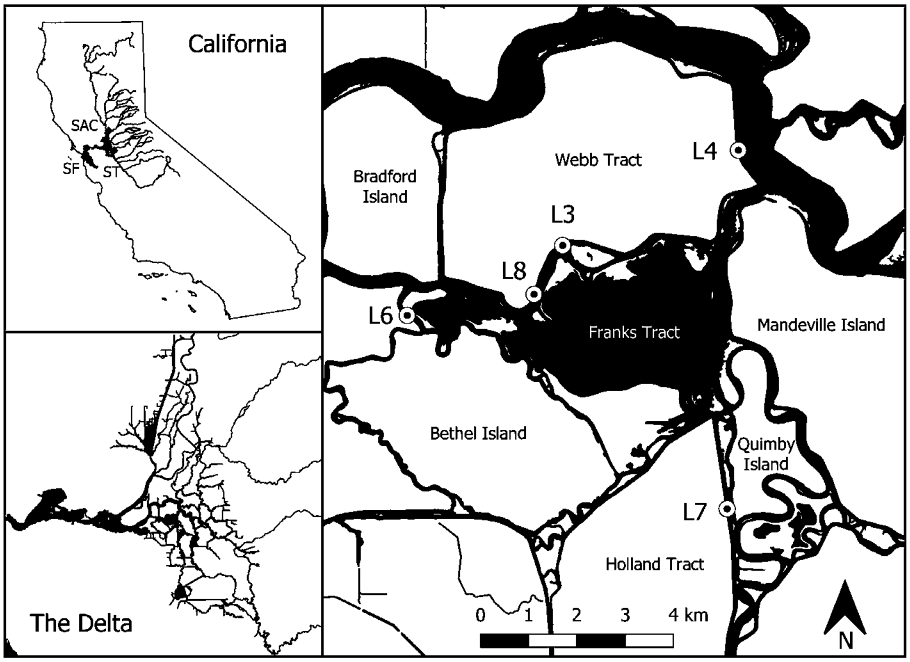

FIGURE 1. Experimental sites within the Sacramento–San Joaquin Delta. The top left panel is the state of California and Central Valley rivers. Sacramento (SAC), Stockton (ST), and San Francisco (SF) are major cities along salmonid out-migration routes denoted by gray diamonds. The lower left panel is the extent of the Sacramento–San Joaquin Delta, and the main panel shows the location of experimental sites.

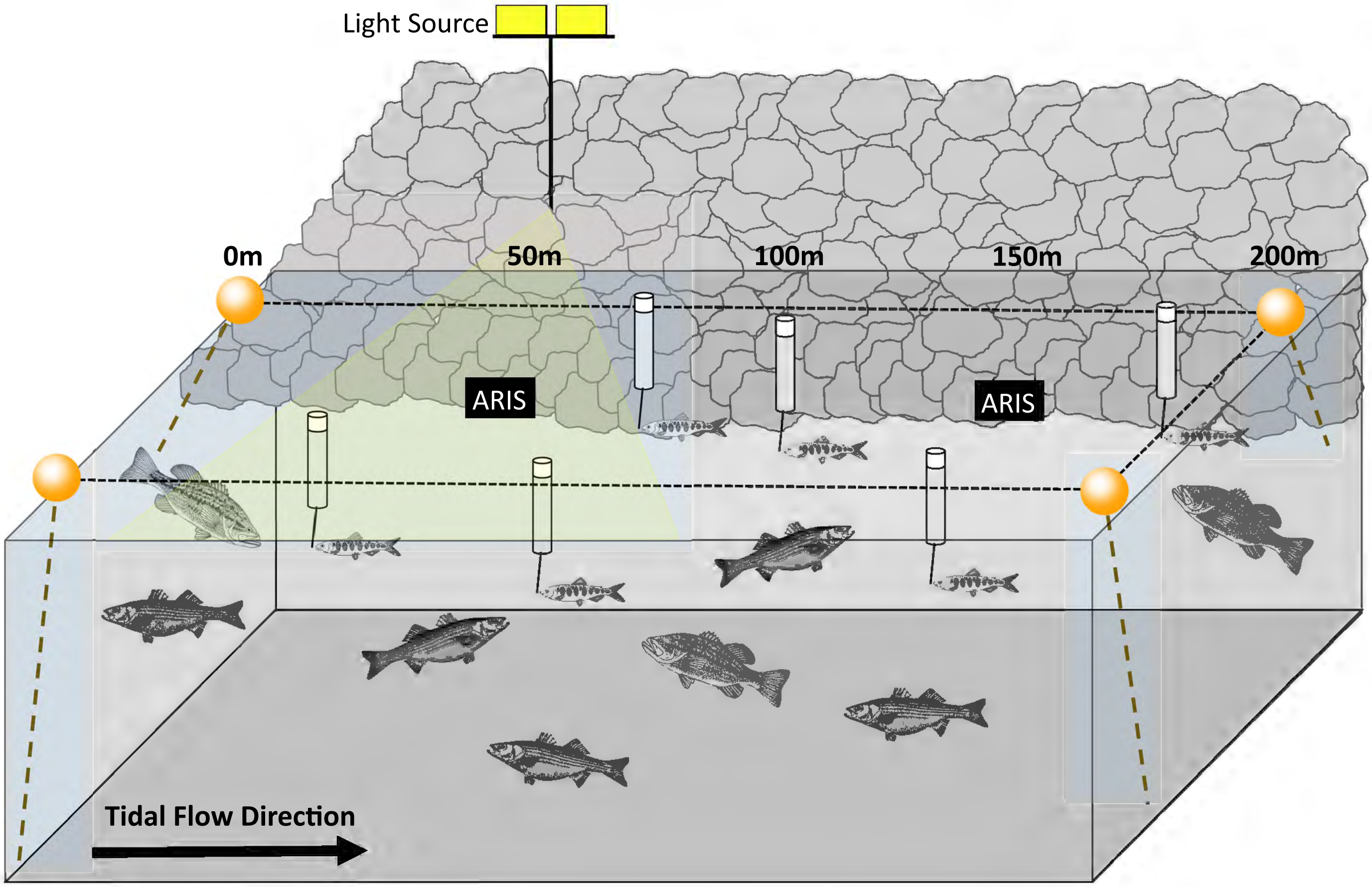

FIGURE 2. Schematic of an experimental study reach. We positioned floating lines parallel to the shoreline to ensure that predation event recorders (cylinders) drifted through water that our introduced LED light source (yellow rectangles) illuminated. Largemouth Bass and Striped Bass represent potential predators. Adaptive resolution imaging sonar (ARIS) cameras and the artificial light source are depicted at their respective positions within the experimental design.

Predation event recorders do not provide an estimation of absolute predation rates as tethered prey are less able to evade capture. However, PERs provide a cost-effective method to investigate drivers of predation and predator response that would be difficult to detect otherwise (Demetras et al. 2016; Michel et al. 2020a, 2020b). Our PERs were slightly modified versions of those described in detail in Demetras et al. (2016). Specifically, we constructed PERs with 5.08-cm-diameter clear PVC pipe with the majority of components (GPS, timer, reed switch) contained within the PVC housing and sealed with a rubber end cap. Given the PERs' ability to capture precise predation locations and times, we were able to associate ALAN intensity (lux) with each observed predation event.

To compare predator density among light and dark treatments, we deployed ARIS (adaptive resolution imaging sonar; Sound Metrics) cameras in experimental reaches at 50 and 150 m (Figure 2). We positioned ARIS cameras at approximately 2 m depth, with one ARIS located directly offshore of the light source (light treatment) and the other at a distance of 100 m from the light source (dark treatment). Cameras continuously recorded from the start of PER deployments to the end, with a viewing window of 2–10 m, a –1° pitch, and a lens heading perpendicular to the reach length. In addition to among-treatment comparisons, ARIS cameras provided predator density data that we incorporated into our predation risk models.

Light surveys.— After all PERs were retrieved, we surveyed surface light intensity (lux) within experimental reaches from a motorized vessel using an optometer (International Light Technologies; ILT2400). We performed survey transects at the inside floating line, the middle of the reach, and the outside line. We measured light attenuation with depth directly parallel to the light source at the nearshore and offshore limits of the study site. Starting at the surface, we lowered the optometer at 0.5-m intervals until the bottom or 4 m was reached and held it for 1 min at each unique depth to record a mean lux value. To account for variation with distance from the light source and inherent variability among nights, we standardized lux at depth by dividing the value at each depth by the surface value from each cast. This value was light attenuation (At), and we fit the following exponential decay equation:

$$At = e^{[-(kd*depth+kt*turb)]},$$

where kd (attenuation with depth) and kt (attenuation with turbidity [$turb$]) were fit with both coefficients or only kd. The model of best fit had a corrected Akaike information criterion (AIC$_c$; –467.772) within 2 units of the model with the lowest AIC$_c$ (–469.411) and included the fewest parameters, kd (1.279) and depth.

We interpolated lux across experimental reaches using the "autoKrige" function (Hiemstra et al. 2009) in the automap package for R and assigned each PER GPS position a lux value at the water surface and at depth. This function generated an exponential variogram (we fixed this model type within the function) from each survey and used weighted least squares to select the bestfitting values of nugget, range, and sill. Using this model, we interpolated water surface lux over a 500,000-cell grid, which resulted in smooth, fine-scale lux values across experimental reaches for each night (Figure 3). We assigned interpolated surface lux values to each PER GPS position and used the above attenuation model to predict lux at 1 m depth—the approximate depth where tethered smolts drifted. If any PERs drifted outside of the survey bounds, we assigned the lux value from the nearest grid cell. Our lux meter malfunctioned during the second night of sampling at L7, so this night was removed from PER predation risk analysis.

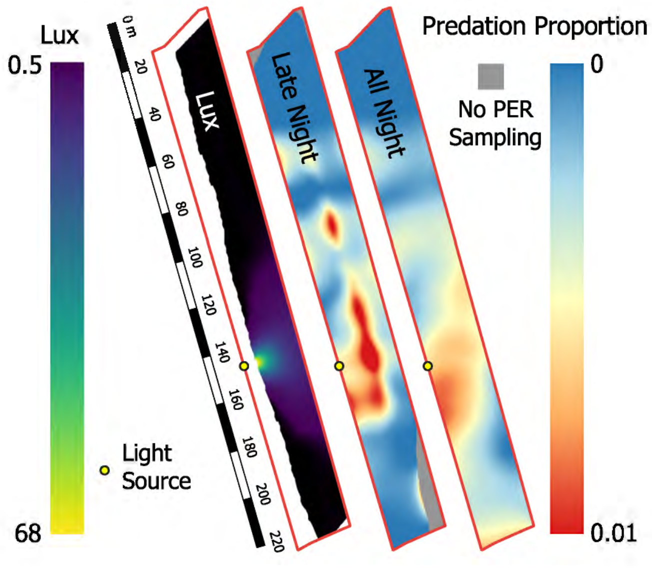

FIGURE 3. Interpolated lux values for site L4 on sampling night 8 (L4_8). Predation proportion rasters are shown for late-night (≥180 min past sunset) and all-night data sets. We produced predation proportion rasters by generating kernel densities of all predation event recorder (PER) predation events and dividing these by kernel densities of all PER GPS positions.

Processing and reduction of ARIS data.— To postprocess ARIS footage, we used Echoview version 10.2. This software removed background data and excess noise, and it identified all fish or fish-like objects (targets) ≥200 mm in the ARIS footage (Boswell et al. 2008). We then manually reviewed each fish-like object and removed all nonfish before analysis. Although both ARIS cameras were deployed with similar settings each night, frame rate differed between and within cameras, given inherent processing speed differences between computers throughout sampling nights. To account for differing frame rate and instances of Echoview assigning multiple unique identifiers to the same fish (double counting), we used fish density instead of fish counts for analysis. To calculate fish density, we exported total beam sampling volume and the total number of fish pings in 30-min increments from each ARIS (light, dark ALAN treatments) on each experimental night. We then divided the number of fish pings by beam volume within the corresponding 30-min time frame to obtain fish per m^3 for each 30 min of sampling within each treatment on a given night. The number of fish pings and beam volume within a given time frame are inherently tied to frame rate. For example, ARIS A has a frame rate of 4 frames/s and ARIS B has a frame rate of 8 frames/s, and each ARIS samples 4 m^3 each frame. Assuming that one fish is continually present on both ARIS A and B for an entire 30-min window, ARIS A would sample 28,800 m^3 and have 7,200 fish pings in 30 min, and ARIS B would sample 57,600 m^3 with 14,400 fish pings. The resulting 30-min fish density for both hypothetical ARIS cameras would be 0.25 fish/m^3 per 30 min. The ARIS in the light treatment malfunctioned during the sixth night of sampling at L4 and density data were not recorded for this night; therefore, it was censored from all statistical analyses. Although we did not identify large fish species, it is likely that these fishes are mainly piscivores (see Discussion), and fish density will be referred to hereafter as predator density.

Statistical analysis.— To determine if ALAN altered predator density and if predator density was related to time of night, we analyzed ARIS data with a generalized linear mixed-effects model (GLMM) using the lme4 package in R (Bates et al. 2015; R Core Team 2019). We fit the GLMM using the Gamma family and a log link, given that the data distribution of 30-min predator density was nonnormal and nonnegative. To remove the few zeros in the data set ($n = 13$; 5.75% of data) and allow the Gamma model to run, we added 1×10^{-9} to all density measurements before GLMM analysis. We included ALAN treatment, minutes past sunset (30-min bin increments 1–8), and the interaction of ALAN and minutes past sunset as independent variables in the GLMM. To account for potential differences in baseline predator density among sampling nights and the fact that each ALAN treatment was resampled throughout each night, we included a random effect of sampling night in the GLMM. To investigate the interaction of minutes past sunset and ALAN on predator density, we split the data into early (1–3 h past sunset) and late-night (3–5 h past sunset) subsets and ran GLMMs without the interaction term.

