this should tell us exactly what concentration they predicted for each analyte at each stream node and what the actual measurement was

Stibnite Gold Project Existing Conditions Site-Wide Water Chemistry (SWWC) Report - Final

Prepared for

Midas Gold Inc.

MIDAS GOLD

Prepared by

srk consulting

SRK Consulting (U.S.), Inc.
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February 2018

Stibnite Gold Project Existing Conditions Site-Wide Water Chemistry (SWWC) Report - Final

Midas Gold Inc.
405 South 8th Street Suite 201
Boise, Idaho 83702

SRK Consulting (U.S.), Inc.
5250 Neil Road
Suite 300
Reno, NV 89502

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Authors:

Ruth Warrender, PhD, CGeol, Eur. Geol.
Senior Consultant (Geochemistry)

Amy Prestia, MSc., P.G.
Principal Consultant (Geochemistry)

Reviewed By:

Rob Bowell, PhD, CChem, CGeol, Eur. Geol.
Corporate Consultant (Geochemistry)

Table of Contents

List of Tables

List of Figures

Appendices

1 Introduction

Midas Gold Idaho, Inc. (Midas Gold) is currently conducting numerical geochemical modeling to assess future water quality associated with the Stibnite Gold Project in Valley County, Idaho. This Project is located in the historic Stibnite-Yellow Pine Mining District and is an advanced exploration/feasibility study phase project. Mining has occurred in this district for over 100 years, producing gold, silver, antimony, and tungsten from deposits that include West End, Hangar Flats, Yellow Pine and others. Numerical geochemical predictions are being conducted to support analysis of the proposed action and alternatives in the National Environmental Policy Act (NEPA) process.

The objective of the exercise is to determine the potential for future groundwater and surface water impacts from the proposed open pits, development rock storage facilities (DRSFs) and tailings storage facility (TSF) described in the Plan of Restoration and Operations (PRO) (Midas Gold, 2016). Surface water quality predictions will be made for a series of prediction nodes downgradient of the mine facilities, both during operations and post-closure. In order to verify the modeling approach, a site-wide water chemistry (SWWC) model has been developed to predict surface water quality under current existing conditions. The purpose of the existing conditions SWWC modeling is to:

- Evaluate the effectiveness of the modeling method to predict existing surface water chemistry at each of the prediction nodes using available data; and
- Identify potential data gaps, for example diffuse sources or groundwater flows that are not accounted for in the baseline water quality dataset (HDR, 2016; 2017) or water balance/ hydrologic model (in progress).

This memorandum has been prepared to provide the U.S. Department of Agriculture, Forest Service (USFS) with details of the calculations, the conceptual and numerical approach, and findings of the calculations related to the existing conditions.

2 Background

Mining in the Stibnite district began in the late 1800s and continued intermittently through to 1997. During this time, there were two major periods of mineral exploration, development and operations. The first period of activity commenced in the mid-1920s and continued to 1952, near the end of the Korean War. It involved the mining of gold, silver, antimony and tungsten by both underground and, later, open pit mining methods. During this period, the district was operated by Bradley Mining Company (BMC). The second major period of activity started with exploration activities in 1974, followed by open pit mining and heap leaching from 1982 to 1997 by multiple operators, including Canadian Superior Mining Company (Superior), Pioneer Metals Corporation (Pioneer), Stibnite Mines Inc. (SMI) and Hecla Mining Company (Hecla).

Details of historical mining activities in the district are provided in Appendix D of the PRO (Midas Gold, 2016). A detailed summary of legacy mine features and activities is also provided in the Water Resources Summary Report (Brown and Caldwell, 2017a) and an inventory of legacy mine features is shown on the figure provided in Appendix A.

The general locations of the historical mine features are shown on Figure 4-1 to Figure 4-3. These features can be grouped into three main areas (Brown and Caldwell, 2017a):

- **South Area** (Figure 4-1) includes the Meadow Creek Mine underground workings, the area of the former BMC Meadow Creek Mill and Smelter, Bradley Tailings Pond Area, spent ore in the Spent Ore Disposal Area (SODA), mill tailings near the former mill and smelter, and tailings and overlying heap leach pads and processing facilities operated by Superior/Pioneer and Hecla Mining Company. The Superior/Pioneer and Hecla leach pads were lined with asphalt and geomembrane, respectively, and portions of the piles remain.
- **Central Area** (Figure 4-2): covers the area where general mine support facilities and the various camps were located. This includes the former sawmill area, pilot plant, equipment staging areas, Stibnite town site, former crusher site, Garnet pit, SMI former man camps, old landfill area and a rock dump from the U.S. Defense Minerals Exploration Administration (DMEA) adit.
- **North Area** (Figure 4-3): includes the BMC Yellow Pine pit and pit lake, Hecla's Homestake pit, the Southeast, Northeast and Northwest Bradley Rock Dumps, the West End pit, West End Extension pit, SMI Northeast pit, SMI Midnight pit, SMI Southeast Extension pit, SMI Lower West End Dump and Upper West End Dump.

The mining, milling and processing activities created numerous legacy impacts, including underground mine workings, multiple open pits, development rock dumps, tailings deposits, heap leach pads, spent ore piles, a mill and smelter site, three town sites, camp sites, a ruptured water dam, haul roads, an abandoned water diversion tunnel, an airstrip and other disturbances (Midas Gold, 2016). Surface water and groundwater in the district have been impacted by past mining activity as well as natural mineralization. Arsenic, antimony and mercury have been identified as the key constituents of interest (COIs) for the district (HDR, 2017; Brown and Caldwell, 2017).

3 Approach

monthly? annual?

The approach applied to the demonstration of existing conditions for the SWWC model is to predict existing surface water quality at a series of prediction nodes at key points in Meadow Creek and the East Fork of the South Fork of the Salmon River (EFSFSR), including:

- YP-T-22: Meadow Creek above EFSFSR
- YP-SR-10: EFSFSR after confluence with Meadow Creek
- YP-SR-8: EFSFSR above Fiddle Creek
- YP-SR-6: EFSFSR above Yellow Pine pit
- YP-SR-4: EFSFSR below Yellow Pine pit
- YP-SR-2: EFSFSR below Sugar Creek and downstream of all historic and proposed mining activities

These prediction nodes represent surface water monitoring locations that were regularly sampled as part of the Surface Water Quality Baseline Study (HDR, 2017). The prediction nodes were selected to capture solute loading contributions from surface water in the EFSFSR and associated tributaries, and from legacy activities in the district. As such, the prediction nodes were typically sited immediately downgradient of legacy facilities and areas of legacy disturbance. The locations of these prediction nodes are shown in the context of the historical mine facilities on Figure 4-1 through Figure 4-3 and details are provided in Table 4-1.

flow from seeps was included in model for existing conditions/ predictions at specific stream nodes

The main sources contributing to flow and constituent loading at each of these prediction nodes were identified from the Surface Water Quality Baseline report (HDR, 2017), the Water Resources Summary Report (Brown and Caldwell, 2017a) and from an inventory of legacy mining features completed by Midas Gold (Appendix A). This included upgradient stream flow, flow from seeps and adits in the catchment, loading from legacy mine features, plus any potential sources of groundwater inflow identified from the gain-loss analysis conducted as part of the Water Resources Summary Report (Brown and Caldwell, 2017a). The alluvial aquifer system was assumed to contribute to surface water flow within gaining stream reaches of the EFSFSR and associated tributaries.

A spreadsheet mass balance approach was used to calculate constituent loads in surface water at each prediction node for comparison to existing conditions. The various contributing sources identified for each prediction node were mixed (i.e., mass balanced) in ratios defined by their flow rate. Flow rates for the stream, seep and adit sources were obtained from the Surface Water Quality Baseline Report (HDR, 2017. These represent spot flow measurements that were collected immediately after the water quality samples during each monitoring period. Flow was calculated using the mid-section method (HDR, 2017); for streams with very low flows and for adit seeps and seeps, graduated buckets in various sizes (1 quart, 1 gallon, 2 gallons, 5 gallons) were used to measure flow. Flow was measured by timing the fill rate of a bucket; this procedure was generally repeated between three to five times. These measurements were then converted into cubic feet per second (cfs). Measurements therefore reflect essentially instantaneous flow values, given that flow varies on the order of hours or days (i.e., less than the period over which the measurements are performed) in this snowmelt-dominated system.

Flow rates for groundwater sources were obtained from the gain-loss analysis conducted as part of the Water Resources Summary Report (Brown and Caldwell, 2017). Flow rates for seepage from the legacy facilities were calculated from the surface area of the facility, using an average annual precipitation rate of 32 inches and an average recharge rate of 12.3 inches (Brown and Caldwell, 2018, in progress). Representative seep, surface water and groundwater chemistry data were obtained from the Groundwater and Surface Water Quality Baseline reports (HDR, 2016; 2017, Table 4-3), supplemented with additional surface water quality data collected in August 2017 (SRK, 2018). Source terms for the legacy mine facilities were developed using the method outlined in Section 4.

Details of the contributing sources at each of the prediction nodes are summarized in Table 4-2, along with the minimum, maximum and average measured flow rate over the period of record (2012 through 2016). Figure 4-1 to Figure 4-3 also show the locations of the contributing sources in relation to the prediction nodes. Average flow conditions over the period of record were assumed for the purpose of the calculations; however additional models were also run for minimum and maximum flow conditions.

After the various contributing sources were mass balanced, the predicted mass balanced chemistry was compared to the average measured chemistry at each prediction node by calculating the Relative Percentage Difference (RPD) as described in Equation [1] (US EPA, 2016).

[1]

$$\mathrm{RPD} = \frac{(Predicted\ concentration - measured\ concentration)}{(Predicted\ concentration + measured\ concentration)/2} \times 100\%$$

If the RPD between the predicted and measured chemistry was found to be greater than 20%, the calibration was adjusted (by either adding or subtracting load) to correct for the discrepancy. An RPD of 20% is consistent with US EPA (2016) acceptable control limit for duplicate samples.

The results of the existing conditions SWWC model under average flow conditions are presented in Section 5, below. The results for minimum and maximum flow conditions are presented in Appendices B and C, respectively.

how do they account for seasonal changes? also - do they considr adding natural or tunnel-influenced springs when model is off?

but HCTs were not conducted for historic WR or tailings

4 Source Term Development for Legacy Facilities

As described in Section 2, the historic mining, milling and processing activities at Stibnite have created numerous legacy impacts that affect the quality of surface water and groundwater in the district. Midas Gold has completed an inventory of legacy mining materials (Appendix A). Many of these legacy features have associated seep data that can be directly incorporated into the SWWC model (HDR, 2017). For those facilities without associated seep data, a source term was calculated according to the methodology outlined below, and this loading was added to the system. The legacy facilities and their associated flow rates are listed in Table 4-2.

4.1 Humidity Cell Inputs

Source terms for the legacy facilities were developed from the results of site-specific laboratory leach tests (i.e., humidity cell tests [HCTs]) from the SRK Phase 1 Geochemical Characterization Program (SRK 2017a) that were scaled to field conditions. Average steady-state humidity cell chemistry data were used for the calculations, where 'steady-state' is defined as stable effluent sulfate concentrations (within ±5 mg/kg/week).

HF has not been mined, so there is no legacy HF material

Although there is no formal record of the lithological composition of material contained within legacy facilities, the origin of material within each of the facilities is known (e.g. Yellow Pine End pit, etc., Table 4-4). For facilities containing material from the Yellow Pine pit, an average steady-state HCT chemistry from four Yellow Pine humidity cells conducted as part of the SRK (2017a) Phase 1 humidity cell program (i.e., HC-11, HC-12, HC-13 and HC-14) was used to develop the source term. For facilities containing material from the West End pit, an average of the steady-state HCT chemistry from the five West End cells humidity cells conducted as part of the SRK (2017a) Phase 1 humidity cell program (i.e., HC-5, HC-6, HC-7, HC-8 and HC-9) was used to develop the source term.

When analysis of the steady-state HCT leachates identified certain elements to be uniformly below the analytical reporting limit for a particular material type, the parameter was not included in source term for that material type. This prevents falsely elevated constituent concentrations for that material type that may arise as an artifact of the scaling calculation relating humidity cell data to field conditions. Silver, beryllium, cobalt, chromium, fluoride, molybdenum, nickel and thallium are consistently below reporting limits in the steady-state HCT effluent for all material types. Barium, copper, mercury, manganese, phosphorus, selenium, strontium and vanadium are also below analytical reporting limits for many of the material types.

but some of these had high MDLs!

4.2 Scaling of Laboratory HCT Data to Field Conditions

A scaling factor was applied to the humidity cell data in order to account for the differences in reaction rates, temperature, and liquid-to-solid ratios between the laboratory test and field conditions. The methodology used for scaling the laboratory HCT data to field conditions is described below and is consistent with the methodology outlined in the Geochemical Modeling Work Plan (SRK, 2017b).

It was assumed that only a small fraction (8%) of the total mass of material within the legacy facilities is effectively contacted by infiltrating meteoric waters. This fraction is termed the 'contacted mass', which is a result of the combined influence of preferential fluid flow pathways within the facility, in addition to temperature, wetting, and grain size effects, whereby a proportion of the total mass will be effectively isolated within larger particles and therefore unavailable for contact with water, weathering and mobilization of constituents. The assumptions regarding the derivation of the contacted mass are described below.

The reactive portion of the legacy facilities is assumed to be associated with fine-grained material (i.e., sand, silt and clay material less than 2 mm in size (Wentworth, 1922; USGS, 2006)) due to the high proportion of the surface area represented by finer fractions. For the purpose of the source term development, it was assumed that 40% of total mass in the legacy facilities will consist of material than 2 mm in size that will be available for chemical weathering reactions. This estimate was obtained from geotechnical drilling undertaken in the Project area in 2011 and 2012 (SRK, 2012).

Six holes (SRK-GM-02S, SRK-GM-03S, SRK-GM-04S, SRK-GM-05S, SRK-GM-08S, SRK-GM-09S and SRK-GM-10S) were drilled using rotosonic methods through fill (assumed to be legacy development rock) in the vicinity of the Yellow Pine pit. From the drill logs, the proportion of material less than 2 mm in size ranged from 41% to 53%, with an average of 48%. Forty percent (40%) fine particles was selected as the base case for the source term calculations, as it is recognized that rotosonic drilling method creates finer-grained material than would be expected in the field. Thus, 40% was deemed a more realistic estimate of the proportion of fine particles. This is also within the 10 to 50% range reported by Schafer and Associates (1997), Price and Kwong (1997), Murray (1977), Munroe et al. (1999), Herasymuik (2006) and Schneider et al. (2010) for development rock. As described below additional sensitivity analysis was conducted for 20% and 60% fine particles, respectively, to assess the uncertainty associated with this parameter

In addition, it was assumed that infiltration to the legacy facilities is restricted to movement along preferential flow paths contacting approximately 20% of the rock volume. This is consistent with information provided by El Boushi (1975) as reported in MEND (1995), which assumes that flow within development rock facilities is restricted to movement along preferential flow paths contacting approximately 20% of the rock volume. The combined effects of grain size (assumed to be 40% particles <2 mm in size) and flow paths (assumed to be 20% of the rock volume) mean that only 8% of the total rock mass within the legacy facilities is considered available for geochemical weathering reactions (i.e., 40% x 20%). The weathering rates from the HCTs were then applied to this 8% rock mass to define source term chemistry as described in Equation [2] below.

In addition to wetting and grain size effects described above, the ambient temperature in the field will also affect reaction rates and solute release; therefore, an additional scaling factor was also applied that considers the difference in air temperature between the laboratory HCT (conducted at 25ºC according to ASTM 5744-13e1) and annual average field conditions in the Project area (2.6ºC, Brown and Caldwell, 2017). This scaling factor was developed from the calculated difference in rate constant, as determined from the Arrhenius equation in Equation [2]:

[2]

$$K = Ae^{\frac{E_A}{RT}}$$

Where: *K =* *rate constant*

A = *frequency factor (assumed to be approximately constant)*

E_A = *Activation energy (assumed to be 88,000 J/mol (Nicholson et al., 1988)*

R = *Gas constant (8.31 J/K/mol)*

T = *Temperature (kelvin)*

Rate constants (*K*) were developed for both laboratory temperature conditions (K_{lab}) and annual average field temperature conditions (K_{field})[1] and the temperature scaling factor (*T*) was defined as K_{field}/K_{lab}. As with the laboratory HCTs, the legacy facilities are assumed to be fully oxygenated and therefore no additional oxygen scaling factor was applied.

[1] K_{lab} and K_{field} were both calculated using the Arrhenius equation (see Equation [2])

Based on these assumptions, the source term chemistry was developed according to Equation [3]:

[3] $$C_i = \frac{R_i \times M \times F \times P \times T \times O}{Q}$$

Where: C_i = *source term concentration for element i (mg/L)*

R_i = *average release rate of element i in the humidity cell tests (mg/kg/week)*

M = total mass of material in facility (kg)

F = proportion of material <2mm in the facility (%)

P = proportion of material contacted by infiltration in the facility (%)

T = temperature scaling factor based on Arrhenius equation (unitless) defined by K_{field}/K_{lab}

O = oxygen scaling factor (unitless), assumed to be 1 for this analysis (i.e. no oxygen scaling factor applied)

Q = average weekly infiltration to facility (L/week)

The calculated source term chemistry for each of the facilities is provided in Table 4-4**.**

4.3 Source Term Sensitivity Analysis

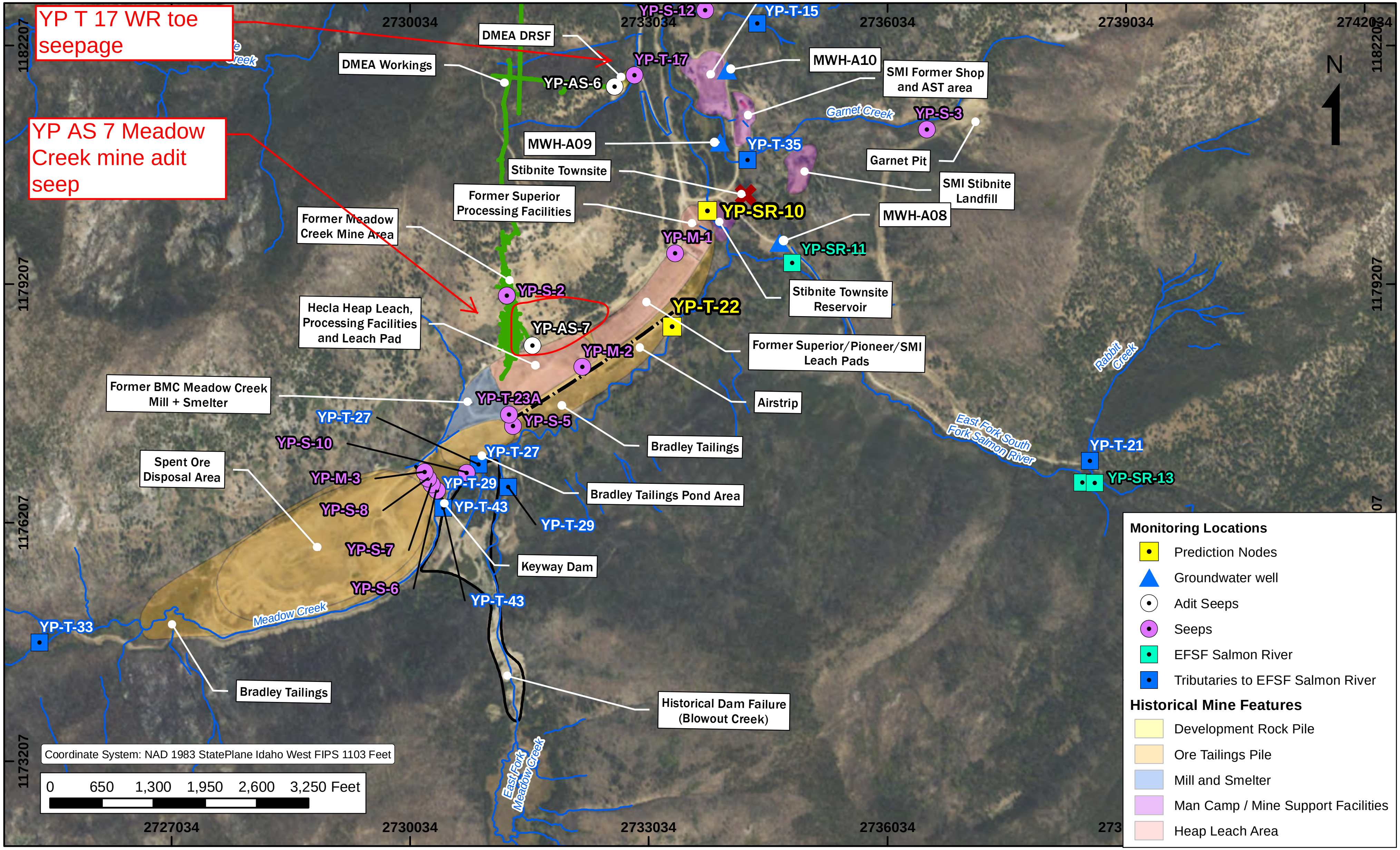
The approach for source term development presented in Section 4.2, is intended to give the most likely output in terms of seepage quality from the legacy facilities and is based on the most likely input parameters. The results for this 'base case' scenario are presented in Section 5. Sensitivity analysis has been carried out to assess the sensitivity of the model to changes in the input parameters for which there is some uncertainty or variation, for example the assumptions surrounding the grain size distribution of material within the facilities and the air temperature used in the temperature scaling factor.

4.3.1 Temperature Sensitivity Analysis

The scaling calculations for the legacy facilities presented in Section 4.2 assume an average annual air temperature in the Project area of 2.6ºC (Brown and Caldwell, 2017). However, sensitivity analysis has been conducted for minimum and maximum monthly temperature conditions of -7.3ºC and 14.5ºC, which represent the minimum and maximum monthly average temperatures for December and July, respectively (Brown and Caldwell, 2017). The results of the temperature sensitivity analysis are presented in Appendix E and are discussed in Section 5.1.

4.3.2 Grain Size Sensitivity Analysis

The scaling calculations for the legacy facilities presented in Section xx assume that the proportion of fine-grained material (i.e. material less than 2 mm in size) in the legacy facilities is approximately 40% (SRK, 2012). However, sensitivity analysis has been conducted for scenarios where 20% and 60% of material is less than 2 mm in size to assess the uncertainty surrounding this parameter. The results of the grain size sensitivity analysis are presented in Appendix F and are discussed in Section 5.2.



FEBRUARY 2018	U6565	STIBNITE GEOCHEMICAL MODELLING	
srk consulting		Historical Mine Features, Water Quality Prediction Nodes and Contributing Sources South Area	Figure 4-1

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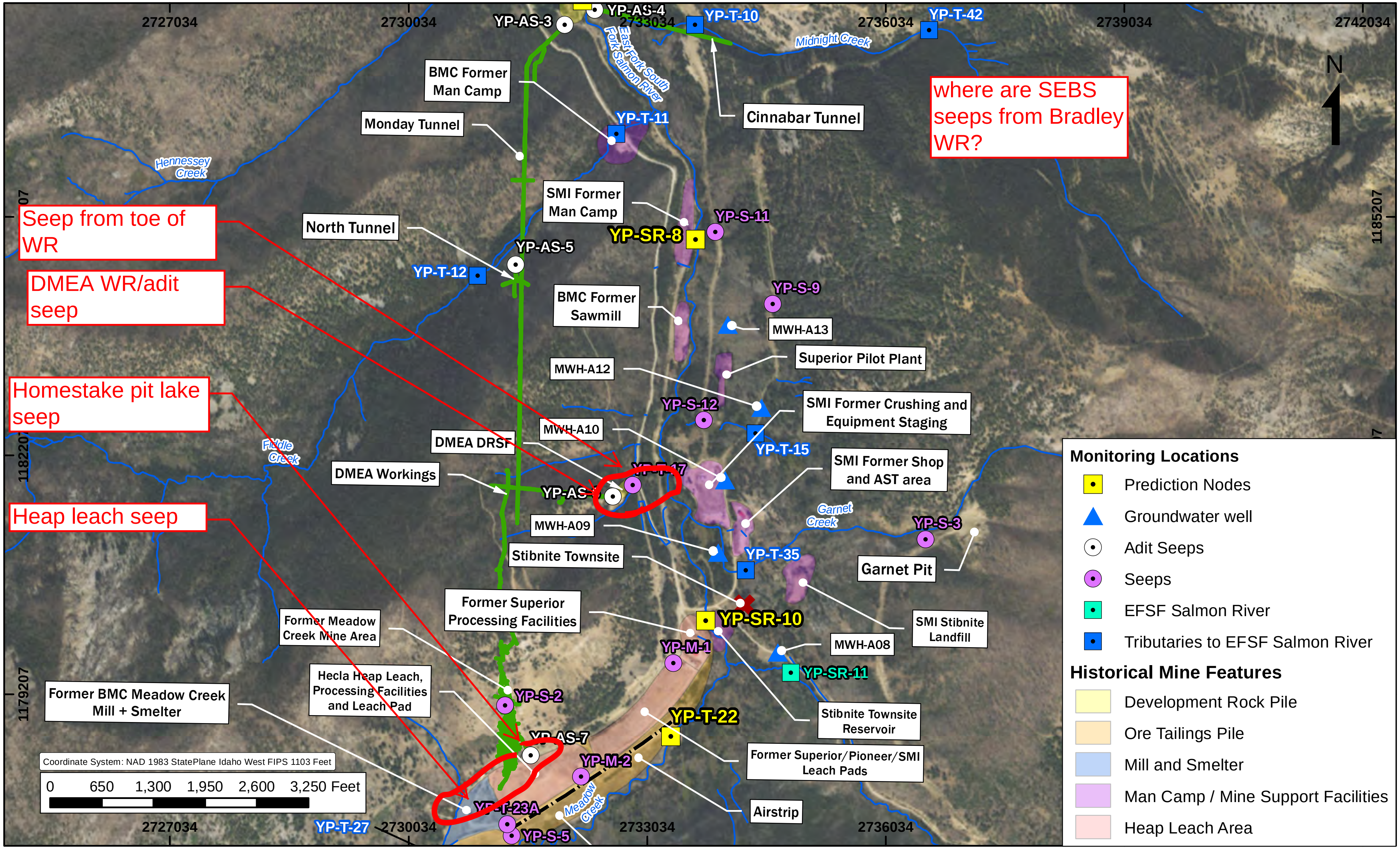

FEBRUARY 2018	U6565	STIBNITE GEOCHEMICAL MODELLING	
srk consulting		Historical Mine Features, Water Quality Prediction Nodes and Contributing Sources Central Area	Figure 4-2

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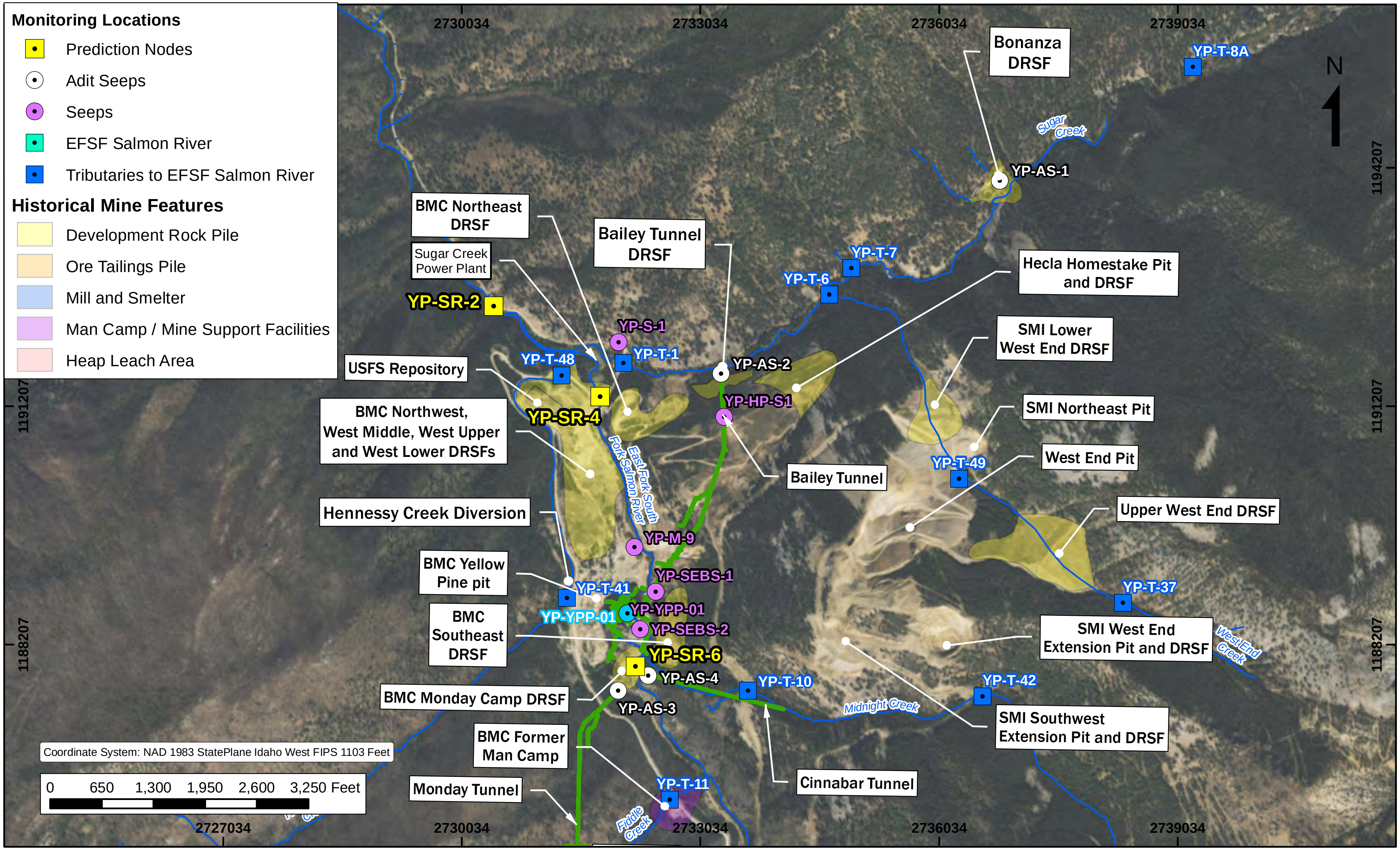

FEBRUARY 2018	U6565	STIBNITE GEOCHEMICAL MODELLING	
srk consulting		Historical Mine Features, Water Quality Prediction Nodes and Contributing Sources North Area	Figure 4-3

Table 4-1: Details of Prediction Nodes (HDR, 2017; Brown and Caldwell, 2017)

Prediction Node/ Monitoring Location ID	Location	Watershed	Legacy Upstream Activities	Potential Future Upstream Activities
YP-T-22	Meadow Creek above EFSFSR	Meadow Creek	Meadow Creek Mine, mill, smelter and DRSF; BMC (Bradley) tailings impoundment; SMI leach pads; Hecla heap leach and processing facilities, Spent Ore Disposal Area (SODA), Pioneer Heap Leach Pads, Keyway Dam; mineralization associated with Hangar Flats ore deposit/Meadow Creek Fault Zone	Hangar Flats DRSF, TSF and pit
YP-SR-10	EFSFSR below Meadow Creek	EFSFSR	BMC ('Bradley') tailings, SMI leach pads, processing facilities and all other impacts listed for YP-T-22. As-Sb bearing mineralization cut by wells MWH-A08 and MWH-B08	Hangar Flats DRSF, TSF and pit
YP-SR-8	EFSFSR above Fiddle Creek	EFSFSR	BMC/DMEA mine adit and DRSF, sawmill, recreation hall, service station; SMI shop, AST, crusher area, pilot plant and camp; Hecla equipment area and camp, Garnet pit and backfill. Outcropping mineralization in Scout Valley near the DMEA area.	Hangar Flats DRSF, TSF and pit
YP-SR-6	EFSFSR above Yellow Pine Pit	EFSFSR	BMC-Pioneer Mining Company (PMC)-SMI Former Man Camp, BMC Cinnabar Tunnel DRSF	Fiddle DRSF, plus facilities listed above
YP-SR-4	EFSFSR below Yellow Pine Pit	EFSFSR	BMC Yellow Pine pit, west, southeast and northwest BMC DRSFs, BMC NE oxide stockpiles, Monday Camp DRSF, Bailey Tunnel Collar	Yellow Pine Pit, plus facilities listed above
YP-SR-2	EFSFSR below Sugar Creek	EFSFSR	Homestake pit backfill, Canadian Superior Mining (CSM)-SMI Backfill, Upper and Lower West End DRSFs, plus all facilities listed above	West End Pit and DRSF, plus facilities listed above

Table 4-2: Existing Conditions SWWC Model Chemistry and Water Balance Inputs

Location	Details	Water Balance Input[a]	Chemistry Input	Period of Record	Number of	Number of	Source of	Minimum Flow	Maximum Flow	Average Flow	Mixing Ratio	Sum
YP-T-22	Meadow Creek above EFSFSR	Upgradient SW inflow in Meadow Creek	SW monitoring data from YP-T-27	April 2012 – Q3 2016	37	37	HDR (2017)	2.55	76.5	17.4	75.4%	100%
		Upgradient SW inflow from Blowout Creek	SW monitoring data from YP-T-29	April 2012 – Q3 2016	37	37	HDR (2017)	0.78	22.2	5.27	22.9%	
		SW flow from settling pond on NE corner of SODA	SW monitoring data from YP-M-3	May 2012 - Q3 2016	34	18	HDR (2017)	0.01	0.75	0.12	0.5%	
		SW flow from South Keyway Dam Seep	SW monitoring data from YP-S-6	May 2012 - Q3 2016	3	18	HDR (2017)	0.00028	0.011	0.006	0.02%	
		SW flow from North Keyway Dam Seep	SW monitoring data from YP-S-8	May 2012 - Q3 2016	30	17	HDR (2017)	0.00031	0.095	0.011	0.05%	
		SW flow from Keyway Marsh Outlet	SW monitoring data from YP-S-10	May 2012 - Q3 2016	34	18	HDR (2017)	0.03	0.86	0.19	0.8%	
		SW flow from Meadow Creek fault seep	SW monitoring data from YP-S-2	May 2012 - Q3 2016	17	6	HDR (2017)	4.1×10^{-7}	0.02	0.003	0.01%	
		SW flow from Smelter Flats seep	SW monitoring data from YP-S-5	May 2012 - Q3 2016	13	7	HDR (2017)	0.0008	0.19	0.03	0.1%	
		SW flow from Meadow Creek Mine adit seep	SW monitoring data from YP-AS-7	May 2012 - Q3 2016	17	8	HDR (2017)	8.2×10^{-6}	0.005	0.002	0.01%	
		SW flow from heap leach seep	SW monitoring data from YP-T-23A	April 2012 – Q3 2016	19	22	HDR (2017)	0.004	0.13	0.03	0.1%	
YP-SR-10	EFSFSR below Meadow Creek	SW flow from Meadow Creek	Chemistry predicted for YP-T-22	April 2012 – Q3 2016	37	37	HDR (2017)	3.9	87.0	22.6	55.7%	100%
		Upgradient SW flow in EFSFSR	SW monitoring data from YP-SR-11	April 2012 – Q3 2016	37	37	HDR (2017)	3.32	80	16.4	40.3%	
		Estimated GW inflow[b]	GW monitoring data from MWH-A08	March 2013 - Q3 2016	-	18	BC (2017)	-	-	1.65	4.1%	
YP-SR-8	EFSFSR above Fiddle Creek	Upgradient SW flow in EFSFSR	Chemistry predicted from YP-SR-10	April 2012 – Q3 2016	37	37	HDR (2017)	6.23	169	39.3	98.7%	100%
		SW flow from Garnet Creek	SW monitoring data from YP-T-35	April 2012 – Q3 2016	32	33	HDR (2017)	0.01	1.88	0.28	0.7%	
		SW flow from Scout Creek	SW monitoring data from YP-T-15	April 2012 – Q3 2016	37	37	HDR (2017)	0.01	0.98	0.17	0.4%	
		SW flow from DMEA waste rock seep	SW monitoring data from YP-T-17	May 2012 - Q3 2016	34	18	HDR (2017)	0.0004	0.12	0.02	0.04%	
		SW flow from DMEA adit seep	SW monitoring data from YP-AS-6	May 2012 - Q3 2016	33	17	HDR (2017)	0.0004	0.02	0.006	0.01%	
		SW flow from Garnet pit seep	SW monitoring data from YP-S-3	May 2012 - Q3 2016	24	14	HDR (2017)	0.005	0.23	0.05	0.1%	
		SW flow from Old Haul Road seep	SW monitoring data from YP-S-9	May 2012 - Q3 2016	22	13	HDR (2017)	0.0008	0.006	0.002	0.01%	
YP-SR-6	EFSFSR above Yellow Pine Pit	Upgradient SW flow from Fiddle Creek	SW monitoring data for YP-T-11	April 2012 – Q3 2016	37	37	HDR (2017)	0.22	20.6	3.56	7.2%	100%
		Upgradient SW flow in EFSFSR	Chemistry predicted from YP-SR-8	April 2012 – Q3 2016	37	37	HDR (2017)	5.88	195	42.4	86.2%	
		SW flow from Monday Tunnel adit seep	SW monitoring data from YP-AS-3	May 2012 - Q3 2016	34	18	HDR (2017)	0.0004	0.04	0.007	0.01%	
		SW flow from Cinnabar Tunnel adit seep	SW monitoring data from YP-AS-4	May 2012 - Q3 2016	35	18	HDR (2017)	0.01	0.37	0.1	0.2%	
		Seepage from BMC Monday Camp DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.0069	0.0145	0.01	0.02%	
		Estimated GW inflow[b]	GW monitoring data from MWH-A09, MWH-A10, MWH-A12, MWH-A13	Sept 2012 - Q3 2016	-	59	BC (2017)	-	-	3.08	6.3%	
YP-SR-4	EFSFSR below Yellow Pine Pit	Upgradient SW flow from EFSFSR	Chemistry predicted for YP-SR-6	April 2012 – Q3 2016	37	37	HDR (2017)	6.95	216	50.6	91.8%	100%
		SW flow from Midnight Creek	SW monitoring data for YP-T-10	April 2012 – Q3 2016	36	36	HDR (2017)	0.15	3.35	0.85	1.5%	
		SW flow from Bradley Dump seep 1	SW monitoring data for YP-SEBS-1	May 2012 - Q3 2016	24	13	HDR (2017)	0.006	0.08	0.03	0.1%	
		SW flow from Bradley Dump seep 2	SW monitoring data for YP-SEBS-2	May 2012 - Q3 2016	24	13	HDR (2017)	0.02	0.54	0.27	0.5%	
		SW flow from Hennessy Creek[f]	SW monitoring data for YP-T-41	April 2012 – Q3 2016	37	37	HDR (2017)	0.15	7.37	1.38	2.5%	
		SW flow from Yellow Pine Pit	SW monitoring data for YP-YPP-01	Aug-17	0	1	Calculated[i]	0.68	10.4	1.75	3.2%	
		Seepage from BMC NE Oxide stockpile #1	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.0065	0.0138	0.010	0.02%	
		Seepage from BMC NE Oxide stockpile #2	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.0078	0.0165	0.012	0.02%	
		Seepage from BMC West Lower DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.0078	0.0165	0.012	0.02%	
		Seepage from BMC NW DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.0338	0.0714	0.051	0.1%	
		Seepage from BMC West Middle DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.0070	0.0149	0.011	0.02%	
		Seepage from BMC West Upper DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.008	0.016	0.011	0.02%	
		Seepage from BMC SE DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.01	0.02	0.02	0.03%	
		SW flow from pond downgradient of Yellow Pine Pit	SW monitoring data for YP-M-9	Aug-17	0	1	Calculated[i]	0.04	0.58	0.10	0.2%	
YP-SR-2	EFSFSR below Sugar Creek	Upgradient SW flow from Sugar Creek	SW monitoring data for YP-T-1	April 2012 – Q3 2016	37	37	HDR (2017)	4.2	213	36.7	40.5%	100%
		SW flow from Bonanza Adit Seep	SW monitoring data for YP-AS-1	May 2012 - Q3 2016	27	16	HDR (2017)	0.0002	0.0941	0.01	0.01%	
		SW flow from Bailey Tunnel Adit Seep	SW monitoring data for YP-AS-2	May 2012 - Q3 2016	36	18	HDR (2017)	0.03	0.22	0.09	0.1%	
		SW flow from Hennessy Creek[g]	SW monitoring data for YP-T-48	June 2013 - Q3 2016	18	18	HDR (2017)	0.09	5.1	1.05	1.2%	
		SW flow from Hillside seep	SW monitoring data for YP-S-1	May 2012 - Q3 2016	27	10	HDR (2017)	0.00003	0.03	0.004	0.004%	
		Upgradient SW flow from EFSFSR	Chemistry predicted for YP-SR-4	April 2012 – Q3 2016	37	37	HDR (2017)	7.67	227	52.5	58.0%	
		Seepage from Lower West End DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.113	0.240	0.17	0.2%	
		Seepage from Upper West End DRSF	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.020	0.043	0.03	0.03%	
		Seepage from HMC Homestake Pit Backfill	Calculated source term	N/A	N/A	N/A	Calculated[h]	0.020	0.042	0.03	0.03%	

N/A = not applicable
[a] SW = surface water; GW = groundwater
[b] Estimated from Gain-Loss Analysis presented in Section 7.6 of the Water Resources Summary Report (Brown and Caldwell, 2017)
[c] Flow rates for surface water sources are obtained from HDR (2017) Surface Water Quality Baseline. Flow rates for groundwater sources are obtained from Gain-Loss Analysis in Brown and Caldwell (2017) Water Resources Summary Report
[d] Average, minimum and maximum flow rates from quarterly spot measurements over the period of record
[e] Based on average flow rates
[f] Hennessy Creek before diversion around Northwest Bradley Rock Dump
[g] Hennessy Creek after diversion around Northwest Bradley Rock Dump
[h] Calculated from the surface area of the facility, assuming an annual average precipitation rate of 32 inches, and an average recharge rate of 12.3 inches (Brown and Caldwell 2018)
[i] Calculated from difference in average flow rates between YP-SR-4 and YP-SR-6. The proportional contribution from YP-YPP-01 and YP-M-9 was then calculated from the surface area of the Yellow Pine Pit lake and the pond downgradient of Yellow Pine Pit

Table 4-3: Average Surface Water and Groundwater Chemistry used in the Mass Balance Calculations

Parameter	Units	Surface water (HDR, 2017)																			
		YP-AS-1	YP-AS-2	YP-AS-3	YP-AS-4	YP-AS-6	YP-AS-7	YP-M-3	YP-M-9	YP-S-1	YP-S-10	YP-S-2	YP-S-3	YP-S-5	YP-S-6	YP-S-8	YP-S-9	YP-SEBS-1	YP-SEBS-2	YP-SR-10	YP-SR-11
pH	pH units	7.27	7.27	7.04	7.43	7.33	7.15	7.08	6.91	7.50	7.26	7.40	7.01	7.66	7.21	7.02	7.23	7.35	7.46	7.40	7.49
Alkalinity as $CaCO_3$, Total	mg/L	148	102	94.7	106	138	360	28.9	26.0	93.8	99.8	35.4	62.5	100	171	133	107	168	109	39.3	38.4
Aluminum, Total	mg/L	0.23	0.014	0.22	0.011	0.013	1.21	0.89	0.020	0.51	0.031	0.44	0.094	0.62	0.054	0.0087	3.16	0.029	0.0075	0.065	0.044
Aluminum, Dissolved	mg/L	0.0086	0.0040	0.0044	0.0021	0.0026	0.0065	0.049	0.012	0.038	0.0042	0.074	0.0064	1.91	0.0072	0.0031	0.015	0.0025	0.0021	0.0096	0.0075
Antimony, Total	mg/L	0.26	0.20	0.0077	0.049	0.022	0.17	0.034	0.15	0.00071	0.047	0.013	0.023	1.88	0.050	0.65	0.093	0.018	0.055	0.013	0.0011
Antimony, Dissolved	mg/L	0.22	0.19	0.0013	0.049	0.022	0.022	0.022	0.16	0.00055	0.042	0.014	0.023	2.00	0.030	0.32	0.091	0.018	0.055	0.012	0.0011
Arsenic, Total	mg/L	0.30	0.28	1.70	0.11	0.24	18.3	0.13	0.58	0.053	0.50	1.06	0.15	1.41	4.31	3.07	0.24	0.12	0.14	0.026	0.010
Arsenic, Dissolved	mg/L	0.053	0.15	0.039	0.11	0.24	5.97	0.083	0.56	0.042	0.077	0.98	0.14	1.74	0.43	2.33	0.14	0.099	0.14	0.024	0.0100
Barium, Total	mg/L	0.11	0.022	0.27	0.0096	0.039	0.12	0.025	0.014	0.095	0.024	0.056	0.0081	0.034	0.081	0.067	0.027	0.14	0.013	0.0094	0.010
Barium, Dissolved	mg/L	0.078	0.021	0.11	0.0096	0.039	0.025	0.0033	0.013	0.079	0.016	0.040	0.0072	0.066	0.038	0.053	0.0063	0.14	0.013	0.0087	0.0097
Beryllium, Total	mg/L	0.00012	8.5E-05	6.6E-05	2.0E-05	2.6E-05	0.00088	0.00020	4.9E-05	0.00014	2.2E-05	0.00012	9.1E-05	0.00014	2.8E-05	2.7E-05	0.00031	2.0E-05	2.0E-05	2.1E-05	2.1E-05
Beryllium, Dissolved	mg/L	2.0E-05	6.0E-05	2.0E-05	2.0E-05	2.0E-05	4.6E-05	2.7E-05	3.6E-05	2.3E-05	2.0E-05	2.7E-05	3.2E-05	0.00040	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05
Boron, Total	mg/L	0.029	0.028	0.026	0.028	0.025	0.023	0.024	0.021	0.032	0.024	0.025	0.028	0.032	0.026	0.025	0.027	0.028	0.028	0.026	0.026
Boron, Dissolved	mg/L	0.028	0.028	0.026	0.028	0.025	0.023	0.025	0.021	0.032	0.025	0.025	0.028	0.032	0.025	0.025	0.027	0.029	0.029	0.026	0.026
Cadmium, Total	mg/L	3.0E-05	2.0E-05	4.7E-05	2.0E-05	2.1E-05	6.6E-05	4.7E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	3.3E-05	2.2E-05	2.0E-05	4.5E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.1E-05	2.1E-05	2.0E-05	2.0E-05	3.0E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	6.1E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05
Calcium, Total	mg/L	40.3	90.9	21.1	31.2	48.4	224	9.94	24.7	30.8	46.4	16.1	17.9	50.1	81.1	66.3	26.9	55.0	34.5	10.2	8.74
Calcium, Dissolved	mg/L	39.6	90.6	20.1	31.0	48.5	215	9.42	24.0	30.5	45.8	16.0	17.8	50.5	78.3	65.6	25.7	55.8	34.5	10.2	8.75
Chloride	mg/L	0.65	0.54	0.64	0.36	0.38	0.48	0.49	1.02	0.48	29.4	1.40	0.36	1.77	34.9	41.1	0.43	0.46	0.38	0.67	0.38
Chromium, Total	mg/L	0.00029	0.00026	0.00057	0.00026	0.00020	0.00069	0.0019	0.00020	0.00027	0.00025	0.00020	0.00022	0.0011	0.00035	0.00021	0.0053	0.00024	0.00029	0.00021	0.00023
Chromium, Dissolved	mg/L	0.00022	0.00021	0.00021	0.00021	0.00023	0.00031	0.00031	0.00020	0.00020	0.00020	0.00022	0.00026	0.0028	0.00022	0.00020	0.00026	0.00026	0.00023	0.00024	0.00021
Cobalt, Total	mg/L	0.0010	0.00045	0.0028	4.1E-05	5.7E-05	0.0039	0.0020	7.2E-05	0.00014	0.0019	0.00017	4.9E-05	0.0013	0.0045	0.0028	0.0013	5.3E-05	3.2E-05	8.6E-05	3.2E-05
Cobalt, Dissolved	mg/L	0.00012	0.00040	0.00028	3.7E-05	4.8E-05	0.0026	0.00041	4.9E-05	4.0E-05	0.0016	6.5E-05	2.5E-05	0.0022	0.0041	0.0028	3.6E-05	2.9E-05	2.5E-05	7.0E-05	2.4E-05
Copper, Total	mg/L	0.00098	0.00050	0.0010	0.00015	0.00058	0.0014	0.0028	0.00041	0.00053	0.00043	0.00038	0.00049	0.0087	0.00053	0.00019	0.0049	0.00014	0.00012	0.00022	0.00012
Copper, Dissolved	mg/L	0.00038	0.00064	0.00019	0.00022	0.00035	0.00018	0.00049	0.0027	0.00026	0.00031	0.00028	0.00032	0.012	0.00032	0.00017	0.00046	0.00019	0.00017	0.00024	0.00021
Fluoride	mg/L	0.27	0.26	0.26	0.26	0.28	0.80	0.26	0.20	0.30	0.26	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.29	0.29
Iron, Total	mg/L	3.99	0.38	24.1	0.025	0.056	66.6	3.33	0.088	0.91	3.06	0.96	0.17	3.42	19.6	11.4	4.75	0.22	0.028	0.15	0.051
Iron, Dissolved	mg/L	0.067	0.046	0.18	0.020	0.023	23.0	0.29	0.042	0.050	0.070	0.11	0.021	9.30	1.51	6.89	0.034	0.023	0.020	0.039	0.020
Lead, Total	mg/L	0.00060	3.1E-05	0.00053	2.1E-05	0.00013	0.0027	0.0018	2.1E-05	0.00029	0.00011	0.00035	5.1E-05	0.0019	0.00012	5.9E-05	0.00094	2.7E-05	2.2E-05	6.6E-05	3.6E-05
Lead, Dissolved	mg/L	2.4E-05	2.2E-05	2.1E-05	2.0E-05	2.1E-05	3.1E-05	0.00013	4.3E-05	2.7E-05	2.2E-05	5.2E-05	2.0E-05	0.0055	2.9E-05	2.1E-05	2.2E-05	2.0E-05	2.0E-05	2.1E-05	2.1E-05
Magnesium, Total	mg/L	13.5	27.5	7.16	8.72	11.9	52.7	1.85	5.12	4.54	11.0	2.94	2.78	7.79	21.7	14.9	11.4	20.7	9.59	2.26	2.25
Magnesium, Dissolved	mg/L	13.4	27.3	7.01	8.65	11.9	51.6	1.45	4.98	4.48	11.1	2.89	2.72	8.33	21.4	14.8	9.20	21.0	9.68	2.23	2.24
Manganese, Total	mg/L	0.31	0.14	1.74	0.0020	0.011	2.07	0.041	0.013	0.021	0.41	0.038	0.013	0.20	1.44	1.02	0.049	0.012	0.0028	0.018	0.0036
Manganese, Dissolved	mg/L	0.039	0.14	0.26	0.0020	0.0028	1.81	0.013	0.0093	0.0030	0.087	0.020	0.0021	0.39	1.08	1.00	0.0026	0.0049	0.0021	0.013	0.0016
Mercury, Total	mg/L	0.00073	1.5E-06	0.00011	3.0E-06	3.6E-06	0.00031	0.00043	1.9E-06	3.9E-05	9.0E-06	0.00039	1.7E-05	0.0017	5.5E-05	1.3E-05	1.6E-05	2.7E-06	2.0E-06	5.8E-06	7.7E-06
Mercury, Dissolved	mg/L	2.0E-05	8.3E-07	1.4E-06	1.3E-06	1.3E-06	4.0E-06	1.4E-05	1.6E-06	3.1E-06	2.6E-06	4.8E-05	2.7E-06	0.00017	9.2E-06	1.4E-06	2.4E-06	7.8E-07	9.2E-07	2.4E-06	3.0E-06
Molybdenum, Total	mg/L	0.0027	0.00077	0.00017	0.0010	0.0039	0.00050	0.00035	6.2E-05	0.00012	0.0016	0.00018	0.0016	0.0019	0.0037	0.0046	0.0014	0.0010	0.00099	0.00089	0.00091
Molybdenum, Dissolved	mg/L	0.0025	0.00075	9.3E-05	0.0010	0.0039	0.00034	0.00040	0.00019	0.00014	0.0015	0.00020	0.0016	0.0020	0.0035	0.0045	0.0014	0.0010	0.00098	0.00089	0.00091
Nickel, Total	mg/L	0.0012	0.00095	0.00059	0.00028	0.00040	0.0039	0.0039	0.00040	0.00036	0.00074	0.00028	0.00026	0.0026	0.0014	0.0011	0.0035	0.00029	0.00027	0.00020	0.00020
Nickel, Dissolved	mg/L	0.00056	0.00099	0.00028	0.00029	0.00041	0.0028	0.00075	0.00045	0.00029	0.00056	0.00025	0.00026	0.0042	0.0011	0.0011	0.00030	0.00034	0.00025	0.00023	0.00024
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.070	0.090	0.22	0.050	0.050	0.10	0.050	0.059	0.064	0.064	0.11	0.087	0.093	0.050	0.050	0.22	0.14	0.050	0.050
Phosphorus, Total	mg/L	0.18	0.039	0.31	0.036	0.036	2.08	0.11	0.042	0.064	0.093	0.14	0.052	0.37	0.29	0.43	0.19	0.036	0.035	0.036	0.035
Phosphorus, Dissolved	mg/L	0.036	0.038	0.037	0.036	0.037	0.11	0.040	0.042	0.033	0.039	0.11	0.038	0.49	0.042	0.050	0.039	0.036	0.036	0.035	0.035
Potassium, Total	mg/L	2.28	2.06	1.24	1.60	1.33	4.00	1.39	1.37	1.48	4.59	1.83	1.07	6.25	7.74	5.99	4.61	1.90	1.65	0.81	0.69
Potassium, Dissolved	mg/L	2.10	2.06	1.09	1.58	1.32	3.38	0.89	2.49	1.18	4.62	1.48	1.05	6.84	7.58	5.96	3.37	1.92	1.66	0.78	0.69
Selenium, Total	mg/L	0.0010	0.0010	0.0011	0.0010	0.0010	0.0017	0.0011	0.0010	0.0010	0.0010	0.0010	0.0010	0.0021	0.0011	0.0010	0.0011	0.0010	0.0010	0.0010	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.0010	0.0010	0.0010	0.0015	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0029	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Silver, Total	mg/L	2.3E-05	2.3E-05	3.1E-05	2.1E-05	2.2E-05	6.1E-05	9.4E-05	2.0E-05	2.2E-05	2.7E-05	3.1E-05	2.0E-05	0.00039	2.8E-05	2.2E-05	0.00021	2.0E-05	2.0E-05	2.1E-05	2.1E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	2.1E-05	2.0E-05	2.1E-05	3.3E-05	2.5E-05	2.0E-05	2.1E-05	2.1E-05	2.0E-05	2.0E-05	0.0013	2.2E-05	2.2E-05	2.0E-05	2.0E-05	2.0E-05	2.1E-05	2.1E-05
Sodium, Total	mg/L	6.53	3.50	6.16	0.95	4.97	7.66	3.96	5.41	3.16	11.5	2.32	2.72	7.44	15.7	14.2	0.92	2.75	1.04	2.12	1.66
Sodium, Dissolved	mg/L	6.57	3.49	6.22	0.95	5.01	7.53	3.82	5.36	3.18	11.6	2.30	2.72	7.54	15.5	14.1	0.88	2.79	1.06	2.12	1.68
Solids, Total Dissolved (TDS)	mg/L	185	471	97.6	130	197	941	60.3	155	133	216	92.2	80.2	217	385	290	104	263	146	51.9	45.1
Solids, Total Suspended (TSS)	mg/L	50.2	5.08	71.1	5.00	5.00	238	89.3	5.00	44.9	26.0	21.1	18.8	26.5	61.6	35.2	43.2	6.85	5.00	5.68	5.04
Sulfate	mg/L	23.7	241	3.10	12.2	42.4	406	11.1	78.3	13.0	36.6	19.6	4.22	70.0	93.0	66.1	3.72	61.0	20.7	4.03	1.58
Thallium, Total	mg/L	2.9E-05	2.2E-05	2.2E-05	2.0E-05	2.0E-05	0.00059	0.00011	2.8E-05	2.0E-05	2.0E-05	0.00017	2.0E-05	8.6E-05	3.5E-05	2.1E-05	5.8E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	3.7E-05	2.3E-05	2.0E-05	2.0E-05	2.0E-05	8.5E-05	2.0E-05	0.00022	2.2E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05
Vanadium, Total	mg/L	0.00041	0.00020	0.0018	0.00020	0.00020	0.0025	0.0032	0.00020	0.00056	0.00032	0.00043	0.00029	0.0025	0.00058	0.00026	0.0049	0.00023	0.00020	0.00031	0.00023
Vanadium, Dissolved	mg/L	0.00020	0.00020	0.00020	0.00020	0.00020	0.00030	0.00080	0.00020	0.00020	0.00020	0.00020	0.00021	0.0050	0.00021	0.00020	0.00038	0.00020	0.00020	0.00021	0.00020
Zinc, Total	mg/L	0.0047	0.0089	0.033	0.00058	0.0048	0.012	0.0089	0.0020	0.0019	0.0015	0.0017	0.00088	0.20	0.0017	0.0012	0.0053	0.00052	0.00059	0.00068	0.00059
Zinc, Dissolved	mg/L	0.00079	0.0085	0.0026	0.00062	0.0041	0.0020	0.0011	0.0030	0.00083	0.00062	0.0013	0.00078	0.36	0.00088	0.0011	0.00064	0.00072	0.00063	0.00063	0.00070

