

TRAINING GUIDE FOR RECLAMATION BOND ESTIMATION AND ADMINISTRATION

For Mineral Plans of Operation authorized and
administered under 36 CFR 228A

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TABLE OF CONTENTS

Introduction	4
I. AUTHORITY	6
Notice of Intention	6
Plans Of Operation	6
Requirement for Reclamation Bonds.....	6
Reclamation Bond Amounts.....	6
Bond Instruments.....	7
Bond Adjustments	7
Bond Release	7
Bond Administration	8
II. BOND ESTIMATES.....	8
STEP 1 – determining the period of Operation covered by the bond?	9
Considerations for Small Exploration and Mine Operations.....	9
STEP 2 – WHAT IS BEING RECLAIMED?.....	10
STEP 3 – WHAT ARE THE STANDARDS TO BE MET?	12
STEP 4 – WHAT ARE THE RECLAMATION TASKS?	13
Interim Operations and Maintenance (Interim O&M).....	13
Hazardous Materials (Hazmat).....	16
Water Treatment	16
Demolition, Removal and Disposal of Uncontaminated Structures, Equipment & Materials (Demolition)	18
Earthwork	19
Revegetation	20
Mitigation	22
Long-Term Operation, Maintenance and Monitoring	23
STEP 5 – ESTIMATION OF DIRECT RECLAMATION COSTS	24
Introduction.....	24
Consistency of Approach.....	24
Comparison of Data.....	24
Sources of Cost Estimation Data	25
STEP 6 – ESTIMATION OF INDIRECT COSTS	40
Engineering Redesign Costs	40
Mobilization and Demobilization.....	41
Contractor’s Costs	41
Agency Project Management.....	42
Contingencies	44
Inflation.....	48
STEP 7 - SUMMARIZE AND REVIEW THE ESTIMATE	49
STEP 8 - BOND ADMINISTRATION	50
STEP 9 - BOND COLLECTION.....	50
Establishing Non-Compliance and/or Default.....	50
Bond Collection	51
Bankruptcy.....	52
REFERENCES	
SUMMARY OF COMMENTS	
APPENDICES	

Appendices

Appendix A	Guide Applicability to Small Scale Mining and Exploration Operations
Appendix B	Bond Administration
Appendix C	Plans of Operation Information
Appendix D	Selected Revegetation References
Appendix E	Guidance for Equipment Selection From OSMRE 2000
Appendix F	Reclamation Bond Summary Sheet
Appendix G	Technical Specifications

This Reclamation Bond Estimating and Administration Guide was prepared by the following Forest Service minerals specialists:

Mary Beth Marks	Geologist, Gallatin National Forest, Bozeman, Montana
Tom Buchta	Locatable Program Leader, Intermountain Region, Ogden, Utah
Craig Newman	Civil Engineer, Humboldt-Toiyabe National Forest, Elko, Nevada
Rod Lentz	Area Mining Geologist, Okanogan National Forest, Okanogan, Washington
Jeff Gabardi	Mining Engineer, Sawtooth National Forest, Twin Falls, Idaho
Peter Werner	Mining Engineer, Gallatin National Forest, Bozeman, Montana
Bob DeTar	Geologist, Tahoe National Forest, Nevada City, California
Tera Curry	Geologist, Eldorado National Forest, Placerville, California
Mike Doran	National Locatable Minerals Program Leader, Washington Office

Other contributors to the effort:

Mike Burnside – Minerals Program Leader - Northern Region
Ruth Seeger – Area Mining Geologist – Siuslaw National Forest
Jim Alexander – Office of General Counsel, USDA
Karyn Harbour - Geologist -Tonto National Forest
Pete Peters – Geological Engineer – Salmon-Challis National Forest
Rob Cordtz – Minerals Technician – Payette National Forest
Jeff Jones – Geologist – Caribou National Forest
Rusty Dersch – Regional Geologist – Rocky Mountain Region
Ron Baer - Geologist - Rocky Mountain Region

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RECLAMATION BOND ESTIMATION AND ADMINISTRATION GUIDE

For Mineral Plans of Operation authorized and administered under 36 CFR 228A

INTRODUCTION

During the mid to late 1990s, precious metals prices plummeted and mines in Nevada, Idaho, Montana and elsewhere had to be closed by the Forest Service using money from reclamation bonds. This experience demonstrated that reclamation requirements and bonds for mining operations on federal lands in the Western United States were inadequate in some cases, particularly in the following areas:

- Interim management of process fluids;
- The need for and cost of water treatment;
- Detoxification and rinsing of spent ore from heap leach piles;
- Closure of tailings impoundments;
- Removal, isolation (liners/covers) or treatment of hazardous materials (chemicals, spent ore, waste rock);
- Site drainage, interim and long-term;
- Monitoring and maintenance of the mine site during and after closure;
- Indirect costs of closure/reclamation; and
- Lack of site specific information in plans of operation

Reasons for inadequate bonds in these areas include the following:

- A perception that mining regulations (36 CFR 228A) limit what can be bonded. In the past, long-term maintenance, monitoring and interim management of the site was not included in the estimate. Now it is accepted practice for items like these to be included in the estimate.
- The lack of authority for the Forest Service to hold bond instruments that earn interest to fund long-term reclamation costs. The FS is working within its authority to define financial arrangements such as trusts which should be used to

fund long-term reclamation obligation. Additional discussion of this issue is found in **Step 4, Long-Term Operation, Maintenance and Monitoring.**

- Incomplete plans of operation. There is tremendous variation in mine deposits and their ecological setting, that may result in a wide range of complexities in mine and mill design. There is little Forest Service guidance, other than the basic plan of operation form, for defining completeness. The basic plan of operation format, while sufficient for many smaller operations, is inadequate for large, complex operations.
- Use of conceptual project design. By necessity, most bonds are initially estimated based on conceptual plans. Final and as-built plans and drawings should be used to revise estimates as they become available.
- Assumptions about environmental effects. Predictions made during permitting should be rigorously verified throughout mine life by proper design and use of monitoring and research data collection programs.
- Lack of FS guidance on how to estimate bonds. Existing guidance from other agencies like the Office of Surface Mining does not adequately address hard rock mineral activities and the FS currently has no guidance of its own.
- Finally, persons with inadequate education, training or experience often estimate reclamation costs. Because of the reasons given above, bond estimates for hard rock mines require considerable judgment that can only be gained through experience, and maintained through continuous practice.



This Reclamation Bond Estimation and Administration Guide (Guide) was written to capture the lessons learned by the Forest Service and other state and federal agencies, as a result of having to close a number of bankrupt and abandoned hard rock mines. The following caveats are needed up-front.

- This guidance is designed to help ensure that reclamation costs are accurately and consistently estimated, so that reclamation bonds are adequate to fund reclamation and closure. It is not designed to produce overly conservative or “worst case” bond estimates.
- The Guide applies to both large and small minerals operations, including mine development and exploration. Appendix A discusses the applicability of the Guide to small-scale operations.
- The Guide includes general discussions of factors that affect cost estimates, like reclamation practices and standards, but does not provide detailed guidance on these topics. The Guide provides references that contain more information on these subjects.
- The Guide is to be used in estimating new bonds and updating existing bonds.
- The Guide will be periodically updated and is meant to be a dynamic document for bond estimating. We plan to continue to learn and share that information so that our bond estimates continue to improve.

While much of the information in this Guide is based on experience gained from the

administration of relatively large mines, the overall process can be applied, with modification, to smaller minerals operations. The basic steps and elements of bond estimation should be considered for small operations with the recognition that it may be necessary to significantly modify, eliminate or scale down certain elements. Appendix A provides some specific guidance for small operations.

Although this guide is written specifically for locatable mineral operations authorized under 36 CFR 228A, the principles and guidance presented in Section II, Bond Estimates, applies to other types of mineral operations such as mineral materials (sand, gravel, stone, etc.) and solid leasable minerals (phosphate, trona, etc.).

Finally, we want to recognize that the majority of hard rock operations are reclaimed in accordance with their approved Plans of Operation. Even when in bankruptcy, many operators continued to maintain site facilities and were instrumental in assisting the FS and other agencies in closing their mines. Without the assistance of these operators and other individuals in the mining and engineering industry, the unanticipated reclamation and closure of these mines would have been much more difficult.

The organization of the Guide is as follows:

- **AUTHORITY** – This section outlines the basic purpose and legal framework for reclamation and bonding under our 36 CFR 228A regulations. It addresses common questions about bond estimates, bond instruments and bond administration.
- **BOND ESTIMATION** – This section covers the information needed for bond estimates as well as the estimation process itself.
- **APPENDICES** – A number of appendices have been included which offer additional guidance and information.

work may be performed and is made part of the POO prior to approval.

I. AUTHORITY

Notice of Intention

A notice of intention to operate (NOI) is required from any person proposing to conduct operations that might cause disturbance of surface resources on National Forest System (NFS) lands. Such notice of intention shall be submitted to the District Ranger having jurisdiction over the area in which the operations will be conducted. If the District Ranger determines that such operations will likely cause significant disturbance of surface resources, the operator shall submit a proposed plan of operation (POO) to the District Ranger.¹

Plans Of Operation

36 CFR 228.4 describes the content of a plan of operation including provisions for reclamation. *“The plan of operation shall include..... measures to be taken to meet the requirements for environmental protection in Sec. 228.8”*². Section 228.8 goes on to address specific resources and facilities like roads, and includes a section on reclamation (228.8g). This direction is general, and detailed POOs must be developed by the Operator and FS so that the information necessary for bond estimation is available. The kind of information needed for bond estimation is discussed in general in Steps 2 and 3 of this Guide. Other guides for POO completeness are presented in Appendix C of the Guide for large or complex mining operations. The FS Plan of Operation Form, FS 2800-5 is a useful guide for smaller, less complex exploration and mining operations. The bond estimate itself, once completed, may add details as to how reclamation

¹ 36 CFR 228.4

² We often hear reference to “reclamation plans”. It is important to remember that there is no requirement for “reclamation plans” in FS regulation or policy. Reclamation requirements should be an integral part of the POO even if, in the case of large or complex operations, the reclamation requirements are described in a separate document. Such separate documents should be clearly incorporated by reference into the overall POO before approval.

Requirement for Reclamation Bonds

*“Any operator required to file a plan of operations shall, when required by the authorized officer, furnish a bond conditioned upon compliance with 228.8(g), prior to approval of such plan of operations.”*³ (emphasis added)

The following is a summary of the above regulation:

- A. We have the authority to bond for Plans of Operation (not Notices of Intent) to cover the cost of required reclamation on NFS lands. If a bond is necessary to insure performance of reclamation and mitigation measures because of the impacts, we should require a plan of operations, not a notice of intent.
- B. Bonding is discretionary. However, according to Forest Service Manual (FSM) direction (FSM 6561.3) bonds are required to cover the cost of reclamation described in the plan of operation. and;
- C. Bonds should be provided to the authorized officer before Plan approval.
- D. Bond estimates are subject to challenge through the FS appeals process (36 CFR 251).

Other policy statements in the Forest Service Manual (FSM 2817.24, 2840.3, 6561.3) and Handbook (FSH 6509.11k, Chapter 83.4) reinforce this regulatory direction.

Reclamation Bond Amounts

*“Bonds are required to cover the estimated reclamation costs for prospecting, mining and other mineral operations on National Forest System Lands”*⁴. *“In determining the amount of the bond, consideration will be given to the estimated cost of stabilizing, rehabilitating, and reclaiming the area of operations.”*⁵

³ 36 CFR 228.13(a)

⁴ FSM 6561.3

⁵ 36 CFR 228.13(b)

The wording in the regulations is general. Again, based on our experience in reclaiming mineral operations, we have identified actual costs for mine closure and reclamation that historically have not been included in reclamation cost estimates.

Bonds should address all FS costs that would be incurred in taking over operations because of Operator default. Bonds should be estimated based on contracting the required reclamation work according to the Federal Acquisition Regulations (FAR). Even for small operations with simple reclamation, reclamation costs need to be estimated based on the actual costs to complete the work. Work that would cost less than \$2500, would not require competition. Davis-Bacon wage rates do not apply to construction contracts under \$2000. Appendix A explains the authorities of contracting for reclamation work for small operations.

Bond Instruments

36 CFR 228.13 and FSM 2817.24 describe bond instruments in general. FSH 6509.11K contains a comprehensive list of all acceptable bond instruments, and also includes **the requirement for use of FS-6500-7 for all reclamation bonds**. The regulatory basis for the types of bond instruments that are acceptable to the federal government is found in the Federal Acquisition Regulations.

Many states also require reclamation bonds for mining operations. Wherever possible the Forest Service should work cooperatively with such states to avoid duplication or double bonding. However, some states accept bond instruments that the federal government cannot. The Forest Service should not waive its bond requirements in lieu of a state bond involving an instrument that is not acceptable to the Forest Service. In some instances, we have Memoranda of Understanding between the FS and other agencies that outline procedures for joint bonding. In those instances, it is advisable that all parties covered by the bond are named on the bond instrument or there is a legal contract between the bonded parties that specifies how the bond will be used.

In addition to meeting the requirements of the Forest Service Handbook and Manual, choice of

bond instruments should consider the safety and accessibility of the instrument. Some costs will begin almost immediately after operator bankruptcy or abandonment; yet some bond instruments, such as sureties, may take up to a year or more before they can be secured. In this case a readily available bond instrument (i.e.; cash, certificate of deposit, or letter of credit) should be required in the POO to cover these immediate costs. As noted above, some states may have similar bond requirements which may satisfy the need for readily accessible bonds. One operation may have several different types of acceptable bond instruments depending upon the type of work to be covered.

Bond Adjustments

The 36 CFR 228A regulations provide for new or adjusted reclamation bonds when making decisions to approve initial, modified (228.4(e)) or supplemental (228.4(d)) POOs. To ensure the bond can be adjusted as needed to reflect the actual cost of reclamation, the FS should **include provisions allowing for the periodic adjustment of bonds in the Plan of Operation prior to approval**. (See FSM 2841.1(f) and Section VI.B of the FS POO Form, FS 2800-5).

Bond Release

36 CFR 228.13 directs the FS to release reclamation bonds for work that has been completed. FSM 2842 states that a plan of operation should contain measurable performance standards for all reclamation requirements. These performance standards are used both in estimating the reclamation cost for bond purposes as well as criteria for bond release. These kinds of standards are discussed in more detail in Step 3 of this Guide. Bonds may be released in two different ways. Partial bond release occurs as work is completed, whereas final bond release occurs when all work is completed in accordance with the POO.

Remember that the reclamation bond estimate may not represent the actual amounts appropriate for a specific item for partial or final bond release. Prior to any partial bond release, the authorized officer should ensure that the entire bond is adequate by considering the following:

- Does the work meet all standards required by law or described in the approved plan or permit?
- What is the likelihood that the work will continue to meet standards? Where long-term success is uncertain, performance standards should be specified in the plan of operation. The performance standards should be met and that success should be demonstrated over a certain period of time before the applicable part of the bond is released. For example, water treatment should be maintained until monitoring/test results demonstrate a stable or improving trend of compliance. In the case of revegetation, the required composition, cover or productivity should be maintained for a series of years before being considered successful. The length of time required to demonstrate successful reclamation will vary by site and mine component and should be stated in the POO.
- Would the remaining total bond amount (after partial release) be adequate to cover all remaining reclamation work?

If the total bond amount is not adequate, the authorized officer should update the bond estimate to ensure that any remaining reclamation work is adequately secured. No partial bond releases should be allowed until the total bond amount is adequate.

Bond Administration

Additional bond administration issues such as acceptable bond instruments, filing, review, adjustments, release of bond instruments, joint bonding and other issues can become as important as the bond estimate itself. These and other topics are addressed in Appendix B.

II. BOND ESTIMATES

The following statement regarding cost estimation for road construction is also true for estimating reclamation costs for mine operations:

“There is no formula that can be used to arrive at an exact construction cost. Each project is a unique situation. Experience, judgment, and knowledge of the job are prerequisites to arriving at an estimate that represents a fair market value for the work to be performed.” (Cost Estimating Guide for Road Construction, USDA – Forest Service, Regions 2, 3, 4, 2002.)

The reclamation bond amount is an estimate of both the direct and indirect costs to reclaim the mineral operation. A basic premise of the estimate is that the operator is not available to complete the reclamation and the Forest Service would need to do the reclamation work. The direct cost of reclamation is based upon the details of the closure and reclamation work outlined in the approved POO. The level of detail will evolve from conceptual design during permitting, to actual design and as-built specifications during construction. Bond estimates should be adjusted as the level of information changes. Indirect costs are those fees and charges over and above the direct reclamation costs that are encountered during any reclamation project. Operators should be invited to participate in every step of bond estimation, such as the initial calculation, development of the detail needed to calculate the bond and discussion of applicable costs.

Examples of bond estimates for different kinds and sizes of operations can be obtained from regional or Forest mineral specialists. Such examples are from past operations and the cost estimates were developed for a specific site at a given time. **Costs from other bond estimates should not be used at other operations without verification.**

The following steps are necessary for bond estimation and administration.

Step 1 – DETERMINING THE PERIOD OF OPERATION COVERED BY THE BOND.

Step 2 – WHAT IS BEING RECLAIMED

Step 3 – WHAT ARE THE STANDARDS TO BE MET

Step 4 – WHAT ARE THE RECLAMATION TASKS

Step 5 – ESTIMATION OF DIRECT RECLAMATION COSTS

Step 6 – ESTIMATION OF INDIRECT COSTS

Step 7 – SUMMARIZE AND REVIEW THE ESTIMATE

Step 8 – BOND ADMINISTRATION

Step 9 - BOND COLLECTION

The following narrative discusses these steps in further detail.

STEP 1 – DETERMINING THE PERIOD OF OPERATION COVERED BY THE BOND?

Bonds may cover a single year, multi-years or the entire life of mine. Selection of the bond period may be based upon some logical stage of mine development such as the construction of, additions to, or reclamation of major mine facilities like tailings ponds, heaps and mine facilities. The bond period may also consider regulatory requirements of the state and other cooperating agencies, or other factors.

Whatever period is covered by the bond, the estimate should address the peak reclamation cost in that period. In the past bond estimates have often been based on the assumption that the peak cost to reclaim a mine is at completion of mining operations. This is not always the case, particularly where costly reclamation work is planned for completion prior to the end of mine life. For example, at a recent mine in Idaho, the end of mine life bond estimate assumed that acid producing waste rock mined early in the operation was buried by net- neutral materials mined later in the operation. When the mine shut down before the net neutral materials were mined, the FS was left with a large reclamation cost that was not covered by the bond.

The potential for this kind of underestimation of reclamation cost is greatest for large, complex mining operations, but exists to some extent for any multi-year operation. One way to avoid underestimating reclamation costs in this way is to estimate the time during the operation when reclamation costs peak. This cost should be estimated based on anticipated reclamation as

approved in the POO (**not worst case scenario**). This will normally occur during the bond period when some combination of the following exists:

1. Greatest area of disturbance;
2. Most equipment, facilities or materials onsite;
3. Largest volume of and/or greatest distance that materials have to be moved in backfilling/regrading;
4. Greatest volume or exposure of materials, facilities or equipment needing special handling, covers, or treatment (i.e., potentially acid-generating material, chemicals, barrels, etc.).
5. Greatest disturbance of resources requiring high cost reclamation or mitigation such as diversions, stream channels, floodplains, wetlands or treatment facilities.
6. Operation, monitoring and maintenance costs of mine facilities that are needed in both the short and long-term to ensure public safety and prevent environmental damage are most costly. (See discussion in Step 4 for Interim Operation and Maintenance)

The point during the operation when peak reclamation expense occurs may be determined subjectively by analyzing the mine schedule and considering the above conditions. A more quantitative method involves the calculation of reclamation costs on an annual basis during the bond period or the entire mine life. Either approach requires that the POO contain a description of planned construction, operation and reclamation as described in Step 2 of the Guide. This fosters a more clear understanding of how the operation will progress, encourages concurrent reclamation, and lays the ground work for both incremental bonding and phased bond release

Considerations for Small Exploration and Mine Operations

Life-of-mine or life-of-project estimates and bonds are most suitable for smaller, less complex exploration and mine operations. In some cases, small operators may limit the amount of bond needed by breaking the operations in smaller stages and performing concurrent reclamation.

For example, conducting a 10 acre placer operation in one acre increments, backfilling and recontouring previously used ponds, roads, mined area before opening another 1 acre increment. This has advantages for both the FS and operator in that the reclamation work and bond needed are minimized. However, this approach requires good administration and monitoring to ensure that work covered by the bond instrument is not exceeded. In addition, organizing the bond estimate by year or some other increment also provides a basis for incremental bond release.

STEP 2 – WHAT IS BEING RECLAIMED?

POOs should describe the **facilities, equipment, activities, materials, and associated surface disturbance** (hereafter referred to as facilities) that would be reclaimed. These descriptions will vary with the size and complexity of the operation involved, but should always describe both the “as built” and “reclaimed” condition for some point in time (see Step 1) when reclamation will occur. This description should address all items in Steps 2 and 3.

Ultimately, these descriptions should be sufficiently detailed so that they could be used to prepare the engineering specifications needed for a reclamation contract. In reality the level of detail in a POO evolves as it is submitted, processed, approved and implemented.

At the project initiation stage, POOs typically contain conceptual level descriptions of the proposed operation based on the results of prospecting, exploration and development activities. This level of information is necessary to allow the FS to initiate the National Environmental Policy Act (NEPA) analysis from scoping through data collection.

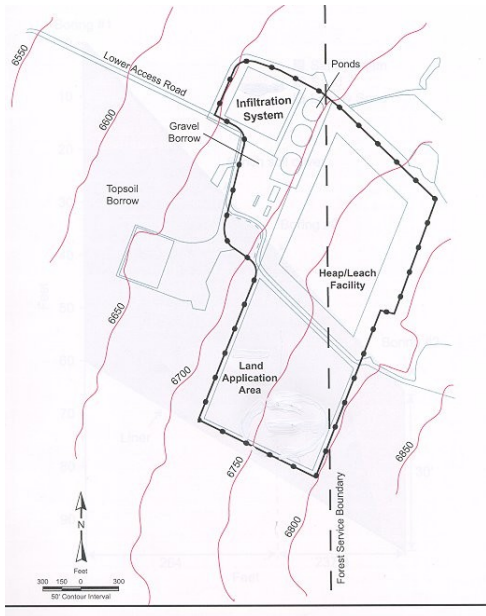
During NEPA data collection and analysis stage, the Operator and/or the FS gather site-specific engineering and environmental baseline data to further characterize the proposed operation, and other reasonable alternatives. These data will often be used by the operator to refine the proposed action, and by the FS in the analysis of alternatives and prediction of effects in the draft NEPA document.

At the approval stage, the POO should be modified by the Operator to implement any changes from the NEPA analysis that the authorized officer determines are necessary to meet the intent of the locatable regulations. At this stage, especially for large or complex operations, the Operator may have engineering drawings and plans for the construction of mine facilities. Initial bond estimates are typically based on this level of information. As noted in Step 1, a schedule of facility construction, operation and reclamation, by year, for the life of the operation is needed to support a bond estimate for a large, complex or multi-year operation. Descriptions of the facilities for small, simple mining or exploration operations may focus on a single point in time when reclamation costs would be greatest, such as a pit that is to be backfilled is totally open.

Finally, as the project is constructed and operated, additional engineering and environmental information is submitted and used to update the initial bond estimate. Appendix C - C1, discusses in more detail, the kind and timing of information needed in POOs. Appendix C - C2 provides a checklist for information needed in a POO, lists possible facilities at mine sites that may need to be reclaimed and actions, such as monitoring, which may be required. These are examples of items that should be included in the bond estimate.

The estimator should be involved in the POO review in order to ensure sufficient detail is provided for estimating purposes. POOs rarely contain the level of detail that is needed for contract specifications and drawings, which is the level of detail needed for an accurate cost estimate. The estimator generally bases his or her initial estimate on a conceptual plan at the permitting stage, which may lack details that should come available as the project advances. (As mentioned previously, this is another reason for regular bond reviews). To compensate for this lack of detail, the estimator should be familiar with mining, reclamation, and heavy civil construction projects, in order to include applicable assumptions and contingencies to account for the inherent uncertainty in the proposed reclamation plan.

Obtaining the level of detailed information discussed may be difficult for small mineral operations. The mineral administrator may need to make a number of specific requests to obtain the kind of information needed from a small or inexperienced operator. If those details are not available, the bond estimator will need to make conservative assumptions (which will likely result in increased bond costs).



Typical categories of information needed to describe the facilities include:

1. Location of the facilities - Adequate maps, scales and contours will vary based on the information being portrayed. Appendix C provides some guidance on the types of maps that will be needed. Include the location of off-site facilities that are not necessarily part of the operation to be reclaimed, but are necessary to perform reclamation such as, material sources, sanitary landfills, hazardous materials disposal sites, etc.
2. Types of equipment, materials and facilities - Include information important to how these should be transported, stored, used or disposed of such as material safety data sheets (MSDS).

3. Quantity/size of equipment, materials, facilities including numbers, dimensions (length, width, height), area and volume - This description should include both narratives and design drawings showing plan views, layouts, representative cross sections and profiles. Appendix C provides some guidance on typical figures.
4. Size and type of surface disturbance, including exposed material characteristics that could affect physical and chemical stability and reclamation/revegetation - This description should include both narratives and design drawings showing plan views, layouts, representative cross sections and profiles. Appendix C provides some guidance on typical drawings and figures. It should also include the location, types (specifications) and volumes of select materials required for reclamation such as gravel, rip-rap, clay etc.
5. Data obtained from studies, modeling and/or monitoring that define baseline conditions or predict post mining characteristics of surface resources like soil, vegetation, topography, surface and groundwater. These data will be necessary to design any reclamation of these resources.

Descriptions of facilities should be submitted as, but not limited to, narratives, tables, maps at an appropriate scale and contour interval to support accurate measurement of distances and volumes, plan views, profile views and cross sections of facilities. Typically, site-specific survey information is downloaded into a geographic information system, CAD (computer aided design) or other drawing programs in order to produce maps at variable scales and contours.

Initial bond estimates will likely be based on conceptual design narratives, drawings and maps. As the project is constructed, more detailed information will become available, enabling the operator to prepare detailed design and “as built” drawings that should be used to recalculate or confirm initial bond estimates.

STEP 3 – WHAT ARE THE STANDARDS TO BE MET?

Standards, as used in this guide, are criteria used in the bond estimate to measure whether the reclamation objectives and requirements in a given POO have been achieved.

Reclamation objectives and requirements and the resulting standards are developed through the NEPA (National Environmental Policy Act) analysis, and implemented by inclusion in the approved POO. Often they are based on higher order planning documents such as Forest Plans, as well as other state and federal laws, rules, regulations, plans and permits. Through this process they reflect input from other state and federal agencies, the public, as well as extensive discussion with the Operator.

As an example, a reclamation objective may be to ensure that a cyanide heap leach pad is left in a stable and productive condition that is compatible with the pre-mining topography, vegetation and land use. Standards to implement that objective might include specifications for removal of facilities, backfill of ponds or excavations, testing of heap materials and leachate, acceptable side-slope gradients, soil replacement and vegetative composition and productivity. Use of such measurable standards allows the Forest Service to estimate the equipment, labor and supplies that will be needed to meet the standard and achieve the objective.

It is not unusual for additional standards to be developed as part of the bond estimation process. This takes place after NEPA documents are issued, but before POO approval. These additional standards typically address the “how to” of reclamation work, and would not have the effect of creating new reclamation requirements that result in different environmental impacts from those disclosed through the NEPA process. This is why it is important that the bond

estimator, along with other resource specialists, participate in developing appropriate standards through the analysis, processing and plan approval process.

Reclamation standards and bond estimates (with accompanying details) become legally binding when the operator changes the proposed POO to include them, posts the required bond, and is notified by the authorized officer that the POO is approved. Standards apply to project facilities, materials, equipment and associated surface disturbances, and typically address the following issues:

1. Interim operations and maintenance (O&M) needed to ensure the integrity of project facilities and systems whose failure could potentially endanger human health and the environment when there is no operator and the Forest Service is responsible for the site. Typically these include fluid management and treatment, site maintenance of site access, utilities, fences and facilities such as heap leach pads and ponds, tailings impoundments, storm water system and buildings where chemicals/reagents are stored.
2. Hazmat - Isolation, removal, treatment or control of hazardous or toxic materials;
3. Demolition – Removal/disposal of non-contaminated facilities, equipment and materials (buildings, concrete foundations, etc.).
4. Facility Design – All engineered facilities that will be left, or constructed for reclamation/closure will have associated design standards. Particularly important are facilities that should perform as designed over the long-term in order to protect human health and the environment. Examples are those needed to isolate or store hazardous materials (covers, caps, liners) and divert, convey, treat or store water (diversions, dams, ditches, channels, water treatment plants, etc.).
5. Water Quality - water quality standards (federal and state) which should be met by project discharges;
6. Landform - Acceptable post-mining land slopes, drainages and contours;

7. Stability – Standards for physical (mass stability, erosion) and chemical stability (release of hazardous or toxic substances) of project components;
8. Revegetation - Acceptable vegetative communities and ground cover requirements;
9. Mitigation - Mitigation required to compensate for damage which cannot be avoided. Typically this involves special construction techniques related to stream channels, wetlands, wildlife habitat, recreation, cultural or other resources;
10. Monitoring/Maintenance - Reclamation protection and monitoring requirements;
11. Safety – Includes all public related safety requirements including fencing, signs, berms, adit closures, etc.
12. Permitting – The Forest Service may have to meet some state or federal requirements if forced to assume reclamation and closure responsibilities.

The operator should reference the applicable standards that apply to each project facility, material, equipment and activity in the bond estimate.

Typical examples of such standards are discussed in Appendix C1. Additional examples of standards may be obtained by reviewing recent environmental impact statements or plans of operation for similar operations and environmental conditions. Such standards should not be incorporated without appropriate modifications for site-specific conditions.

State or federal agencies with jurisdiction over mine facilities should be contacted for advice on required standards.

STEP 4 – WHAT ARE THE RECLAMATION TASKS?

Once you have the necessary project information and the performance standards are determined, the activities, equipment, material and personnel needed for reclamation can be described and costs estimated.

Typical reclamation tasks fall into the eight categories listed and described below. This list can be used to organize your bond calculation:

- Interim Operation and Maintenance
- Hazardous Materials
- Water Treatment
- Demolition, Removal and Disposal of Uncontaminated Structures, Equipment and Materials
- Earthwork
- Revegetation
- Mitigation
- Long-term Operation, Maintenance and Monitoring

Interim Operations and Maintenance (Interim O&M)

When an operator abandons the site or goes into bankruptcy, some mine facilities and operations should be immediately operated, maintained, and monitored by the FS or a cooperating Agency to assure public safety and environmental protection until bonds are secured, contracts awarded and reclamation work completed.

If an operation is in bankruptcy, existing facilities may be removed by creditors and be unavailable for use at the mine site (i.e.: water treatment plants, pumps and piping, generators, heavy equipment and other rolling stock, etc).

As a general rule, we recommend that bonds be estimated assuming that all equipment, supplies, and labor needed for reclamation will be obtained through the federal contracting process, and no onsite equipment or materials will be available to the FS. The reason for this assumption is that such facilities and equipment may not be available to the FS or its contractors during final reclamation in the event of bankruptcy, abandonment, or other instances of Operator default.

For an exception to this general rule to be considered, a legally binding agreement must be developed that assures that the facility or

equipment in question will be available for use by the Forest Service in the event of operator default, bankruptcy or abandonment. The prerequisites for such agreements are demanding. At a minimum the property must be present onsite, operating, and maintained to be capable of meeting meet current and all future expected requirements. The owner/operator must have fee simple title and there must be no other owners or lien holders.

Discussions with Forest Service legal counsel have indicated that there may be a mechanism whereby an operator can irrevocably commit equipment or other personal property to the FS as part of the bond for the plan of operations. This could perhaps be done through a lien arrangement where the operator commits the equipment as collateral in part for the bond, or through a "title in escrow" agreement whereby title to equipment unencumbered by other liens can be held in an escrow account. What approach might be best needs further legal research, however. As we obtain more suggestions, information, or other legal advice to further address this issue, we will include it in future updates to this Guide.

Prior to considering such an agreement, obtain the assistance and advice of your Regional Minerals Program Leader and Office of General Counsel. We recommend this type of agreement be limited to critical equipment or facilities that must be kept in immediate operation to assure public safety and prevent environmental damage, should default, bankruptcy, or abandonment occur. The facilities most likely to fit this definition are those described in this Guide under "Interim Operation and Maintenance", and include equipment for diverting, pumping, conveying, storing or treating storm water or process water, as well as the ancillary facilities needed to support them (power and distribution lines). In short, pumps, pipes, water treatment plants and supporting facilities might qualify. It should be noted

that that such an agreement might satisfy part (construction of a facility) of the bond obligation, but other costs (maintenance, replacement, power, labor, supplies) still need to be covered by the estimate.