To assess whether the relative predation risk of Chinook Salmon smolts was related to lux, time of night, and predator density, we evaluated Cox proportional hazards models with the R function "coxph," in the survival package (Cox 1972; Therneau 2015). We included lux, minutes past sunset, mean 30-min predator density among light and dark treatments throughout experimental nights, and the interaction of lux and minutes past sunset as independent variables. To investigate the interaction of minutes past sunset and lux, we split the data into early (1–3 h past sunset) and late-night (3–5 h past sunset) subsets and ran Cox models without the interaction term. We checked proportional hazards assumptions of Cox models using the "cox.zph" function in R, within the survival package (Therneau 2015). Although lux at depth was predicted from surface lux, we evaluated another set of Cox models using this variable instead of surface lux to demonstrate how predation risk responded to changes in lux at depth. To investigate the relative effect on predation risk of each variable, we also ran the Cox models using scaled (independent) variables. Neither of these approaches changed overall model fits or significance; however, they provided further insight that we might have missed in original model output.

RESULTS

We found that predator density was positively related to ALAN presence late in the night. When we analyzed all density data, the effects of minutes past sunset and ALAN presence on predator density were nonsignificant; however, a significant interaction between these two variables was present (Table 1). In the early-night model, neither minutes past sunset nor ALAN presence had a significant relationship with predator density. While in the late-night model, predator density was predicted to increase by a factor of 3.96 in the presence of ALAN (Figure 4A), and no relationship of minutes past sunset was detected (Table 1). This difference in the ALAN effect between early- and late-night models demonstrates why the interaction of ALAN and minutes past sunset was significant in the overall model.

Relative predation risk of Chinook Salmon smolts increased with artificial illumination intensity (lux) late in the night and was positively related to predator density in all models (Figures 3, 4B, and 5). In the full-night model, relative predation risk had a positive relationship with predator density, a negative relationship with minutes past sunset, and a positive relationship with the interaction of minutes past sunset and lux. However, no overall relationship of relative predation risk with lux was detected (Table 2). Neither minutes past sunset nor lux was significantly related to predation risk in the early-night model, but the positive relationship with predator density remained. In the late-night model, relative predation risk was predicted to increase by factors of 1.030 (scaled factor = 1.217) and 1.502×10^{19} (scaled factor = 1.987) for each unit increase in lux and predator density, respectively, and no significant effect of minutes past sunset was detected (Table 2; Figure 5). For each unit increase of lux at 1 m depth in the late-night model, the raw factor change was greater (1.111). However, this increase was

TABLE 1. Results of predator density generalized linear mixed models for all data, early-night (1–3 h past sunset), and late night-data subsets (3–5 h past sunset). Coefficient estimates of the presence of ALAN, minutes past sunset (Min), and their interaction are given. Exponentiated estimates (e^{est}), standard error (SE), t, and P-values are also reported for each parameter.

	Estimate	e^{est}	SE	t	P
		All data			
ALAN	−0.310	0.734	0.448	−0.691	0.490
Min	−0.015	0.985	0.060	−0.254	0.799
ALAN × Min	0.212	1.237	0.090	2.358	0.018
		Early data			
ALAN	0.207	1.230	0.280	0.740	0.459
Min	0.022	1.022	0.108	0.201	0.841
		Late data			
ALAN	1.376	3.957	0.297	4.627	<0.001
Min	0.108	1.114	0.140	0.771	0.441

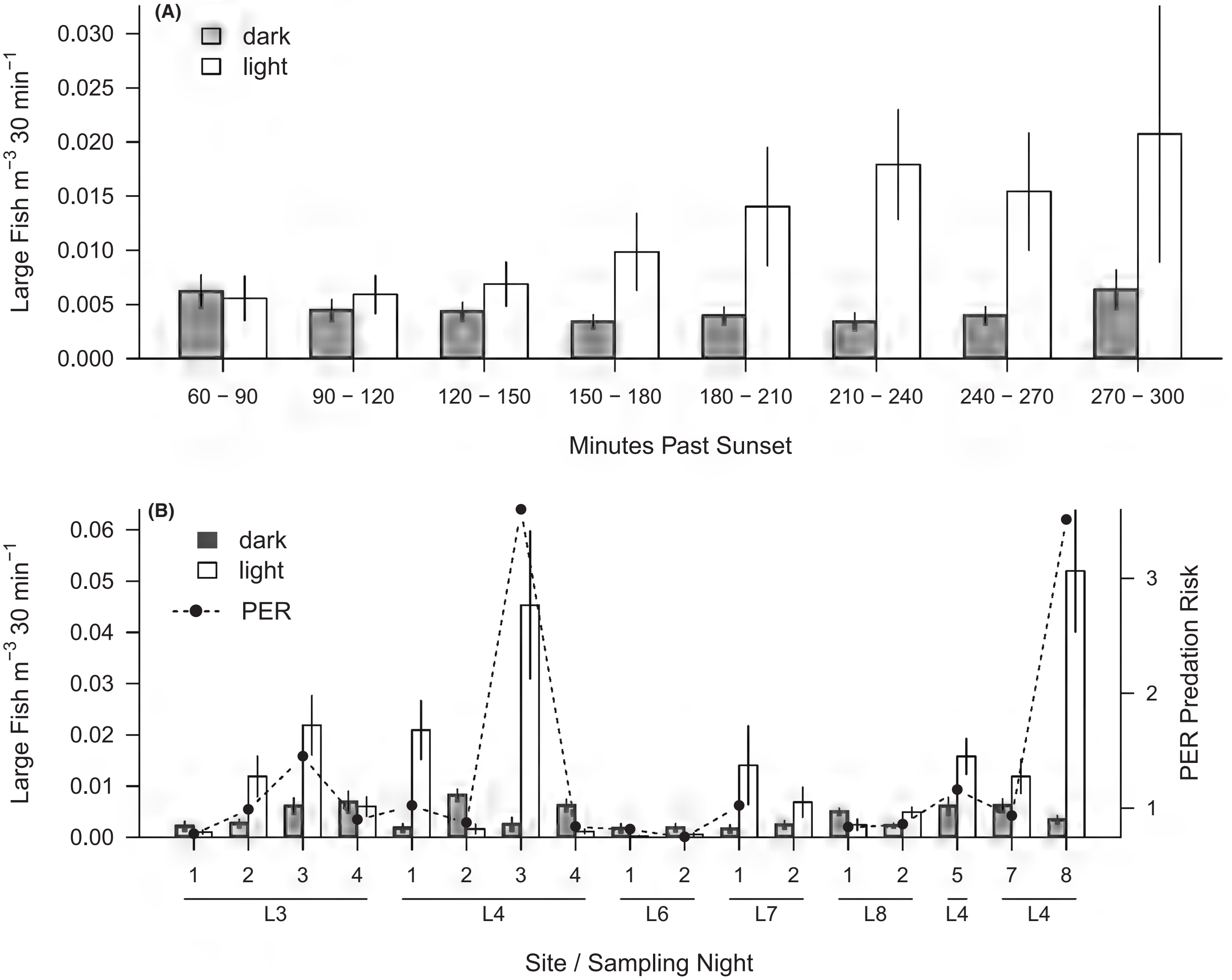

FIGURE 4. Mean large fish (≥200 mm TL, likely predators) density (large fish/m^3 per 30 min [±1 SE]) **(A)** across each time bin within both light and dark treatments, and **(B)** across each experimental night (±1 SE) within both light and dark treatments. The estimated nightly mean PER predation risk (filled circles) is shown from the overall Cox model. Continuous lines under experimental nights represent consecutive experimental nights at a given site.

because lux at depth only varied from 0 to 20, while lux at the surface varied from 0 to 72 (Table 2). Similar to the predator density models, the significant interaction of lux and minutes past sunset in the overall model was the result of a significant effect of lux late in the night with no effect early in the night on relative predation risk.

DISCUSSION

With continuing human development along rivers, estuaries, and coastlines, it will be increasingly important to consider the impacts of ALAN on aquatic organisms and ecosystems (Davies et al. 2014; Jechow and Hölker 2019; Zapata et al. 2019). Elsewhere, ALAN has attracted young salmonids and their predators, resulting in elevated predation rates (Tabor et al. 2004, 2017). Similarly, introduced ALAN in the Delta increased predator density and relative predation risk of Chinook Salmon smolts; however, these effects were only detected 3 h past sunset and later. These results indicate that ALAN reduction may decrease predation rates and mortality of out-migrating salmonids in the Delta and are an important first step in assessing ALAN impacts along out-migration routes in the California Central Valley and elsewhere.

As with any field experiment, there were notable environmental limitations and assumptions associated with our study. First and foremost, our metric of relative

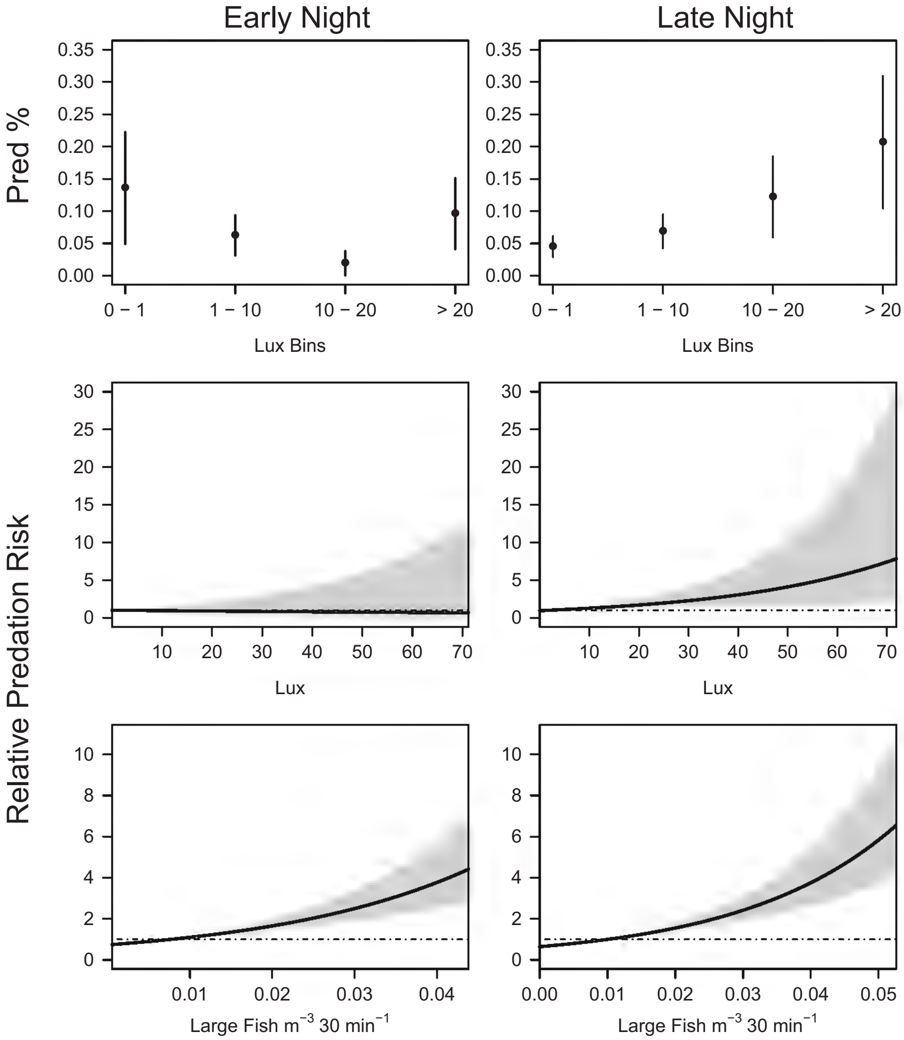

FIGURE 5. The nightly mean percentage (±1 SE) of PER observations when predation events occurred (Pred %) binned across increasing lux values (top row) for early-night (1–3 h after sunset; column 1) and late-night (3–5 h past sunset; column 2) data subsets. Predicted relative predation risk of increasing lux (row 2) and large fish (≥200 mm, likely predators) density (row 3). Predictions (solid black line) above the horizontal dashed line (risk = 1) indicate increased relative predation risk and below the dashed line represent decreased risk, with 95% confidence intervals in gray. The mean observation of each variable within each model is where the solid black line crosses the dashed line.

predation risk focused only on predators and did not account for any prey effects, given that we used tethered smolts. Nonetheless, the PER technique has been used to investigate environmental drivers of predation (Demetras et al. 2016; Michel et al. 2020a, 2020b), and the drifting PER tether likely mimics natural prey behavior better than traditional fixed-tethering experiments. Given this tethering limitation and the focus on predators, future research should determine how ALAN affects free swimming out-migrating smolts. Detailed analysis of past, current, and future smolt telemetry data comparing migration speed, timing, and mortality in illuminated and dark river reaches (e.g., Celedonia et al. 2011) is one way to elucidate these ALAN effects. Field experiments where free-swimming acoustically tagged smolts are released under artificially illuminated and dark conditions coupled with a high-resolution telemetry array could also be used to determine if ALAN affects smolt movement and migration. Artificial illumination may reduce migration speed and survival because salmon out-migration is predominately nocturnal (Chapman et al. 2013; Clark et al. 2016; Furey et al. 2016) and ALAN attracts and slows juvenile salmonids (Tabor et al. 2004, 2017; Celedonia et al. 2011; Riley et al. 2013). This attraction may bring salmonids closer to shore, exposing them to mammalian (e.g., river otters; Dolloff 1993) and avian piscivores (e.g., herons;