Table 4-3 (Cont'd): Average Surface Water and Groundwater Chemistry used in the Mass Balance Calculations

Parameter	Units	Surface water (HDR, 2017)																	Groundwater (HDR, 2016)	
		YP-SR-2	YP-SR-4	YP-SR-6	YP-SR-8	YP-T-1	YP-T-10	YP-T-11	YP-T-15	YP-T-17	YP-T-22	YP-T-23A	YP-T-27	YP-T-29	YP-T-35	YP-T-41	YP-T-48	YP-YPP-01	MWH-A08	MWH-A09, MWH-A10, MWH-A12 and MWH-A13
pH	pH units	7.61	7.50	7.38	7.48	7.68	8.10	7.19	7.41	7.34	7.44	7.06	7.39	7.60	7.49	7.10	7.20	6.43	7.08	7.15
Alkalinity as $CaCO_3$, Total	mg/L	47.6	42.8	40.9	43.0	56.7	90.3	25.3	46.6	95.4	39.7	61.6	38.2	41.5	51.4	21.5	21.9	56.0	71.8	105
Aluminum, Total	mg/L	0.088	0.075	0.11	0.079	0.14	0.043	0.088	0.051	0.35	0.15	0.22	0.056	0.35	0.075	0.078	0.18	0.015	0.15	0.23
Aluminum, Dissolved	mg/L	0.016	0.012	0.011	0.010	0.011	0.0044	0.017	0.0066	0.0045	0.014	0.0086	0.013	0.012	0.0061	0.016	0.010	0.0063	0.0086	0.0086
Antimony, Total	mg/L	0.022	0.031	0.020	0.017	0.0036	0.046	0.00057	0.00015	0.032	0.0080	1.49	0.0061	0.0010	0.044	0.00057	0.029	0.070	0.016	0.062
Antimony, Dissolved	mg/L	0.022	0.031	0.019	0.017	0.0036	0.046	0.00056	0.045	0.027	0.0078	1.44	0.0060	0.0010	0.044	0.00052	0.027	0.035	0.015	0.064
Arsenic, Total	mg/L	0.049	0.070	0.032	0.030	0.014	0.092	0.0018	0.00051	0.61	0.037	1.44	0.036	0.0071	0.17	0.0026	0.033	0.11	0.021	0.086
Arsenic, Dissolved	mg/L	0.043	0.061	0.030	0.028	0.013	0.091	0.0016	0.086	0.18	0.033	1.00	0.033	0.0063	0.16	0.0022	0.026	0.085	0.019	0.081
Barium, Total	mg/L	0.012	0.012	0.012	0.011	0.012	0.0086	0.014	0.0098	0.062	0.0095	0.051	0.0057	0.019	0.0084	0.017	0.017	0.014	0.048	0.043
Barium, Dissolved	mg/L	0.011	0.011	0.010	0.0099	0.011	0.0083	0.012	0.0090	0.033	0.0073	0.034	0.0053	0.012	0.0077	0.016	0.015	0.013	0.045	0.038
Beryllium, Total	mg/L	2.4E-05	2.4E-05	2.4E-05	2.2E-05	3.2E-05	2.1E-05	2.3E-05	2.1E-05	0.00023	2.7E-05	8.3E-05	2.0E-05	4.6E-05	2.5E-05	2.1E-05	2.2E-05	2.0E-05	2.7E-05	3.5E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05
Boron, Total	mg/L	0.026	0.026	0.026	0.026	0.028	0.028	0.027	0.026	0.024	0.024	0.026	0.024	0.024	0.026	0.028	0.022	0.021	0.019	0.019
Boron, Dissolved	mg/L	0.026	0.026	0.026	0.026	0.028	0.028	0.027	0.027	0.025	0.025	0.026	0.025	0.025	0.026	0.028	0.022	0.021	0.020	0.019
Cadmium, Total	mg/L	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.4E-05	2.0E-05	2.1E-05	2.0E-05	3.8E-05	2.1E-05	3.2E-05	2.0E-05	2.0E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	2.1E-05	2.5E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	2.0E-05	2.8E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.2E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.6E-05
Calcium, Total	mg/L	14.2	12.6	11.3	11.4	16.4	25.2	5.64	4.29	38.5	11.2	53.1	11.3	10.0	14.3	4.47	5.47	17.1	19.2	27.4
Calcium, Dissolved	mg/L	14.2	12.6	11.3	11.3	16.3	25.2	5.60	12.2	37.5	11.1	53.0	11.3	9.94	14.2	4.47	5.37	15.0	19.2	25.6
Chloride	mg/L	0.52	0.66	0.68	0.73	0.38	1.65	0.39	0.38	0.42	0.99	0.83	1.22	0.38	0.38	0.38	0.39	0.50	0.47	1.32
Chromium, Total	mg/L	0.00026	0.00024	0.00028	0.00025	0.00024	0.00027	0.00020	0.00023	0.00036	0.00028	0.00043	0.00021	0.00045	0.00022	0.00022	0.00020	0.00020	0.00060	0.00073
Chromium, Dissolved	mg/L	0.00021	0.00022	0.00020	0.00022	0.00020	0.00021	0.00026	0.00023	0.00022	0.00025	0.00021	0.00022	0.00022	0.00023	0.00021	0.00020	0.00020	0.00029	0.00031
Cobalt, Total	mg/L	9.8E-05	0.00014	0.00014	0.00013	7.6E-05	4.9E-05	3.1E-05	2.7E-05	0.00057	0.00016	0.0012	0.00013	0.00021	6.2E-05	3.8E-05	4.8E-05	7.5E-05	8.6E-05	0.00041
Cobalt, Dissolved	mg/L	7.2E-05	0.00011	9.6E-05	0.00011	2.9E-05	3.4E-05	2.2E-05	2.5E-05	5.5E-05	0.00010	0.00088	0.00012	3.0E-05	3.4E-05	2.3E-05	2.1E-05	7.9E-05	8.2E-05	0.00042
Copper, Total	mg/L	0.00019	0.00022	0.00021	0.00019	0.00018	0.00017	0.00014	0.00012	0.0015	0.00024	0.0032	0.00018	0.00029	0.00028	0.00012	0.00017	0.00040	0.0011	0.0023
Copper, Dissolved	mg/L	0.00023	0.00025	0.00023	0.00032	0.00046	0.00021	0.00021	0.00024	0.00026	0.00027	0.0014	0.00024	0.00027	0.00029	0.00029	0.00022	0.00038	0.00069	0.00086
Fluoride	mg/L	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.29	0.26	0.28	0.32	0.28	0.28	0.29	0.28	0.21	0.20	0.22	0.23
Iron, Total	mg/L	0.17	0.23	0.19	0.17	0.11	0.048	0.079	0.050	3.52	0.32	2.86	0.16	0.55	0.091	0.15	0.28	0.094	0.28	0.45
Iron, Dissolved	mg/L	0.037	0.057	0.029	0.034	0.021	0.020	0.023	0.023	0.052	0.071	1.04	0.063	0.028	0.021	0.042	0.023	0.048	0.023	0.026
Lead, Total	mg/L	6.5E-05	6.3E-05	6.8E-05	6.5E-05	9.8E-05	2.9E-05	3.1E-05	2.5E-05	0.00040	7.8E-05	0.0011	4.8E-05	0.00012	4.8E-05	5.8E-05	0.00011	3.6E-05	0.00010	0.00028
Lead, Dissolved	mg/L	2.1E-05	2.0E-05	2.0E-05	2.2E-05	2.3E-05	2.0E-05	2.0E-05	2.0E-05	2.5E-05	2.1E-05	3.5E-05	2.0E-05	2.3E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	2.9E-05	3.0E-05
Magnesium, Total	mg/L	2.99	2.89	2.54	2.55	3.08	8.22	0.74	0.53	9.61	2.21	5.83	2.10	2.22	3.46	0.58	1.24	4.17	5.43	8.13
Magnesium, Dissolved	mg/L	2.97	2.86	2.51	2.52	3.05	8.26	0.73	3.50	9.42	2.15	5.87	2.10	2.10	3.41	0.57	1.18	3.49	5.38	7.60
Manganese, Total	mg/L	0.017	0.030	0.016	0.018	0.0047	0.0029	0.0051	0.0035	0.29	0.032	0.62	0.031	0.028	0.0056	0.014	0.013	0.022	0.0054	0.11
Manganese, Dissolved	mg/L	0.011	0.020	0.0087	0.011	0.0021	0.0019	0.0019	0.0029	0.0083	0.022	0.36	0.025	0.0046	0.0021	0.0064	0.0018	0.016	0.0012	0.095
Mercury, Total	mg/L	4.0E-05	6.3E-06	5.8E-06	6.0E-06	0.00018	1.1E-05	3.5E-06	2.7E-06	6.0E-05	1.8E-05	6.7E-05	2.6E-06	8.9E-06	9.1E-06	4.1E-06	8.0E-06	3.0E-06	8.8E-06	1.7E-05
Mercury, Dissolved	mg/L	5.7E-06	2.4E-06	2.4E-06	2.5E-06	7.6E-06	3.9E-06	1.9E-06	1.5E-06	2.2E-06	1.7E-06	6.2E-06	1.5E-06	2.0E-06	3.6E-06	2.0E-06	2.0E-06	2.1E-06	9.4E-07	1.7E-06
Molybdenum, Total	mg/L	0.00085	0.00082	0.00080	0.00087	0.00095	0.00099	0.00011	0.00010	0.0022	0.00086	0.0016	0.00095	0.00065	0.0012	8.7E-05	8.6E-05	0.0010	0.00088	0.0045
Molybdenum, Dissolved	mg/L	0.00086	0.00082	0.00079	0.00086	0.00095	0.00099	0.00011	0.0012	0.0022	0.00088	0.0016	0.00094	0.00067	0.0012	8.4E-05	8.6E-05	0.00093	0.00087	0.0042
Nickel, Total	mg/L	0.00022	0.00023	0.00024	0.00022	0.00026	0.00029	0.00020	0.00020	0.00077	0.00026	0.0018	0.00022	0.00037	0.00025	0.00020	0.00020	0.00020	0.00051	0.0073
Nickel, Dissolved	mg/L	0.00024	0.00023	0.00026	0.00021	0.00025	0.00027	0.00021	0.00021	0.00035	0.00027	0.0013	0.00023	0.00034	0.00024	0.00020	0.00020	0.00020	0.00031	0.0068
Nitrate + Nitrite as Nitrogen	mg/L	0.053	0.051	0.052	0.052	0.051	0.27	0.053	0.050	0.050	0.052	0.20	0.053	0.051	0.054	0.081	0.073	0.050	0.21	0.20
Phosphorus, Total	mg/L	0.036	0.036	0.035	0.035	0.035	0.033	0.036	0.036	0.18	0.039	0.16	0.036	0.054	0.037	0.040	0.044	0.042	0.047	0.046
Phosphorus, Dissolved	mg/L	0.035	0.035	0.034	0.034	0.035	0.033	0.035	0.035	0.038	0.036	0.057	0.036	0.036	0.036	0.036	0.040	0.042	0.039	0.042
Potassium, Total	mg/L	0.88	0.90	0.86	0.84	0.81	1.53	0.56	0.48	1.68	0.89	3.63	0.87	0.83	0.95	0.60	0.64	1.15	1.70	2.02
Potassium, Dissolved	mg/L	0.84	0.88	0.82	0.82	0.76	1.53	0.55	1.07	1.55	0.84	3.43	0.87	0.69	0.91	0.58	0.58	1.13	1.60	1.81
Selenium, Total	mg/L	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0031	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0030	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Silver, Total	mg/L	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	3.6E-05	2.1E-05	7.0E-05	2.1E-05	2.1E-05	2.2E-05	2.1E-05	2.0E-05	2.0E-05	2.1E-05	3.1E-05
Silver, Dissolved	mg/L	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.1E-05	2.1E-05	2.4E-05	2.1E-05	2.1E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	3.1E-05	2.0E-05
Sodium, Total	mg/L	2.30	2.29	2.32	2.35	2.26	0.77	2.20	1.96	4.02	2.44	6.61	2.42	2.10	1.84	2.44	2.43	2.26	3.71	17.1
Sodium, Dissolved	mg/L	2.30	2.29	2.33	2.35	2.25	0.79	2.20	1.86	4.04	2.42	6.57	2.43	2.10	1.82	2.45	2.41	2.52	3.65	15.8
Solids, Total Dissolved (TDS)	mg/L	66.5	66.0	57.3	59.4	125	111	36.5	62.9	170	54.8	240	56.2	61.2	68.2	33.4	37.7	76.5	94.9	160
Solids, Total Suspended (TSS)	mg/L	5.43	5.88	6.46	5.93	7.16	5.97	5.78	5.82	75.0	9.74	22.9	5.18	15.1	6.00	5.46	10.1	5.00		
Sulfate	mg/L	9.08	8.74	6.33	6.67	8.60	13.0	1.70	6.25	46.2	4.97	105	5.72	2.09	8.05	1.67	6.24	10.1	9.26	31.7
Thallium, Total	mg/L	2.0E-05	2.0E-05	2.1E-05	2.0E-05	2.3E-05	2.0E-05	2.0E-05	2.0E-05	6.1E-05	2.1E-05	9.0E-05	2.0E-05	2.5E-05	2.1E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.3E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	3.8E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05
Vanadium, Total	mg/L	0.00029	0.00031	0.00039	0.00033	0.00030	0.00022	0.00025	0.00023	0.0011	0.00057	0.00099	0.00029	0.0012	0.00022	0.00027	0.00029	0.00023	0.00071	0.00067
Vanadium, Dissolved	mg/L	0.00020	0.00021	0.00020	0.00020	0.00020	0.00020	0.00021	0.00021	0.00020	0.00025	0.00031	0.00022	0.00030	0.00020	0.00021	0.00020	0.00021	0.00040	0.00027
Zinc, Total	mg/L	0.00086	0.00085	0.00082	0.00091	0.00071	0.00065	0.00062	0.00083	0.0099	0.0011	0.013	0.00059	0.0014	0.00078	0.00070	0.0062	0.0020	0.0017	0.0096
Zinc, Dissolved	mg/L	0.00069	0.00071	0.00077	0.00070	0.00089	0.00060	0.00061	0.00062	0.00092	0.00066	0.0076	0.00071	0.00073	0.00074	0.00068	0.0051	0.0020	0.0012	0.0073

Table 4-4: Legacy Facility Source Term Chemistry used in the Mass Balance Calculations

Parameter	Units	CSM-SMI Backfill and Lower West End DRSFs	CSM-SMI Upper West End DRSF	HMC Homestake Pit Backfill	BMC NE Oxide stockpile	BMC NE Oxide stockpile #2	BMC West Lower DRSF	BMC NW DRSF	BMC West Middle DRSF	BMC West Upper DRSF	BMC SE DRSF	BMC Monday Camp DRSF
		Source terms for legacy facilities (calculated)										
Source of Material >>		*West End*	*West End*	*Homestake Pit*	*Yellow Pine pit*	*Yellow Pine pit*	*Yellow Pine pit*	*Yellow Pine pit*	*Yellow Pine pit*	*Yellow Pine pit*	*Yellow Pine pit*	*Yellow Pine pit,*
*HCT chemistry used in Source Term Development**		*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*	*Average steady-*
pH	pH units	7.64	7.64	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68
Alkalinity as CaCO3, Total	mg/L	333	734	267	91.4	161.2	163	280	179	123.3	239	121.2
Aluminum, Dissolved	mg/L	0.41	0.91	0.34	0.116	0.20	0.21	0.36	0.23	0.157	0.30	0.154
Antimony, Dissolved	mg/L	0.123	0.27	0.120	0.041	0.072	0.073	0.125	0.080	0.055	0.107	0.054
Arsenic, Dissolved	mg/L	2.09	4.61	1.67	0.57	1.01	1.02	1.75	1.12	0.77	1.49	0.76
Barium, Dissolved	mg/L	0.072	0.16	0.076	0.026	0.046	0.046	0.079	0.051	0.035	0.068	0.034
Beryllium, Dissolved	mg/L	-	-	-	-	-	-	-	-	-	-	-
Boron, Dissolved	mg/L	0.89	1.97	0.54	0.18	0.33	0.33	0.57	0.36	0.25	0.48	0.25
Cadmium, Dissolved	mg/L	0.00079	0.0017	0.00027	0.00009	0.00017	0.00017	0.00029	0.00018	0.00013	0.00025	0.00012
Calcium, Dissolved	mg/L	71.4	157.3	69.4	23.8	41.9	42.4	72.8	46.5	32.1	62.2	31.5
Chloride	mg/L	3.39	7.5	-	-	-	-	-	-	-	-	-
Chromium, Dissolved	mg/L	-	-	-	-	-	-	-	-	-	-	-
Cobalt, Dissolved	mg/L	-	-	0.016	0.005	0.010	0.010	0.017	0.011	0.007	0.014	0.007
Copper, Dissolved	mg/L	0.026	0.057	0.011	0.0038	0.0068	0.0068	0.012	0.0075	0.0052	0.010	0.0051
Fluoride	mg/L	-	-	-	-	-	-	-	-	-	-	-
Iron, Dissolved	mg/L	0.19	0.43	0.122	0.042	0.074	0.075	0.128	0.082	0.056	0.109	0.055
Lead, Dissolved	mg/L	0.0086	0.019	0.0056	0.0019	0.0034	0.0034	0.0058	0.0037	0.0026	0.0050	0.0025
Magnesium, Dissolved	mg/L	46.6	102.7	29.3	10.02	17.7	17.9	30.7	19.6	13.52	26.2	13.28
Manganese, Dissolved	mg/L	0.053	0.118	0.115	0.039	0.069	0.070	0.121	0.077	0.053	0.103	0.052
Mercury, Dissolved	mg/L	-	-	0.00018	0.00006	0.00011	0.00011	0.00019	0.00012	0.00008	0.00016	0.00008
Molybdenum, Dissolved	mg/L	-	-	0.026	0.009	0.016	0.016	0.027	0.017	0.012	0.023	0.012
Nickel, Dissolved	mg/L	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite as Nitrogen	mg/L	1.05	2.31	0.83	0.28	0.50	0.50	0.87	0.55	0.38	0.74	0.37
Phosphorus, Dissolved	mg/L	0.82	1.80	0.74	0.25	0.45	0.45	0.77	0.49	0.34	0.66	0.33
Potassium, Dissolved	mg/L	11.62	25.6	9.44	3.23	5.70	5.77	9.89	6.32	4.36	8.45	4.28
Selenium, Dissolved	mg/L	-	-	-	-	-	-	-	-	-	-	-
Silver, Dissolved	mg/L	-	-	-	-	-	-	-	-	-	-	-
Sodium, Dissolved	mg/L	4.67	10.30	5.91	2.03	3.57	3.61	6.20	3.96	2.73	5.30	2.68
Solids, Total Dissolved (TDS)	mg/L	415	914	352	120.4	212	215	369	236	162.4	315	159.6
Sulfate	mg/L	53.2	117.3	46.7	16.00	28.2	28.6	49.0	31.3	21.6	41.9	21.2
Thallium, Dissolved	mg/L	-	-	-	-	-	-	-	-	-	-	-
Vanadium, Dissolved	mg/L	-	-	-	-	-	-	-	-	-	-	-
Zinc, Dissolved	mg/L	0.075	0.17	0.034	0.012	0.021	0.021	0.036	0.023	0.016	0.031	0.015

'-' Indicates constituent concentration was consistently below analytical reporting limits in the HCT effluent and was not included in the source term development

* Steady-state chemistry for the HCTs is defined as: HC-5: weeks 6 to 184
HC-6: weeks 15 to 144
HC-7: weeks 47 to 144
HC-8: weeks 41 to 144
HC-9: weeks 28 to 144
HC-11: weeks 25 to 144
HC-12: weeks 33 to 144
HC-13: weeks 3 to 144
HC-14: weeks 47 to 144

they only used dissolved metals for legacy waste inputs

5 Results

The results of the existing conditions SWWC model are provided in Table 6-1 through Table 6-6, and results for key inorganic parameters are illustrated on Figure 6-1 through to Figure 6-31. These tables and figures show predicted vs. measured chemistry at each of the prediction nodes under average flow conditions. The predicted chemistry under minimum and maximum flow conditions is provided in Appendices B and C, respectively. Pie charts illustrating the sources of arsenic, antimony, sulfate and mercury loading at each node under average flow conditions are provided in Appendix D. The loading from each source was calculated by multiplying the average concentration (in mg/L) by the flow (in liters), and then determining the proportional contribution of that source to the overall loading in the system at each given node.

The model results show good calibration for pH as well as most major ions and trace elements at all prediction nodes under average flow conditions. Seventy-five percent (75%) of mass balance concentrations were comparable to actual conditions (i.e., within the ±20% acceptable RPD bracket), indicating that the major controls on the chemistry at that node were accounted for in the calculations. Parameters for which this is the case include: pH, alkalinity, barium, beryllium, boron, cadmium, calcium, chromium, fluoride, magnesium, manganese, phosphorus, potassium, selenium, silver, total dissolved solids (TDS), total suspended solids (TSS) and thallium. Therefore, these constituents can be predicted with a high degree of confidence for existing conditions and no adjustment to the calibration was required for these parameters.

Furthermore, predicted mass balanced pH (Figure 6-1), alkalinity (Figure 6-2), calcium (Figure 6-3 and Figure 6-4), magnesium (Figure 6-5 and Figure 6-6), potassium (Figure 6-7 and Figure 6-8), fluoride (Figure 6-18), boron (Figure 6-19 and Figure 6-20), selenium (Figure 6-21 and Figure 6-22), silver (Figure 6-27 and Figure 6-28) and thallium (Figure 6-23 and Figure 6-24) were typically within ±5% of average measured concentrations, and predicted barium (Figure 6-25 and Figure 6-26), phosphorus (Figure 6-29 and Figure 6-30), TDS (Figure 6-31) and dissolved mercury (Figure 6-15) were typically within ±10% of average measured concentrations, indicating that these constituents can be predicted with a high degree of confidence.

The remaining 25% of the predicted mass balance concentrations showed greater variability, with the agreement between measured and predicted concentrations generally decreasing downgradient in the system. Sulfate (Figure 6-9), arsenic (Figure 6-10 and Figure 6-11) and antimony (Figure 6-12 and Figure 6-13) concentrations were generally under predicted by the calculations, particularly between prediction nodes YP-SR-8 and YP-SR-2. Concentrations of these constituents were underpredicted by up to 48%, 60% and 88%, for sulfate, arsenic antimony, respectively, indicating that constituent loading upgradient of these nodes potentially originates from both specific sources (i.e., streamflow, adit seeps and development rock seeps that are currently accounted for the in the model) in addition to diffuse sources and/or unquantified sources that are not quantified in the calculations and available dataset. It is also possible that the loading from legacy facilities has been underpredicted based on available data.

Constituents that displayed high variability between measured and predicted concentrations were adjusted (i.e., addition or subtraction of constituent load) to provide a systematic calibration of the SWWC model. As described above, adjustments were only made to those parameters for which the RPD between measured and predicted concentrations was greater than ±20%. The model calibration for arsenic, antimony and sulfate was adjusted by incorporating additional load to the calculations to account for these diffuse and/or unquantified sources.

The greatest adjustments to the calibration were typically required between prediction nodes YP-SR-8 and YP-SR-4, owing to the diffuse loading and/or unquantified source loading between these points.

A couple of parameters were over predicted by the mass balance calculations, including manganese at YP-SR-6 and mercury at YP-SR-4. For these parameters, the model calibration was adjusted by subtracting the difference between predicted and measured concentrations. These adjusted values are provided in Table 6-1 through to Table 6-6 for average flow conditions and Appendices B and C for minimum and maximum flow conditions, respectively. For mercury, the overprediction likely relates to concentrations being close to analytical reporting limits, which results in greater apparent variation.

For manganese, the overprediction is primarily related to the assumed contribution from groundwater, as calculated from the gain-loss analysis (Brown and Caldwell, 2017). The alluvial groundwater from wells MWH-A09, MWH-A10, MWH-A12 and MWH-A13 in the vicinity of YP-SR-6 is characterized by higher manganese concentrations than the adjacent surface waters (Table 4-3), resulting in higher loading from this source.

The correlation between predicted and measured chemistry for maximum flow conditions (Appendix C) was comparable to the average flow conditions. In contrast, poorer correlation was observed between predicted and measured chemistry for minimum flow conditions (Appendix B), with many parameters being overpredicted by the mass balance model, particularly at YP-SR-6, YP-SR-4 and YP-SR-2. These parameters required adjustment to calibrate the model. As with the average flow conditions model, these adjustments to the minimum and maximum flow conditions models were made for parameters that showed an RPD greater than 20%, by either adding or subtracting load to correct for the discrepancy.

A number of possible diffuse and/or unquantified sources have been identified in the district that may be contributing to unquantified constituent loading, including:

- Legacy mine facilities, including the BMC Former Man Camp (Figure 4-3), SMI Former Crushing Site and pilot plant site (Figure 4-2) and the former septic drainfield. Limited (or no) surficial materials sampling has been carried out in these areas, and most do not have a monitoring well. However, the limited available characterization data indicate elevated arsenic and antimony in these areas.
- Mineralized bedrock outcrops within the district, in particular the rôche moutonnées[2] south of the Yellow Pine pit (Figure 4-3) and in Scout Valley. The Scout Valley mineralization contains a potentially underground mineable gold-silver-antimony deposit (Midas Gold, 2014) that also has elevated arsenic. The mineralization is associated with several large fault zones that are entirely covered beneath glacial outwash, talus slides, an alluvial fan from Garnet Creek and colluvium (Figure 4-2), but are likely contributing some loading that is unaccounted for; and
- Unquantified subsurface groundwater load inputs originating from the gravels intersected in the Monday Tunnel and the Cinnabar Tunnel (Figure 4-2), with mineralization farther in the tunnels providing the metal sources. This is supported by the results of the USGS (2015) study into the occurrence and transport of constituents in the Project area, which demonstrated that much of the arsenic and antimony loading between the Garnet Creek and Sugar Creek confluences of the EFSFSR is attributable to groundwater sources.

5.1 Temperature Sensitivity Analysis

The results presented in Section 5, assume an average annual air temperature in the Project area of 2.6°C (Brown and Caldwell, 2017). However, sensitivity analysis has been conducted for minimum

[2] A rôche moutonnée is a large block of exposed bedrock generated from glacial scouring action. Rôche moutonnées in the Stibnite project area have been identified in the EFSFSR valley above the current Yellow Pine pit lake and in Scout Valley

and maximum monthly temperature conditions of -7.3ºC and 14.5ºC, respectively (Brown and Caldwell, 2017).

The results of the temperature sensitivity analysis are presented in Appendix E and demonstrate that predicted constituent concentrations are lower for minimum monthly temperature conditions, and higher for monthly maximum temperature conditions, with an approximate linear release in constituent release with temperature. These results are expected, as reaction rates increase at higher temperature, therefore increasing constituent release. However, the variations in predicted chemistry under minimum and maximum monthly temperature conditions are typically less than 20%, and are not sufficient to affect the overall outcomes and conclusions of the model.

5.2 Grain Size Sensitivity Analysis

The results presented in Section 5 assume that the proportion of fine-grained material (i.e. material less than 2 mm in size) in the legacy facilities is approximately 40% (SRK, 2012). However, sensitivity analysis has been conducted for scenarios where 20% and 60% of material is less than 2 mm in size to assess the uncertainty surrounding this parameter. The results of the grain size sensitivity analysis are presented in Appendix F and demonstrate that predicted constituent concentrations increase as the proportion of material less than 2mm in size increases. These results are expected as the finer-grained material is assumed to be the more reactive portion of the development rock; therefore, constituent release will be higher when there is a greater portion of fine-grained material. However, the variations in predicted chemistry are typically less than 5%, and are not sufficient to affect the overall outcomes and conclusions of the model.

6 Summary

A SWWC model has been developed to predict existing surface water quality at a series of prediction nodes in Meadow Creek and the EFSFSR. The results show that the majority of constituents can be predicted with a high level of confidence, which supports use of the modeling approach for numerical models that are being developed to evaluate the change in constituent load as a result of the proposed mining and reclamation activities.

This exercise identified unquantified sources of constituent loading in the EFSFSR between the Fiddle Creek and Sugar Creek tributaries, likely originating from several sources including mineralized bedrock outcrops and unquantified subsurface groundwater load inputs. This is consistent with the findings of USGS (2015), which identified sources of arsenic and antimony (in particular from groundwater) in specific reaches along the EFSFSR between the Garnet Creek and Sugar Creek confluences.

Adjustment of the SWWC model calibration (i.e., addition or subtraction of constituent load) is required to correct for the discrepancies between measured and predicted concentrations for some constituents and account for potential unaccounted sources of loading at each node, in particular arsenic, antimony and sulfate. These adjustments in constituent load will be included in the models that are being developed to predict surface water quality under future operational and post-closure conditions based on the proposed action. For example, if a constituent was found to be underpredicted by more than 20% in the existing conditions SWWC model and additional load had to be added to achieve calibration at a particular node, this additional load will also be added to the future conditions model for that node. Similarly, if a particular constituent was found to be overpredicted by more than 20% in the existing conditions SWWC model and load had to be removed to achieve calibration at a particular node, this load will also be removed to the future conditions model for that node.

The results of the proposed future action modeling will be provided under separate cover.

Table 6-1: Predicted vs. Measured Chemistry at YP-T-22 under Average Flow Conditions

Parameter	Units	YP-T-22			
		Measured	Predicted	RPD (%)	Predicted
pH	s.u.	7.44	7.43	-0.1%	7.43
Alkalinity as $CaCO_3$, Total	mg/L	39.7	39.6	-0.1%	39.6
Aluminum, Total	mg/L	0.15	0.13	-13.8%	0.13
Aluminum, Dissolved	mg/L	0.014	0.015	8.7%	0.015
Antimony, Total	mg/L	0.0080	0.0099	21.1%	0.0080
Antimony, Dissolved	mg/L	0.0078	0.0096	20.5%	0.0078
Arsenic, Total	mg/L	0.037	0.041	10.7%	0.041
Arsenic, Dissolved	mg/L	0.033	0.033	-1.2%	0.033
Barium, Total	mg/L	0.0095	0.0091	-3.6%	0.0091
Barium, Dissolved	mg/L	0.0073	0.0070	-4.6%	0.0070
Beryllium, Total	mg/L	2.7E-05	2.7E-05	2.1%	2.7E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.1E-05	2.5%	2.1E-05
Boron, Total	mg/L	0.024	0.024	0.05%	0.024
Boron, Dissolved	mg/L	0.025	0.025	0.04%	0.025
Cadmium, Total	mg/L	2.1E-05	2.0E-05	-4.7%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	0.3%	2.0E-05
Calcium, Total	mg/L	11.2	11.5	2.3%	11.5
Calcium, Dissolved	mg/L	11.1	11.4	2.7%	11.4
Chloride	mg/L	0.99	1.28	26.0%	0.99
Chromium, Total	mg/L	0.00028	0.00027	-2.5%	0.00027
Chromium, Dissolved	mg/L	0.00025	0.00022	-14.2%	0.00022
Cobalt, Total	mg/L	0.00016	0.00018	7.0%	0.00018
Cobalt, Dissolved	mg/L	0.00010	0.00012	10.2%	0.00012
Copper, Total	mg/L	0.00024	0.00023	-4.1%	0.00023
Copper, Dissolved	mg/L	0.00027	0.00027	0.4%	0.00027
Fluoride	mg/L	0.28	0.28	-0.1%	0.28
Iron, Total	mg/L	0.32	0.31	-2.7%	0.31
Iron, Dissolved	mg/L	0.071	0.074	5.1%	0.074
Lead, Total	mg/L	7.8E-05	7.8E-05	0.9%	7.8E-05
Lead, Dissolved	mg/L	2.1E-05	2.8E-05	29.1%	2.1E-05
Magnesium, Total	mg/L	2.22	2.21	0.8%	2.22
Magnesium, Dissolved	mg/L	2.15	2.20	2.1%	2.20
Manganese, Total	mg/L	0.032	0.035	8.9%	0.035
Manganese, Dissolved	mg/L	0.022	0.023	1.6%	0.023
Mercury, Total	mg/L	1.8E-05	8.6E-06	-72.8%	1.8E-05
Mercury, Dissolved	mg/L	1.7E-06	1.9E-06	12.2%	1.9E-06
Molybdenum, Total	mg/L	0.00086	0.00089	3.8%	0.00089
Molybdenum, Dissolved	mg/L	0.00088	0.00089	0.8%	0.00089
Nickel, Total	mg/L	0.00026	0.00028	7.0%	0.00028
Nickel, Dissolved	mg/L	0.00027	0.00027	-1.1%	0.00027
Nitrate + Nitrite as Nitrogen	mg/L	0.052	0.053	1.0%	0.053
Phosphorus, Total	mg/L	0.039	0.042	6.1%	0.042
Phosphorus, Dissolved	mg/L	0.036	0.037	1.9%	0.037
Potassium, Total	mg/L	0.89	0.91	2.0%	0.91
Potassium, Dissolved	mg/L	0.84	0.87	3.7%	0.87
Selenium, Total	mg/L	0.0010	0.0010	0.4%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.5%	0.0010
Silver, Total	mg/L	2.1E-05	2.2E-05	4.3%	2.2E-05
Silver, Dissolved	mg/L	2.1E-05	2.3E-05	7.1%	2.3E-05
Sodium, Total	mg/L	2.44	2.45	0.3%	2.45
Sodium, Dissolved	mg/L	2.42	2.46	1.5%	2.46
Solids, Total Dissolved (TDS)	mg/L	54.8	59.3	8.0%	59.3
Solids, Total Suspended (TSS)	mg/L	9.74	8.15	-17.9%	8.15
Sulfate	mg/L	4.97	5.45	9.3%	5.45
Thallium, Total	mg/L	2.1E-05	2.2E-05	3.3%	2.2E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	1.4%	2.0E-05
Vanadium, Total	mg/L	0.00057	0.00051	-10.7%	0.00051
Vanadium, Dissolved	mg/L	0.00025	0.00025	0.9%	0.00025
Zinc, Total	mg/L	0.0011	0.0011	-3.6%	0.0011
Zinc, Dissolved	mg/L	0.00066	0.0012	54.3%	0.00066

*	Parameter only adjusted if RPD>20%
(non-shaded box)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded box)	Shaded cells indicate predicted concentration has been manually adjusted

Table 6-2: Predicted vs. Measured Chemistry at YP-SR-10 under Average Flow Conditions

Parameter	Units	YP-SR-10			
		Measured	Predicted	RPD (%)	Predicted
pH	s.u.	7.40	7.44	0.6%	7.44
Alkalinity as $CaCO_3$, Total	mg/L	39.3	40.5	3.0%	40.5
Aluminum, Total	mg/L	0.065	0.095	37.5%	0.065
Aluminum, Dissolved	mg/L	0.0096	0.012	20.1%	0.0096
Antimony, Total	mg/L	0.013	0.0066	-62.6%	0.013
Antimony, Dissolved	mg/L	0.012	0.0064	-63.5%	0.012
Arsenic, Total	mg/L	0.026	0.028	6.4%	0.028
Arsenic, Dissolved	mg/L	0.024	0.023	-4.9%	0.023
Barium, Total	mg/L	0.0094	0.011	17.1%	0.011
Barium, Dissolved	mg/L	0.0087	0.0096	9.9%	0.0096
Beryllium, Total	mg/L	2.1E-05	2.5E-05	15.0%	2.5E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	1.4%	2.0E-05
Boron, Total	mg/L	0.026	0.025	-3.4%	0.025
Boron, Dissolved	mg/L	0.026	0.025	-3.4%	0.025
Cadmium, Total	mg/L	2.0E-05	2.0E-05	0.8%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	0.8%	2.0E-05
Calcium, Total	mg/L	10.2	10.7	4.2%	10.7
Calcium, Dissolved	mg/L	10.2	10.7	4.3%	10.7
Chloride	mg/L	0.67	0.88	27.4%	0.67
Chromium, Total	mg/L	0.00021	0.00027	23.6%	0.00021
Chromium, Dissolved	mg/L	0.00024	0.00022	-9.6%	0.00022
Cobalt, Total	mg/L	8.6E-05	0.00011	28.1%	8.6E-05
Cobalt, Dissolved	mg/L	7.0E-05	7.7E-05	9.5%	7.7E-05
Copper, Total	mg/L	0.00022	0.00022	-0.5%	0.00022
Copper, Dissolved	mg/L	0.00024	0.00026	9.9%	0.00026
Fluoride	mg/L	0.29	0.28	-2.0%	0.28
Iron, Total	mg/L	0.15	0.21	29.6%	0.15
Iron, Dissolved	mg/L	0.039	0.050	26.2%	0.039
Lead, Total	mg/L	6.6E-05	6.2E-05	-6.1%	6.2E-05
Lead, Dissolved	mg/L	2.1E-05	2.5E-05	21.3%	2.1E-05
Magnesium, Total	mg/L	2.37	2.26	4.6%	2.37
Magnesium, Dissolved	mg/L	2.23	2.34	5.0%	2.34
Manganese, Total	mg/L	0.018	0.021	18.4%	0.021
Manganese, Dissolved	mg/L	0.013	0.013	1.1%	0.013
Mercury, Total	mg/L	5.8E-06	8.2E-06	34.4%	5.8E-06
Mercury, Dissolved	mg/L	2.4E-06	2.3E-06	-3.1%	2.3E-06
Molybdenum, Total	mg/L	0.00089	0.00090	0.6%	0.00090
Molybdenum, Dissolved	mg/L	0.00089	0.00089	0.1%	0.00089
Nickel, Total	mg/L	0.00020	0.00026	24.1%	0.00020
Nickel, Dissolved	mg/L	0.00023	0.00026	11.7%	0.00026
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.058	14.7%	0.058
Phosphorus, Total	mg/L	0.036	0.039	9.9%	0.039
Phosphorus, Dissolved	mg/L	0.035	0.036	3.4%	0.036
Potassium, Total	mg/L	0.81	0.85	5.7%	0.85
Potassium, Dissolved	mg/L	0.78	0.83	6.2%	0.83
Selenium, Total	mg/L	0.0010	0.0010	0.2%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.3%	0.0010
Silver, Total	mg/L	2.1E-05	2.2E-05	2.4%	2.2E-05
Silver, Dissolved	mg/L	2.1E-05	2.2E-05	5.8%	2.2E-05
Sodium, Total	mg/L	2.12	2.18	2.6%	2.18
Sodium, Dissolved	mg/L	2.12	2.19	3.3%	2.19
Solids, Total Dissolved (TDS)	mg/L	51.9	55.1	5.8%	55.1
Solids, Total Suspended (TSS)	mg/L	5.68	6.56	14.5%	6.56
Sulfate	mg/L	4.03	4.05	0.5%	4.05
Thallium, Total	mg/L	2.0E-05	2.1E-05	5.0%	2.1E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.8%	2.0E-05
Vanadium, Total	mg/L	0.00031	0.00041	28.6%	0.00031
Vanadium, Dissolved	mg/L	0.00021	0.00023	10.4%	0.00023
Zinc, Total	mg/L	0.00068	0.00091	29.3%	0.00068
Zinc, Dissolved	mg/L	0.00063	0.00097	42.6%	0.00063

*	Parameter only adjusted if RPD>20%
(non-shaded box)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded box)	Shaded cells indicate predicted concentration has been manually adjusted

Table 6-3: Predicted vs. Measured Chemistry at YP-SR-8 under Average Flow Conditions

Cu poorly predicted but very low concentration

Parameter	Units	YP-SR-8			
		Measured	Predicted	RPD (%)	Predicted
pH	s.u.	7.48	7.44	-0.4%	7.44
Alkalinity as $CaCO_3$, Total	mg/L	43.0	40.6	-5.7%	40.6
Aluminum, Total	mg/L	0.079	0.095	18.8%	0.095
Aluminum, Dissolved	mg/L	0.010	0.012	12.9%	0.012
Antimony, Total	mg/L	0.017	0.0070	-84.4%	0.017
Antimony, Dissolved	mg/L	0.017	0.0069	-85.5%	0.017
Arsenic, Total	mg/L	0.030	0.030	-1.1%	0.030
Arsenic, Dissolved	mg/L	0.028	0.024	-12.1%	0.024
Barium, Total	mg/L	0.011	0.011	2.3%	0.011
Barium, Dissolved	mg/L	0.0099	0.0096	-3.0%	0.0096
Beryllium, Total	mg/L	2.2E-05	2.5E-05	13.0%	2.5E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	1.5%	2.0E-05
Boron, Total	mg/L	0.026	0.025	-3.3%	0.025
Boron, Dissolved	mg/L	0.026	0.025	-3.3%	0.025
Cadmium, Total	mg/L	2.0E-05	2.0E-05	0.8%	2.0E-05
Cadmium, Dissolved	mg/L	2.8E-05	2.0E-05	-31.1%	2.8E-05
Calcium, Total	mg/L	11.4	10.7	-5.7%	10.7
Calcium, Dissolved	mg/L	11.3	10.7	-5.5%	10.7
Chloride	mg/L	0.73	0.88	18.6%	0.88
Chromium, Total	mg/L	0.00025	0.00027	7.7%	0.00027
Chromium, Dissolved	mg/L	0.00022	0.00022	-3.0%	0.00022
Cobalt, Total	mg/L	0.00013	0.00011	-14.6%	0.00011
Cobalt, Dissolved	mg/L	0.00011	7.6E-05	-31.5%	0.00011
Copper, Total	mg/L	0.00019	0.00022	16.1%	0.00022
[illegible], Dissolved	mg/L	0.00032	0.00026	-19.6%	0.00026
[illegible]e	mg/L	0.29	0.28	-2.0%	0.28
[illegible]tal	mg/L	0.17	0.21	19.3%	0.21
[illegible]ssolved	mg/L	0.034	0.050	38.4%	0.034
Lead, Total	mg/L	6.5E-05	6.2E-05	-4.1%	6.2E-05
Lead, Dissolved	mg/L	2.2E-05	2.5E-05	13.5%	2.5E-05
Magnesium, Total	mg/L	2.38	2.55	-6.6%	2.38
Magnesium, Dissolved	mg/L	2.52	2.36	-6.5%	2.36
Manganese, Total	mg/L	0.018	0.021	16.8%	0.021
Manganese, Dissolved	mg/L	0.011	0.013	14.1%	0.013
Mercury, Total	mg/L	6.0E-06	8.2E-06	31.6%	6.0E-06
Mercury, Dissolved	mg/L	2.5E-06	2.3E-06	-5.2%	2.3E-06
Molybdenum, Total	mg/L	0.00087	0.00090	3.3%	0.00090
Molybdenum, Dissolved	mg/L	0.00086	0.00090	4.6%	0.00090
Nickel, Total	mg/L	0.00022	0.00026	16.5%	0.00026
Nickel, Dissolved	mg/L	0.00021	0.00026	22.5%	0.00021
Nitrate + Nitrite as Nitrogen	mg/L	0.052	0.058	10.6%	0.058
Phosphorus, Total	mg/L	0.035	0.039	11.5%	0.039
Phosphorus, Dissolved	mg/L	0.034	0.036	5.0%	0.036
Potassium, Total	mg/L	0.84	0.86	1.5%	0.86
Potassium, Dissolved	mg/L	0.82	0.83	1.4%	0.83
Selenium, Total	mg/L	0.0010	0.0010	0.2%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.3%	0.0010
Silver, Total	mg/L	2.1E-05	2.2E-05	1.4%	2.2E-05
Silver, Dissolved	mg/L	2.1E-05	2.2E-05	5.7%	2.2E-05
Sodium, Total	mg/L	2.35	2.18	-7.8%	2.18
Sodium, Dissolved	mg/L	2.35	2.19	-7.2%	2.19
Solids, Total Dissolved (TDS)	mg/L	59.4	55.3	-7.1%	55.3
Solids, Total Suspended (TSS)	mg/L	5.93	6.60	10.7%	6.60
Sulfate	mg/L	6.67	4.11	-47.6%	6.67
Thallium, Total	mg/L	2.0E-05	2.1E-05	5.0%	2.1E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.8%	2.0E-05
Vanadium, Total	mg/L	0.00033	0.00041	19.7%	0.00041
Vanadium, Dissolved	mg/L	0.00020	0.00023	15.6%	0.00023
Zinc, Total	mg/L	0.00091	0.00091	-0.1%	0.00091
Zinc, Dissolved	mg/L	0.00070	0.00097	32.5%	0.00070