This Guide makes a distinction between operation and maintenance which should be done immediately after bankruptcy or abandonment (discussed here) and long-term monitoring and maintenance of an operation after reclamation and closure is complete (discussed later in the Guide). The above discussion is also applicable to long term monitoring and maintenance.

Interim operation and maintenance responsibilities fall into the following general categories:

1. Public Safety - Some sites may require immediate action to assess and address public safety issues. Sometimes facilities are left which require installation of signs, fences, gates, berms, adit closures or other measures to assure physical safety issues. The most common measures include signing, fencing, gates or berms to warn the public of hazards associated with open pit highwalls, underground mine openings and unsafe buildings or facilities where chemicals, petroleum products or reagents are stored. Long-term maintenance requirements of any physical safety facilities should be minimized to the extent possible.



2. Access and Utilities – Another immediate concern at many sites is to provide or maintain site access, including road maintenance and snow removal; and to continue to provide utilities, such as electricity, water and gas that are needed for the operation. Long-term maintenance requirements

of any access or utilities should be minimized to the extent possible.



3. Water Management – By far the most critical and costly interim operation and maintenance requirement is for facilities designed to divert, convey, store or treat water. Operation and maintenance of these facilities may be as simple as inspecting diversions, ditches, pipelines, tanks and sediment ponds to ensure that they are intact and capable of handling design flows. For other facilities such as cyanide heaps, mine adits, tailings or other lined ponds, water or solutions may have to be actively managed by pumping or treatment to prevent discharges which endanger human health or the environment. Long-term maintenance of any water management facility should be minimized to the extent possible.

All interim operation and maintenance requirements should be evaluated when processing POOs and identified and addressed in the POO prior to approval. Initial bond estimates will be made on the basis of descriptions in the approved POO. Later, these initial estimates should be adjusted based on actual cost data obtained during operations.



The cost of these operations and associated maintenance and monitoring should be identified separately in the bond estimate, and secured by a bond instrument that is readily and immediately available in the event of abandonment or bankruptcy (cash, certificate of deposit, letter of credit, etc.). There is no preset time period for the interim operation and maintenance of a site prior to the start of reclamation; much depends on the legal proceedings associated with the bankruptcy. It is probably a good rule-of-thumb to allow for a minimum of 6 months for smaller operators whose corporate structure may not be that complex, while the bankruptcy of large operators may be litigated for 12 months or more. Another factor that may extend the length of interim operations needed prior to the start of reclamation is the time at which the bond is collected relative to the construction season. For instance, if a bond is collected in September and reclamation work can not begin until May, the cost of interim operations and maintenance for 8 months should be included in the bond.

If there are leach pads, tailings impoundments, underground workings that have an adit discharge or any other kind of operation that uses water, provisions should be made for the ongoing management and treatment of these solutions. This manual makes a distinction between water management during an interim period and water management and treatment once reclamation and closure has begun in earnest. During the interim period this may involve little more than monitoring water levels in ponds, or it may require more costly undertakings such as the recirculation of millions of gallons of solution to avoid system upset and impacts to health and environmental safety. Water treatment systems

are addressed in more detail in a following section.

Hazardous Materials (Hazmat)

This task includes the cost of decontaminating, neutralizing, disposing, treating or isolating hazardous materials used, produced, or stored at the project site. Detailed information about chemicals, petroleum products and other hazardous materials used or produced on site should be described in the Plan of Operations (descriptions of materials, volumes and containers). Good administration is needed to verify the materials actually on site and any contaminated soil that may be present. At a minimum, an inventory of hazardous materials onsite should be completed during the bond adjustment.

The following are typical hazmat items to be considered:

1. Chemicals or petroleum products, which should be disposed of as a hazardous waste. (Costs may be obtained from existing hazardous material contracts, Regional or Forest Hazmat specialists or environmental engineers. Testing and disposal should be separate contracts. If it is one contract, the contractor will bid disposal assuming all materials are hazardous.)



2. Mill buildings, labs, vehicle maintenance and wash facilities, chemical and fuel storage areas which likely would have an accumulation or storage of chemicals, petroleum products or other hazardous materials would need to be decontaminated or removed for offsite disposal. Examples of such facilities

includes sumps in laboratories and vehicle maintenance and wash facilities, drain system for the different facilities and liner and containment systems for fuels and chemicals. There may also be contaminated soil around these facilities.



3. Empty chemical and petroleum product storage tanks, barrels or other containers. The estimator may want to include a provision for testing and removal of petroleum contaminated soil.

Water Treatment

Water treatment systems are the single largest reclamation cost in many mineral operations. Water treatment costs can add substantially to the overall reclamation liability. To illustrate this point, Figure 1 presents reclamation cost estimates for mines that include a water treatment component as part of their closure plan. Each water treatment cost estimate in this figure is for different water treatment scenarios and assumptions and do not necessarily represent final approved bond amounts. Since each estimate is site specific they are not directly comparable.

Water treatment measures addressed in the bond estimate may include rinsing of a heap leach facility, construction of covers to minimize infiltration of water (likely estimated in the earthwork section), or the construction, operation, maintenance and replacement of an active or passive water treatment system based on projected flows and water chemistry. When determining the projected flows for a water treatment system, it is important to consider all precipitation, surface run-on and subsurface seepage that may add to the

water presently onsite. Water treatment may be for a specific period of time or perpetual treatment may be necessary. The primary sources of water requiring continual treatment include drainage from percolation through a cover, drainage from underground workings, dewatering from consolidation of tailings and drainage from waste rock dumps.

Active water treatment systems require the operation of a water treatment plant. Bonds should address engineering design, operating maintenance, and replacement costs, including labor, power, equipment and supplies. Components of an active water treatment plant typically include ponds, berms, drains, pumps, pipe, chemical bins, power supply, electrical controls and buildings. The estimator should consider the treatment and disposal of any sludge generated by the water treatment facility, as well as water quality monitoring of the discharge and receiving waters. Passive water treatment systems include facilities like wetlands that should be designed, constructed, maintained and replaced periodically. Passive water treatment systems would have some of the same kinds of costs as active water treatment systems, such as engineering design, removal and disposal of sludge and replacement cost.

For the purposes of bond estimation, water treatment is discussed under the following headings:

- Predicted During Permitting
- Discovered During Operations
- Risk

Water Treatment Predicted During Permitting

During permitting, the potential for mine facilities to release contaminants is analyzed using information developed from sampling and testing of materials and considering the geology, climate and hydrology of the mine site. Such information may be used to run hydrologic and/or geochemical models to predict the quantity and quality of post mine discharges. Such discharges may include contamination from sediment (stormwater), the dissolution of minerals exposed by mining (acid or other mine drainage), or process water from heap leach facilities, ponds or tailings facilities. This discussion does not include contamination from accidental spills of

chemicals or petroleum products since they cannot be predicted or quantified with any degree of certainty.

The estimator uses the predictions from these models and analyses to determine whether certain materials will have to be isolated, neutralized or removed and whether water treatment will be needed. The predicted waste handling procedures, water treatment methods and facilities, as well as the cost estimate for these items, is included in the POO prior to approval.

The best data available and most logical assumptions are used to predict the hydrology and geochemistry of discharges from mine facilities. Once an operation has been monitored, model predictions and assumptions can be reviewed to determine the validity of the model results. The bond can be adjusted accordingly as discussed below

Need for Water Treatment Discovered during Operations

Despite the best efforts to predict water treatment needs during permitting, unanticipated constituents in mine drainage (e.g. nitrate, sulfate, thiocyanate and selenium) may be discovered during operations and require treatment prior to discharge. Conversely, on going monitoring may provide data that suggests that water quality will be better than predicted. This underscores the importance of monitoring programs to detect changes in the chemistry of process solutions and discharges from all project facilities. Such monitoring programs should be designed to identify statistically significant trends in water chemistry. In this way changes in operating procedures may be implemented to avoid the need for water treatment, and to ensure that the need for water treatment is evaluated, designed and implemented before actual exceedances of water quality standards occur.

If the need for water treatment is discovered during operations, the bond estimate will have to be updated and bond amount adjusted accordingly. Estimates for water treatment needs identified during operation will often be more accurate since they are based at least in part on actual measurements of flow and water chemistry. In all cases the requirements for water treatment and updated bond estimate should be included in

the POO through a supplement or modification because it is a major change in the operation.

RECLAMATION BOND ESTIMATES

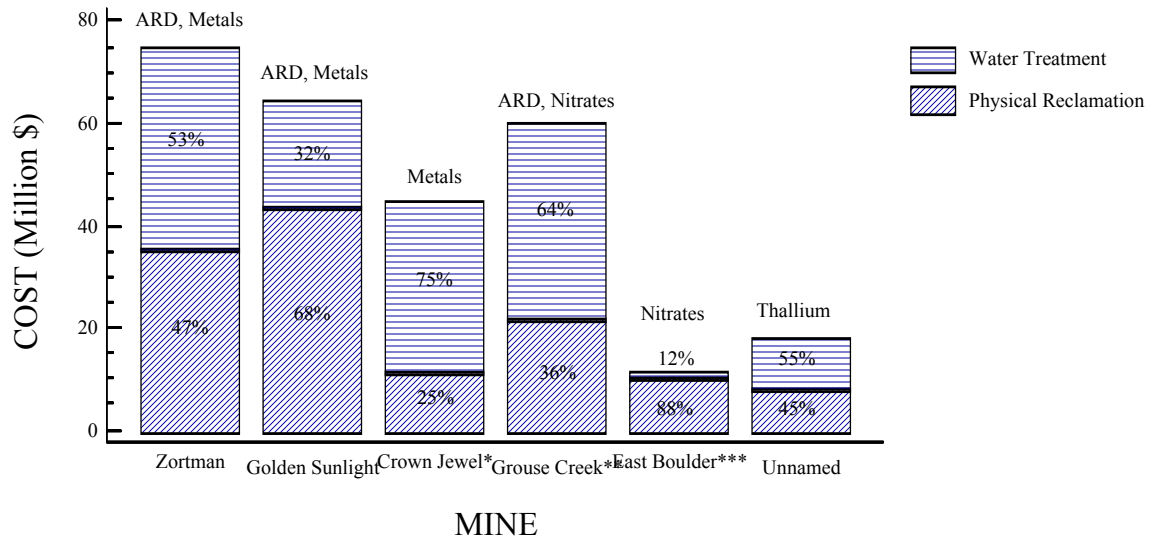


Figure 1: Comparison of physical reclamation and perpetual water treatment costs for select mines. Contaminants treated at each mine are indicated above the bar. (ARD – Acid Rock Drainage)

*Crown Jewel- Water treatment (if water treatment is necessary)

**Grouse Creek- Water treatment costs are for 15 years

***East Boulder- Water treatment costs are for 3 years

Demolition, Removal and Disposal of Uncontaminated Structures, Equipment & Materials (Demolition)

This reclamation activity includes the demolition, removal and disposal of all mine facilities, equipment and materials. It includes the removal and disposal of “uncontaminated” or “decontaminated” buildings, crushers, storage facilities, tanks, fences, cattle guards, culverts, bridges, signs, explosive magazines, conveyor systems, foundations, septic systems, retaining walls, pipelines, power lines, electrical substations, miscellaneous debris, etc. It also includes materials and their containers like fuels and chemicals which have been stored and labeled properly and can be recycled as a usable product.

All facilities, except those planned for approved post-mining uses, should be bonded for demolition and disposal. The operator should be encouraged to removed unnecessary facilities to reduce the estimated cost of Demolition. Conversely, the FS administrator should, at all times, ensure that the removal of all facilities present onsite is included in the bond estimate. Include all disposal costs, such as on-site burial (if allowed), loading, hauling and fees at appropriate landfills or other disposal sites. Generally, all solid waste should be hauled to an approved landfill. The estimator should assume that all heavy equipment and other rolling stock are inoperable and heavy equipment will be needed in order to load and remove it from the site.

No salvage value for facilities is allowed in the bond estimation. The reason is if a mine site has been abandoned or is in bankruptcy, many of the facilities, equipment, materials, etc. will be owned by different entities. There are two types of properties that may be abandoned, real property and personal property. In general, real property is attached to the ground (e.g. building with foundation) and personal property is not. Prior to completing any reclamation work that may affect property owned by others, you should go through the proper procedures of notification and impoundment.

Title 36 CFR 262.12 regulations for impounding of property must be followed. The Office of General Counsel (OGC) should be consulted on how to proceed with an impoundment and deal with property issues at the site in order to complete reclamation.

Once the property becomes government property, it can be disposed of in a government sale. All proceeds go to the General Treasury and are not available for the reclamation of the site.



For small minerals operations, Forest Service Construction and Maintenance crew personnel with experience removing small structures may be a good source of equipment selection and the time needed to complete the work. However, bond estimates are always to be based on completing the work by contract, including Davis-Bacon Act wage rates for construction contracts over \$2000.

Earthwork

Earthwork includes, but is not limited to, consideration of roads, reclamation material stockpiles, low grade ore or sulfidic stockpiles, waste rock dumps, tailings, spent ore and other constructed features; closure of mine openings; material source development for covers; drainage or armor layers; backfilling (diversions, ditches, sediment ponds, etc.); and placement of topsoil or other growth medium. Construction of facilities like diversions channels and drains, stream channels, wetlands and special purpose facilities is also considered to be earthwork.

The operator should be required in the POO to regularly submit an accounting of stockpiled materials such as subsoil, and topsoil so that the reclamation review calculations are based on factual data rather than conjecture. It is incumbent on FS personnel to ensure that the operator is stockpiling any such materials as the mine is developed and that the stockpile volumes are accurate. We do not want to have to “mine” needed reclamation materials from another site in order to reclaim the mine.

The steps involved in earthwork estimates include:

1. Estimate material volumes to be excavated, pushed, or applied
2. Select type of equipment
3. Estimate haul or push distances
4. Estimate grades and slope angles
5. Determine necessary special construction methods such as crushing, sorting, compaction, use of geosynthetic materials etc.
6. Estimate any special cover material volumes



In general, material volumes are estimated by using scaled drawings and cross sections of facilities showing pre-reclamation and post-reclamation topography. Volume estimates should take into account:

- Differences in the type of materials
- Volume differences between in place material and loose material (swell factor)
- Amount of material that should be re-handled.

Regrading is a common component of most mine reclamation projects and it is an activity that can be easily miscalculated. In order to approach a realistic estimate of regrade production, it is important to remember that productivity falls off exponentially over distance. Push distances should be limited to around 200 feet and regrade calculations should be based on this or a lesser distance.

Another common mistake when estimating regrade production is to assume that the “cut” volume will be handled one time. For recontouring slope lengths greater than approximately 200 ft, such as on a waste rock dump, an operator begins to re-handle material that has already been pushed. Hence, for long slopes the actual volume of material moved on the ground will be greater than the volume of the “cut” prism calculated from a cross-section (Campbell, 1992). The estimator should also be aware that the size and type of equipment selected

for a reclamation project could make a significant difference to the overall cost. A good rule-of-thumb in selecting equipment for reclamation is to see what the mine used during production. Knowledge of the contractors who might bid the job and their equipment fleets is also helpful.



Changes in material volumes and unit weights caused by initial displacement should be considered when selecting equipment and estimating production. Swell and weight factors are listed in or can be derived from tables in many standard equipment productivity manuals.

The haul distance and grade affects the equipment selection and efficiency and cost of all excavation, backfilling and grading operations. Haul distances can be determined from the mine plan maps and drawings. The approximate center of each source of material to be moved and its destination should be identified so that the distance can be determined. Grades can be estimated from the road design drawings, as built drawings, cross-sections or a detailed site map; or measured on the ground (survey).

The experience of FS Construction and Maintenance crews and other specialists may be a good source of information for equipment selection and the time needed to complete the earthwork for small minerals operations.

Revegetation

Revegetation is an integral component and determinant of long-term reclamation success. This is especially important if one is depending on a cover cap and vegetation to provide water-

holding capacity to minimize infiltration. These types of covers are commonly known as “water balance” covers and are typically used on waste rock dumps, leach pads, and tailings impoundments. The proper function of a cover is highly dependent on the health of the vegetative community. It is important to be realistic in estimating the time it will take to establish an effective vegetation on a cover.



Once an area has been backfilled and graded to the desired shape and slope, revegetation can occur. Revegetation activities include the following:

1. Subsoil Preparation - Where compacted layers may inhibit vegetative growth, the surface of the area should be ripped or disked along the contour (typically slopes allowing, 3.0 to 1 or less).
2. Topsoil or other acceptable growing medium will be replaced and final grading should be along the contour (typically slopes allowing, 3.0 to 1 or less).
3. Seedbed preparation typically consists of ripping or harrowing the topsoil along the contour to slow runoff. Where erosion is expected to be a problem, mulch, terraces, contour furrows or dozer basins may be used.
4. Where soil fertility is expected to be a limiting factor, a fertilizer, weed-free mulch or other soil amendment may be required on the basis of soil testing. Fertilizers and amendments

may include materials that provide nutrients, improve physical characteristics, adjust pH, or provide soil microorganisms.

Organic amendments such as wood chips, sawdust, or specialty amendments (e.g., BIOSOL) can be very expensive, sometimes doubling or tripling the cost of revegetation. These amendments are typically applied at the same time as the seed.

5. Installation of sediment control measures. This does not include the basic excavation, backfilling or earthwork construction associated with sumps, ditches, diversions or ponds that are covered under “Earthwork”. Included here is the use of erosion control measures and materials such as weed-free mulch, erosion control fencing, mats, wattling, etc., to provide stability and reduce erosion of the reclaimed site.
6. Distribution of woody debris, if required, is best done prior to seeding and planting activities, if possible. Costs will include load, haul and placement.
7. Seeding to meet the post mining land use objectives are typically accomplished by broadcasting, drilling, or hydro-seeding with weed-free seed, depending on the slopes and nature of the material to be reclaimed. Seeding will typically be timed soon after seedbed preparation and to take advantage of conditions that favor seed conditioning, germination and growth. This is typically in the fall prior to initial snowfall in the Intermountain West. Optimal time for seeding may vary in other parts of the country. Livestock exclusion fences may be necessary and should be maintained until revegetation is accepted by the agencies.
8. Planting of tree or shrub seedlings, if required, would normally occur in the spring. Planting is typically

accomplished using bare-root stock, or containerized seedlings/saplings.

9. Sufficient bond should be held to allow for retreatment of areas that do not meet revegetation standards within a specified time and control of any noxious weeds. This may include items 2 through 8. Locally derived survival rates for planted species should be used, if available, to assess replanting needs.



Development of a revegetation strategy should include contacting the appropriate Forest or Regional resource staff (soil scientists, botanists, range specialists, foresters, minerals specialists, etc.), the Natural Resources Conservation Service, Forest Service research scientists, County Extension Agents, other agencies, universities, and revegetation contractors for information about local conditions, best plant species, planting times, fertilizers, application rates and revegetation costs. Information needed to develop revegetation tasks should be included in the reclamation section of POO where details on topsoil replacement, application of soil amendments, plant species to be used, erosion control structures and the approved post-mining land uses are provided. Finally, the establishment of vegetation test plots during mine operation is strongly encouraged to validate and/or refine the reclamation strategies developed during permitting. These plots should cover the range of treatments (seed mixes, planting methods, soil amendments, mulch, etc.) and site conditions (growth media, slope, aspect) that are expected at closure.

References that describe typical revegetation practices are listed in Appendix D.

Mitigation

- Title 36 CFR 228A regulations specifically discuss rehabilitation of fisheries and wildlife habitat at 228.8g(5). Mitigation usually consists of requirements to avoid, minimize, reclaim or compensate for environmental damage caused by the proposed operations. The cost of reclamation for mitigation work that is a requirement in the approved POO should be included in the reclamation bond.

The FS reclamation bond would not normally cover mitigation required by other state or federal agencies, unless it is also required by FS regulations or in the approved POO. The FS, in coordination with the appropriate state or federal agencies, will decide how such mitigation would be bonded for and which agency would hold the bond. Forest Service should not hold bonds for mitigation work on non-NFS lands.

Some mitigations, such as wildlife habitat enhancement (e.g. bat habitat), restoring the natural function and value of streams and constructing wetlands and associated floodplains are highly technical and require consultation with various state and federal agencies, as well as expertise typically only available from engineering or environmental firms specializing in such work.



Long-Term Operation, Maintenance and Monitoring

Long-term operation, maintenance and monitoring requirements should be minimized through project planning to the extent feasible. Where these can not be eliminated, associated costs should be included in the bond estimate.

There are two types of long-term maintenance requirements that need to be considered. The first involves actions with a finite life. Protection of reclaimed areas may need fencing, road closures, or other means until such time as long-term stability, erosion control and revegetation have been successfully established. Active control of noxious weeds may also be necessary to achieve successful revegetation in the near term.

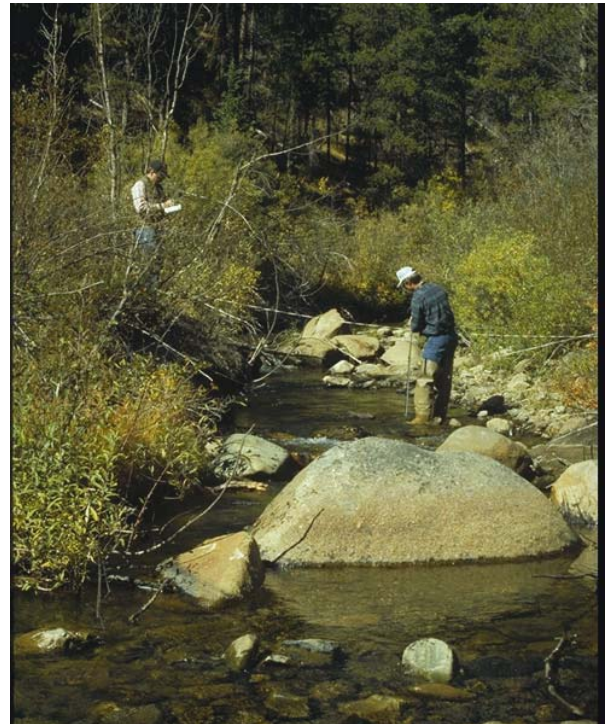


Included in the second type of long-term maintenance are activities that may have an open-ended timeframe or be required for a long time. Facilities that may need long-term operation and maintenance include but are not limited to, roads (including maintenance and snow removal), diversion ditches, dams, water treatment plant, fencing, gates, and signs. In some cases such maintenance may have to continue indefinitely, (e.g. water treatment facilities, dams and diversions). Assume that some level of periodic maintenance will be necessary for all engineered facilities whose continued function is essential to meet reclamation standards. This includes the monitoring and other permitting costs that may be required under various state and federal laws.

In addition to the monitoring effort itself, which includes sampling, lab testing, data analyses and reporting, there are other costs involved with closing/reclaiming monitoring sites. These may include surface water monitoring stations, groundwater wells, experimental study sites and air quality stations.

Monitoring of reclaimed areas should be conducted until reclamation bond release criteria (reclamation standards) have been met. This may include surface/groundwater, vegetation, waste rock dumps, heaps, tailings impoundments and dams for physical and/or chemical stability, and sampling of potentially hazardous or toxic materials and leachate from project facilities. The FS may need to hire a contractor to monitor the site, especially if the site is large and the monitoring requirements are extensive. Costs should be estimated accordingly.

Estimating costs and bonding mechanisms may also vary by the two types of long-term operation, maintenance and monitoring (O&M) required. For the work described earlier in this section as having a finite life, the costs and duration of the work may be adequately estimated using the standard process outlined in this Guide.



For work described as being costly, long-term or open ended, different methods of cost analyses

and types of bond instruments may need to be considered. For example, the annual cost of operating a conventional lime water treatment plant may total one-half million dollars a year or more and be required for an indefinite period of time. Using the standard method of cost estimation and including even a nominal amount (2%) for inflation would result in a bond in the neighborhood of 150 million dollars for a 100 year period. Considering that such costs do not consider replacement of the facility, or that they may continue indefinitely, it is easy to see that securing a conventional bond instrument for such an operation would likely be impossible.

In recent years, trust funds have been investigated as a means to fund such long-term future costs. Such trusts allow the operator to make an initial deposit or deposits which are then invested by the trustee in conservative instruments such as federal government securities. The amount of the initial payment to be placed in the trust can be estimated using a present net value analysis using assumptions about interest and inflation.

Although trust funds may be the best way to fund long-term O&M, at the present time there are legal and technical questions about whether and how the Forest Service could use them. If such an arrangement is needed, consultation with the Office of General Counsel, Fiscal and Mineral Staffs at the Regional and perhaps National level would be required.

Finally, we want to emphasize that because of the risks involved, the interest of both operator and Forest Service are best served by minimizing long-term O&M costs to the extent feasible, and in particular, by avoiding the need for long-term or perpetual water treatment through appropriate project design and mitigation.

STEP 5 – ESTIMATION OF DIRECT RECLAMATION COSTS

Introduction

Contractors, the mine operator or Forest Service personnel may estimate initial reclamation bonds. However, in all cases, Forest Service personnel should review and determine if the estimate is adequate and based on an approach consistent with this Guide.

The more detailed the POO information, the fewer assumptions that need to be made. Assumptions imply uncertainty, and uncertainty translates into higher costs. The estimator's (Forest Service, mine operator, or contractor) job begins by ensuring that sufficient detail is present in the POO to calculate a reclamation estimate. It is strongly advised that the Forest Service person estimating or reviewing the reclamation bond be involved in the POO review. Additional information or clarification requested during the review process can provide for a more accurate reclamation estimate.

Consistency of Approach

The estimator should approach every estimate in a consistent and defensible manner. The estimator should attempt to use the same type of information sources and the same methodologies and protocols in constructing each estimate. Whether the bond estimate is for a large or small operation, it should be consistent in approach to other estimates for similar size operations, well referenced, and as accurate as possible. Appendix A discusses the applicability of this guide to small scale operations.

Comparison of Data

The best information for estimating direct reclamation costs is actual as-built costs or bid prices from contracts for similar type work in the area. Contractors, equipment dealers, rental shops and FS engineers typically have information based on real-time and real-life experiences and sound professional judgment. **When using information from other projects, you should be careful to consider how applicable it is to your project.** Because reclamation cost estimates are often project and site-specific, a "cookbook" approach can lead to poor results. Using costs from other projects should be done only after a careful review of the assumptions and cost factors used in that estimate. Haul profiles, equipment types, and unit costs, are examples of assumptions that are dependent on the specifics of the site. The estimator should not apply the same unit costs indiscriminately between two estimates; rather the estimator should construct an estimate based on the specifics of the site in question. Costs from

other operations should only be used for comparison purposes.

Sources of Cost Estimation Data

Equipment –

- ✓ Contractor Quotes
- ✓ Equipment Dealers
- ✓ Bids for equipment rental contracts
- ✓ Forest Service Cost Estimating Guide For Road Construction...
- ✓ Means Building Construction Cost Data, Means Heavy Construction Cost Data, and Means Site Work and Landscape Cost Data
- ✓ Western Mine Engineering Mining Cost Service
- ✓ CAT Handbook
- ✓ Cost Reference Guide for Construction Equipment (Equipment Watch/Primedia).

Cost estimates for equipment necessary to perform reclamation may be based on the above reference sources or other handbooks or data that reflect regional cost of equipment.

Appendix E gives general guidance for earthmoving equipment selection for common reclamation tasks. The cost of this equipment is typically expressed in dollars per hour and may be estimated from the above references. These references are also helpful for selecting equipment.

In using these sources one should pay attention to what items are included in the unit costs. Hourly equipment rates should include items such as, fuel, maintenance, replacement, insurance, sales tax, ownership and operating costs, etc. All unit costs used in a bond estimate should be consistent in what items are included so that costs are not overlooked or double-counted later in indirect costs.

Labor – All federal contracts for projects greater than \$2500 require payment of Davis-Bacon Act wage rates. Hourly labor rates must be estimated using regional Davis-Bacon wage rates from the Department of Labor. This applies to all work on federal land; work on state or private land may use different wage rates. Davis-Bacon wage rates are updated at least quarterly for each zone

(www.davisbacon.ntis.gov). It is incumbent upon the estimator to ensure that the rates being used are current and apply to the area in which the reclamation is to take place. The direct labor cost includes the base hourly Davis-Bacon rate, fringe benefit allowance and zone differential. Fringe benefits typically include workman's compensation, unemployment, risk and liability insurance and other charges.

CALCULATING THE ESTIMATE

The determination of reclamation costs is the final step in an interdisciplinary process that began with site-specific reclamation standards and requirements in the POO. An individual familiar with cost estimating should be involved in the reclamation bond estimate. The estimator should use a team approach when calculating the bond estimate, and at a minimum, one other person, preferably an individual with estimating experience should review each reclamation bond estimate. An estimator will improve bond accuracy and consistency by including other experienced and knowledgeable individuals, and by ensuring that cost assumptions are consistent with other reclamation work under contract. This ultimately will also make the estimate more defensible in the event of an appeal or legal challenge.

Assume for bond calculation purposes that all equipment, supplies and labor needed for reclamation will be secured through the federal contracting process, and no onsite equipment or materials will be available to the FS. The reason for this assumption is that facilities, equipment or materials used by the operator may not be available to the FS or its contractors during final reclamation.

In select situations, Forest Service Construction and Maintenance crews (C&M crews) with qualified equipment operators may be used to reclaim mine sites. Regardless of whether a C&M crew is used, the bond estimate should reflect the cost of contracting the reclamation work to an outside service provider.

This guide discourages using the same unit costs from site to site. The estimator may have heard quotes of typical or standard earthmoving costs such as "a buck a yard". Please be aware that there are no standard costs in mine reclamation. The estimator should take the time to calculate

each estimate based on the conditions and reclamation criteria of the site. As an example, the cost difference between \$1.00/cy and \$1.25/cy when moving 2 million cy is a quarter of a million dollars. Enough of a difference to make any estimator wish they'd used a sharper pencil.

This guide does not provide convenient step-by-step, fill-in-the-blanks cost estimating sheets to be used in calculating costs. While these can be useful for preliminary estimates where it may be beneficial to determine the magnitude of reclamation costs, the use of these is discouraged for detailed estimates. In general, the fill-in-the-blank estimating sheets do not provide adequate detail to determine unit costs or provide information to support cost assumptions. The estimate should be clear, comprehensive, have sufficient detail and be adequately referenced to aid in discussions with operators. Detailed documentation enables the Forest Service to justify *and* defend the reclamation estimate, if necessary.

The following tables are intended to provide the estimator with a highly generalized checklist of cost items that may be encountered when preparing a cost estimate. Examples of reclamation estimates may be obtained from Forest Service mineral specialists.

Step 4 identified the reclamation tasks required for mine closure. Based on the description of these jobs (and any assumptions made), the estimator can now develop individual costs for each task. The estimator is encouraged to format and detail his or her estimate in a manner commensurate with the size and complexity of the operation. The bond estimate should be organized using the eight reclamation tasks identified in Step 4:

- Interim Operation and Maintenance
- Hazardous Materials
- Water Quality
- Demolition, Removal and Disposal of Uncontaminated Structures, Equipment and Materials
- Earthwork
- Revegetation

- Mitigation
- Long-term Operation, Maintenance and Monitoring

The tables in this section help identify some of the subtasks necessary for each reclamation task. For each subtask listed there is a description of how to obtain the cost data needed and how to approach calculating the cost estimate. Please note that these tables are not all-inclusive and that there may be other subtasks, data sources, and methods of estimating the costs that are not described here. Use these tables as an aid in calculating your bond, not as a “cookbook” or checklist.

For each task and subtask, a volume (quantity), production rate (time required for the task), and unit costs (equipment, material, and labor costs) will have to be identified to develop the total cost for the reclamation task. This total cost can be calculated using the following basic equation:

$$(\text{VOLUME} \div \text{PRODUCTION RATE}) \times \text{UNIT COSTS} = \text{TOTAL COST}$$

$$\text{EX: } [(\text{CUBIC YARDS}) \div (\text{CUBIC YARDS/HOUR})] \times (\$/\text{HOUR}) = \$$$

The tables in this section give examples of the units to be used in this equation for each subtask. The tables also give information on where to obtain the inputs (volumes; production rates; and labor, material, and equipment costs) to use for each subtask.