TABLE 2. Results of Cox proportional hazard models for all data, early-night (1–3 h past sunset), and late-night (3–5 h past sunset) data subsets. Predictor variables include light intensity (Lux) or lux at depth (Lux [Depth]), minutes past sunset (Min), and 30-min predator (fish ≥200 mm) density (Pred Den). The coefficient (*coef*) column indicates the direction (positive versus negative) of the effect of each predictor variable on relative predation risk and coefficient standard error (SE [*coef*]) is reported. The e^{coef} columns report the relative predation risk change for each unit increase in predictor variables of both raw and scaled variables. The *z* column is the Wald statistic value, which evaluates whether the coefficient of a given variable is significantly different from 0, and the significance value is indicated in the *P* column. The *P*-value for the "cox.zph" test (which checked proportional hazards assumptions of Cox models) is also reported in the *p_zph* column.

	coef	raw e^{coef}	SE (*coef*)	scaled e^{coef}	*z*	*P*	*p_zph*
			All data				
Lux	−0.061	0.940	0.041	0.670	−1.494	0.135	0.782
Lux (Depth)	−0.220	0.803	0.147	0.670	−1.494	0.135	0.782
Min	−0.004	0.996	0.001	0.472	−3.123	0.002	0.227
Pred Den	42.3099	2.369×10^{18}	4.228	1.843	10.006	<0.001	0.590
Lux × Min	0.0004	1.0004	0.0002	1.625	2.228	0.026	0.696
			Early data				
Lux	−0.006	0.994	0.022	0.964	−0.267	0.789	0.879
Lux (Depth)	−0.021	0.979	0.078	0.964	−0.267	0.789	0.879
Min	−0.006	0.994	0.004	0.429	−1.723	0.085	0.490
Pred Den	41.111	7.150×10^{17}	6.501	1.708	6.323	<0.001	0.591
			Late data				
Lux	0.029	1.030	0.009	1.217	3.017	0.003	0.770
Lux (Depth)	0.105	1.111	0.035	1.217	3.017	0.003	0.770
Min	−0.006	0.994	0.003	0.252	−1.902	0.057	0.281
Pred Den	44.156	1.502×10^{19}	5.979	1.987	7.385	<0.001	0.404

Sherker 2020), as well as benthic (e.g., sculpin and catfish) and vegetation-associated (e.g., Largemouth Bass) piscivorous fishes (Michel et al. 2018, 2020a). If ALAN sufficiently slows out-migration, increased water temperatures, low river flows, and prolonged exposure to predators along the out-migration corridor could also reduce salmonid survival (Henderson et al. 2019; Michel et al. 2020a). Although our study found a response of predators to ALAN, future investigations focused on prey responses will help elucidate if ALAN reduction is a viable restoration strategy.

While we were not able to identify the large fishes used for predator density calculations to species, it is likely that many were piscivores, given the positive relationship between density and relative predation risk. Furthermore, we conducted opportunistic hook-and-line sampling on a few occasions prior to nightly experiments, and Largemouth Bass and Striped Bass were caught and released at site L4. These species are common predators of salmonid smolts in the Delta (Sabal et al. 2016; Michel et al. 2018) and were likely a major component of the predator community in this study. Because this study was conducted at night, we could not use traditional video recordings to identify PER predators. Coupling underwater infrared light sources with traditional video (Mazur and Beauchamp 2003) may aid in nighttime predator community identification without introducing additional light in the visible spectrum (Jordan and Howe 2007; Horodysky et al. 2010; Mitchem et al. 2018). However, the sampling area of traditional video would likely be less than it was for our ARIS cameras, and traditional video would be problematic in turbid waters. Combining ARIS with infrared-assisted video analysis could be advantageous for low-light predator density and community analysis. Our predator density metric also did not differentiate between individual fish remaining under the light source or new individuals being attracted to the light, distinctions that are potentially important but are pooled in our analysis. Future work should investigate differences in fish behavior in dark and illuminated treatments to determine how ALAN may change the behavioral response of fishes.

Predator density was greater in ALAN treatments and relative predation risk of Chinook Salmon smolts increased with increasing ALAN intensity (lux) 3 h past sunset and later. However, no ALAN impacts on density or predation risk were detected early in the night. These discrepancies may be driven by ambient light levels and the relationship of predation success with light. Foraging efficiency and predation success of piscivorous fishes increases with increasing light levels, but fish can also successfully forage in low light (McMahon and Holanov 1995; Mazur and Beauchamp 2003, 2006). Mazur and Beauchamp (2003) suggested that salmonids have a foraging threshold around 1 lx, with success continually increasing until it asymptotes around 20 lx. However, for Largemouth Bass, this threshold could be as low as ambient moonlight (0.003 lx; McMahon and

Holanov 1995). Early in experimental nights, ambient light levels may have been sufficient for successful foraging and depredation throughout experimental reaches, resulting in similar predator densities and predation risk throughout the reach. After 3 h past sunset, an ambient light foraging threshold may have been reached where predation success was diminished in unilluminated reach sections. The additional light provided by ALAN likely allowed for continued unimpeded predation success in illuminated portions of the reach. This increased success likely led to greater predator density in ALAN treatments and increased predation risk with increasing lux late in the night. Therefore, the overall decrease in predation risk with elapsed minutes past sunset may be explained by decreasing successful foraging area with time.

The late-night relationship of elevated predation risk with increasing lux was also likely driven by increased predator density in ALAN treatments, given that predation risk was positively correlated with predator density in all models. The increased foraging success of predators in ALAN would have also contributed to the elevated predation risk with lux. However, decoupling these two drivers was not possible in our experiment. To elucidate foraging thresholds and quantify the effects of ambient illumination on predation risk, future studies should deploy a light meter throughout the night to monitor background illumination.

The lack of ALAN effects on predation early in the night could also be a result of the predator community we sampled and our experimental lights. As mentioned above, predation risk in our study was higher earlier in the night, but ALAN did not affect density or predation risk during this time. Assuming that the majority of our predators were roving channel-associated fishes (e.g., Striped Bass), it may have taken time for them to cue into the light, which we established each night. If our light was a permanent fixture, perhaps fishes and other piscivores would have established nocturnal feeding habits under this fixture early in the night. For example, harbor seals that fed on out-migrating salmonids under an illuminated bridge were most abundant 1–1.5 h after nightfall and decreased as the night progressed (Yurk and Trites 2000). It is also possible that our experimental ALAN attracted prey fishes, which in turn attracted predators (Becker et al. 2011), but this mechanism took time to establish. Future studies could replicate our experiment at existing artificial illumination sources to see if the delayed ALAN effect exists at established light sources across variable predator communities. Recording ARIS footage continuously at illuminated and unilluminated sites could also determine how light impacts prey and predator density on a 24-h cycle (e.g., Becker et al. 2011).

Another pertinent direction for future research that would benefit ALAN management is to determine a minimum lux value that does not impact fishes. Our experiment did not empirically test variable lux intensity; however, we did sample a large range of lux values that may provide insight into predator response. If we fit a penalized spline to the lux predictor in our late-night Cox model, predation risk does not increase until after 8 lx is reached. A similar trend can be seen in the top right panel of Figure 2, with greater increases in predation percentage after 10 lx. However, we did not use this spline in our final model, given that the linear fit was much better ($\Delta AIC_c =$ 12.33), so this value should be interpreted with caution. Additionally, this minimum value may only be relevant to the system and predator community studied here. Previous work has suggested that ALAN intensities should remain as low as possible (<0.1 lx) to mitigate impacts on salmonids during out-migration (Tabor et al. 2004, 2017). To determine a minimum lux management goal, future experimental tests of ALAN intensity with variable treatments among experimental nights are needed.

The discrepancies between early- and late-night ALAN effects on predator density and predation risk could prove useful for ALAN management. For humans, artificial illumination is one of the building blocks of modern society and many social, recreational, and economic benefits result from ALAN (Doll et al. 2006; Hölker et al. 2010a; Gaston et al. 2014b). However, human activity is still highest during the day and early hours of the night, decreasing as the night progresses (Monsivais et al. 2017; Martín-Olalla 2018; Bhattacharya and Kaski 2019). Our results suggest that ALAN effects on predator density and predation may be minimal early in the night, but this trend could be driven by our experimental light design and predator community. If these temporal trends prove robust to future investigations, late-night lighting reduction campaigns during out-migration could maximize the human benefits of artificial illumination while minimizing the negative impacts on out-migrating salmonids. Overall, our findings align with others and suggest that ALAN increases juvenile salmonid predation (Tabor et al. 2004, 2017). Although many questions remain unanswered, it appears that reducing artificial illumination is a practical management strategy to reduce predation on out-migrating salmonids.

ACKNOWLEDGMENTS

We thank Tom Pham, Rebecca Robinson, Renae Logston, John Deane, Vanessa Lo, Flora Cordoleani, and Alison Collins for help with field work, as well as Alison Collins and Corey Phillis for assistance in study design. Funding was provided by the Central Valley Project Improvement Act Anadromous Fisheries Restoration Program administered by the U.S. Bureau of Reclamation (grant agreement R18AP00136). Fish handling was conducted under University of California, Santa Cruz

IACUC #KIERJ1604. The U.S. Fish and Wildlife Service Lodi office is thanked for one of the two ARIS cameras used in our study. Material and logistical support was provided by the National Marine Fisheries Service Southwest Fisheries Science Center. The views expressed are those of the authors and do not necessarily represent the views of the U.S. Bureau of Reclamation. Reference to trade names does not imply endorsement by the U.S. Government. There is no conflict of interest declared in this article.

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Received: 7 June 2023 | Accepted: 30 August 2023

DOI: 10.1002/vzj2.20286

Vadose Zone Journal

ORIGINAL ARTICLE

Heat transport from atmosphere through the subsurface to drinking-water supply pipes

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Assigned to Associate Editor Jingfeng Wang.

Abstract

Drinking-water quality in supply pipe networks can be negatively affected by high temperatures during hot summer months due to detrimental bacteria encountering ideal conditions for growth. Thus, water suppliers are interested in estimating the temperature in their distribution networks. We investigate both experimentally and by numerical simulation the heat and water transport from ground surface into the subsurface, (i.e., above drinking-water pipes). We consider the meteorological forcing functions by a sophisticated approach to model the boundary conditions for the heat balance at the soil–atmosphere interface. From August to December 2020, soil temperatures and soil moisture were measured dependent on soil type, land-use cover, and weather data at a pilot site, constructed specifically for this purpose at the University of Stuttgart with polyethylene and cast-iron pipes installed under typical in situ conditions. We included this interface condition at the atmosphere–subsurface boundary into an integrated non-isothermal, variably saturated (Richards') the numerical simulator DuMu^x 3. This allowed, after calibration, to match measured soil temperatures with ±2°C accuracy. The land-use cover influenced the soil temperature in 1.5 m more than the soil material used for back-filling the trench above the pipe.

1 | INTRODUCTION

In recent years, unusually warm water in drinking-water supply pipes has been observed and suspected to be caused by high air temperatures during the summers (Osmancevic & Hüsam, 2021). Such conditions pose a threat to drinking-water quality as elevated temperatures can lead to increased and undesired microbial activity and, hence, to deteriorated drinking-water quality. It is feared that this situation will worsen with climate change. Therefore, detailed knowledge on the influence of soil and recharge temperatures is needed for being able to estimate the temperature in the water of distribution networks.

Generally, higher soil temperatures over the last decades are confirmed (e.g., Chen et al., 2021) and have various effects on microbiological and chemical processes as well as on vegetation periods that vary with time. Therefore, there are several approaches to determine soil temperatures with simple models, validated for special regions. Sharma et al. (2010) were predicting soil temperatures up to 0.5 m, based on air temperature, using linear regression in Southern Mexico. Horton Brian (2011) worked with a coefficient model, based on rainfall and air temperature, covering entire Australia. Jungqvist et al. (2014) were interested in Swedish forests and worked with climate models. Rankinen et al. (2004) proposed a model, working with regional soil and climate parameters, predicting soil temperatures between 20 and 50 cm, interested on snow-covered soils.

Various codes to calculate water saturations are available, which are all based on solving Richards' equation, with different priorities. Simunek and Bradford (2008) give an overview of various simulation codes available, namely HYDRUS, MODFLOW-SURFACT, STOMP, SWAP, TOUGH2, and VS2DI. HYDRUS is commonly used for variably saturated non-isothermal conditions, for example, Steenpass et al. (2010). Guo et al. (2017) use PCSiWaPro to predict seepage and concentration of pollutants. The tool WASIM is often used to describe catchments, as for example in Burkina Faso (Idrissou et al., 2020), where a successful validation was performed.

There are many topics, related to soil temperature and saturation, such as drainage in cyclic loading (Komolvilas & Kikumoto, 2017) or the influence of groundwater temperature on river temperature (Kurylyk et al., 2015). Kelleners et al. (2016) worked on water flow in variably saturated soils, taking into account snow. Herrada et al. (2014) proposed a model to predict infiltration rates. Corona and Ge (2022) were focusing on high intensity precipitation events. Tran et al. (2016) showed that taking heat transport into account yields better results for an inversion scheme to define soil parameters. Sandor and Fodor (2012) demonstrated the relevance of a good vegetation model to quantify root uptake. Wessolek et al. (2022) focused on heat transport and worked with earth cables as heat sources.

Literature shows various approaches to describe the temperature evolution in soils forced from the atmosphere together with water flow. One approach is to reconstruct the soil thermal field from a single measurement, which was developed and validated by Wang (2012). Another approach, one that we are also following, is to solve the energy balance at the surface, which needs expressions for evapotranspiration and sensible heat flow. This is, for example, done in Saito et al. (2006) within the simulator HYDRUS, where evaporation is set as boundary condition (Bittelli et al., 2008) and evaporation is part of the solution.