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

Table 6-4: Predicted vs. Measured Chemistry at YP-SR-6 under Average Flow Conditions

Parameter	Units	YP-SR-6			
		Measured	Predicted	RPD (%)	Predicted
pH	s.u.	7.38	7.41	0.3%	7.41
Alkalinity as $CaCO_3$, Total	mg/L	40.9	43.7	6.5%	43.7
Aluminum, Total	mg/L	0.11	0.10	-6.3%	0.10
Aluminum, Dissolved	mg/L	0.011	0.012	11.9%	0.012
Antimony, Total	mg/L	0.020	0.010	-64.6%	0.020
Antimony, Dissolved	mg/L	0.019	0.010	-63.4%	0.019
Arsenic, Total	mg/L	0.032	0.032	-1.9%	0.032
Arsenic, Dissolved	mg/L	0.030	0.027	-11.6%	0.027
Barium, Total	mg/L	0.012	0.013	11.9%	0.013
Barium, Dissolved	mg/L	0.010	0.012	13.2%	0.012
Beryllium, Total	mg/L	2.4E-05	2.5E-05	3.1%	2.5E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	1.2%	2.0E-05
Boron, Total	mg/L	0.026	0.025	-4.0%	0.025
Boron, Dissolved	mg/L	0.026	0.025	-4.0%	0.025
Cadmium, Total	mg/L	2.0E-05	2.1E-05	2.6%	2.1E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.1E-05	2.7%	2.1E-05
Calcium, Total	mg/L	11.3	11.5	1.3%	11.5
Calcium, Dissolved	mg/L	11.3	11.3	0.2%	11.3
Chloride	mg/L	0.68	0.87	24.5%	0.68
Chromium, Total	mg/L	0.00028	0.00029	2.7%	0.00029
Chromium, Dissolved	mg/L	0.00020	0.00023	12.4%	0.00023
Cobalt, Total	mg/L	0.00014	0.00013	-8.2%	0.00013
Cobalt, Dissolved	mg/L	9.6E-05	9.5E-05	-1.1%	9.5E-05
Copper, Total	mg/L	0.00021	0.00035	49.1%	0.00021
Copper, Dissolved	mg/L	0.00023	0.00030	26.2%	0.00023
Fluoride	mg/L	0.29	0.28	-3.3%	0.28
Iron, Total	mg/L	0.19	0.21	14.4%	0.21
Iron, Dissolved	mg/L	0.029	0.046	44.6%	0.029
Lead, Total	mg/L	6.8E-05	7.4E-05	8.8%	7.4E-05
Lead, Dissolved	mg/L	2.0E-05	2.6E-05	23.5%	2.0E-05
Magnesium, Total	mg/L	2.64	2.54	4.0%	2.64
Magnesium, Dissolved	mg/L	2.51	2.59	2.9%	2.59
Manganese, Total	mg/L	0.016	0.026	44.5%	0.016
Manganese, Dissolved	mg/L	0.0087	0.018	67.2%	0.0087
Mercury, Total	mg/L	5.8E-06	8.5E-06	38.0%	5.8E-06
Mercury, Dissolved	mg/L	2.4E-06	2.3E-06	-4.0%	2.3E-06
Molybdenum, Total	mg/L	0.00080	0.0011	28.6%	0.00080
Molybdenum, Dissolved	mg/L	0.00079	0.0011	28.3%	0.00079
Nickel, Total	mg/L	0.00024	0.00070	96.4%	0.00024
Nickel, Dissolved	mg/L	0.00026	0.00066	87.0%	0.00026
Nitrate + Nitrite as Nitrogen	mg/L	0.052	0.067	26.2%	0.052
Phosphorus, Total	mg/L	0.035	0.040	10.9%	0.040
Phosphorus, Dissolved	mg/L	0.034	0.036	5.8%	0.036
Potassium, Total	mg/L	0.86	0.91	5.9%	0.91
Potassium, Dissolved	mg/L	0.82	0.88	6.3%	0.88
Selenium, Total	mg/L	0.0010	0.0010	0.2%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.2%	0.0010
Silver, Total	mg/L	2.1E-05	2.2E-05	4.7%	2.2E-05
Silver, Dissolved	mg/L	2.1E-05	2.2E-05	4.3%	2.2E-05
Sodium, Total	mg/L	2.32	3.11	28.9%	2.32
Sodium, Dissolved	mg/L	2.33	3.04	26.4%	2.33
Solids, Total Dissolved (TDS)	mg/L	57.3	60.6	5.7%	60.6
Solids, Total Suspended (TSS)	mg/L	6.46	6.13	-5.2%	6.13
Sulfate	mg/L	6.33	5.68	-10.8%	5.68
Thallium, Total	mg/L	2.1E-05	2.1E-05	2.5%	2.1E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.7%	2.0E-05
Vanadium, Total	mg/L	0.00039	0.00041	4.1%	0.00041
Vanadium, Dissolved	mg/L	0.00020	0.00023	15.8%	0.00023
Zinc, Total	mg/L	0.00082	0.0014	54.4%	0.00082
Zinc, Dissolved	mg/L	0.00077	0.0013	54.4%	0.00077

Cu poorly predicted but very low concentration

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

Table 6-5: Predicted vs. Measured Chemistry at YP-SR-4 under Average Flow Conditions

Parameter	Units	YP-SR-4			
		Measured	Predicted	RPD (%)	Predicted
pH	s.u.	7.50	7.38	-1.6%	7.38
Alkalinity as $CaCO_3$, Total	mg/L	42.8	44.9	4.8%	44.9
Aluminum, Total	mg/L	0.075	0.098	27.0%	0.075
Aluminum, Dissolved	mg/L	0.012	0.012	-2.5%	0.012
Antimony, Total	mg/L	0.031	0.013	-82.9%	0.031
Antimony, Dissolved	mg/L	0.031	0.012	-88.8%	0.031
Arsenic, Total	mg/L	0.070	0.038	-59.0%	0.070
Arsenic, Dissolved	mg/L	0.061	0.033	-60.8%	0.061
Barium, Total	mg/L	0.012	0.014	14.4%	0.014
Barium, Dissolved	mg/L	0.011	0.012	10.1%	0.012
Beryllium, Total	mg/L	2.4E-05	2.5E-05	3.9%	2.5E-05
Beryllium, Dissolved	mg/L	2.1E-05	2.0E-05	-1.6%	2.0E-05
Boron, Total	mg/L	0.026	0.025	-1.2%	0.025
Boron, Dissolved	mg/L	0.026	0.025	-1.3%	0.025
Cadmium, Total	mg/L	2.0E-05	2.1E-05	3.9%	2.1E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.1E-05	4.0%	2.1E-05
Calcium, Total	mg/L	12.6	11.9	-6.0%	11.9
Calcium, Dissolved	mg/L	12.6	11.7	-7.0%	11.7
Chloride	mg/L	0.66	0.85	25.0%	0.66
Chromium, Total	mg/L	0.00024	0.00029	19.2%	0.00029
Chromium, Dissolved	mg/L	0.00022	0.00022	2.9%	0.00022
Cobalt, Total	mg/L	0.00014	0.00014	1.5%	0.00014
Cobalt, Dissolved	mg/L	0.00011	0.00011	0.1%	0.00011
Copper, Total	mg/L	0.00022	0.00036	49.2%	0.00022
Copper, Dissolved	mg/L	0.00025	0.00031	22.2%	0.00025
Fluoride	mg/L	0.29	0.27	-4.3%	0.27
Iron, Total	mg/L	0.23	0.21	-11.8%	0.21
Iron, Dissolved	mg/L	0.057	0.046	-22.6%	0.057
Lead, Total	mg/L	6.3E-05	7.8E-05	20.9%	6.3E-05
Lead, Dissolved	mg/L	2.0E-05	3.2E-05	46.9%	2.0E-05
Magnesium, Total	mg/L	2.81	2.89	-2.8%	2.81
Magnesium, Dissolved	mg/L	2.86	2.74	-4.3%	2.74
Manganese, Total	mg/L	0.030	0.025	-19.0%	0.025
Manganese, Dissolved	mg/L	0.020	0.017	-17.9%	0.017
Mercury, Total	mg/L	6.3E-06	8.4E-06	29.0%	6.3E-06
Mercury, Dissolved	mg/L	2.4E-06	2.5E-06	5.9%	2.5E-06
Molybdenum, Total	mg/L	0.00082	0.0011	27.0%	0.00082
Molybdenum, Dissolved	mg/L	0.00082	0.0011	25.1%	0.00082
Nickel, Total	mg/L	0.00023	0.00066	97.1%	0.00023
Nickel, Dissolved	mg/L	0.00023	0.00063	91.5%	0.00023
Nitrate + Nitrite as Nitrogen	mg/L	0.051	0.072	34.0%	0.051
Phosphorus, Total	mg/L	0.036	0.040	11.5%	0.040
Phosphorus, Dissolved	mg/L	0.035	0.037	5.2%	0.037
Potassium, Total	mg/L	0.90	0.93	3.3%	0.93
Potassium, Dissolved	mg/L	0.88	0.90	3.3%	0.90
Selenium, Total	mg/L	0.0010	0.0010	0.02%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.0%	0.0010
Silver, Total	mg/L	2.1E-05	2.2E-05	3.8%	2.2E-05
Silver, Dissolved	mg/L	2.1E-05	2.2E-05	3.4%	2.2E-05
Sodium, Total	mg/L	2.29	3.03	27.6%	2.29
Sodium, Dissolved	mg/L	2.29	2.97	25.8%	2.29
Solids, Total Dissolved (TDS)	mg/L	66.0	62.3	-5.8%	62.3
Solids, Total Suspended (TSS)	mg/L	5.88	6.06	3.1%	6.06
Sulfate	mg/L	8.74	6.12	-35.2%	8.74
Thallium, Total	mg/L	2.0E-05	2.1E-05	4.7%	2.1E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.5%	2.0E-05
Vanadium, Total	mg/L	0.00031	0.00040	24.2%	0.00031
Vanadium, Dissolved	mg/L	0.00021	0.00023	11.9%	0.00023
Zinc, Total	mg/L	0.00085	0.0015	52.8%	0.00085
Zinc, Dissolved	mg/L	0.00071	0.0014	63.3%	0.00071

Cu poorly predicted but very low concentration

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

Table 6-6: Predicted vs. Measured Chemistry at YP-SR-2 under Average Flow Conditions

Parameter	Units	YP-SR-2			
		Measured	Predicted	RPD (%)	Predicted
pH	s.u.	7.61	7.50	-1.5%	7.50
Alkalinity as $CaCO_3$, Total	mg/L	47.6	50.1	5.2%	50.1
Aluminum, Total	mg/L	0.088	0.12	27.2%	0.088
Aluminum, Dissolved	mg/L	0.016	0.012	-24.4%	0.016
Antimony, Total	mg/L	0.022	0.0098	-76.3%	0.022
Antimony, Dissolved	mg/L	0.022	0.0091	-81.8%	0.022
Arsenic, Total	mg/L	0.049	0.033	-38.7%	0.049
Arsenic, Dissolved	mg/L	0.043	0.029	-39.7%	0.043
Barium, Total	mg/L	0.012	0.013	9.4%	0.013
Barium, Dissolved	mg/L	0.011	0.012	4.7%	0.012
Beryllium, Total	mg/L	2.4E-05	2.8E-05	14.4%	2.8E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.7%	2.0E-05
Boron, Total	mg/L	0.026	0.028	9.1%	0.028
Boron, Dissolved	mg/L	0.026	0.028	9.0%	0.028
Cadmium, Total	mg/L	2.0E-05	2.4E-05	16.9%	2.4E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.2E-05	9.4%	2.2E-05
Calcium, Total	mg/L	14.2	13.9	-2.4%	13.9
Calcium, Dissolved	mg/L	14.2	13.7	-3.2%	13.7
Chloride	mg/L	0.52	0.66	24.2%	0.52
Chromium, Total	mg/L	0.00026	0.00027	3.2%	0.00027
Chromium, Dissolved	mg/L	0.00021	0.00022	1.4%	0.00022
Cobalt, Total	mg/L	9.8E-05	0.00012	18.0%	0.00012
Cobalt, Dissolved	mg/L	7.2E-05	8.1E-05	10.9%	8.1E-05
Copper, Total	mg/L	0.00019	0.00033	52.7%	0.00019
Copper, Dissolved	mg/L	0.00023	0.00042	58.8%	0.00023
Fluoride	mg/L	0.29	0.28	-2.9%	0.28
Iron, Total	mg/L	0.17	0.17	-0.6%	0.17
Iron, Dissolved	mg/L	0.037	0.036	-4.4%	0.036
Lead, Total	mg/L	6.5E-05	0.00010	45.8%	6.5E-05
Lead, Dissolved	mg/L	2.1E-05	4.6E-05	75.8%	2.1E-05
Magnesium, Total	mg/L	3.01	2.99	0.7%	3.01
Magnesium, Dissolved	mg/L	2.97	2.96	-0.5%	2.96
Manganese, Total	mg/L	0.017	0.017	-2.7%	0.017
Manganese, Dissolved	mg/L	0.011	0.011	-0.1%	0.011
Mercury, Total	mg/L	4.0E-05	8.0E-05	65.9%	4.0E-05
Mercury, Dissolved	mg/L	5.7E-06	4.6E-06	-22.4%	5.7E-06
Molybdenum, Total	mg/L	0.00085	0.0010	17.2%	0.0010
Molybdenum, Dissolved	mg/L	0.00086	0.0010	15.3%	0.0010
Nickel, Total	mg/L	0.00022	0.00049	75.2%	0.00022
Nickel, Dissolved	mg/L	0.00024	0.00047	65.0%	0.00024
Nitrate + Nitrite as Nitrogen	mg/L	0.053	0.065	20.6%	0.053
Phosphorus, Total	mg/L	0.036	0.040	11.3%	0.040
Phosphorus, Dissolved	mg/L	0.035	0.038	7.3%	0.038
Potassium, Total	mg/L	0.88	0.91	3.4%	0.91
Potassium, Dissolved	mg/L	0.84	0.87	3.4%	0.87
Selenium, Total	mg/L	0.0010	0.00100	-0.2%	0.00100
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.2%	0.00100
Silver, Total	mg/L	2.1E-05	2.1E-05	-0.1%	2.1E-05
Silver, Dissolved	mg/L	2.1E-05	2.1E-05	-0.4%	2.1E-05
Sodium, Total	mg/L	2.30	2.72	16.7%	2.72
Sodium, Dissolved	mg/L	2.30	2.68	15.1%	2.68
Solids, Total Dissolved (TDS)	mg/L	66.5	88.7	28.6%	66.5
Solids, Total Suspended (TSS)	mg/L	5.43	6.55	18.6%	6.55
Sulfate	mg/L	9.08	7.46	-19.5%	7.46
Thallium, Total	mg/L	2.0E-05	2.2E-05	9.1%	2.2E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Vanadium, Total	mg/L	0.00029	0.00036	20.6%	0.00029
Vanadium, Dissolved	mg/L	0.00020	0.00022	8.6%	0.00022
Zinc, Total	mg/L	0.00086	0.0014	45.1%	0.00086
Zinc, Dissolved	mg/L	0.00069	0.0014	65.9%	0.00069

Cu poorly predicted but very low concentration

*	Parameter only adjusted if RPD>20%
(non-shaded box)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded box)	Shaded cells indicate predicted concentration has been manually adjusted

copper is not shown- poorly predicted but only has low concentrations as xisting

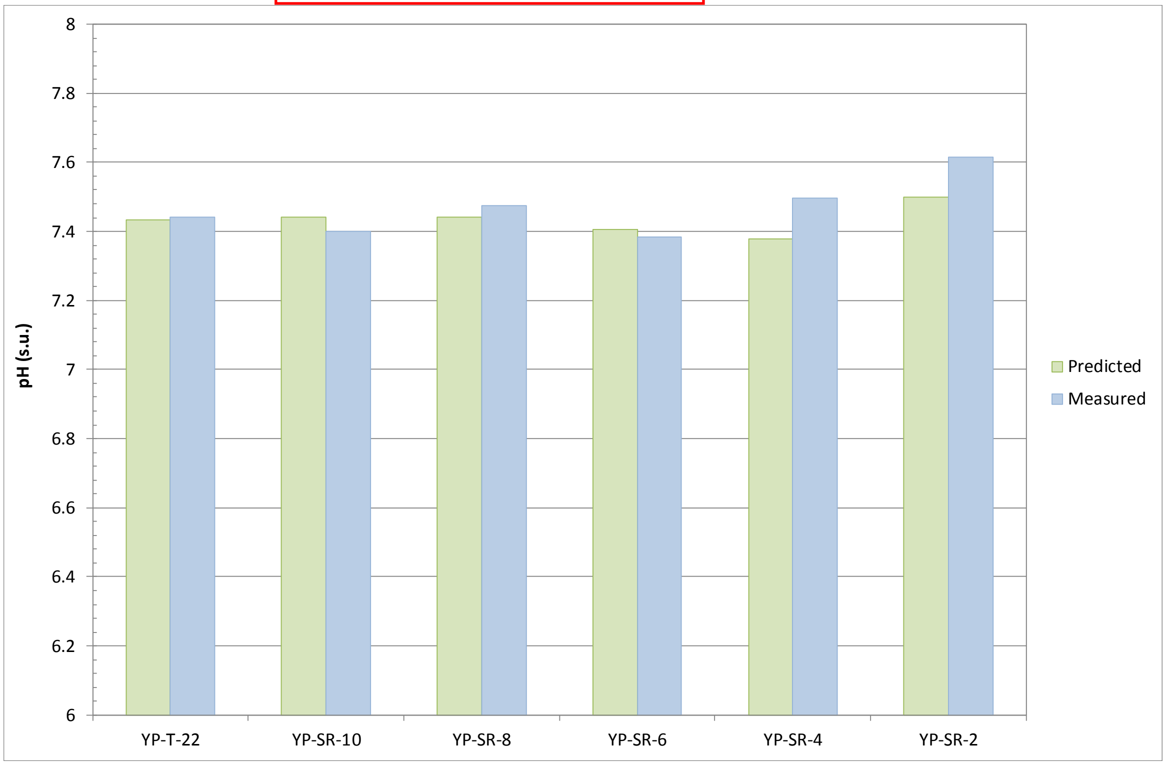

Figure 6-1: Predicted vs. Measured pH under Average Flow Conditions

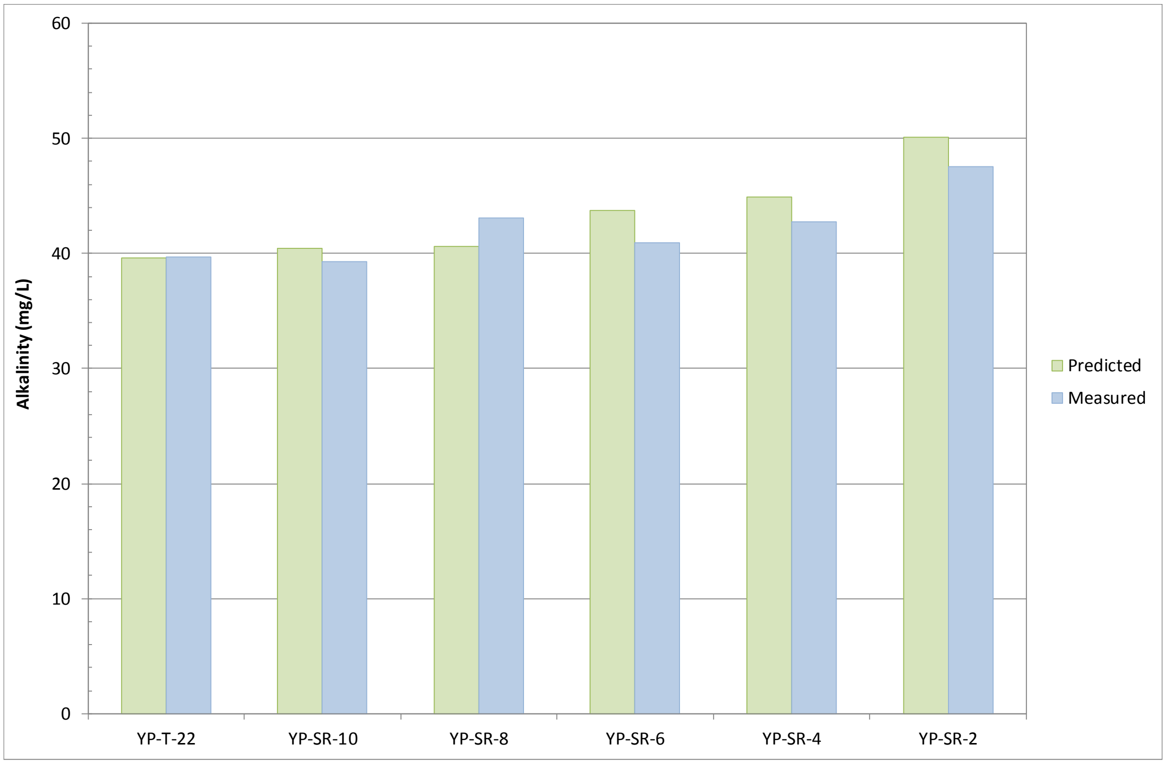

Figure 6-2: Predicted vs. Measured Alkalinity under Average Flow Conditions

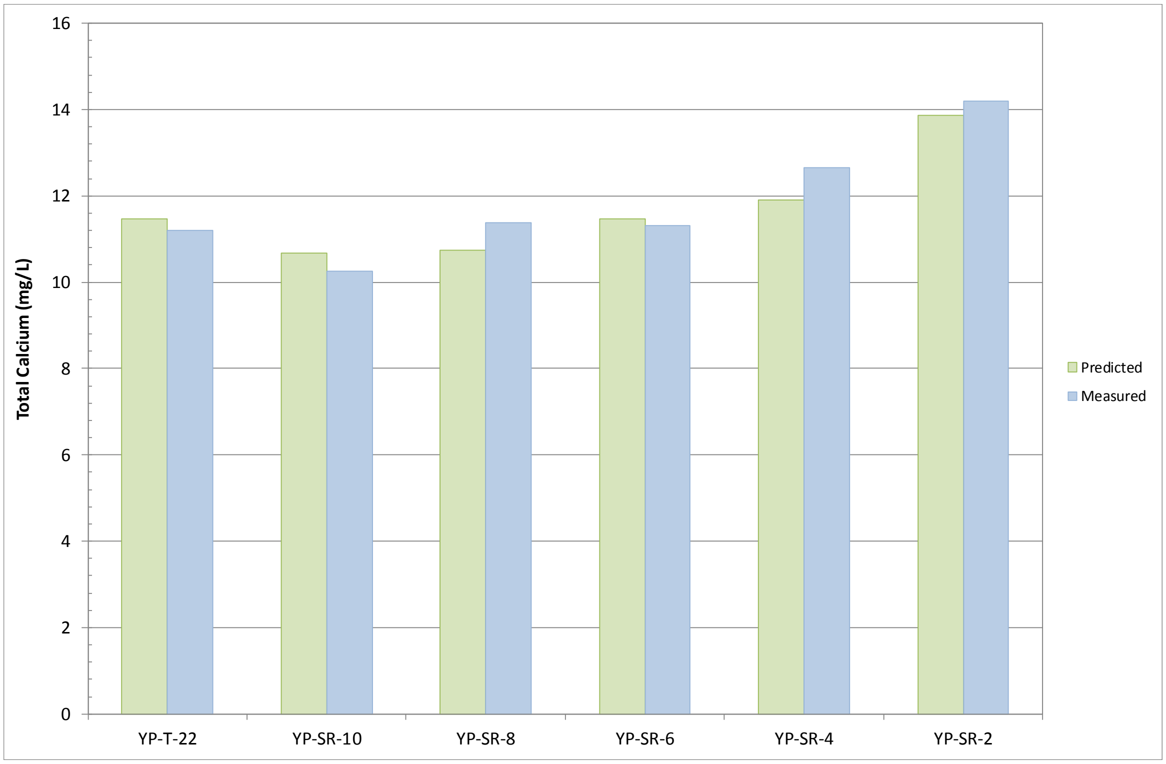

Figure 6-3: Predicted vs. Measured Total Calcium under Average Flow Conditions

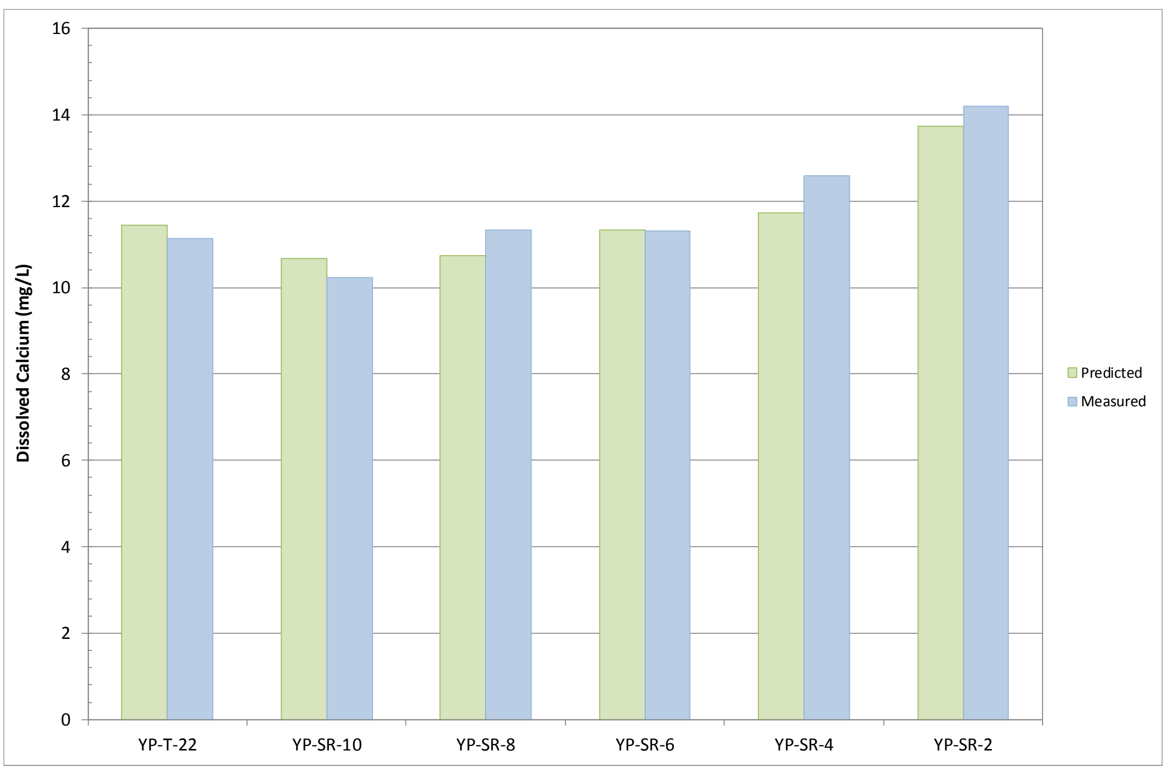

Figure 6-4: Predicted vs. Measured Dissolved Calcium under Average Flow Conditions

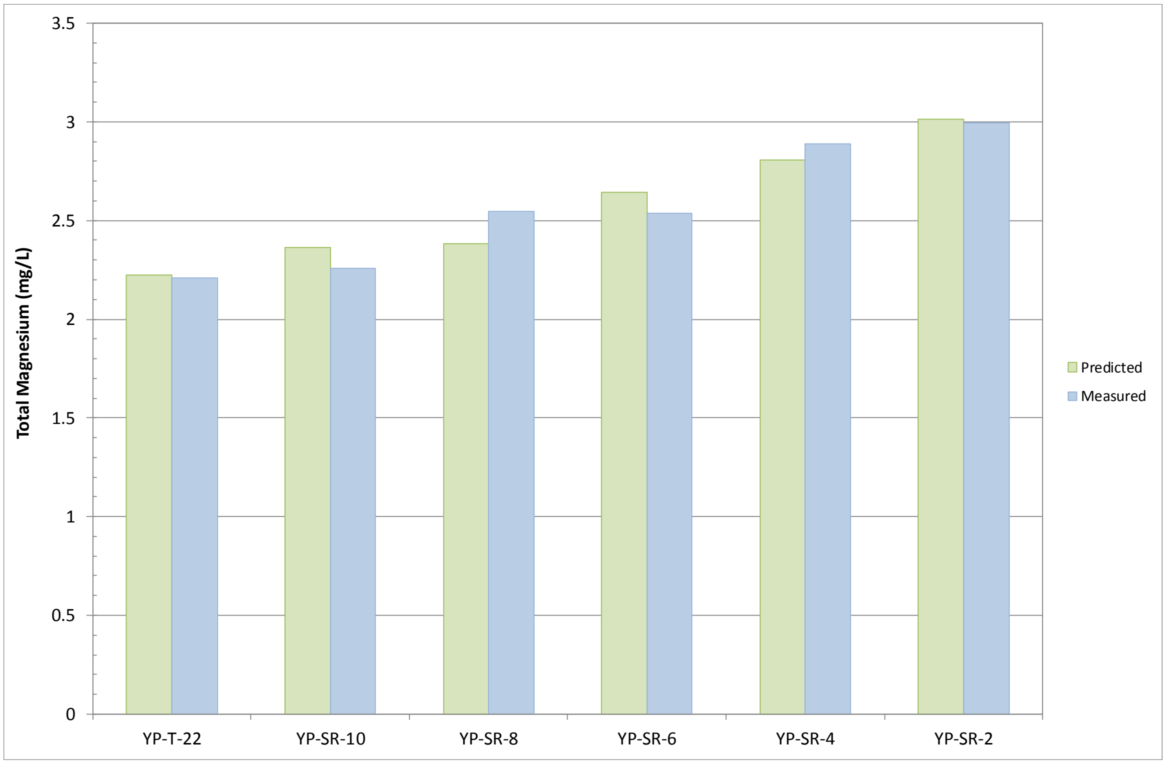

Figure 6-5: Predicted vs. Measured Total Magnesium under Average Flow Conditions

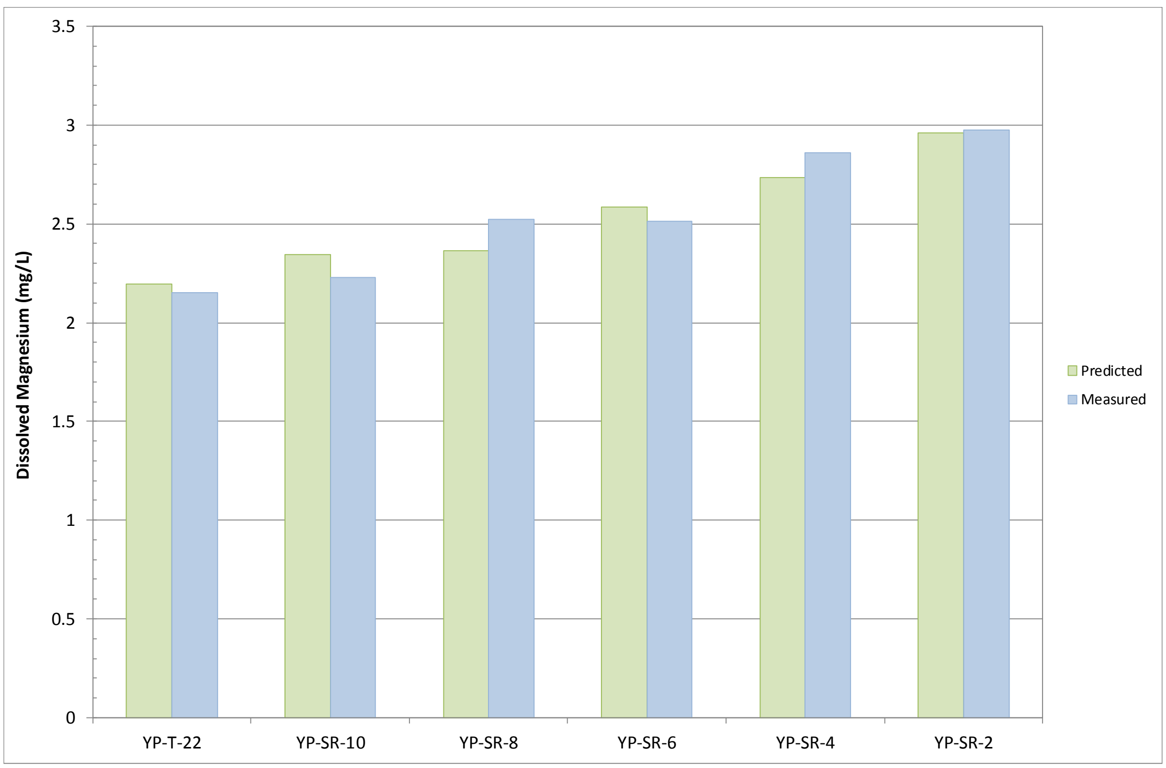

Figure 6-6: Predicted vs. Measured Dissolved Magnesium under Average Flow Conditions

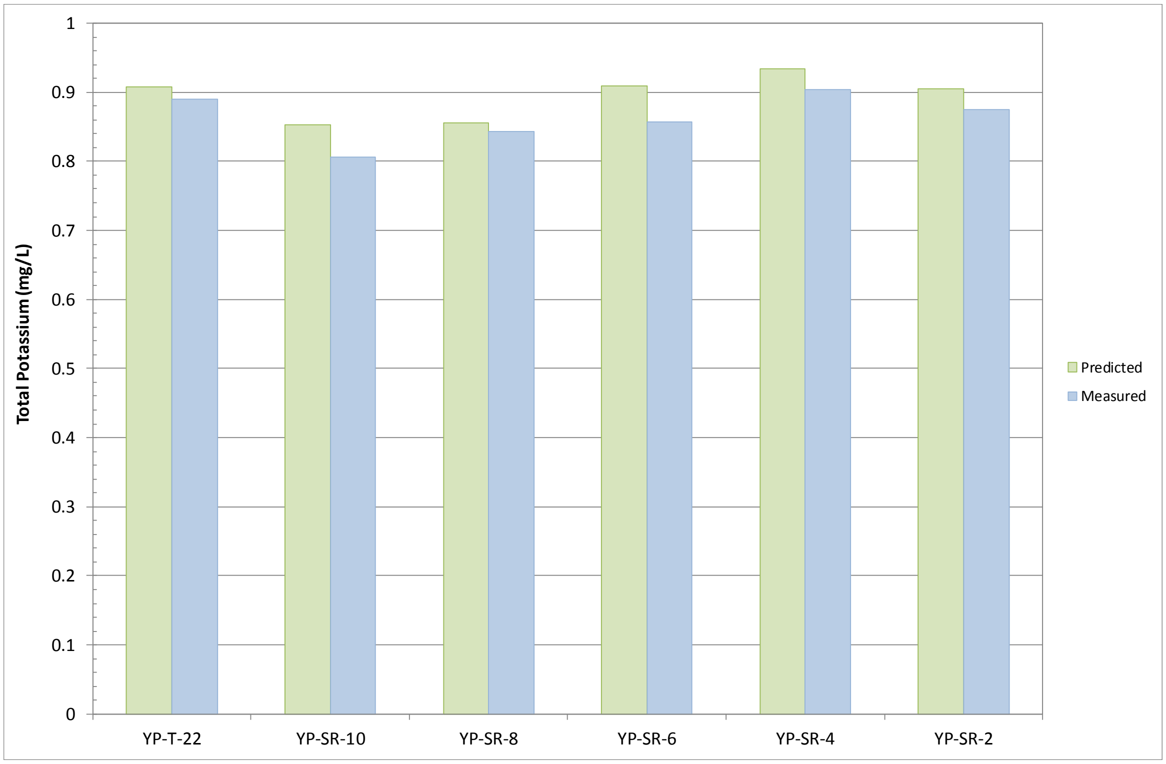

Figure 6-7: Predicted vs. Measured Total Potassium under Average Flow Conditions

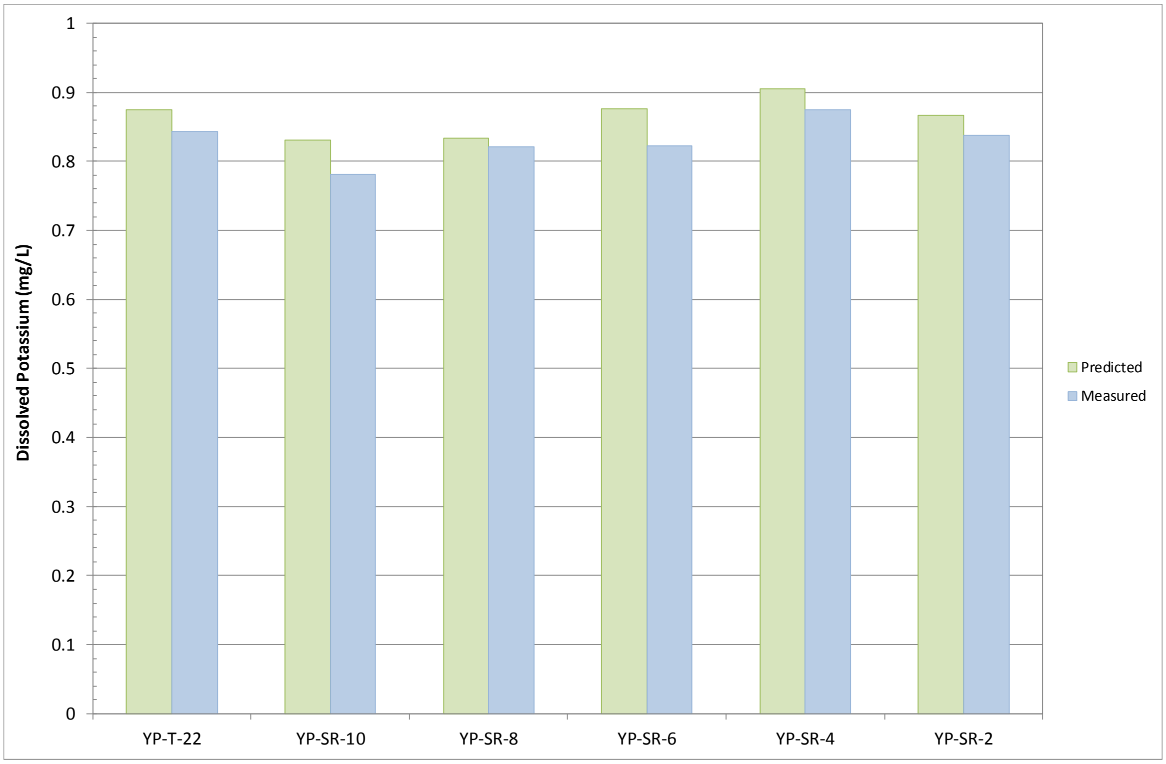

Figure 6-8: Predicted vs. Measured Dissolved Potassium under Average Flow Conditions

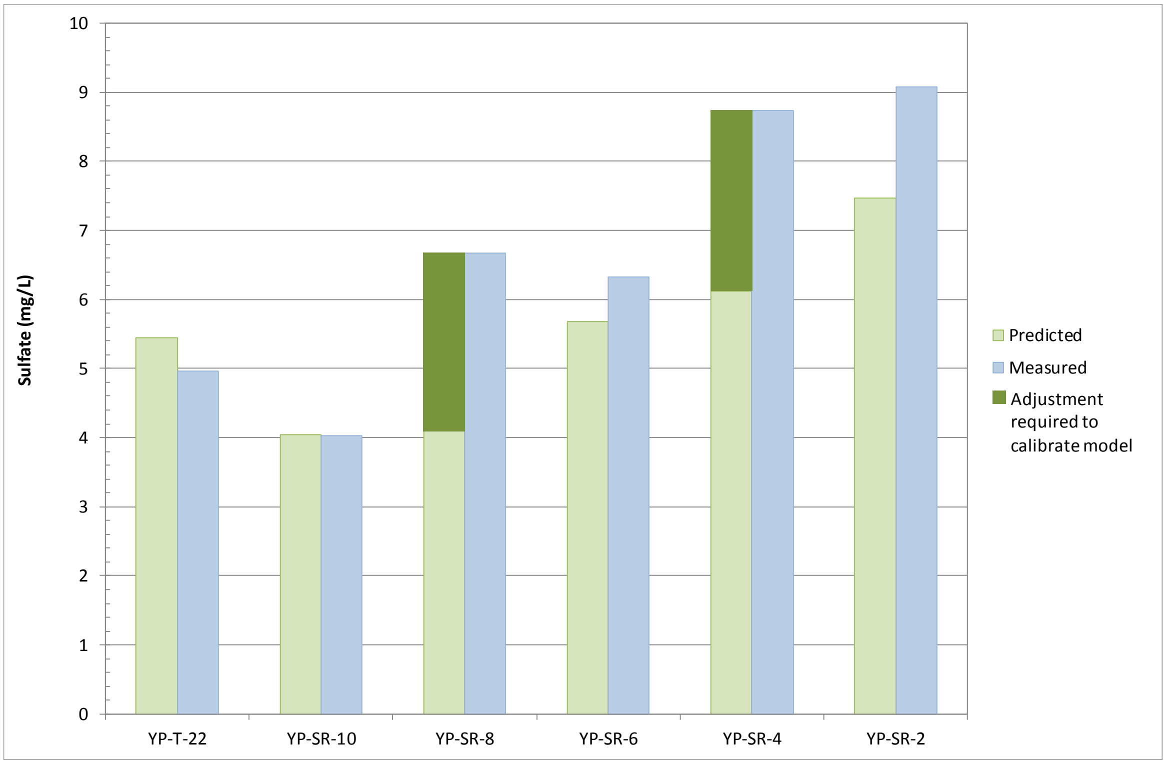

Figure 6-9: Predicted vs. Measured Sulfate under Average Flow Conditions

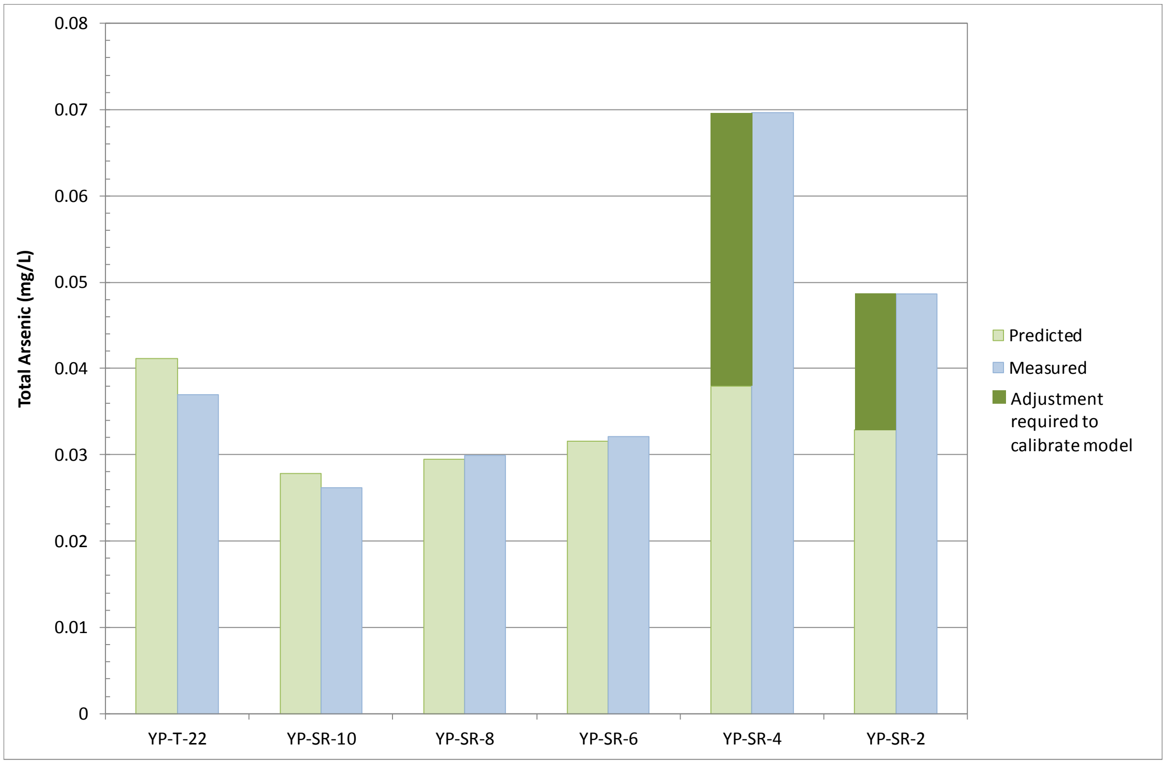

Figure 6-10: Predicted vs. Measured Total Arsenic under Average Flow Conditions

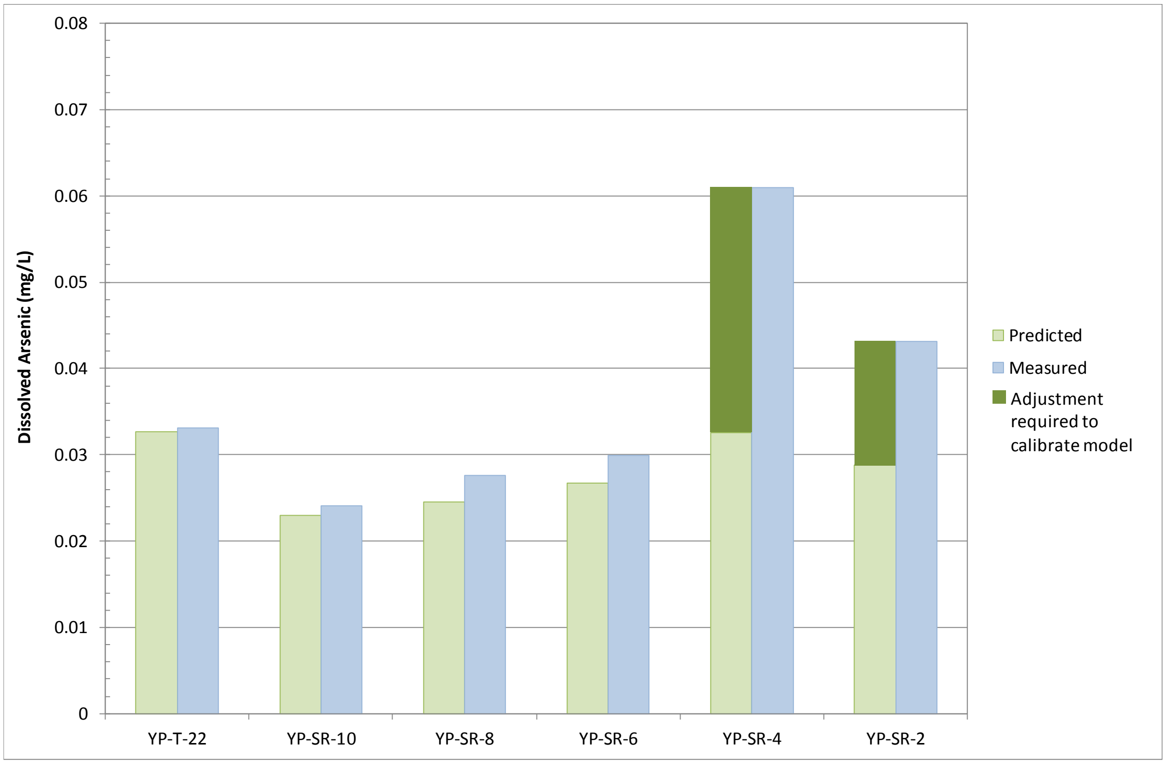

Figure 6-11: Predicted vs. Measured Dissolved Arsenic under Average Flow Conditions