Once total costs for each subtask are estimated, a grand total for each of the eight reclamation tasks should be calculated. Remember that this is an estimate and that it is customary to round these sums to an appropriate significant digit. These grand totals can then be summed to determine your estimate of total direct reclamation costs. Indirect costs are then applied to these direct costs to determine your total bond estimate. These indirect costs will be explained in Step 6.

INTERIM OPERATION AND MAINTENANCE

As described in Step 4, this section includes those on-site items that require on-going maintenance and management to prevent a threat to human health and the environment. Tasks commonly associated with interim care and maintenance frequently involves water management. Heap leach or milling operations with tailings impoundments are the principal types of operations that require active water management, although most if not all operations require some level of oversight. Estimating the cost of water management is facilitated by working with the operator and using their costs during operations as a guide for the costs that can be expected during any interim period. The following are tasks specific to interim operations and maintenance.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Site Safety, Security and Access	<ul style="list-style-type: none"> • Secure buildings & Gates • Deter unauthorized access/vandalism. • Secure underground workings. • Maintain site access • Maintain power & utilities 	<ol style="list-style-type: none"> 1. Est. cost of new locks/guard 2. Est. fence maintenance cost 3. Est. maintenance/gating costs 4. Est. road maintenance/snow removal costs 5. Est. utility costs, electric, propane, generators 	<ul style="list-style-type: none"> ▪ Service sector ▪ FS Operations/Range ▪ FS Operations ▪ FS C&M crew, Co. Road Dept. ▪ Local power company, propane, diesel supplier
Storm water	<ul style="list-style-type: none"> ▪ Maintain Best Management Practices to avoid environmental damage and water quality problems • Road maintenance • Diversions and sediment pond maintenance • Stormwater treatment (flocculant) 	<ol style="list-style-type: none"> 1. Erosion fence, hay bales, rock check dams, water bars 2. Est. road maintenance costs, cleaning ditches/culverts, blading road surface 3. Est. diversions and sediment pond maintenance (cleanout with excavator/dozers, sediment disposal) 4. Power, reagents, labor, discharge monitoring & reporting 	<ul style="list-style-type: none"> ▪ FS C&M crew, Co. Road Dept. ▪ Contractor quotes ▪ Regional Forest Estimating Guides ▪ Operator costs for treatment to remove sediment, seed suppliers and nurseries, erosion control material suppliers, etc.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Solution Management	<ul style="list-style-type: none"> • Ensure basic solution recirculation to avoid system upset • Prevent leach pad & ponds overtopping • Prevent tailings pond overtopping • Ensure compliance with standards 	<ol style="list-style-type: none"> 1. Understand pump and pipe network 2. Inventory solutions in system for quantity and quality 3. Estimate additions to solution inventory from various sources (e.g., precipitation, underground flows, dump seepage, etc.) 4. Costs <ul style="list-style-type: none"> • Est. system operation labor • Estimate power needs/costs for basic recirculation • Est. reagent and chemical needs and costs • Est. capital goods maintenance and replacement costs for ongoing water management 	<ul style="list-style-type: none"> ▪ Operator data, as-built design ▪ Third party contractor ▪ POO, Applicable permits ▪ O & M manual ▪ Local suppliers (pumps, pipe, etc.)

HAZARDOUS MATERIALS AND SHORT TERM WATER TREATMENT AND DISPOSAL

From Step 4, the estimator should know what on-site materials that will require decontamination, neutralization, disposal, isolation or treatment. A qualified contractor should perform the removal and disposal of hazardous materials, and the estimate should include characterization, transportation and disposal costs. The estimator should seek quotes from certified contractors. Information may also be available from the engineering sections of the FS region or Supervisors’ office.

The goal of short-term water treatment is to treat and dispose of the solutions currently in inventory. The estimator should have data concerning water quality and solution volumes in circulation, or should be able to secure this information from the operation. These will help guide the short-term treatment and disposal program.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
A) HAZMAT			
Inventory, sample, test, remove/dispose of hazardous material	<ul style="list-style-type: none"> Inventory, sample, test, remove and dispose (Note: Buildings may contain explosives, chemicals, mill residues, asbestos, etc.) 	<ol style="list-style-type: none"> Conduct hazmat inventory Sample/test materials Dispose onsite Remove, transport, dispose offsite 	<ul style="list-style-type: none"> RO HAZMAT Specialist FS certified blaster (for state and federal protocols for explosive disposal) Contractor quote/Cost guides Hazardous waste disposal facilities
Inventory, sample, test, dispose, recycle, petroleum products	<ul style="list-style-type: none"> Inventory, sample, test, isolate, neutralize, recycle, or dispose of petroleum products or contamination 	<ol style="list-style-type: none"> Conduct inventory, of products and contamination Sample/test materials Isolate, neutralize, dispose onsite Remove, transport, dispose, recycle offsite 	<ul style="list-style-type: none"> RO HAZMAT Specialist Local fuel distributor Contractor quote/Cost guides Hazardous waste disposal facilities

WATER TREATMENT

A) Short Term

Once the immediate need of ensuring the ongoing operation of systems that involve the management of water, such as leach pads or tailings impoundments, has been addressed (see Interim Operation and Maintenance), the estimator will be required to assess costs associated with treating and disposing of system solutions. The estimator should have data concerning water quality and solution volumes from the existing operation that will assist in determining short-term handling and treatment costs. The objective is to treat and dispose of the solutions currently in inventory. Remember that additional waters may be collected over the course of near-term treatment that will also require handling and treatment. Possible sources of additional water include, but are not limited to precipitation, seepage from waste dumps or tailings impoundments, or inflow into underground workings.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
A) SHORT TERM			
Process Solution Characterization	<ul style="list-style-type: none"> • Manage process solutions to prevent overtopping, spills or upsets of containment ponds or facilities 	<ol style="list-style-type: none"> 1. Determine current solution inventory and facility water balance, including input for precipitation, snowmelt, and losses from evaporation 2. Sample/test to assess solution quality 3. Model solution quality and quantity over time 	<ul style="list-style-type: none"> ▪ Operator/old reports to FS ▪ Independent analysis (use EPA certified lab) ▪ Water balance information from permits, NEPA documents, weather stations ▪ Secure through contracting
Receiving Water, Land Application Area Characterization	<ul style="list-style-type: none"> • Compliance w/ standards 	<ol style="list-style-type: none"> 1. Determine established surface and groundwater standards 2. Estimate potential discharge rate into receiving water by evaluating volume, quality and buffering capacity of receiving waters 3. Estimate potential discharge rate to land application area by evaluating depth to ground/surface water, and soil infiltration, percolation, and attenuation characteristics of land application area 	<ul style="list-style-type: none"> ▪ State/EPA Standards ▪ Permits ▪ NEPA Documents ▪ Technical Reports ▪ Monitoring Records ▪ Published Standards ▪ Operator ▪ Closure plans ▪ LAD documents ▪ Operator/old reports to FS ▪ Secure through contractor

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Treat and Dispose Water		<p>With data from above, calculate volume to be treated and disposed of annually. Estimate number of years required for LAD operations.</p> <p><u>Active Treatment</u></p> <ol style="list-style-type: none"> 1. Understand treatment operation details 2. Labor cost 3. Estimate power requirements for plant 4. Estimate reagent cost 5. Estimate equipment maintenance and replacement costs 6. Operate, maintain facility 7. Monitor and report results <p><u>Passive Treatment</u></p> <ol style="list-style-type: none"> 1. If system is not in place, retain third party contractor for design and construction. 2. If system is operating, monitor for water quality compliance. If not in compliance, consider cost of active treatment. 3. Estimate operating costs, including power, labor, inspection, monitoring, reporting, parts and supplies, and replacement costs. 	<ul style="list-style-type: none"> ▪ O & M manual ▪ Operator/hourly rates ▪ POO ▪ Old electric bills ▪ Equipment maintenance and replacement schedules ▪ Local suppliers (e.g., reagents, pumps, piping, etc.) ▪ Contractor bids

B) Long Term

Reclamation items that require an indefinite commitment of time and resources usually pertain to water management and treatment. Long-term water treatment costs should be based on annual operating and maintenance costs, as well as replacement costs for capital goods and equipment. Typical operating costs include costs of reagents, parts and supplies, power, and labor. Water monitoring costs need to include sample collection, analytical work, and report preparation. Once water quality standards are met, monitoring wells will require closure based on state requirements for plugging and abandonment. Other costs that need to be considered are equipment replacement due to normal wear-and-tear, and site access. The best source of information for annual operating and maintenance costs are the real-time costs for the operation of the existing water treatment facility. If a long term water treatment cost estimate is needed, consultation with the Mineral Staffs at the Regional and perhaps National level would be required.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATOIN SOURCES</u>
B) LONG TERM			
Treat Water	<ul style="list-style-type: none"> • Determine long-term treatment requirements • Active treatment • Passive treatment 	1. Refer to steps described for interim water treatment program	<ul style="list-style-type: none"> • Interim treatment costs • Operator data • Contractor estimate • Plan/permit data • NEPA documents • Technical reports
Total Project Costs	<ul style="list-style-type: none"> • Develop total annual costs to meet treatment standards in the interim and long-term 	1. Refer to short-term program for labor, reagents, equipment and power. Include site maintenance, access and security, labor and/or 3 rd party management requirements. 2. Est. and include long-term plant maintenance and replacement costs	<ul style="list-style-type: none"> • Short-term treatment costs • Operator data • Equipment maintenance and replacement schedules • O & M manual • Equipment, reagent, plant suppliers
Discounted Cash Flow Analysis	<ul style="list-style-type: none"> • Derive trust fund requirements to generate sufficient annual income to cover annual expenses and replacement costs 	1. Choose annual inflation rate, expected annual interest rate. Sum discounted annual costs over a minimum of 100 ⁶ years to arrive at initial fund requirement	<ul style="list-style-type: none"> • Inflation rate: index such as CCI • Interest rate: Fed. Gov't guaranteed • Discount analysis: contact FS economists
Bond Instrument	<ul style="list-style-type: none"> • Secure appropriate bond instrument⁷ 	2. Consult FS regulations and Line Officers	<ul style="list-style-type: none"> • FS Regulations

⁶ In most discounted cash flow analyses, discounted costs past 100 years are negligible to total. A time sensitivity analysis should be run to determine the appropriate time period to be used for the calculation.

⁷ FS is currently seeking appropriate interest-bearing bond instruments to address long-term reclamation obligations.

DEMOLITION, REMOVAL AND DISPOSAL OF UNCONTAMINATED STRUCTURES, EQUIPMENT AND MATERIALS

The estimator should complete an inventory of structures, miscellaneous equipment and material, and identify the disposal options for the various materials. Some items may be disposed of on-site by burning provided the necessary permits are secured. Other items, such as concrete that has been sampled and proven to be non-hazardous may be buried on-site at the discretion of the authorized officer. Customarily, concrete should be broken into pieces no larger than 3-4 feet in diameter and buried under a minimum of 4 feet of cover material. All materials that can be recycled should be transported to the nearest recycler. Any remaining materials should be disposed of at an approved landfill. Cost associated with landfill disposal should include loading and unloading, transport, and landfill disposal fees. The estimator should consider quotes from demolition contractors or referenced cost guides.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Inventory structures, equipment and materials	<ul style="list-style-type: none"> Account for all infrastructure buildings, equipment, materials and other infrastructure (e.g., pipelines, power lines, septic systems, misc.) 	<ol style="list-style-type: none"> Description of structures and construction type (e.g., linear-aerial-volumetric dimensions; steel siding, wood frame) Estimate material volumes/tonnage (concrete, wood, steel, non-hazardous reagents) Description of equipment to be removed. 	<ul style="list-style-type: none"> List of facilities and equipment in POO Site inspection Onsite as-built drawings Contractor bid
Removal and Disposal	<ul style="list-style-type: none"> Removal of all buildings, equipment and materials from site unless specified for alternative post-mine use. Some buildings and equipment may be needed during the course of reclamation. 	<ol style="list-style-type: none"> Determine demolition costs Estimate demolition and salvage costs Estimate disposal costs: Assume hourly rate for loader and dump truck or lowboy; assume total number of hours for transport off site and disposal. Include landfill fees. 	<ul style="list-style-type: none"> Demo/salvage contractors Cost guides Local recyclers Power Co. for power line and power substation removal Contact local landfill for disposal fees Hourly equipment rates/Cost guides

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
	<p>On site disposal</p> <p><i>(Note: Salvage value is never included in the bond estimate because ownership and value at abandonment or bankruptcy is uncertain. Moreover, any proceeds from government sale will go to the general fund and are not available to fund reclamation.)</i></p>	<p>NO SALVAGE VALUE SHOULD BE INCLUDED IN THE ESTIMATE.</p> <ol style="list-style-type: none"> 1. Ownership of equipment, facilities and materials should be established in court or through 36CFR 262 impoundment procedures. If government ownership is established, items may be used, sold for salvage, disposed of offsite as described above, or onsite as described below. 2. Assume hourly rate for loader/dozer. 3. Estimate hours for material handling and burial 	

EARTHWORK

Earthmoving equipment productivity is usually expressed in work units per hour (e.g., cubic yards per hour), or in some cases like grading, in miles or acres per hour. Besides material properties (compaction, swell, weight) and site conditions (haul distance, grades), equipment capacity, cycle time and operator efficiency should be considered when estimating productivity. Equipment handbooks and cost estimating guides contain capacity and cycle time information as well as operator efficiency factors for various pieces of equipment. Equipment manufacturers also make software that will calculate haul times, unit costs and offer guidance on equipment selection. The productivity of each piece of equipment used should be estimated for each site including operator and material characteristics. Once the productivity rate (cubic yards per hour, acres per hour, etc.) is estimated, it can then be applied to the volume of material to be moved.

The basic formula used to calculate direct costs is:

$$(\text{Vol.} / \text{Prod. Rate}) \times (\text{Hourly Labor} + \text{Hourly Equipment Costs}) = \text{Direct Reclamation Cost}$$

$$\text{Example: } (\text{CY}) / (\text{CY/hr}) \times (\$/\text{hr}) = \$$$

Worksheets in OSMRE, 2000 illustrate how to factor equipment productivity (can also be found in CAT Handbook) and cost into bond estimates for various tasks. The OSM Handbook for Calculation of Reclamation Bond Amounts can be accessed at www.osmre.gov.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Identify earthworks requiring reclamation	<ul style="list-style-type: none"> Inventory all features that require earthwork (waste dumps, leach pads, ponds, placer workings, roads, facility sites, etc.) 	<ol style="list-style-type: none"> Assess existing facilities in their existing condition vs. reclaimed configuration Delineate facility areas and quantities (linear feet, slope angles, acres, etc.) <ul style="list-style-type: none"> Units of Measure: AC, FT, CY 	<ul style="list-style-type: none"> POO/As-Built Maps/FS Files FS field survey Contract survey
Regrading	<ul style="list-style-type: none"> Regrade slopes to improve slope stability, reduce surface erosion, maximize post-mine land uses, enhance aesthetics, etc. 	<ol style="list-style-type: none"> Develop cross-sections for final configuration Estimate cut and fill volumes Determine equipment production rates <ul style="list-style-type: none"> Units of Measure: CY 	<ul style="list-style-type: none"> POO/post-mining maps Operator files/maps Field survey Equipment production and cost guides Previous contracts for similar work in area
Ripping	<ul style="list-style-type: none"> Promote water infiltration into compacted areas (haul roads, facilities areas), and provide improved adhesion for fill cover. 	<ol style="list-style-type: none"> Measure surface areas Determine ripping production rates <ul style="list-style-type: none"> Units of Measure: AC, CY 	<ul style="list-style-type: none"> POO/As-Built Maps Operator files and maps Field survey Equipment production and cost guides Local heavy equipment dealer
Reclamation Cover Placement	<ul style="list-style-type: none"> Adequate cover for capillary barrier, water balance or water barrier cover for waste isolation, and topsoil for rooting depth. 	<ol style="list-style-type: none"> Delineate areas requiring cover Determine cover depths Locate source of cover materials Select equipment for hauling and spreading Inspection, sampling, and materials testing Determine production rates <ul style="list-style-type: none"> Units of Measure: AC, CY, 	<ul style="list-style-type: none"> POO Operator files Equipment production and cost guides From contracts for similar work in area
Diversion Ditch Construction	<ul style="list-style-type: none"> Manage surface water for erosion control Diversion of water away from sensitive areas Reconstruction of pre-mine drainage systems 	<ol style="list-style-type: none"> Identify facilities requiring surface water management/isolation Determine location of ditches Specify storm event and size ditch accordingly Determine suitable ditch bedding materials <ul style="list-style-type: none"> Units of Measure: LF, SQ FT, SQ YD, CY 	<ul style="list-style-type: none"> POO FS hydrologists Third party consultants Design manuals Design software Previous contract work in area.

REVEGETATION

Refer to Worksheet 14, “Revegetation Costs” in the OSM Handbook referred to above. For more complex sites, the estimator should consider securing quotes from local contractors that supply seed, shrubs and trees, and who do reclamation work at disturbed sites. The OSM Handbook may be accessed at www.osmre.gov. OSM has developed these worksheets to include failure rates of vegetation.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Finish Grading	<ul style="list-style-type: none"> Prepare site for growth medium placement 	<ol style="list-style-type: none"> Estimate area needing growth medium Labor and equipment for finish grading w/ dozer, grader or farm implement Labor and equipment to scarify, disc, harrow 	<ul style="list-style-type: none"> POO Site inspection Field survey Equipment production and cost guides Previous contracts for similar work in area
Growth medium placement	<ul style="list-style-type: none"> Place growth medium 	<ol style="list-style-type: none"> Determine cover depth and estimate cover volumes Identify stockpiles and borrow sources and estimate volumes Estimate labor and equipment cost to load, haul, apply topsoil 	<ul style="list-style-type: none"> POO Site inspection Survey Equipment production and cost guides Previous contracts for similar work in area
Soil Amendments	<ul style="list-style-type: none"> Assess whether soil amendments are necessary 	<ol style="list-style-type: none"> Test topsoil for organic content, fertility, coarse rock fragments Evaluate site characteristics (slope, aspect, elevation, climate) Purchase soil amendments Labor and equipment to incorporate mulch, fertilizer or appropriate soil amendment 	<ul style="list-style-type: none"> FS range specialists Soil Contractors Soil Inventory Fertilizer, amendment suppliers Equipment production and cost guides Previous contracts for similar work in area
Seed/mulch	<ul style="list-style-type: none"> Revegetation of disturbed areas 	<ol style="list-style-type: none"> Determine area requiring seeding Determine seed mix and purchase seed, seedlings Labor and equipment for seeding/planting method (broadcast, drilling, hydroseeding, hand planting) 	<ul style="list-style-type: none"> POO Field inspection FS range specialists Local contractors for seeds Local nurseries for tree and forb stock Equipment production and cost guides Previous contracts for similar work in area

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Weed Control	<ul style="list-style-type: none"> Control noxious weeds 	<ol style="list-style-type: none"> Identify areas of weed infestation Purchase herbicide Labor and equipment to apply herbicide 	<ul style="list-style-type: none"> Site inspection FS weed specialist FS C&M crew Herbicide supplier County Agent Equipment production and cost guides Previous contracts for similar work in area

MITIGATION MEASURES

Examples of mitigation measures that may require bond estimates are construction and/or protection of wetlands, enhancement of fisheries and wildlife habitat, reconstruction of disturbed drainages, and similar undertakings that are approved in the POO. Mitigation measures of this scale should be approved in the POO with accompanying design specifications. It is advised that the estimator seek specific quotes for these items concerning specialized construction techniques. They should involve other forest specialists (e.g., biologists, hydrologists, soil scientists) in the design and calculation.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Wetland construction	<p>Establish new wetland Enhance existing wetlands</p> <p>Note: Design and construction of this kind of mitigation is usually accomplished by third party contract.</p>	<ul style="list-style-type: none"> Develop design to meet requirements of POO Implement design contained in POO Administer contract Inspect and monitor 	<ul style="list-style-type: none"> POO or Permit Agencies Contractors Nurseries FS Specialists Equip. production and cost guides Previous contracts for similar work
Stream Restoration	<ul style="list-style-type: none"> Locate new, or re-establish old stream course <p>Note: Design and construction of this kind of mitigation is usually accomplished by third party contract.</p>	<ol style="list-style-type: none"> Develop design to meet requirements of POO Implement design contained in POO Administer contract Inspect and monitor 	<ul style="list-style-type: none"> POO State Agencies Field survey FS hydrologist FS engineering Specialty contractors Equipment production and cost guides Previous contracts for similar work in area

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Fisheries or wildlife habitat enhancement	<ul style="list-style-type: none"> • Replace wildlife or fisheries habitat <p>Note: Design and construction of this kind of mitigation is usually accomplished by third party contract.</p>	<ol style="list-style-type: none"> 1. Develop design to meet requirements of POO 2. Implement design contained in POO 3. Administer contract 4. Inspect and monitor 	<ul style="list-style-type: none"> • POO • Field survey • FS biologist and hydrologists • FS engineering • Specialty contractors • Equipment production and cost guides • Previous contracts for similar work in area
Adit and Shaft Closure	<ul style="list-style-type: none"> • Close mine openings for public safety • Preserve bat and other wildlife habitat • Plug openings for water control 	<ol style="list-style-type: none"> 1. Determine number and type of portal/collar closures <ul style="list-style-type: none"> • Gates w or w/o access • Collapsing/Backfill • Water tight plug 2. Estimate costs 	<ul style="list-style-type: none"> • POO • FS Biologists • FS Abandoned Mine Program • Third Party Consultants • Equipment production and cost guides • Previous contracts for similar work in area

LONG TERM SITE OPERATION, MAINTENANCE AND MONITORING

Two types of long-term maintenance requirements should be considered. The first involves tasks such as revegetation, weed control, and operational water monitoring which involve a finite period for performance (3 – 5 years). The other involves operation and maintenance of facilities that have an indefinite design life or have on-going maintenance requirements. Examples of these include diversion ditch maintenance, sediment pond cleaning, cover and cap repair, and water treatment. Revegetation success and weed control requirements can be estimated by assuming some level of initial revegetation failure and hence a requirement to reseed a certain number of acres on the mine site in subsequent years. An example would be making the assumption that there will be a 25% failure rate in the first year, a 10% failure rate the second year and so forth. The estimator may also want to include an annual allowance for fertilizer and weed control for the first several years to enhance revegetation with desired species. The revegetation portion of the bond may be released for those acres that meet the revegetation success criteria contained in the POO. Forest Service vegetation and soils specialists should be consulted to ensure that the assumptions are realistic for the site and environment.

Other reclamation items that may require a more long-term commitment include cover repair, diversion ditch cleaning and other similar annual maintenance activities. These types of requirements are readily estimated by assuming a work crew will perform the work over a defined period of time each year. For example, the estimator could assume that in order to repair erosion rill and gullies, clean out diversion ditches and reseed failed areas that it will require a 3 person work crew with dump truck, backhoe and bull dozer over a 3 week period each summer. The estimator will need to make assumptions as to how long these types of activities will be required,

and the possibility of having to do snow removal in the winter to accomplish the necessary site operation and maintenance. FS Construction and Maintenance crews can be a good source of information for annual costs and requirements for this type of work.

In certain instances, long-term water monitoring may be required that is not associated with water treatment requirements. An example of this could be water and aquatic wildlife monitoring related to sedimentation and TSS along a stretch of reclaimed stream channel.

<u>SUB-TASK</u>	<u>OBJECTIVE</u>	<u>COST ITEMS</u>	<u>INFORMATION SOURCES</u>
Cover Repair	<ul style="list-style-type: none"> • Repair failed cap areas 	<ol style="list-style-type: none"> 1. Assess damage and design repair 2. Regrade, re-soil, and install erosion control measures 	<ul style="list-style-type: none"> ▪ Site inspection ▪ Engineering ▪ FS C&M crew ▪ Contractor
Reseeding	<ul style="list-style-type: none"> • Repair failed vegetation 	<ol style="list-style-type: none"> 1. Assess failure 2. Test soil vegetation 3. Determine area requiring reseeded 4. Reseed 	<ul style="list-style-type: none"> • Site inspection • Soil Scientist, range specialist, botanist • FS C&M crew • Contractor
Diversion ditch clean-out and repair	<ul style="list-style-type: none"> • Maintain surface water diversions for continued performance 	<ol style="list-style-type: none"> 1. Assess capacity and function 2. Determine clean-out/repair 3. Clean-out and repair as needed 	<ul style="list-style-type: none"> • Site inspection, • Hydrologist, engineering • FS C&M crew • Contractor
Weed Control	<ul style="list-style-type: none"> • Control noxious weeds 	<ol style="list-style-type: none"> 1. Determine extent and area of weed infestation 2. Determine treatment 3. Treat 	<ul style="list-style-type: none"> • Site inspection • Soil Scientist, range specialist, botanist • FS C&M crew • Contractor
Water Monitoring	<ul style="list-style-type: none"> • Meet water quality standards • Meet permit requirements 	<ol style="list-style-type: none"> 1. Determine sample design (location, frequency, test type, parameters, labs) 2. Estimate labor and analytical costs 	<ul style="list-style-type: none"> • FS hydrologists • State Agencies/Permits • Analytical Lab • Contractor

STEP 6 – ESTIMATION OF INDIRECT COSTS

Indirect costs are those fees and charges over and above the direct reclamation costs that are encountered during any reclamation project. Such costs may be related to the planning, design, contracting, administration or actual performance of reclamation work. Either the Forest Service or its contractor incurs these costs. Many indirect costs are derived from industry wide averages and are summarized in graphs referenced by this Guide. It is essential that these costs be validated based on locality, size of operation, and other site-specific information.

Typical indirect costs fall into the following categories:

- Engineering Redesign
- Mobilization and Demobilization
- Contractor's Costs
- Agency Project Management
- Contingencies
- Inflation

Appendix A discusses the applicability of Indirect Costs to small scale operations.

Because indirect costs are typically calculated as a percentage of total direct costs, it is important that direct costs not include indirect cost items. This can be a concern when using costs from the Forest Service Cost Estimating Guide for Road Construction, which may have already accounted for some indirect costs such as contractor's profit and overhead.

Indirect costs are applied individually as a percentage of the total direct reclamation costs, with the exception of inflation. Inflation is applied to the total of all direct and indirect costs. For an example see Appendix F that shows how these costs are applied and totaled.

Engineering Redesign Costs

The reclamation section of the POO, as submitted by the operator, generally assumes some interim or final reclamation and closure configuration. However, the level of detail in the POO is

typically not sufficient for construction purposes. In the event of operator bankruptcy or abandonment, additional site characterization is needed to develop the engineering specifications and drawings required for contracting. This work often includes the following tasks:

1. Preparation of maps and plans to show the extent of required reclamation and collect detailed information for quantities.
2. Survey of topsoil and waste stockpiles to determine amount of material available.
3. Sampling and analysis of waste rock, tails, heap material, surface and ground water, etc.
4. Sampling and analysis of topsoil and waste piles to determine whether special handling or treatment is necessary.
5. Evaluation of structures to determine requirements for demolition and removal.
6. Evaluation of storm water facilities and process solutions or water impoundments to determine if treatment, clean out, or other improvements are necessary.
7. Assessment of previously reclaimed areas to determine whether standards have been met.

The site characterization information is then used to develop detailed engineering construction specifications, plans and drawings; and a government cost estimate (design) for the site. Appendix G is an example of the level of detail required in engineering specifications for contracting purposes. Coordination with other specialists and agencies may result in changes or additions to the design.

Changed environmental conditions or impacts may necessitate a change in the final reclamation of the site, requiring supplemental environmental analysis prior to design implementation. Existing, new or overlooked state and federal requirements may also require consideration.

For example, closure of heap leach pads in the State of Nevada requires a detailed analysis to address and mitigate the potential impacts to waters of the state from the heap solids and any leachate. This requires in part a characterization of the heap solids and leachate, a water balance and groundwater characterization, and modeling

of the post-closure heap to assess any related impacts.

Engineering redesign costs typically range between 2% and 10% of the total direct costs.⁸ The estimator may be justified in applying a higher percentage or using a different amount for the engineering redesign cost. This may be true in Nevada, where specific data is available on the cost of complying with state closure requirements, for instance.

Design for work needed to deal with an emergency situation or to avoid irreparable injury to National Forest resources (e.g., water quality) may have to be accomplished soon after bankruptcy or abandonment of a property. So, like Interim Operation and Maintenance, a readily available source of funding should be required in the POO for this part of the reclamation bond (cash, certificate of deposit, letter of credit, etc).

Mobilization and Demobilization

Mobilization and demobilization are indirect costs for moving personnel, equipment, supplies and incidentals to and from the reclamation site. Important factors influencing these costs are the remoteness of the site, availability of equipment, road use restrictions and permits. "Unusual time constraints, a need for special equipment, the presence of non-standard features or conditions that hinder equipment mobility, or a remote location may require actual cost estimates that could result in the use of a higher percentage" (OSMRE, 2000)

The standard allowances for this category normally ranges up to 10 percent of the total direct costs.⁸ Mobilization and Demobilization costs can also be estimated on a site-specific basis, by considering the above costs on an item by item basis. Calculation of mobilization and demobilization on a site specific basis is particularly appropriate for smaller operations.

⁸ Cost Estimating Guide for Road Construction, Regions 2,3,4, USDA-Forest Service; Office of Surface Mining, Handbook for the Calculation of Reclamation Bond Amounts Bond Guidance, April 2004
FINAL



Contractor's Costs

In most cases, the Forest Service will hire an outside party or contractor to conduct the actual reclamation work. That contractor's expenses will be passed on to the FS and should be included in the bond estimation. The amount will vary with the size of the job and operating techniques, business structure, the contractor's financial status, as well as the job conditions and local tax rates.

Contractor's profit and overhead is a large portion of cost the Forest Service will pay when contracting for mine reclamation. It will therefore make up a large portion of the indirect costs to be included in every bond estimate. Examples of contractor's profit and overhead costs include:

- Project Management (managers, superintendents, etc.)
- Construction office and storage trailers
- Safety/Personal Protective Equipment
- Temporary sanitary utilities
- Security fencing
- Scheduling
- Surveying
- Quality Control
- Special Tools
- Subcontracting costs
- Overtime Costs
- Unemployment and Social Security Taxes
- Workers' Compensation
- Owner's compensation (profit)
- Project manager's and estimator's wages
- Clerical support wages
- Office rent and utilities
- Insurance
- Performance and Payment Bonds

Profit and overhead allowances are usually estimated based on a percentage of the total direct costs, typically ranging between 15%-30% (R.S. Means). Figure 2 – Profit and Overhead – can be used to determine the percentage to be applied to the direct costs for profit and overhead.

In some cases, the estimator may be justified in applying a different percentage or using a different amount for the profit and overhead cost. This may be the case where experience with these costs in connection with reclamation of similar mine sites is available. The estimator should consider job conditions including job location and the availability of contractors, subcontractors, equipment, materials, and labor. Several R.S. Means publications and other cost guide sources may be used to estimate percentage add-ons or reductions for job conditions.

State sales tax, if applicable, is also paid by the contractor or subcontractors on all materials, rental equipment, and supplies; and is passed on to the Forest Service. Sales tax should be calculated based on materials and supplies needed to reclaim the site, such as seed, fertilizer, mulch, seedlings, erosion control materials, piping, water treatment supplies, etc. Sales tax may be estimated using the following formula:

Estimated Sales Tax = Tax rate (%) x (Cost of supplies and materials). In general, supplies and materials are typically 40 to 60% of total direct costs.

Federal construction contracts exceeding \$25,000 require both a performance and payment bond (Miller Act, 40 USC 270a *et seq.*). Each bond premium is estimated to be 1.5% of the total project costs for a total of 3% to be applied to total direct costs on projects exceeding \$25,000.



Agency Project Management

Agency project management includes costs for Agency Administration and Contract Administration associated with the closure of mineral operations, due to bankruptcy, abandonment or other reasons. These costs include personnel time and agency overhead costs. The Forest Service is funded through its regular appropriations to administer on-going mine operations, including active mining and reclamation. Once a mine operator is no longer present and operating or reclaiming the site, the Forest Service should take over that role and the costs for project management increases dramatically.

For the purpose of bond estimates “unplanned and unbudgeted costs” means those costs incurred when the FS takes control of the project that are above and beyond those costs ordinarily in our budget. Total Agency (FS) Administration costs for the project should be reduced by the dollar amount normally budgeted by the FS for administration of the approved operation.

The highest Contract Administration costs will be incurred for management of large mine closures that involve multiple contractors working over a long period of time. Less management, and therefore less cost, is required for smaller projects involving a single contractor, or those that can be closed with Forest Service equipment and personnel.

Because contract development and administration involve specialized personnel and regulations, Agency Project Management is subdivided into Agency Administration and Contract Administration.