This study uses an approach similar to HYDRUS, calculating sensible heat flow based on the Penman–Monteith equation (Allen et al., 1998) by using adequate measurements of meteorological data. The evaporation is then calculated from the latent heat flow, using the Bowen ratio, as described in Section 2.2.6. The goal of this study is to implement this kind of boundary condition in an open-access code, to calibrate against longer time series, and finally to obtain time series of the temperature of groundwater recharge which in this case improve the management of drinking-water networks during changing climatic conditions.

Core Ideas

- We measure and model the temperature of groundwater recharge.
- We solve the heat and water balance at the atmosphere–subsurface interface.
- Data: time series of hydrometeorological parameters, hydraulic, and thermal material properties.
- Goal: estimate temperatures relevant for buried drinking-water supply pipes.

We modeled the influence of the meteorological forcing functions, the soil structure, and the land-use cover on temperatures between ground surface and the subsurface. At a pilot site, we focus with our analysis up to a depth of 1.5 m, that is, a typical laying depth for drinking-water pipes in Germany. While applied to drinking-water supply pipes, this work is of general relevance as it describes and models the temperature of groundwater recharge driven by meteorological forcing functions. This temperature distribution and its evolution with climate change are critical for resilient urban infrastructure.

A pilot site at the University of Stuttgart has been constructed, where drinking-water pipes of PE and cast iron were installed at a depth of 1.50 m over a horizontal stretch of 15 m. The trench was back-filled with two different materials: gravelly material typical for conditions when pipes are buried below streets and the naturally occurring silty clay. Two different types of land cover, natural vegetation and asphalt, have been placed on the surface. The subsurface has been instrumented with 64 temperature sensors, 8 soil moisture sensors, and detailed hydrometeorological observations are available from the neighboring University of Stuttgart's weather station. In addition to the measurements, we adapted and employed a numerical simulator for estimating both soil temperatures and moisture contents. The study aimed at including the incorporation of the meteorological forcing and the variable saturation conditions.

Section 2 describes the test site and the numerical simulation methods, starting with a description of the pilot site. Furthermore, this section introduces the numerical model and the novel approach chosen to implement the conditions at the air–subsurface interface. The results section (Section 3) presents the comparison between measured data and numerical simulations with a calibrated set of parameters. The results are discussed in Section 4, followed by the conclusions (Section 5).

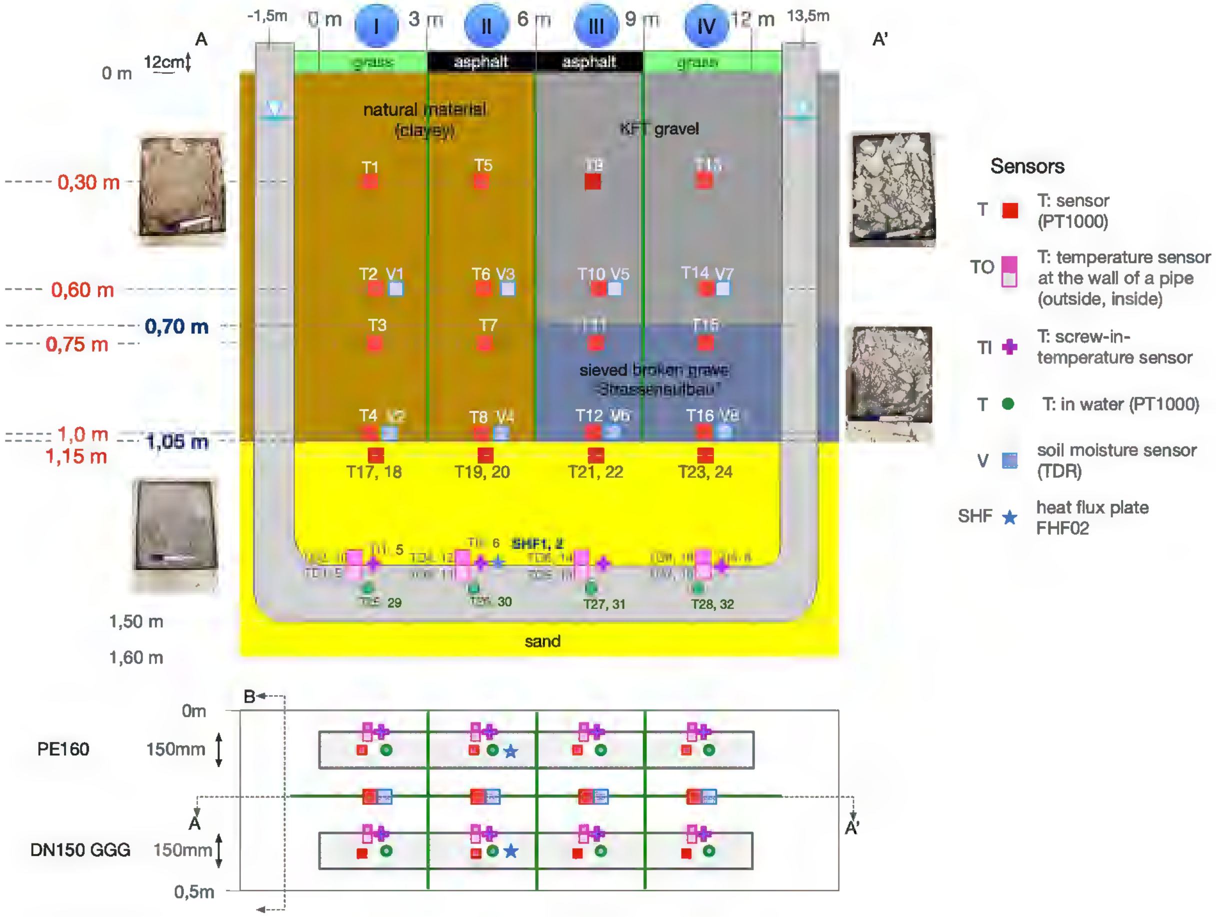

FIGURE 1 Setup of the pilot site.

2 | MATERIALS AND METHODS

This section provides a description of the pilot site, then the numerical model is introduced. A particular emphasis is put on the adaption of the model to be capable of including the meteorological forcing functions in the heat and mass balances.

2.1 | The experimental pilot site

Two pipes typical for drinking-water supply in terms of dimension (inner diameter: 150 mm) and material (PE and cast iron) were laid into a 1.50 m deep, 15 m long, and ≈1 m wide trench (Figure S1). The pipe was set on a slight angle into beach sand with a horizontal length of 12 m, Figure 1 shows the dimensions. At both ends of the pipes, vertical extensions above ground surface were constructed. The trench was backfilled with two types of porous media, (a) a silty clay, the naturally occurring material at the site and (b) gravelly material typical for street construction ("KFT gravel" and "sieved broken gravel"). The pipes were filled with drinking water. On the ground surface, two ≈12 cm thick layers of different land-use were established, (a) the naturally occurring vegetation ("grass") and (b) asphalt. Thus, in total, four combinations of porous media and land-use were replicated, the stations referenced by Roman numerals. Each station was insulated against thermal influences from the neighboring sites.

The trench was installed in direct vicinity to (https://lhg-902.iws.uni-stuttgart.de) the weather station of the University of Stuttgart, where the following hydro-meteorological variables are measured:

- long wave radiation incoming
- short wave radiation incoming
- air temperature in 2 m above ground
- wind velocity in 2 m above ground
- relative humidity in 2m above ground
- precipitation intensity

At the site, a stationary phreatic water table at a depth of ~5.1 m below ground surface has been observed, sitting on top of a local low-conductive layer ("Arietenkalk"). Atmospheric pressure was set constant to a value of 101,325 Pa, as its influence on vapor pressure was considered negligible.

The variables soil temperature and soil moisture were observed with 64 sensors (24 temperature sensors in the porous media, 16 temperature sensors in each pipe, 8 soil moisture sensors) with the aim to monitor the evolution of temperature and soil moisture from the ground surface toward the water pipes. Temperatures were measured using PT1000 sensors, soil moistures using "Teros 10" sensors from the metergroup. Time series of all variables were recorded in 5 min intervals, backed up, and stored in a hdf5 file using python (Virtanen et al., 2020) for data processing.

The observed data will be compared to numerical simulation results obtained by including meteorological forcing functions at the ground surface on both heat and water balances.

2.2 | The numerical model

2.2.1 | Balance equations

The modeling of heat transport in a partially water saturated porous medium requires solving the coupled balances for water and heat. Our system of interest is located in the variably saturated zone, where the water balance can be formulated in terms of the Richards' equation, which can be considered as a simplified version of the multiphase flow equation under the assumption of an infinitely mobile gas phase. Richards' equation combines the multiphase version of Darcy's law with the continuity equation for water, thus taking into account the effects of capillary pressure and relative permeability:

$$\frac{\partial\, \phi S_{\mathrm{w}} \varrho_{\mathrm{w}}}{\partial t} - \nabla \left\{ \varrho_{\mathrm{w}} \frac{k_{\mathrm{rw}}}{\mu_{\mathrm{w}}} \mathbf{K} \left(\nabla p_{\mathrm{w}} - \varrho_{\mathrm{w}} \mathbf{g} \right) \right\} = q_{\mathrm{w}} \,, \qquad (1)$$

where S is the saturation, ϕ the porosity, ϱ the density, μ the dynamic viscosity, k_{r} the relative permeability as a function of saturation, p the pressure, q_{w} the source term for water, and K the hydraulic conductivity tensor. The index w denotes water. The Richards' model assumes that the pressure of the gas phase is constant, that is, in our setting at atmospheric conditions, 1 bar. The pressure of the water phase depends on the water saturation via the capillary-pressure-saturation relationship as will be detailed further below.

Assuming thermal equilibrium between solid and fluids, the heat balance coupled to the Richards' equation can be written as follows:

$$\phi \frac{\partial(\rho_{\mathrm{w}} u_{\mathrm{w}} S_{\mathrm{w}})}{\partial t} + (1-\phi)\frac{\partial(\rho_{\mathrm{s}} c_{\mathrm{s}} T)}{\partial t} + \nabla \cdot \left(\rho_{\mathrm{w}} h_{\mathrm{w}} \mathbf{v}_{\mathrm{w}} - \lambda \nabla T\right) = q_{\mathrm{h}}. \qquad (2)$$

Here, u_{w} is the specific internal energy of the water phase, c_{s} is the specific heat capacity of the solid, h the specific enthalpy, λ represents the averaged heat conductivity of the fluid-filled porous medium, v_{w} is the velocity of the water phase, which is obtained from Darcy's law as it is already implicitly inserted in Equation (1), T is the temperature, and q_{h} the source term for heat.

2.2.2 | Numerical simulation platform

For numerical implementation, we were working with DuMu$^{\mathrm{x}}$ 3 (Koch et al., 2020; Scheer et al., 2020), an open-source simulator and research code for flow and transport in porous media. With its modular design, DuMu$^{\mathrm{x}}$ allows for a flexible choice of physics and discretization methods and solution algorithms, and it facilitates the implementation of new approaches and adaption as in this study. For spatial discretization, we used the Box method for this study; for details, we refer to Scheer et al. (2020). The Box method employs a finite element mesh containing the nodes at which the solution is calculated, while there is a secondary mesh constructed, on which a finite-volume scheme is used. Thus, the Box method guarantees local mass conservation.

2.2.3 | Hydraulic properties

Richards' equation describes water flow in partially saturated porous media. Thus, the gas phase is present, though not explicitly modeled. Using the Richards' approach of multiphase flow in the variably saturated zone implies that the relative permeability of the water phase as a function of water saturation is considered as well as the capillary pressure also dependent on water saturation. We aim to reduce the overall uncertainty by measuring relevant parameters (saturated hydraulic conductivity, relationship between capillary pressure and saturation). In situations where measurements are difficult, for example, because of large grain sizes such as in the gravel for this study, the uncertainty due to the parameterisation is considered minor compared to the uncertainty of the overall behavior. For the variably saturated relationships, several models exist in addition to the van Genuchten parameterisation, for example, Brooks and Corey (1966) or Clapp and Hornberger (1978). Working with a different approach can lead to different results, as demonstrated in Yang and Wang (2014). We compared parameters of a Brook–Corey model to van Genuchten's model and saw similar results for both models but a better stability for van Genuchten's model. For this reason, in this study, the relative-permeability-saturation relationship as well as the capillary-pressure-saturation relationship were used according to van Genuchten's model. It can be written for the capillary pressure as:

$$p_c = \frac{1}{\alpha}\left(S_e^{-1/m} - 1\right)^{1/n} \tag{3}$$

with the effective saturation

$$S_e = \frac{S_{\mathrm{w}} - S_{\mathrm{wr}}}{1 - S_{\mathrm{wr}}} \; . \tag{4}$$

α [1/Pa] and n are parameters to be determined specifically for the porous material. α is a scaling parameter for the magnitude of the capillary pressure (comparable to the entry pressure in Brooks–Corey's approach), and the parameter n characterizes the uniformity or non-uniformity of the pore-size distribution. A large n expresses a comparatively uniform soil. Commonly, the parameter m is expressed in terms of n by

$$m = 1 - \frac{1}{n} \; . \tag{5}$$

The relative-permeability function is, accordingly:

$$k_{\mathrm{rw}} = \sqrt{S_e}\left[1 - \left(1 - S_e^{1/m}\right)^m\right]^2 . \tag{6}$$

We measured α, n, and saturated conductivity for the natural material with the simplified evaporation method as described in Peters and Durner (2008) with a HYPROP device. This method was not suitable for the sandy gravel, as these materials are too coarse for measurements, hence their parameters were calibrated. Asphalt is basically not permeable, thus should receive a close-to-zero permeability. However, in our case, the 1D simplification of the model domain cannot account for effects that occur close to the surface and lead to small lateral inflow of water, which contradicts the idealized 1D assumption of an impermeable boundary. Thus, the apparent permeability of the asphalt in the simplified 1D system is part of the calibration procedure. For the grass surface, it is difficult to perform representative measurements. Consequently, all permeabilities were used as calibration parameters. Another key hydraulic property is the porosity. Again, this could be measured for some soils (e.g., sand), for others, (e.g., grass) it would have been difficult to measure. For this reason, properties were also used as calibration parameters.