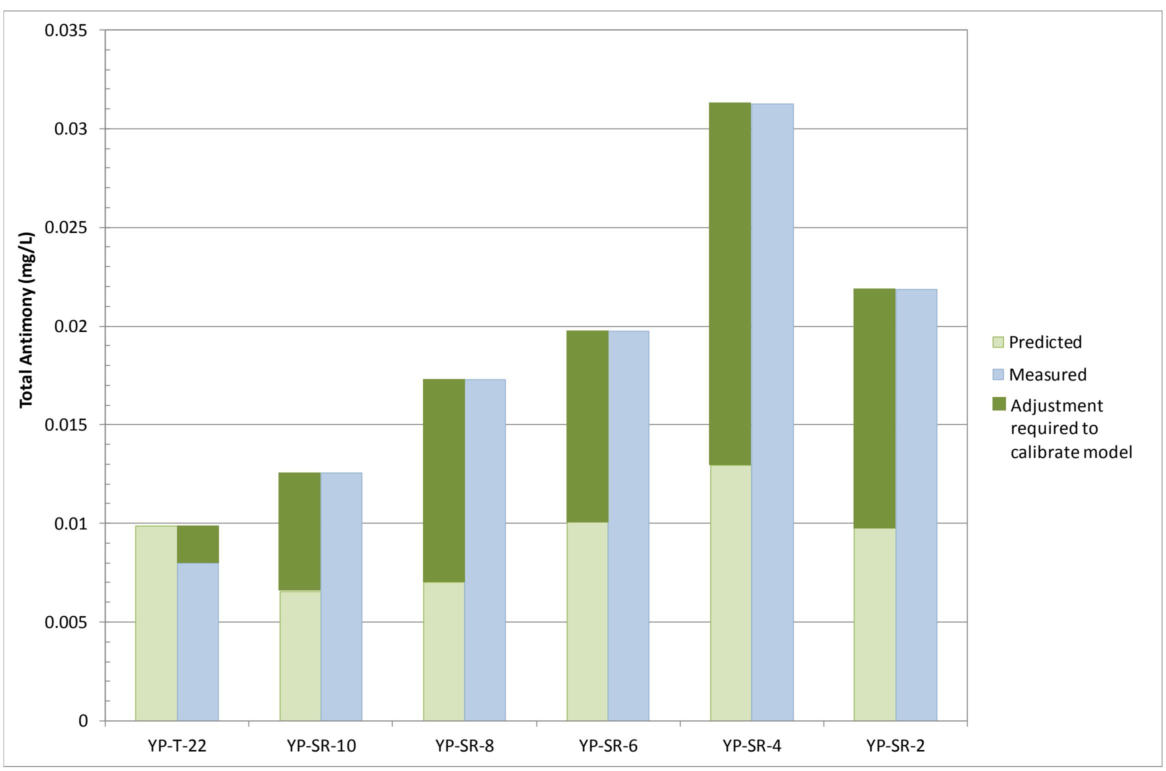

Figure 6-12: Predicted vs. Measured Total Antimony under Average Flow Conditions

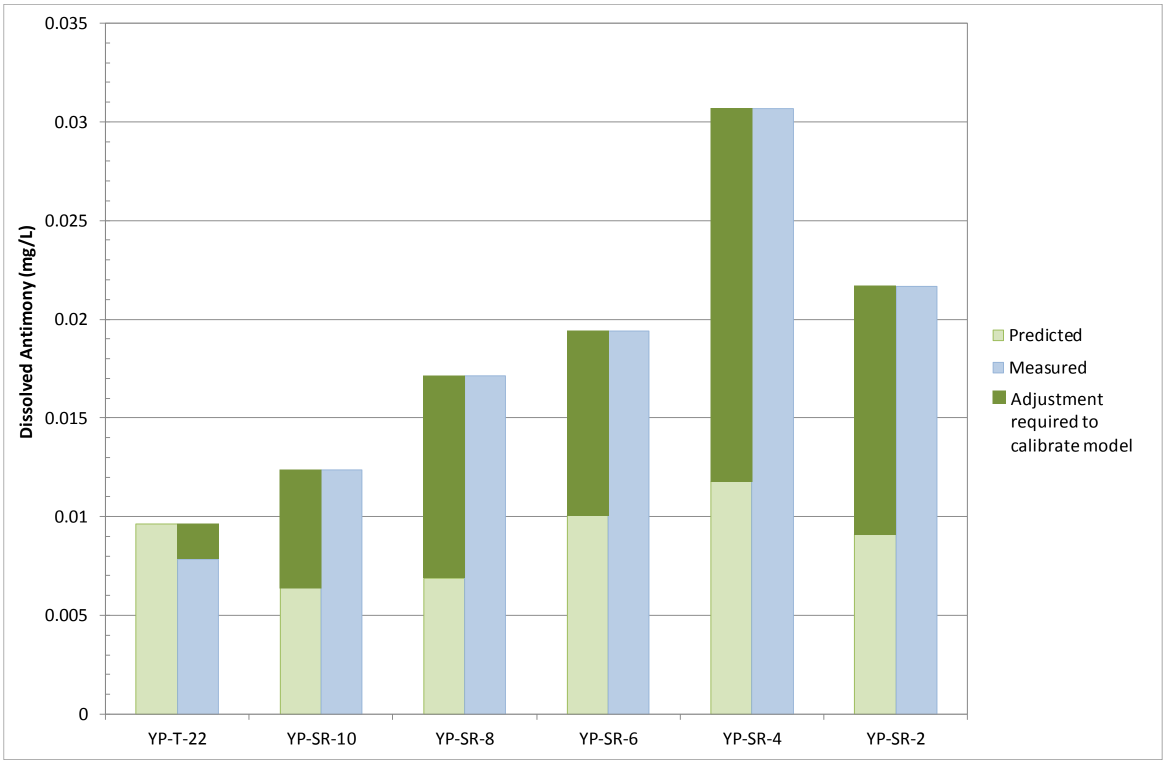

Figure 6-13: Predicted vs. Measured Dissolved Antimony under Average Flow Conditions

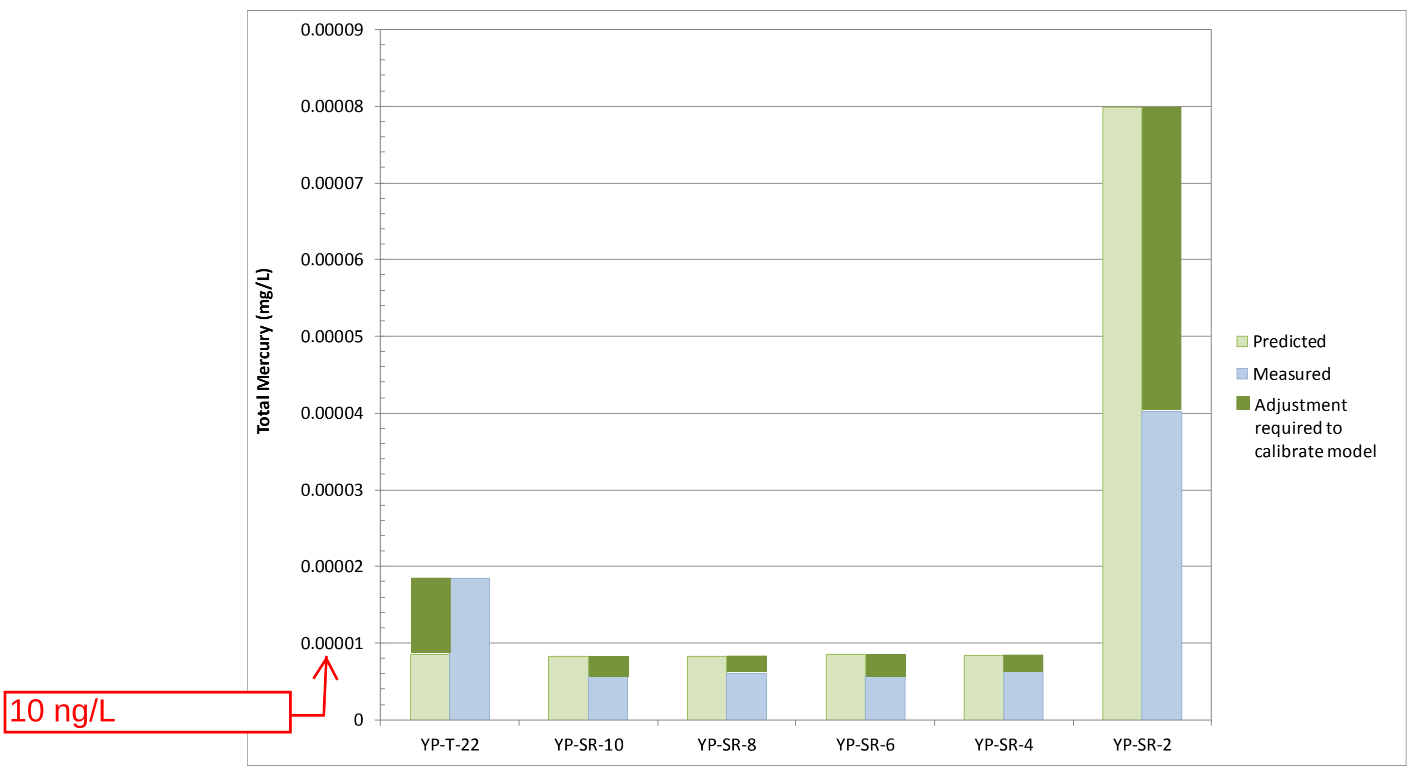

Figure 6-14: Predicted vs. Measured Total Mercury under Average Flow Conditions

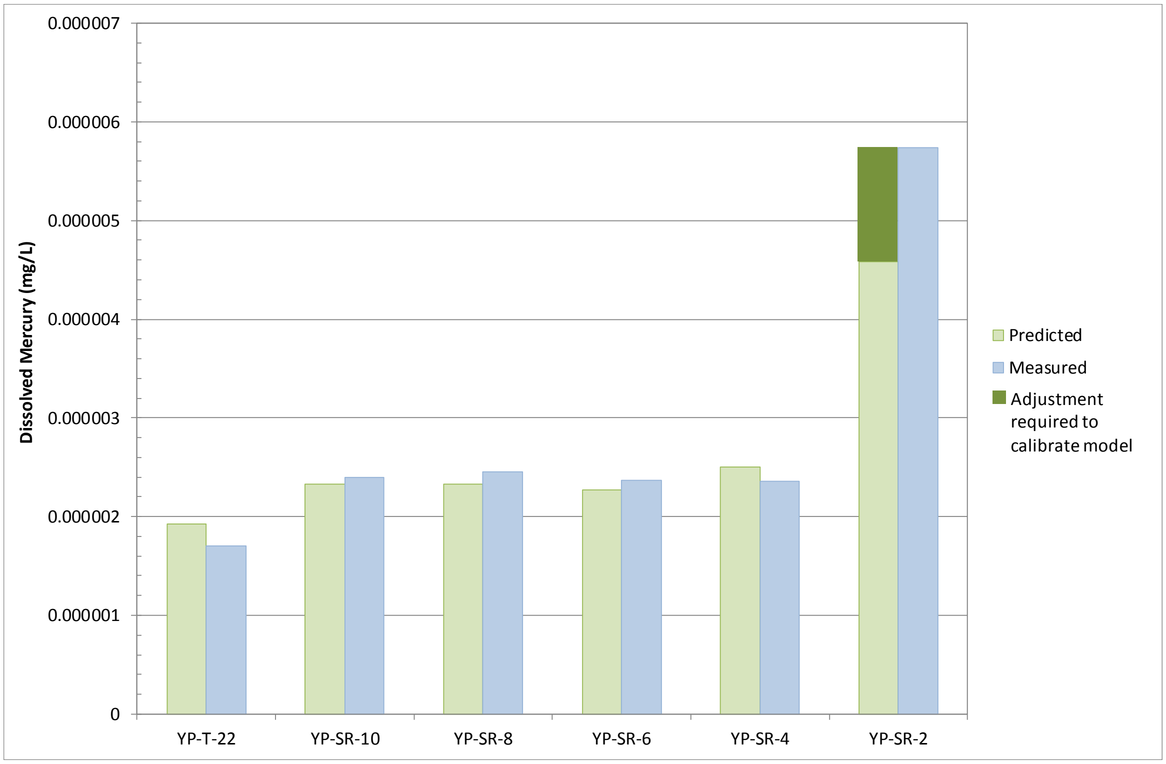

Figure 6-15: Predicted vs. Measured Dissolved Mercury under Average Flow Conditions

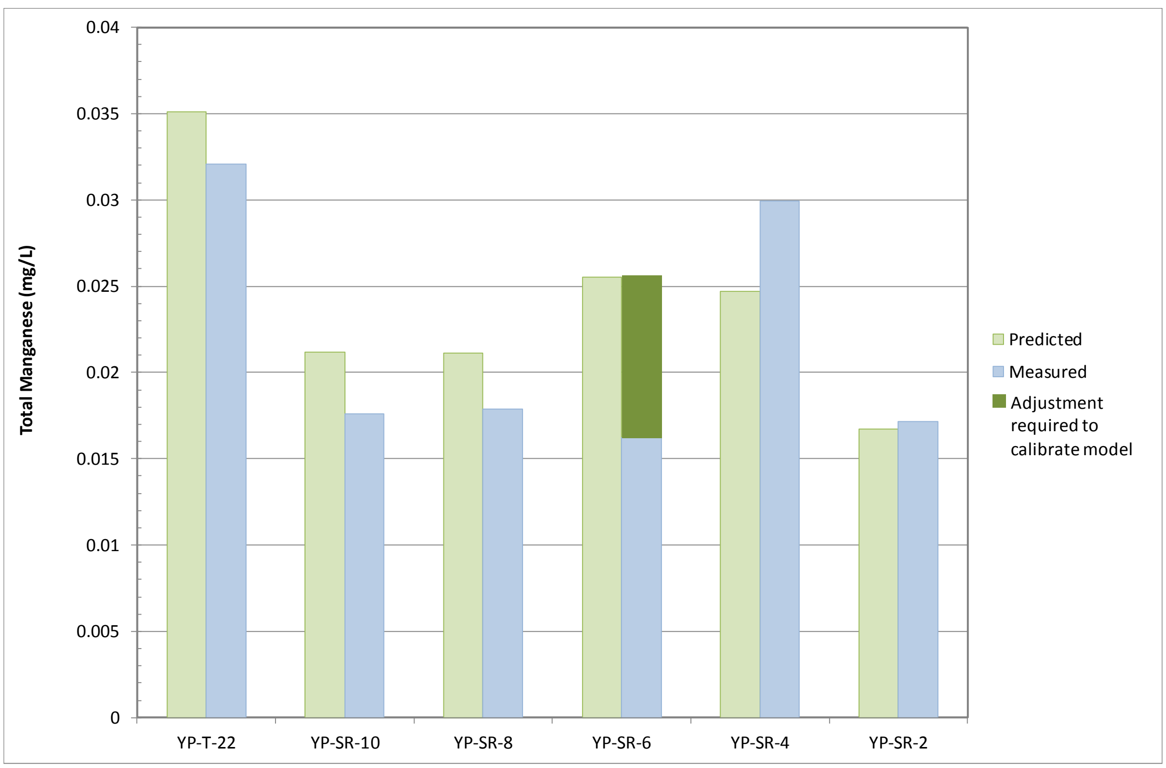

Figure 6-16: Predicted vs. Measured Total Manganese under Average Flow Conditions

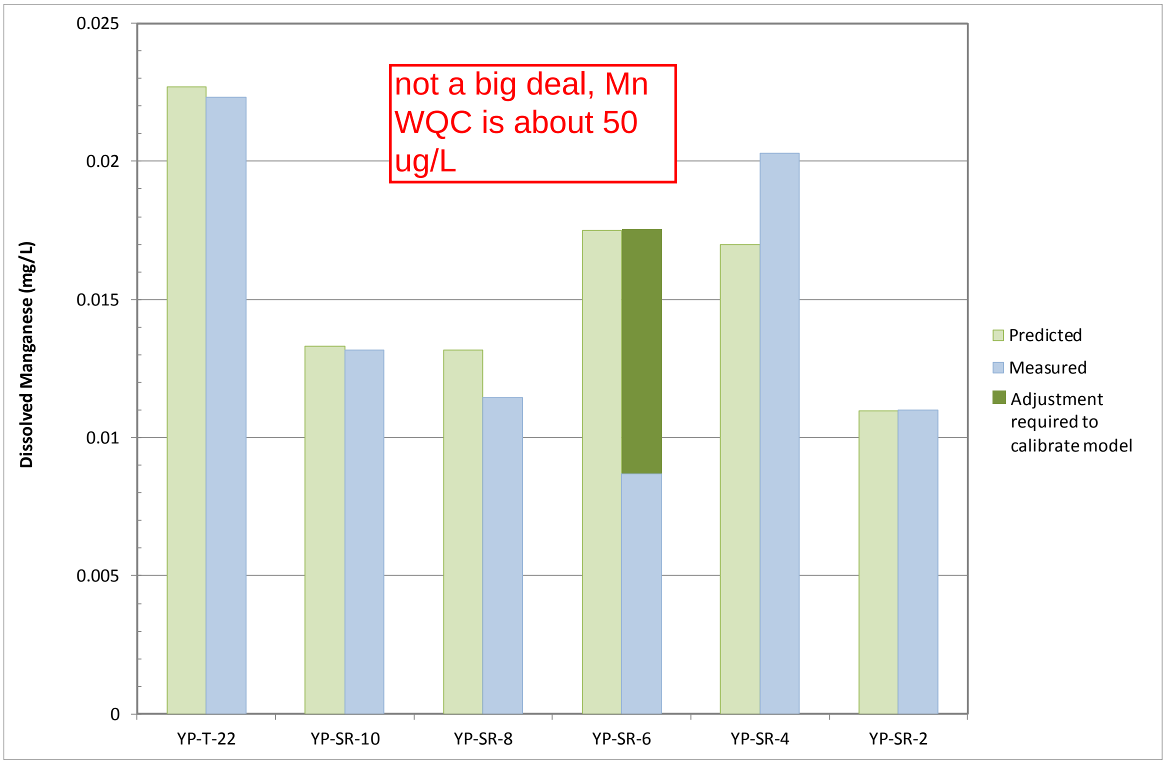

Figure 6-17: Predicted vs. Measured Dissolved Manganese under Average Flow Conditions

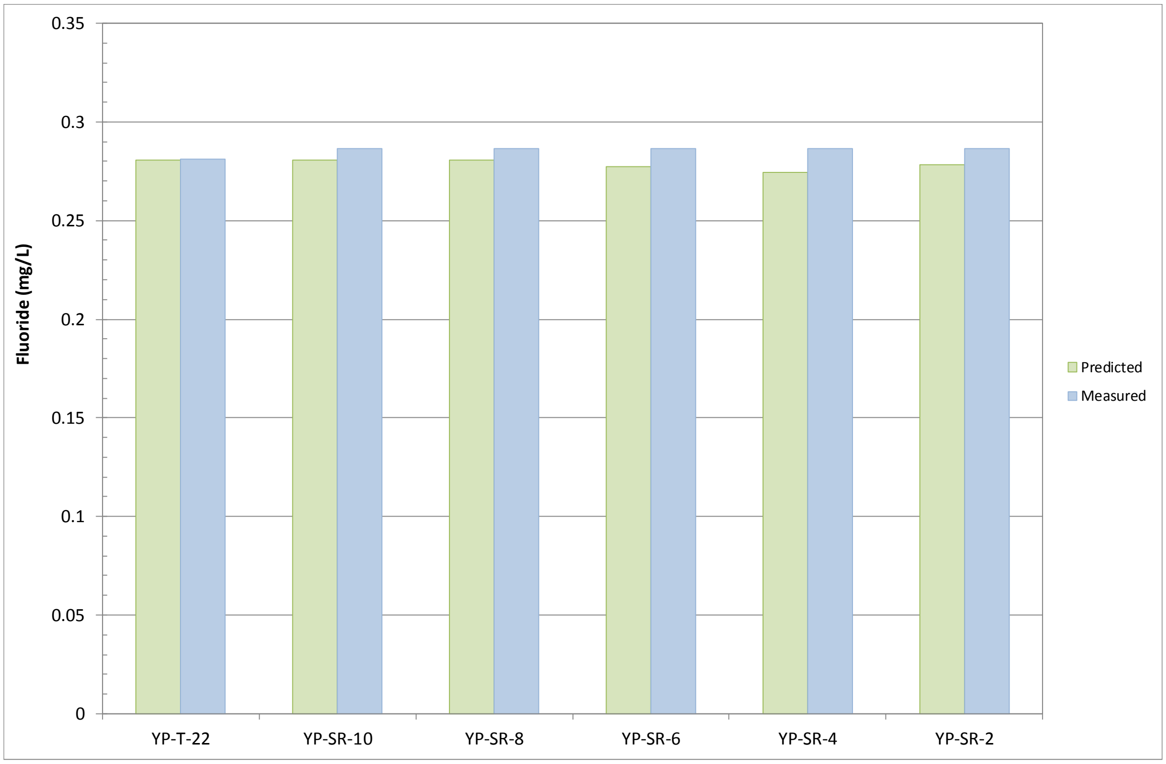

Figure 6-18: Predicted vs. Measured Fluoride under Average Flow Conditions

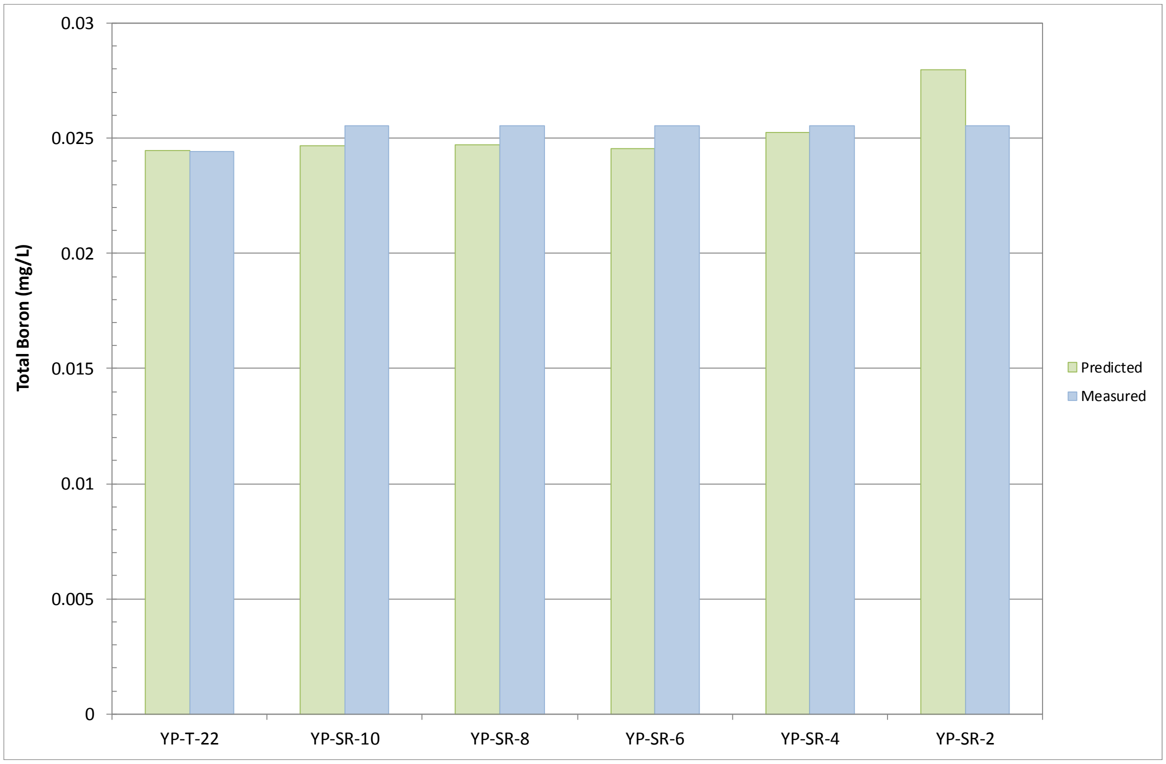

Figure 6-19: Predicted vs. Measured Total Boron under Average Flow Conditions

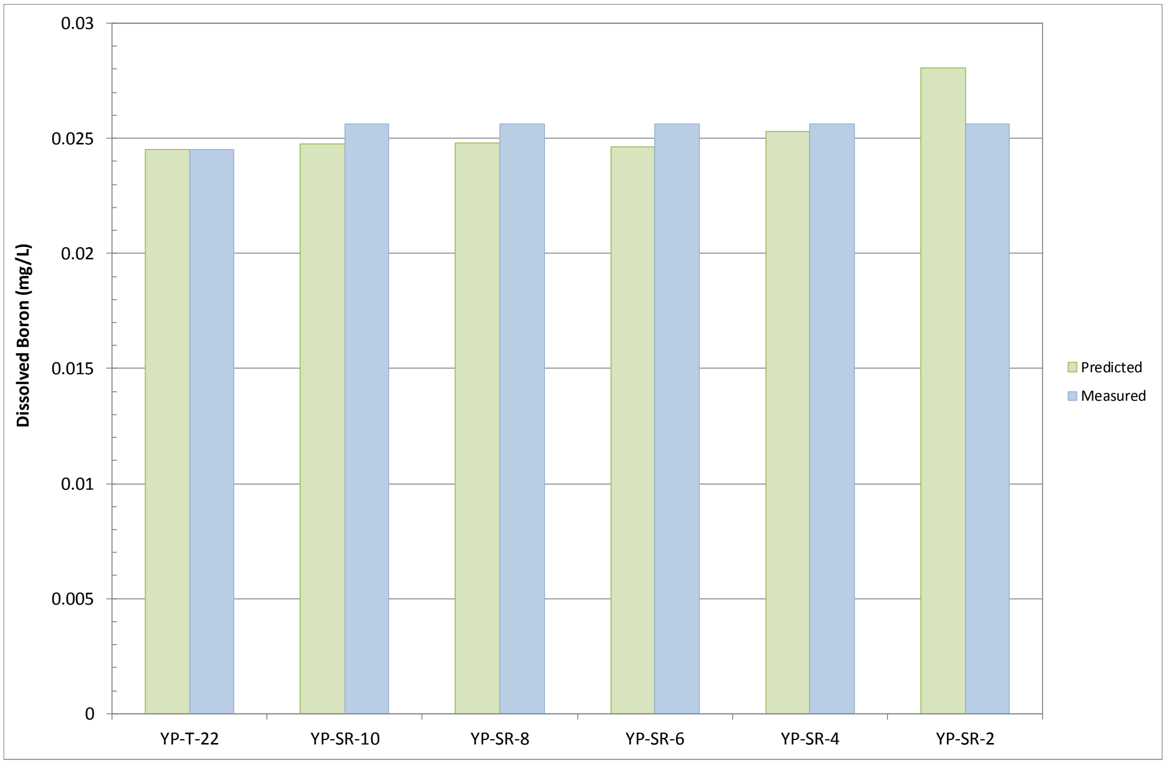

Figure 6-20: Predicted vs. Measured Dissolved Boron under Average Flow Conditions

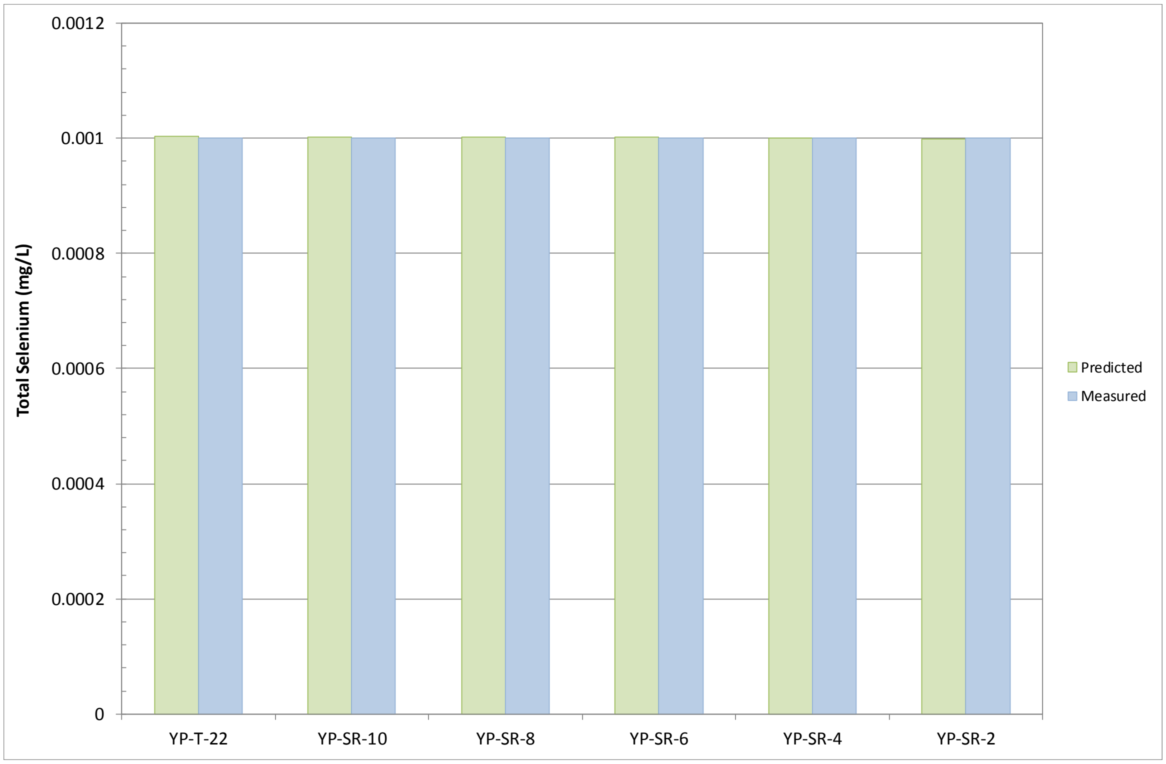

Figure 6-21: Predicted vs. Measured Total Selenium under Average Flow Conditions

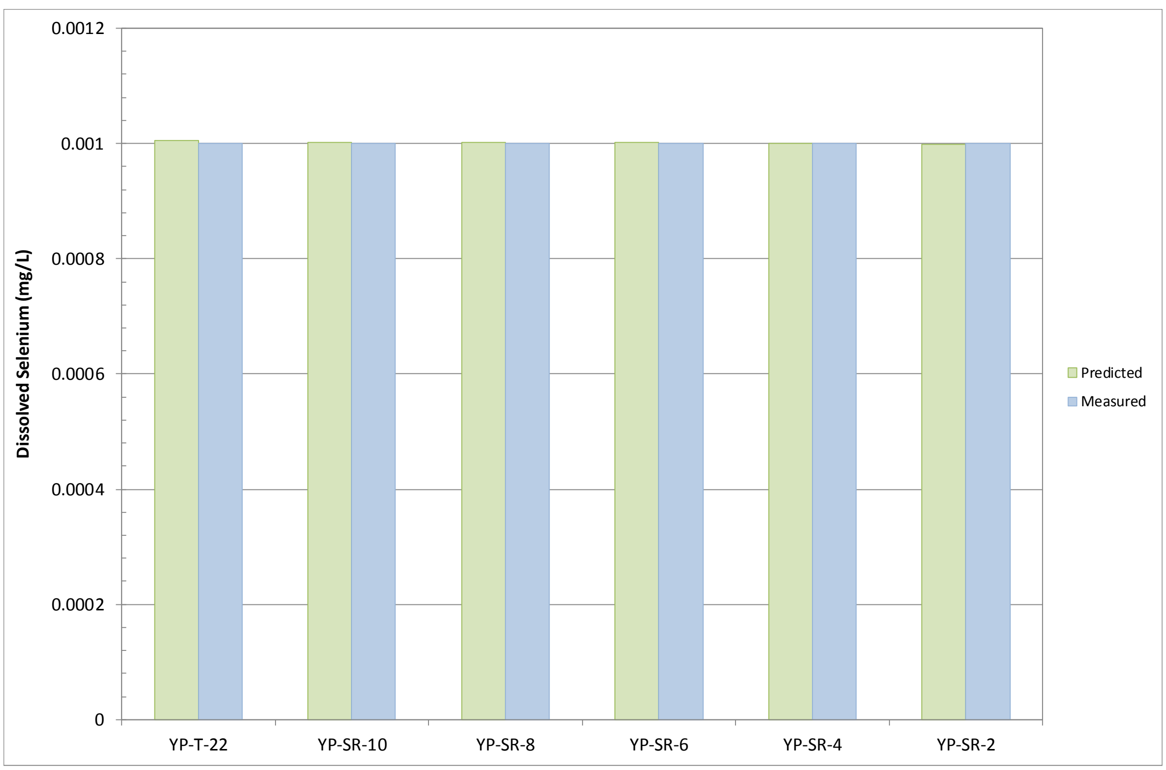

Figure 6-22: Predicted vs. Measured Dissolved Selenium under Average Flow Conditions

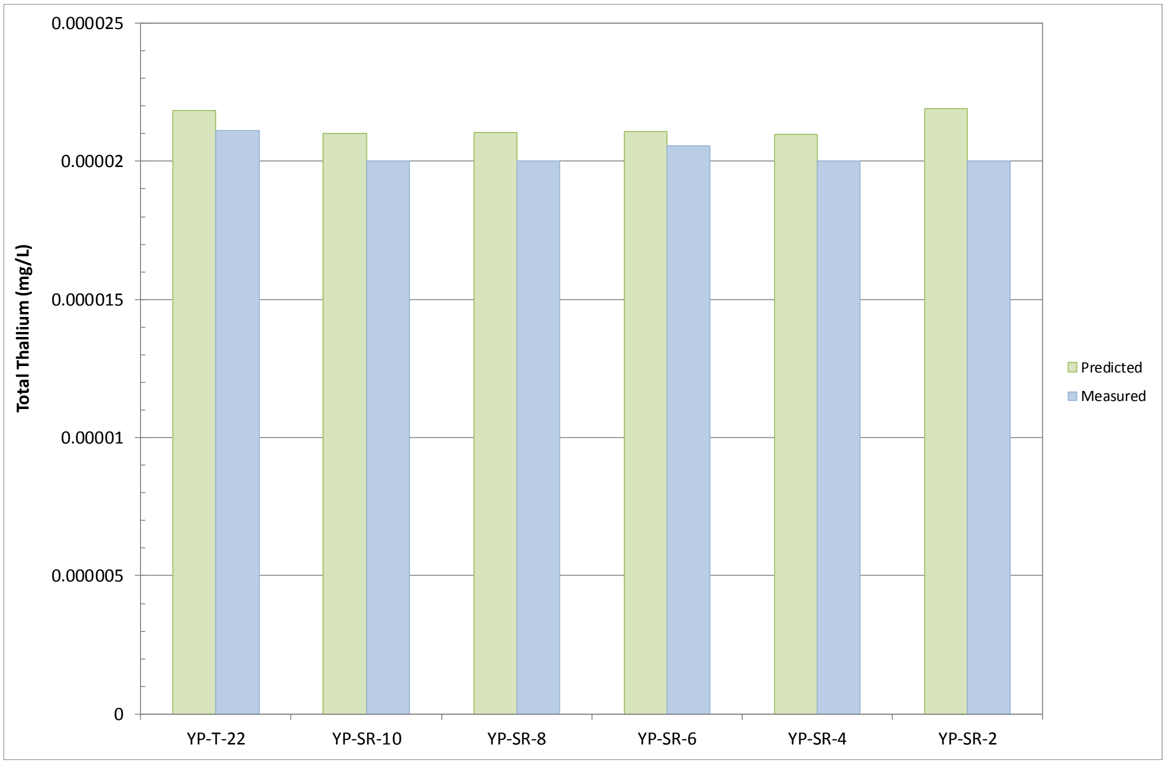

Figure 6-23: Predicted vs. Measured Total Thallium under Average Flow Conditions

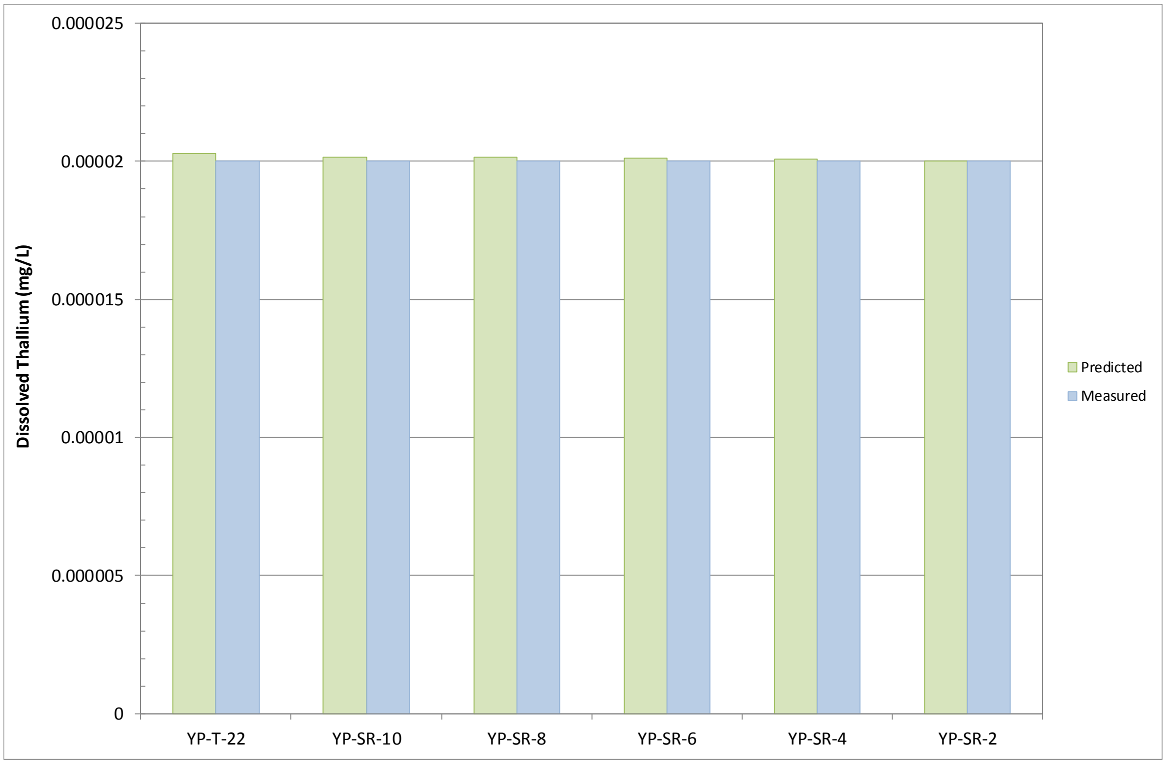

Figure 6-24: Predicted vs. Measured Dissolved Thallium under Average Flow Conditions

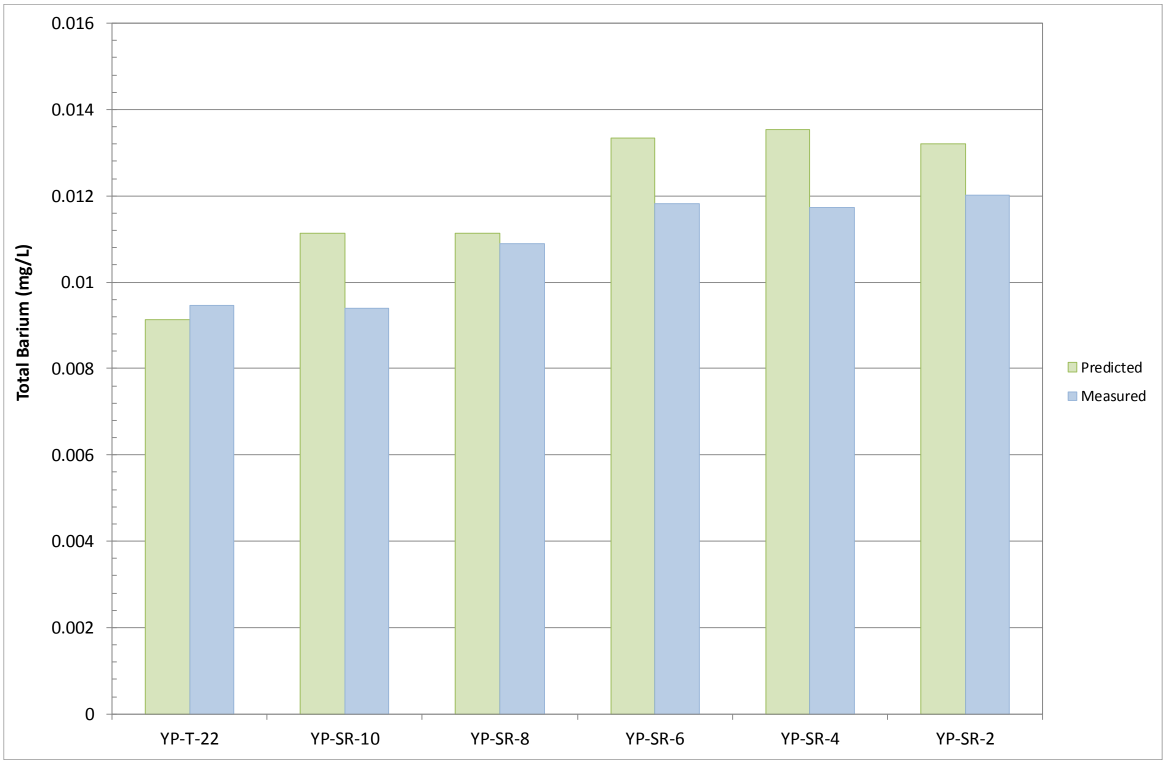

Figure 6-25: Predicted vs. Measured Total Barium under Average Flow Conditions

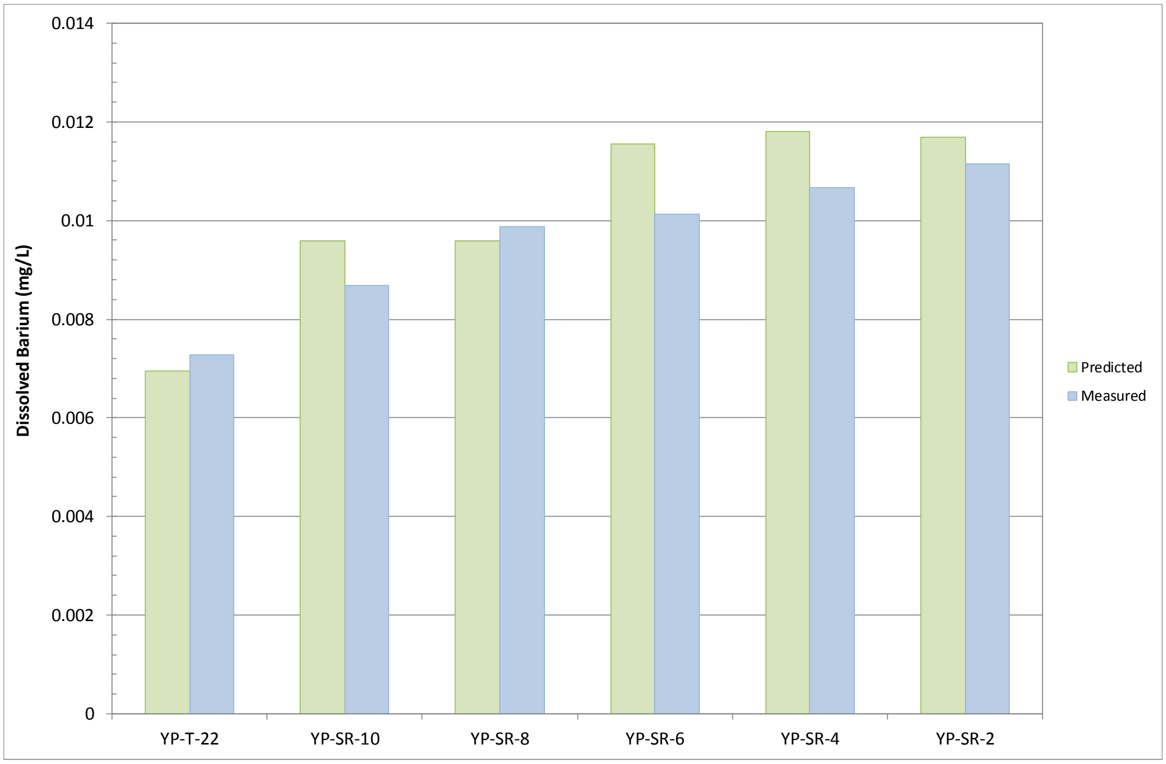

Figure 6-26: Predicted vs. Measured Dissolved Barium under Average Flow Conditions

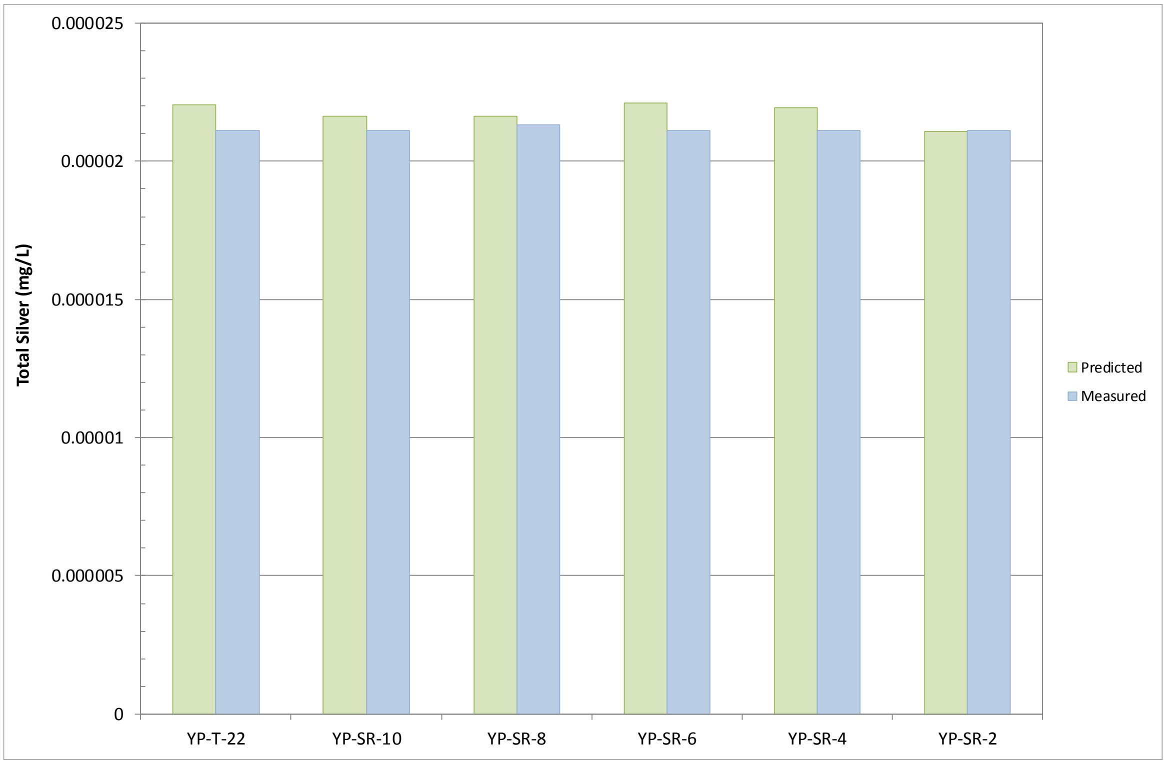

Figure 6-27: Predicted vs. Measured Total Silver under Average Flow Conditions

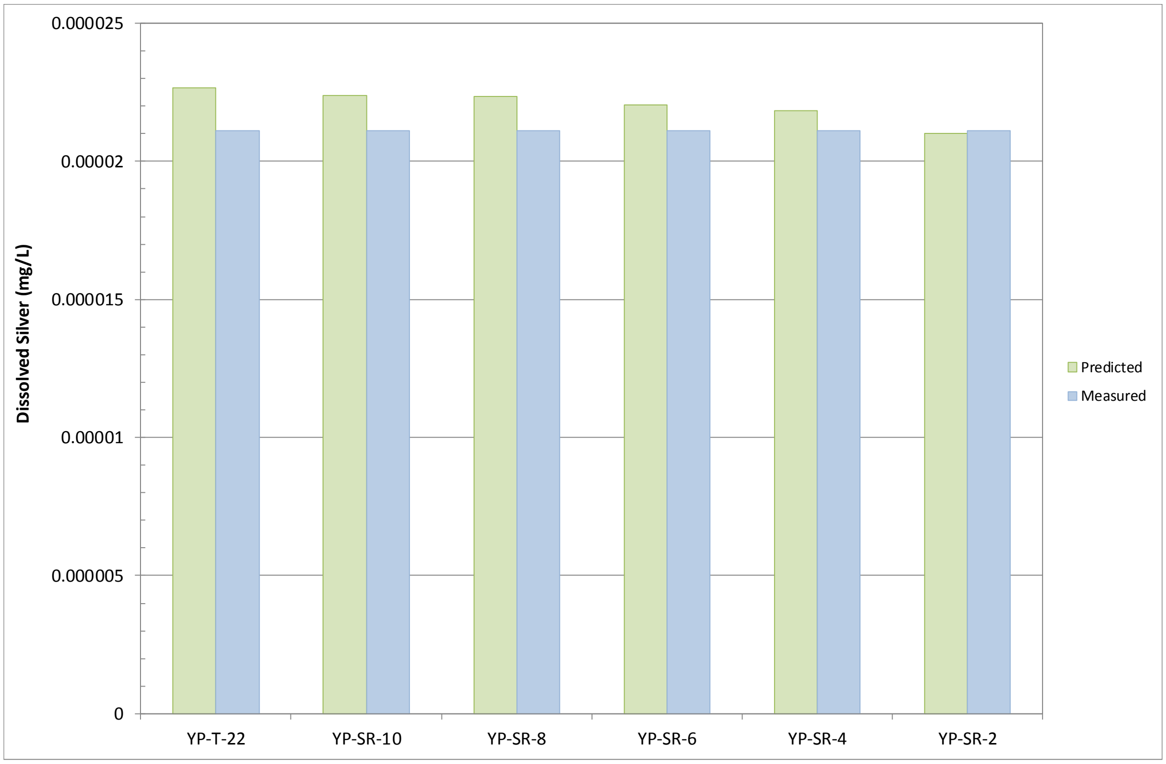

Figure 6-28: Predicted vs. Measured Dissolved Silver under Average Flow Conditions