Agency Administration This item includes all work performed by Forest Service personnel and associated overhead costs of administrative work in support of agency closure of a mine (above and beyond that normally budgeted through appropriation). It does not include work that would be required for normal administration of reclamation performed by the operator. Typically, personnel supporting the project would include the minerals administrator, Forest Geologist, engineers, law enforcement, etc. The costs of non-Forest Service personnel may be included in a reclamation bond, when a single reclamation

bond is held by multiple agencies (e.g. Federal or State).

PROFIT AND OVERHEAD

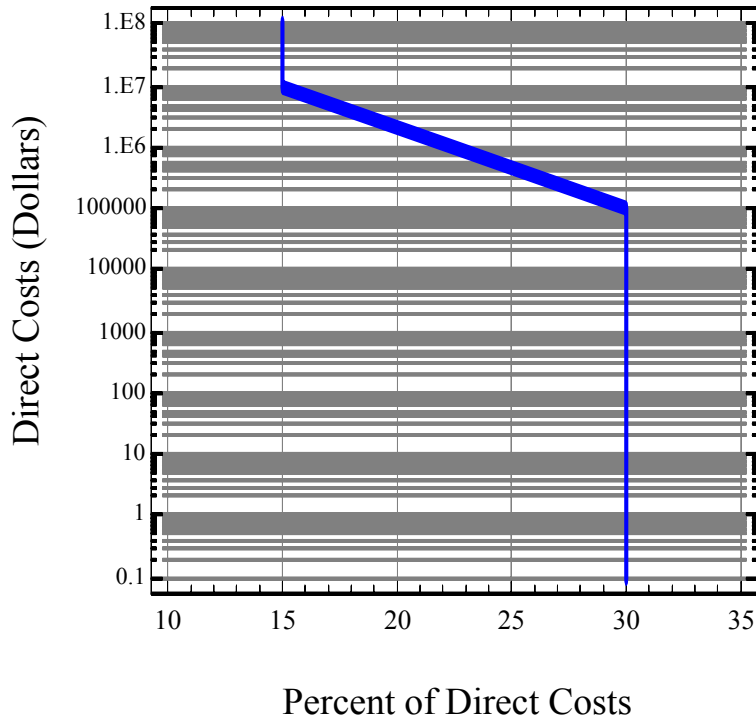


Figure 2: Graphical representation of reference lines 01310 062 0300 through 0450 (Modified from Means, 2002)

Agency Administrative costs are best determined by estimating expected person days and overhead charged to the project. Actual employee costs to government should be used. Agency overhead includes additional costs for space, supplies, telephone, copying, postage, vehicle, travel, and overtime expected for the project. Examples of qualifying project work include:

- Planning
- Budgeting
- Hiring
- Supervision
- Site Inspection
- Monitoring
- Sampling
- Surveying
- Testing
- Review
- Law Enforcement

Exclude any expenses already itemized under Direct Costs. Experience shows that Agency Administration costs are in the same range as Contract Administration costs (discussed below). However, direct cost calculation (not a percentage) should be used to determine Agency Administrations costs because personnel needs and overhead costs vary from project to project.

Contract Administration This item includes all costs of the preparation and administration of oversight, design, construction or other contracts needed to accomplish closure and other operating plan requirements. Bond cost estimates should assume that reclamation work would be accomplished under one or more construction contract administered by FS personnel. Additionally, there may be other contracts, such as engineering design or project management (contractor may be hired by the FS to oversee and manage large and complex reclamation projects). Contract administration costs vary and may be estimated using Figure 3 . These costs are consistent with actual Forest Service costs for recent contracts for exploration and mine reclamation, EXCEPT FOR CONTRACTS UNDER \$50,000. Certain contract administrations costs do not decrease with the dollar amount of the contract. These costs should be estimated on a project specific basis.

Contingencies

Including a contingency cost item is a common practice in cost estimation and **is not** a way to estimate the cost of worst-case scenarios, such as a spill of fuel during transport or tailings dam failure where these events are not predicted to occur. Contingency costs are meant to address the errors that exist in every estimate resulting from the use of assumptions and conceptual information rather than actual measurement of work to be performed.

The two types of contingencies discussed in this Guide are scope and bid contingencies. Scope contingency addresses the uncertainty inherent in producing a closure design. Bid contingency addresses the cost uncertainty inherent in actual construction or implementation of the project design.

The level of scope and bid contingency cost estimates will vary based on the kind of operation proposed, and the level of information available to define the operation and associated surface resources that could be affected. For example, contingency costs may be negligible for an exploratory drilling program where potential impacts are minor and well defined, but high for a large scale mining proposal involving facilities like tailings dams and potential impacts like acid rock drainage.

For this reason, contingency costs as defined in this Guide are applicable only to large or complex operations. As a guide, large operations are those with reclamation bonds greater than \$100,000.

Scope Contingency

To estimate scope contingency costs, we are using information from Gentry, 1979, which describes four broad categories of stage of project development (Table 1).

For purposes of these guidelines, the level of detail contained in initial Plans of Operation typically falls in the “Order-of Magnitude” Category in an accuracy range of from 30 to 50 percent. This level of accuracy is sufficient to define the kind, area and amount of environmental impact expected in order to establish the scope of the NEPA analysis.

The level of POO detail increases as engineering and environmental data are gathered during the

NEPA analysis. The level of information required to conduct a detailed effects analysis and evaluation of alternatives in a draft NEPA document, typically fall within the “Preliminary” Category in an accuracy range of from 10 to 30 percent. Changes to the POO based on analyses in the NEPA disclosure document (EA or EIS) and subsequent approval of the POO, generally increases the level of detail to the point where the plan should meet at least the lower range of the percentages defined in the “Preliminary” Category (10 – 20 percent). . The estimator will be required to construct an estimate using this level of detail prior to any surface disturbance.

Once mine construction and operations commence, the details of the project and reclamation plan may approach a “Definitive” Category (6-10 percent) as defined in the table. There still may be certain components of the plan where the levels of uncertainty remain high. These frequently include issues pertaining to water quality.

By the time reclamation begins, the level of detail approaches the “Detailed” category. This category would be at the stage of highest detail and thus the lowest contingency (4-7 percent). There will always be some uncertainty associated with the project so a contingency should always be applied.

CONTRACT ADMINISTRATION COST

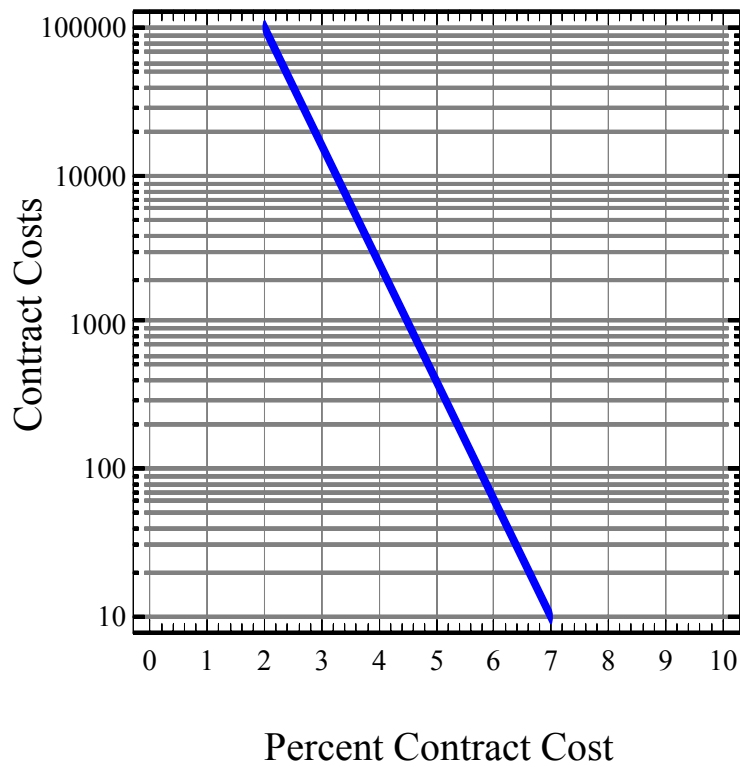


Figure 3: Contract Administration Costs
(Modified from OSMRE, 2000)

TABLE 1
 COMPARISON OF VARIOUS COST ESTIMATES WITH PERTINENT ESTIMATING
 CHARACTERISTICS
 (After Gentry, 1979)
 (Taken from Mine Investment Analysis, Gentry and O'Neil, 1984)

TYPE OF COST ESTIMATE AND ASSOCIATED STAGE OF PROJECT DEVELOPMENT	ACCURACY (%)	TIME REQUIRED FOR ESTIMATE	CONTINGENCY REQUIRED (%)	PERCENTAGE COMPLETION OF PREPRODUCTION ENGINEERING EFFORT (%)	PERCENTAGE OF PREPRODUCTION CAPITAL EXPENDITURE (%)
Order of Magnitude	30-50	1-2 Days	20-30	<5	< 0.5
Preliminary	10-30	1-6 Weeks	10-20	15-20	2-5
Definitive	10	3-6 Months	6-10	50-60	10-15
Detailed	<5	2-9 Months	4-7	90-100	50-60

The contingency allowance should be modified downward only when assumptions have been confirmed and the level of uncertainty reduced.

Bid Contingency

The bid contingency is meant to address construction costs, unforeseeable at the time of the bond estimate, which are likely to become known only as actual reclamation and closure work is conducted. Bid contingency is sometimes referred to as “construction” contingency for this reason. These costs result from changes in site conditions or work required which necessitate additional costs and contract modifications, change orders and/or claims. Such changes may be caused by adverse weather, material or supply shortages or other factors.

Bid contingency typically ranges from 10 to 20 percent of direct costs depending on the complexity and scope of construction and amount of data available for the site. (EPA,2000)

Summary

Scope and bid contingencies are applied as a percentage of the total direct costs, in the same way as other indirect costs.

Inflation

Inflationary factors in the marketplace will generally increase the cost of reclamation over time. Inflation then, should be considered whenever a substantial time interval may pass between the bond estimate or update and potential bond collection and use. Consider, for example, a project for which the bond estimate is updated every two years and the planned reclamation operations will take three years to complete. If bankruptcy or abandonment occurs just prior to a bond estimate update, nearly five years could elapse before bond funds are ultimately consumed. Additionally, experience has shown that actual collection of the bond funds will likely take another year due to bankruptcy or other legal issues. Inflation can significantly erode the bond value during these six years. Adjusting the total bond amount by a reasonable inflation rate will mitigate this devaluation.

Adjustment for inflation may be accomplished by summing incremental inflation amounts for each year of delay; succeeding year’s adjustments being based upon the total bond plus the previous year’s inflation. The time period over which inflation is to be calculated should include (1) the number of years until the next bond estimate update, (2) the number of years required for reclamation and (3) one year obtaining bond release. Note that bond amounts should not be adjusted down for any potential deflation.

The trend of inflation during recent years, as well as current US economic indicators, should be considered when determining a reasonable inflation rate. Has inflation been relatively constant over the recent past? Has recession resulted in declining prices (deflation)? What is the near-term economic outlook? A number of published cost indexes may be used to determine past inflation/deflation trends. These trends may, in turn, be used to calculate a reasonable inflation rate. Your local or regional Forest Service mineral economist may be consulted for inflation information and assistance.

A cost index describes changes over time of the selling prices received by domestic producers of goods and services. The changes are indexed to some base year and month, which is set at 100. Succeeding months are assigned values greater or lower depending on actual price changes. An index of 110, for example, indicates an inflationary increase of 10 percent. One index used for mining related activities is the Construction Cost Index (CCI) published by *Engineering News Record* (<http://www.enr.com>; search on “cost indexes”). An inflation/deflation rate over a specified period of time (1 years in this example) may be calculated from these indexes using the following method (assumes the use of CCI):

Index point (most recent date):

November, 2002 CCI = 6578

Previous index (earliest date):

November, 2001 CCI = 6410

Percent change (over 1 years) = $[(6578 - 6410) / 6410] \times 100 = 2.6\%$

Assuming inflation will continue at the rate, the cost of inflation for the coming year may be estimated by multiplying the total bond estimate by 0.026. If the initial total bond amount is represented by “P” and the average estimated annual inflation rate is “i”, then the inflation adjustment factor at the end of “n” years may be estimated as follows:

$$\begin{aligned} \text{Inflation Adjustment Factor} &= (1 + i)^n \\ \text{Revised Bond Cost adjusted for a set period} &= \\ &P (1+i)^n \end{aligned}$$

If P=\$10 million and i=2.6% the revised bond cost adjusted for inflation for a 5 year delay would be:

$$\begin{aligned} &\$10M(1 + 2.6\%)^5 \\ &\$10M(1.026)^5 = \$11.4M \end{aligned}$$

STEP 7 - SUMMARIZE AND REVIEW THE ESTIMATE

Typically the following types of bond estimate summaries are produced.

- Summary of costs by reclamation task, :
 - Interim Operations and Maintenance
 - Hazardous Materials
 - Water Quality
 - Demolition, Removal and Disposal of Uncontaminated Structures, Equipment and Materials
 - Earthwork
 - Revegetation
 - Mitigation
 - Long-term Operation, Maintenance and Monitoring
- Summary of reclamation costs associated with each facility, as applicable.
- Summary of direct reclamation costs
- Summary of indirect costs

Indirect costs are applied individually as a percentage of the total direct reclamation costs, with the exception of inflation. Inflation is applied to the total of all direct and indirect costs.

For an example see Appendix F that shows how these costs are applied and totaled.

The level of effort put into breaking down and summarizing data should be commensurate with the complexity of the project. It will be both to the estimator’s and operator’s advantage if the cost estimate is highly annotated and sub-divided so that each cost item can be quickly and easily be reviewed and recalculated.

Interdisciplinary FS personnel and the authorized officer should review the draft bond estimate. Once a draft bond estimate is completed, state and federal land management agencies, other federal agencies, the operator and/or their contractors typically review the estimate. The following review process should allow for a timely and equitable review. The review process is as follows:

- Internal review by Forest Service personnel.
- Completed bond cost estimate is provided for review to operator, other agencies, etc. Establish a timeframe for review up to 30 days.
- Written comments are provided to the Forest Service with a request for a meeting to discuss the comments, if necessary.
- Conduct meeting to discuss comments, if necessary.
- Forest Service considers and evaluates the written comments as well as information provided in the meeting, modifies the estimate as warranted, and advises the operator and agencies of the bond amount required.
- The completed bond estimate is incorporated into the POO prior to approval. The bond estimate often adds detail to how the reclamation work will be performed. As mentioned, the FS decision on the POO and the bond estimate are subject to administrative appeal by the operator.

STEP 8 - BOND ADMINISTRATION

Once the bond estimate has been finalized, an operator should provide an acceptable bond instrument(s) (per US Treasury regulation) before the POO is approved. Once the bond instrument is determined to be acceptable, it should be:

- Filed in a secure place by the Forest Service;
- Reviewed annually for accuracy and adequacy;
- Adjusted as conditions and costs change;
- Be released when reclamation standards are met; or
- Be secured by the agency to finance the reclamation work in the event that the operator is determined to be in default with the approved POO.

The purpose of the bond review is to confirm that the estimate is still adequate. This review should consider any new or unanticipated changes in operations, unit costs, local economy or environmental impacts.

The annual bond review may trigger recalculation of the estimate and a bond adjustment. Under the following conditions a bond adjustment may be required if the authorized officer determines that acceptable reclamation can not be accomplished with the existing bond.

1. When the POO is modified or supplemented;
2. When the operator requests a reduction in bond for reclamation work completed;
3. When identified or scheduled in the POO;
4. When the annual review identifies changes in reclamation cost assumptions, i.e.: unit costs, labor rates, equipment, materials, etc.;
5. When new or unanticipated environmental impacts occur;
6. Changes in the status of the bond instrument or financial institution; and
7. Other scheduled bond updates which may be described in the Plan of Operation.

Appendix B discusses bond administration in detail from acceptance to release, including periodic review of bond instruments.

STEP 9 - BOND COLLECTION

In the event the operator is unwilling or unable to close and reclaim operations, the Forest Service should take a number of steps prior to bond collection. These include:

- Establish operator non-compliance and default with the plan of operation and/or the 36 CFR 228A regulations (consult with OGC).
- Participate through Office of General Counsel (OGC) and the Department of Justice, in any bankruptcy court proceedings.
- Collect the bond and establish appropriate accounts with financial personnel.
- Track the money used for reclamation of site.

Establishing Non-Compliance and/or Default

The first step in collecting a reclamation bond is to document that the operator is unable or unwilling to perform reclamation/closure obligations stated in the approved plan of operations (POO) or Forest Service 228A Regulations. Note that the parts of the 36 CFR 228A regulations which are applicable are:

228.8(g) – “This section sets the time frames (one year) for the operator to begin reclamation once operations have ceased. It is important that the FS document the date that operations cease to establish the starting point of the timeframe. Note that there is a provision (228.10) for the operator to request to extend this time-frame

228.9 – This section describes the operator’s obligation to maintain structures, equipment and other facilities in a safe, neat and workmanlike manner. When an operator is unable or unwilling to operate and maintain the site in compliance with the plan, this section can be used to establish default.

228.10 – Provides for removal of structures, equipment and facilities within a reasonable time frame. It also requires the operator to file an annual statement stating their intention to maintain facilities in order to extend the time frames for reclamation in 228.8(g).

There are many possible closure scenarios that will affect the way default is established. The following are some examples.

Operator abandons the site and cannot be reached. In this case establish the record of attempts to contact the operator with return-receipt requested letters documenting the non-compliance or failure to perform as required by the plan of operations. Cite violations of 228.8(g), 228.9 and 228.10 as appropriate.

Operator has ceased operations but is unwilling to begin reclamation as required in 228.8(g) and the approved POO. Document correspondence establishing cessation of operations and notifications to operator to begin reclamation, or file a verified statement under 228.10. Failure to do either may constitute noncompliance and lead to bond default.

Operator is unable to operate, maintain or reclaim operations due to bankruptcy. Circumstances will dictate the course of action, but the FS should still establish noncompliance and default with the POO or regulations before gaining access to and using the reclamation bond. In some cases, the Forest Service may request the operator or bankruptcy trustee to provide a letter stating that they are unable to perform as required under the POO. It is important to remember that it is the inability to perform as required by the POO or regulations that constitutes default, not bankruptcy itself.

In some cases, particularly in Chapter 11 (reorganization) bankruptcy proceedings, the operator or a court appointed trustee may continue to maintain the site as required by 228.9 and 228.10. Usually this is the case where the operation is still economically viable on its own or in combination with other assets. In this situation the FS should coordinate closely with the regional office, Office of General Counsel and Dept. of Justice Attorneys who are assigned to the case. See discussion below on bankruptcy.

In Chapter 7 bankruptcy, the operator or court may respond to FS notifications under 228.8(g), 228.9 and 228.10, that the operator is no longer able to operate, maintain or reclaim the site. This constitutes default.

In all cases of abandonment, non-compliance or bankruptcy, the FS should provide copies of all correspondence to other parties with jurisdiction (i.e.: other state and federal agencies) and financial institutions providing the reclamation bond. Copies will also be provided to forest and regional minerals and fiscal offices and the Office of General Counsel.

Bond Collection

Once default has been established, the FS can begin procedures for collecting the bond. These procedures vary with the type of instrument involved. Forest or regional fiscal officers should be relied upon to take the necessary collection action, place the money in the appropriate account and provide the funds to accomplish the required reclamation. Forest personnel should consult with OGC in the case of a bankruptcy.

Estimated time to collect bonds under various instruments is as follows:

- Cash – Days. Time involved is for transferring the money from Treasury into a Forest account and requesting permission from the Regional Office to charge against the account. For this reason it is important to take the time to determine whether such use is appropriate. This may involve consultation with Forest or Regional Office personnel, or legal counsel.
- Assignments (savings accounts and Certificates of Deposit) and Letters of Credit (LOC) – Days to weeks assuming the assignment instrument or letter of credit was set up as described in FSM 6509.11k, the financial institution is readily accessible, and the procedures for drawing on the instrument clearly defined and followed. However, when dealing with a private institution there is the possibility of a dispute that could take

time to resolve. If this occurs collecting an assignment or LOC may take longer than a government security.

- Government Securities – Weeks to collect. The FS Regional Office Fiscal Officer should request collection or sale of U.S. Treasury Bills, Notes or Bonds, in writing from the Federal Reserve Bank holding the securities. Although this procedure is more demanding than collection of an assignment or LOC, there is almost no potential for a dispute to arise that would delay payment.
- Surety Bonds – Months to over a year to collect due to the lengthy process that should be followed for bond demand (see FSM 6509.11k). Surety bonds are usually the most troublesome for the FS to collect because of the potential for disputes with the surety company that may further delay the bond collection.

Appendix B discusses bond collection procedures in general.

Bankruptcy

In the event of bankruptcy the Forest Service should immediately initiate a request for representation in the proceedings by the Department of Justice. Court rulings may have significant impact on our ability to secure the bond and operate and maintain the site. This request is by the OGC through the Regional Forester. The most important bankruptcy actions which need to be taken on our behalf are:

1. Attend court hearings and provide bankruptcy related schedules, correspondence and orders to the appropriate FS and OGC offices.
2. Filing of claims for closure/reclamation of the site. To support this claim, the Forest should obtain specialized expertise to review the bond estimate and identify any unfunded closure and reclamation costs that may be present. Often, there is no time to collect additional information; this cost should be

developed quickly. This estimate should include direct and indirect costs including provision for unexpected contingencies.

3. Request the bankruptcy court and trustee to manage or allow the operator to continue to manage the mine site to ensure public safety and prevent environmental damage, until such time as reclamation bonds can be secured. This includes paying personnel, preventing the premature sale of necessary facilities and equipment and purchase of needed supplies and utilities. This will likely require that the FS document the critical facilities, equipment and materials that are needed to operate and maintain the site to prevent environmental damage and ensure public safety.

Every effort should be taken to ensure that adequate representation continues throughout the bankruptcy proceedings. Forest Service needs to stay involved in the court proceedings to help ensure that our interest is protected.

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SUMMARY OF COMMENTS
RECLAMATION BOND ESTIMATING AND ADMINISTRATION GUIDE
USDA Forest Service

On May 15, 2003 the Forest Service released the Draft Reclamation Bond Estimating and Administration Guide (Bond Guide) for comment. Copies of the Bond Guide were sent to reviewers including all Forest Service Regional Minerals Staffs, other State and Federal Agencies, Mining Industry and Environmental Groups as well interested publics. A list of reviewers who received the Guide is attached. In addition the Bond Guide was made available through the Forest Service Washington Office Minerals and Geology website.

Approximately 20 comment letters were received by the close of the comment period, representing a cross-section of the agencies, mining industry, environmental groups and the public. The following summary addresses comments received from multiple reviewers, or which triggered significant changes in the final Bond Guide.

The Forest Service (FS) would like to thank all those who submitted comments, both large and small, for their time and effort. The Bond Guide Working Group reviewed all the comments received and made many editorial and substantive changes in the Final Guide making it a more comprehensive, clear and accurate document.

INTRODUCTION

There were several comments received that noted that the overall tone of the Introduction was too negative leaving the impression that most operations were inadequately bonded. Other reviewers questioned the need for the Introduction in the Bond Guide.

We chose to retain this section because of its value in explaining both the need and purpose of this first edition of the Bond Guide. However we recognized that most reclamation is successfully completed by operators, and even in bankruptcy many operators continued to play a key role in the operation and closure of their mines.

Finally, a few comments were received that the document was too long. We acknowledge that the Bond Guide is not typical of most bonding guidance issued by other state or federal agencies. In addition to bond cost estimation, it includes sections on bond administration, bond collection procedures, guidance for plan of operation content and other pertinent information. Finally in this first edition of the Bond Guide we describe the need for such guidance, as well the process itself.

Finally as stated in the Introduction, the Bond Guide is meant to be a living document that is modified based on experience with its use. The Bond Guide will be posted on the national Forest Service Minerals and Geology website at <http://www.fs.fed.us/geology/>. The intent is to gather comments on any changes and improvements to the Guide.

I. AUTHORITIES

Comments were received that questioned whether the FS had the authority to bond for items like monitoring, maintenance and indirect costs. The FS recognizes that the wording in the current 36

CFR 228A regarding reclamation does not specifically list the cost items that must be addressed in a reclamation cost estimate. However, the cost elements presented in the Bond Guide are based on experience with actual mine closures, are commonly included in current reclamation guides and bond estimates and are based on standard industry cost estimation practices. For these reasons, these items are consistent with the scope and intent of the reclamation provisions in 36 CFR 228A and should be addressed in bond estimates.

BOND ESTIMATES

STEP 1 – DETERMINING THE PERIOD COVERED BY THE BOND

This section has been extensively revised to address concerns about the use of terms like “maximum cost” in describing cost estimates and the requirements for periodic bond review and update.

The rewrite of this section clarifies that our intent is to stress that bond estimates may cover single to multiple year periods of an operation provided that it is sufficient to cover the full cost of reclamation at any time during the period. In the current version of the Bond Guide we have substituted the term “peak reclamation” for “maximum” to describe this cost. Further we stress that this is an actual, estimated cost, not a “worst case” assumption or scenario.

The topic of periodic bond reviews and updates was dropped from this section of the Bond Guide and will be addressed in the discussion of **Step 8 – Bond Administration**.

Step 2 – What Is Being Reclaimed

Minor modifications were made to this section to emphasize the point that detailed descriptions of facilities, equipment, materials, activities and personnel in the POO provide the basis for the bond estimate.

STEP 3 – WHAT ARE THE STANDARDS TO BE MET

This section was rewritten to clarify the relationship between reclamation objectives and standards, and to underscore the importance of including performance standards in POOs and bond estimates.

STEP 4 – WHAT ARE THE RECLAMATION TASKS

The section on Interim Operations and Maintenance (Interim O&M) was reorganized to address three general types of Interim O&M concerns; public safety, access and utilities, and water management. We did receive comments to expand the treatment of water management in this section. We agree that water management is a major concern during Interim O&M, however we believe that the short discussion here, and the more lengthy discussion in the section on Water Treatment adequately addresses this issue.

The section on Water Treatment was rewritten to address a number of comments that were received including:

- The need for water treatment should be based on impacts that are predicted to occur not a worst case assumption.
- The cost of such treatment should be based on actual flow and quality data, not addressed as an indirect, contingency cost.
- The need for and cost of water treatment should be updated based on monitoring data
- Water management and treatment, where it is needed, is the most costly item in reclamation estimates.

We also received comments questioning the use of Figure 1 to display the relative costs of physical reclamation verses water treatment. We have retained this Figure in the final Bond Guide because it underscores the significant expense of water treatment.

Several comments were received urging the FS to reconsider its advice on salvage values in the section on Demolition. However based on actual experience with mine abandonment and bankruptcy we have retained the wording from the Draft Bond Guide that no salvage value for facilities should be allowed in the cost estimate.

On a related issue, the FS did investigate the possibility that certain high cost facilities, like water treatment plants, could be protected during bankruptcy or abandonment, so that the cost of replacement would not have to be included in the bond estimate. This discussion is presented in the section on **Long-Term Operation, Monitoring and Maintenance (Long-Term O&MM)**.

Also in response to comments, we have included a discussion about estimation and bond instruments for long-term costs associated with facilities like water treatment plants. This discussion briefly describes issues involved with cost analysis and interest bearing accounts. We acknowledge that legal and technical issues exist that make it imperative that Forests involve regional and national experts when considering cost estimation or bonding for these types of facilities.

Step 5 – Estimation of Direct Reclamation Costs

Minor changes were made in this section. The table for long-term operation and maintenance was modified to address comments regarding discounted cash flow, net present value analyses, and the time period for the analysis. Some reviewers suggested that we include standardized unit costs for common reclamation tasks. We do not believe that it would be appropriate to include standardized unit costs in the Bond Guide which is intended to apply across the wide range of operations and site conditions that exist on the National Forests.

STEP 6 – ESTIMATION OF INDIRECT COSTS

There were relatively few comments on indirect costs.

One reviewer felt that including an indirect cost for contingency duplicated some of the other indirect costs. We reviewed these comments, but do not believe that there is duplication of indirect costs, and that the guidance is in-line with other cost estimating references and guides.

Another reviewer asked us to reconcile our guidance on indirect costs with that of other agencies like the Office of Surface Mining, Bureau of Land Management and the Environmental Protection

Agency. After a cursory review of other agency indirect cost guidance we concluded that overall differences between agencies were relatively small and resulted from certain costs going to different indirect items, agency policies, and the size, type and complexity of operations being managed.

STEP 7 – SUMMARIZE AND REVIEW

No significant comments were received or changes made in this section. A number of reviewers suggested that we include examples of bond estimates to illustrate the process outlined in the Bond Guide. While we agree that such examples would be helpful, none exist at the present time that illustrates all aspects of the process. However we are hopeful that such examples will be developed in the future as the Bond Guide is used to develop bond estimates.

STEP 8 – BOND ADMINISTRATION

This section was rewritten to address comments received concerning the requirement for periodic bond review and update. Several reviewers applauded the emphasis on periodic bond review and update, but others were concerned it would result in excessive work and require almost constant update of bond instruments.

In the re-write of this section we distinguish between bond reviews, bond estimate recalculation, and bond instrument updates. Bond reviews are intended to be a relatively straightforward check which is done annually to verify that no significant changes to operations or bond assumptions have occurred. Bond reviews include both field and office review of the operation. Bond recalculations would only be done when significant changes in the operation or bond estimate assumptions occur. Bond instrument updates only occur as a result of bond recalculation and if addition bond is required.

Some reviewers suggested that we include guidance on cost thresholds that would be used to determine when bond updates would be required. For example it was suggested that bond updates would only occur if bond review and recalculation demonstrated that the cost estimate was off by 10 percent or more. We do not believe that setting a specific threshold for bond update would be appropriate in the Bond Guide, but states that the authorized officer should determine whether acceptable reclamation can be accomplished with the existing bond.

STEP 9 – BOND COLLECTION

There were no significant comments or changes in this section.

APPENDIX A – GUIDE APPLICABILITY TO SMALL OPERATIONS

One reviewer suggested that we address exploration operations in this Appendix. The title and text of Appendix A was revised to address this issue.

APPENDIX B – BOND ADMINISTRATION

There were no significant changes in this Appendix.

APPENDIX C – PLANS OF OPERATION INFORMATION

There were no significant changes in this Appendix.

APPENDIX D – SELECTED REVEGETATION REFERENCES

One reviewer suggested that we include references for reclamation tasks other than revegetation. We agree that such additional references would be valuable and may provide them in future revisions of the Bond Guide.

APPENDIX E – GUIDANCE FOR EQUIPMENT SELECTION

Other than a reference to the Office of Surface Mining website there were no significant changes in this Appendix.

APPENDIX F – RECLAMATION BOND SUMMARY SHEET

There were no significant changes in this Appendix.

Appendix G – Technical Specifications

One reviewer questioned the usefulness of this material. We have retained this Appendix for the time being to serve as an example of the level of detail in engineering specifications required to contract out the reclamation work described in a bond estimate.