2.2.4 | Thermal properties

Basically, the thermal conductivity and the heat capacity are material- and temperature-dependent properties of the porous medium. While temperature dependence is small in the range of temperatures encountered in our application (-10 to 40°C), water content plays a more important role. In reality, we have an inhomogeneous mixture of soil, water, and air. Thus, the water saturation has an effect on the thermal properties. It is challenging to find an appropriate model or a set of tabulated values for a given material. There are several models available to calculate thermal conductivity based on water content, for example, Ghanbarian and Daigle (2015); Lu et al. (2007); Lu and Dong (2015); Markert et al. (2017); Sadeghi et al. (2018).

The effective heat capacity can be computed as the volumetric average of water, air, and solid heat capacity. The effective thermal conductivity of a wet solid matrix with a given water content depends on the grain sizes. Johansen (1975) introduced a way to determine the effective thermal conductivity by defining the effective thermal conductivity and using K_e, the Kersten number:

$$\lambda_{\mathrm{eff}} = \lambda_{\mathrm{dry}} + K_e(S_{\mathrm{w}})\left(\lambda_{\mathrm{wet}} - \lambda_{\mathrm{dry}}\right). \tag{7}$$

Thus, the effective conductivity is calculated from the values for the dry conductivity and the wet conductivity. There are several models available based on measured correlations (e.g., Somerton et al., 1974). For this research, we were working with Lu et al. (2007), as the temperatures and soils used for the underlying correlation fit to our test settings. In their approach, the definition for K_e is

$$K_e(S_{\mathrm{w}}) = \exp \alpha_{Lu}\left[1 - S^{\mathrm{w}}_{(\alpha_{Lu}-1.33)}\right], \tag{8}$$

and the dry conductivity is calculated as

$$\lambda_{\mathrm{dry}} = -a \cdot \phi + b, \tag{9}$$

where α_{Lu} is 0.27 for fine-textured soil and 0.96 for coarse-textured soil, a and b are empirical parameters and are determined to be 0.56 and 0.51 with ϕ being the porosity. Typically, the saturated (wet) conductivity is calculated via Johansen (1975):

$$\lambda_{\mathrm{wet}} = \lambda_{\mathrm{solid}}^{(1-\phi)} \times \lambda_{\mathrm{w}}^{\phi}. \tag{10}$$

2.2.5 | Model domain

The dominant force at our test site in heat and water transport acts in the z-direction (from surface to ground). There is no force for a transport to occur in a horizontal direction. The zones corresponding to various porous media and land-use covers extend horizontally for short distances only (perpendicular to the pipes' length about 0.4 m, parallel to the pipes' length about 3 m) and are thermally insulated with polystyrene. Thus, boundary effects in horizontal directions are very small and can be neglected. For this reason, we chose to represent the four stations of our setup (I, II, III, and IV) each with a 1D model without modeling the pipe of the test side. We worked with a daily resolution of the boundary conditions. For the different sections of the trench, there were layers in the solid materials modeled as seen in Figure 1. Each layer has its specific thermal and hydraulic properties. The covering layer was modeled as a separate layer for grass as well as for asphalt.

2.2.6 | Boundary conditions

The boundary condition at the bottom of the domain at the groundwater table was modeled as a Dirichlet boundary, which means, constant temperature and pressure were set. Temperature was set to the long-term groundwater average of 10°C; pressure was set to the equivalent of 0.9 m, which is the long-term water table at 5.1 m below ground surface. The boundary conditions at the ground surface for heat and water flow were set as Neumann boundary conditions, implying that both heat and water fluxes needed to be defined. To determine the flux values required for the Neumann condition, we computed heat and water balances at the interface.

Calculating Neumann conditions at the interface

The system behavior is driven by water and heat exchange with the atmosphere. We assume a constant temperature, as we reach lower soil layers, where conditions should be constant over time. Radiation and precipitation measured values of environmental influences, and the resulting heat and water fluxes need to be calculated to impose these influences as Neumann boundary conditions.

Heat

The balance of heat at the boundary can be written as:

$$\begin{aligned}\text{Soil heat flux} &= \text{Net radiation} - \text{Latent heat flux}\\ &\quad - \text{Sensible heat flux} - \text{Heat flux due to net}\\ &\quad \text{water flux.}\end{aligned} \tag{11}$$

The temperature of the infiltrating recharge as well as the contribution stemming from the evapotranspirating water is considered via the specific heat capacity of water and the temperature of air at 2 m height.

Incoming long and short wave radiation values are measured directly. Taking into account the albedo (ratio of incoming and outgoing short wave radiation; ω) of the surface and Boltzmann's law for outgoing long wave radiation, the resulting balance is:

$$\text{Net radiation} = H_{\text{short,in}} \times (1-\omega) + H_{\text{long,in}} - \sigma \times T_{\text{abs}}^4. \tag{12}$$

This equation can be directly solved, but latent and sensible heat fluxes cannot be directly calculated. Therefore, we use the so-called Bowen ratio:

$$\frac{\text{Sensible heat}}{\text{Latent heat}} = \frac{H_{\text{sens}}}{H_{\text{ET}}} = \gamma \times \frac{\frac{\partial \overline{T}}{\partial z}}{\frac{\partial \overline{e}}{\partial z}}. \tag{13}$$

The ratio of latent (H_{ET}) to sensible (H_{sens}) heat flux is equal to the ratio of the vertical gradients of temperature T with vapor pressure e multiplied by a constant, the so-called psychometric constant γ. This is based on the assumption of their similar turbulent diffusion coefficients. Now, we are approximating the gradients of e and T over a height z by the difference of their measured values at 2 m (e_{m} and T_{m}) and at surface (e_{surf} and T_{surf}). Then, we solve the equation by H_{ET}:

$$\frac{H_{\text{sens}}}{H_{\text{ET}}} = \gamma \times \frac{T_{\text{surf}} - T_{\text{m}}}{(e_{\text{surf}} - e_{\text{m}})} \rightarrow H_{\text{ET}} = \frac{(e_{\text{surf}} - e_{\text{m}}) \times H_{\text{sens}}}{(T_{\text{surf}} - T_{\text{m}}) \times \gamma}. \tag{14}$$

This gives us a relation for H_{sens} and H_{ET}, but does not define one of them. H_{ET} is defined as the heat flux at phase transition, this means latent heat of vaporization times density of water $\Delta H_{\text{vap}} \times \varrho_{\text{w}}$ times the rate of evapotranspiration ET:

$$H_{\text{ET}} = ET \times \Delta H_{vap} \times \varrho_{w} \tag{15}$$

To approximate ET, we use the Penman–Monteith equation, following Allen et al. (1998). Assuming a large surface of constant vegetation height, calculations based on boundary layer theory and Prandtl–Karman's velocity distribution lead to:

$$\begin{aligned}ET &= \frac{m_{\text{H}_2\text{O}}}{\varrho_{\text{w}} R T_{\text{abs}}} \frac{\kappa^2}{\left[\ln\left(\frac{z_{\text{m}} - t_{\text{d}}}{z_0}\right)\right]^2} u_{\text{m}} \times (e_{\text{surf}} - e_{\text{m}})\\ &= \frac{m_{\text{H}_2\text{O}}}{\varrho_{\text{w}} R T_{\text{abs}} \times r_{\text{a}}} \times (e_{\text{surf}} - e_{\text{m}}),\end{aligned} \tag{16}$$

with the universal gas constant R, the von Karman constant κ the absolute temperature T_{abs} in K and r_{a} defined as

$$r_{\text{a}} = \frac{\left[\ln\left(\frac{z_{\text{m}} - t_{\text{d}}}{z_0}\right)\right]^2}{\kappa^2 \times u_{\text{m}}}, \tag{17}$$

which represents the aerodynamic resistance, $m_{\text{H}_2\text{O}}$ is the molar mass of water. Combining Equations (14)–(16), we end up with:

$$\begin{aligned}\frac{H_{\text{sens}}}{ET \times \Delta H_{\text{vap}} \times \varrho_{\text{w}}} &= \frac{H_{\text{sens}} \times R T_{\text{abs}} \times r_{\text{a}}}{m_{\text{H}_2\text{O}} \times \Delta H_{\text{vap}} \times (e_{\text{surf}} - e_{\text{m}})}\\ &= \frac{(T_{\text{surf}} - T_{\text{m}}) \times \gamma}{(e_{\text{surf}} - e_{\text{m}})},\end{aligned} \tag{18}$$

Approximating r_a with $208/u_m$ (Allen et al., 1998), with the definition of the specific gas constant for air $R_s = R/m_{air}$, and $\epsilon = m_{H_2O}/m_{air}$ our boundary condition for H_{sens} results in:

$$H_{sens} = \frac{\epsilon \times \Delta H_{vap} \times \gamma}{T_{kv} \times R_s} \times \frac{u_m}{208} \times (T_{surf} - T_m), \qquad (19)$$

T_{kv} is the virtual temperature, defined as $1.01 \times (T/°C + 273)$ (Allen et al., 1998).

The psychrometric constant γ is 66 Pa K^-1. As ET is defined as the evapotranspiration from a large surface of constant vegetation height, we need to consider the deviation from that idealized assumption at our site. To be pragmatic, we consider it as potential evapotranspiration and use a calibration factor f_{ET} to take into account the different surfaces as a property of the surface. Based on H_{sens}, we are now able to calculate H_{ET}, again using the Bowen ratio (Equation 14).

$$H_{ET} = f_{ET} \times \frac{\epsilon \times \Delta H_{vap}}{T_{kv} \times R_s} \times \frac{u_m}{208} \times (e_{surf} - e_m). \qquad (20)$$

While the vapor pressure at ground surface, e_{surf}, is calculated via the Kelvin equation, the vapor pressure at 2 m, e_m, is determined from temperature T and humidity at 2 m, using the ideal gas law, directly in the simulation code.

Using Equations (20)–(12) we can now solve the heat balance (11) and assign meaningful boundary conditions.

Water

With ET defined in Equation (15), the water balance

$$\text{Incoming water} = \text{Precipitation - Evapotranspiration (ET)}, \qquad (21)$$

can be solved as precipitation intensities were measured.

The basic balances are valid at the transition from air to soil. The asphalt cover can be described with its material parameters. For the land-use cover, we need to add an additional resistance, because the grass acts as an additional resistance. This resistance can be calculated as by Equation (19), but with the bulk surface resistance r_s instead of the aerodynamic resistance. The equation for the resistance λ of the grass cover is given below, where the value of r_s is set to 71 m s^-1 according to Allen et al. (1998).

$$\lambda = \frac{T_{kv} \times R_s}{\epsilon \times \Delta H_{vap} \times \gamma} \times r_s. \qquad (22)$$

2.2.7 | Initial conditions

The system is sensitive to the initial conditions. Sensors were covering depths between 0.45 and 1.15 m, while values between 0 and 6 m were needed. Our initial approach was to interpolate the measured temperatures from 1.15 m below ground surface linearly down to the groundwater table (where the groundwater temperature is fixed to 10°C; see Section 2.2.6) and to assume a constant temperature between 0.45 m below ground surface and ground surface. This did not succeed, as we observed rising temperatures in lower layers at the beginning of calculation time, which seemed to have no physical reason. However, starting simulations with 1 year initialization period solved the problem, as shown in Figure S2. This fits to results presented in Yu et al. (2019), where the uncertainties of initial conditions are well documented.

2.2.8 | Calibration of the model

The required model parameters are known to different degrees and are associated with different uncertainties. As already indicated in the description of the boundary conditions above, some model parameters, such as permeability of the asphalt, must also assume "apparent" values due to the use of a 1D simplification, in order to integrate unconsidered multidimensional effects into the model through the back door, so to speak.

The properties of the fluids water (and air, though not modeled explicitly) are well known and their implementation in the model can be trusted. In particular the hydraulic properties in porous-media flow are usually associated with great uncertainty and variability. In this study, also the parameters for the thermal balance required attention since a sophisticated model was elaborated as explained above.

Some of the required parameters were measured, others are based on literature values (because measuring would have been too complicated). As the simulation time was short (approximately 20 min for one run), we calibrated parameters and finally arrived at parameter sets in good agreement with measurements. We note that the calibration was performed based on expert judgement without sophisticated algorithms or correlation analyses.

Assigning proper values to parameters for heat intake was difficult, as common databases such as Stephan et al. (2019) describe the material as one continuous solid at one fixed water saturation, not considering different saturations. In fact, in the partially saturated soil we encounter varying saturations and need to model property changes with saturation. Bertermann et al. (2018) give an overview on the change of soil properties based on their water contents. Farouki (1981) gives values for "pure" materials. These were used as average values for the parameter calibration for density, heat capacity, and solid thermal conductivity. The set of calibrated parameters, which we finally used as well as their values of variation are listed in Table 1. The capillary pressure–saturation curves for

TABLE 1 Overview over parameter values used in simulations.

(a) Parameters for heat transport.