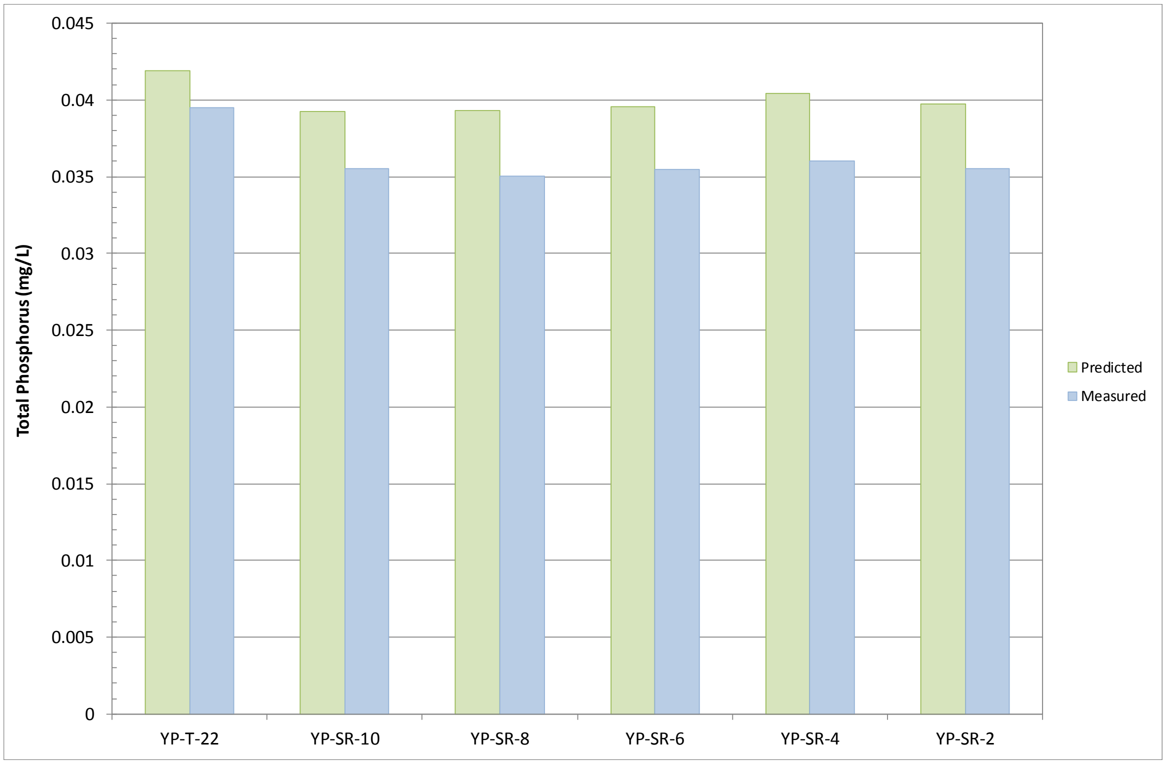

Figure 6-29: Predicted vs. Measured Total Phosphorus under Average Flow Conditions

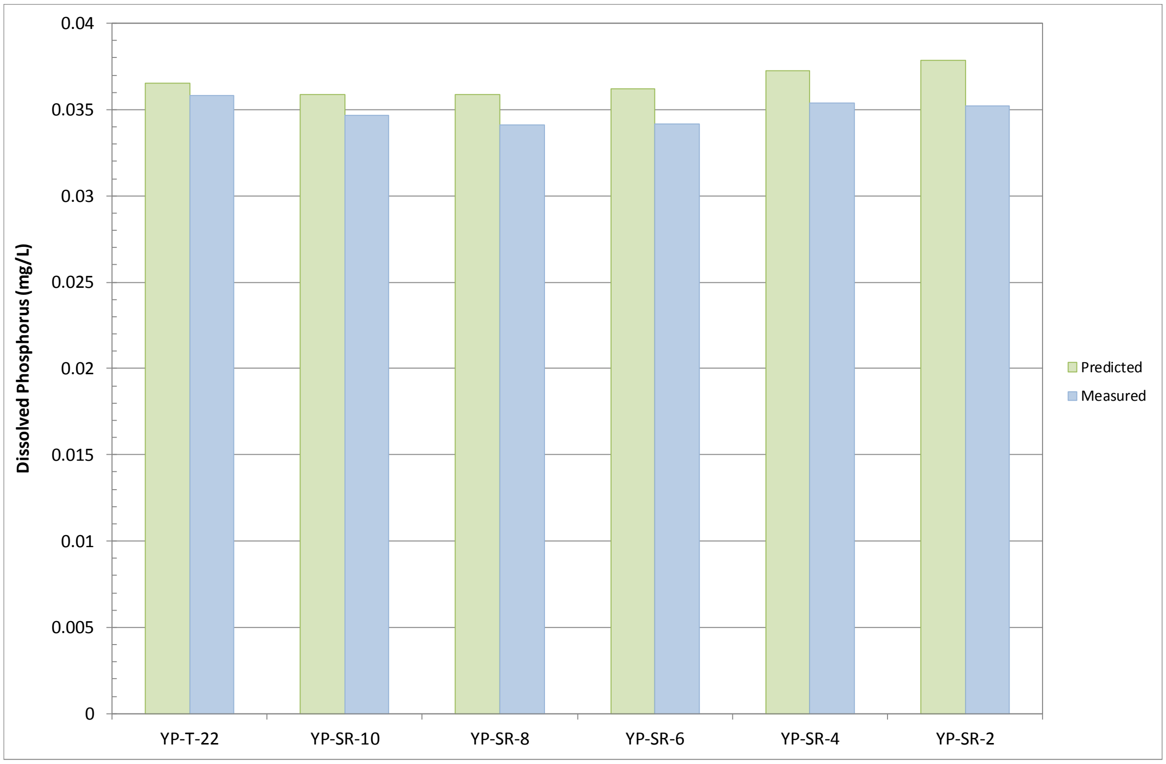

Figure 6-30: Predicted vs. Measured Dissolved Phosphorus under Average Flow Conditions

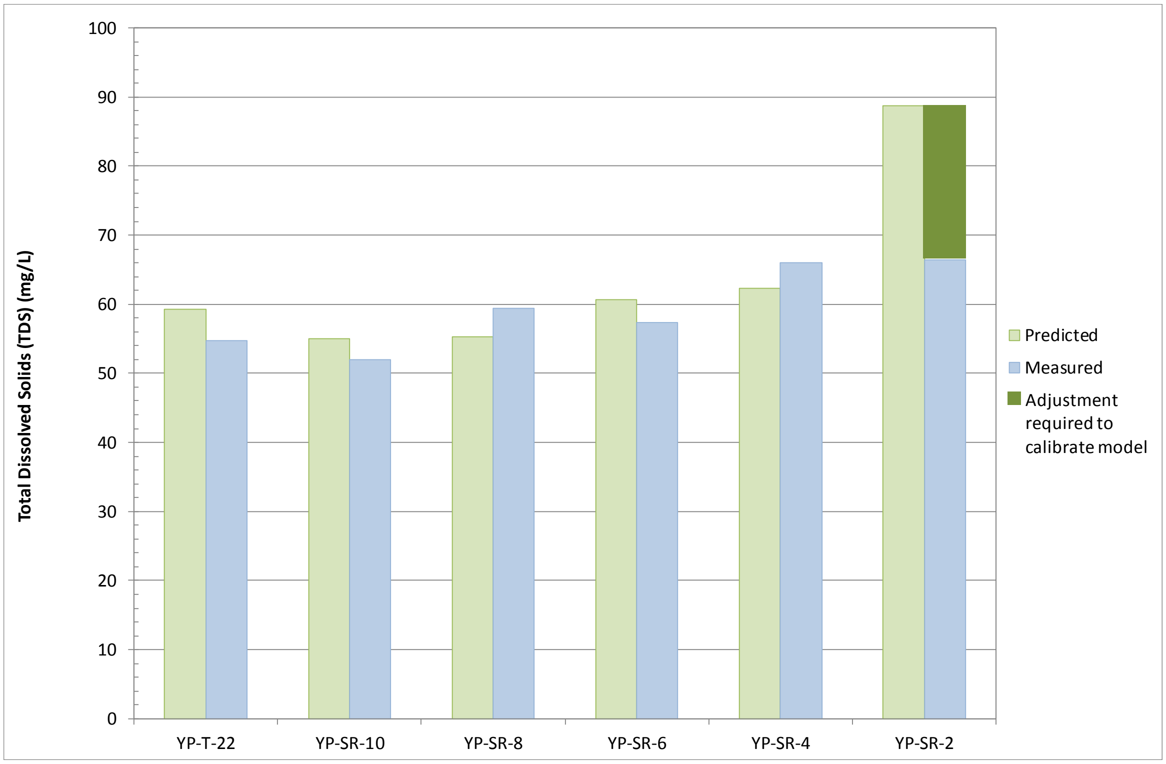

Figure 6-31: Predicted vs. Measured TDS under Average Flow Conditions

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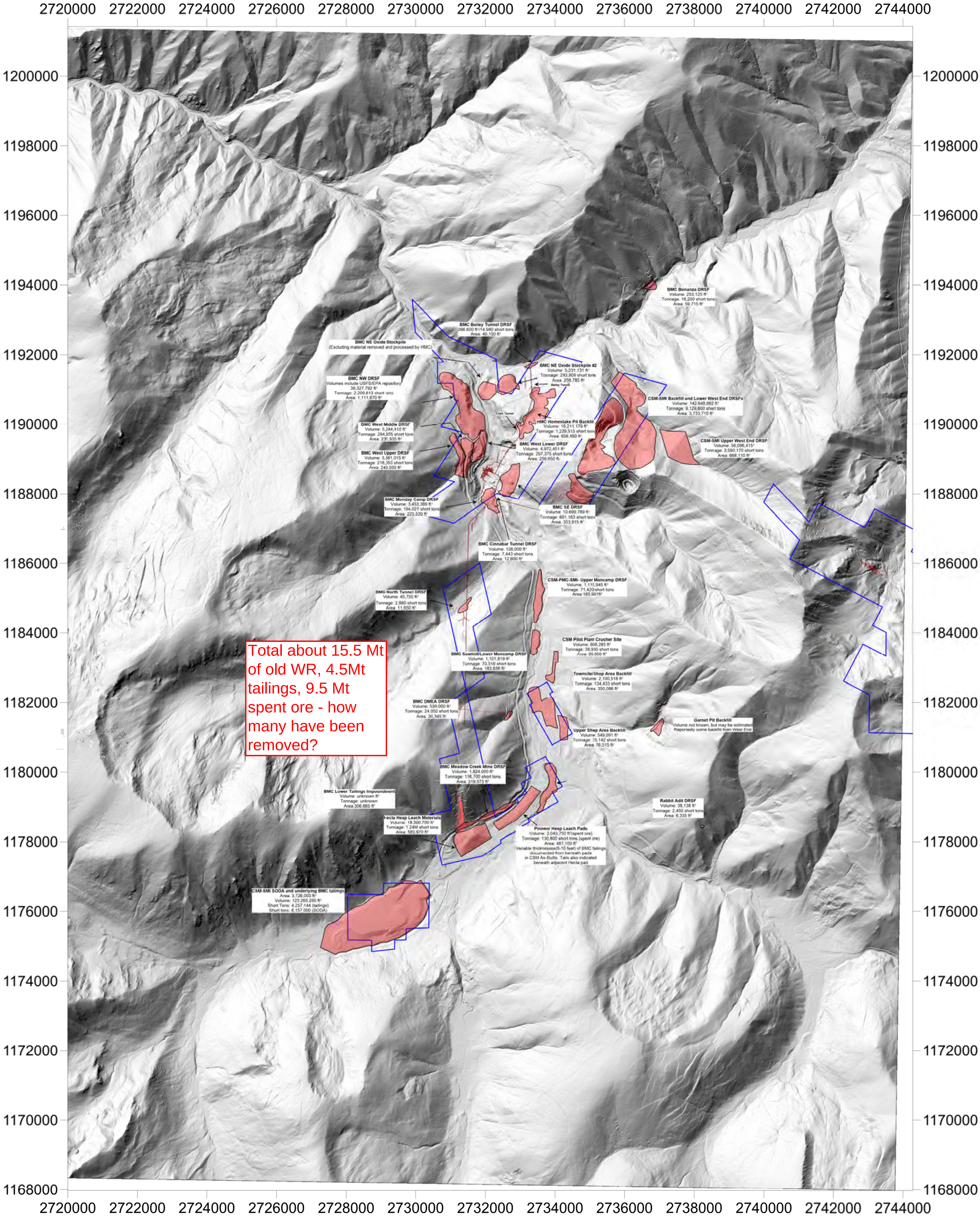
APPENDIX A:
AREAS OF KNOWN LEGACY DRSFS, STOCKPILES AND BACKFILL

AREAS OF KNOWN, EXISTING, LEGACY, DRSF, STOCKPILES, BACKFILL



Topography from 2009 LIDAR
Polygons, volumes from various MGII estimates
Geochem sources as noted

Legacy DRSF, stockpile or backfill from public records and company files

Patented private lands

SCALE IN FEET 0 500 1000 1500 2000

MIDAS GOLD

APPENDIX B:
PREDICTED CHEMISTRY UNDER MINIMUM FLOW CONDITIONS

why would they predict such high AsT? for measured average and minimum flows, AsT=AsD

this is +24, not -24

Table B1: […]sured Chemistry at YP-T-22 under Minimum Flow Conditions

Parameter	Units	YP-T-22			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	8.24	7.67	-7.2%	7.67
Alkalinity as $CaCO_3$, Total	mg/L	46.0	47.2	2.6%	47.2
Aluminum, Total	mg/L	0.027	0.016	51.9%	0.016
Aluminum, Dissolved	mg/L	0.0060	0.0051	15.7%	0.0051
Antimony, Total	mg/L	0.0047	0.0060	-23.9%	0.0060
Antimony, Dissolved	mg/L	0.0047	0.0057	18.8%	0.0057
Arsenic, Total	mg/L	0.029	0.059	-70.0%	0.059
Arsenic, Dissolved	mg/L	0.026	0.027	1.0%	0.027
Barium, Total	mg/L	0.0079	0.0087	-10.0%	0.0079
Barium, Dissolved	mg/L	0.0077	0.0078	0.5%	0.0078
Beryllium, Total	mg/L	2.0E-05	2.1E-05	-2.9%	2.0E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.4%	2.0E-05
Boron, Total	mg/L	0.020	0.020	0.0%	0.020
Boron, Dissolved	mg/L	0.020	0.020	0.1%	0.020
Cadmium, Total	mg/L	2.0E-05	2.0E-05	-0.2%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	0.05%	2.0E-05
Calcium, Total	mg/L	13.0	13.9	-6.4%	13.0
Calcium, Dissolved	mg/L	12.1	13.9	14.2%	13.9
Chloride	mg/L	1.26	1.80	35.4%	1.26
Chromium, Total	mg/L	0.00020	0.00020	-2.4%	0.00020
Chromium, Dissolved	mg/L	0.00020	0.00020	0.3%	0.00020
Cobalt, Total	mg/L	0.00013	0.00014	-6.5%	0.00013
Cobalt, Dissolved	mg/L	0.00013	0.00013	-3.0%	0.00013
Copper, Total	mg/L	0.00010	0.00019	-64.3%	0.00019
Copper, Dissolved	mg/L	0.00030	0.00058	64.0%	0.00030
Fluoride	mg/L	0.20	0.20	0.0%	0.20
Iron, Total	mg/L	0.16	0.35	-73.9%	0.35
Iron, Dissolved	mg/L	0.080	0.073	-8.7%	0.073
Lead, Total	mg/L	2.0E-05	3.6E-05	-57.8%	3.6E-05
Lead, Dissolved	mg/L	2.0E-05	2.1E-05	6.5%	2.1E-05
Magnesium, Total	mg/L	2.60	2.77	-6.4%	2.60
Magnesium, Dissolved	mg/L	2.42	2.79	14.1%	2.79
Manganese, Total	mg/L	0.032	0.049	-42.7%	0.049
Manganese, Dissolved	mg/L	0.027	0.031	12.8%	0.031
Mercury, Total	mg/L	1.3E-06	2.8E-06	-72.2%	2.8E-06
Mercury, Dissolved	mg/L	7.0E-07	8.7E-07	22.2%	7.0E-07
Molybdenum, Total	mg/L	0.00091	0.0010	-11.4%	0.00091
Molybdenum, Dissolved	mg/L	0.00092	0.0010	9.7%	0.0010
Nickel, Total	mg/L	0.00020	0.00022	-9.9%	0.00020
Nickel, Dissolved	mg/L	0.00030	0.00036	17.6%	0.00036
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.052	4.3%	0.052
Phosphorus, Total	mg/L	0.040	0.045	-11.6%	0.040
Phosphorus, Dissolved	mg/L	0.040	0.040	0.3%	0.040
Potassium, Total	mg/L	0.91	0.99	-8.2%	0.91
Potassium, Dissolved	mg/L	0.87	0.97	10.7%	0.97
Selenium, Total	mg/L	0.0010	0.0010	-0.1%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.1%	0.0010
Silver, Total	mg/L	2.0E-05	2.0E-05	-2.1%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	1.5%	2.0E-05
Sodium, Total	mg/L	2.99	2.88	3.7%	2.99
Sodium, Dissolved	mg/L	2.78	2.92	5.0%	2.92
Solids, Total Dissolved (TDS)	mg/L	66.0	62.0	-6.2%	62.0
Solids, Total Suspended (TSS)	mg/L	50.0	6.99	-151%	50.0
Sulfate	mg/L	5.07	6.05	17.6%	6.05
Thallium, Total	mg/L	2.0E-05	2.0E-05	-1.0%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.2%	2.0E-05
Vanadium, Total	mg/L	0.00020	0.00024	-17.1%	0.00020
Vanadium, Dissolved	mg/L	0.00020	0.00020	0.9%	0.00020
Zinc, Total	mg/L	0.0016	0.0011	33.9%	0.0011
Zinc, Dissolved	mg/L	0.00090	0.0018	66.6%	0.00090

why does this show them using the POOR predictions? For average flow they used MEASURED in the "adjusted predicted".

v low concentrations

* Parameter only adjusted if RPD>20%

Non-shaded cells indicate no adjustment was required to calibrate

Shaded cells indicate predicted concentration has been manually adjusted

Table B2: Predicted vs. Measured Chemistry at YP-SR-10 under Minimum Flow Conditions

Parameter	Units	YP-SR-10			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.45	7.33	-1.6%	7.33
Alkalinity as $CaCO_3$, Total	mg/L	54.0	54.3	0.6%	54.3
Aluminum, Total	mg/L	0.013	0.039	-101%	0.039
Aluminum, Dissolved	mg/L	0.0032	0.0050	43.6%	0.0032
Antimony, Total	mg/L	0.012	0.0060	68.9%	0.0060
Antimony, Dissolved	mg/L	0.013	0.0059	-71.4%	0.013
Arsenic, Total	mg/L	0.024	0.034	-35.5%	0.034
Arsenic, Dissolved	mg/L	0.023	0.020	-14.9%	0.020
Barium, Total	mg/L	0.0097	0.017	-54.3%	0.017
Barium, Dissolved	mg/L	0.010	0.016	46.3%	0.010
Beryllium, Total	mg/L	2.0E-05	2.2E-05	-7.4%	2.0E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.2%	2.0E-05
Boron, Total	mg/L	0.020	0.020	0.5%	0.020
Boron, Dissolved	mg/L	0.020	0.020	-0.4%	0.020
Cadmium, Total	mg/L	2.0E-05	2.0E-05	-0.5%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	0.02%	2.0E-05
Calcium, Total	mg/L	12.5	13.7	-9.4%	12.5
Calcium, Dissolved	mg/L	13.0	13.9	6.7%	13.9
Chloride	mg/L	1.13	1.03	-9.3%	1.03
Chromium, Total	mg/L	0.00020	0.00028	-32.0%	0.00028
Chromium, Dissolved	mg/L	0.00020	0.00022	7.9%	0.00022
Cobalt, Total	mg/L	9.0E-05	8.8E-05	2.0%	9.0E-05
Cobalt, Dissolved	mg/L	9.0E-05	8.2E-05	-9.3%	8.2E-05
Copper, Total	mg/L	0.00010	0.00032	-105%	0.00032
Copper, Dissolved	mg/L	0.00020	0.00042	71.3%	0.00020
Fluoride	mg/L	0.20	0.20	2.1%	0.20
Iron, Total	mg/L	0.067	0.21	-105%	0.21
Iron, Dissolved	mg/L	0.022	0.044	67.0%	0.022
Lead, Total	mg/L	3.0E-05	4.2E-05	-34.1%	4.2E-05
Lead, Dissolved	mg/L	2.0E-05	2.2E-05	10.7%	2.2E-05
Magnesium, Total	mg/L	2.85	3.32	-15.3%	2.85
Magnesium, Dissolved	mg/L	2.94	3.36	13.5%	3.36
Manganese, Total	mg/L	0.017	0.023	-26.9%	0.023
Manganese, Dissolved	mg/L	0.016	0.014	-13.7%	0.014
Mercury, Total	mg/L	2.5E-06	4.5E-06	-57.1%	4.5E-06
Mercury, Dissolved	mg/L	1.5E-06	1.6E-06	6.9%	1.6E-06
Molybdenum, Total	mg/L	0.00097	0.0010	-4.3%	0.00097
Molybdenum, Dissolved	mg/L	0.0010	0.0010	-0.7%	0.0010
Nickel, Total	mg/L	0.00020	0.00027	-28.6%	0.00027
Nickel, Dissolved	mg/L	0.00020	0.00029	37.0%	0.00020
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.081	47.8%	0.050
Phosphorus, Total	mg/L	0.040	0.043	-8.4%	0.040
Phosphorus, Dissolved	mg/L	0.040	0.040	-0.3%	0.040
Potassium, Total	mg/L	0.82	1.03	-23.5%	1.03
Potassium, Dissolved	mg/L	0.85	1.00	15.3%	1.00
Selenium, Total	mg/L	0.0010	0.0010	0.0%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.05%	0.0010
Silver, Total	mg/L	2.0E-05	2.0E-05	-1.8%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.2E-05	10.4%	2.2E-05
Sodium, Total	mg/L	2.38	2.63	-10.0%	2.38
Sodium, Dissolved	mg/L	2.46	2.67	8.1%	2.67
Solids, Total Dissolved (TDS)	mg/L	51.0	61.0	17.9%	61.0
Solids, Total Suspended (TSS)	mg/L	5.00	4.94	-1.1%	4.94
Sulfate	mg/L	5.06	5.20	2.7%	5.20
Thallium, Total	mg/L	2.0E-05	2.0E-05	-0.6%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Vanadium, Total	mg/L	0.00020	0.00031	-43.7%	0.00031
Vanadium, Dissolved	mg/L	0.00020	0.00024	17.2%	0.00024
Zinc, Total	mg/L	0.00050	0.00100	-66.2%	0.00100
Zinc, Dissolved	mg/L	0.00050	0.0012	81.8%	0.00050

* Parameter only adjusted if RPD>20%

Non-shaded cells indicate no adjustment was required to calibrate

Shaded cells indicate predicted concentration has been manually adjusted

Table B3: Predicted vs. Measured Chemistry at YP-SR-8 under Minimum Flow Conditions

Parameter	Units	YP-SR-8			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	8.49	7.33	-14.7%	7.33
Alkalinity as $CaCO_3$, Total	mg/L	46.0	54.4	16.6%	54.4
Aluminum, Total	mg/L	0.030	0.039	-25.7%	0.039
Aluminum, Dissolved	mg/L	0.0062	0.0050	-22.0%	0.0062
Antimony, Total	mg/L	0.028	0.0062	127%	0.0062
Antimony, Dissolved	mg/L	0.028	0.0061	-129%	0.028
Arsenic, Total	mg/L	0.037	0.035	4.9%	0.037
Arsenic, Dissolved	mg/L	0.035	0.021	-51.3%	0.035
Barium, Total	mg/L	0.011	0.017	-43.3%	0.017
Barium, Dissolved	mg/L	0.011	0.016	40.7%	0.011
Beryllium, Total	mg/L	2.0E-05	2.2E-05	-8.5%	2.0E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.2%	2.0E-05
Boron, Total	mg/L	0.020	0.020	0.4%	0.020
Boron, Dissolved	mg/L	0.020	0.020	-0.3%	0.020
Cadmium, Total	mg/L	2.0E-05	2.0E-05	-0.5%	2.0E-05
Cadmium, Dissolved	mg/L	0.00027	2.0E-05	-172%	0.00027
Calcium, Total	mg/L	13.4	13.8	-2.6%	13.4
Calcium, Dissolved	mg/L	13.8	13.9	0.9%	13.9
Chloride	mg/L	1.10	1.03	-6.9%	1.03
Chromium, Total	mg/L	0.00020	0.00028	-31.9%	0.00028
Chromium, Dissolved	mg/L	0.00050	0.00022	-79.2%	0.00050
Cobalt, Total	mg/L	0.00015	8.8E-05	51.9%	8.8E-05
Cobalt, Dissolved	mg/L	0.00014	8.2E-05	-52.5%	0.00014
Copper, Total	mg/L	0.00020	0.00032	-46.3%	0.00032
Copper, Dissolved	mg/L	0.00020	0.00042	71.3%	0.00020
Fluoride	mg/L	0.20	0.20	2.2%	0.20
Iron, Total	mg/L	0.11	0.22	-67.1%	0.22
Iron, Dissolved	mg/L	0.049	0.044	-11.2%	0.044
Lead, Total	mg/L	2.0E-05	4.2E-05	-71.9%	4.2E-05
Lead, Dissolved	mg/L	2.0E-05	2.2E-05	10.6%	2.2E-05
Magnesium, Total	mg/L	3.06	3.33	-8.3%	3.06
Magnesium, Dissolved	mg/L	3.14	3.37	7.0%	3.37
Manganese, Total	mg/L	0.016	0.023	-33.4%	0.023
Manganese, Dissolved	mg/L	0.015	0.014	-2.4%	0.014
Mercury, Total	mg/L	3.7E-06	4.5E-06	-20.6%	4.5E-06
Mercury, Dissolved	mg/L	2.2E-06	1.6E-06	-31.1%	2.2E-06
Molybdenum, Total	mg/L	0.00094	0.0010	-7.7%	0.00094
Molybdenum, Dissolved	mg/L	0.00094	0.0010	7.7%	0.0010
Nickel, Total	mg/L	0.00020	0.00027	-28.6%	0.00027
Nickel, Dissolved	mg/L	0.00020	0.00029	36.9%	0.00020
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.081	47.7%	0.050
Phosphorus, Total	mg/L	0.040	0.044	-8.5%	0.040
Phosphorus, Dissolved	mg/L	0.040	0.040	-0.3%	0.040
Potassium, Total	mg/L	1.00	1.03	-3.3%	1.00
Potassium, Dissolved	mg/L	1.00	1.00	-0.4%	1.00
Selenium, Total	mg/L	0.0010	0.0010	0.0%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.0010	0.05%	0.0010
Silver, Total	mg/L	2.0E-05	2.0E-05	-1.8%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.2E-05	10.4%	2.2E-05
Sodium, Total	mg/L	2.91	2.63	10.1%	2.91
Sodium, Dissolved	mg/L	2.84	2.67	-6.3%	2.67
Solids, Total Dissolved (TDS)	mg/L	64.0	61.1	-4.6%	61.1
Solids, Total Suspended (TSS)	mg/L	5.00	4.99	-0.3%	4.99
Sulfate	mg/L	9.24	5.21	-55.8%	9.24
Thallium, Total	mg/L	2.0E-05	2.0E-05	-0.6%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Vanadium, Total	mg/L	0.00020	0.00031	-43.7%	0.00031
Vanadium, Dissolved	mg/L	0.00020	0.00024	17.2%	0.00024
Zinc, Total	mg/L	0.00050	0.00100	-66.3%	0.00100
Zinc, Dissolved	mg/L	0.00050	0.0012	81.7%	0.00050

* Parameter only adjusted if RPD>20%

Non-shaded cells indicate no adjustment was required to calibrate

Shaded cells indicate predicted concentration has been manually adjusted

Table B4: Predicted vs. Measured Chemistry at YP-SR-6 under Minimum Flow Conditions

Parameter	Units	YP-SR-6			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.53	7.28	-3.4%	7.28
Alkalinity as $CaCO_3$, Total	mg/L	47.0	70.7	40.3%	47.0
Aluminum, Total	mg/L	0.011	0.10	-161%	0.10
Aluminum, Dissolved	mg/L	0.0026	0.0063	83.0%	0.0026
Antimony, Total	mg/L	0.018	0.025	-29.6%	0.025
Antimony, Dissolved	mg/L	0.018	0.025	32.8%	0.018
Arsenic, Total	mg/L	0.030	0.052	-52.2%	0.052
Arsenic, Dissolved	mg/L	0.029	0.041	34.4%	0.029
Barium, Total	mg/L	0.012	0.025	-70.5%	0.025
Barium, Dissolved	mg/L	0.012	0.023	64.0%	0.012
Beryllium, Total	mg/L	2.0E-05	2.6E-05	-26.9%	2.6E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Boron, Total	mg/L	0.020	0.020	0.4%	0.020
Boron, Dissolved	mg/L	0.020	0.020	-0.6%	0.020
Cadmium, Total	mg/L	2.0E-05	2.2E-05	-8.8%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.2E-05	10.5%	2.2E-05
Calcium, Total	mg/L	14.3	18.2	-23.9%	18.2
Calcium, Dissolved	mg/L	14.4	17.7	20.6%	14.4
Chloride	mg/L	0.91	1.10	19.2%	1.10
Chromium, Total	mg/L	0.00020	0.00042	-71.9%	0.00042
Chromium, Dissolved	mg/L	0.00020	0.00025	21.4%	0.00020
Cobalt, Total	mg/L	0.00010	0.00020	-66.3%	0.00020
Cobalt, Dissolved	mg/L	0.00011	0.00020	57.7%	0.00011
Copper, Total	mg/L	0.00020	0.00099	-133%	0.00099
Copper, Dissolved	mg/L	0.00050	0.00057	12.4%	0.00057
Fluoride	mg/L	0.20	0.21	5.5%	0.21
Iron, Total	mg/L	0.076	0.29	-116%	0.29
Iron, Dissolved	mg/L	0.020	0.037	60.8%	0.020
Lead, Total	mg/L	4.0E-05	0.00012	-101%	0.00012
Lead, Dissolved	mg/L	2.0E-05	2.7E-05	29.4%	2.0E-05
Magnesium, Total	mg/L	3.35	4.89	-37.4%	4.89
Magnesium, Dissolved	mg/L	3.37	4.74	33.7%	3.37
Manganese, Total	mg/L	0.013	0.050	-120%	0.050
Manganese, Dissolved	mg/L	0.0076	0.041	137.4%	0.0076
Mercury, Total	mg/L	2.3E-06	8.7E-06	-116%	8.7E-06
Mercury, Dissolved	mg/L	1.4E-06	1.7E-06	18.6%	1.7E-06
Molybdenum, Total	mg/L	0.00092	0.0022	-80.7%	0.0022
Molybdenum, Dissolved	mg/L	0.00092	0.0021	77.4%	0.00092
Nickel, Total	mg/L	0.00020	0.0026	-172%	0.0026
Nickel, Dissolved	mg/L	0.00020	0.0025	170%	0.00020
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.12	82.4%	0.050
Phosphorus, Total	mg/L	0.040	0.045	-11.0%	0.040
Phosphorus, Dissolved	mg/L	0.040	0.041	2.0%	0.041
Potassium, Total	mg/L	0.97	1.36	-32.9%	1.36
Potassium, Dissolved	mg/L	0.96	1.26	26.9%	0.96
Selenium, Total	mg/L	0.0010	0.00100	0.0%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.02%	0.00100
Silver, Total	mg/L	2.0E-05	2.4E-05	-18.2%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.1E-05	6.7%	2.1E-05
Sodium, Total	mg/L	2.95	7.44	-86.5%	7.44
Sodium, Dissolved	mg/L	2.98	7.05	81.2%	2.98
Solids, Total Dissolved (TDS)	mg/L	52.0	93.8	57.4%	52.0
Solids, Total Suspended (TSS)	mg/L	5.00	3.33	-40.2%	5.00
Sulfate	mg/L	8.72	14.0	46.4%	8.72
Thallium, Total	mg/L	2.0E-05	2.1E-05	-5.2%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	0.0%	2.0E-05
Vanadium, Total	mg/L	0.00020	0.00043	-72.6%	0.00043
Vanadium, Dissolved	mg/L	0.00020	0.00025	21.7%	0.00020
Zinc, Total	mg/L	0.00080	0.0039	-131%	0.0039
Zinc, Dissolved	mg/L	0.0011	0.0032	97.9%	0.0011

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

Table B5: Predicted vs. Measured Chemistry at YP-SR-4 under Minimum Flow Conditions

Parameter	Units	YP-SR-4			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.35	7.23	-1.6%	7.23
Alkalinity as $CaCO_3$, Total	mg/L	50.0	71.0	34.7%	50.0
Aluminum, Total	mg/L	0.0062	0.092	-174.9%	0.092
Aluminum, Dissolved	mg/L	0.0025	0.0091	114%	0.0025
Antimony, Total	mg/L	0.039	0.030	26.3%	0.030
Antimony, Dissolved	mg/L	0.038	0.028	-32.8%	0.038
Arsenic, Total	mg/L	0.089	0.074	18.7%	0.089
Arsenic, Dissolved	mg/L	0.079	0.062	-24.2%	0.079
Barium, Total	mg/L	0.013	0.025	-60.4%	0.025
Barium, Dissolved	mg/L	0.013	0.023	54.5%	0.013
Beryllium, Total	mg/L	2.0E-05	2.5E-05	-23.7%	2.5E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.1%	2.0E-05
Boron, Total	mg/L	0.020	0.025	-22.8%	0.025
Boron, Dissolved	mg/L	0.020	0.025	22.7%	0.020
Cadmium, Total	mg/L	2.0E-05	2.4E-05	-17.5%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.4E-05	18.8%	2.4E-05
Calcium, Total	mg/L	16.0	18.7	-15.4%	16.0
Calcium, Dissolved	mg/L	16.1	18.1	11.5%	18.1
Chloride	mg/L	0.89	1.01	13.0%	1.01
Chromium, Total	mg/L	0.00020	0.00039	-65.0%	0.00039
Chromium, Dissolved	mg/L	0.00020	0.00024	18.3%	0.00024
Cobalt, Total	mg/L	0.00011	0.00032	-97.1%	0.00032
Cobalt, Dissolved	mg/L	0.00012	0.00032	90.3%	0.00012
Copper, Total	mg/L	0.00010	0.00099	-163%	0.00099
Copper, Dissolved	mg/L	0.00040	0.00064	45.9%	0.00040
Fluoride	mg/L	0.20	0.21	6.0%	0.21
Iron, Total	mg/L	0.15	0.26	-54.8%	0.26
Iron, Dissolved	mg/L	0.061	0.039	-44.1%	0.061
Lead, Total	mg/L	2.0E-05	0.00016	-155%	0.00016
Lead, Dissolved	mg/L	2.0E-05	7.4E-05	115%	2.0E-05
Magnesium, Total	mg/L	3.78	5.10	-29.7%	5.10
Magnesium, Dissolved	mg/L	3.80	4.91	25.5%	3.80
Manganese, Total	mg/L	0.025	0.047	-60.9%	0.047
Manganese, Dissolved	mg/L	0.024	0.038	45.7%	0.024
Mercury, Total	mg/L	2.1E-06	9.4E-06	-127%	9.4E-06
Mercury, Dissolved	mg/L	1.3E-06	3.3E-06	86.2%	1.3E-06
Molybdenum, Total	mg/L	0.00095	0.0022	-79.5%	0.0022
Molybdenum, Dissolved	mg/L	0.00092	0.0021	79.2%	0.00092
Nickel, Total	mg/L	0.00020	0.0023	-168%	0.0023
Nickel, Dissolved	mg/L	0.00030	0.0021	151%	0.00030
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.12	85.6%	0.050
Phosphorus, Total	mg/L	0.040	0.050	-22.0%	0.050
Phosphorus, Dissolved	mg/L	0.040	0.047	15.2%	0.047
Potassium, Total	mg/L	0.99	1.41	-35.0%	1.41
Potassium, Dissolved	mg/L	0.98	1.33	30.1%	0.98
Selenium, Total	mg/L	0.0010	0.00099	0.6%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00099	-0.6%	0.00099
Silver, Total	mg/L	2.0E-05	2.3E-05	-15.4%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.1E-05	5.2%	2.1E-05
Sodium, Total	mg/L	2.81	6.76	-82.6%	6.76
Sodium, Dissolved	mg/L	2.90	6.46	76.0%	2.90
Solids, Total Dissolved (TDS)	mg/L	58.0	94.2	47.6%	58.0
Solids, Total Suspended (TSS)	mg/L	5.00	3.53	-34.5%	5.00
Sulfate	mg/L	11.4	14.1	21.3%	11.4
Thallium, Total	mg/L	2.0E-05	2.1E-05	-4.1%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.6%	2.0E-05
Vanadium, Total	mg/L	0.00020	0.00040	-66.2%	0.00040
Vanadium, Dissolved	mg/L	0.00020	0.00024	18.9%	0.00024
Zinc, Total	mg/L	0.00050	0.0038	-154%	0.0038
Zinc, Dissolved	mg/L	0.00080	0.0033	121.4%	0.00080

* Parameter only adjusted if RPD>20%

Non-shaded cells indicate no adjustment was required to calibrate

Shaded cells indicate predicted concentration has been manually adjusted

Table B6: Predicted vs. Measured Chemistry at YP-SR-2 under Minimum Flow Conditions

Parameter	Units	YP-SR-2			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.65	7.68	0.4%	7.68
Alkalinity as $CaCO_3$, Total	mg/L	56.5	71.8	23.8%	56.5
Aluminum, Total	mg/L	0.013	0.062	-131%	0.062
Aluminum, Dissolved	mg/L	0.0037	0.012	105%	0.0037
Antimony, Total	mg/L	0.030	0.021	35.8%	0.021
Antimony, Dissolved	mg/L	0.032	0.020	-48.6%	0.032
Arsenic, Total	mg/L	0.063	0.079	-22.8%	0.079
Arsenic, Dissolved	mg/L	0.059	0.071	18.4%	0.071
Barium, Total	mg/L	0.015	0.021	-34.5%	0.021
Barium, Dissolved	mg/L	0.015	0.020	24.2%	0.015
Beryllium, Total	mg/L	2.0E-05	2.3E-05	-14.5%	2.0E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.3%	2.0E-05
Boron, Total	mg/L	0.050	0.035	35.0%	0.035
Boron, Dissolved	mg/L	0.050	0.035	-35.0%	0.050
Cadmium, Total	mg/L	2.0E-05	3.3E-05	-48.0%	3.3E-05
Cadmium, Dissolved	mg/L	2.0E-05	3.3E-05	48.6%	2.0E-05
Calcium, Total	mg/L	19.3	20.0	-3.6%	19.3
Calcium, Dissolved	mg/L	20.3	19.8	-2.3%	19.8
Chloride	mg/L	0.60	0.74	20.5%	0.60
Chromium, Total	mg/L	0.00020	0.00031	-43.2%	0.00031
Chromium, Dissolved	mg/L	0.00020	0.00022	10.4%	0.00022
Cobalt, Total	mg/L	0.00015	0.00023	-42.6%	0.00023
Cobalt, Dissolved	mg/L	0.00017	0.00023	30.5%	0.00017
Copper, Total	mg/L	0.00020	0.00097	-131%	0.00097
Copper, Dissolved	mg/L	0.00030	0.0010	111%	0.00030
Fluoride	mg/L	0.40	0.21	-60.7%	0.40
Iron, Total	mg/L	0.11	0.16	-35.8%	0.16
Iron, Dissolved	mg/L	0.057	0.034	-51.8%	0.057
Lead, Total	mg/L	2.0E-05	0.00022	-166.6%	0.00022
Lead, Dissolved	mg/L	2.0E-05	0.00017	158%	2.0E-05
Magnesium, Total	mg/L	4.66	5.18	-10.5%	4.66
Magnesium, Dissolved	mg/L	4.94	5.10	3.1%	5.10
Manganese, Total	mg/L	0.020	0.029	-33.7%	0.029
Manganese, Dissolved	mg/L	0.020	0.025	22.9%	0.020
Mercury, Total	mg/L	5.5E-06	1.0E-05	-62.3%	1.0E-05
Mercury, Dissolved	mg/L	2.5E-06	4.0E-06	46.4%	2.5E-06
Molybdenum, Total	mg/L	0.0011	0.0019	-54.7%	0.0019
Molybdenum, Dissolved	mg/L	0.0011	0.0018	48.6%	0.0011
Nickel, Total	mg/L	0.00030	0.0015	-132%	0.0015
Nickel, Dissolved	mg/L	0.00030	0.0015	131.6%	0.00030
Nitrate + Nitrite as Nitrogen	mg/L	0.078	0.11	32.5%	0.078
Phosphorus, Total	mg/L	0.020	0.057	-96.2%	0.057
Phosphorus, Dissolved	mg/L	0.020	0.055	93.6%	0.020
Potassium, Total	mg/L	1.04	1.33	-24.8%	1.33
Potassium, Dissolved	mg/L	1.07	1.30	19.3%	1.30
Selenium, Total	mg/L	0.0010	0.00099	1.1%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00099	-1.1%	0.00099
Silver, Total	mg/L	2.0E-05	2.2E-05	-8.6%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	2.4%	2.0E-05
Sodium, Total	mg/L	2.88	5.16	-56.8%	5.16
Sodium, Dissolved	mg/L	3.05	4.95	47.5%	3.05
Solids, Total Dissolved (TDS)	mg/L	65.0	90.8	33.1%	65.0
Solids, Total Suspended (TSS)	mg/L	5.00	4.11	-19.6%	4.11
Sulfate	mg/L	17.3	14.1	-20.6%	17.3
Thallium, Total	mg/L	2.0E-05	2.0E-05	-1.7%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	-1.1%	2.0E-05
Vanadium, Total	mg/L	0.00020	0.00031	-44.2%	0.00031
Vanadium, Dissolved	mg/L	0.00020	0.00022	10.8%	0.00022
Zinc, Total	mg/L	0.0017	0.0035	-70.1%	0.0035
Zinc, Dissolved	mg/L	0.00080	0.0061	153%	0.00080

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

APPENDIX C:
PREDICTED CHEMISTRY UNDER MAXIMUM FLOW CONDITIONS

Table C1: Predicted vs. Measured Chemistry at YP-T-22 under Maximum Flow Conditions

Parameter	Units	YP-T-22			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	8.21	7.02	-15.6%	7.02
Alkalinity as $CaCO_3$, Total	mg/L	22.1	21.3	-3.6%	21.3
Aluminum, Total	mg/L	0.44	0.74	-51.3%	0.74
Aluminum, Dissolved	mg/L	0.022	0.026	18.5%	0.026
Antimony, Total	mg/L	0.0083	0.011	-28.4%	0.011
Antimony, Dissolved	mg/L	0.0084	0.011	24.3%	0.0084
Arsenic, Total	mg/L	0.021	0.023	-11.4%	0.021
Arsenic, Dissolved	mg/L	0.019	0.019	-1.0%	0.019
Barium, Total	mg/L	0.010	0.017	-49.1%	0.017
Barium, Dissolved	mg/L	0.0050	0.0045	-11.1%	0.0045
Beryllium, Total	mg/L	3.0E-05	6.6E-05	-75.4%	6.6E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.9%	2.0E-05
Boron, Total	mg/L	0.050	0.020	85.8%	0.020
Boron, Dissolved	mg/L	0.050	0.020	-85.8%	0.050
Cadmium, Total	mg/L	2.0E-05	2.2E-05	-9.7%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.9%	2.0E-05
Calcium, Total	mg/L	6.19	6.24	-0.9%	6.19
Calcium, Dissolved	mg/L	5.86	5.83	-0.4%	5.83
Chloride	mg/L	0.40	0.43	6.4%	0.43
Chromium, Total	mg/L	0.00040	0.00068	-52.5%	0.00068
Chromium, Dissolved	mg/L	0.00050	0.00050	0.7%	0.00050
Cobalt, Total	mg/L	0.00022	0.00036	-47.5%	0.00036
Cobalt, Dissolved	mg/L	6.0E-05	5.2E-05	-14.6%	5.2E-05
Copper, Total	mg/L	0.00050	0.00061	-20.2%	0.00061
Copper, Dissolved	mg/L	0.00020	0.00029	36.7%	0.00020
Fluoride	mg/L	0.40	0.40	-1.0%	0.40
Iron, Total	mg/L	0.61	1.44	-81.6%	1.44
Iron, Dissolved	mg/L	0.022	0.046	69.4%	0.022
Lead, Total	mg/L	0.00021	0.00036	-53.1%	0.00036
Lead, Dissolved	mg/L	2.0E-05	2.0E-05	-0.9%	2.0E-05
Magnesium, Total	mg/L	1.21	1.42	-15.9%	1.21
Magnesium, Dissolved	mg/L	1.05	1.05	0.0%	1.05
Manganese, Total	mg/L	0.030	0.067	-76.3%	0.067
Manganese, Dissolved	mg/L	0.0061	0.0065	5.7%	0.0065
Mercury, Total	mg/L	9.2E-06	1.1E-05	-21.0%	1.1E-05
Mercury, Dissolved	mg/L	2.4E-06	2.6E-06	7.5%	2.6E-06
Molybdenum, Total	mg/L	0.00059	0.00049	18.3%	0.00059
Molybdenum, Dissolved	mg/L	0.00056	0.00051	-8.5%	0.00051
Nickel, Total	mg/L	0.00040	0.00048	-18.9%	0.00040
Nickel, Dissolved	mg/L	0.00030	0.00040	29.3%	0.00030
Nitrate + Nitrite as Nitrogen	mg/L	0.060	0.062	3.1%	0.062
Phosphorus, Total	mg/L	0.040	0.10	-85.9%	0.10
Phosphorus, Dissolved	mg/L	0.040	0.040	-0.9%	0.040
Potassium, Total	mg/L	0.77	0.96	-23.1%	0.96
Potassium, Dissolved	mg/L	0.58	0.66	12.8%	0.66
Selenium, Total	mg/L	0.0010	0.00099	0.7%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.5%	0.00100
Silver, Total	mg/L	2.0E-05	2.0E-05	0.2%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	-0.9%	2.0E-05
Sodium, Total	mg/L	1.65	1.63	1.5%	1.65
Sodium, Dissolved	mg/L	1.57	1.57	-0.02%	1.57
Solids, Total Dissolved (TDS)	mg/L	39.5	33.8	-15.6%	33.8
Solids, Total Suspended (TSS)	mg/L	16.5	33.4	67.6%	16.5
Sulfate	mg/L	2.71	2.65	-2.3%	2.65
Thallium, Total	mg/L	2.0E-05	2.8E-05	-33.8%	2.8E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.7%	2.0E-05
Vanadium, Total	mg/L	0.0010	0.0017	-50.7%	0.0017
Vanadium, Dissolved	mg/L	0.00020	0.00022	10.1%	0.00022
Zinc, Total	mg/L	0.0015	0.0029	-62.3%	0.0029
Zinc, Dissolved	mg/L	0.00050	0.00068	30.2%	0.00050

*	Parameter only adjusted if RPD>20%
(non-shaded box)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded box)	Shaded cells indicate predicted concentration has been manually adjusted

Table C2: Predicted vs. Measured Chemistry at YP-SR-10 under Maximum Flow Conditions

Parameter	Units	YP-SR-10			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.48	7.27	-2.9%	7.27
Alkalinity as $CaCO_3$, Total	mg/L	22.5	22.4	-0.3%	22.4
Aluminum, Total	mg/L	0.22	0.45	-70.3%	0.45
Aluminum, Dissolved	mg/L	0.016	0.020	22.6%	0.016
Antimony, Total	mg/L	0.0099	0.0062	46.7%	0.0062
Antimony, Dissolved	mg/L	0.010	0.0060	-50.3%	0.010
Arsenic, Total	mg/L	0.015	0.015	3.7%	0.015
Arsenic, Dissolved	mg/L	0.015	0.012	-18.4%	0.012
Barium, Total	mg/L	0.0082	0.013	-46.5%	0.013
Barium, Dissolved	mg/L	0.0059	0.0057	-3.7%	0.0057
Beryllium, Total	mg/L	2.0E-05	4.4E-05	-75.0%	4.4E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.5%	2.0E-05
Boron, Total	mg/L	0.050	0.034	37.5%	0.034
Boron, Dissolved	mg/L	0.050	0.034	-37.5%	0.050
Cadmium, Total	mg/L	2.0E-05	2.1E-05	-5.1%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.5%	2.0E-05
Calcium, Total	mg/L	5.99	5.92	1.2%	5.99
Calcium, Dissolved	mg/L	5.65	5.65	0.002%	5.65
Chloride	mg/L	0.40	0.41	3.5%	0.41
Chromium, Total	mg/L	0.00020	0.00055	-93.2%	0.00055
Chromium, Dissolved	mg/L	0.00080	0.00036	-76.5%	0.00080
Cobalt, Total	mg/L	0.00011	0.00021	-64.0%	0.00021
Cobalt, Dissolved	mg/L	6.0E-05	3.7E-05	-47.3%	6.0E-05
Copper, Total	mg/L	0.00030	0.00042	-33.6%	0.00042
Copper, Dissolved	mg/L	0.00030	0.00025	-17.7%	0.00025
Fluoride	mg/L	0.40	0.40	-0.9%	0.40
Iron, Total	mg/L	0.26	0.82	-104%	0.82
Iron, Dissolved	mg/L	0.026	0.033	26.0%	0.026
Lead, Total	mg/L	0.00012	0.00023	-61.1%	0.00023
Lead, Dissolved	mg/L	2.0E-05	2.0E-05	0.0%	2.0E-05
Magnesium, Total	mg/L	1.24	1.37	-10.2%	1.24
Magnesium, Dissolved	mg/L	1.15	1.16	1.2%	1.16
Manganese, Total	mg/L	0.015	0.039	-90.8%	0.039
Manganese, Dissolved	mg/L	0.0050	0.0057	13.4%	0.0057
Mercury, Total	mg/L	1.2E-05	1.2E-05	-0.5%	1.2E-05
Mercury, Dissolved	mg/L	3.2E-06	3.1E-06	-4.7%	3.1E-06
Molybdenum, Total	mg/L	0.00062	0.00056	10.9%	0.00062
Molybdenum, Dissolved	mg/L	0.00062	0.00057	-8.8%	0.00057
Nickel, Total	mg/L	0.00020	0.00035	-54.4%	0.00035
Nickel, Dissolved	mg/L	0.00050	0.00031	-48.2%	0.00050
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.058	14.4%	0.058
Phosphorus, Total	mg/L	0.040	0.071	-56.0%	0.071
Phosphorus, Dissolved	mg/L	0.040	0.040	-0.5%	0.040
Potassium, Total	mg/L	0.60	0.77	-25.4%	0.77
Potassium, Dissolved	mg/L	0.56	0.60	7.0%	0.60
Selenium, Total	mg/L	0.0010	0.00100	0.3%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.2%	0.00100
Silver, Total	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Sodium, Total	mg/L	1.52	1.52	0.01%	1.52
Sodium, Dissolved	mg/L	1.51	1.50	-1.0%	1.50
Solids, Total Dissolved (TDS)	mg/L	33.5	32.8	-2.0%	32.8
Solids, Total Suspended (TSS)	mg/L	7.00	19.6	94.7%	7.00
Sulfate	mg/L	2.05	1.90	-7.5%	1.90
Thallium, Total	mg/L	2.0E-05	2.4E-05	-19.0%	2.0E-05
Thallium, Dissolved	mg/L	2.05	1.90	-7.5%	1.90
Vanadium, Total	mg/L	0.00050	0.0011	-75.8%	0.0011
Vanadium, Dissolved	mg/L	0.00020	0.00021	6.2%	0.00021
Zinc, Total	mg/L	0.00080	0.0019	-80.1%	0.0019
Zinc, Dissolved	mg/L	0.00080	0.00074	-7.7%	0.00074