APPENDIX - A
GUIDE APPLICABILITY TO SMALL SCALE MINING AND
EXPLORATION OPERATIONS

GUIDE COMPONENT	PROJECT APPLICABILITY
AUTHORITY	Discussion in this section of Guide applies to all projects regardless of scale
BOND ESTIMATION	
Step 1. When	The procedure for estimating the point in time where reclamation cost would be highest is applicable to all projects regardless of scale. For smaller, less complex projects, it will be more common to calculate bond estimates to cover the point in life of the operation where reclamation costs would be highest. However, provisions in the POO for annual bond review and update (if necessary) must always be included.
Step 2. What	The typical categories of information needed to support bond estimates apply to all projects regardless of scale. Large, well-financed mining or exploration companies are typically able to provide detailed descriptions, maps, figures and drawings for their proposed operations. Small operators often submit less detailed project information and require assistance from mineral administrators or engineering personnel, to provide sufficiently detailed descriptions. Such assistance is reasonable for the typical small, simple exploration or mining project. Where small operators are proposing projects that are large or complex, have the potential to expose or generate potentially hazardous materials or involve construction or use of facilities that pose significant environmental risk, they should obtain the expertise necessary to produce the required level of project detail.
Step 3. Standards	Standards to address the project or resource issues described in the Guide should be developed for all projects regardless of scale. However, small-scale exploration or mining projects typically involve fewer of these issues than large operations.
Step 4. Tasks	
Interim Operation...	Discussion in this section of the Guide applies to all projects regardless of scale. Typical issues for small mines are usually limited to maintenance of access, stormwater and fuel storage facilities. Typical issues for exploration projects are usually limited to maintenance of access.
Hazmat & Water Quality	Discussion in this section of the Guide applies to all projects, regardless of scale where hazardous materials are used or water treatment is needed. For most small-scale exploration or mining projects such work will be limited to cleanup of small spills of fuel or other petroleum products and removal of any chemicals or hydrocarbon products stored at the site. For exploration projects the FS should require the operator to submit Material Data Safety Sheets for any drilling additives to be used in the operation. Only additives that are non-toxic and bio-degradable should be used and disposed of on NFS land.
Demolition	Discussion in this section of the Guide applies to all projects where structures, equipment or materials are located on NFS Lands. Exploration

	operations will typically only store small amounts of equipment and materials. Few, if any, structures should be proposed.
Earthwork	Discussion in this section of the Guide applies to all projects regardless of scale. Reclamation of roads, ditches, ponds and excavations are most common for small scale exploration and mining operations.
Revegetation	Discussion in this section of the Guide applies to all projects where reclamation and revegetation of disturbed areas will be required. A chief difference between large/complex and smaller projects is the extent to which specialized machinery is needed to perform revegetation work.
Mitigation	Discussion in this section of the Guide applies to all projects where mitigation is required as part of the Plan of Operation.
Long term	Discussion in this section of the Guide applies to all projects where long-term monitoring and maintenance is required to insure that reclamation standards are met. For exploration and small-scale mining proposals such long-term monitoring and maintenance are the exception rather than the rule. In general, two to five years of vegetation monitoring is general required for final acceptance.
Step 5. Direct	The process described in this section of the Guide is generally applicable to all projects where the dollar amount of the reclamation estimate is greater than \$2500. If the work is estimated to be less than \$2500, competition is not required and local contractors may be called for quotes to complete the work. Davis-Bacon wage rates are required on all construction contracts greater than \$2000. Quotes from contractors for work less than \$2000 may be used in lieu of Davis Bacon Wage Rates, resulting in lower unit costs for labor and equipment. These dollar limitations for Davis-Bacon wage rates and requiring competition should be verified at the time the estimate is done. The Federal Acquisition Regulations for government contracting are complex and ever changing. Consult you Contracting Officer to determine what costs are appropriate when working on these smaller reclamation estimates.
Step 6. Indirect	All indirect costs (see Step 6 (pg. 36) of this Guide) should at least be considered for all projects. For exploration or small-scale mining proposals, engineering redesign and contingencies costs may be minimal. For projects where the estimate is less than \$2500, some contractors' costs may not be required. Discuss which contractors' costs are necessary with your contracting officer. In general, mobilization/demobilization, agency administration and inflation apply to all projects.
Step 7. Summarize	Discussion in this section of Guide applies to all projects regardless of scale
Step 8. Administration	Discussion in this section of Guide applies to all projects regardless of scale
Step 9. Collect	Discussion in this section of Guide applies to all projects regardless of scale

APPENDIX B – BOND ADMINISTRATION

The following is a suggested procedure for approving, administering and releasing reclamation bonds for locatable mineral operations. Certain parts reflect Forest Service Manual or Handbook direction; others are simply good advice based on experience. Wording based on Forest Service official policy or regulation is highlighted. Items designated as advice may be modified or adapted by local forests based on their own situation and experience.

- A) Reclamation requirements, performance standards for bond release and schedule for periodic review and update of bond calculations should be identified in the NEPA analysis and required in the plan of operations (POO).
- B) Bond calculation can begin after the Forest Service has finished the NEPA disclosure document (EA or EIS) and is drafting the decision on the proposed plan of operations. Calculate reclamation bonds with input from other experienced federal and state minerals and engineering personnel.
- C) Bond calculations should be sufficiently detailed to support partial bond release for each project facility, activity, material and associated surface disturbance⁹. They should be sufficient to cover the estimated cost to contract work needed to complete the required stabilization, rehabilitation or reclamation work including future survey, design, construction and administration.
- D) Following completion of the NEPA analysis and issuance of the decision, notify the operator of the changes needed for Plan approval (if any) including:
 - Reclamation requirements;
 - Performance standards for bond release;
 - Bond requirements, and;
 - Provisions for periodic bond review and update.

Inform operator of available bonding options and provide sample instruments (See Exhibits in FSH 6509.11k). Use of FS 6500-7, Reclamation Performance Bond Form is required for all bonds. This decision must also notify the operator of their appeal rights under 36 CFR 251 or 36 CFR 215.

- E) Operator sends updated plan and bond to the authorized officer (AO) (Ranger or Forest Supervisor). The Operator/principal may work directly with the Regional Office to establish regional blanket bonds.

⁹ For each facility, activity, material or associated disturbance, describe as-built and post-reclamation configuration which will affect the cost of reclamation using: 1) Narrative descriptions; 2) Calculations of areas disturbed and volume of materials moved; 3) Road and facility surface grades; 4) Accurate scale contour maps & figures showing general and individual facility arrangement; 5) Accurate scale drawings including plan & profile views and cross sections; 6) Schedule of construction, use and closure; 7) Reclamation standards which apply; 8) The reclamation activities, materials, equipment, labor and administrative costs needed to achieve the standards on the anticipated schedule; 9) Kind and volume of hazardous materials stored onsite including kind and volume of containers.

- F)** The AO for Plan approval has authority to approve the bond (see definition of bond approving officer in FSM 6560.44). Prior to approval the AO must ensure that the Plan has been changed to incorporate the requirements of the decision and that the bond instrument is in the required amount and in an acceptable format. This is typically done as follows:
- The District/Forest Minerals Specialist reviews the Plan for necessary changes and ensures that the bond amount is adequate;
 - The Minerals Specialist arranges for review of the bond instrument by a Bond Reviewing Officer (BRO)¹⁰ or Forest Fiscal Officer who will do the following:
 - ✓ If the bonding instrument is deficient, the BRO or Forest Fiscal Officer will return it to the AO or Minerals Specialist explaining the deficiencies and how to correct them;
 - ✓ The BRO or Forest Fiscal Officer will ensure that all instruments are formatted as required in FSH 6509.11K. This Handbook has exhibits for most of the bond instruments including letters of credit, assignments of certificates of deposit and savings. Negotiable securities will be handled through the Director, Fiscal and Accounting Services, Regional Office. It takes approximately three to four weeks to get the original accounts established before an operator can deposit Treasury Notes/Bonds to meet the bonding requirements.
 - When the bonding instrument is acceptable, the BRO or Forest Fiscal Officer will notify the Minerals Specialist or AO. Notification to the BRO or Forest Fiscal Officer is from the Director of Fiscal and Accounting Management in the case of negotiable securities.
- G)** On the advice of the minerals specialist and/or BRO or Forest Fiscal Officer, the AO will notify the operator of any deficiencies to be corrected in the Plan or bond. The AO should notify the operator that the Plan and bond are approved only after the Minerals Specialist and BRO or Forest Fiscal Officer confirms that they are acceptable.
- H)** Negotiable bond instruments (letters of credit, assignments) should be kept in a locked file or safe at the office where the Plan of Operation is approved. Suspense accounts are established for cash bonds and money sent to NFC. Regional blanket bonds will be maintained in Regional Fiscal and Accounting Services. Other bond instruments (form 6500-7, surety bond) and copies of negotiable bond instruments should be kept with copies of the approved Plan in both District and Forest 2810 files. Copies of negotiable bond instruments should be marked on each page "COPY".

¹⁰ Typically a person at the District and/or Forest is assigned the duties of a BRO, which consist of ensuring that bond instruments meet and are administered to FSM 6560 and FSH 6509.11k requirements

- I) The District and/or Forest should develop a tracking system to ensure that all bonds on the unit are periodically reviewed by both the mineral specialist and BRO or Forest Fiscal Officer to ensure that:
- Bond amounts are reviewed and updated (if necessary) as required in the approved Plan. ;
 - Bond instruments remain current (especially letters of credit, assignments of CD's), sureties remain listed on Circular 570, and;
 - Bonds are being released in a timely manner as described in the Plan of Operations.

The Department of Treasury website for surety bonds is, <http://www.fms.treas.gov/c570/c570.html>. On this page note that you can also request to be notified by e-mail of any changes in sureties listed on the Circular.

- J) The AO is responsible for approving partial or final bond release. This will be done only after the minerals specialist inspects the site and documents that partial or final reclamation activities meet the requirements of the approved Plan. The AO will notify the Operator in writing when partial or final requirements have been met. This letter should refer to the bond calculation and specify the work being accepted, bond amount being released and the remaining bond amount being held. A copy of this release letter should be sent to the BRO or Forest Fiscal Officer who can then release the surety, refund cash, or request release of regional blanket bonds or negotiable securities from the Regional Director of Fiscal and Public Safety.

If the Operator fails to complete required reclamation work, and informal contacts to discuss the non-compliance are not effective, the AO should notify the Operator by certified letter of:

- The non-compliance, citing appropriate sections of the approved Plan and 228A Regulations;
- The work to be done to come back into compliance;
- A specific date to complete the required work, (*set the date so that the FS can collect the bond and complete the work in a timely manner if the operator does not perform*), and;
- Actions to be taken (bond collection, enforcement) if work is not done.

If the operator fails to comply within the specified time, the AO will take additional enforcement action or request that the BRO or Forest Fiscal Officer initiate action to collect the bond as appropriate.

Procedures for collecting the bond varies with the type of instrument involved. Rely on your BRO or Forest Fiscal Officer to take the necessary collection action, place the money in the appropriate account and provide the funds to accomplish the required reclamation. The AO and minerals specialist administering the reclamation work should keep good records on the reclamation work performed and the costs incurred. Funds that are not needed to reclaim the site (make sure the work meets the performance criteria) are returned to the principal. Reclamation costs in excess of the

available bond can be recovered from the operator through court action with good records and if serious enough to warrant such action.

K) Bond Collection, General

Prior to drawing on a reclamation bond, default¹¹ or non-compliance with the approved Plan of Operations and/or 36 CFR 228A Regulations must have been established as follows:

- The Principal has received written notification of what is wrong, what needs to be done to rectify it, and when it must be accomplished.
- Follow-up contact: If no action is taken FS makes second written contact with operator and indicates bond will be taken if no action is performed
- Copies of notification letters forwarded to appropriate third parties such as the Surety or LOC issuer and advise that the FS will seek payment if no action is taken. This may bring additional pressure to bear on the Principal to perform
- Official written notice that establishes that non-compliance and default has occurred.

General steps to follow regardless of type of instrument involved:

- Get fiscal people involved early in process. If an expiration date of the bond instrument is involved, collect no later than seven – 10 working days prior to expiration.
- Sufficient time should be left in case problems are encountered when bond collection demand is made
- A collection officer should collect the bond amount

Drawing On A Corporate Surety

Take the following steps to collect a corporate surety:

- The Forest issues a demand letter and Bill for Collection to the corporate surety requesting payment within 30 days. This first demand should inform the surety of (1) the basis of the claim, (2) the standards for assessing interest, penalties, and administrative costs as required by the Debt Collection Act of 1982 and (3) the date by which the surety must make payment. Forest Service can issue one to three progressively stronger worded demands; generally interest and administrative fees can be charged to the surety company, but not in all cases.
- If the surety makes full payment after demand or satisfactorily performs the required work in fulfillment of the contract/operating plan, the Bond Approving Officer will provide the surety with a Notice of Release and Claims Cancellation (FSH 6509.11k, Section 84, Exhibit 1).

¹¹ “Default” is the term used in FSH 6509.11k when referring to bond collection actions, and is also the term used on FS 6500-7, Reclamation Bond Form. The equivalent term in 36 CFR 228A is “Non-Compliance. Both terms are used in this paper to make it clear that they are related, however, use of the term Non-compliance is mandatory for all correspondence with the operator in connection with a POO submitted under 36 CFR 228A.

- If surety fails to pay upon receipt of the final letter, contact the Regional Office, Financial Resources (FR) Bond group for additional direction.

Drawing On Treasury Bills, Notes And Bonds

Forward copies of default/noncompliance letters to the Regional Office, Fiscal Officer in charge of these instruments so that they are aware of the pending action. Contact them if the principal still fails to comply and they will arrange to collect or sell the securities in satisfaction of the damages.

Drawing On Cash Bond

Cash deposits are the most accessible bonds as there is no intermediary party to deal with in. So, additional safeguards must be taken to ensure that all the legal requirements have been met before the bond is drawn. Bond Approving Officer and the Fiscal Officer must work together to set up a unique job code and move the funds into it. It should be a separate management code and not commingled with other funds. Keep in mind that bond authority to expend the funds must be received from the RO budget shop.

Drawing on a Letter of Credit

The financial institution is obligated to adhere to the terms and conditions as listed in the LOC so it is very critical that the FS scrutinizes what it accepts. If we do not adhere to the LOC, the bank is obligated to refuse payment.

Before accepting the letter of credit, it is highly recommended that the Bond Approving Officer get the financial institution to list the requirements to be met in order to draw upon it. Have the bank put these in writing, sign and date it. File this in the case folder as to be available should the need arise. These requirements should include whether a sight draft is needed when a physical (in-person) demand is made on the bank, contents of an acceptable sight draft, whether the sight draft must be endorsed by the Bond Approving Officer, and a description of any other documents the bank will require. The bank may request surrender of the LOC. Do not surrender if only part of the bond is being demanded. The financial institution may choose to endorse or note on the back of the LOC the amount drawn and the remaining balance. If it is for the full amount, it can be surrendered if the financial institution requests it. However, a copy marked "COPY" should be kept in the files as a record.

Drawing on an Assignment of Savings Account

Instructions for an assignment of savings account instrument should contain the financial institution's requirements for drawing on the account. Get it in writing with a signature and date and file it in the case folder. It is possible that the bank will handle it like a LOC, do not surrender the assignment particularly if it is only for a partial amount.

A sight draft may be required to draw against the Assignment. Instructions on how to prepare the example sight draft use to be in FSH 6509.11k, Chapter 30. With the been moved. The bond Approving Officer and the Fiscal Officer must work together to ensure that it is properly prepared.

Drawing on an Assignment of Certificate of Deposit

If the Forest Service has physical custody of the CD, the Fiscal Officer shall present it to the financial institution as outlined in the Assignment agreement.

If the Forest Service does not have physical custody of the CD, the Bond Approving Officer should work with the financial institution to determine what their requirements will be in order to draw upon it. Preferably, this would be done prior to the acceptance of the assignment. Again, these should be documented in the case folder.

L) Transfer of Bonds and Plans of Operations

As described above, reclamation bond instruments must be accepted by the authorized officer prior to approval of a plan of operation (POO). Instruments must include FS 6500-7 and should be reviewed for adequacy by trained bond reviewing officers. This form does not take the place of the bond instrument but it reinforces or enhances our ability to draw on the bond instrument.

A properly executed 6500-7 establishes a legal relationship among the following:

- The work approved in the named POO
- The operator who signs the POO and is also named as the principal on the FS 6500-7.
- The type of bond instrument and amount of the bond
- The surety, person or institution providing or underwriting the bond.

The Plan of Operation should be assigned a unique identification number or name. This might be some combination of the date the POO was received plus a District or Forest number. Ensure that plans of operation are signed by the operator or persons authorized to act on behalf of the operator. If other than an individual (partnership, corporation), require documentation to support legal authority to act (partnership agreement, articles of incorporation, corporate by-laws & officers, power of attorney, etc.).

A change in the operator who signs the POO and is also named as the principal on the FS 6500-7 and the surety, person, or institution providing or underwriting the bond affects the legal relationship and requires changes in the approved POO or bond instrument to maintain the bond coverage. Because of the many variables involved, Regional Office Minerals, Fiscal and Office of the General Counsel Staff should be consulted in the event of such changes to ensure that all existing and proposed operations including reclamation work remain legally and fully covered by a sufficient POO and bond.

Often these types of changes (if needed) provide the Forest with an opportunity to re-evaluate the adequacy of POO and bond requirements, and update them as a condition of the new POO approval.

Some typical situations are as follows:

Changes in ownership of the property (mining claims, facilities, supplies, equipment, etc.) - Change in ownership of the mining property may or may not require a change in the POO or bond. If change in ownership does not affect the operator's status (they may be separate entities) or the approved operations, then a change in the POO and bond may not be required.

Conversely, if the change in ownership affects the legal status of the operator or alters the operation, a change in POO and bond amount and/or instrument will be needed to ensure that both the existing and the new/proposed operator (and operations) remain covered by the surety or institution. Be sure the current approved POO and bond remain in effect until a satisfactory replacement POO and bond are in approved.

Change Of The Operator/Principal

This could occur due to a buyout, reorganization or takeover of a corporation, partnership or other legal entity who is the designated operator in an approved POO.

There are no provisions in 36 CFR 228A for transferring an existing POO to a new operator. However the existing POO can be used to streamline the process for submitting and approving a POO under 36 CFR 228.4 and 228.5.

First the new operator may notify the authorized officer (AO), in writing, of their wish to adopt the existing POO in whole or in part, describing in detail any changes/additions they propose, and that they assume all responsibility for reclamation of surface disturbance including that caused by the previous operator(s). Alternatively, the new operator may submit a complete POO based in whole or part (as described above) on the existing POO. Legally, either approach is acceptable, but submittal of a complete POO establishes a clearer, more concise record for the new proposed POO.

After reviewing the adoption letter and existing POO and bond estimate (adoption), or, the new POO that is submitted, the AO may notify the operator:

1. That the adopted or new POO is adequate, operations are within the scope of the existing NEPA analysis and may be approved after the operator submits a new, acceptable replacement bond instrument and properly executed FS 6500-7.
2. That the adopted or new POO is within the scope of the existing NEPA analysis, but that changes are needed (in POO or bond amount) before it can be approved. Once a POO with the required changes and an acceptable bond instrument are received, the AO will notify the operator the POO is approved.

3. That the adopted or new POO is not within the scope of the existing NEPA analysis and that more time is needed to conduct the necessary review.

New bond instruments (assignment, letter of credit, surety, etc.) and FS 6500-7 must be in the name of the new operator/principal. These bond instruments and the FS 6500-7 must specifically state that the liability under the new bond extends to all acts for which reclamation is required on areas disturbed in connection with the existing POO (specify) and Operator/Principal (specify) as well as the new POO (specify) and Operator/Principal (specify), both prior and subsequent to the date of the new bond instrument.

Until the new POO and bond is submitted by the new Operator and approved by the Forest Service, the current plan and bond must remain in effect.

APPENDIX C

PLANS OF OPERATION INFORMATION

Part C1

Part C2

**APPENDIX C1 - PROCESSING LOCATABLE PLANS OF OPERATION (Plan)
UNDER 36 CFR 228A**

INFORMATION NEEDED

PURPOSE

This paper provides guidance on the type and timing of information needed to process a Plan for a large or complex mining proposal on National Forest System Lands, These operations typically require preparation of an environmental impact statement, and do not easily fit into the format of the FS 2800-5 which is used for smaller, less complex operations.

Much of the content of this paper is based on the draft completeness requirements of the State of Montana, and references that document (Appendix C2). Several important differences between this document (C1) and the Draft Montana Guidelines are as follows:

STATE OF MONTANA PERMIT APPLICATION REQUIREMENTS	FOREST SERVICE PLAN REQUIREMENTS
Mine permits include social, economic and environmental baseline information as well as project design, construction, operation and closure information.	Regulations discuss general requirements for Plan content (36 CFR 228.4c) and focus on the proposed operation including requirements for environmental protection. Other social, economic and environmental baseline information is developed through the NEPA process .
Development of information needed for the joint Montana Environmental Policy Act/National Environmental Policy Act (MEPA/NEPA) environmental analysis is the responsibility of the applicant	Under 36 CFR 228A operator is responsible for describing the proposed operation including requirements for environmental protection (228.4c). FS is responsible for preparing environmental statements (228.4f). See additional discussion under " Authority " below.
Completed permits including environmental baselines required before beginning the joint state/federal MEPA/NEPA process.	No requirements for completeness in 36 CFR 228A. Typical information requirements to comply with federal NEPA process are described under " Timing " below.

Based on these differences, Appendix C1 is written based on experience with locatable Plans for large, complex operations submitted in compliance with 36 CFR 228A without consideration of requirements which will vary state by state. These state specific requirements must be considered by the mining operator and FS administrator on a case by case basis, as it affects the type, format and timing of information.

ORGANIZATION

The discussion of Plan completeness which follows is loosely based on the Draft Montana guidelines but differs as follows¹²:

C1 – ORGANIZATION	C2 - DRAFT MONTANA GUIDELINES FORMAT
I. Introduction	1. Project Summary
II. Site Conditions	2. Baseline Environmental Information
III. Project Description	3. Proposed Mine Plan
IV. Monitoring & Mitigation	4. Proposed Operational Monitoring
Include in II, III, IV. And VI.	5. Proposed Testing and Modeling
Include In IV.	6. Proposed Mitigation

¹² Some consider it useful for project administration purposes to address the topics of mitigation and monitoring and/or reclamation under each appropriate facility or activity under "Project Description", rather than in separate sections as shown above. For the purposes of this discussion however, the sections are separated rather than combined.

V. Plan For Interim Shutdown (Added)	7. Plan For Interim Shutdown
VI. Reclamation	8. Proposed Final Reclamation Plan
Include In IV.	9. Post Mining Monitoring
Include in II., III., IV., V., and VI	10. Proposed Contingency Plans
VIII. Figures, IX. Tables, X. Appendices	11. Maps

While this format is not required by regulation or policy, it is based on a survey of Plans in effect in several FS regions. Although Operators may submit FS Plans in any format they choose, it is highly likely that these topics will be addressed in some fashion order to meet the requirements of 36 CFR 228A and NEPA.

Timing

The level of information needed in each of the first 5 headings (Sections II. through VIII.) depends on where you are in the (federal) analysis/approval process. For that reason in this paper the discussion under each of these headings focuses on **(3)** three stages in the FS analysis and approval process. These three stages are the:

Initial Plan - Level of information should be sufficient to demonstrate preliminary project feasibility and to allow the FS to initiate and complete the scoping phase of NEPA analysis...

Preliminary Draft Environmental Impact Statement - Level of information now should include site specific engineering and environmental baseline data to support analysis of alternatives and prediction of effects...

Final Plan of Operations - Plan fully reflects results of NEPA analysis and decision and will support estimation of a detailed reclamation bond .

These stages of project analysis are also related to certain stages in mine development as shown on Table 1.

**TABLE 1 - PLAN COMPLETENESS
MINE DEVELOPMENT/ANALYSIS STAGES**

MINE DEVELOPMENT	ANALYSIS
<p>Pre-Feasibility - A pre-feasibility determination is typically completed by mining companies before a mining proposal is submitted. It is based on data gathered from the exploration effort, as well as pilot or bench scale metallurgical testing. With this information geologists, metallurgists, mine engineers and economists develop and evaluate the feasibility of conceptual mining plans.</p> <p>Environmental baseline data on the geochemistry of ore, spent ore and mine waste (from metallurgical testing); surface, ground water and air quality (typical long-term baseline programs) may also be available if the operator has worked with state and federal agencies to anticipate mine permitting issues.</p>	<p>An Initial Plan of Operations (Initial Plan) submitted to start the analysis and approval should contain sufficient information to support scoping and data collection decisions which are made at the beginning of the NEPA process. To provide this level of information a conceptual project design should be available and have been determined to be feasible based on a critical analysis of geologic, metallurgical, economic and engineering data.</p> <p>While this level of information is sufficient to initiate the NEPA analysis, it does not fully meet most state and federal permit/plan application requirements.</p>

Feasibility and Preliminary Design - In order to move from a conceptual to preliminary design for an operation additional engineering field investigations and environmental baseline studies are needed to locate and design project facilities. This stage in mine development is analogous to baseline data collection in the NEPA process. If coordinated with the environmental analysis of the Initial Plan, both will be accomplished with a minimum of time and expense. These studies are typically documented as stand alone technical reports but may trigger supplements to the Initial Plan.

Prior to development of a **preliminary draft environmental impact statement (PDEIS)**, additional, site specific baseline environmental and engineering data must be gathered and mitigation, monitoring and reclamation measures developed so that the lead agency can reliably predict social, economic and environmental effects of the proposed action along with a reasonable range of project alternatives. These studies are typically documented as stand alone technical reports but may trigger supplements to the Initial Plan. At this time there is generally sufficient information to support applications for most state or federal permit/plan applications.

Detailed Design - Detailed site investigation and design will be needed once a preferred project alternative can be identified through the project development and permitting processes. This information is the basis for the actual construction and operation of facilities. It is at this stage that mitigation, monitoring and reclamation requirements developed during the permitting process are applied on a site specific basis to design and construction of project facilities.

A **Final Plan of Operations (Final Plan)** is produced at the completion of the various state and federal permitting processes. It consists of the information from the Initial Plan and PDEIS stages of the analysis as modified by the various state and federal permitting processes. It does not necessarily repeat information contained in these reports, permits and plans, but incorporates them by reference and summarizes the important conclusions and requirements.

Plan Formats

Because Plans for large mining operations typically require several volumes and are often supplemented or modified even after they are approved, the following is a recommended approach to track Plan changes throughout the life of the project.

Initial Plan - The Initial Plan should be submitted in a format similar to that described for the **Final Plan**. However, since extensive modifications or revisions to the **Initial Plan** are to be expected as a result of the permitting process, it is usually replaced in its entirety, rather than modified. (SEE DISCUSSION FOR **Final Plan**)

PDEIS Stage - Additional information for this stage is typically submitted as baseline environmental or engineering design. Any changes to the operation as a result of these studies must be made at this point for them to be considered in analyzing the effects of the proposed action. Procedurally, changes including different design, operation, location, mitigation, monitoring or reclamation measures should be submitted as supplements to the **Initial Plan**.

Final Plan - It is recommended that this Plan should be submitted on loose leaf paper in a binder so that pages can be replaced or supplemented as revisions or amendments are reviewed and approved. The Table of Contents should include the topics/components described below. Replacement pages to the original document should preserve the original numbering (i.e., replace page 3-31 with 3-21), if additional pages are needed to extend a discussion, subsequent pages should have the replacement page # plus an additional identifier (3-21a, 3-21 b, 3-21 c, etc.). The replacement page should have the date it was revised printed on it and should be a different color than the original. Each round of revisions should be a different color.

Authority

The basic legal authority for requiring Plans is found in the 1897 Organic Act. This Act opened National Forest System Lands to entry under the 1872 Mining Law and gave the Secretary of Agriculture authority to regulate such activities. Regulations defining this authority were issued in 1974 and are found in 36 CFR 228A. These regulations describe the contents of a Plan at 36 CFR 228.4, 228.12, 228.13 and 228.8. In general terms they direct operators to include information describing legal entities responsible for claims or operations, the proposed operations and how other requirements of state and federal laws and regulations will be met.

Project information must also be sufficient to support the analysis required by the National Environmental Policy Act (NEPA). NEPA regulations contain some guidance on the information required, (40 CFR 1502; 40; and 40 CFR 1508). In general, these regulations require that project information needed to predict environmental impacts or compare alternatives should be provided if necessary for evaluating alternatives, and it is technically and economically feasible to do so.

The discussion which follows does not distinguish between information that the operator should gather to support project design vs. that which the agency should gather to minimize impacts on the environment and conduct the environmental analysis. At a minimum, the FS is responsible for preparing environmental statements and the operator is responsible for designing/describing the proposed operation in sufficient detail to support the environmental analysis and bond estimate. Both of these responsibilities require collection and use of environmental, engineering and geologic data. In practice these information requirements overlap and for large mining projects the operator usually elects (with agency concurrence) to finance the necessary data collection, analysis and documentation needed for the EIS.

I. INTRODUCTION

Normally the level of information in this section will not change between the Initial and **Final Plans**. The focus of this section should be on the legal issues relating to the identity of operator and claim owner(s), and ownership of the surface and mineral estates.

Location & Project Summary

This should consist of a brief summary of the operation being proposed and its location. Since the operation will be described later in the Plan, only the bare minimum of detail is needed here, i.e., type and size of the mining operation and anticipated workforce in addition to the location.

Project Owner/Operator

This should describe the individual(s), corporation or partnership and their ownership interest in the project-property. Typical information includes, names, addresses and phone numbers of designated officials or individuals who are legal representatives or authorized to act on behalf of the corporation, partnership or individual, and articles of incorporation filed with the state in which the project is located.

Describe similar information for the operator of the project if different from the owner.

Land Status

This section should include a narrative, table and map showing the surface and mineral claim ownership in the project and surrounding area which could potentially be affected by project facilities. Information provided should include claim names, BLM serial numbers, township range and section, and mining claim types.

Permits & Approvals

Include table and/or discussion of the permits/plans/approvals needed from federal, state, and local agencies.

II. SITE CONDITIONS

Plans should include discussion of factors that directly affect the design and location of facilities, typically the physical site factors which are discussed below. The discussions summarize more detailed information found in stand-alone technical reports. The Draft Montana Guidelines in C2 includes discussion of baseline biotic, social and economic issues.

Typically, but not always, the operator will develop baseline information on the physical environmental factors that directly affect project design and location of facilities both before and after initiation of the

NEPA process. The FS, or contractors funded by the operator but working under the direction of the FS will typically collect the social, economic and biologic baseline data, after initiation of the NEPA process.

In the **Initial Plan** the amount of information in this section of the Plan will vary depending on the amount of data collection which has been done in the prospecting and exploration stages of mine development. At a minimum, detailed geologic, geochemical and metallurgical information should be available that demonstrates the size, grade and mineability of the ore body. (See discussion under pre-feasibility in Table 1)

Prior to the **PDEIS** stage of the NEPA analysis information must be available from baseline data collection and studies. These studies are usually documented as stand alone baseline environmental or engineering design reports. Changes to the **Initial Plan** at this point are often made based on the information collected in order to avoid or minimize adverse environmental effects. If changes to the **Initial Plan** are to be considered as part of the proposed action in the NEPA process, they should be submitted as supplements to the **Initial Plan**.

In the **Final Plan**, updates will be based on data from the approved baseline reports, NEPA analysis, bond estimates or required permits. Supporting material (reports, permits decision documents) should be referenced in, and filed with **Final Plan** so that there is a single, comprehensive package which is available for future operators, administrators, or permitting agencies.

The baseline guidance in both Appendix C1 and Appendix C2 should be considered a starting point for discussion between the operator and the FS. Site specific legal requirements, techniques, policies guidelines will alter these suggestions on a case by case basis. In addition many different publications offer in depth discussion of these issues. The publication, ***EPA and Hard Rock Mining: A Source Book for Industry in the Northwest and Alaska***, EPA 910-R-99-016, is a particularly useful source of information for baseline data collection and analysis of climate, surface and ground water, geology and geochemistry, mine waste, waste water, aquatic resources and wetlands. This document may be downloaded from the Region 10 EPA website.

Climate

Climatological data is used to conduct environmental analyses as well as design project facilities. This information comes from nearby weather stations but is most useful when adjusted with data collected onsite. Great care must be used in predicting the project water balance and designing water diversion, conveyance, storage and treatment facilities based on offsite data. In all cases, predictions and designs should address the extreme ranges of climate which has occurred in the historic record, not the average condition. Assumptions based on average conditions usually result in designs that are inadequate to handle the natural range of conditions at the site.

Typical climate information includes:

- Daily/monthly temperature, 10/20 year means and extremes;
- Precipitation, 10/20 year means for monthly and annual amounts including snow accumulation and water content. Extreme events (typically calculated for 50, 100, 500 year, 24 hour, week/month/year wet period).
- Evaporation, 10/20 year average pan evaporation rates by month. Designs should address both prolonged drought (high evaporation) and wet periods (low evaporation) .
- Wind, average direction, velocity.

If long term baseline data collection programs were started during exploration the **Initial Plan** may contain some information in these areas. Typically at least one years data from an onsite weather station (precipitation, snowpack, temperature, evaporation) is summarized together with available historical data as a baseline technical report in order to prepare the DEIS.

The publication, ***EPA and Hard Rock Mining: A Source Book for Industry in the Northwest and Alaska***, EPA 910-R-99-016, contains information for baseline data collection and analysis of climate

data. This document may be downloaded from the Region 10 EPA website, <http://www.epa.gov/region10/>, (search on the title).

Geology

The following geologic information is critical to the design, operation and reclamation of project facilities as well as predicting the environmental effects of the project.