	λ		c_p	
Material	**Varied range**	**End value**	**Varied range**	**End value**
Asphalt	0.7–1	1	600–800	700
Grass	3–9	5	600–800	800
Sand	2.5–7	5	600–900	600
Gravel coarse	2.5–9	5	600–800	800
Gravel sieved	2.5–9	5	600–800	800
Natural material	2.5–9	3	600–800	732
Lower material	2.5–9	5	600–800	732

(b) Parameters for water transport where "VG" stands for van Genuchten.

	Permeability in 1 m^2	Porosity		VG: α	VG: n
Material	**Value**	**Varied range**	**End value**	**value**	**value**
Asphalt	1.46e−10	-	0.3	18.395	1.2
Clay	9.45e−12	Measured	0.533	18.395	1.301
Lower material	1.1e−11	0.3–0.533	0.4	15	1.1
Gravel coarse	6.65e−12	0.3–0.4	0.36	2	1.5
Gravel sieved	9.3e−12	0.3–0.4	0.3	2	1.5
Grass	6.65e−12	0.3–0.4	0.36	2	1.45
Sand	9.3e−12	0.3–0.4	0.36	15	1.3

(c) Parameters for forcing function at ground surface.

	f_{ET}		albedo	
Material	**Varied range**	**End value**	**Varied range**	**End value**
Grass	0.4–0.6	0.6	0.18–0.26	0.26
Asphalt	0.6–0.8	0.8	0.12–0.15	0.15

the porous media at the pilot site with final calibrated values of Table 1 are shown in Figure S3.

The temperature in the topmost region is highly sensitive to the fitting parameter for evapotranspiration, f_{ET}, and the albedo value ω, while transport parameters become relevant further below. Based on that, we first fitted f_{ET} and ω to the temperature measurements in the topmost 30 cm, upon which heat transport parameters were varied, that is, heat conductivity and heat capacity. Parameters with high sensitivity include the permeability, the moisture content, which is closely coupled to porosity. The used set of parameters can be found in Table 1).

3 | RESULTS

3.1 | Measured data

The results of the measurements, which we interpret as the meteorological forcing functions for the temperature evolution in the different stations of our experimental pilot site are given in Figure 2. They include (from top to bottom) long wave and short wave radiation, the temperature at a height of 2 m above ground, the wind velocity at 2 m height, the air humidity, and the precipitation. The data show the transition from the summer (i.e, August 2020) to the winter (i.e., December 2020) with associated trends of decreasing temperatures and radiation intensities as well as increasing air humidity.

Figure 3 shows the temperature time series for the four stations at the experimental pilot site separated into individual panels for discrete vertical depths. Gaps in the bottom panel indicate missing data. The land-use cover at Stations I and IV is natural vegetation (grass), while it is asphalt at Stations II and III. The subsurface material is naturally occurring silty clay at Stations I and II, and is gravelly material at Stations III and IV. The data show that the type of land-use cover has a larger influence on the evolution of subsurface temperatures than the porous material in the subsurface at our pilot site. This is indicated by small temperature differences between the green curves and the grey curves in Figure 3.

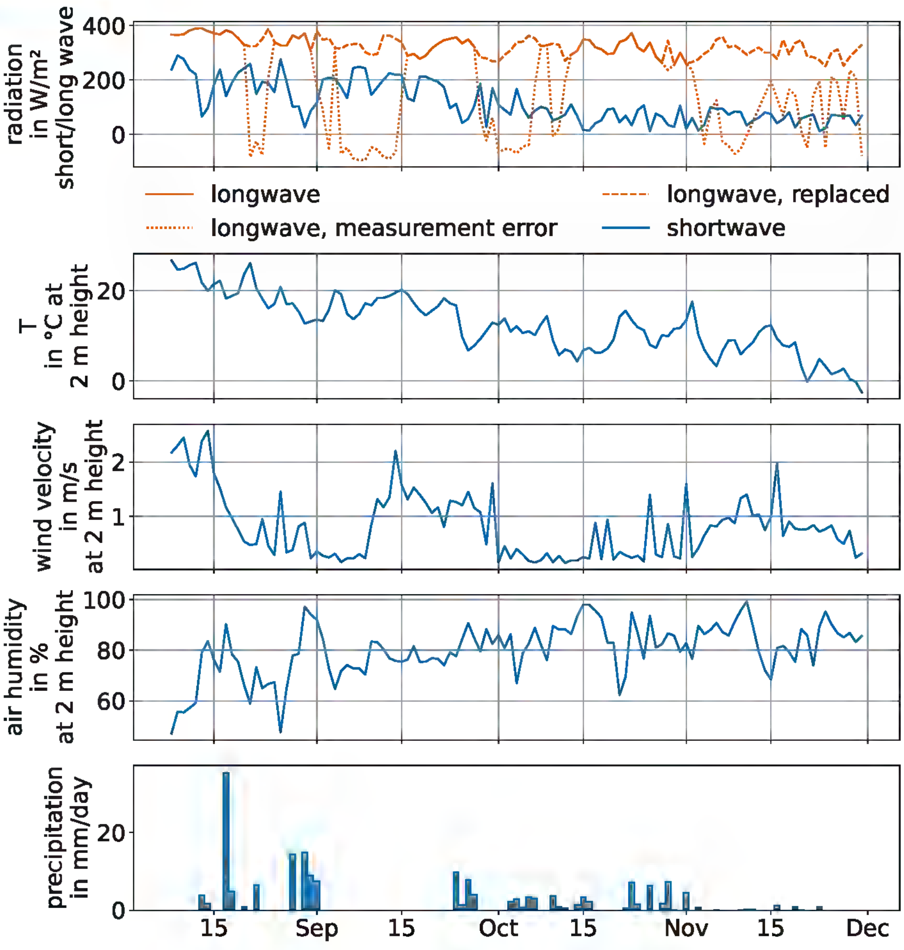

FIGURE 2 Meteorological forcing functions: Data from the nearby weather station.

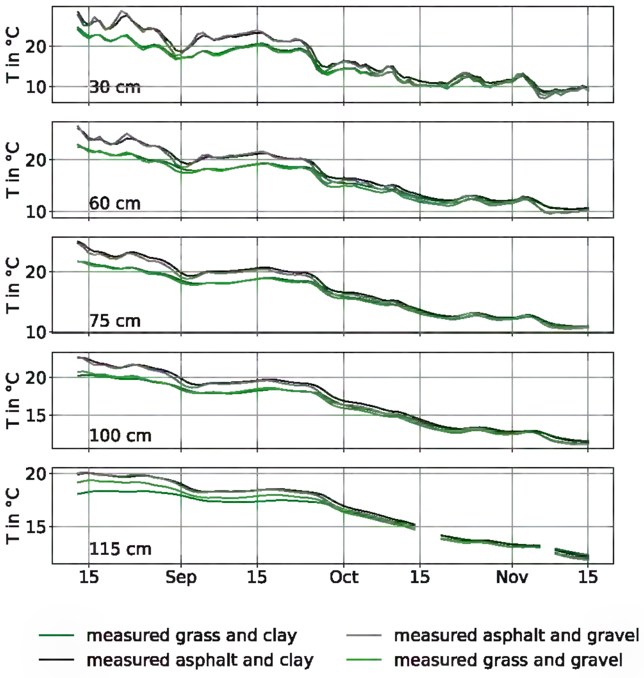

FIGURE 3 All measured soil temperatures over time.

3.2 | The match between measurements and numerical model

The main results of this study is the calibration of the numerical model to the measured data, which is presented below.

Figure 4 shows two subplots of subsurface temperature evolutions during a time period in September 2020 at the four stations. Subplot (a) contains the measured temperatures and in comparison to that there is subplot (b) with the calibrated corresponding numerical simulation results. From (a), the dynamics in the evolution of the vertical temperature profiles is visible. The color coding indicates the time from September 1 (purple) to September 21 (yellow). A larger spatial spread can be observed in this figure's central panels (Stations II and III), which represent the asphalt land-use, than in the most left and most right panel (Stations I and IV), which are both with grass as land-use. This indicates that, at least for this design of the experiments, the type of land-use has a stronger influence on temperature evolution than the soil properties. The asphalt-covered gravel section (Station III) spreads even more than the corresponding natural material

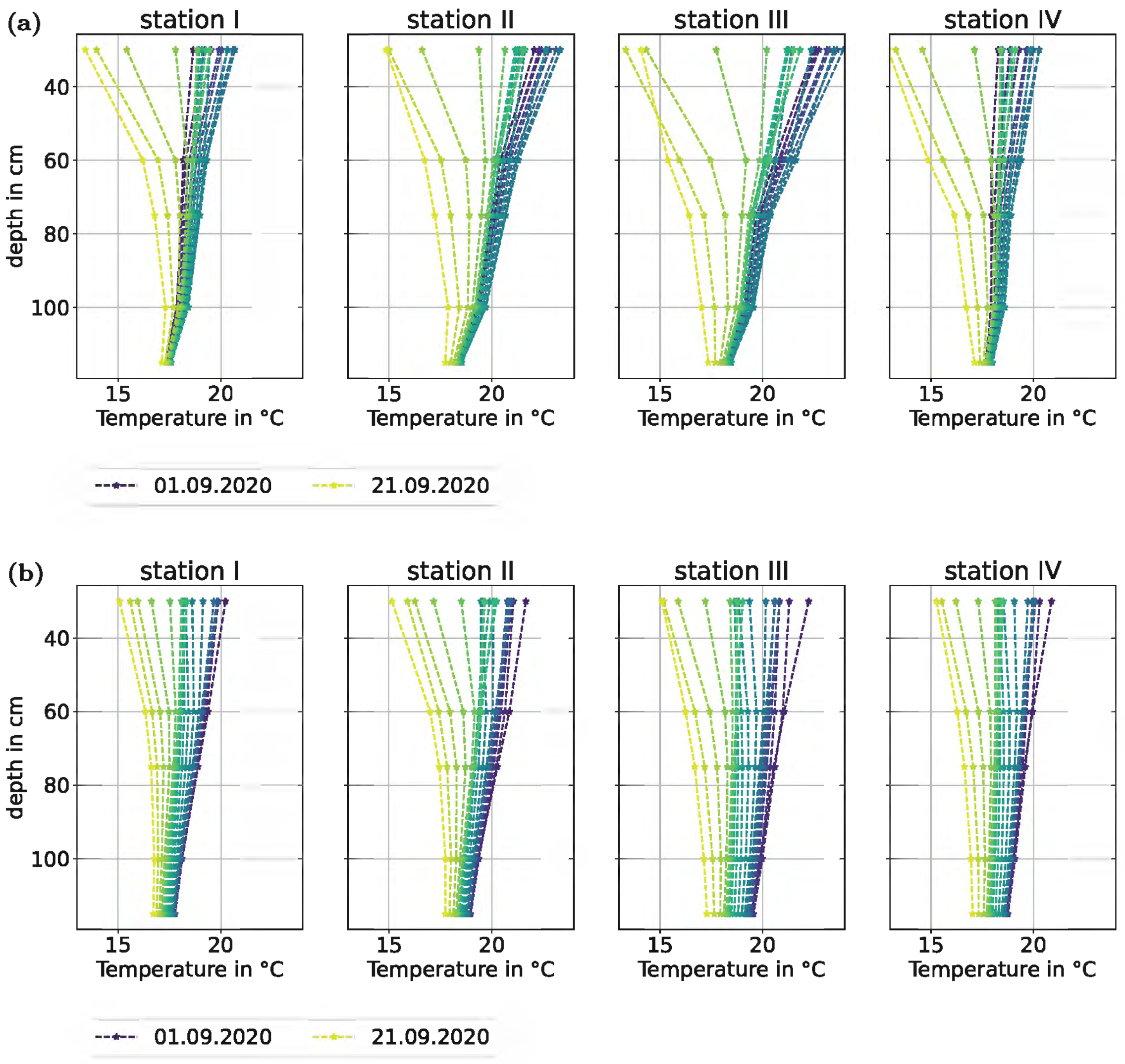

FIGURE 4 Evolution of temperature profiles in the subsurface. (a) Temperature over depth for several days, *measured*, (b) Temperature over depth for several days, *simulated*. Legend dates are dd.mm.yyyy.

underneath (Station IV), which proves that there is certainly also an effect due to the different layers below the top cover. Generally, the model is able to reproduce measured soil moisture dynamics at various depths and under various land-use as well.

Figure 4 contrasts precipitation data (top panel) with both measured and simulated water saturations in two different depths, that is, at 60 cm (middle panel) and at 100 cm (bottom subplot). The different stations I–IV are represented in the curves according to their labeling in the legend with grass or asphalt as covers and natural material or gravel underneath underneath. Easy to remember, green curves represent grass land-use and, accordingly, black represents asphalt. Dashed lines indicate simulated curves. Our calibrated model (panel b) is able to reproduce the larger temperature spread under asphalt than under grass with depth and its temporal evolution very similarly at the observations (panel a). The influence of precipitation in the curves observed in the experiments at the pilot site is smaller at deeper regions. Relatively small precipitation events, even where they occur over multiple consecutive days (e.g., during October 2020) are not detected in the saturation data. In contrast to that, the simulated curves show the impact of precipitation on water saturation, that is, soil moisture, is more finely nuanced.

Overall, during the period from August until December 2020, subsurface temperatures decline as expected following the trend of declining seasonal average temperatures in the fall. The deeper below ground surface the more are the amplitudes of temperature fluctuations attenuated. Figure 6 shows how the calibrated model reproduces the observed temperatures in good qualitative agreement; the accuracy of the match between calibrated model and observation tends to be better in the deeper regions close to the drinking-water pipes. The curves for the natural material underneath with asphalt/grass on top (Stations I/II) is plotted on the left, accordingly Stations III/IV with gravel underneath are seen on the right. Asphalt cover is plotted in black and grass cover in green.