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

Table C3: Predicted vs. Measured Chemistry at YP-SR-8 under Maximum Flow Conditions

Parameter	Units	YP-SR-8			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.78	7.28	-6.7%	7.28
Alkalinity as $CaCO_3$, Total	mg/L	20.4	22.6	10.2%	22.6
Aluminum, Total	mg/L	0.16	0.45	-93.3%	0.45
Aluminum, Dissolved	mg/L	0.016	0.019	22.9%	0.016
Antimony, Total	mg/L	0.012	0.0066	58.9%	0.0066
Antimony, Dissolved	mg/L	0.012	0.0064	-60.5%	0.012
Arsenic, Total	mg/L	0.019	0.016	14.3%	0.019
Arsenic, Dissolved	mg/L	0.017	0.014	-19.6%	0.014
Barium, Total	mg/L	0.0079	0.013	-49.5%	0.013
Barium, Dissolved	mg/L	0.0059	0.0057	-3.1%	0.0057
Beryllium, Total	mg/L	2.0E-05	4.4E-05	-74.7%	4.4E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Boron, Total	mg/L	0.050	0.034	37.2%	0.034
Boron, Dissolved	mg/L	0.050	0.034	-37.2%	0.050
Cadmium, Total	mg/L	2.0E-05	2.1E-05	-5.1%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.5%	2.0E-05
Calcium, Total	mg/L	5.95	5.99	-0.6%	5.95
Calcium, Dissolved	mg/L	6.02	5.72	-5.0%	5.72
Chloride	mg/L	0.40	0.41	3.5%	0.41
Chromium, Total	mg/L	0.00030	0.00054	-57.7%	0.00054
Chromium, Dissolved	mg/L	0.00020	0.00035	55.7%	0.00020
Cobalt, Total	mg/L	0.00011	0.00021	-62.9%	0.00021
Cobalt, Dissolved	mg/L	5.0E-05	3.7E-05	-30.2%	5.0E-05
Copper, Total	mg/L	0.00030	0.00042	-34.2%	0.00042
Copper, Dissolved	mg/L	0.00030	0.00025	-17.1%	0.00025
Fluoride	mg/L	0.40	0.40	-1.0%	0.40
Iron, Total	mg/L	0.23	0.81	-113.1%	0.81
Iron, Dissolved	mg/L	0.020	0.033	49.0%	0.020
Lead, Total	mg/L	0.00011	0.00022	-67.9%	0.00022
Lead, Dissolved	mg/L	2.0E-05	2.0E-05	0.0%	2.0E-05
Magnesium, Total	mg/L	1.24	1.39	-11.7%	1.24
Magnesium, Dissolved	mg/L	1.18	1.19	0.7%	1.19
Manganese, Total	mg/L	0.014	0.038	-94.8%	0.038
Manganese, Dissolved	mg/L	0.0050	0.0057	12.8%	0.0057
Mercury, Total	mg/L	3.8E-06	1.2E-05	-105%	1.2E-05
Mercury, Dissolved	mg/L	3.3E-06	3.1E-06	-7.3%	3.1E-06
Molybdenum, Total	mg/L	0.00065	0.00056	14.6%	0.00065
Molybdenum, Dissolved	mg/L	0.00055	0.00057	4.0%	0.00057
Nickel, Total	mg/L	0.00030	0.00035	-14.9%	0.00030
Nickel, Dissolved	mg/L	0.00020	0.00030	41.2%	0.00020
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.058	14.5%	0.058
Phosphorus, Total	mg/L	0.024	0.071	-97.2%	0.071
Phosphorus, Dissolved	mg/L	0.020	0.040	66.0%	0.020
Potassium, Total	mg/L	0.68	0.77	-13.5%	0.68
Potassium, Dissolved	mg/L	0.61	0.61	0.8%	0.61
Selenium, Total	mg/L	0.0010	0.00100	0.3%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.2%	0.00100
Silver, Total	mg/L	2.4E-05	2.0E-05	17.7%	2.4E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Sodium, Total	mg/L	1.53	1.52	0.5%	1.53
Sodium, Dissolved	mg/L	1.57	1.50	-4.7%	1.50
Solids, Total Dissolved (TDS)	mg/L	25.5	33.0	25.7%	25.5
Solids, Total Suspended (TSS)	mg/L	5.00	19.3	118%	5.00
Sulfate	mg/L	2.44	1.99	-20.5%	2.44
Thallium, Total	mg/L	2.0E-05	2.4E-05	-18.7%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.4%	2.0E-05
Vanadium, Total	mg/L	0.00050	0.0011	-74.6%	0.0011
Vanadium, Dissolved	mg/L	0.00020	0.00021	6.1%	0.00021
Zinc, Total	mg/L	0.00070	0.0019	-90.7%	0.0019
Zinc, Dissolved	mg/L	0.00050	0.00074	38.6%	0.00050

* Parameter only adjusted if RPD>20%

Non-shaded cells indicate no adjustment was required to calibrate

Shaded cells indicate predicted concentration has been manually adjusted

Table C4: Predicted vs. Measured Chemistry at YP-SR-6 under Maximum Flow Conditions

Parameter	Units	YP-SR-6			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.60	7.19	-5.5%	7.19
Alkalinity as CaCO3, Total	mg/L	21.5	23.2	7.7%	23.2
Aluminum, Total	mg/L	0.17	0.45	-89.3%	0.45
Aluminum, Dissolved	mg/L	0.016	0.021	26.4%	0.016
Antimony, Total	mg/L	0.013	0.0069	62.0%	0.0069
Antimony, Dissolved	mg/L	0.012	0.0068	-56.6%	0.012
Arsenic, Total	mg/L	0.020	0.016	18.8%	0.020
Arsenic, Dissolved	mg/L	0.017	0.014	-18.2%	0.014
Barium, Total	mg/L	0.0083	0.014	-51.8%	0.014
Barium, Dissolved	mg/L	0.0060	0.0065	7.3%	0.0065
Beryllium, Total	mg/L	2.0E-05	4.6E-05	-79.0%	4.6E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Boron, Total	mg/L	0.050	0.033	41.6%	0.033
Boron, Dissolved	mg/L	0.050	0.033	-41.6%	0.050
Cadmium, Total	mg/L	2.0E-05	2.1E-05	-4.9%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	0.0%	2.0E-05
Calcium, Total	mg/L	5.91	6.09	-3.0%	5.91
Calcium, Dissolved	mg/L	5.66	5.80	2.4%	5.80
Chloride	mg/L	0.40	0.43	6.2%	0.43
Chromium, Total	mg/L	0.00020	0.00051	-87.8%	0.00051
Chromium, Dissolved	mg/L	0.00020	0.00034	51.6%	0.00020
Cobalt, Total	mg/L	0.00010	0.00021	-70.9%	0.00021
Cobalt, Dissolved	mg/L	4.0E-05	4.3E-05	6.7%	4.3E-05
Copper, Total	mg/L	0.00030	0.00046	-41.5%	0.00046
Copper, Dissolved	mg/L	0.00020	0.00029	38.0%	0.00020
Fluoride	mg/L	0.40	0.39	-1.5%	0.39
Iron, Total	mg/L	0.21	0.80	-117%	0.80
Iron, Dissolved	mg/L	0.020	0.033	47.9%	0.020
Lead, Total	mg/L	0.00011	0.00023	-70.2%	0.00023
Lead, Dissolved	mg/L	2.0E-05	2.1E-05	5.7%	2.1E-05
Magnesium, Total	mg/L	1.18	1.42	-18.4%	1.18
Magnesium, Dissolved	mg/L	1.12	1.22	8.3%	1.22
Manganese, Total	mg/L	0.013	0.040	-104%	0.040
Manganese, Dissolved	mg/L	0.0050	0.0066	26.9%	0.0050
Mercury, Total	mg/L	3.4E-06	1.2E-05	-112%	1.2E-05
Mercury, Dissolved	mg/L	2.1E-06	3.2E-06	40.1%	2.1E-06
Molybdenum, Total	mg/L	0.00057	0.00057	-0.4%	0.00057
Molybdenum, Dissolved	mg/L	0.00049	0.00058	16.8%	0.00058
Nickel, Total	mg/L	0.00020	0.00043	-73.4%	0.00043
Nickel, Dissolved	mg/L	0.00020	0.00040	67.1%	0.00020
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.059	17.1%	0.059
Phosphorus, Total	mg/L	0.022	0.070	-104%	0.070
Phosphorus, Dissolved	mg/L	0.020	0.040	66.1%	0.020
Potassium, Total	mg/L	0.70	0.78	-10.8%	0.70
Potassium, Dissolved	mg/L	0.63	0.63	-0.004%	0.63
Selenium, Total	mg/L	0.0010	0.00100	0.3%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.2%	0.00100
Silver, Total	mg/L	2.0E-05	2.0E-05	-1.3%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Sodium, Total	mg/L	1.56	1.74	-10.8%	1.56
Sodium, Dissolved	mg/L	1.51	1.70	11.9%	1.70
Solids, Total Dissolved (TDS)	mg/L	25.5	34.3	29.4%	25.5
Solids, Total Suspended (TSS)	mg/L	7.50	20.4	92.5%	7.50
Sulfate	mg/L	2.38	2.34	-1.8%	2.34
Thallium, Total	mg/L	2.0E-05	2.4E-05	-17.0%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.3%	2.0E-05
Vanadium, Total	mg/L	0.00050	0.0011	-72.5%	0.0011
Vanadium, Dissolved	mg/L	0.00020	0.00021	6.0%	0.00021
Zinc, Total	mg/L	0.00060	0.0020	-108%	0.0020
Zinc, Dissolved	mg/L	0.00050	0.00086	52.4%	0.00050

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

Table C5: Predicted vs. Measured Chemistry at YP-SR-4 under Maximum Flow Conditions

Parameter	Units	YP-SR-4			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.66	7.16	-6.7%	7.16
Alkalinity as $CaCO_3$, Total	mg/L	22.4	25.0	10.9%	25.0
Aluminum, Total	mg/L	0.13	0.42	-103%	0.42
Aluminum, Dissolved	mg/L	0.018	0.021	13.4%	0.021
Antimony, Total	mg/L	0.016	0.010	42.3%	0.010
Antimony, Dissolved	mg/L	0.016	0.0087	-57.1%	0.016
Arsenic, Total	mg/L	0.026	0.023	10.8%	0.026
Arsenic, Dissolved	mg/L	0.022	0.020	-11.2%	0.020
Barium, Total	mg/L	0.0078	0.014	-57.7%	0.014
Barium, Dissolved	mg/L	0.0062	0.0069	10.9%	0.0069
Beryllium, Total	mg/L	2.0E-05	4.4E-05	-75.1%	4.4E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.2%	2.0E-05
Boron, Total	mg/L	0.050	0.032	43.3%	0.032
Boron, Dissolved	mg/L	0.050	0.032	-43.3%	0.050
Cadmium, Total	mg/L	2.0E-05	2.1E-05	-4.7%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	0.4%	2.0E-05
Calcium, Total	mg/L	6.26	6.75	-7.6%	6.26
Calcium, Dissolved	mg/L	5.90	6.39	8.0%	6.39
Chloride	mg/L	0.40	0.43	6.9%	0.43
Chromium, Total	mg/L	0.00040	0.00049	-20.3%	0.00049
Chromium, Dissolved	mg/L	0.00020	0.00033	47.9%	0.00020
Cobalt, Total	mg/L	0.00010	0.00020	-67.3%	0.00020
Cobalt, Dissolved	mg/L	5.0E-05	4.8E-05	-4.0%	4.8E-05
Copper, Total	mg/L	0.00020	0.00045	-76.0%	0.00045
Copper, Dissolved	mg/L	0.00020	0.00030	39.6%	0.00020
Fluoride	mg/L	0.40	0.38	-5.6%	0.38
Iron, Total	mg/L	0.19	0.74	-117.9%	0.74
Iron, Dissolved	mg/L	0.020	0.033	49.0%	0.020
Lead, Total	mg/L	9.0E-05	0.00022	-82.5%	0.00022
Lead, Dissolved	mg/L	2.0E-05	2.3E-05	12.7%	2.3E-05
Magnesium, Total	mg/L	1.30	1.60	-20.7%	1.60
Magnesium, Dissolved	mg/L	1.26	1.38	9.4%	1.38
Manganese, Total	mg/L	0.014	0.038	-95.2%	0.038
Manganese, Dissolved	mg/L	0.0057	0.0068	18.0%	0.0068
Mercury, Total	mg/L	7.4E-06	1.2E-05	-45.8%	1.2E-05
Mercury, Dissolved	mg/L	3.7E-06	3.2E-06	-13.8%	3.2E-06
Molybdenum, Total	mg/L	0.00052	0.00058	-11.5%	0.00052
Molybdenum, Dissolved	mg/L	0.00052	0.00059	11.9%	0.00059
Nickel, Total	mg/L	0.00030	0.00041	-32.1%	0.00041
Nickel, Dissolved	mg/L	0.00020	0.00038	62.9%	0.00020
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.062	21.9%	0.050
Phosphorus, Total	mg/L	0.020	0.068	-109%	0.068
Phosphorus, Dissolved	mg/L	0.020	0.040	66.1%	0.020
Potassium, Total	mg/L	0.65	0.80	-21.4%	0.80
Potassium, Dissolved	mg/L	0.63	0.66	5.9%	0.66
Selenium, Total	mg/L	0.0010	0.00100	0.3%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.2%	0.00100
Silver, Total	mg/L	2.0E-05	2.0E-05	-1.1%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	0.0003%	2.0E-05
Sodium, Total	mg/L	1.55	1.76	-12.7%	1.55
Sodium, Dissolved	mg/L	1.53	1.74	12.6%	1.74
Solids, Total Dissolved (TDS)	mg/L	35.5	37.7	6.0%	37.7
Solids, Total Suspended (TSS)	mg/L	5.00	19.3	118%	5.00
Sulfate	mg/L	3.08	3.01	-2.1%	3.01
Thallium, Total	mg/L	2.0E-05	2.3E-05	-15.5%	2.0E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.4%	2.0E-05
Vanadium, Total	mg/L	0.00040	0.00100	-85.5%	0.00100
Vanadium, Dissolved	mg/L	0.00020	0.00021	5.6%	0.00021
Zinc, Total	mg/L	0.00070	0.0020	-94.5%	0.0020
Zinc, Dissolved	mg/L	0.00050	0.00090	57.6%	0.00050

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

Table C6: Predicted vs. Measured Chemistry at YP-SR-2 under Maximum Flow Conditions

Parameter	Units	YP-SR-2			
		Measured	Predicted (unadjusted)	RPD (%)	Predicted (adjusted)*
pH	s.u.	7.74	7.27	-6.3%	7.27
Alkalinity as $CaCO_3$, Total	mg/L	23.7	27.8	16.0%	27.8
Aluminum, Total	mg/L	0.16	0.38	-82.2%	0.38
Aluminum, Dissolved	mg/L	0.023	0.015	-39.5%	0.023
Antimony, Total	mg/L	0.011	0.0066	53.4%	0.0066
Antimony, Dissolved	mg/L	0.011	0.0057	-64.0%	0.011
Arsenic, Total	mg/L	0.020	0.018	9.7%	0.020
Arsenic, Dissolved	mg/L	0.018	0.015	-19.4%	0.015
Barium, Total	mg/L	0.0081	0.012	-38.9%	0.012
Barium, Dissolved	mg/L	0.0065	0.0064	-2.1%	0.0064
Beryllium, Total	mg/L	3.0E-05	4.7E-05	-43.8%	4.7E-05
Beryllium, Dissolved	mg/L	2.0E-05	2.0E-05	0.1%	2.0E-05
Boron, Total	mg/L	0.050	0.041	20.0%	0.050
Boron, Dissolved	mg/L	0.050	0.041	-20.0%	0.041
Cadmium, Total	mg/L	2.0E-05	2.1E-05	-3.9%	2.0E-05
Cadmium, Dissolved	mg/L	2.0E-05	2.0E-05	1.7%	2.0E-05
Calcium, Total	mg/L	7.25	7.55	-4.0%	7.25
Calcium, Dissolved	mg/L	7.12	7.28	2.3%	7.28
Chloride	mg/L	0.40	0.42	3.9%	0.42
Chromium, Total	mg/L	0.00020	0.00049	-84.3%	0.00049
Chromium, Dissolved	mg/L	0.00020	0.00026	27.6%	0.00020
Cobalt, Total	mg/L	9.0E-05	0.00021	-78.0%	0.00021
Cobalt, Dissolved	mg/L	4.0E-05	3.5E-05	-13.2%	3.5E-05
Copper, Total	mg/L	0.00030	0.00043	-36.3%	0.00043
Copper, Dissolved	mg/L	0.00020	0.00031	42.7%	0.00020
Fluoride	mg/L	0.40	0.39	-3.4%	0.39
Iron, Total	mg/L	0.19	0.55	-96.7%	0.55
Iron, Dissolved	mg/L	0.022	0.027	19.8%	0.027
Lead, Total	mg/L	0.00012	0.00027	-76.7%	0.00027
Lead, Dissolved	mg/L	2.0E-05	2.5E-05	21.9%	2.0E-05
Magnesium, Total	mg/L	1.42	1.58	-10.6%	1.42
Magnesium, Dissolved	mg/L	1.40	1.43	2.1%	1.43
Manganese, Total	mg/L	0.010	0.025	-82.3%	0.025
Manganese, Dissolved	mg/L	0.0050	0.0059	17.2%	0.0059
Mercury, Total	mg/L	0.00040	0.00051	-26.0%	0.00051
Mercury, Dissolved	mg/L	3.0E-05	7.6E-06	-118%	3.0E-05
Molybdenum, Total	mg/L	0.00047	0.00047	-0.3%	0.00047
Molybdenum, Dissolved	mg/L	0.00048	0.00047	-2.6%	0.00047
Nickel, Total	mg/L	0.00020	0.00045	-77.5%	0.00045
Nickel, Dissolved	mg/L	0.00020	0.00029	37.9%	0.00020
Nitrate + Nitrite as Nitrogen	mg/L	0.050	0.057	13.2%	0.057
Phosphorus, Total	mg/L	0.020	0.045	-76.8%	0.045
Phosphorus, Dissolved	mg/L	0.020	0.031	42.0%	0.020
Potassium, Total	mg/L	0.67	0.77	-13.3%	0.67
Potassium, Dissolved	mg/L	0.63	0.62	-0.6%	0.62
Selenium, Total	mg/L	0.0010	0.00100	0.2%	0.0010
Selenium, Dissolved	mg/L	0.0010	0.00100	-0.2%	0.00100
Silver, Total	mg/L	2.0E-05	2.0E-05	-0.5%	2.0E-05
Silver, Dissolved	mg/L	2.0E-05	2.0E-05	-0.1%	2.0E-05
Sodium, Total	mg/L	1.58	1.71	-8.0%	1.58
Sodium, Dissolved	mg/L	1.61	1.69	4.8%	1.69
Solids, Total Dissolved (TDS)	mg/L	47.0	47.5	1.1%	47.5
Solids, Total Suspended (TSS)	mg/L	7.50	16.0	72.2%	7.50
Sulfate	mg/L	3.33	3.14	-6.0%	3.14
Thallium, Total	mg/L	2.0E-05	2.6E-05	-27.9%	2.6E-05
Thallium, Dissolved	mg/L	2.0E-05	2.0E-05	-0.2%	2.0E-05
Vanadium, Total	mg/L	0.00040	0.00075	-61.4%	0.00075
Vanadium, Dissolved	mg/L	0.00020	0.00021	2.8%	0.00021
Zinc, Total	mg/L	0.00070	0.0016	-80.3%	0.0016
Zinc, Dissolved	mg/L	0.00060	0.00075	22.7%	0.00060

*	Parameter only adjusted if RPD>20%
(non-shaded)	Non-shaded cells indicate no adjustment was required to calibrate
(shaded)	Shaded cells indicate predicted concentration has been manually adjusted

APPENDIX D:
PIE CHARTS SHOWING SOURCES OF ARSENIC, ANTIMONY, SULFATE AND MERCURY LOADING AT EACH NODE

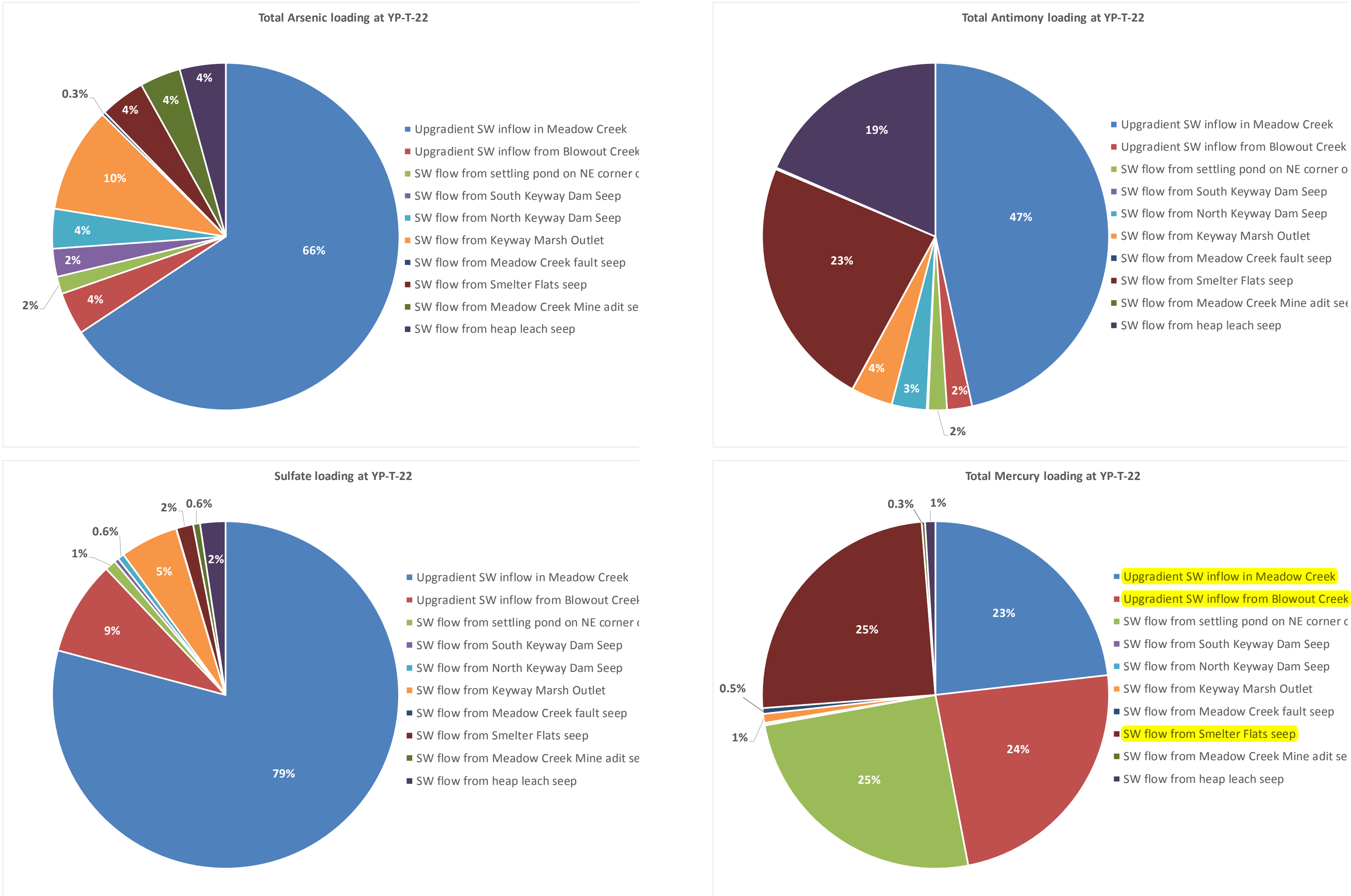


Figure D1: Total Arsenic, Total Antimony, Sulfate and Total Mercury Loading at YP-T-22 (Meadow Creek above EFSFSR)

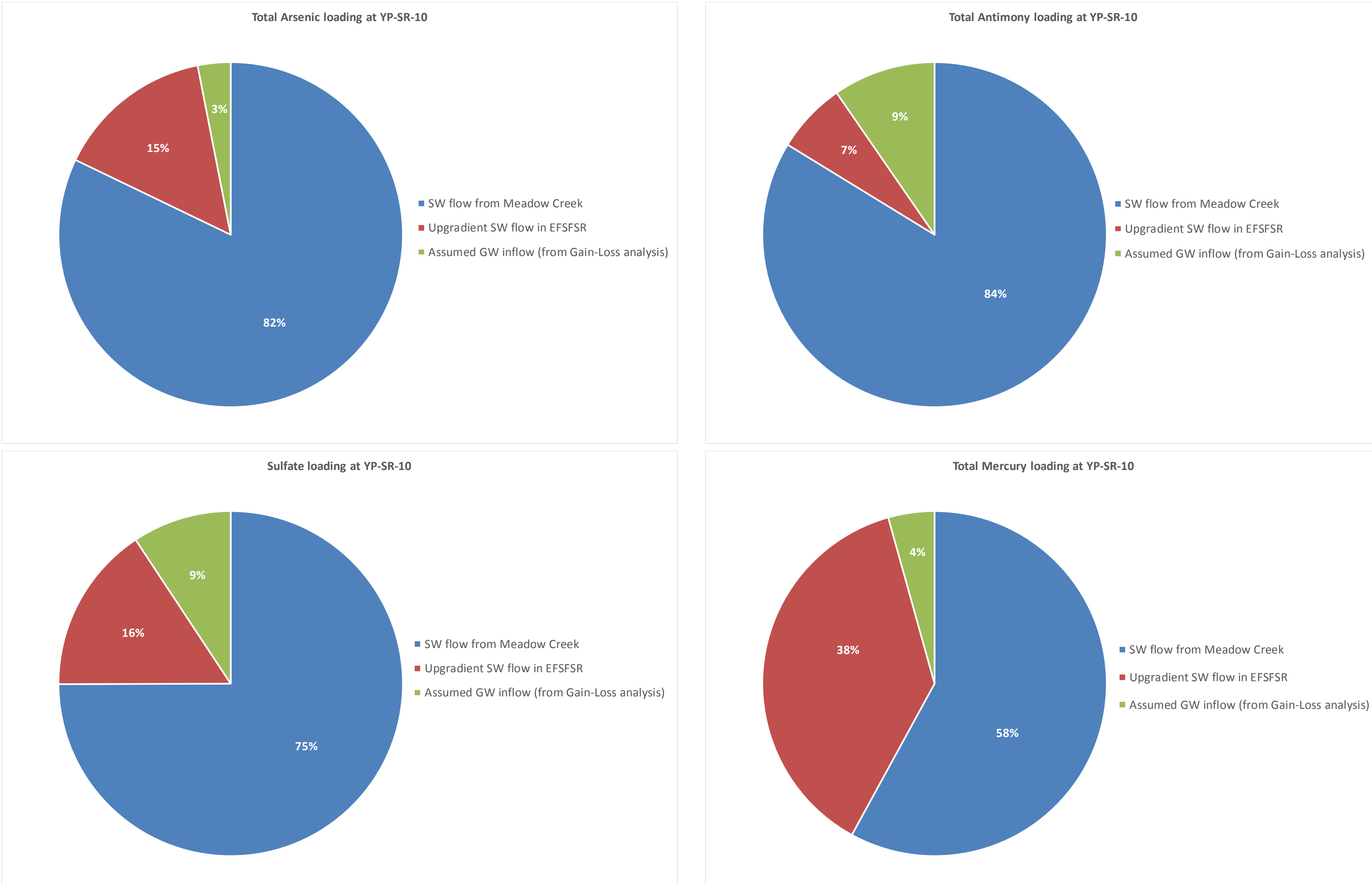


Figure D2: Total Arsenic, Total Antimony, Sulfate and Total Mercury Loading at YP-SR-10 (EFSFSR below Meadow Creek)

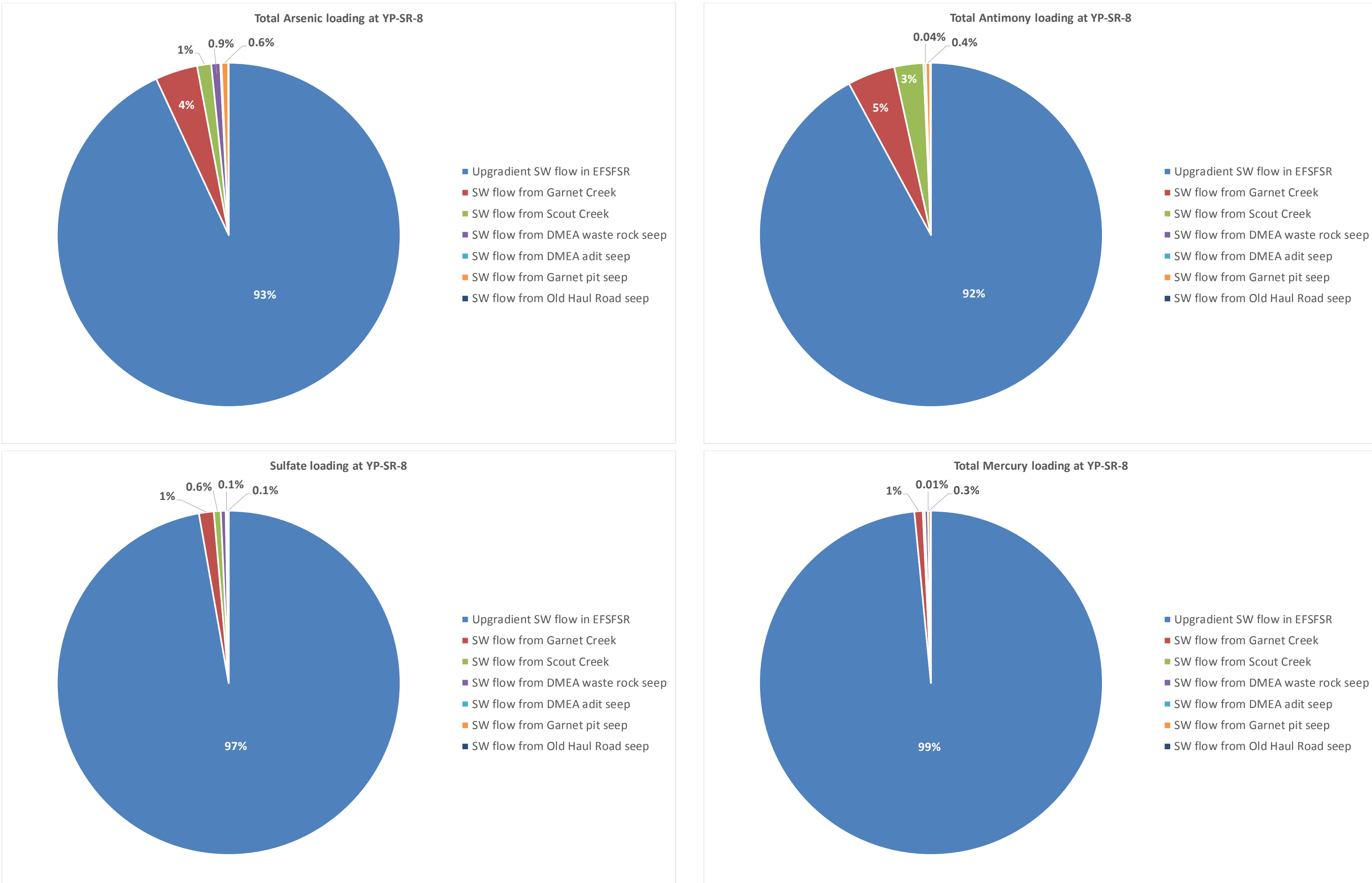


Figure D3: Total Arsenic, Total Antimony, Sulfate and Total Mercury Loading at YP-SR-8 (EFSFSR above Fiddle Creek)

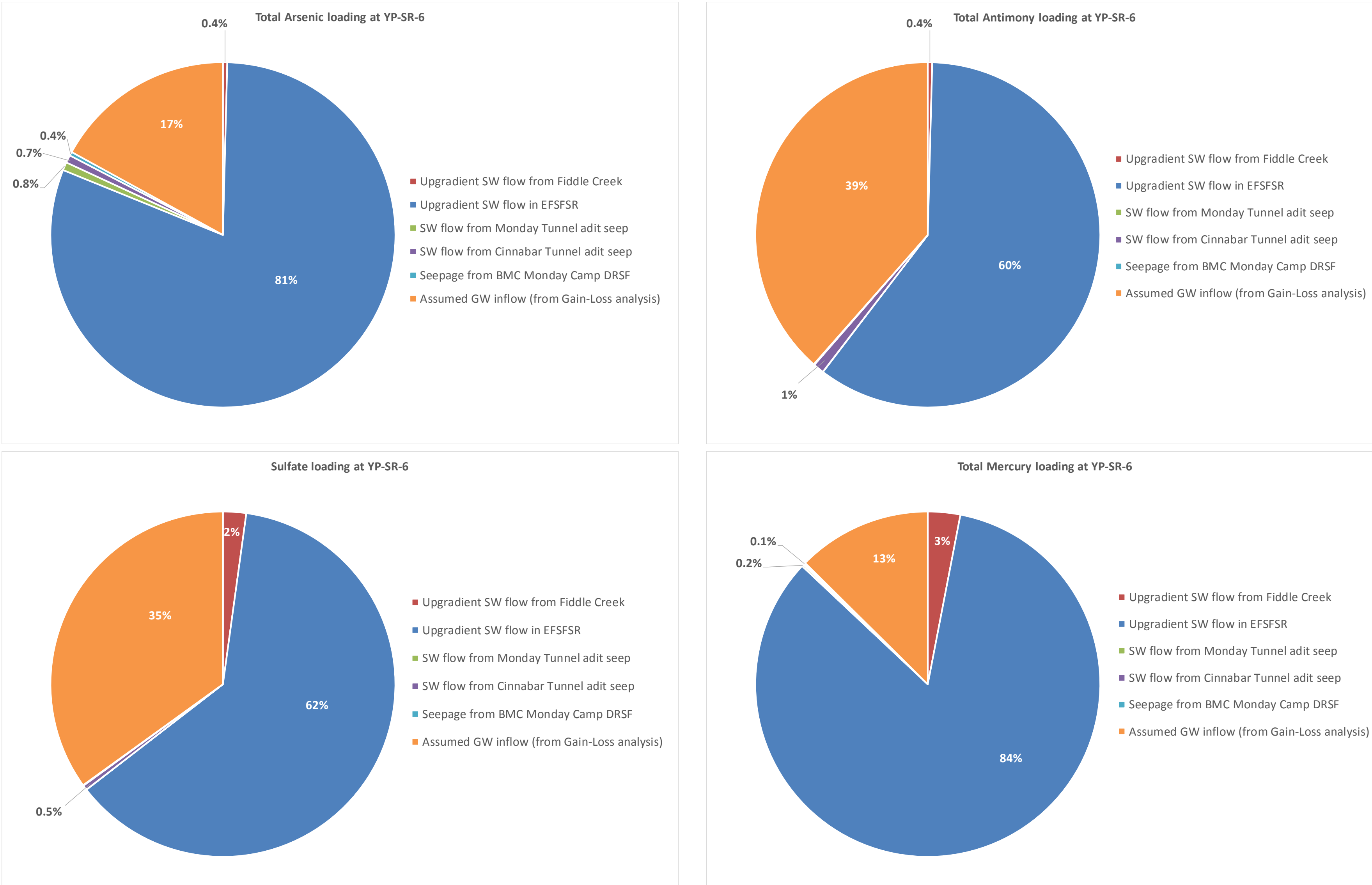


Figure D4: Total Arsenic, Total Antimony, Sulfate and Total Mercury Loading at YP-SR-6 (EFSFSR above Yellow Pine Pit)

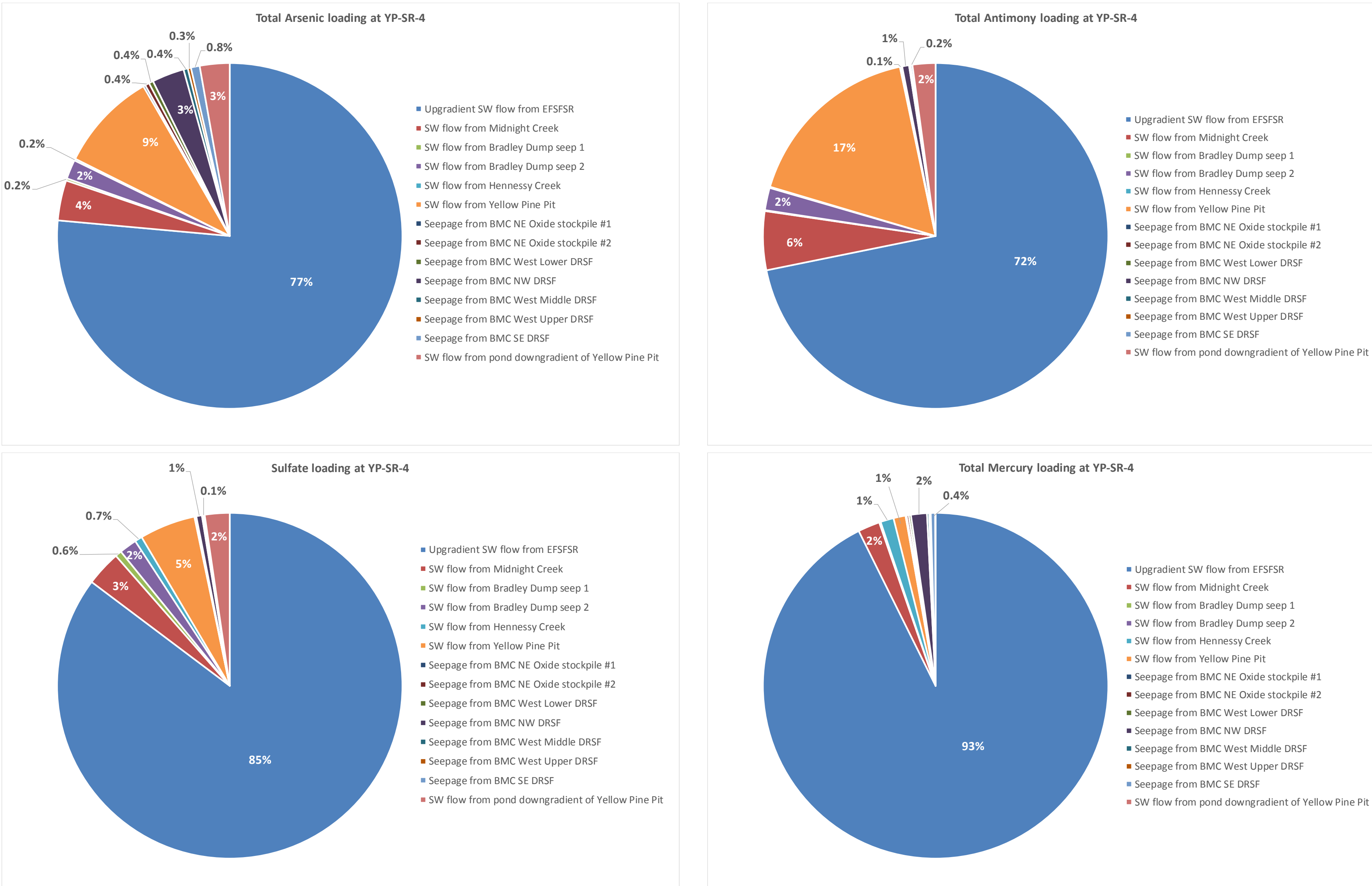


Figure D5: Total Arsenic, Total Antimony, Sulfate and Total Mercury Loading at YP-SR-4 (EFSFSR below Yellow Pine Pit)

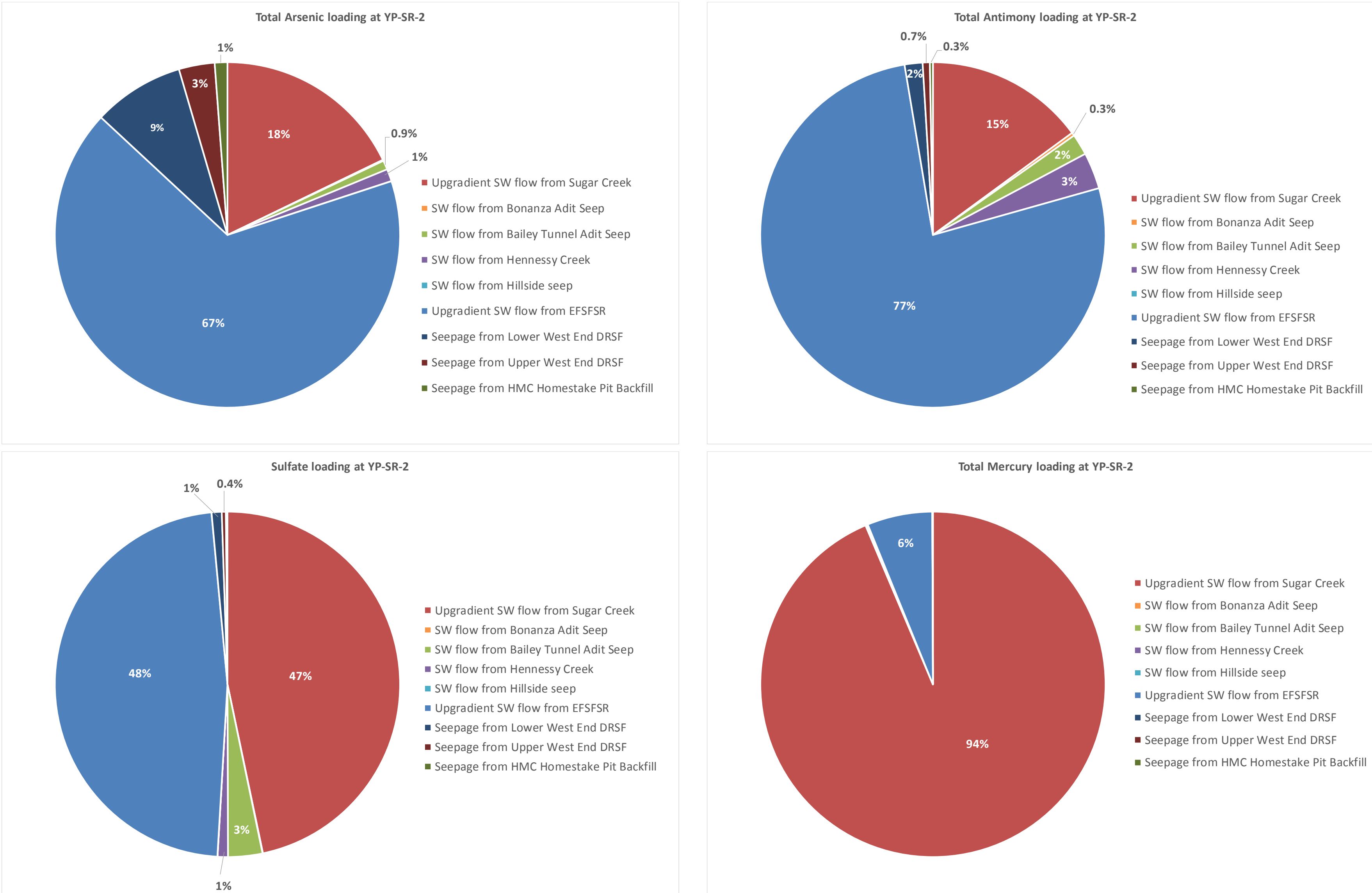


Figure D6: Total Arsenic, Total Antimony, Sulfate and Total Mercury Loading at YP-SR-2 (EFSFSR below Sugar Creek)

APPENDIX E:
TEMPERATURE SENSITIVITY ANALYSIS

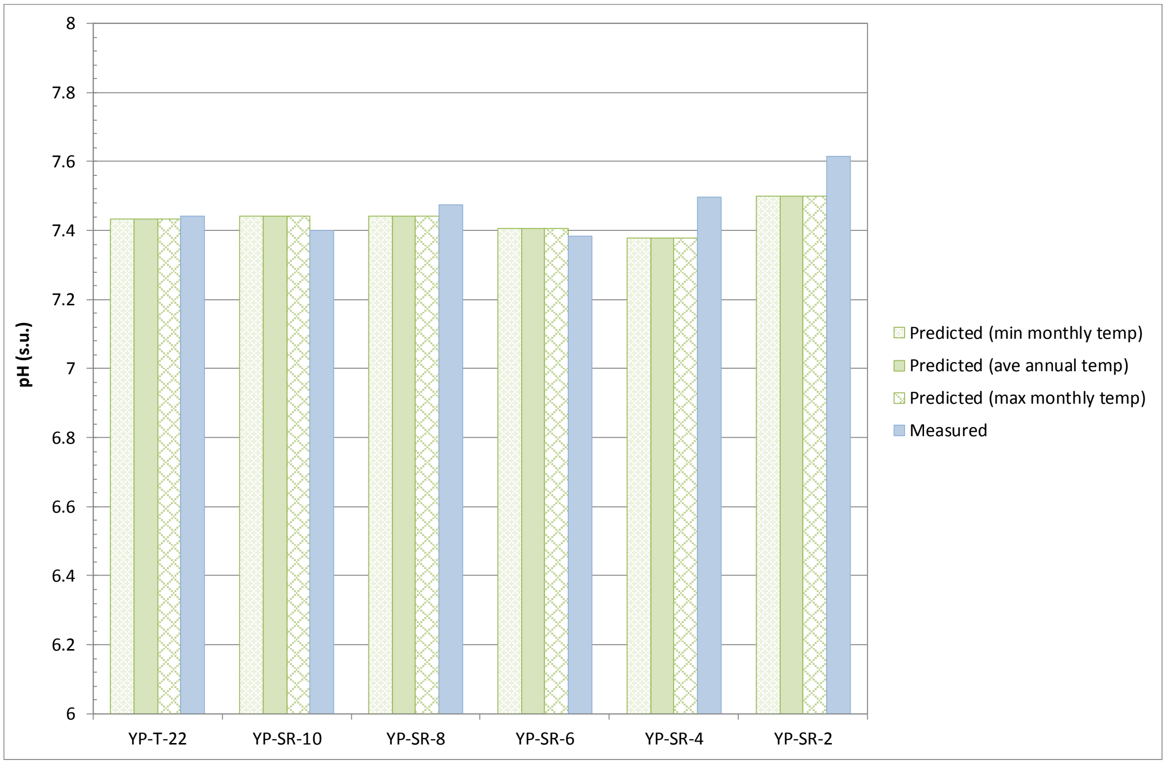


Figure E1: Temperature Sensitivity Analysis for Predicted vs. Measured pH under Average Flow Conditions

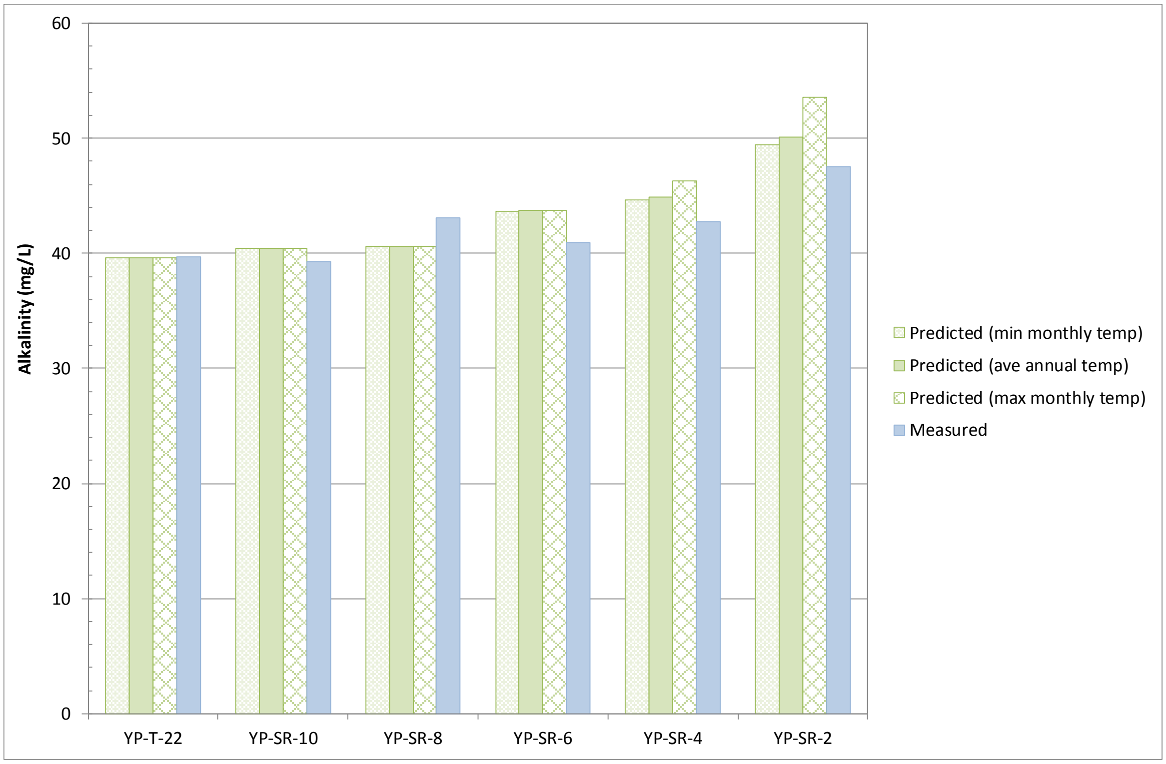


Figure E2: Temperature Sensitivity Analysis for Predicted vs. Measured Alkalinity under Average Flow Conditions