- General Geology, genesis of the ore body, rock types, stratigraphy, structure in the project area and vicinity of the ore body.
- Geophysics, description of the physical characteristics of rock types as they affect rock strength, moisture content, slaking characteristics, durability, particle size and hydraulic conductivity of ore and waste. Describe the basis for delineating and testing rock types rock units expected to have similar physical characteristics. Describe sampling procedure including location, number, type and size of samples, and the tests and classification system used. Information on soil, subsoil, depth to bedrock and bedrock types are needed for facility design.
- Geochemistry, describe the basis for delineating rock units expected to be geochemically homogenous (relatively) for the purposes of sampling. Describe sampling procedure including the number, type and size of samples, their location, and chain of custody from sample site to laboratory testing. Describe testing procedures including multi-element whole rock, sulfide mineralogy/thin sections to identify crystal structure and size, sulfur speciation, static tests for acid potential characterization and synthetic leaching procedures used to characterize toxicity of leachates from all mine waste produced by the operation. Describe criteria used to evaluate test results and how they were used to decide whether additional kinetic testing was required, and to design special handling and disposal of mine waste, spent ore and/or tailings. Describe proposals for field scale, long-term leach tests to refine or confirm predictions.
- Seismicity & Geologic Hazards - Information about potential earth movement which could affect the project area is used to locate and design project facilities. Basic information should include project and regional identification of faults which could move in the event of an earthquake, and a review of the historical earthquakes in the region. This information will be used to establish a maximum credible earthquake and frequency for the project area and the estimation of resulting ground accelerations which could affect project facilities.

Considering the regional project seismicity, discuss stability analyses, methodology, assumptions, factors of safety under static and dynamic conditions for mine, waste rock disposal, spent heaps, tailings, dams or other major earthen structures.

- Other geologic hazards that could affect project facilities or activities should also be identified. These include all forms of mass movement and avalanche.

Most of the information described under Geology should be available for inclusion in an **Initial Plan**.

Longer term studies such as kinetic testing and design of waste facilities based on the results of these studies should be available at the **PDEIS** stage of analysis. **Final Plans** focus on monitoring and operating procedures to verify pre-mining predictions and to ensure that facilities are built as designed.

Discussions of the geophysical and geochemical characterization needed can be found in publications and in standards and guidelines developed by permitting agencies. The publication, *EPA and Hard Rock Mining: A Source Book for Industry in the Northwest and Alaska*, EPA 910-R-99-016, contains information for baseline data collection and analysis of climate data. This document may be downloaded from the Region 10 EPA website (search on the title

Air

The extent of air quality information needed for the site will vary depending on whether the project is considered a “major” source (emitting more than a certain level of certain “criteria” (NO₃, SO₂, CO, PM, Pb, and Ozone)) pollutants; have regulated facilities (i.e., crushers, conveyors, loading or unloading facilities, or; they involve the use of hazardous air pollutants).

This section of the **Initial Plan** should discuss the anticipated project emissions (criteria pollutants, regulated facilities and hazardous air pollutants).

Based on the expected emissions and discussions with the State Air Quality Bureau, the ambient air quality of the project and nearby areas, along with meteorological baseline data may be needed for the **PDEIS** stage of the analysis. This information is collected over the period of one year at onsite monitoring stations, using EPA approved or equivalent methods. Using the projected project emissions, air and meteorological data, EPA approved or equivalent models are used to determine if emission standards will be met

The **Final Plan** will contain air related mitigation and monitoring required by the State for criteria pollutants, regulated facilities or hazardous pollutants associated with the project. This information may be included by summarizing the air quality permits needed for the project.

The publication, ***EPA and Hard Rock Mining: A Source Book for Industry in the Northwest and Alaska***, EPA 910-R-99-016, contains information for baseline data collection and analysis of air quality data. This document may be downloaded from the Region 10 EPA website, <http://www.epa.gov/region10/>, (search on the title).

Water

This section should describe the surface and ground water resources by describing the drainages which could be directly or indirectly affected by the proposal and by summarizing existing water quality, quantity (including stormflows for the design precipitation/snowmelt events described under Climate), ownership and use. It should also describe the physical characteristics of stream channel/banks and ground water aquifers as they affect or may be affected by the project.

The discussion in the **Initial Plan** may be based on existing information on water resources in the area. In some cases surface water quality or stream flow data may be available from existing monitoring stations. Groundwater information may be available from exploratory drilling or nearby wells, seeps or springs. Some projects may have begun collecting water quality and streamflow data during the exploration or development drilling phase of the project. Information on water ownership and use should be available from the state agency which oversees water rights.

For the **PDEIS** stage of the analysis, data on water resources upgradient, in the vicinity of, and downstream of project facilities will include maps showing surface and ground water monitoring sites including existing wells, seeps and springs which occur in the project area; surface and ground water quality descriptions at monitoring sites; surface water flows (average annual and the flows for the design storm events described under Climate), ground water aquifer flow characteristics from pump tests of water wells and exploratory drilling, and; maps and cross-sections showing the potentiometric surface, hydrostratigraphic units, direction of flow and flowrate of ground water in the project area. Descriptions of surface and groundwater quality and quantity should include discussion of the relationship to the geology of the area. Sampling protocol and analytical methods should be described for both surface and ground water programs including rationale for monitoring station selection, well descriptions (completion logs, screened and sampled intervals, completion depth, materials used, flow rates, quality) quality assurance and quality control methods.

The **Final Plan** will contain predictions of project related impacts to surface and ground water quality and quantity including descriptions of monitoring which is designed to confirm predictions, monitor compliance with established standards, and identify statistically significant, project related changes in water quality or

quantity. These descriptions will address both area or drainage-wide impacts and that associated with major project facilities affecting surface or ground water including mine, waste rock disposal, spent heap or tailings.

Expert surface and ground water hydrologists and chemists will be needed to design data collection programs for this issue. EPA and the U.S. Geological Survey have published numerous references on state of the art water quality and quantity sampling and analysis techniques. State water quality agencies can also provide input on the kind of information needed and acceptable methodologies. Data collection programs should be designed to provide statistically valid baselines against which project related changes can be compared.

The publication, ***EPA and Hard Rock Mining: A Source Book for Industry in the Northwest and Alaska***, EPA 910-R-99-016, contains information for baseline data collection and analysis of surface and groundwater data. This document may be downloaded from the Region 10 EPA website, <http://www.epa.gov/region10/>, (search on the title).

Soils

Soil data is needed to address the following issues: 1) To determine the location, quantity and quality of the soils in the project area that are suitable for use in reclamation of disturbed areas; 2) To establish the feasibility of salvaging soil suitable for use in reclamation; 3) To estimate the erosion hazard of soils likely to be disturbed by the project and develop mitigation or monitoring measures to minimize project erosion; 4) To provide soil information needed to conduct hydrologic modeling of the watershed; 5) To identify existing and potential areas of mass instability and develop mitigation and monitoring measures to minimize project related mass instability; 6) To evaluate changes in soil productivity due to project disturbance and develop mitigation and monitoring measures to reduce impacts on productivity and enhance revegetation and reclamation efforts.

To accomplish these objectives a qualified soil scientist will inventory, describe and map project soils using standards established by the National Cooperative Soil Survey (NCSS). Typically an order 2 (as defined by NCSS) will be done on areas proposed to be disturbed to provide the suitability, salvageability, erosion hazard and mass stability interpretations. The remaining area in the affected drainages will be mapped at order 3 intensity to provide information needed for hydrologic modeling.

The soils will be mapped on topographic maps and aerial photos at a scale of 1:24000, or smaller. Map units should be designed to be useful in estimating quantities of suitable and salvageable soils. Slope classes might be divided at angles where salvage becomes impractical or unsafe. Areas which have significantly different depths of suitable soils should be mapped separately.

Soil analysis to be performed will be determined by the Forest Service and may include; particle size analysis, pH, cation exchange capacity, organic matter %, NPK analysis (these are standard tests which can be performed by state (university) or private agricultural laboratories), acid/base accounting, metals, and/or TCLP analysis (these tests should be performed using EPA approved test methods and procedures)

Finally Interpretations will be developed for each soil and mapping unit to address: 1) acres of soil disturbed; 2) Amount of growth medium needed to reclaim disturbed areas; 3) volume, location and suitability of salvageable soil (by mapping unit); 4) changes in soil hydrologic characteristics due to disturbance; 5) erosion potential of disturbed areas; 6) changes in soil productivity.

III. PROJECT DESCRIPTION

In the **Initial** Plan project components such as facilities, activities, equipment, materials, and workforce should be described. Especially important are those attributes of components which affect surface resources, size, location, design, and operation.

We recommend that mitigation, monitoring and reclamation measures be summarized here by component, even if they are described later under their own headings (Sections IV. and VI. in this example). This may seem like a duplication of effort, but in large operations we find that both approaches are useful. For example, there is no question that organizing mitigation, monitoring and reclamation by component is most useful to project administration once construction begins. However, stand alone sections in these same areas are often required (the State of Idaho Reclamation Plan), or useful in presenting information on these topics. For that reason we have retained both approaches in this example while recognizing that operators may choose to combine them to minimize writing requirements.

Where reasonable alternatives exist or were considered for project components they should be described along with the criteria used to select the preferred project configuration. Information at this stage of the operation may be conceptual in nature, but based on data typically available at the prefeasibility stage of mine development.

The following discussion summarizes the type of information needed at these stages of project analysis. The Draft Montana Guidelines contain a more detailed checklist of factors to address. The publication, *EPA and Hard Rock Mining: A Source Book for Industry in the Northwest and Alaska*, EPA 910-R-99-016, contains more detailed discussion of project information needed for NEPA analysis including mine waste characterization, water balance, design of water diversions, conveyance, storage or treatment facilities and stormwater facilities. This document may be downloaded from the Region 10 EPA website, <http://www.epa.gov/region10/>, (search on the title).

Mining - Describe operation of pits & waste rock dumps, tonnage of ore and waste rock types described under geology, expected production rate, season of operation, equipment to be used, method of dump construction including special handling of select waste, pit dewatering. Include cross-sections and plan-views of mine and waste disposal facilities at closure and agreed upon intervals during the life of mine. Address mitigation, monitoring and reclamation particularly geochemical and stability mitigation and monitoring, mitigation and monitoring for hydrologic impacts (erosion control, diversions, drains, water storage and treatment) and reclamation requirements.

Milling/Processing - Describe mill or process operations and facilities, ore handling, expected production rate, season of operation, equipment to be used for conveyance-crushing-agglomeration and processing, schematic of process circuit including reagents, design of process facilities including water balance and capacity for containment/storage of water or process solutions. Include cross-sections and plan-views of processing facilities mine and waste disposal facilities at closure and agreed upon intervals during the life of mine. Address mitigation and monitoring particularly that needed to address geochemical and physical stability, hydrologic impacts (erosion control, diversions, drains, water storage and treatment), and reclamation requirements.

Transportation - Describe proposed new or upgraded access to the mine and haul roads for ore and waste rock including their design, location and maintenance. Include plan views and typical cross sections for the facilities during operation and after reclamation. Discuss the kinds and volume of traffic which will occur as a result of the project.

Power/Utilities - Describe proposed facilities needed for power, communications and heating.

Water Use & Treatment - Describe a typical project water balance under average and extreme climatic conditions (see discussion under **Climate**) including inputs, losses, uses, sources, transport, storage and treatment facilities, chemicals used and quality and quantity of resulting discharges.

Workforce & Schedule - Describe the anticipated schedule for construction, operation and closure including the workforce requirements by job categories at each stage.

Support Facilities - Describe additional project facilities such as; offices, maintenance shop, warehouse, storage, laboratory, sample storage, fuel storage, lime silos, other separate chemical storage, explosive

storage, conveyors, pipelines, parking areas, fences. Include location maps, plan view and cross sections of the facilities during operation and after reclamation.

Equipment - Describe typical equipment used in operations of similar type and size. Address construction, operation and maintenance of project facilities.

Sanitary & Solid Waste - Describe facilities for treating or disposing of sanitary waste. Address solid waste disposal as well.

Hazardous Materials - In the **Initial Plan** section describe the hazardous materials used in the operation. Include petroleum products, process and lab chemicals, chemicals used in mining and water treatment, and mine wastes such as sludges. Describe expected volumes and how they will be transported, stored, used and disposed of. Include Material Safety Data Sheets for hazardous materials.

At the **PDEIS** stage changes or refinements to the operation as a result of baseline studies or discussions with permitting agencies must be made for them to be considered in analysis of effects for the proposed action. Procedurally, changes including different design, operation, location, mitigation, monitoring or reclamation measures should be submitted as supplements to the **Initial Plan**. This information should be available from feasibility and preliminary design studies as well as baseline environmental studies.

The **Final Plan** consists of the information from the **Initial Plan** and **PDEIS** stages of the analysis, modified as needed to reflect the alternatives, mitigation, monitoring or reclamation requirements developed in the permitting process. The **Final Plan** document focuses heavily on information and planning that is needed to construct, operate and reclaim the project as required under the various state and federal permits and plans. It does not repeat information contained in the baseline technical reports, permits and Plans (which are recommended to be incorporated as appendices), but references them and summarizes the important conclusions and requirements of these documents.

Typical figures and tables used to illustrate the narratives are listed under sections **VII. FIGURES** and **VIII. TABLES**.

IV. PROJECT MITIGATION AND MONITORING

For the purposes of this discussion mitigation is taken to mean anything which will prevent or reduce adverse effects. This includes Plan requirements which would avoid, minimize, reclaim or compensate for the impact. Monitoring programs are designed to measure actual environmental and project performance to ensure compliance with approved Plans. Important elements of mitigation and monitoring discussions are:

- Objectives, standards or thresholds of concern which must be met for project or environmental performance. These may be taken from established regulatory requirements (water quality standards), or may be developed specifically for the project (thresholds for total or pyritic sulfur which require special handling). Where possible these should be designed to detect trends which may lead to exceedance of standards or thresholds.
- Proposed methods. These are methods that are proposed to be used to meet the performance standards or objectives. They include what will be done, where and when. Proposed methods may change during the life of the Project based on experience, or development of new technology or methods.
- Monitoring. Most of the requirements described have provisions for measuring the performance of the proposed methods in meeting the prescribed standards and objectives. Monitoring programs should describe procedures for sampling procedures and testing methods, storage and analysis of test results reporting requirements and actions to be taken if performance objectives or thresholds of concern are exceeded.

Discussions of mitigation and monitoring in the **Initial Plan** will vary considerably from project to project. In some cases where considerable consultation with permitting agencies has been done during exploration and pre-feasibility this section may be well developed, consisting of measures which are more or less standard parts of the required permits and approvals.

At the **PDEIS** stage additional mitigation or monitoring developed as a result of baseline studies or discussions with permitting agencies may be added to the **Initial Plan** or included in other alternatives being analyzed in the EIS. Additions to the **Initial Plan** should be made as formal supplements for them to be considered in analysis of effects for the proposed action.

The **Final Plan** should contain mitigation and monitoring from the **Initial Plan** and **PDEIS** stages of the analysis, modified as needed to reflect the alternatives, mitigation, monitoring or reclamation requirements developed in the permitting process. It should not only focus on what is required, but also how mitigation and monitoring requirements will be implemented, evaluated and updated as necessary to reflect on the ground experience. These summary discussions in the **Final Plan** are based on baseline studies/technical reports produced prior to the **PDEIS** as well as final state and federal permits and Plans. The final permits and Plans, along with the baseline technical reports should be referenced and filed with the Plan to provide the background for the summary discussion in this section.

Mitigation and monitoring requirements can be discussed under categories of the environment (including physical, biotic and socio-economic) or under the categories of the facilities, activities, equipment, materials or workforce causing the impacts. We have done some of both in this example by recommending that mitigation and monitoring be summarized by facility or activity in Section III., and described in more detail in this section.

The Draft Montana Guidelines discusses operational and long-term monitoring and project mitigation under separate headings in C1.

Geology

Mitigation and monitoring typically addresses:

- Stability of project components, factors of safety under static and pseudostatic conditions, monitoring of settlement, slope movement, phreatic surfaces;
- Mine waste segregation and management based on geochemical/geophysical properties. This should include monitoring and testing procedures to classify materials exposed by the project in spent ore, tailings, waste rock, pits or underground mine workings, as well as measures to isolate, neutralize or control such materials to ensure that toxic materials are not released into the environment in the short or long-term.
- Mitigation and monitoring related to mass movement, avalanche or other geomorphic site features.

Air

Mitigation and monitoring is based on this analysis and is typically specified in the New Source Construction and Operating Permit for the project, if required by the State. This permit along with the operator's application will specify the emission limits which apply to project facilities, the control measures to be employed on various project facilities and activities to achieve the standards and the monitoring and reporting requirements. These will address "criteria" (NO₃, SO₂, CO, PM, Pb, and Ozone) pollutants; regulated facilities (i.e., crushers, conveyors, loading or unloading facilities, and; any "hazardous air pollutants, such as sodium cyanide, mercury vapor, smelter/scrubber.

Water Resources

Many mitigation measures described under other categories such geology, soil, vegetation, etc., also serve to prevent adverse effects to the water resource.

Mitigation and monitoring which are unique to water resources might include:

- Minimum design standards for facilities which divert, convey or store water;
- Erosion control plans for all project disturbance, best management practices (stormwater plan);
- Design for reconstruction of natural drainage disturbed by mining;
- Water quality/quantity monitoring including sampling points (surface water quality stations and wells) and reason for location; constituents to be monitored; water quality standards to be met or statistical measures for identifying significant trends; frequency and duration of sampling; analytical methods; QA/QC; data storage and statistical analysis; and reporting requirements.
- Suspended sediment and bedload sediment sampling;
- Mitigation and monitoring required by NPDES permits for point source discharge of process water, water which comes in contact with mine waste (mine drainage) and uncontaminated meteoric water (stormwater).

Soils

Mitigation and monitoring related to the soil resource is typically in the areas of productivity and erosion. Mitigation typically includes provisions for:

- Salvage of growing medium from areas to be cleared and/or excavated;
- Erosion control, stabilization and revegetation to minimize soil loss from disturbed areas including soil storage, project facilities and all disturbed areas. This includes measures which are taken concurrently, seasonally and at final reclamation.
- Chemical and physical analysis of soils to be used for reclamation;
- Reclamation procedures for disturbed areas including re-sloping, site preparation, respreading of growth medium, seedbed preparation and fertilization, reseeding and mulching.

Monitoring the soil resource includes;

- Inspection of growth medium salvage;
- Annual assessment of the volume of growth medium to ensure that predicted volumes are available for reclamation;
- Inspection of diversions, storage facilities and sediment control or treatment measures to ensure that design capacity is maintained and performing as predicted.
- Inspection of reclamation of disturbed areas including replacement of topsoil to design depths (more detail on this under **VI. RECLAMATION** and **Vegetation** in this Section).

Wildlife

Mitigation related to wildlife typically includes plans to restore disturbed wildlife habitats to pre-activity levels and/or mitigate long term loss of wildlife habitat by creating or enhancing existing habitat. Special emphasis is placed on threatened/endangered or sensitive wildlife species and their habitat.

Also included in mitigation are measures to educate employees on: state and federal laws relating to hunting; avoidance of inadvertent or purposeful harassment of wildlife; recognition and protection of state and federal threatened and endangered species and Forest sensitive species in the Project area; and reporting of any T & E or sensitive plant or animal species to the Forest Service or state fish and game agencies. Other potential mitigation measures include:

- Busing of employees;
- Fencing around the project facilities which contain toxic materials;
- Covering or other management of process ponds to prevent avian mortality.

Monitoring typically consists of tracking and reporting project related wildlife mortality so that additional corrective measures can be taken, and monitoring habitat restoration, creation or enhancement efforts to ensure the proposed level of mitigation is achieved.

Where threatened or endangered species are present, this section may also summarize the results of consultation as required under Section 7A of Endangered Species Act.

Aquatic Biology

Mitigation in this area is meant to ensure that there is no net loss or degradation of aquatic resources (including habitat) as a result of the operation. Special emphasis is placed on threatened/endangered/sensitive fish species and their habitat.

Typical measures include reconstruction of disturbed habitat; improvement of existing habitat through creation or enhancement of limiting habitat features (Plants, riffles, cover, bank and channel stability, riparian vegetation and large woody debris, etc.); protecting water quality and quantity (see also measures under Water Resources, Vegetation, Soils).

Monitoring typically includes the condition and trends in aquatic habitat including benthic invertebrates, fish population and species composition, percent fines and cross channel transects for width to depth ratios and bottom composition above and below the project and at sites sampled during the baseline study. The purpose of this program would be to help quantify fluctuations in the quality of aquatic habitat and fish population.

Description of aquatic resource monitoring should include sampling points and reason for location; parameters to be monitored; standards/thresholds of concern to be met or statistical measures for identifying significant trends; frequency and duration of sampling; analytical methods; QA/QC; data storage and statistical analysis; and reporting requirements.

Where threatened or endangered species are present, this section may also summarize the results of consultation as required under Section 7A of Endangered Species Act.

Vegetation

Under this broad topic mitigation and monitoring can be addressed for all vegetative resources including timber, range, threatened/endangered/sensitive plant species, noxious weeds, wetlands and riparian areas. In general the goal is to ensure there is no net losses or degradation of these resources/habitats, or that losses are mitigated by creating or enhancing replacement habitats on or off-site. Additional mitigation and monitoring is described under **VI. RECLAMATION**, and Soil in this Section.

Where threatened or endangered species are present, this section may also summarize the results of consultation as required under Section 7A of Endangered Species Act.

Requirements of separate permits addressing wetlands (Section 404 of the Clean Water Act) may be summarized in the **Final Plan** and the appropriate permit referenced for additional information.

Cultural Resources

The management of cultural resources on federal lands or federally funded, licensed, or permitted projects is governed by Section 106 of the National Historic Preservation Act and associated regulations.

Mitigation plans must be reviewed by the Forest in consultation with the State Historic Preservation Officer (SHPO) and the Advisory Council for Historic Preservation. Once approved the cultural resource mitigation plan is incorporated into the **Final Plan**.

Mitigation plans typically include: data recovery or protection of sites which have been found to be eligible for nomination to the National Register of Historic Places and stabilization and interpretation of features found to be highly significant.

Monitoring typically includes having a qualified individual inspect and/or monitor surface disturbing activities in the vicinity of any identified cultural resource. Monitoring and inspection of proposed mitigation activities is also recommended on a regularly scheduled basis, with the involvement of the Forest Archeologist and State Historic Preservation Officer.

Aesthetics

Mitigation for visual resources is tied to the visual resource objectives as determined by the Forests Service Visual Management System. Mitigation for project facilities might include the use of non-reflective earth-tone paints for buildings and other major project features; retaining vegetation and trees wherever possible to screen facilities and maintain a forested appearance to the extent possible; locating facilities where they can be screened from view; designing cuts, fills and design clearings to blend in with the surrounding areas.

Recreation

Recreation resources which could be affected by mining operations including developed picnic and campgrounds; backcountry access and use; winter and water sports; hunting and fishing, and; viewing of scenery, wildlife or cultural resources. Mitigation and monitoring is designed to maintain or enhance these opportunities or mitigate for their loss by providing acceptable alternatives.

Some mitigation which has been used at mining sites:

- Promoting environmental awareness as part of new employee training. Hunting, fishing and other recreation issues are expected to be explained to employees as part of the training;
- Reducing the impacts of dust along access roads by watering, surfacing, or treatment with approved chemical amendments. Treatment shall focus on the areas adjacent to established recreation sites;
- Improving parking areas and signing for recreational facilities;
- Considering peak recreation use (holidays) when planning project activities;
- Providing or enhancing recreation use in the project areas particularly those which interpret present day or historic mining activity;
- Providing alternate access where existing routes have been affected.

Fire & Safety

This section should summarize the Mine Safety and Health Administration (MSHA) standards which apply to mining operations including mandatory safety and first aid training and equipment as well as requirements which apply to project facilities and materials such as explosives, hazardous materials, mine pits, haul roads, waste dumps, process facilities.

Forest and state requirements should be summarized for burning of slash and other debris, maintenance of fire tools and equipment, approved mufflers and spark arresters for all internal combustion equipment, fire extinguishers, pumps or other fire fighting equipment.

Other typical fire and/or safety mitigation might include:

- Meeting with county ambulance service to discuss coordinated response to vehicle or other emergencies on Forest roads and within the mine area;
- Providing emergency medical technicians and its own land based emergency transport service from the mine;
- Standing agreements for "Life Flight" services to allow rapid transport in the case of extreme emergencies including designating a helicopter landing facility at the mine site.
- Observance of speed limits and other transportation related requirements (see Transportation).

Monitoring provisions should describe periodic visits conducted by MSHA. Operators should designate individuals to be responsible for all aspects fire and safety requirements. This individual is responsible for periodic inspections to ensure that fire, medical and safety caches/stations contain the required type and number of tools and equipment.

Hazardous Materials

The kinds of hazardous materials to be transported, used, stored, generated or disposed of should be described in **Section III, Project Description**. This section under **Mitigation and Monitoring** typically focuses on spill prevention, response and notification procedures. Finally in **Section VI. Reclamation**, disposal of these same materials should be covered.

There are numerous legal requirements that apply spill prevention, response and notification and may be regulated by other state and federal agencies in addition to the FS. These various permits need not be duplicated in the FS Plan but they should be recognized and addressed in the NEPA analysis, and their requirements should be referenced or summarized in the Plan. These typically focus on reducing the risk that spills or releases will occur during transport, storage, use and disposal of hazardous materials and containing and cleaning up those that do occur.

These mitigation requirements for hazmat spill response are usually organized into 3 main areas.

- 1. Transportation of Hazardous Materials (on forest system roads)**
- 2. Onsite Spill Prevention and Response for Petroleum Products**
- 3. Onsite Spill Prevention and Response for non-Petroleum Products**

Transportation of Hazardous Materials (on forest system roads) - Transport of hazardous materials on federal highways are regulated under the Hazardous Materials Transportation Act (HMTA), primarily in 49 CFR 172 and 173. This act and regulations cover vehicles, containers, labeling, driver certification and training, and spill prevention, control and response. Title II of SARA (Community Right to Know) also requires that companies transporting more than certain amount of hazardous materials coordinate with community emergency response committees (usually set up on a county basis). Many of the provisions required under HMTA will satisfy transportation requirements on forest system roads as well, but additional requirements will normally be needed where needed to address hazards unique to Forest System Roads should be included in the Plans.

Such additional requirements for transport on forest system roads may include: required types of vehicles; forms of materials and material containers (i.e., single unit 4000 gallon fuel trucks, cyanide in briquette form in flo-bin containers); employee busing; use of pilot vehicles; hauling in daylight hours; caravanning of supplies; spill prevention plans; caches of spill response equipment; additional training requirements for mine employees and drivers; communication equipment and notification procedures.

Onsite Spill Prevention and Response for Petroleum Products - Requirements for spill prevention and response are typically developed for both petroleum and non-petroleum materials.

The U.S. Environmental Protection Agency (EPA) administers the Spill Prevention Control and Countermeasures (SPCC) program for **non-transportation related, above ground petroleum storage tanks** as authorized under Section 311(c) of the CWA. The program requires SPCC Plans for storage facilities with single tanks holding in excess of 660 gallons, or combined tanks holding more than 1320 gallons of petroleum product where a release of petroleum product could enter waters of the United States. Implementing regulations are found at 40 CFR 112.

General provisions of the regulations are:

That SPCC Plans be prepared within 180 days of start up of the facility.
Plans should be implemented immediately but no later than one year after start up of the facility.
The Plan must be reviewed and certified by a Registered Professional Engineer.

Although the SPCC Plan is normally required within six months of beginning operations, this Plan or an equivalent, should be submitted and approved as part of the **Final Plan** of Operation prior to the transport and storage of petroleum products.

Onsite Spill Prevention and Response for non-Petroleum Products - *Onsite spill prevention and response for non-petroleum hazardous materials* should be required for hazardous materials used in connection with ore processing and refining, including laboratory testing. Where states regulate cyanide or mineral processing facilities, we should work with them to address the proper spill response and clean-up of these materials through the permit and/or the FS Plan.

Other hazardous materials that may be present onsite and require mitigation and monitoring requirements include hazardous waste, pesticides or explosives.

Resource Conservation and Recovery Act (RCRA) was enacted in 1976. It is the principal federal program for management of solid and hazardous waste from generation to final disposal (cradle to grave). It was amended in 1980 and 1984. The 1984 amendments were designated as the **Hazardous and Solid Waste Amendment (HSWA)**. These federal laws apply to the generation, transport, storage and disposal of solid and hazardous waste and may be administered by the EPA or delegated to the states.

If the operation produces, stores, ships or treats hazardous waste these activities will be regulated by the EPA or State under these laws. These issues and requirements should be addressed in the NEPA analysis and may be included by supplement to the FS Plan. The extent of regulation which applies to the operation depends on volume of waste generated in a calendar month. For additional information regarding these laws, contact the state hazardous materials bureau or the EPA Regional Office.

The **Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) of 1972** regulates the registration, labeling, storage, handling, and disposal of pesticides. The required practices should be described or referenced in the **Plan**. Such pesticides are sometimes required for use in mining operations to control noxious weeds on disturbed areas.

The transport storage and use of explosives are regulated by the **Bureau of Alcohol, Tobacco and Firearms**. The FS may have additional requirements for transport storage and use of these materials that must be coordinated with the BATF and MSHA. Such requirements should be referenced or included in the Plan.

There are other notification and reporting procedures related to hazardous materials/substances required under federal laws like CERCLA and SARA. Although these are not "Plans" as such, the procedures and notification requirements should be identified in the NEPA analysis and referenced or incorporated into the FS Plan.

Transportation

Mitigation and monitoring for transportation typically addresses:

- Minimum road construction, signing, and maintenance standards;
- Transport of employees to the site;
- Employee education regarding traffic rules, speed limits;
- Development of a transportation spill prevention and response plan. Such plans typically address: required types of vehicles, forms of materials and material containers (i.e., single unit 4000 gallon fuel trucks, cyanide in briquette form in flo-bin containers); employee busing, use of pilot vehicles; hauling in daylight hours; caravanning of supplies; spill prevention plans; caches of spill response equipment; training requirements for mine employees and drivers; communication equipment; notification procedures.
- Providing information to local communities regarding transport and use of toxic or hazardous chemicals as required under Superfund Amendment and Reauthorization Act of 1986 (SARA);
- Assisting local communities in preparing for and responding to spills of hazardous materials;

Monitoring typically addresses:

- Responsibility for and periodic review of spill response caches and first aid stations to ensure to ensure that they all emergency first aid and spill response materials are current and stored in the proper place;
- Radio communications equipment on pilot vehicles and trucks are in working order;
- The kind and number of vehicles, and material containers;
- Operator and shipping company compliance with the terms of the Spill Response Plan including requirements for spill response materials and training of personnel.

Socioeconomics

While the Forest Service is required to analyze and display socioeconomic impacts including potential mitigation measures, it does not have the authority to implement mitigation for impacts occurring off of National Forest System Lands. not r the jurisdiction of the Forest Service.

V. PLAN FOR INTERIM SHUTDOWN

- The Draft Montana Guidelines contains guidance for addressing interim shutdown due to cessation of mining. This section was developed as a consequence of mine bankruptcies and abandonment. It serves two purposes.
 -
 - When an operator abandons the site or goes into bankruptcy, some mine facilities must be operated, maintained and monitored by the FS or cooperating State Agency to assure public safety and environmental protection until bonds are secured, contracts are awarded and reclamation work completed. The most immediate concerns at many sites are to secure access, maintain utilities and fences, operate heap leach ponds, tailings impoundments, and storm water systems and secure buildings where explosives and chemicals/reagents are stored. The description of interim shut-down in the Plan will be used by the FS to estimate the cost of performing or contracting this operation and maintenance responsibility.
 -
 - Finally, an interim shutdown plan will spell out interim reclamation requirements and time frames for project facilities.
 -
 - Plans for interim shutdown should be included in the **Initial Plan**. It is likely that additional detail will be required in the **Final Plan** in order to support the actual cost bond estimate.
 -

VI. RECLAMATION

Discussions of reclamation in the **Initial Plan** will vary considerably from project to project. In some cases where considerable consultation with permitting agencies has been done during exploration and pre-feasibility this section may be well developed, consisting of measures which are more or less standard parts of the required permits and approvals.

At the **PDEIS** stage additional reclamation measures resulting from baseline studies or discussions with permitting agencies may be added to the **Initial Plan** or included in other alternatives being analyzed in the EIS. Additions to the **Initial Plan** should be made as formal supplements for them to be considered in analysis of effects for the proposed action.

In many cases a stand alone reclamation plan will be added as a supplement to the **Final Plan**. An example of a stand alone Reclamation Plan format has been developed to assist operators and mineral administrators. This example duplicates some of the information that is found in this Plan format, but it is useful as a guide to document reclamation requirements and information needed to support bond calculations.

Final reclamation requirements will reflect the results of all state and federal permit/plan requirements. In general it will contain provisions for concurrent, interim and final reclamation of project related disturbance and facilities. A very simple way to think about what is needed in a reclamation plan is that it should answer the questions; what is being reclaimed; when is it being reclaimed; how we know when reclamation is complete, and; how reclamation will be accomplished.