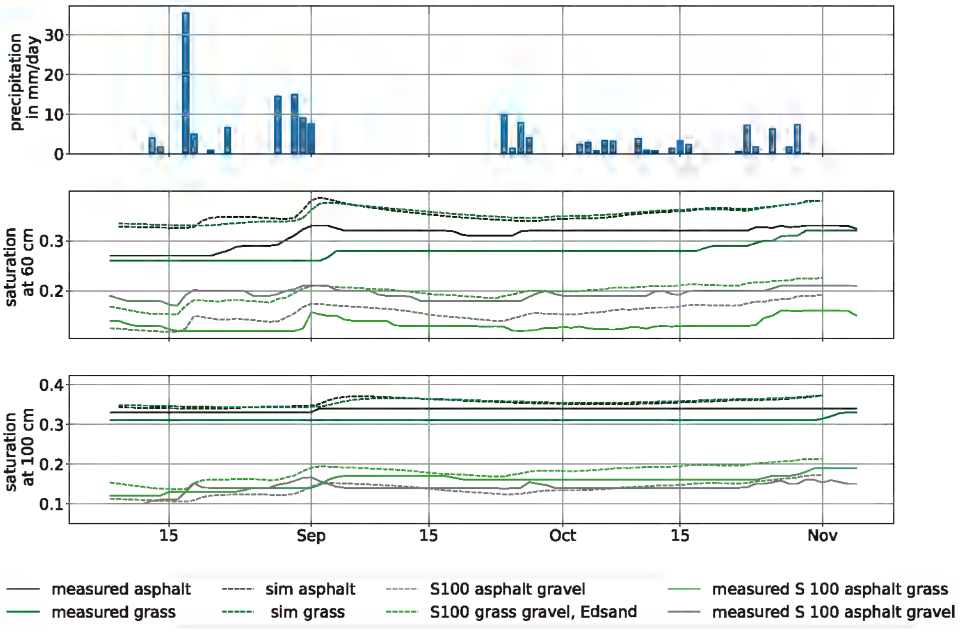

FIGURE 5 Precipitation data and corresponding measured versus simulated saturations over time. Dashed lines show simulated curves.

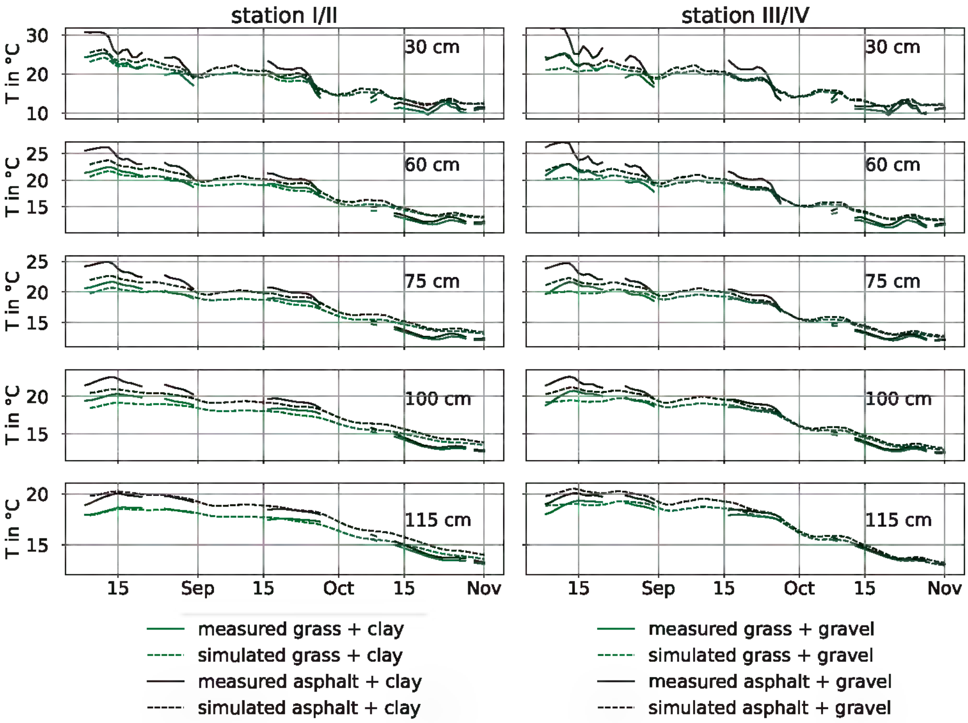

FIGURE 6 Simulated (after calibration) and measured temperatures at different depths versus time for all stations.

The amplitudes of temperatures at the interface between soil and the meteorological are dampened with increasing depth and are not detectable anymore at a depth of 115 cm. Up to depths of about about 1 m, the short-term high temperature amplitudes are dampened and occur at the pilot site with a delay of about 1 to 2.5 days.

There is a noticeable mismatch between measured and simulated curves for the asphalt cover at the very early times, which can be attributed to the still hot asphalt after its pouring. This mismatch diminishes by early September. The periods where the temperature data is not plotted continuously, gaps marks those time periods where there are no correct

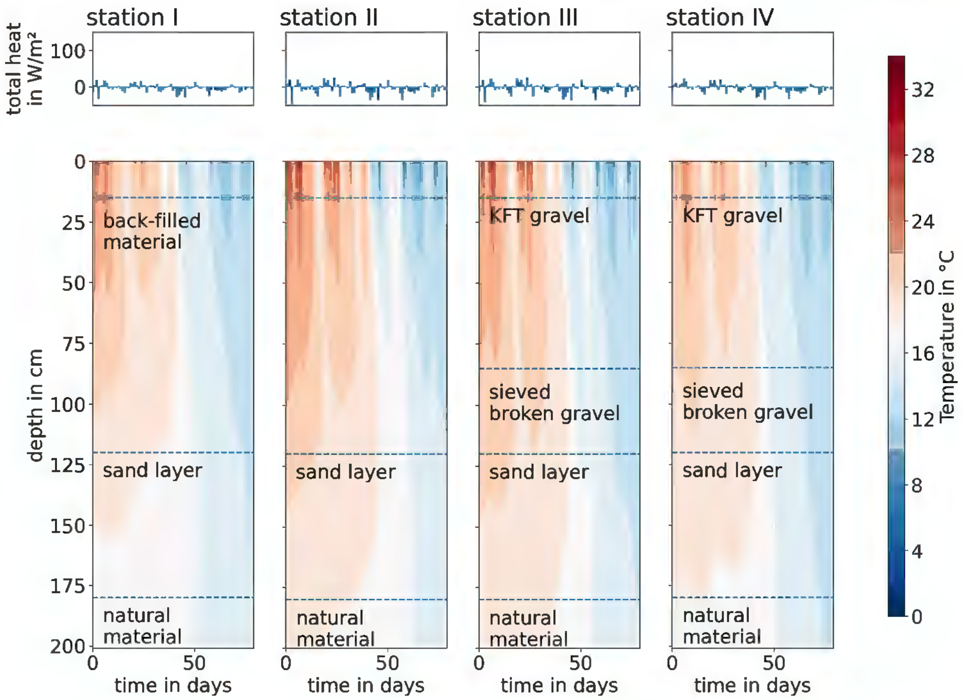

FIGURE 7 Soil temperatures plotted over time and height with total heat as forcing function (top panels).

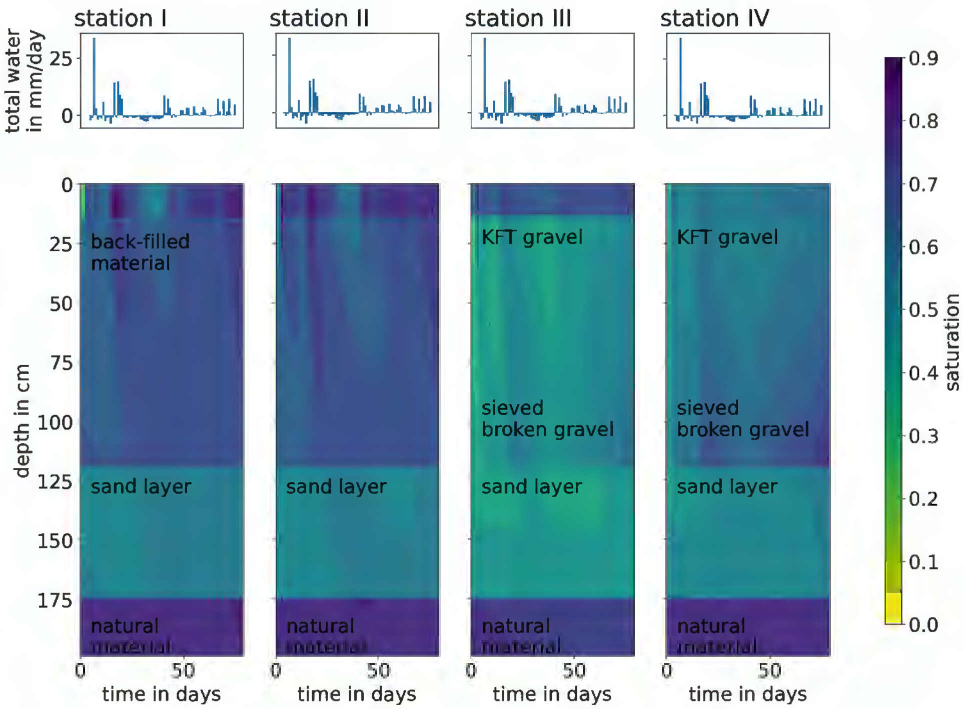

FIGURE 8 Contour plots of water saturations over time in the soil with total water influx as forcing function.

boundary conditions available, particularly due to the erroneous long wave sensor. To be able to feed the model with required boundary conditions, we used the long-wave data of the year 2015, which exhibited similar statistical moments in those periods. Obviously, the simulated temperatures mostly follow the measured trends, but start with a bigger difference after periods with missing "correct" radiation data. Looking at absolute temperature differences, we notice that they are smaller than ≈8 K in the beginning at higher positions, while at lower positions they are below 1 K. The temporal

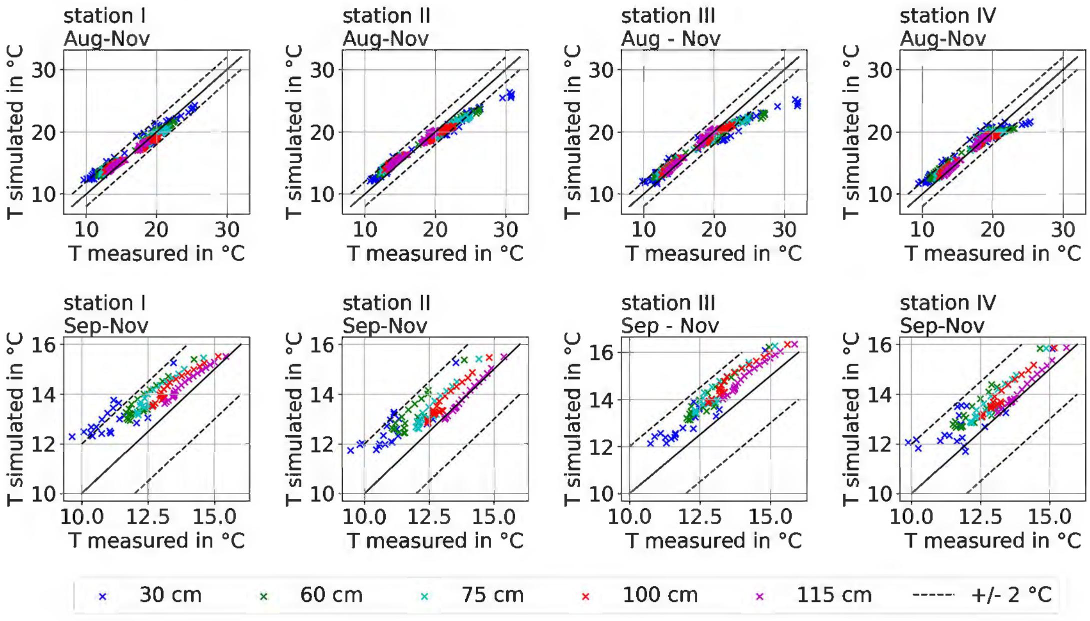

FIGURE 9 Performance plots of measured versus simulated temperatures. Top panels for entire time series, bottom panels for a smaller temperature range exclude the early time when the temperatures were still biased by freshly installed asphalt.

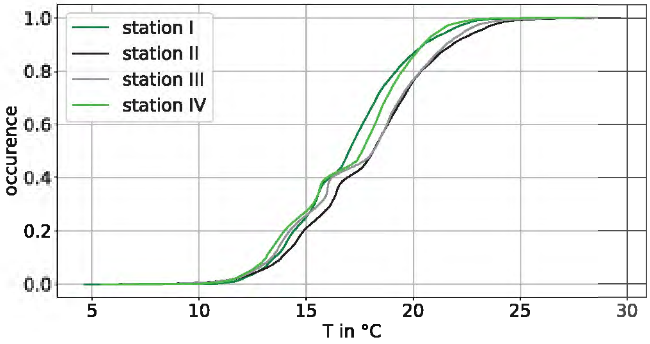

FIGURE 10 Standardized cumulative frequency of simulated temperatures.

evolution of temperature differences between measurements and observations is shown in Figure S6.