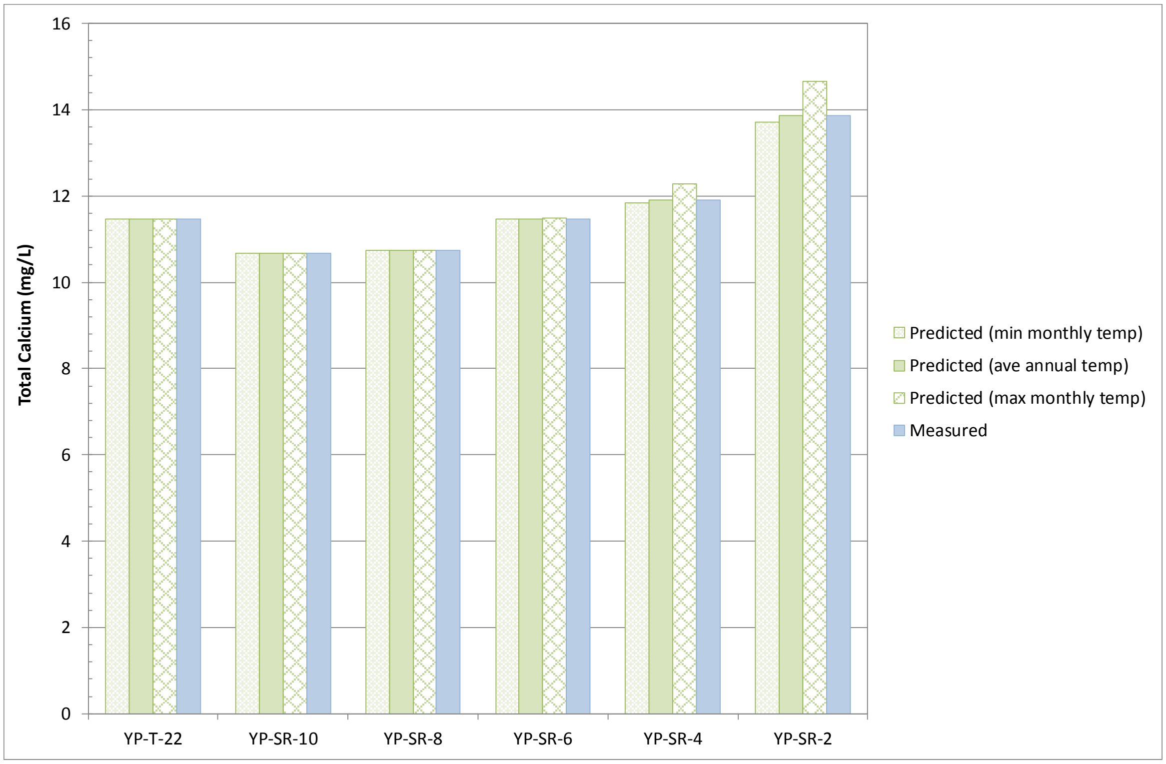


Figure E3: Temperature Sensitivity Analysis for Predicted vs. Measured Total Calcium under Average Flow Conditions

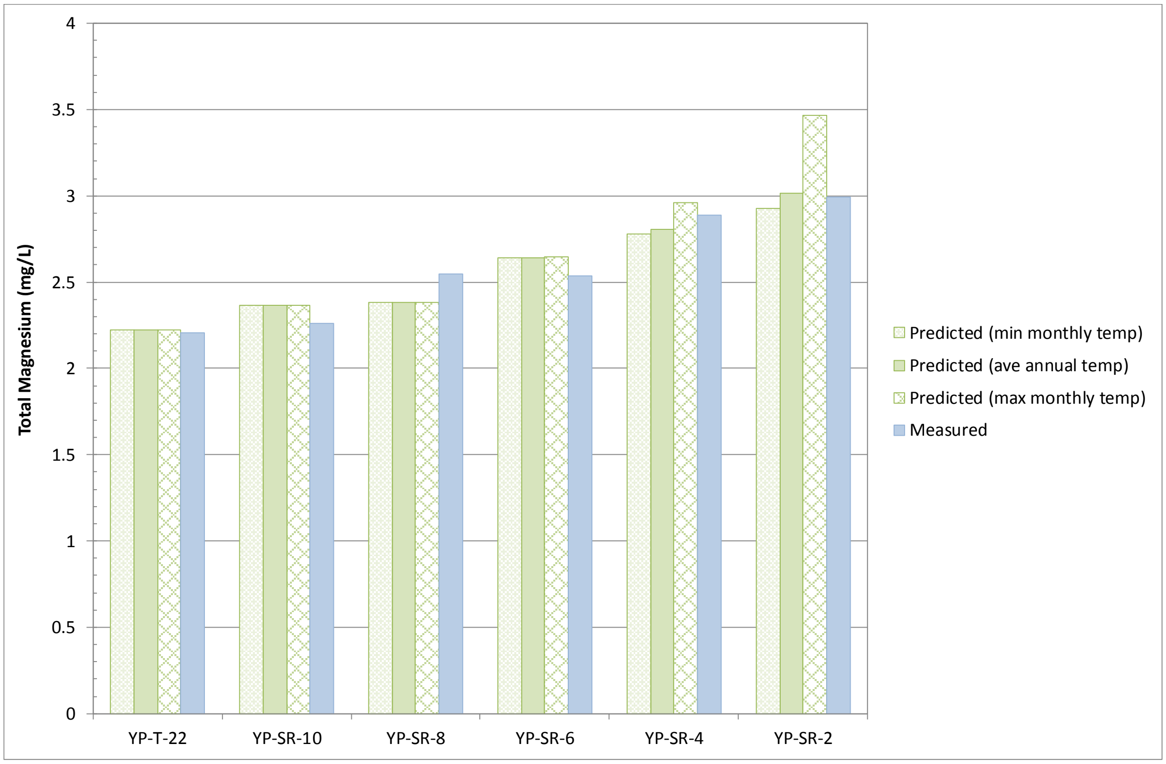


Figure E4: Temperature Sensitivity Analysis for Predicted vs. Measured Total Magnesium under Average Flow Conditions

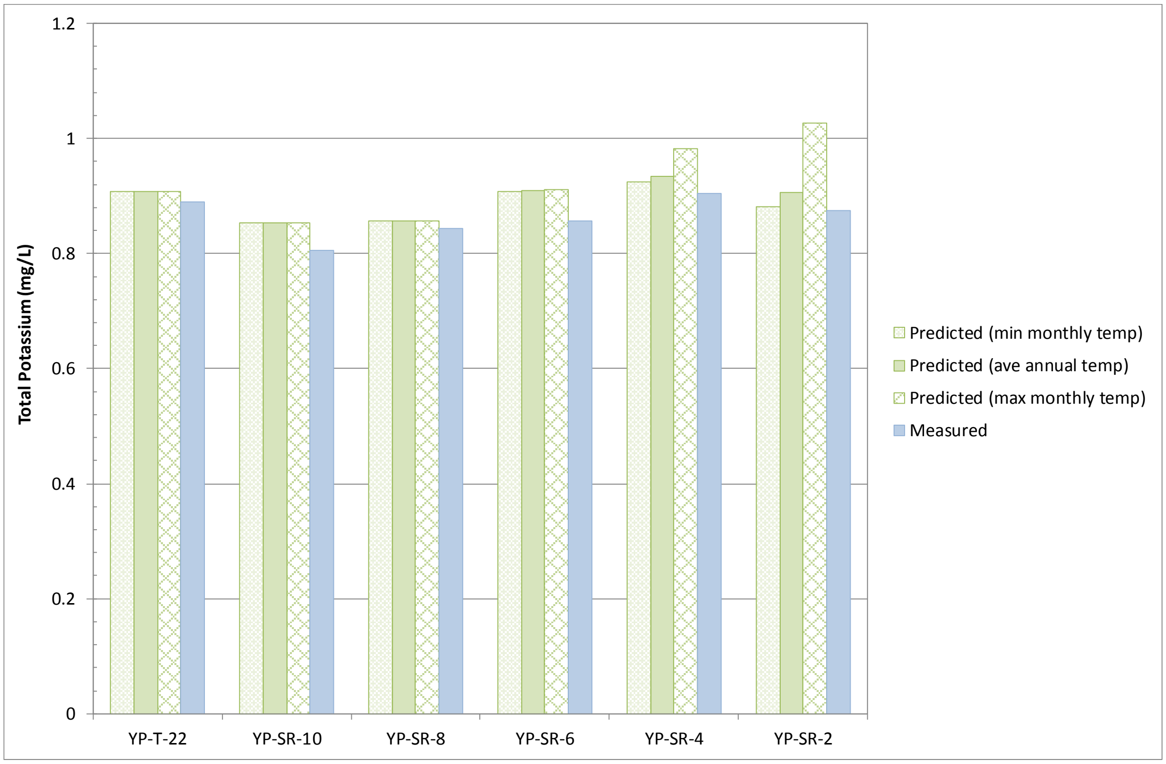


Figure E5: Temperature Sensitivity Analysis for Predicted vs. Measured Total Potassium under Average Flow Conditions

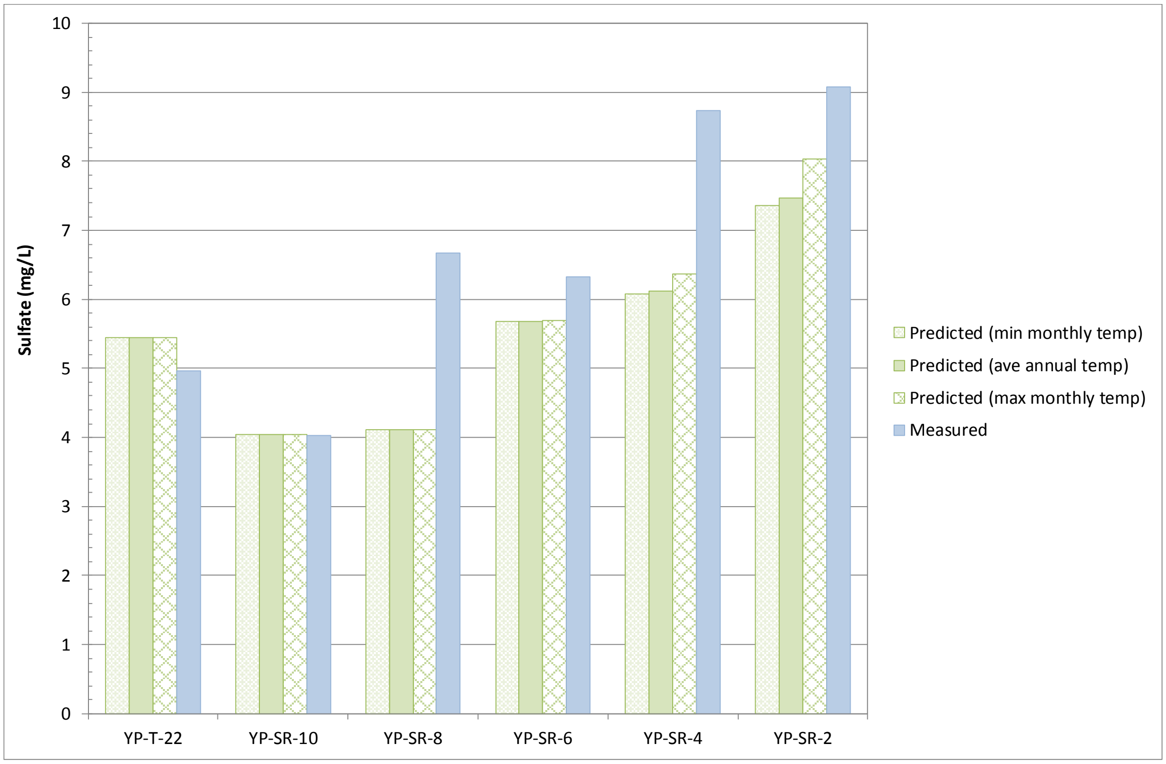


Figure E6: Temperature Sensitivity Analysis for Predicted vs. Measured Sulfate under Average Flow Conditions

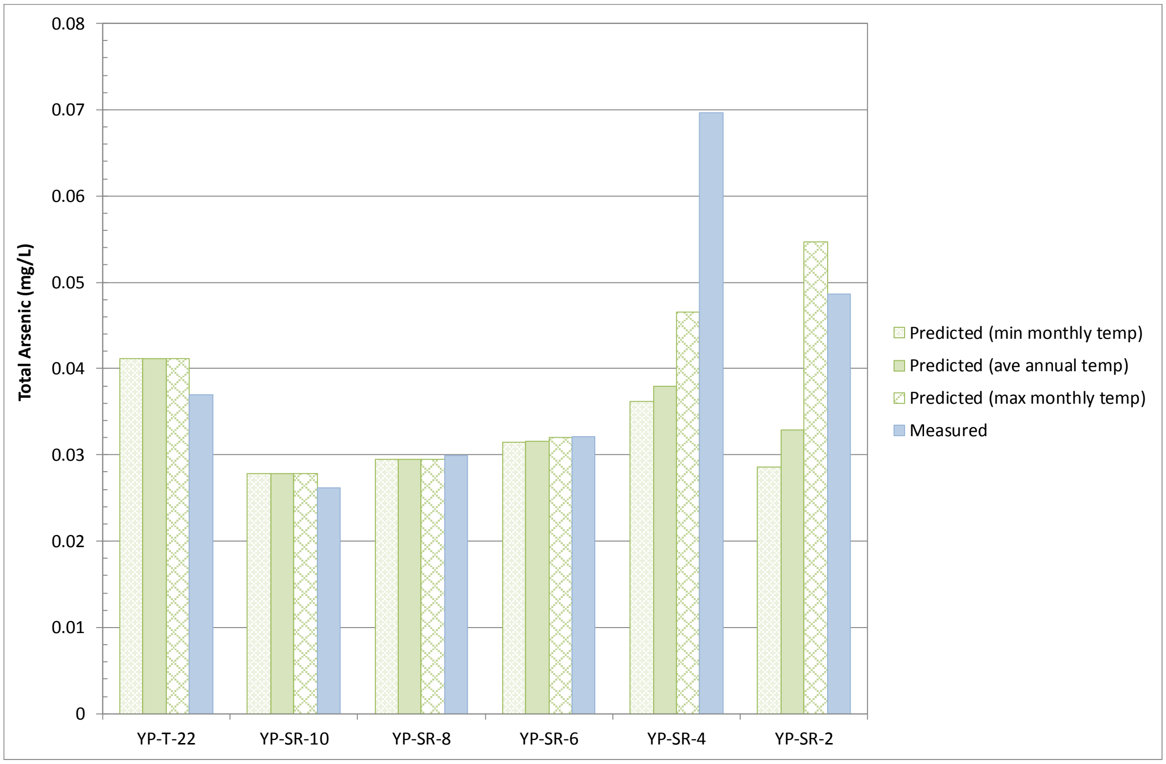


Figure E7: Temperature Sensitivity Analysis for Predicted vs. Measured Total Arsenic under Average Flow Conditions

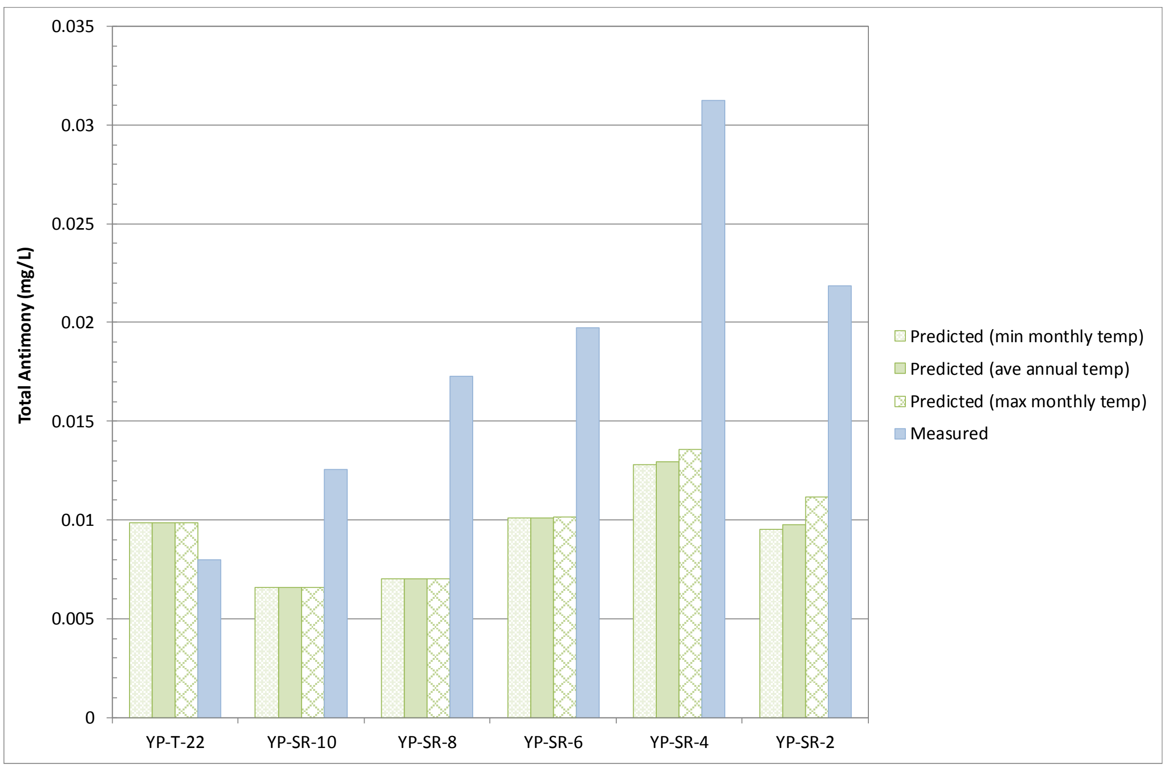


Figure E8: Temperature Sensitivity Analysis for Predicted vs. Measured Total Antimony under Average Flow Conditions

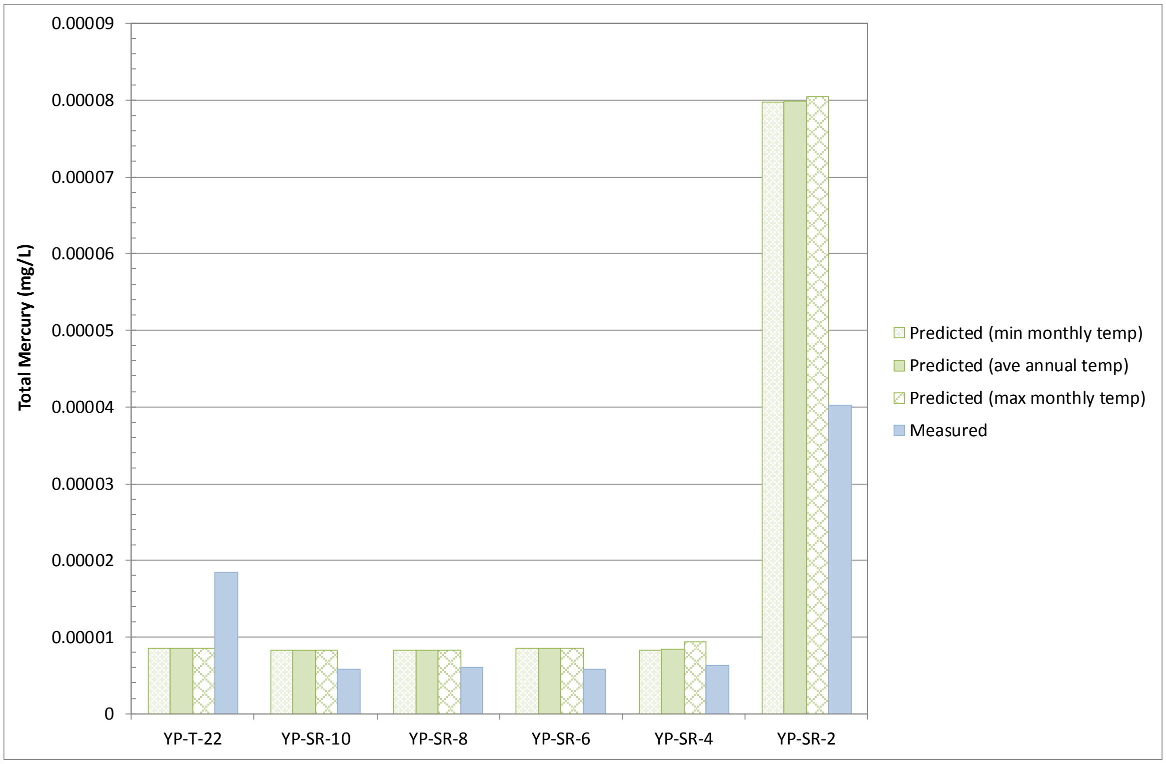


Figure E9: Temperature Sensitivity Analysis for Predicted vs. Measured Total Mercury under Average Flow Conditions

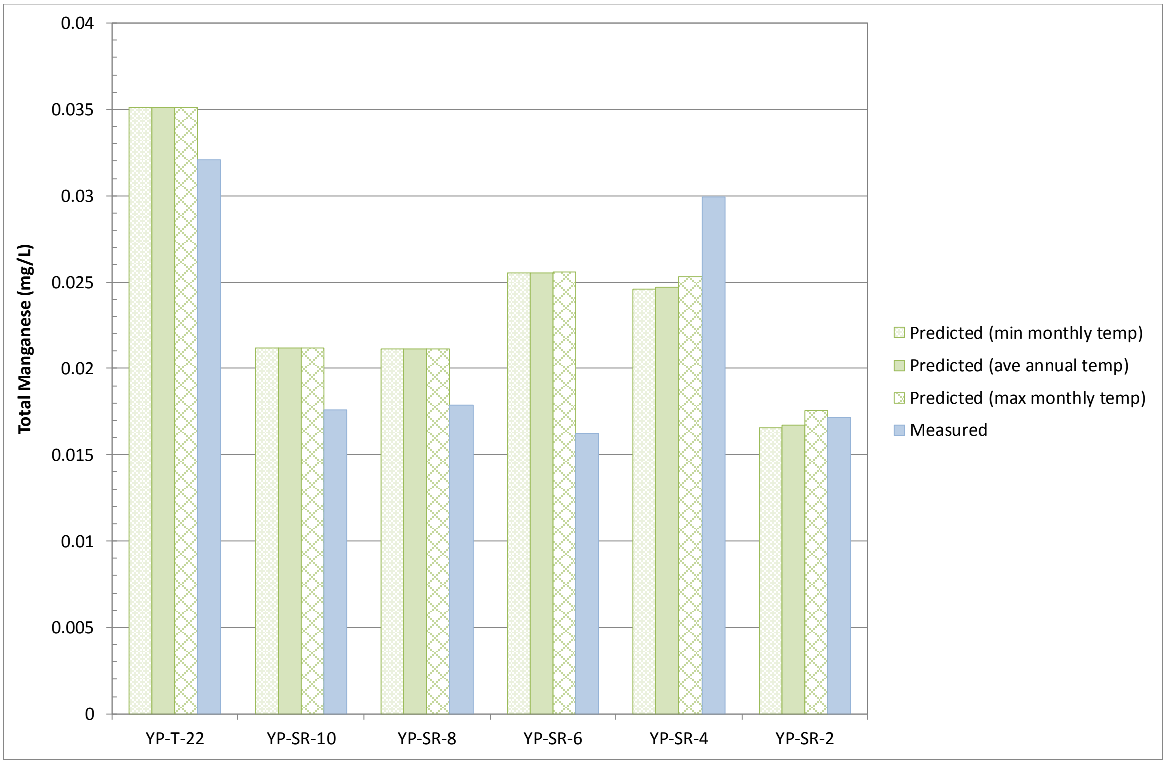


Figure E10: Temperature Sensitivity Analysis for Predicted vs. Measured Total Manganese under Average Flow Conditions

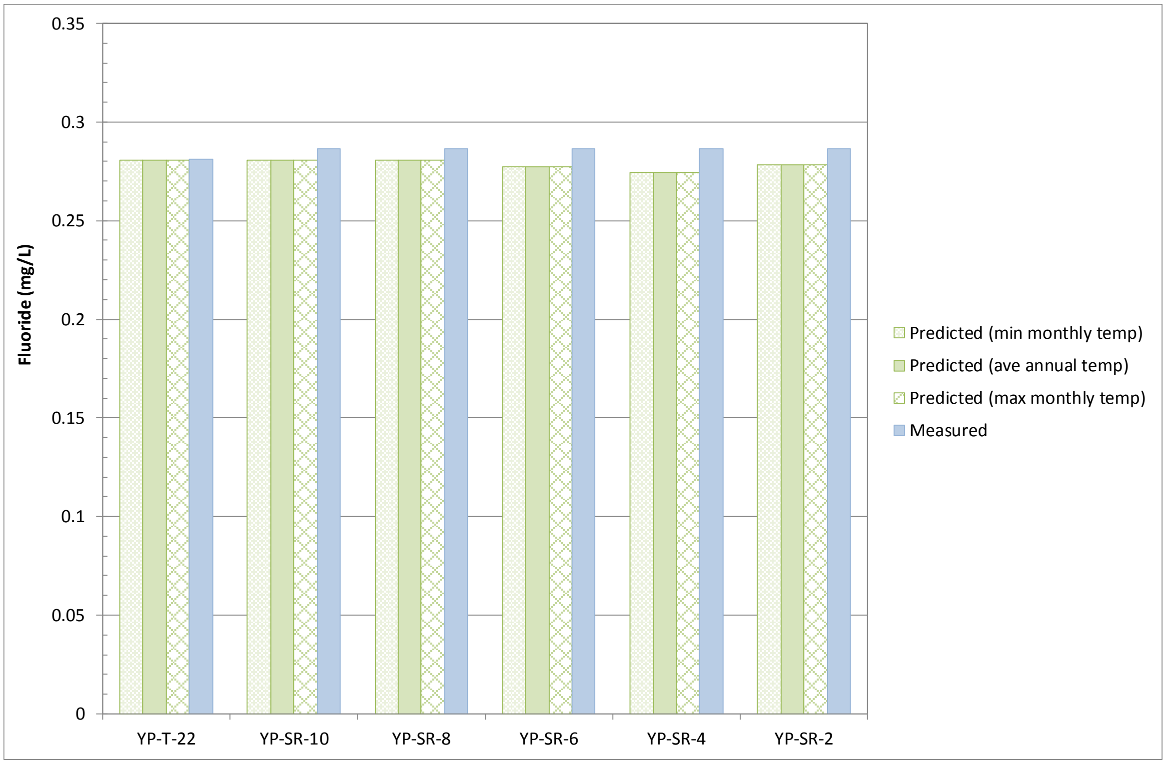


Figure E11: Temperature Sensitivity Analysis for Predicted vs. Measured Fluoride under Average Flow Conditions

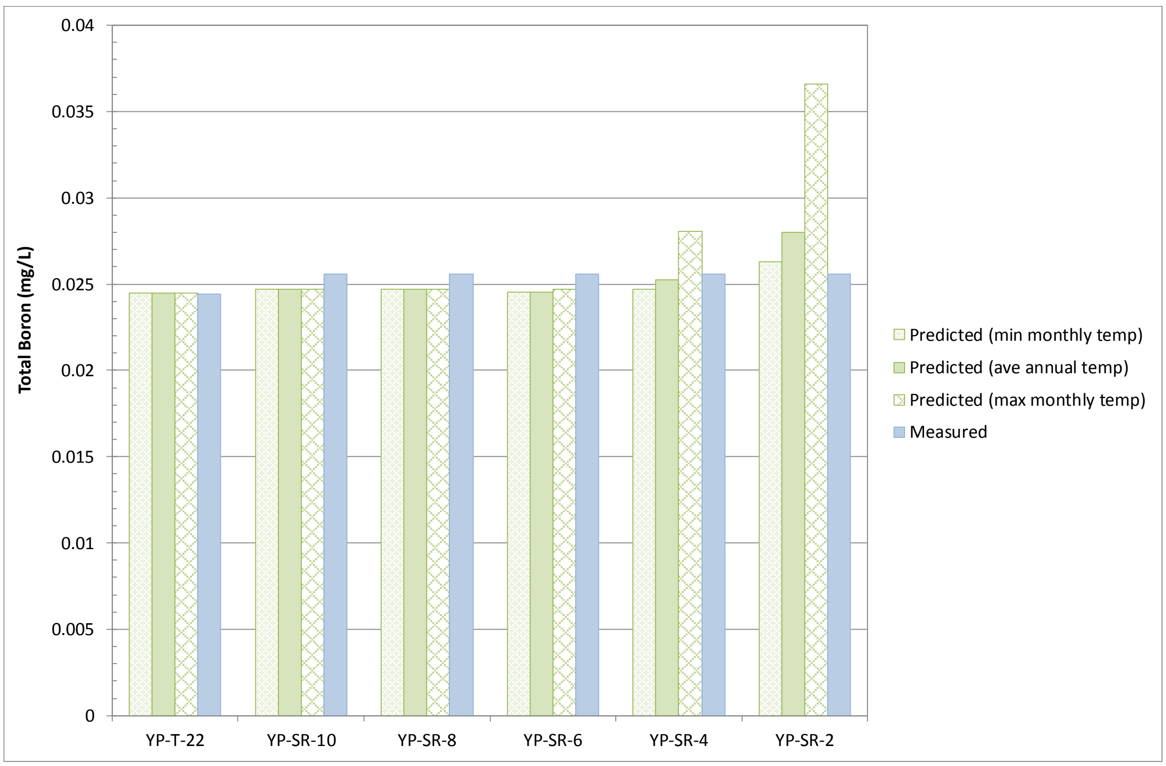


Figure E12: Temperature Sensitivity Analysis for Predicted vs. Measured Total Boron under Average Flow Conditions

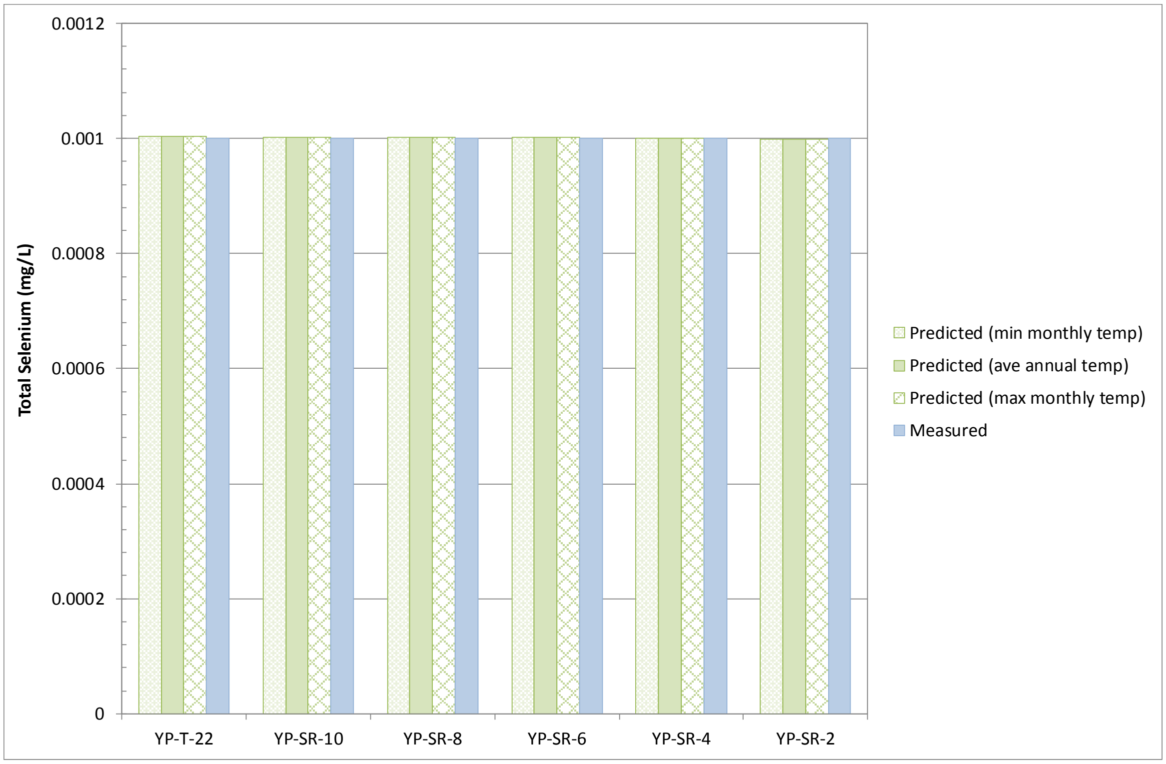


Figure E13: Temperature Sensitivity Analysis for Predicted vs. Measured Total Selenium under Average Flow Conditions

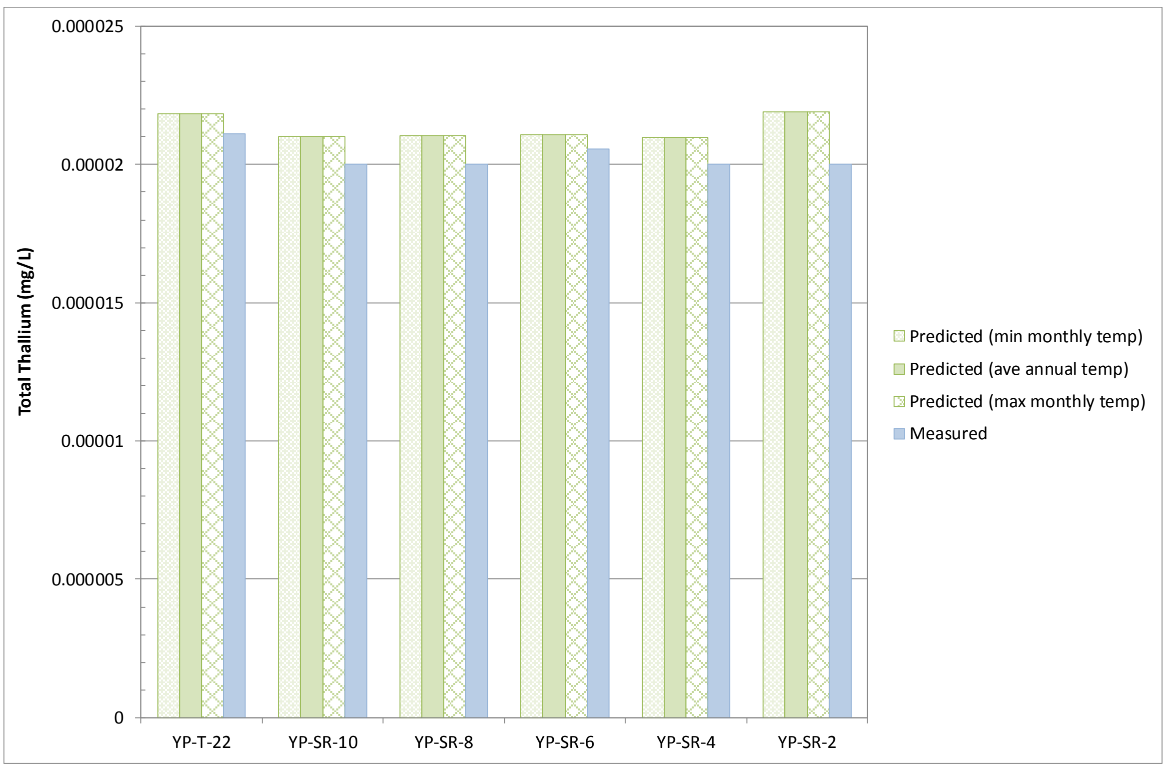


Figure E14: Temperature Sensitivity Analysis for Predicted vs. Measured Total Thallium under Average Flow Conditions

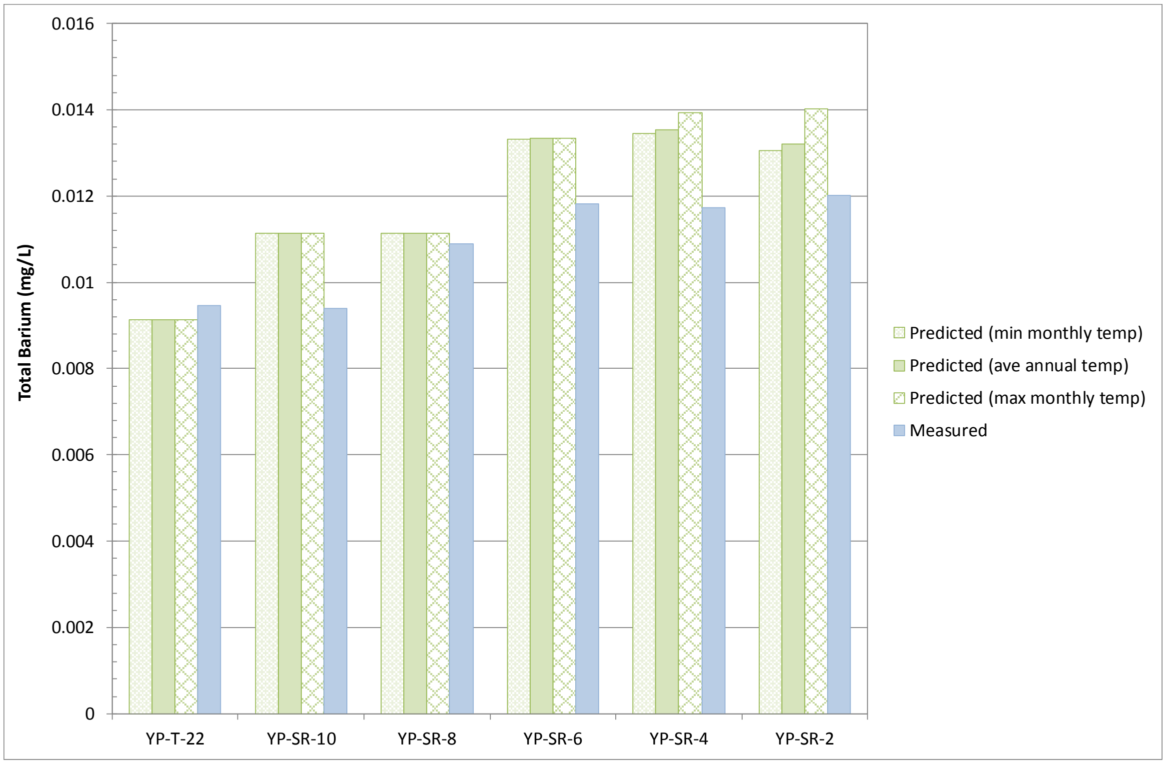


Figure E15: Temperature Sensitivity Analysis for Predicted vs. Measured Total Barium under Average Flow Conditions

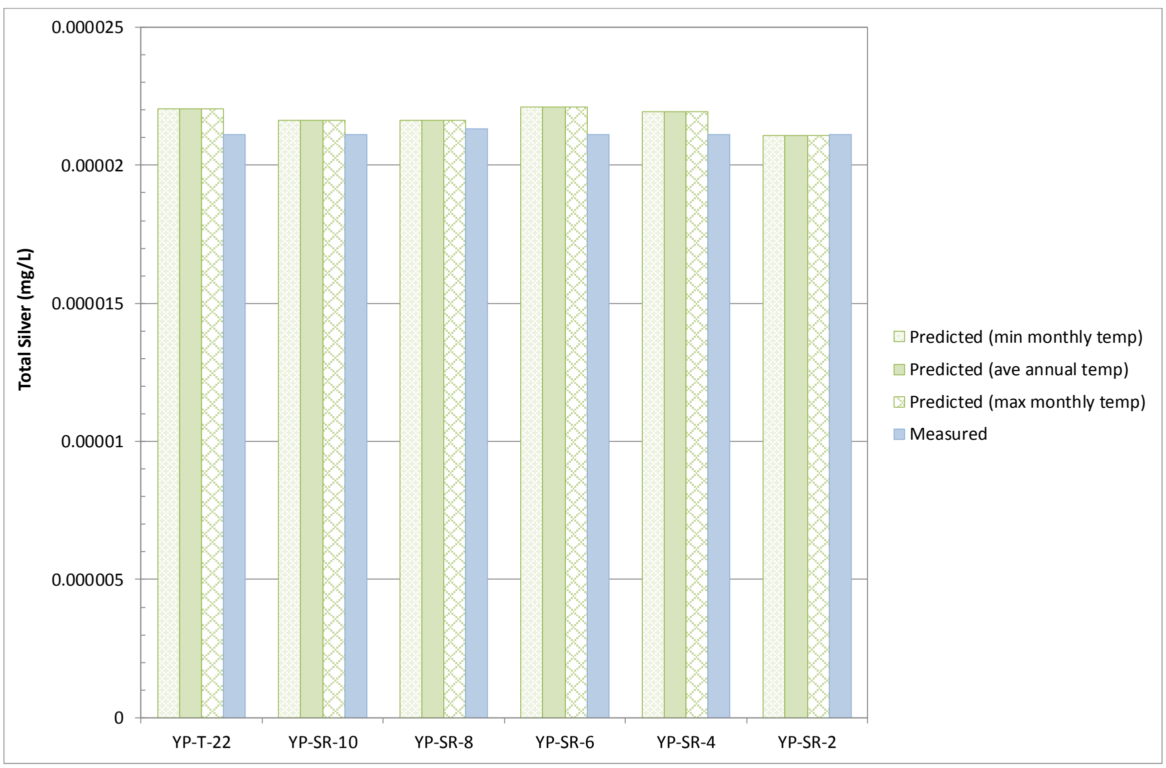


Figure E16: Temperature Sensitivity Analysis for Predicted vs. Measured Total Silver under Average Flow Conditions

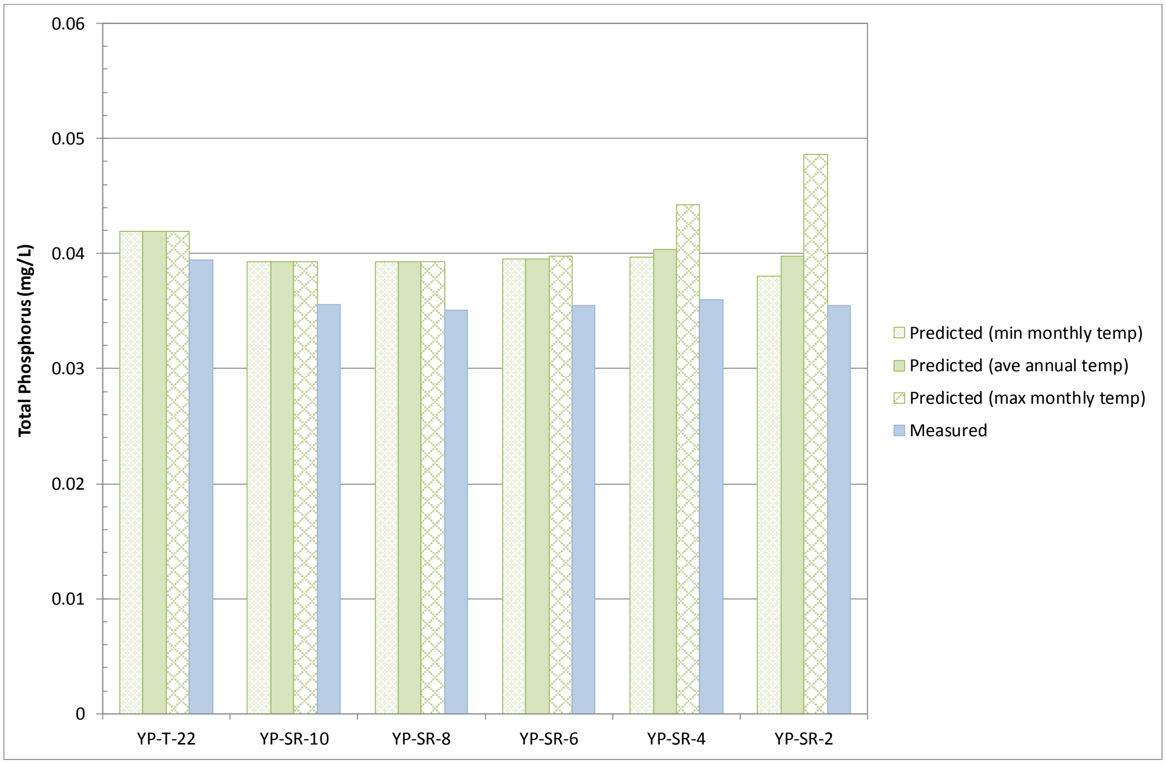


Figure E17: Temperature Sensitivity Analysis for Predicted vs. Measured Total Phosphorus under Average Flow Conditions

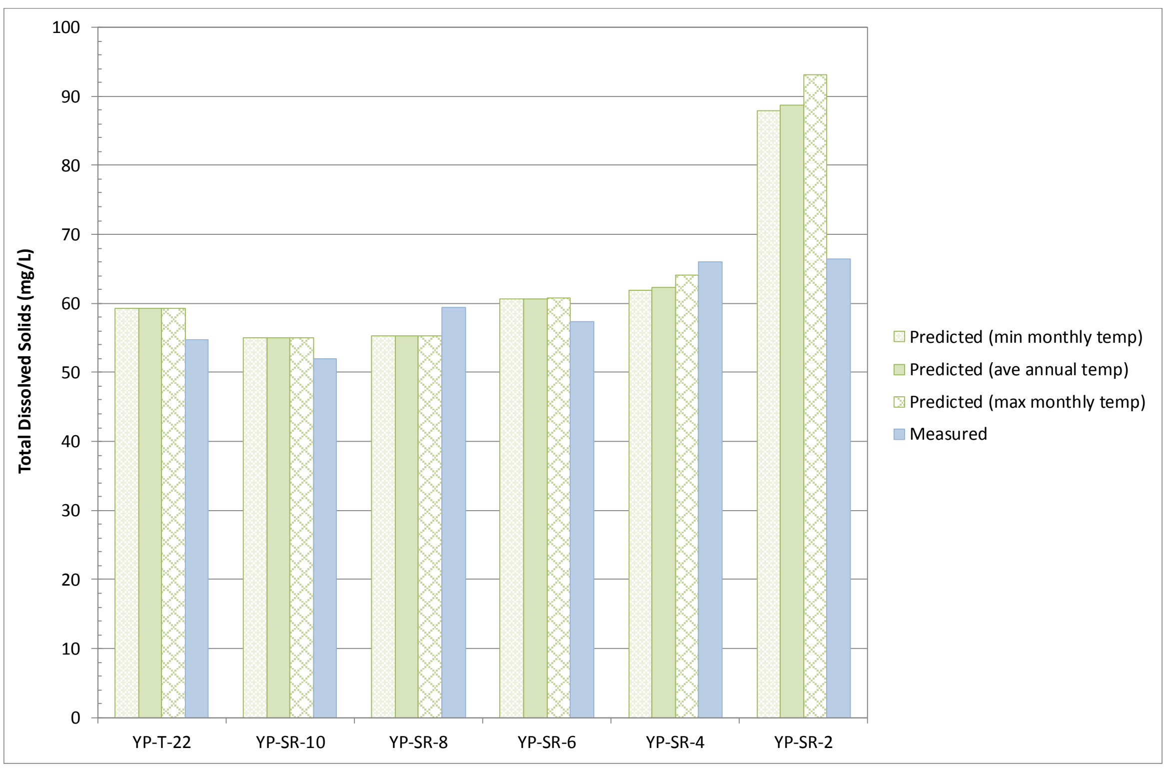


Figure E18: Temperature Sensitivity Analysis for Predicted vs. Measured TDS under Average Flow Conditions

APPENDIX F:
GRAIN SIZE SENSITIVITY ANALYSIS

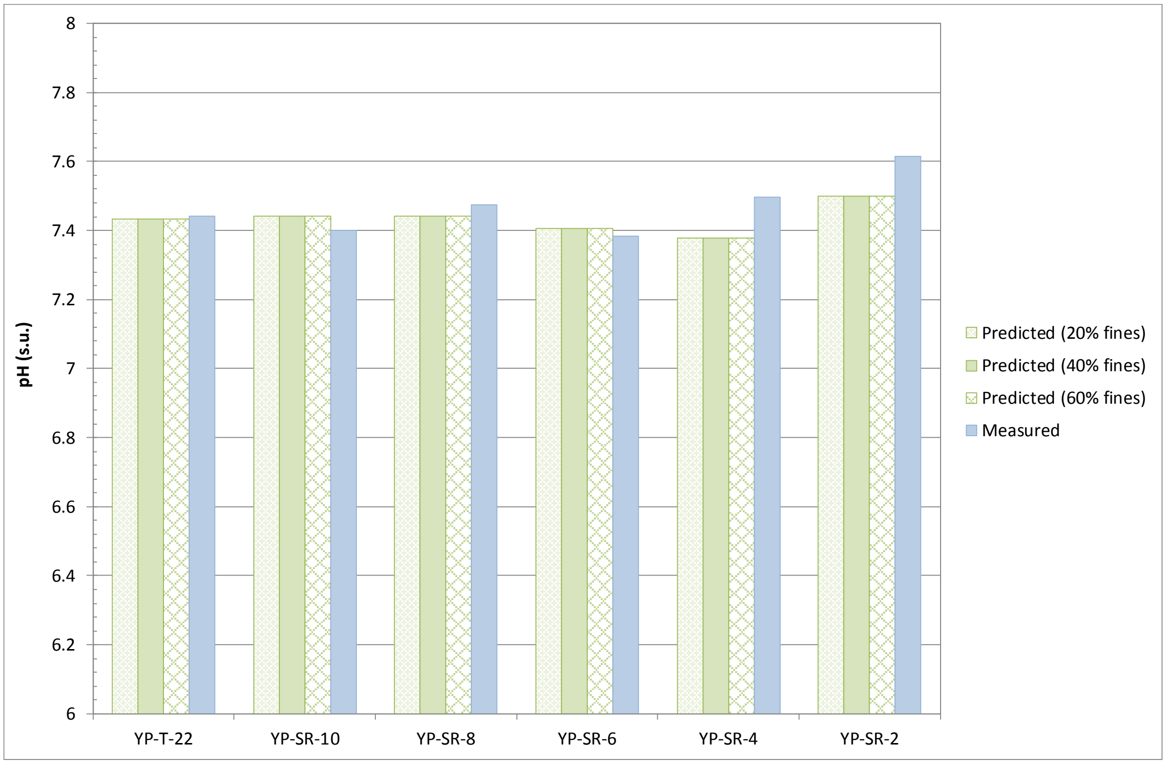


Figure F1: Grain Size Sensitivity Analysis for Predicted vs. Measured pH under Average Flow Conditions