What is being Reclaimed? (Project Description)

The **Final Plan** should contain written descriptions, plan-views and cross-sections describing the physical and chemical configuration of the project facilities and associated disturbance on an annual basis (or some other agreed upon interval), and at mine closure. The following information should be provided for project-related disturbance and facilities:

- Area and type of disturbance;
- Volumes of material to be moved in re-contouring and applying growth medium;
- The type and amounts of materials/supplies to be removed;
- Volumes of solid or hazardous waste;
- Size (square footage) of Project facilities which must be removed;

When Is It Being Reclaimed (Reclamation Schedule)

As important as what will be reclaimed, is when, or at what point in the life of the project will the project be reclaimed. To answer this question, the anticipated schedule for project construction, operation, and closure is needed. With this information, reclamation bond estimates can be made annually (concurrent reclamation) or at some other pre-determined interval (interim reclamation), in addition to mine closure. This will allow both phased and full term bonding, and is needed to choose the right size, type and amount of labor and equipment for any given period.

How Do We Know When Reclamation Is Complete? (Reclamation Standards)

This is a description of the end product or condition we are trying to achieve with our reclamation efforts.

These are based on the kind of project impacts expected, resources affected, and the long term management objectives for the area. They include:

- Requirements for facility, material and equipment removal;
- Isolation, removal or control of hazardous or toxic materials;
- Control of water runoff;
- Water quality standards;
- Standards for physical and chemical stability of project components.
- Acceptable post-mining land contours and drainages;
- Acceptable vegetative communities and ground cover requirements;
- Rehabilitation of fisheries and wildlife habitat;
- Measures needed to ensure the physical and chemical stability of project components;
- Mitigation required to compensate for environmental damage which cannot be avoided;
- Reclamation protection and monitoring requirements;
- Maintenance requirements.

These should be expressed as land or resource conditions to be achieved, and we should be able to measure and monitor that achievement.

How Will Reclamation Be Accomplished

With the necessary project information, and the reclamation standards that must be met, the reclamation activities needed to reclaim the project can be described and costs estimated at each pre-determined interval (annually/mine closure) using the following procedure:

- Divide the project into logical units like heap, roads, tailings impoundment, pits, mill facilities, support facilities and dumps, etc.;

- List the reclamation tasks necessary to achieve the desired standard for each facility. These steps typically include:
 - Operation & maintenance of the mine in standby status for a period of 6 months to address time needed to secure bonds. This should include the facilities and equipment including needed access, materials, and personnel necessary to assure public safety and environmental protection at the site, i.e., operation of heap leach ponds/tailings impoundments, stormwater system and buildings where chemicals/reagents are stored;
 - Sampling to identify hazardous materials stored, spilled or contamination;
 - Isolation, neutralization, removal or treatment of hazardous materials;
 - Removal of equipment, materials and facilities;
 - Backfilling and/or recontouring of disturbed sites;
 - Subsoil Preparation - Where compacted layers would inhibit vegetative growth, the subsoil will be ripped or harrowed on the contour;
 - Topsoil Spreading - Topsoil or other acceptable growing medium will be spread and final grading should be on the contour ;
 - Installation of erosion landslide and water control measures;
 - Seedbed Preparation - Where compacted layers would inhibit vegetative growth, the topsoil will be ripped or harrowed on the contour. Where erosion is expected to be a problem, mulch and/or terracing will be used.
 - Where soil fertility is expected to be a limiting factor, a fertilizer or other amendment may be required. Fertilizer will normally be applied in the spring after a successful fall seeding results in germination.
 - Reseeding - A seed mixture designed to meet the post mining land use objectives will be applied by broadcasting, drilling or hydromulching depending on the slopes and nature of the material to be reclaimed. The timing of reseeded will normally be in the fall immediately following backfilling, recontouring, and topsoil placement.
 - Channel Reconstruction - Where stream channels and/or floodplain and riparian areas will be reconstructed, sound engineering and hydrologic design will ensure replacement of the original function and values of the stream system including: 1) Width to depth ratios; 2) Sinuosity; 3) Stream gradient; 4) Channel substrate; 5) Floodplain/riparian area shape and vegetative composition.
 - Rehabilitation of fish and wildlife habitat;
 - Water Treatment
 - Completion of other mitigation required by the approved Plan.
 - Reclamation Protection - Reclaimed areas will be protected as necessary with fencing, road closures, or other means until such time as minimum stocking levels have been achieved;

Bond Calculation

The purpose of any reclamation plan and bond is to provide the information and funds to allow the FS, or its contractor to complete reclamation as described in the approved Plan.

Using the descriptions given above, the bond can be calculated using the following procedure.

- Select the equipment to be used and obtain equipment and labor costs for each task;
- Calculate quantities, haul costs, disposal fees, material source development, neutralization, revegetation or other special costs;
- Calculate the direct costs of doing the work;
- Calculate the indirect costs, contracting, mobilization, administration, re-engineering/design fees and contingencies;
- Index costs to allow future adjustments for inflation;
- Document all of your work, assumptions, calculations, etc.;

All of this work (project description, schedule, standards to be met, and bond calculation) should comprise the reclamation plan for the project.

VII. FIGURES

Typical figures needed to illustrate the contents of a **Final Plan**:

- Location Map;
- Land Ownership;
- General Facilities Layout;
- Generalized Geology;
- Geologic Cross Sections For Major Project Facilities;
- Location Of Drill Holes For ARD Characterization;
- Cross Section Showing Rock Types According To ARD Potential;
- Location Air Quality, Meteorological Monitoring Stations;
- Location Of Surface And Ground Water Sampling Stations;
- Potentiometric Surface Of Ground Water In Project Area;
- Typical Haul And Access Roads Cross sections;
- Project Development Schedule;
- Alternative Facility Locations Considered;
- Cross Sections And Plan Views Of Major Project Facilities Before And After Reclamation;
- Operation Schematic, Mining, Milling, Waste Disposal;
- Cross Sections Of Isolation Cells, Covers, Seals For Hazardous Or Acid Forming Materials;
- Process Circuit , Including Inputs Of Ore, Water, Chemicals;
- Project Water Balance;
- Graph Results Of Acid/Base Accounting By Lithologic Unit, Typically Ratios Of Neutralization To Acid Producing Potential (NP/AP), And/Or Net Neutralization Potential (NNP) Plotted Against Values Of Total Or Pyritic Sulfur Or Paste Ph;
- Graph Results Of Humidity Cell Testing By Lithologic Unit, Typically Final Ph Vs Total Sulfur, Paste Ph, Sulfate, NNP And/Or NP/AP;
- Post Mining Contours.

VIII. TABLES

Typical tables in a **Final Plan**:

- Permits Needed;
- Proposed Facilities;
- Surface Area Disturbance By Facility;
- Monthly Mean And Extremes For Temperature, Precipitation, Evaporation, Snow;
- Flood Flows In Project Drainage For Selected Storm Events;
- Air Quality-Climate Monitoring Stations/Parameters;
- Air Emissions Inventory, Before And After Controls;
- Water Rights on project area streams;
- Water Consumption;
- Ore & Waste Rock Types/Volumes;
- ARD Static Testing Results By Rock Types, Include Descriptive Statistics By Lithology;
- ARD Kinetic Testing Results By Rock Types;
- Results Of Synthetic Leach Testing Of Mine Waste;
- Stability Analyses For Major Components;
- Typical Equipment List;
- Typical Reagent Use, Kind And Volumes Stored Onsite;
- Potential Material Suppliers, Routes To Mine Site;

- Materials Shipped To The Site, Types Of Vehicles, Load Volume, # Of Trips;
- Existing Average Daily Traffic By Type Vs Project Related;
- Surface And Groundwater Monitoring Sites/Frequency Of Sampling/Analytes;
- Summaries Of Baseline Surface And Ground Water Quality;
- Soil, Suitability And Volume By Soil Horizon;
- Acres By Vegetative Habitat Types, (Wetlands Riparian Areas) Disturbed By Facility;
- Operation And Reclamation Schedule;

IX. APPENDICES

Because they contain information and analyses directly relating to the design of project facilities, the following reports should be considered as supplements to the **Final Plan**. They can be referenced in the Plan itself, but stored in separate documents.

- Geology, addressing topics discussed in Geology discussion in Section II. of the Plan;
- Climate/Air;
- Water Resources;
- Design reports for pits, dumps, tailings, heaps, dams or other major project facilities;
- Monitoring plans including air, water and aquatic resources, geochemical monitoring of ore and waste;
- Wildlife;
- Fisheries;
- Vegetation/Wetlands/Timber/Range;
- Cultural Resources;
- Recreation & Visual Resources;
- Transportation Analysis;
- Socioeconomics;

In addition the following permits/plans and approvals (typical in Idaho) should also be included as appendices or supplements to the Plan:

- Reclamation Plan;
- Dam Safety Permits/Plans;
- NPDES Permits (including Stormwater);
- Other State Permits for Major Mine Facilities;
- SPCC Plan;
- Onsite Spill Prevention and Control;
- Hazardous Waste Management Plan;
- Water Rights;
- Aquatic and Water Resource Monitoring Plans;
- Geochemical Monitoring and Mine Waste Handling Plan;
- Air Quality Permit to Construct and Operate;
- Cultural Resource Mitigation Plans;
- Sewage Disposal, Drinking Water Permits.

REFERENCES

**APPENDIX C2
EXCERPTS FROM MONTANA DRAFT
RECOMMENDED CHECKLIST GUIDELINES FOR MINING PERMIT
APPLICATIONS
AND AMENDMENTS OR REVISIONS**

The outline below is an excerpt from draft State of Montana guidance for the submittal of mine permit applications. Sections 3 to 13 and is meant to be used as a checklist of facilities (including facilities, equipment, activities, materials and associated surface disturbance) to consider in reclamation bond estimates. It is not meant to be guidance for the responsibility, format or timing of information required to process Forest Service Plans of Operation (POOs).

As noted in Appendix C1, Montana requires that the operator develop and present this information in the mining permit application prior to initiation of the State's environmental impact statement. Appendix C1 notes that the Forest Service (FS) has no such specific requirements, but describes how similar information is typically developed based on the requirements of 36 CFR 228A and Forest Service (FS) procedures for implementing the National Environmental Policy Act (NEPA).

DRAFT
RECOMMENDED CHECKLIST GUIDELINES FOR MINING PERMIT APPLICATIONS
AND AMENDMENTS OR REVISIONS

The outline below was prepared to facilitate the procedure for submittal of mine permit applications. Submission of all of the information below in the appropriate format will facilitate timely and thorough reviews by the technical staff. In some cases the information requested below may not apply to every mine operation, in which instance that portion of the checklist may be omitted or provide a negative declaration. This checklist is redundant and should be used to make sure all areas listed in this guideline are at least considered and then addressed or dismissed.

Completeness is achieved when the permit application contains environmental resource baseline information addressing: 1) quantity, 2) quality, 3) location, 4) shape, and 5) behavior of potentially affected resources, and detailed plans for 1) construction, 2) operation, 3) reclamation which could include mitigation as well, 4) water and/or facility monitoring for contaminant production and migration, and 5) any contingencies. The applicant must demonstrate that plans do not conflict with air and water quality laws. Plans must be more than conceptual designs. They must be at least preliminary designs with sufficient detail for DSL to calculate a bond for reclamation. All numbers and limits in permit commitments and conditions are considered to be maximums, not approximations, even where the text of a permit indicates an approximation. This guideline should be used in conjunction with other materials provided by the agencies. Please contact the agencies when there is any need for clarification.

FORMAT

The permit application should be submitted on white loose leaf paper in a three ring reinforced binder so that pages can be replaced or supplemented as revisions or amendments are reviewed and approved. The narrative should be double spaced and have an outline system similar to the one used for this outline. The original page numbers should not change when revisions or additions are submitted to the agencies (i.e. if a revision of page 3-21 requires that page be replaced, the new, revised page should still have the same page number, 3-21; if an additional page is needed to extend a discussion on a certain subject the subsequent pages would be numbered 3-21-a, 3-21-b, etc.). The replacement page should have the date it was revised printed on it and should be of a different color other than white. Each round of revisions should be a different color. Amendments to the operating permit should be submitted as replacement pages to the original document to avoid ending up with multiple documents in which the mine plan resides.

MAPS

Much of the information will be presented in map form. The agencies have noted in the outline where maps are needed. To the extent possible, all maps should be at the same scale and should delineate all facilities and the permit boundary. Printing maps on translucent paper allows various maps to be overlain on a light table. The maps should distinguish what is currently permitted and/or disturbed from what is proposed. Topography should be shown, but screened to 30-50%.

TABLES

In addition to whatever tables are constructed, include the following summary tables. They can be referred to throughout the text, as they relate to many topics.

- * Summary (life of mine) time line (grant chart) showing phases when various pit stages will be mined, certain portions of waste dumps will be inactive and reclaimed, heap leaching will occur, concurrent and final reclamation will occur, etc. (see "timing and scheduling" in each section).
- * Summary of equipment and manpower requirements for each facility per year or phase
- * Breakdown of specific disturbances given in acres/year or acres/mining phase which can be related to a map
- * Soil and nonreactive capping material stockpiles, volumes/tonnages in yd³/year or yd³/mining phase, and tons/year or tons/mining phase which can be related to a map
- * Cultural resources mitigation table - when will mitigation start

APPENDICES

All raw data and supporting information used to derive results and conclusions should be given in these appendices - one each for each baseline subject.

NOTE: THE FOLLOWING OUTLINE MAY INCLUDE INFORMATION GAPS. SITE SPECIFIC CONDITIONS MAY WARRANT THE SUBMISSION OF INFORMATION IN ADDITION TO WHAT HAS BEEN IDENTIFIED BELOW.

1 PROJECT SUMMARY

1.1 Introduction

Include name and address of operator, project location, mineral to be mined, and certification pursuant to 82-4-335 (MCA).

1.2 Permits Required

Include table of all permits needed to facilitate the mine plan from all appropriate federal, state, and local agencies.

1.3 Surface Ownership

Detail surface ownership of all lands within an area of one-half mile around any part of the permit area. Include a map.

1.4 Mineral Ownership

Include map of mineral ownership of all areas within the permit boundary

1.5 Summary of Proposed Activities

Describe the permit boundary (include a legal description) and all proposed facilities including pits, underground workings, heaps, dumps, tailings impoundments, topsoil stockpiles, neutral

waste stockpiles, water management structures, mill, support facilities, administration buildings, access roads, utility lines, etc. Include map.

1.6 Overview of Mining and Processing

Describe the mining technique to be used. Include maximum estimates for production rates, and maximum total tonnage for ore, waste rock, and, tailings. Include evaluation of the expected life of any facility and the potential for expansion of the facility, e.g. tailing impoundment, waste dump, etc. Describe the processing technique to be used.

1.7 Manpower Requirements

Include estimates for all phases of mine life: construction, operations, and reclamation.

1.8 Scheduling

Define mine life schedule from start up through closure. Include concurrent and final reclamation schedules. Define conditions which would force a temporary cessation of mining. Define conditions which would extend mine life or would cause operator to seek an expansion.

1.9 Land Use

Describe current use of proposed mine area and adjacent area including type, amount, and seasonality of all uses. Define post mining land use; e.g. wildlife and/or livestock grazing, industrial, small bird and mammal use; pit use, water use, etc.

2 BASELINE ENVIRONMENTAL INFORMATION - discussion of results from baseline investigation should be presented here - raw data should be supplied as appendices

2.1 Geology - Include map. Pertinent delineation and condemnation drill logs should be placed in the appendices. Include detailed description of:

2.1.1 General geology - history, genesis of the deposit rock types, stratigraphy, structures, estimates of tonnage for each lithology/alteration assemblage, particle size distribution, description of sulfide mineralogy especially iron sulfides; include sampling sites used for geochemical characterization

2.1.2 Physical characteristics of waste and ore - moisture content, particle size distribution, slaking characteristics, strength, durability, and hydraulic conductivity.

2.1.3 Geologic stability analyses for the affected area - include regional seismicity

2.1.4 Unique geological features

2.1.5 Identification of other potential mineral resources in the area

2.1.6 Geochemical comparisons of similar or neighboring mines and districts.

2.1.7 Complete geochemical characterization of all rock and stream sediments for areas which have been disturbed or will be disturbed, excavated, or mined. Report should include the following information for both previously mined or disturbed materials and materials proposed for disturbance.

2.1.7.1 sampling rationale and locations - can be included on the geology map

- 2.1.7.2 mineralogy - petrographic thin section analysis of representative ore and waste samples with emphasis on iron sulfides and the geochemical spatial relationships in the microenvironment
 - 2.1.7.2.1 geochemical hazards - radioactive minerals, asbestiform minerals, arsenic, mercury, lead, cadmium, etc.
 - 2.1.7.3 static test protocol and results
 - 2.1.7.3.1 sulfur fractionation - sulfur species, abundance, crystal size and form
 - 2.1.7.3.2 paste pH analyses
 - 2.1.7.4 leachate extraction test protocol and results
 - 2.1.7.4.1 USEPA method 1312 or meteoric water leachate short term tests
 - 2.1.7.4.2 kinetic testing - humidity cells (use coarse samples for materials which will become pit-run waste or spent ore)
 - 2.1.7.5 field scale, long term leachate extraction test protocol and results
 - 2.1.7.6 mathematical modeling

2.1.8 Topography and Geomorphology

2.1.9 Natural hazards

- 2.1.9.1 landslide or mass movement hazards
- 2.1.9.2 earthquake hazards
- 2.1.9.3 avalanche hazards
- 2.1.9.4 water hazards
- 2.1.9.5 fire
- 2.1.9.6 other

2.2 Hydrology - Contact the National Resource Information System and the Water Quality Bureau for available information and possible permit requirements. One year baseline required, two years is preferred. Include map of monitoring wells, springs, streams, and surface water sampling sites.

2.2.1 Data Analyses - Include description of:

- 2.2.1.1 sampling protocol and analytical protocol
- 2.2.1.2 statistical methods used in analyses
- 2.2.1.3 mathematical modeling
- 2.2.1.4 loading estimates for existing surface water and groundwater conditions

2.2.2 Surface water - The description of surface water should include:

- 2.2.2.1 ownership and use
- 2.2.2.2 sampling locations for baseline investigation
- 2.2.2.3 delineation of affected watersheds
- 2.2.2.4 description of volumes and flow rates for affected watersheds
- 2.2.2.5 description of rationale for selection of design storm
- 2.2.2.6 description of water quality

2.2.3 Groundwater - The description of groundwater should include the following:

2.2.3.1 ownership and use

2.2.3.2 describe and map all groundwater well locations used for baseline investigation; be sure to gather information from areas upgradient of any proposed facilities

2.2.3.3 describe and map all other registered wells and springs including: depth of completion, interval sampled, flow rates, quality; also include non-registered wells and springs in affected areas

2.2.3.4 map and describe the potentiometric surface, direction of movement, and estimated flow rates

2.2.3.5 provide at least one cross-section through the affected area, showing the hydrostratigraphic units

2.2.3.6 description of water quality

2.2.3.7 discussion relating geologic setting to groundwater regime

2.2.3.8 completion logs for all groundwater wells - intervals screened, pertinent drill logs.

2.3 Soils and Alluvium - Contact the Soil Conservation Service and academia for available information. Include detailed map. Include detailed description of the following:

2.3.1 Type of soil survey used - use Order 1 soil survey for actual disturbed areas, use Order 3 soil survey for areas within permit area which will not be disturbed.

2.3.2 Soil types present, their parent material, and their development - use the National Cooperative Soil Survey for classification of soils.

2.3.3 Erosion potential for each type

2.3.4 Analysis of: texture, chemistry, pH, EC, SAR, porosity, permeability, (standard oil analysis)

2.3.5 Determine total soil volumes; and salvageable depths, areas, volumes; and suitability for reclamation and construction - salvage depths should be delineated for each soil map unit.

2.4 Vegetation - Contact the Agricultural Experiment Station, U.S. Forest Service, the Bureau of Land Management, and academia for available information. Include detailed map. Describe the following:

2.4.1 Taxonomic list of species by morphological class

2.4.2 Distribution and productivity of each type.

2.4.3 Distribution and types in riparian areas and wetlands.

2.4.4 Distribution and types of threatened, endangered, or rare plants

2.4.5 Distribution and types of noxious weeds

2.4.6 Plant communities present.

2.4.7 Current use of plants or communities.

2.4.8 Biodiversity

2.5 Climate - Contact the National Oceanic and Atmospheric Administration for available information. Include map (one year baseline required). Describe the following:

- 2.5.1 Historical climatic conditions - annual, monthly
- 2.5.2 Annual temperatures
- 2.5.3 Evaporation vs. precipitation balances and predictions
- 2.5.4 Storm frequencies, durations and intensities
- 2.5.5 Probable maximum flood
- 2.5.6 Snowpack
- 2.5.7 Wind - direction, velocity (include rose diagrams), erosion potential

2.6 Air Quality - Contact the Air Quality Bureau for available information and permit requirements. Include detailed map. Include description of air shed classifications, existing air quality of project area and adjacent areas. One year of baseline is required.

2.7 Roads and Traffic - Include a detailed map. Describe the current and expected uses.

- 2.7.1 Access roads
 - 2.7.1.1 current traffic type and density
 - 2.7.1.2 expected traffic type and density due to mining or mining related activity
- 2.7.2 Onsite roads
 - 2.7.2.1 current traffic type and density
 - 2.7.2.2 expected traffic type and density due to mining or mining related activity

2.8 Power and Utilities - Include a detailed map. Describe the following:

- 2.8.1 Location of existing power lines, roads, streams, railroads, and utility lines
- 2.8.2 Location and discussion of proposed sources - include map of powerline or pipeline routes. This discussion may be extensive and could be submitted as a separate document.

2.9 Wildlife - Contact the Montana Fish, Wildlife, and Parks, U.S. Fish, Wildlife Service, U.S. Forest Service, the Bureau of Land Management, and academia for available information. Include detailed map. Describe the following:

- 2.9.1 Terrestrial
 - 2.9.1.1 discussion of species known to occur in the affected area
 - 2.9.1.2 discussion of wildlife habitat types, include protective cover and important seasonal ranges if any (are any critical, if so describe)
 - 2.9.1.3 threatened or endangered species present, if so describe.
 - 2.9.1.4 special offsite concerns
 - 2.9.1.5 biodiversity
- 2.9.2 Avian
 - 2.9.2.1 discussion of species known to occur in the affected area (give common and binomial names)

2.9.2.2 discussion of avian habitat types including wetlands, protective cover, critical habitat if any

2.9.2.3 describe known or suspected nesting sites of threatened and endangered species

2.10 Fisheries and Aquatic Biology - Include detailed map. Describe the following:

2.10.1 Fisheries

2.10.1.1 known species occurrence and distribution within the affected area, to include critical habitat if any

2.10.1.2 threatened or endangered species present, if so describe

2.10.1.3 special offsite concerns (downstream fisheries)

2.10.1.4 biodiversity

2.10.2 Aquatics

2.10.2.1 known species occurrence and distribution within the affected area, to include critical habitat if any (aquatic insects, algae, etc.)

2.10.2.2 special offsite concerns (downstream fisheries)

2.10.2.3 biodiversity

2.11 Cultural Resources - Contact the State Historic Preservation Office, U.S. Forest Service, Bureau of Land Management, and academia for available information. Include detailed map.

Describe the following:

2.11.1 Prehistoric sites

2.11.2 Historic sites

2.11.3 Archeologic sites

2.11.4 Paleontologic sites

2.11.5 Districts

2.11.6 NRHP sites and others eligible under the Federal 106 regulations (National Register) and the State Antiquities Act

2.12 Aesthetics - Describe the following:

2.12.1 Visual quality - existing and changes due to lighting and/or added disturbances

2.12.2 Noise

2.12.2.1 Background levels

2.12.2.2 Frequency distribution (include diagram)

2.12.2.3 Estimated increases due to mining; especially nearby schools, hospitals, libraries, recreational, or residential areas.

2.12.3 Odors - existing and changes due to mining

2.13 Recreation - Contact the U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Montana Department of Fish, Wildlife and Parks, and academia for available information. Describe the following:

2.13.1 Present use including both frequency, distribution, and seasonality

2.13.2 Estimated expected use during mining phases.

2.14 Socioeconomic and Human Environment - Contact the Hard Rock Impact Board and the Department of Community Affairs for available information and permit requirements.

Describe the following:

2.14.1 Existing environment - include a discussion of the socioeconomic history of the area including:

2.14.1.1 social: structure and mores

2.14.1.2 cultural: uniqueness and diversity

2.14.1.3 population: quantity and distribution

2.14.1.4 housing: quantity and distribution

2.14.1.5 income: community and personal

2.14.1.6 employment: quantity and distribution

2.14.1.7 tax base: local and state tax revenue

2.14.1.8 demand on government services

2.14.1.9 industrial and commercial activities

2.14.1.10 environmental plans and goals (local and regional)

2.14.2 Estimated manpower requirements - include any changes to any of the topics listed above which would occur due to the proposed mining.

3 PROPOSED MINE PLAN

3.1 Proposed Design and Construction - how will these facilities be designed and constructed? Identify how all plans will limit the volume of water to be treated during construction.

3.1.1 Underground mine or open pit and ancillary pumping facilities

3.1.1.1 location and mining method - shrinkage stoping, shovel-truck, placer, etc.

3.1.1.2 expected life and potential for expansion

3.1.1.3 timing and scheduling of construction (in table form)

3.1.1.4 preliminary design - what size stopes, adits, portals; or bench sizes and highwall slope angle

3.1.1.4.1 cross sections - underground configuration, surface, open pit, open cut, placer

3.1.1.4.2 plan view - underground configuration, surface, open pit, open cut, placer

3.1.1.5 stability analyses for the underground working or pits - regional seismicity, potential for subsidence, proximity to flood plain

3.1.1.6 hydrology - identification of water table elevation, water balance, pit water inflow and quality predictions, loading analyses downgradient

3.1.1.7 disturbance acreage - delineate on a map

3.1.1.8 soil/alluvium salvage/vegetation disposal method or mulching method

- 3.1.1.8.1 salvage depths and areas (in acres) by soil type
- 3.1.1.8.2 total volume of soil materials
- 3.1.1.8.3 volume calculations for salvageable soil by type
- 3.1.1.8.4 soil stockpile location and configuration - include cross-section, areas (in acres) and locations
- 3.1.1.8.5 life of soil stockpile
- 3.1.1.8.6 soil/alluvium amendments
- 3.1.1.9 seasonal considerations (e.g. freezing, flooding, snow removal)
- 3.1.2 Mine waste segregation and management** - provide for stockpiling of non-reactive waste or overburden early on so that sufficient tonnage of neutral waste may be stockpiled for use in capping if necessary or if conditions change within a particular facility (i.e. if results from geochemical testing is inconclusive or wrong).
 - 3.1.2.1 sampling method and parameters to be analyzed
 - 3.1.2.2 isolation technique
 - 3.1.2.3 neutral waste stockpile areas - show locations and indicate the area (in acres) on a map
 - 3.1.2.4 verification of segregation method (see section 5 Proposed Testing and Modeling)
- 3.1.3 Waste dumps and ancillary facilities**
 - 3.1.3.1 location and site selection criteria
 - 3.1.3.2 expected life and potential for expansion
 - 3.1.3.3 timing and scheduling for construction (in table form)
 - 3.1.3.4 condemnation drilling results (in appendix)
 - 3.1.3.5 preliminary design: slopes, and construction method; underdrains - be sure foundation and underdrain materials are nonreactive; show phases of progression; discuss any efforts taken during construction which will restrict acid production such as building the waste dump in small, compacted, backsloped lifts; if waste will be reactive discuss provisions to isolate the underdrain system from the waste rock facility (i.e. clay liner on top of a limestone underdrain)
 - 3.1.3.6 stability analyses for the waste rock facility - regional seismicity, proximity to flood plain
 - 3.1.3.7 hydrology - water balance; infiltration and seepage predictions; loading analyses for proposed disturbances; discuss how any springs and surface water which will be covered will be isolated from the dump material
 - 3.1.3.8 disturbance acreage - delineate on a map
 - 3.1.3.9 soil/alluvium salvage - vegetation disposal method or mulching method
 - 3.1.3.9.1 total volume of soil materials
 - 3.1.3.9.2 salvage depths and areas (in acres) by soil type
 - 3.1.3.9.3 volume calculations for salvageable soil by type
 - 3.1.3.9.4 soil stockpile location and configuration-include cross-section, areas (in acres) and locations

- 3.1.3.9.5 life of soil stockpile
- 3.1.3.9.6 soil/alluvium amendments and rates of application
- 3.1.3.10 seasonal considerations (e.g. freezing, flooding, snow removal)
- 3.1.4 Heap leach pads and ancillary facilities design and construction**
 - 3.1.4.1 location and site selection criteria
 - 3.1.4.2 expected life and potential for expansion
 - 3.1.4.3 timing and scheduling of construction (in table form)
 - 3.1.4.4 condemnation drilling results (in appendix)
 - 3.1.4.5 preliminary design (free-draining or internal sumps)
 - 3.1.4.5.1 design capacity and size - capacity vs. surface area computations
 - 3.1.4.5.2 foundation design and preparation - be sure foundation is non-reactive material
 - 3.1.4.5.3 embankment design, slopes, and construction
 - 3.1.4.5.4 liner/underdrain/fingerdrain design, construction, and Quality Assurance Quality Control (QA/QC) - be sure material used for underdrain is non-reactive
 - 3.1.4.6 stability analyses for the leach pads - regional seismicity, proximity to flood plain
 - 3.1.4.7 hydrology - water balance; infiltration and seepage predictions; loading analyses for proposed disturbances; discuss how any springs which will be buried will be isolated from the facility
 - 3.1.4.8 ancillary facilities - barren and pregnant ponds, sumps, and other facilities
 - 3.1.4.8.1 design capacity and size - sizing calculations; capacity vs. process volume (at what % of capacity will the process normally operate?)
 - 3.1.4.8.2 preliminary design and construction
 - 3.1.4.8.2.1 stability
 - 3.1.4.8.2.2 sealing methods
 - 3.1.4.8.2.3 sediment disposal
 - 3.1.4.8.2.4 run-off control
 - 3.1.4.8.2.5 bird netting
 - 3.1.4.8.2.6 water loss
 - 3.1.4.9 special monitoring systems
 - 3.1.4.9.1 piezometers
 - 3.1.4.9.2 discussion of hydrologic balance under and within the heap - cross sections showing phreatic surfaces
 - 3.1.4.10 disturbance acreage - delineate on a map
 - 3.1.4.11 soil/alluvium salvage/vegetation disposal method or mulching method
 - 3.1.4.11.1 total volume of soil materials
 - 3.1.4.11.2 salvage depths and areas (in acres) by soil type
 - 3.1.4.11.3 volume calculations for salvageable soil by type

3.1.4.11.4 soil stockpile location and configuration- include cross-section, areas (in acres) and locations

3.1.4.11.5 life of soil stockpile

3.1.4.12 seasonal considerations (e.g. freezing, flooding, snow removal)

3.1.4.13 added measures which will be implemented which addresses lowering impacts to the environment

3.1.5 Ore processing

3.1.5.1 life of ore processing operation - will ore processing operation extend beyond the life of the mine to process ore from other locations?

3.1.5.2 description of ore processing method (e.g. milling, concentration by flotation, cyanide or acidic heap leach, metal recovery system)

3.1.5.3 maximum capacity and processing rates (input and output)

3.1.5.4 process circuit preliminary design and construction

3.1.5.5 mill and/or process circuit flow sheet

3.1.5.6 ore sorting - to include type of equipment

3.1.5.7 crusher and agglomerator facility design and construction

3.1.5.8 condemnation drilling results (in appendix)

3.1.5.9 wash plants - to include type of equipment

3.1.5.10 reagents, solvents, chemicals, etc. - include Material Safety Data Sheets in appendix

3.1.5.10.1 chemical or biological breakdown period of the various reagents, solvents, chemicals, etc.

3.1.5.10.2 amount of each reagent that will report to leach pad, tailing impoundment, etc.