Figures 7 and 8 are intended to give an impression of the dynamics of heat and moisture transport in the soil body as obtained from the numerical model. At the top of these time-map illustrations, we provide the meteorological forcing functions, that is, total heat and total water, respectively. The heat forcing is reflected directly by the temperature response in the model domain. Comparing Stations I and IV (both grass cover, but with different layers underneath), we observe a difference in the temperature distributions: in gravel, the extents of zones of elevated temperatures are larger with smaller gradients. The gravel systems, as expected, react faster than the clayey zones. This difference in heat transport dynamics is smaller for Stations II and III (with asphalt). Regarding the soil moisture dynamics as expressed by the time maps of water saturation in Figure 8, we can see that the gravel layer acts as an efficient drainage (green zones). While there is no strong difference in soil moisture dynamics between asphalt and grass cover for the back-filled material, the gravel and grass cover combination tends to lead to a drier soil body.

Focusing on the difference of the stations, all simulated temperatures were summed and plotted as standardized cumulative frequency of T in Figure 10. Grass-covered stations (green lines) are to the left of the other lines in this plot, which indicates that grass-covered regions have a tendency to be colder. In the range of to 20˚C, there are differences in slope, which means that the difference of temperatures is not always the same. The type of land-use cover plays an even more important role during hot days (Figure S7).

We conclude this results section with a detailed quantitative assessment of the match between measured and simulated temperatures as given by Figure 9. The performance plot analyses the deviations between model and experiment for different depth zones. The top row considers the entire time period, while in the bottom row the first month was left out. It was mentioned already above that we expect here a bias due to freshly poured asphalt and, thus, elevated temperatures which are not due to meteorological forcing functions. The model can reproduce the trends of the measured data, that is, the order of temperatures, higher temperature spreading under asphalt cover. The match between model results and observation data is generally good, while the deviations vary in a range of ~±2 K for the entire period (upper panels). When excluding the first month from this analysis, the performance is always better than ±2 K, while a small consistent overestimation (~+2 K) by the model can be noticed.

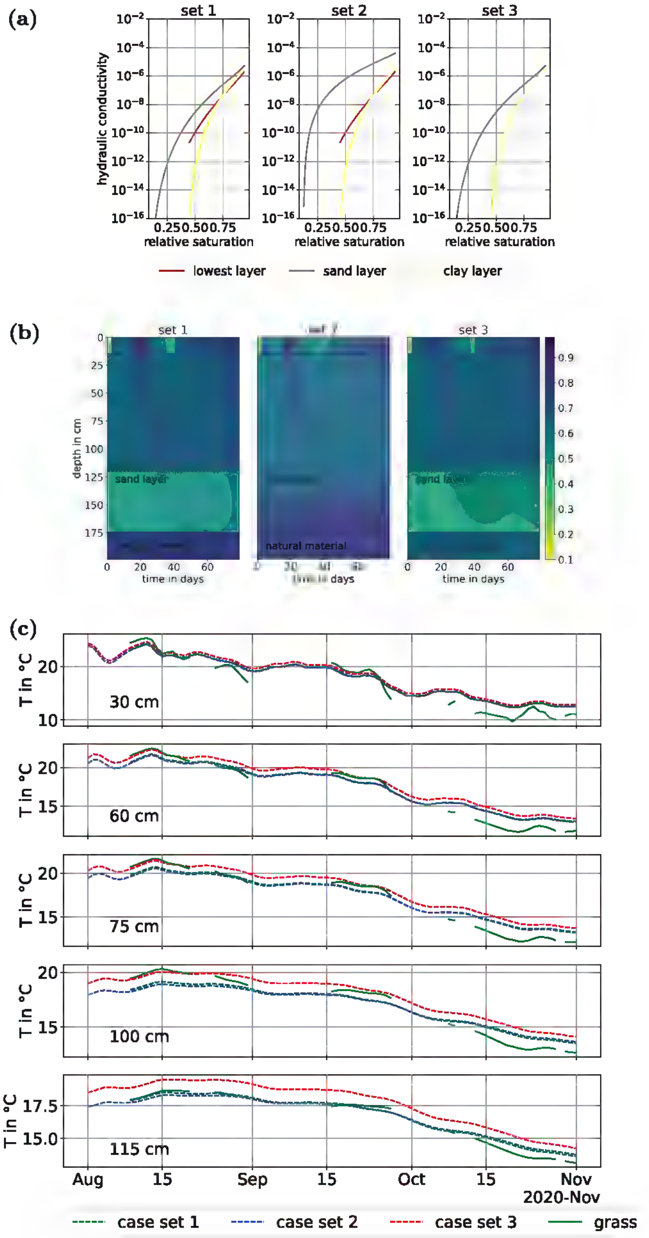

FIGURE 11 Evaluating the effect of the variably-saturated material properties. (a) Three sets of possible capillary pressuresaturation relationships, (b) Simulated saturations (contoured over depth and time) for the different sets, (c) Simulated temperatures at various depths for the different sets.

4 | DISCUSSION

4.1 | The agreement between measurement and simulation (part A)

The results show, as summarized, for example, in Figure 9, that calibrated numerical simulations are in satisfactory, partly even excellent agreement with the measured data. Thus, we can claim with confidence that the model is able to not only qualitatively, but also quantitatively is able to describe on a seasonal time scale the governing physical processes that lead to temperature evolution in the depths of drinking-water pipes as driven by meteorological forcing functions in terms of temperature curves and precipitation data. We note that the calibration was not globally optimized and no correlation metrics were calculated. For example, the simulated results are sensitive to the van Genuchten parameters for relative permeability and capillary pressure. We have tested several sets of parameters and evaluated them with respect to best fitting the measured data. We have found that for the overall match between data and simulation, it is in particular important to match saturations in the lowest and topmost regions and to adapt the van Genuchten parameters accordingly, as shown in Figure 11a.

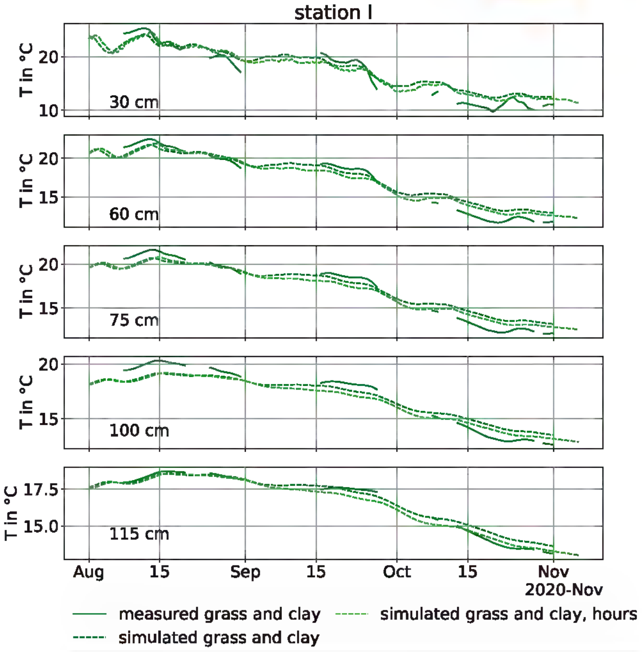

FIGURE 12 Comparison of time series of simulated and measured temperatures with varying temporal resolution in input data.

4.2 | The agreement between measurement and simulation (part B)

The calibrated 1D model had to cope with some effects that are obviously multidimensional, which inevitably means that the calibrated parameter values are not in all instances the “real” values. For example, the asphalt cover is ideally close to impermeable, while there has been some small amount of water infiltrating from laterally, see also the discussion on boundary conditions.

4.3 | On initial conditions

Furthermore, the difficulties with a good set of initial conditions has been mentioned, which was addressed here with a simulated initialization period. The materials were back-filled into the trench and had to equilibrate with ambient conditions for some time. It is also important to note that the measurements started while the asphalt still was fresh and the temperatures were still elevated for a couple of days. This explains why the agreement between simulation results and measurements improves at later time periods.

4.4 | On the influence of the boundary conditions

Grass is not sufficiently homogeneous for practical measurements of variably saturated parameters and asphalt is not permeable. Water intrusion does not occur through the asphalt layer itself, but, since it has limited lateral extent, from the sides, so that the situation modeled as 1D must in reality be considered at least 2D. Thus, the material underneath the asphalt is in fact not completely dry, which means, that a representative set of variably saturated parameter values at the top boundary had to be found in order to cope with that situation. Alternatively, the system had to be modeled in 2D, which would have increased computational costs tremendously. Instead of that, we were fitting van Genuchten parameters and permeability such that the resulting saturation fitted to observations.

The boundary conditions in the 1D system strongly affect the moisture distribution in the porous media. The two coarse layers transport all water faster. For achieving a good fit in saturation, it is important to work with values, which have at all times a better conductivity than sand. Parameter studies also showed that the natural material below the test side needs to have saturation values that are different from those of the back-filled material. As the deeper material was not manipulated and might also change in greater depths, this seems reasonable.

4.5 | On the length of simulation period

We modeled only the cooling phase, as other values were not available, when we started. This leaves the possibility, a calibration would have led to different parameters with a longer period. For this reason, we are at the moment working on longer time periods.

4.6 | On the heat balance solved in this application

The solution of the heat balance coupled to the moisture transport employs a novel and sophisticated approach to consider the soil–atmosphere interface. This involves a number of parameters, which need to be determined, partly based on idealized assumptions, which may not be given as ideal as assumed. This concerns in particular the assumption of a large surface of constant vegetation height, as required for calculating the evapotranspiration, see Equation (16). In order to have a tool to adapt the assumption to the reality, we introduced a calibration parameter, f_{ET}. Thus, one might question the approach with respect to possible over-parameterization or over-sophistication for such a small surface as we have it in our application. On the other hand, the coupled, calibrated solution, gave very satisfactory agreement and the model helps including meteorological parameters to foster the better understanding of processes and parameters, which is considered as important as the reliable prediction of temperatures.

In addition, such sophisticated models require reliable meteorological time series over long periods. As our study showed, sometimes sensors fail and backup sensors, double measurements, etc. would be useful.

4.7 | On the temporal resolution of the data as input for the modeling

Regarding the temporal resolution of the measured data in the numerical model, we note that a daily precipitation time series was chosen instead of the available hourly series. The reason for that is that the daily series is more smooth and does not force the model to resolve sudden high peak values, which led to very strong changes in saturation, in particular for the gravel. Relative to the observation time, we assume that a daily average does not introduce significant errors in water content distribution over depth, as can be seen in Figure 12.

5 | CONCLUSIONS

The transient dynamics of water saturation and temperatures in the shallow subsurface, dependent on land-use cover and back-fill material were modeled with quite some confidence when meteorological data are available. Beyond this study, the prediction of seepage water temperatures has relevance for further applications as in geothermal heating/cooling systems especially in urban environments. The influence of heat balances coupled to water transport, thus including also evapotranspiration, is in particular high due to the water's very high latent heat of vaporization.

The land-use cover has the biggest effect both on temperatures and saturations in the subsurface, while the soil structure is also relevant, but not as much.

Good initial data at all depths have proven to be crucial. They need to be either known and if (partially) missing be obtained by an initialization period in the model to allow for the conditions in the layer to adapt to meteorological data.

To achieve a good quality of predicted temperature distribution, it is important to have correct saturation data. The model reacts sensitively on saturation parameters and radiation data, while density, heat capacity, and thermal conductivity are more robust.

More calibration and validation efforts are needed. We plan to calibrate also the spring season, where temperatures tend to increase, and thus to further increase the confidence in the model. This will allow for modeling climate-change scenarios to derive suggestions for resilient design criteria for drinking-water supply networks.

AUTHOR CONTRIBUTIONS

Elisabeth Nissler: Conceptualization; formal analysis; data curation; investigation; writing—original draft; visualisation. **Samuel Scherrer**: Conceptualization; methodology development; software. **Holger Class**: Conceptualization; methodology; writing—review and editing. **Tanja Müller**: Pilot site construction; investigation; resources; data curation. **Mark Hermannspan**: Pilot site construction; investigation; resources; data curation. **Esad Osmancevic**: Conceptualization; methodology; resources; writing—review and editing; funding acquisition. **Claus Haslauer**: Conceptualization; methodology; resources; writing—review and editing; supervision; project administration; funding acquisition.

ACKNOWLEDGMENTS

We thank Radhakrishna Bangalore Lakshmiprasad for his tireless efforts during the establishment of the pilot site. We also thank Oliver Trötschler, Henning Eickhoff, Marko Schmitt, Alexander Bässler, and Steffen Hägele for their technical and humorous support. Special thanks to Oliver Trötschler for his expertise as an operating engineer, to Ramona Häckl for her versatile support, and all colleagues in the coffee corner. We also thank the public services department of the city of Sindelfingen ("Stadtwerke Sindelfingen") for their technical support.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

At publication time the code and the data will be made available as a FAIR (https://www.izus.uni-stuttgart.de/en/fokus/darus/) DaRUS repository. The code and its results are in the dataset (https://darus.uni-stuttgart.de/dataset.xhtml?persistentId=doi:10.18419/darus-3552) DockerContainer, where dumux can be run via a docker-container and the results are documented for the four stations as tabulated values. Data, used for Boundary Conditions is available at (https://darus.uni-stuttgart.de/dataset.xhtml?persistentId=doi:10.18419/darus-3554) Meteorologic data, while measured soil moisture and temperature data, used for validation is to be found at (https://darus.uni-stuttgart.de/dataset.xhtml?persistentId=doi:10.18419/darus-3555) Soil Data.

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How to cite this article: Nissler, E., Scherrer, S., Class, H., Müller, T., Hermannspan, M., Osmancevic, E., & Haslauer, C. (2023). Heat transport from atmosphere through the subsurface to drinking-water supply pipes. *Vadose Zone Journal*, *22*, e20286. https://doi.org/10.1002/vzj2.20286