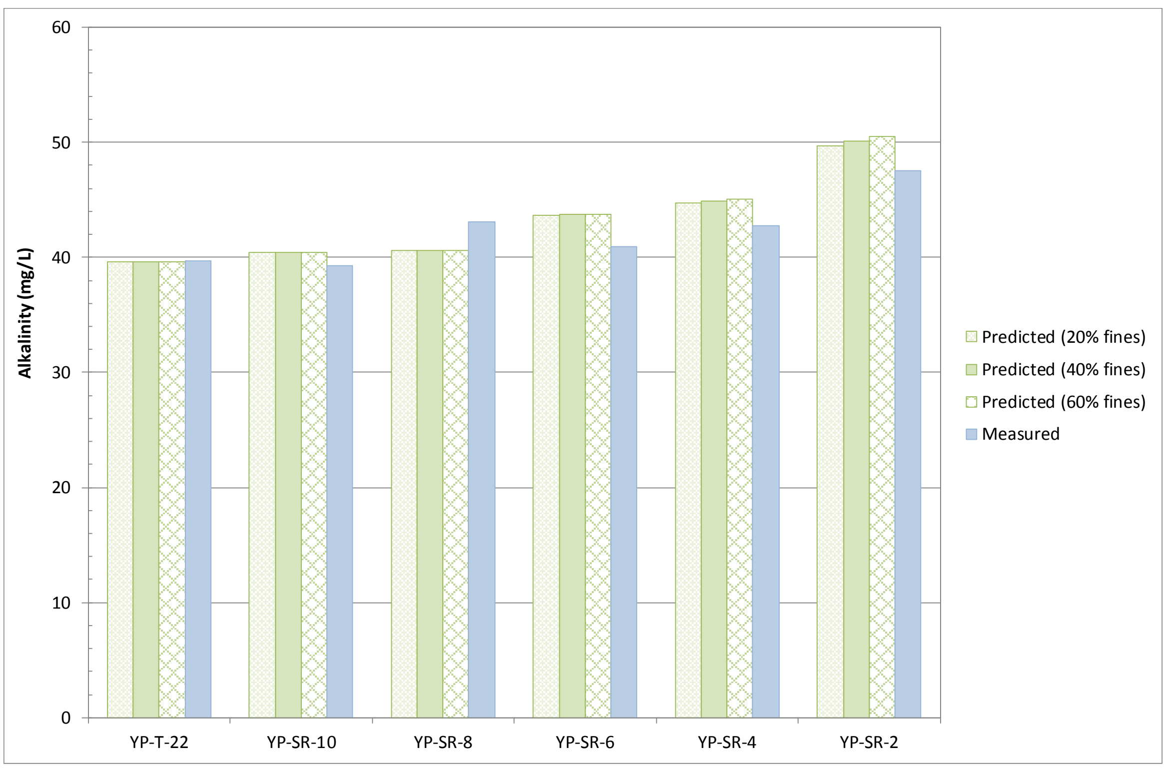


Figure F2: Grain Size Sensitivity Analysis for Predicted vs. Measured Alkalinity under Average Flow Conditions

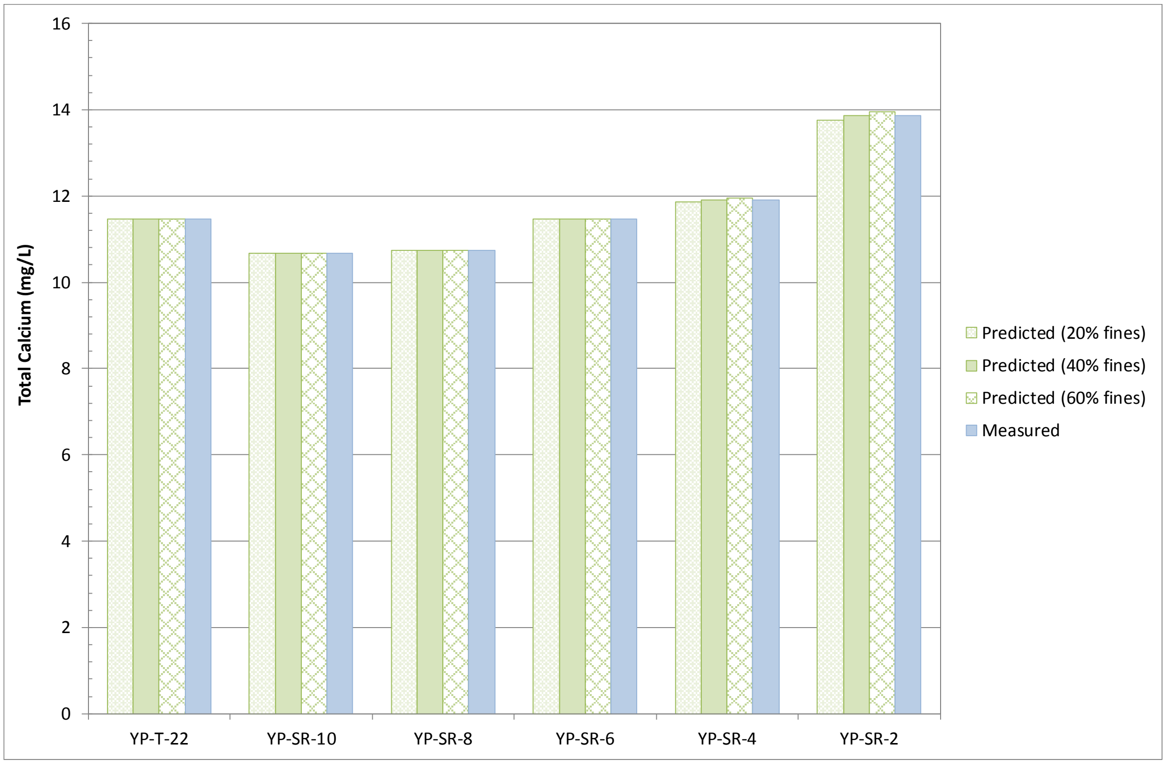


Figure F3: **Grain Size Sensitivity Analysis for Predicted vs. Measured Total Calcium under Average Flow Conditions**

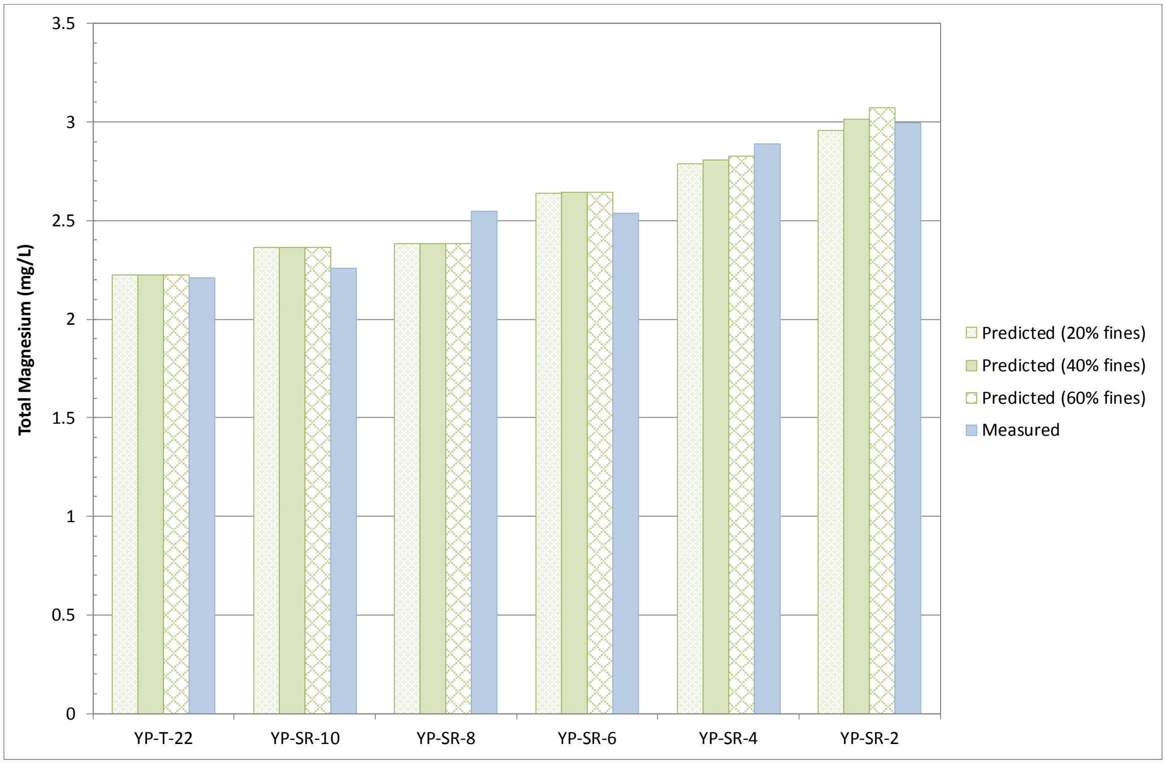


Figure F4: **Grain Size Sensitivity Analysis for Predicted vs. Measured Total Magnesium under Average Flow Conditions**

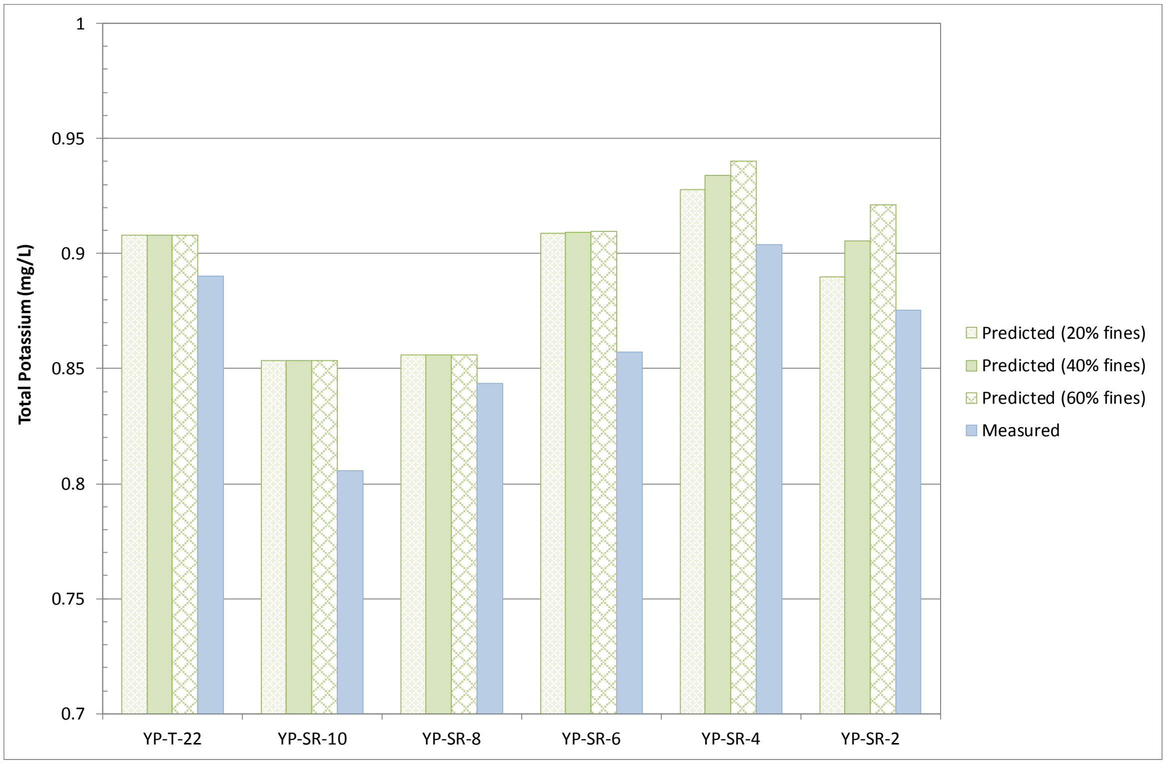


Figure F5: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Potassium under Average Flow Conditions

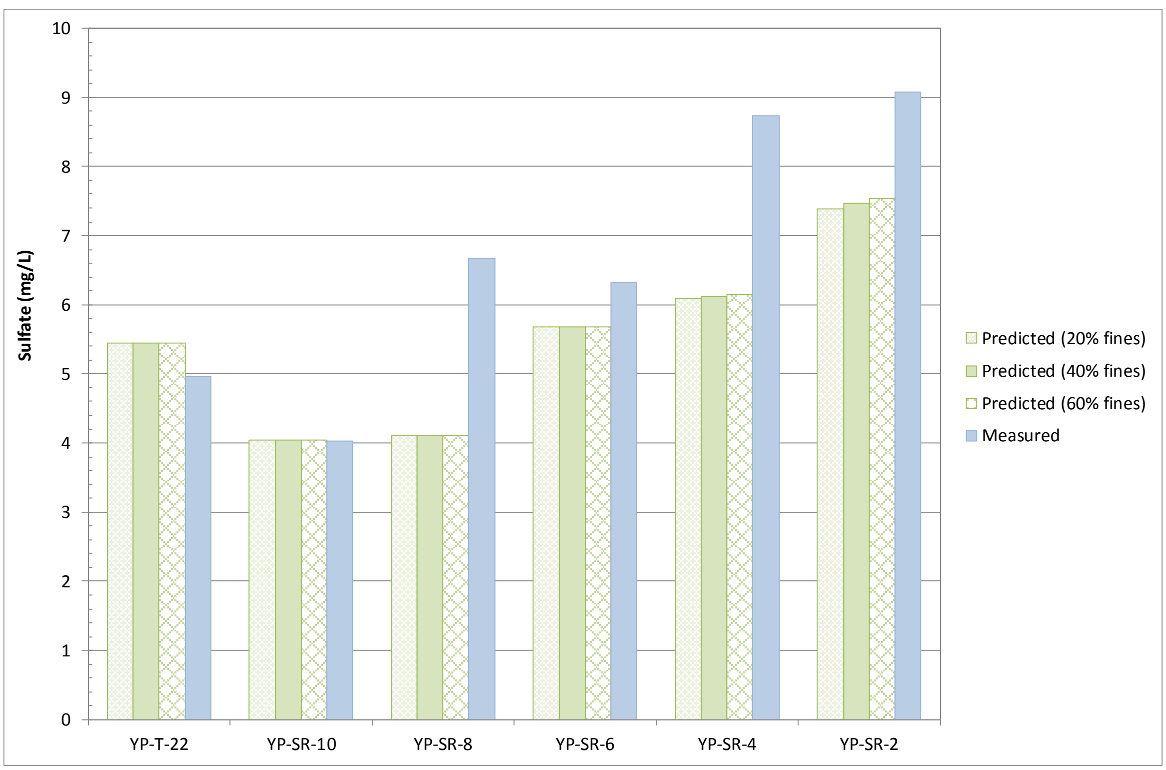


Figure F6: Grain Size Sensitivity Analysis for Predicted vs. Measured Sulfate under Average Flow Conditions

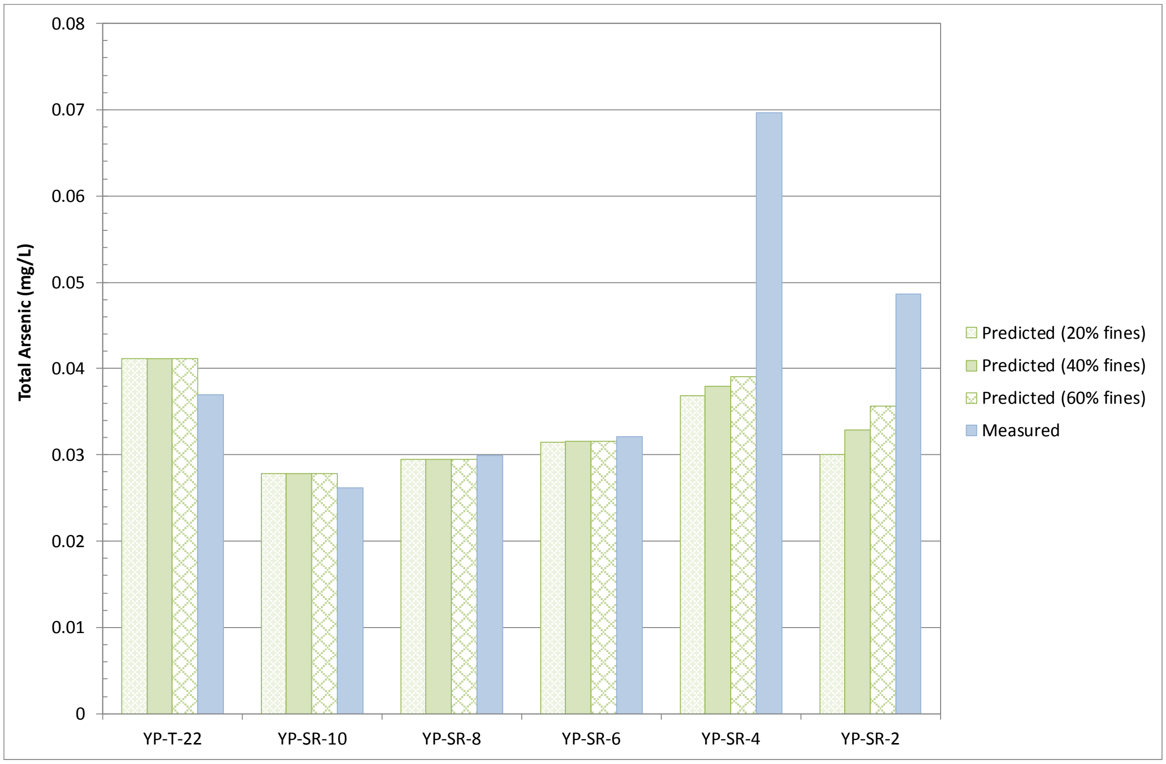


Figure F7: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Arsenic under Average Flow Conditions

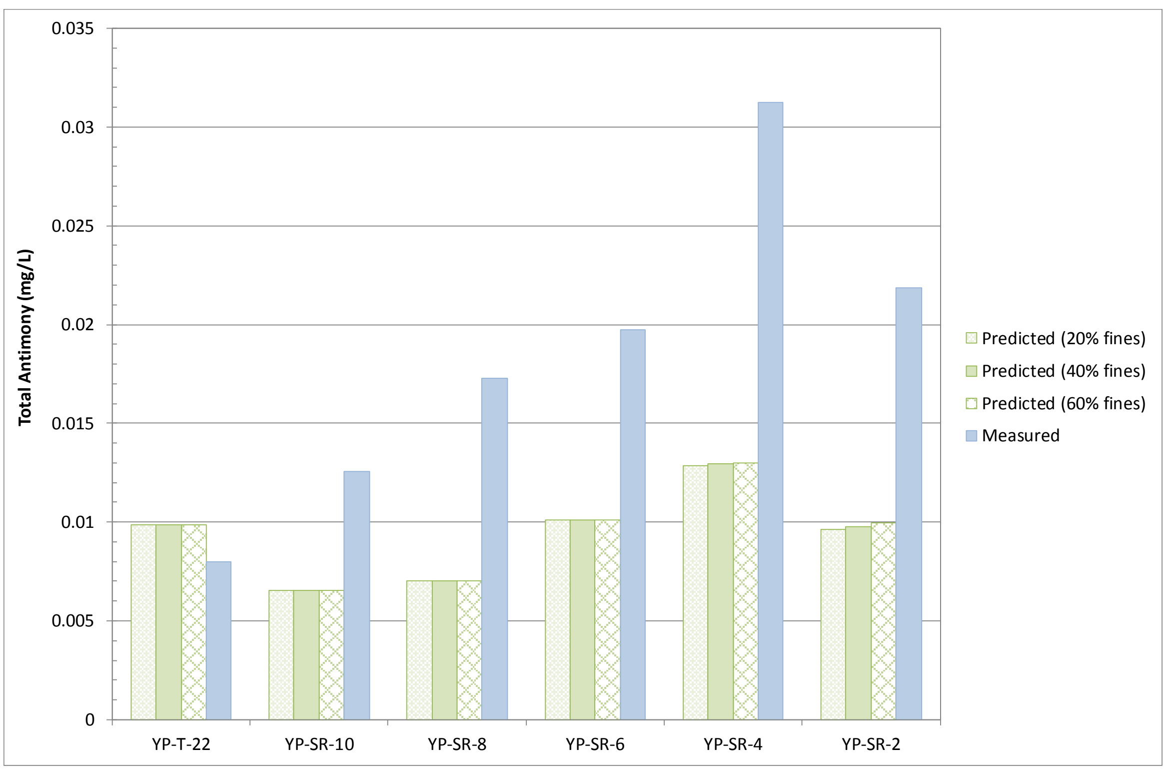


Figure F8: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Antimony under Average Flow Conditions

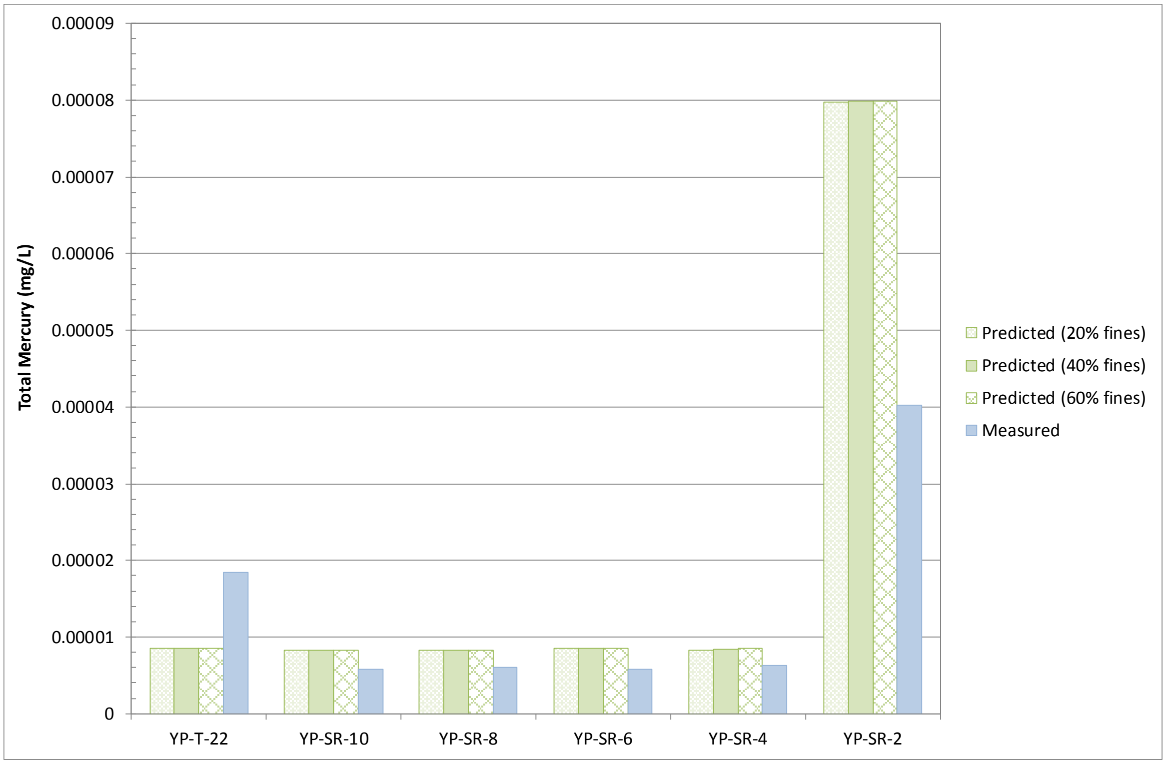


Figure F9: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Mercury under Average Flow Conditions

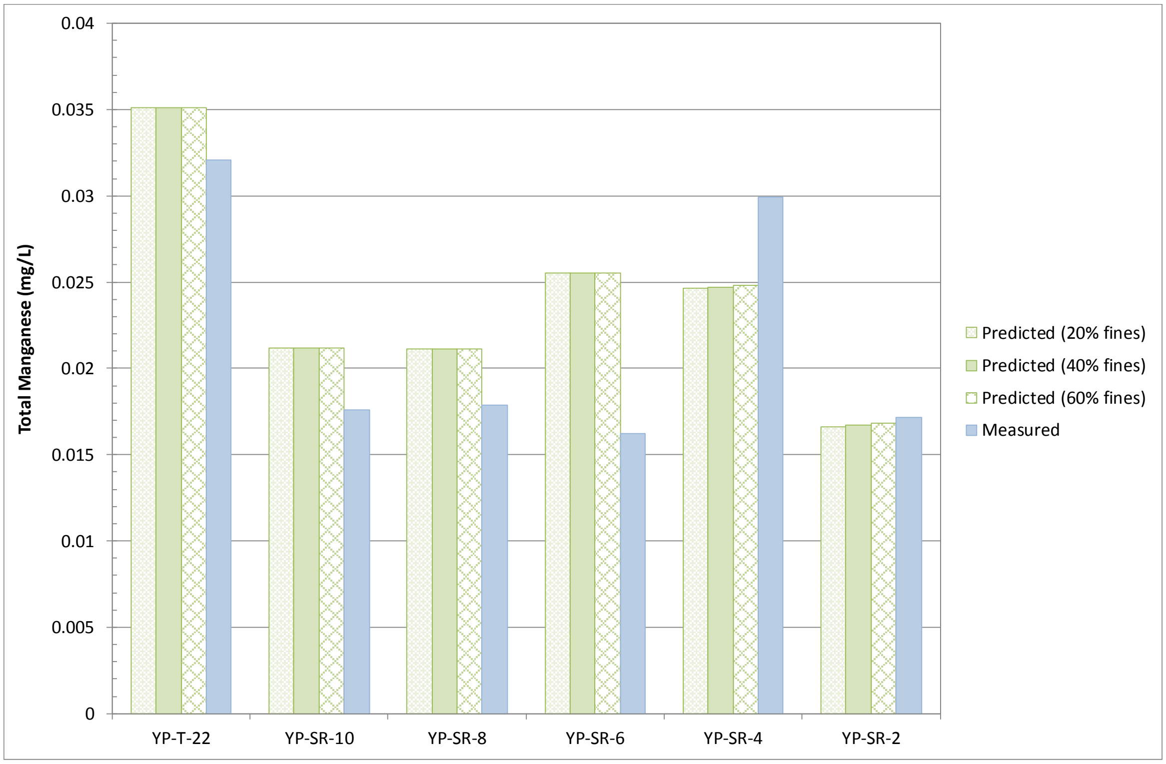


Figure F10: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Manganese under Average Flow Conditions

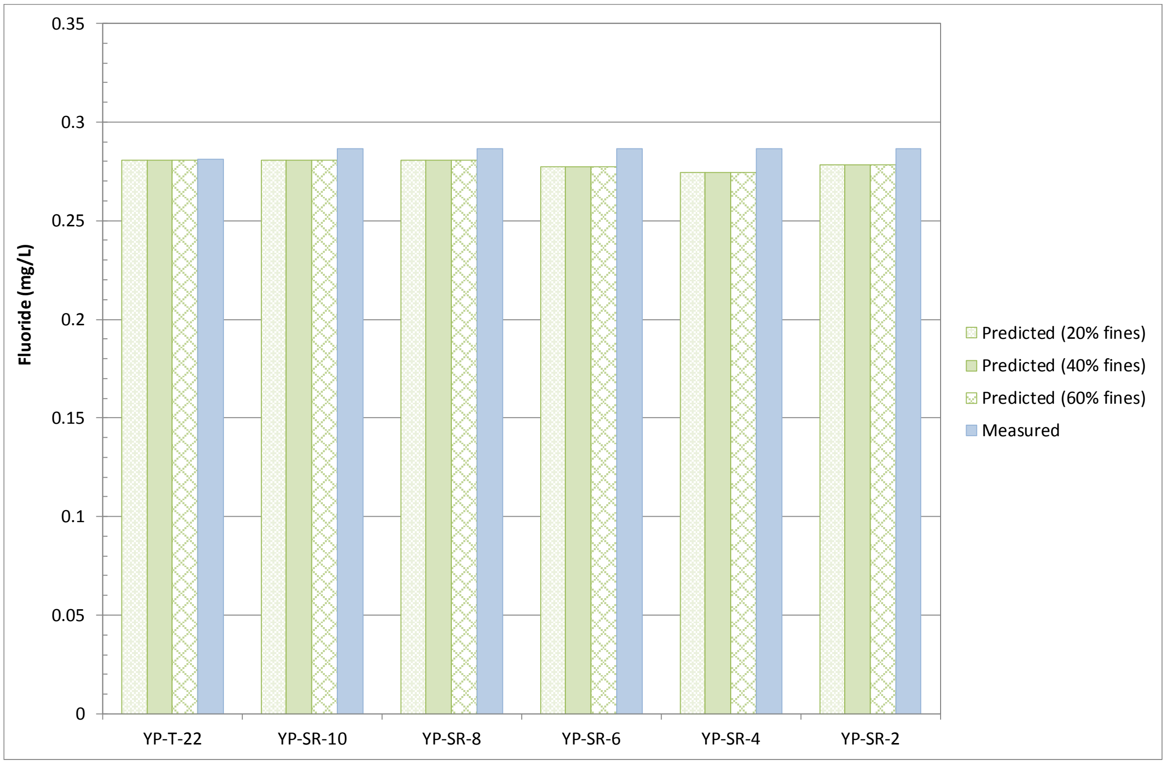


Figure F11: Grain Size Sensitivity Analysis for Predicted vs. Measured Fluoride under Average Flow Conditions

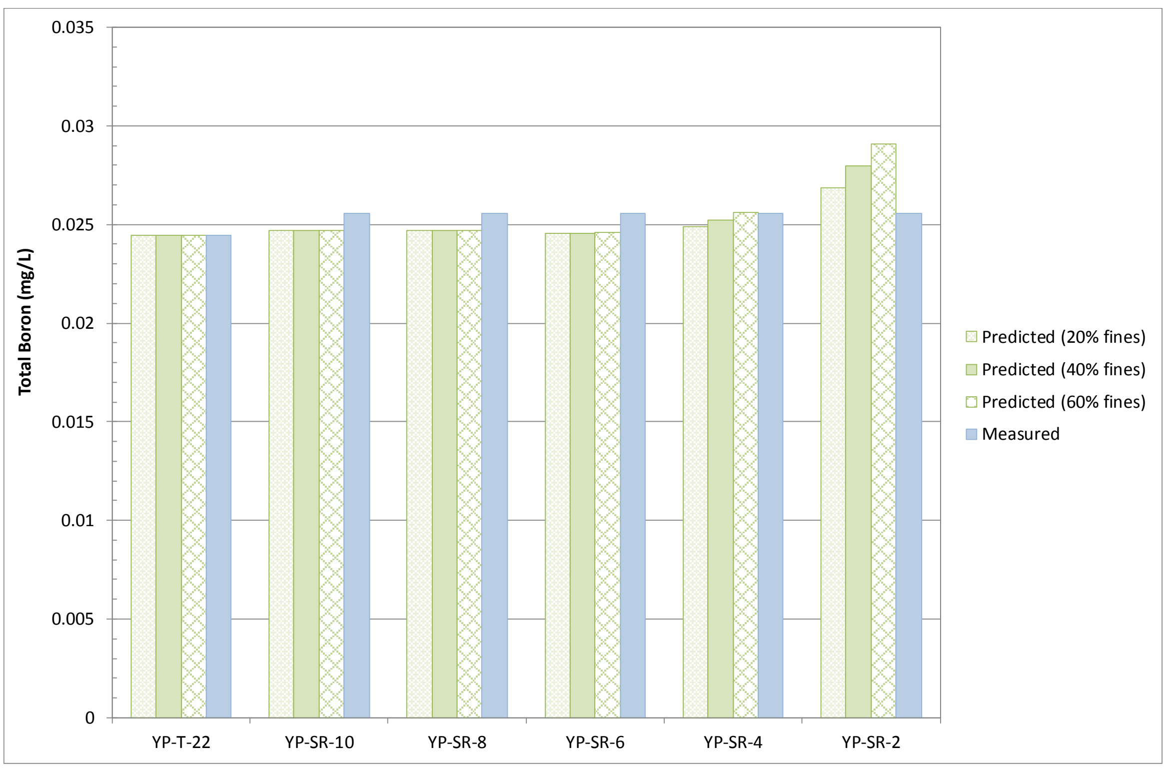


Figure F12: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Boron under Average Flow Conditions

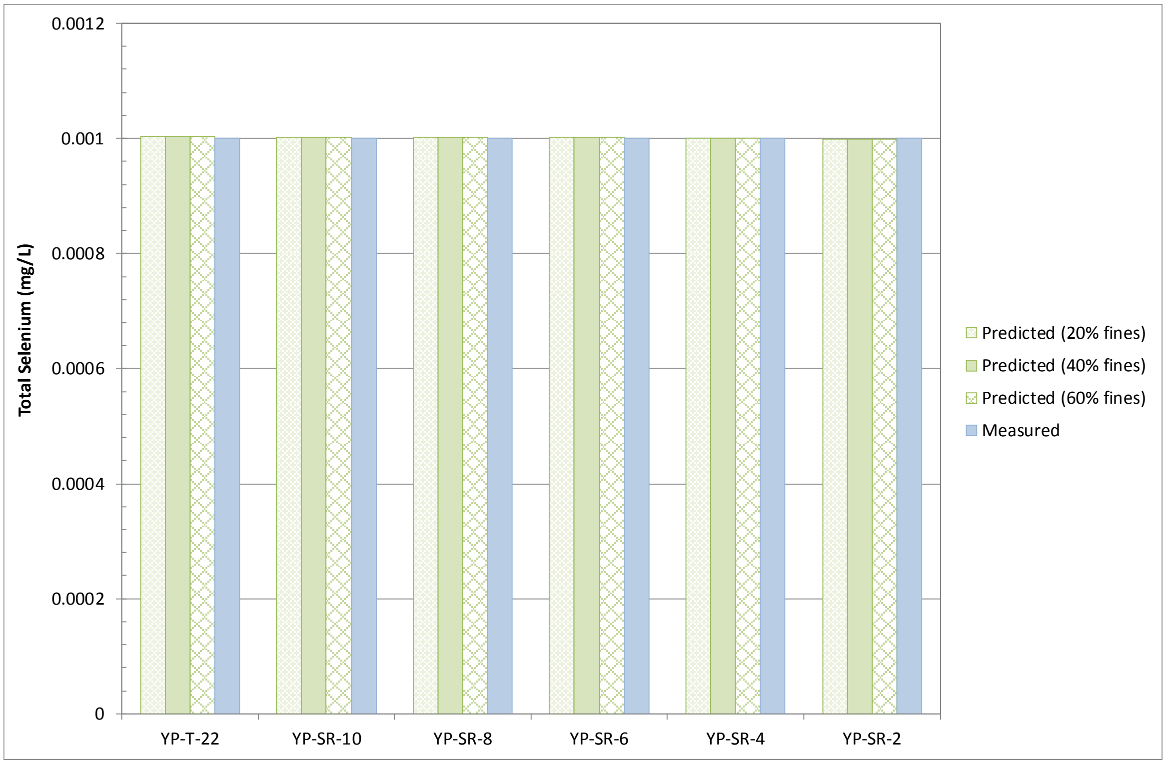


Figure F13: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Selenium under Average Flow Conditions

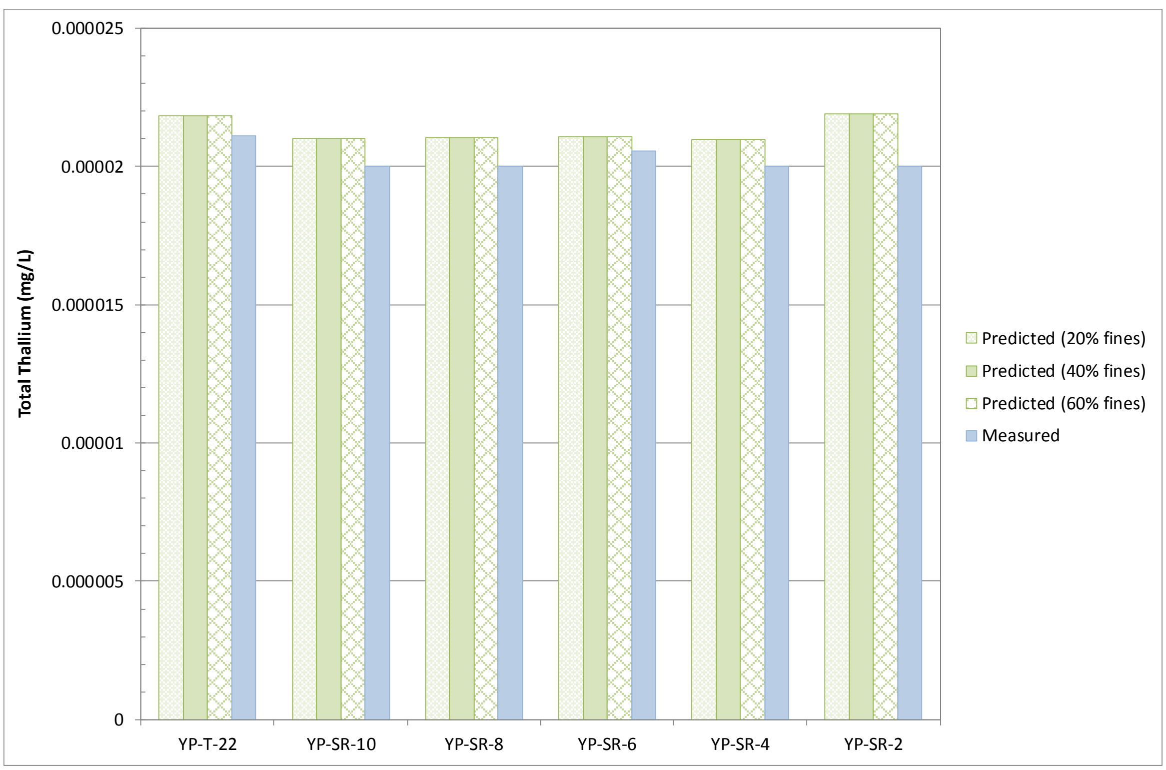


Figure F14: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Thallium under Average Flow Conditions

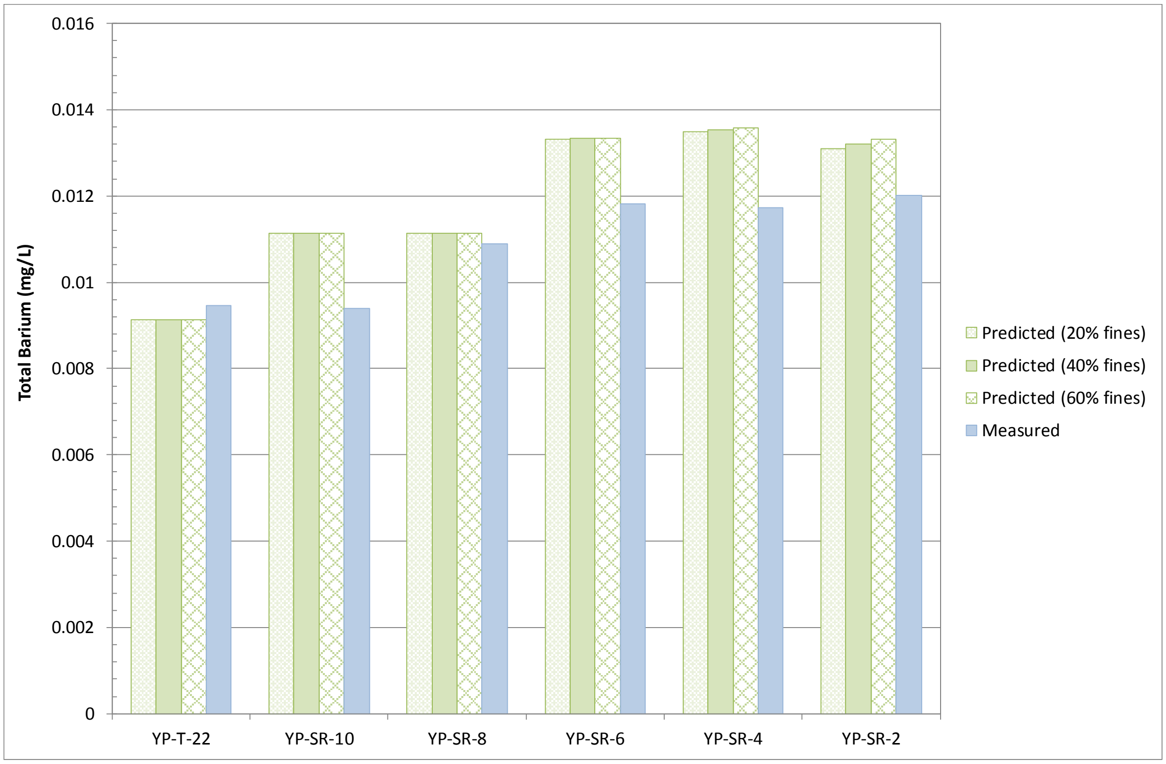


Figure F15: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Barium under Average Flow Conditions

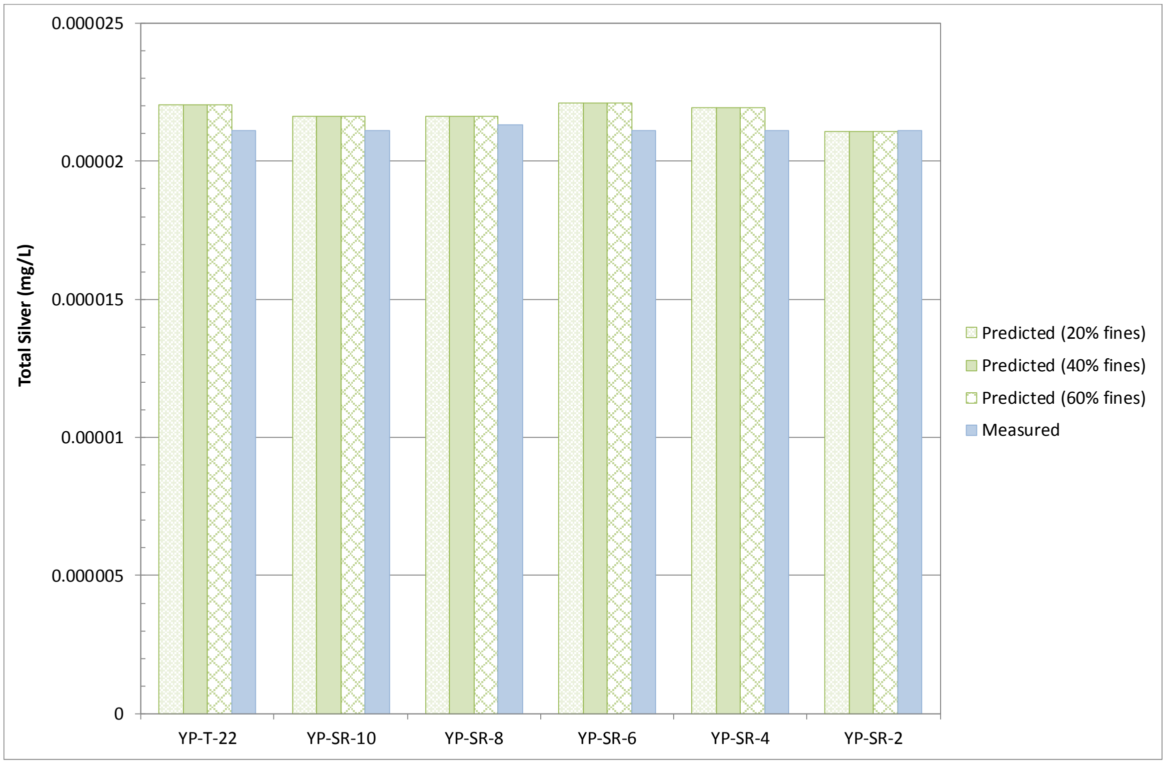


Figure F16: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Silver under Average Flow Conditions

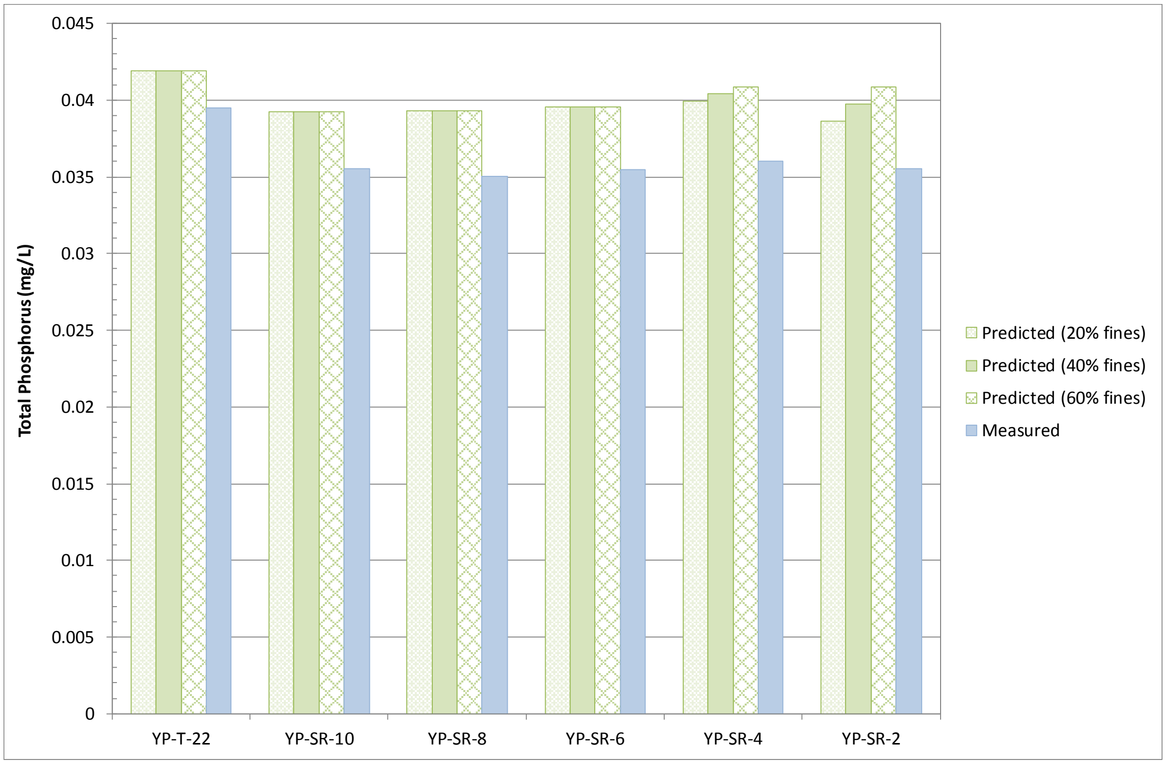


Figure F17: Grain Size Sensitivity Analysis for Predicted vs. Measured Total Phosphorus under Average Flow Conditions

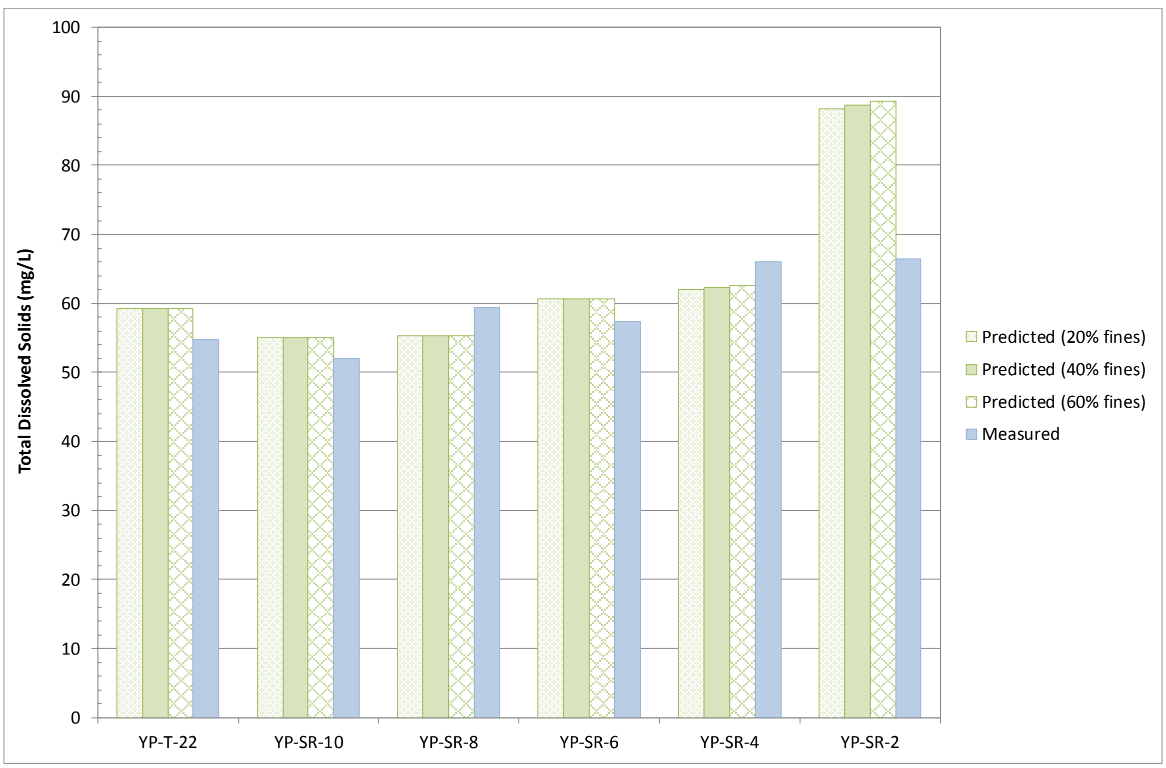


Figure F18: Grain Size Sensitivity Analysis for Predicted vs. Measured TDS under Average Flow Conditions