3.1.5.10.3 reagent storage and packaging

3.1.5.10.4 cyanide

3.1.5.10.4.1 application rate

3.1.5.10.4.2 recovery system

3.1.5.10.4.3 container disposal

3.1.5.10.4.4 concentration, annual consumption and loss

3.1.5.10.5 flotation (list of reagents and their function)

3.1.5.10.5.1 application rate (lbs/ton of ore)

3.1.5.10.5.2 spill procedures

3.1.5.10.5.3 worker exposure limits

3.1.5.10.5.4 toxicity range

3.1.5.11 seasonal considerations (e.g. freezing, flooding, snow removal)

3.1.5.12 condemnation drilling results (in appendix)

3.1.6 Tailing impoundments and ancillary facilities

3.1.6.1 location and site selection criteria

- 3.1.6.2 expected life of impoundment and potential for expansion
- 3.1.6.3 timing and scheduling for construction for major mining phases (in table form)
- 3.1.6.4 condemnation drilling results (in appendix)
- 3.1.6.5 preliminary design
 - 3.1.6.5.1 capacity vs. surface area computation
 - 3.1.6.5.2 foundation design and preparation
 - 3.1.6.5.3 embankment design and construction (upstream, centerline, downstream, multi-cell, or other)
 - 3.1.6.5.4 method of construction, starter dam, use of borrow material, cyclone tailing, toe drains, cell systems, freeboard
 - 3.1.6.5.5 liner/underdrain/fingerdrain design, construction, inspection schedule, and QA/QC
- 3.1.6.6 stability analyses of the impoundment, regional seismicity, proximity to flood plain
- 3.1.6.7 hydrology - water balance; infiltration and seepage predictions; loading analyses including proposed disturbances; discuss how any springs which will be buried will be isolated from the facility
- 3.1.6.8 tailing slurry system - pumps, slurry lines, thickener tanks, and ancillary facilities design, sizing calculations, and construction
- 3.1.6.9 tailing decant/water recycle system,
- 3.1.6.10 special monitoring systems
 - 3.1.6.10.1 piezometers
 - 3.1.6.10.2 discussion of hydrologic balance under and within the impoundment - cross sections showing phreatic surfaces
- 3.1.6.11 disturbance acreage - delineate on a map
- 3.1.6.12 soil/alluvium salvage/vegetation disposal method or mulching method
 - 3.1.6.12.1 total volume of soil materials
 - 3.1.6.12.2 salvage depths and areas (in acres) by soil type
 - 3.1.6.12.3 volume calculations for salvageable soil by type
 - 3.1.6.12.4 soil stockpile location and configuration- include cross-section, areas (in acres) and locations
 - 3.1.6.12.5 life of soil stockpile
- 3.1.6.13 seasonal considerations (e.g. freezing, flooding, snow removal)
- 3.1.6.14 other
- 3.1.7 Surface support facilities** - conveyors, pipelines, powerlines, utilities, warehouses, water tanks, change houses, powder magazines, office buildings, parking areas, loadout facilities, bone yards, ventilation shafts, security fences, mine camps, potable water supply, etc.
 - 3.1.7.1 location and site selection criteria
 - 3.1.7.2 expected life and potential for expansion

3.1.7.3 design capacities

3.1.7.4 design specifications

3.1.7.5 seasonal considerations (e.g. freezing, flooding, snow removal)

3.1.8 Roads - Include typical cross section of each different road design, discuss any efforts taken during construction to identify areas which will be excavated which might produce acid and/or contaminated leachate

3.1.8.1 design, construction and methods - best management practices

3.1.8.2 cross section(s) of typical road(s)

3.1.8.3 typical grade (%)

3.1.8.4 drainage design (culverts, design capacity, and bridges)

3.1.8.5 road base and road surface materials

3.1.8.6 maintenance - best management practices

3.1.8.7 seasonal considerations (e.g. freezing, flooding, snow removal)

3.1.8.8 relocations of existing roads

3.1.8.9 life of road network

3.1.9 Air quality emissions control and dust abatement plan - for all facilities

3.1.10 Surface water and groundwater monitoring plan - one year of baseline is required prior to any construction

3.1.11 Surface water/stormwater management plan

3.1.11.1 temporary diversions

3.1.11.1.1 expected life of each diversion

3.1.11.1.2 design capacity

3.1.11.1.3 sizing calculations

3.1.11.1.4 cross section of typical diversion(s)

3.1.11.1.5 grade and profile

3.1.11.1.6 seasonal considerations (e.g. freezing, flooding, snow removal)

3.1.11.2 permanent diversions (as above)

3.1.11.3 settling ponds, percolation ponds - sizing calculations, permeability estimates

3.1.11.4 run-off and sediment erosion control structures

3.1.11.5 best management practices

3.1.11.6 provisions to avoid accumulation of stagnant water

3.1.12 Equipment requirements - for each facility; in table form

3.1.13 Power sources design and construction

3.1.14 Final design reports - Commit to annual reports, submission of as-builts for all heap leach pads and tailing impoundment facilities

3.1.15 Weed control - how will weeds be controlled during construction and at start up. Interim seeding of all disturbances should be done as soon as possible following the disturbance usually the same day.

3.1.16 Wildlife control

3.1.17 Public safety and mine security

3.1.18 Public nuisance - commitment and procedures to avoid foreseeable situation of public nuisance

3.1.19 Aesthetics - discussion of predicted light and noise levels by activity during construction phase

3.1.20 Sewage disposal

3.1.20.1 Type of system to be used

3.1.20.2 Capacity

3.1.20.3 Location(s)

3.1.21 Solid/hazardous waste disposal

3.1.21.1 Local ordinances

3.1.21.2 Toxic waste disposal

3.1.22 Fire protection

3.1.22.1 Local ordinances

3.1.22.2 U.S. Forest Service requirements

3.1.22.3 Other

3.2 Proposed Operations - How will these facilities operate and be maintained? Include discussion of changes which will occur after the construction phase is completed.

3.2.1 Underground mine or open pit and ancillary facilities

3.2.1.1 mining technique - pit stage progression through each mining phase - include a discussion of any possibility of pit backfilling

3.2.1.2 timing and scheduling (in table form and on maps show progression in phases)

3.2.1.3 maximum ore tonnage and production rates (tonnage/day)

3.2.1.4 production schedule (hrs/day, days/week)

3.2.1.5 blasting plan and schedule

3.2.1.5.1 best management practices which will limit nitrate release into the environment

3.2.1.5.2 type and solubility of explosive

3.2.1.6 hydrology - pit water inflows and quality, processing of objectionable effluent prior to discharge. Discuss at what elevation the pitwall would have to be maintained to prevent outflows to surface water or alluvial groundwater.

3.2.1.7 ancillary facilities - sumps, pumps, ore conveyors, crusher, agglomerator, dust suppression

3.2.1.8 public safety, fences, warning signs

3.2.2 Reactive materials identification, segregation and management

- 3.2.2.1 sampling method and parameters to be analyzed (total sulfur block segregation)
- 3.2.2.2 isolation technique
- 3.2.2.3 neutral waste stockpile areas - show locations, estimate tonnage, and indicate the area (in acres) on a map
- 3.2.2.4 verification of segregation method

3.2.3 Waste dumps and ancillary facilities

- 3.2.3.1 construction method - backsloped lifts or end dumping - show phases of progression
- 3.2.3.2 timing and scheduling - in table form and on maps show progression in phases
- 3.2.3.3 maximum waste tonnage and production rates (tonnage/day)
- 3.2.3.4 selective handling and stockpiling (see Reactive material identification, segregation and management)
- 3.2.3.5 grading and drainage plans to route clean water around the facility or to route contaminated water to collection and treatment facilities.

3.2.4 Heap leach pads and ancillary facilities

- 3.2.4.1 heap leach process and flow sheet
- 3.2.4.2 timing and scheduling (in table form and on map show progression in phases)
- 3.2.4.3 maximum process rates

3.2.5 Ore processing - summary of the process circuit, metal recovery system

3.2.6 Mine/process water management plan - mine/pit/process circuit water balance flow sheet per mining phase

- 3.2.6.1 sources and volumes reporting to each adit or pit- explain if or how these volumes/flows of water will change during major mining phases.
- 3.2.6.2 total storage capacity
- 3.2.6.3 total consumption uses - maximum volumes required for use
 - 3.2.6.3.1 adit water or pit water on mine site
 - 3.2.6.3.2 ore processing
 - 3.2.6.3.3 tailing disposal
 - 3.2.6.3.4 dust suppression
- 3.2.6.4 total predicted make-up water needs
- 3.2.6.5 collection, treatment
- 3.2.6.6 direct discharge or land application disposal (contact Water Quality Bureau for permit requirements)

3.2.7 Tailing impoundments

- 3.2.7.1 tailing disposition and flow sheet per mining phase
- 3.2.7.2 timing and scheduling (in table form and on map - show progression in phases)
- 3.2.7.3 maximum tonnage/volume per mining phase

- 3.2.8 Soils/alluvium** - propose a volume/quality verification program to demonstrate that the soil resource will meet the reclamation objectives. Results will be submitted annually in the annual report.
- 3.2.9 Surface support facilities** - will any power lines, utility lines, or buildings need to be moved due to your plan?
- 3.2.10 Roads** - describe changes or relocations during each mining phase, dust control, sediment erosion control, maintenance, and snow removal
- 3.2.11 Air quality emissions control and dust abatement** - specify for each facility any changes that will occur in the operational phase
- 3.2.12 Surface water/stormwater management plans** - sediment erosion control, best management practices, explain any changes which will occur during each mining phase
- 3.2.13 Equipment** - specify requirements for each facility
- 3.2.14 Power source and consumption** - specify for each facility
- 3.2.15 Wildlife control** - specify any changes for each facility
- 3.2.16 Public safety, employee safety, and mine security**
- 3.2.17 Public nuisance** - commitment and procedures to avoid foreseeable situation of public nuisance
- 3.2.18 Aesthetics** - discussion of predicted light and noise levels by activity during operational phase
- 3.2.19 Sewage disposal** - any changes
- 3.2.19.1 type of system to be used
- 3.2.19.2 capacity
- 3.2.19.3 location(s)
- 3.2.20 Solid/hazardous waste disposal** - any changes
- 3.2.20.1 local ordinances
- 3.2.20.2 toxic waste disposal
- 3.2.21 Fire protection** - any changes
- 3.2.21.1 local ordinances
- 3.2.21.2 U.S. Forest Service requirements
- 3.2.21.3 other

4 PROPOSED OPERATIONAL MONITORING

4.1 Surface Water and Groundwater Monitoring Plan during operations

- 4.1.1 underground mine or open pits
- 4.1.1.1 purpose or objectives of the plan
- 4.1.1.2 sampling locations - rationale for the location and interval sampled for each station or well

- 4.1.1.3 constituents to be monitored
 - 4.1.1.4 frequency and duration
 - 4.1.1.5 analytical methods
 - 4.1.1.6 QA/QC and data validation
 - 4.1.1.7 reporting procedures and dates
 - 4.1.2 waste dumps (as above)
 - 4.1.3 heap leach pads (as above)
 - 4.1.4 ore processing area
 - 4.1.5 tailing impoundment (as above)
 - 4.1.6 surface/stormwater diversions (as above)
 - 4.1.7 surface support facilities (as above)
 - 4.1.8 roads (as above)
 - 4.1.9 reference sites and other
 - 4.1.10 completion logs for all groundwater wells - intervals screened, pertinent drill logs.
 - 4.2 Aquatics Monitoring** if potential for contaminant migration is high
 - 4.3 Surface Water/Stormwater Management Structures Monitoring** - all diversions -
- RECORD STORM EVENTS AT CLIMATE STATIONS
- 4.4 Weed Control and Monitoring**
 - 4.5 Air Quality Emissions Control and Dust Abatement** (include QA/QC)
 - 4.6 Wildlife Control and Monitoring**
 - 4.7 Public Safety and Mine Security**

5 PROPOSED TESTING AND MODELING

5.1 Geochemical Characterization for Reactive Materials Identification and Segregation

- 5.1.1 Reconnaissance mapping - local geochemical comparisons with neighboring mines, map historical, existing, and natural acid rock drainage; and sulfide occurrences
- 5.1.2 Mineralogical analyses - multielement geochemistry
- 5.1.3 Static tests - type of test, test procedure, rock types to be tested, when tests will be initiated
 - 5.1.3.1 paste pH
 - 5.1.3.2 sulfur speciation, abundance, crystal form and size
- 5.1.4 Leachate extraction testing
 - 5.1.4.1 method 1312 short term extraction
 - 5.1.4.2 kinetic testing - humidity cells
 - 5.1.4.3 long term, field scale leachate extraction tests - type of test, protocol, rock types to be tested

5.1.5 Mathematical modeling

5.2 Test Plots - infiltration and vegetative success test plots

5.2.1 Infiltration test plots

5.2.1.1 purpose and objectives

5.2.1.2 design criteria

5.2.1.3 sampling and testing protocol

5.2.1.4 monitoring plan and reporting of results

5.2.1.5 success criteria

5.2.1.6 HELP modeling

5.2.2 Vegetative success test plots on portions of the tailing impoundment, heap and/or waste dump (as above)

5.2.2.1 reclamation success criteria for each facility

6 PROPOSED MITIGATION

6.1 Concurrent Reclamation and Sediment Erosion Control Plan - Include efforts taken which will reduce disturbances and control any impacts to air or water. The plan shall provide that reclamation activities shall be completed not more than two years after completion or abandonment of that portion of the complex.

6.2 Revegetation - Describe how reclamation success will be demonstrated. Describe concurrent reclamation or the use of mulched vegetation as a growing medium. Describe how failed attempts at vegetation will be mitigated.

6.3 Geochemical Characterization - Describe efforts which will be taken to identify and avoid or isolate reactive, acid producing materials or materials which might produce contaminated leachate in:

6.3.1 Underground mine or open pits - pit backfilling with waste or spent ore so pits drain externally

6.3.2 Waste dumps- is waste reactive? - waste dumps constructed in backsloped lifts so stormwater run-off is facilitated and concurrent reclamation is possible

6.3.3 Heap leach pads - are foundation and underdrain materials non-reactive?

6.3.4 Tailing impoundments - are tailing reactive? how will tailing be capped to isolate it from water and oxygen?

6.3.5 Surface support facilities - are foundation materials reactive

6.3.6 Roads - are fill and cut slopes reactive? - sediment erosion control structures

6.3.7 Surface water/stormwater management structures - describe efforts taken to divert all waters around affected areas

6.3.8 Other facilities

- 6.4 Engineering Considerations** - Describe how stability, subsidence, soil and sediment erosion, or natural hazards concerns be mitigated.
- 6.4.1 Surface water/stormwater diversions for run-on/run-off control
 - 6.4.2 Soil stockpile stabilization
 - 6.4.3 Best management practices for sediment erosion control
- 6.5 Hydrology Concerns** - Describe how mitigation would reduce or prevent adverse effects to the environment.
- 6.5.1 Underground mine or open pits - cut-off walls, grout barriers, guard walls, sumps, pumps, etc. to prevent excess water inflow - the use of concurrent reclamation of pit benches as mined to limit recharge to groundwater
 - 6.5.2 Waste dumps - how will reactive waste placed in valleys be prevented from affecting surface water or groundwater?
 - 6.5.3 Heap leach pads - concurrent reclamation of heap leach pad dikes - how can underdrain and liner systems be designed to prevent adverse effects downgradient?
 - 6.5.4 Ore processing - how could the mill be designed to mitigate a spill or a pipe rupture to prevent adverse effects to the environment with respect to chemicals and/or reagents?
 - 6.5.5 Tailing impoundments - concurrent reclamation of tailing embankment - how will the detection system alleviate effects on the groundwater system?
 - 6.5.6 Surface support facilities - concurrent reclamation of all surface support facilities - how will disturbances be kept to a minimum?
 - 6.5.7 Roads - concurrent reclamation of all roads onsite and offsite, isolation of reactive material, best management practices
 - 6.5.8 Surface water/stormwater management structures - sediment erosion control - best management practices
- 6.6 Air Quality** - describe how emissions or dust will be decreased or prevented.
- 6.7 Wildlife** - describe how effects to wildlife will be mitigated.
- 6.8 Fisheries and Aquatics** - describe how effects to fisheries and aquatics will be mitigated.
- 6.9 Cultural Resources** - describe how effects to cultural resources will be mitigated.
- 6.10 Natural Hazards** - describe how natural hazards, fire, earthquakes, will be mitigated.
- 6.11 Aesthetics** - describe how noise and lights will be controlled to decrease impacts.
- 6.12 Recreation** - describe how effects to recreation will be mitigated.
- 6.13 Socioeconomic and Human Environment** - describe mitigation.

7 PLAN FOR INTERIM SHUT DOWN DUE TO CESSATION OF MINING

7.1 Cessation of Mining - What would have to happen to cause cessation and what will the mine do with its facilities?

7.2 Interim Process/Mine Water Management Plan

7.2.1 Operational water balance - volumes and flow rates

7.2.2 Temporary storage

7.2.3 Treatment and land application disposal or direct discharge

7.3 Interim Surface Water and Groundwater Monitoring Plans

7.3.1 Surface water

7.3.2 Groundwater

7.4 Interim Surface Water/Stormwater Management Plan for All Facilities

7.4.1 Diversions - permanent and temporary

7.4.2 Sediment erosion control, best management practices

7.4.3 Water collection/treatment/discharge

7.5 Interim Surface Reclamation - Provide for structural, erosional and chemical stability for all facilities. Include weed control.

7.5.1 Surface water/stormwater management structures

7.5.2 Underground mine, adits, portals, pits

7.5.3 Waste dumps

7.5.4 Heap leach pads

7.5.5 Ore processing area

7.5.6 Tailing impoundments - dust control

7.5.7 Surface support facilities

7.5.8 Roads, diversions, and other areas

7.6 Interim Air Quality Control and Dust Abatement for all Facilities

7.7 Interim Maintenance Activities and Staffing Levels

8 PROPOSED FINAL RECLAMATION PLAN - The plan shall provide for the reclamation of disturbed land to comparable utility and stability as that of adjacent areas. Describe and map. How does the proposed reclamation plan meet the objective of limiting the volume of water to be treated in the future.

8.1 Closure of Underground Facilities - provide for measures to decrease subsidence and control adit water.

8.2 Pit Reclamation - describe and map include cross sections

8.2.1 Proposed reclamation success criteria

8.2.2 Timing and scheduling (in table form)

- 8.2.3 Resoiling/revegetation plans for backfilled or open pit
- 8.2.4 Permanent diversion structures and long term maintenance
- 8.3 Waste Dump Reclamation** - describe and map include cross sections
 - 8.3.1 Proposed reclamation success criteria
 - 8.3.2 Timing and scheduling (in table form)
 - 8.3.3 Final design including surface preparation to facilitate runoff and/or slope reduction, specify the reslope angle
 - 8.3.3.1 estimate the tonnage of rock needed to be moved to produce the proposed slope lengths, gradients, and surface drainage configurations
 - 8.3.3.2 geochemical characterization and liming of resloped material
 - 8.3.3.3 capping scenario and volume/tonnage of various capping materials needed - verify that there will be sufficient capping material and soil volumes available
 - 8.3.4 Soil/alluvium
 - 8.3.4.1 replacement volumes, cover thicknesses, sources, haul distances, haul routes
 - 8.3.4.2 scarification prior to
 - 8.3.4.3 placement - grading techniques and average replacement thicknesses
 - 8.3.4.4 soil amendments (e.g. fertilizer, lime, mulch, jute netting, etc.) - include sources, haul routes, haul distances; estimate volumes; and describe incorporation methods and depths.
 - 8.3.4.5 special handling techniques if any
 - 8.3.5 Permanent water diversion structures on the dumps; design criteria, sizing calculations, low permeability liners used for diversions which cross over reactive material, and long term maintenance
 - 8.3.6 Revegetation plans
 - 8.3.6.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity
 - 8.3.6.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)
 - 8.3.6.3 use of containerized shrubs
 - 8.3.6.4 fencing to ensure reclamation success
 - 8.3.7 Verification of cap and soil thicknesses
- 8.4 Land Application Disposal of Neutralized Process Solution/Mine Water**
- 8.5 Water Treatment** - sources, predicted water quality, flow rates
- 8.6 Heap Leach Pad Reclamation** - describe and map include cross sections
 - 8.6.1 Proposed reclamation success criteria
 - 8.6.2 Timing and scheduling (in table form)
 - 8.6.3 Rinsing (to what numeric standard?)
 - 8.6.4 Final design including surface preparation and resloping to facilitate runoff
 - 8.6.4.1 estimate the tonnage of rock needed to be moved to produce the proposed slope length, gradients and surface drainage configurations

- 8.6.4.2 geochemical characterization of resloped material
- 8.6.4.3 lime amendments
- 8.6.4.4 capping scenario - estimate the volume/tonnage of neutral material needed - verify that there will be sufficient capping material and soil available for reclamation
- 8.6.5 Soil/alluvium
 - 8.6.5.1 replacement volumes, cover thicknesses, sources, haul distances, haul routes
 - 8.6.5.2 scarification prior to
 - 8.6.5.3 placement - grading techniques and average replacement thicknesses
 - 8.6.5.4 soil amendments (e.g. fertilizer, lime, mulch, jute netting, etc.) - include sources, haul routes, haul distances; estimate volumes; and describe incorporation methods and depths.
 - 8.6.5.5 special handling techniques if any
- 8.6.6 Permanent diversion structures on the pads, design criteria, sizing calculations, use of low permeability liners for diversions which cross over reactive material, and long term maintenance
- 8.6.7 Revegetation plans
 - 8.6.7.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity
 - 8.6.7.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)
 - 8.6.7.3 use of containerized shrubs
 - 8.6.7.4 fencing to ensure reclamation success
- 8.6.8 How will the cap and soil thicknesses be verified (surveyed, estimated)
- 8.6.9 Liner perforation
- 8.7 Ore Processing Area Reclamation** - describe and map, include cross sections
 - 8.7.1 Recontouring and reclamation success criteria
 - 8.7.2 Timing and scheduling (in table form)
 - 8.7.3 Revegetation plans
 - 8.7.3.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity
 - 8.7.3.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)
 - 8.7.3.3 use of containerized shrubs
 - 8.7.3.4 fencing to ensure reclamation success
- 8.8 Tailing Impoundments Reclamation** - describe and map, include cross sections
 - 8.8.1 Settling and consolidation estimates; dewatering methods and estimated rates
 - 8.8.2 Reclamation success criteria
 - 8.8.3 Timing and scheduling (in table form)
 - 8.8.4 Final design including topography, reslope angles, slope lengths, permanent water diversion structures, design criteria, sizing calculations, long term maintenance; include grading to facilitate runoff
 - 8.8.4.1 estimate the tonnage of rock needed to be moved to produce the proposed slope gradients and surface drainage configurations

- 8.8.4.2 geochemical characterization of tailing and amendments for resloped materials
- 8.8.4.3 capping scenarios including volume/tonnage of neutral materials needed - verify there will be sufficient capping material available for reclamation
- 8.8.5 Soil/alluvium
 - 8.8.5.1 replacement volumes, cover thicknesses, sources, haul distances, haul routes
 - 8.8.5.2 scarification prior to
 - 8.8.5.3 placement - grading techniques and average replacement thicknesses
 - 8.8.5.4 soil/alluvium amendments (e.g. fertilizer, lime, mulch, jute netting, etc.) - include sources, haul routes, haul distances; estimate volumes; and describe incorporation methods and depths.
 - 8.8.5.5 special handling techniques if any
- 8.8.6 Revegetation plans
 - 8.8.6.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity
 - 8.8.6.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)
 - 8.8.6.3 use of containerized shrubs
 - 8.8.6.4 fencing to ensure reclamation success
- 8.8.7 How cap and soil thicknesses will be verified
- 8.9 Surface Support Facilities** - describe and map, include cross sections
 - 8.9.1 Reclamation success criteria
 - 8.9.2 Timing and scheduling (in table form)
 - 8.9.3 Demolition or removal of all buildings, temporary structures, conveyor systems, pipelines, power corridors, etc.
 - 8.9.4 Recontouring
 - 8.9.5 Revegetation plans
 - 8.9.5.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity
 - 8.9.5.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)
 - 8.9.5.3 use of containerized shrubs
 - 8.9.5.4 fencing to ensure reclamation success
- 8.10 Roads** - network removal and reclamation, describe and map, include cross sections
 - 8.10.1 Onsite
 - 8.10.1.1 reclamation success criteria
 - 8.10.1.2 timing and scheduling (in table form)
 - 8.10.1.3 recontouring
 - 8.10.1.4 revegetation plans
 - 8.10.1.4.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity
 - 8.10.1.4.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)
 - 8.10.1.4.3 use of containerized shrubs

8.10.1.4.4 fencing to ensure reclamation success

8.10.2 Offsite/Access (as above)

8.11 Power and Utility Line Corridors (as above)

8.12 Surface water/stormwater management plans following closure - Describe and map, include cross sections. Describe any changes that will occur after mine closure other than what is described for the construction and operational plans

8.12.1 Permanent diversions and impoundments

8.12.1.1 cross sections and longitudinal profile - total length

8.12.1.2 use of rip rap or sealants

8.12.1.3 revegetation plans

8.12.1.3.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity

8.12.1.3.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)

8.12.1.3.3 use of containerized shrubs

8.12.1.4 long term maintenance if any

8.12.2 Reconstructed stream channels

8.12.2.1 methods for reconstruction

8.12.2.2 engineering design

8.12.2.3 stability

8.12.2.4 length and sinuosity

8.12.2.5 revegetation plans

8.12.2.5.1 seed mix and rate (lbs. PLS/acre) to allow for biodiversity

8.12.2.5.2 method of seeding (e.g. drill, broadcast, hydroseeding, etc.)

8.12.2.5.3 use of containerized shrubs

8.12.2.6 long term maintenance

9 POST MINING MONITORING

9.1 Reclamation Success Monitoring Plan

9.1.1 Revegetation success

9.1.2 Wind erosion

9.1.3 Soil loss

9.1.4 Subsidence

9.2 Surface Water and Groundwater Monitoring Plan following closure - indicate compliance with water quality standards

9.2.1 Underground mine or open pits

9.2.1.1 objectives of the plan; criteria for cessation of monitoring

9.2.1.2 sampling locations - rationale for the location or each station or well

9.2.1.3 constituents to be monitored

- 9.2.1.4 frequency and duration
- 9.2.1.5 analytical methods
- 9.2.1.6 QA/QC and data validation
- 9.2.1.7 reporting procedures and dates
- 9.2.2 Waste dumps (as above)
- 9.2.3 Heap leach pads (as above)
- 9.2.4 Tailing impoundment (as above)
- 9.2.5 Surface support facilities
- 9.2.6 Other areas not covered above

9.3 Mitigation Plan for Post-Mining Surface Water or Groundwater Discharges

including underground workings, tailing impoundment seepage, heap leach pad seepage after liner perforation, waste dump seepage, etc.

9.4 Water Treatment Plan - maximum flow/treatment rates - life of treatment

9.5 Surface Water/Stormwater Management Structures - sediment erosion control - best management practices - when and how often will structures be inspected?

9.6 Weed Control and Monitoring

9.7 Air Quality Emissions Control and Dust Abatement Monitoring

9.8 Wildlife Control and Monitoring

9.9 Public safety

10 PROPOSED CONTINGENCY PLANS: Note: These are plans in case an unexpected event occurs. They benefit the mine, the public, and the agencies in that the approved plans are in place. Be sure to discuss the water treatment processes and/or land application that would occur. Note that these contingency plans will be bonded

10.1 Reclamation Plan - describe what would be done if vegetation fails - describe what would be done if soil acidifies.

10.2 Land Application Disposal of Excess Mine/Process Water due to storm events or interim cessation of mining.

10.3 Hazardous Materials Spills - en route and on site

10.4 Higher than Anticipated Seepage or Inflows - to any pits or adits

10.5 Structural Failure or Contaminant Release from Any Facility

- 10.5.1 Possible locations and control of releases
- 10.5.2 Contaminant clean up
- 10.5.3 Pumpback systems - sizing calculations
- 10.5.4 Contingency ponds - sizing calculations
- 10.5.5 Slurry cut-off walls
- 10.5.6 Grouting/sealing

10.6 Noxious Weeds - rampant spread of

10.7 Cultural Resources - what will the mine do should a previously unknown cultural resource site be identified

10.7.1 Avoidance

10.7.2 Salvage

10.8 Emergency Evacuation of Personnel

11 MAPS

11.1 Separate baseline maps for: (see the respective requirements in Baseline Environmental Information Section 2)

11.1.1 Geology - include lithology, structure, bedding planes, fault planes, slumps, mineralogy especially iron sulfides, etc.

11.1.1.1 surface water - show baseline sampling sites and perennial and intermittent stream flow drainages, include springs

11.1.1.2 groundwater - show the potentiometric surface, direction of flow, baseline groundwater well sites

11.1.1.3 operational water monitoring sites - surface sampling stations and groundwater wells on the same map - distinguish those which are permitted from those which are proposed, show the proposed facilities including stormwater management structures on the same map or provide a mylar overlay

11.1.2 Soils and alluvium - map types, depths, areas (in acres), quality

11.1.3 Vegetation - include riparian, officially designated wetlands and noxious weeds, threatened/endangered/rare species

11.1.4 Climate - show climate stations and any National Oceanic and Atmospheric Administration (NOAA) sites

11.1.5 Air quality - show air monitoring sites

11.1.6 Wildlife - species, habitat, critical habitat, seasonal ranges, protective cover

11.1.7 Cultural resources - the cultural resource map must show all cultural sites and all existing and proposed disturbances. If you will be covering or disturbing any of these sites, the text must have a table that lists the sites and when they will be mitigated prior to disturbance.

11.2 Land status - private vs. public lands

11.3 Current topography and existing disturbances - including historical mining, roads, utility lines, bridges, railroads, etc. - delineate on a map

11.4 Facilities - new disturbances expected throughout mine life - delineate on a map

11.4.1 Indicate all mine related disturbances in phases; include all facilities, stormwater management structures, soil and neutral waste stockpile areas, the permit boundary, and all other pertinent structures

11.4.2 Include cross sections of the underground workings, pit, waste dumps, heap leach pads, tailing impoundments which show the relationship between the facility and the surface water and/or groundwater hydrology

11.5 Stockpiles for nonreactive capping material and soil salvage - should indicate tonnage/volumes - these maps can be submitted annually to show the mine is stockpiling sufficient material to provide for successful reclamation

11.6 Roads and Traffic - include access and transportation routes for mining related traffic - differentiate existing from proposed roads

11.7 Power and Utilities - include power line routes as well as railroads, roads, utility lines, streams, etc. - differentiate existing from proposed

11.8 Post-mining topography for all disturbances associated with any facility showing resloped areas and permanent diversions or other permanent structures which will remain

12 BIBLIOGRAPHY OF SUPPORTING DOCUMENTS

NOTE: This outline suggests a format for a major amendment or a revision pursuant to 82-4-337 (MCA). Plans outlined below would only be described when amendments are submitted by an existing mine with a valid operating permit.

13 CURRENT PLANS

13.1 Currently Permitted Operational Mine Plan (if applicable)

13.1.1 Permitting history (summarize all existing permits)

13.1.2 Surface water/stormwater management plans - operational and following closure

13.1.2.1 permanent diversion structures and maintenance

13.1.2.2 temporary diversion structures and maintenance

13.1.2.3 sediment erosion control - best management practices

13.1.3 Underground mine or open pits

13.1.4 Mine waste segregation and management - Has enough nonreactive rock been stockpiled to date to reclaim existing disturbances according to the permitted mine plan?

13.1.5 Waste dumps

13.1.6 Heap leach pads

13.1.7 Crusher / agglomerator / dust suppression

13.1.8 Ore processing / Metal recovery system

13.1.9 Mine/process water management plans - process circuit water balance flow sheet

13.1.9.1 sources

13.1.9.2 maximum storage capacity

13.1.9.3 total consumption and requirements

- 13.1.9.3.1 adit water, pit water on mine site
- 13.1.9.3.2 ore processing
- 13.1.9.3.3 tailing disposal
- 13.1.9.3.4 dust suppression
- 13.1.9.4 total predicted make-up water requirement
- 13.1.9.5 collection, treatment and/or discharge or land application disposal
- 13.1.10 Tailing impoundments
- 13.1.11 Surface support facilities - Will any power lines, pipelines, utility lines, or buildings need to be moved due to change in your plan? (brief description)
- 13.1.12 Roads (as above)
- 13.1.13 Air quality emissions control and dust abatement
- 13.1.14 Equipment (brief description)
- 13.1.15 Energy source and consumption (brief description)
- 13.1.16 Wildlife control
- 13.1.17 Safety and security (brief description)
- 13.1.18 Sewage disposal (brief description)
- 13.1.19 Solid and hazardous waste disposal (briefly describe recycling, scrap hauled away by employees, landfill use, disposal of hazardous wastes)
- 13.1.20 Fire protection (brief description)

13.2 Currently Permitted Monitoring Plans

- 13.2.1 Mine waste segregation and monitoring
- 13.2.2 Surface water and groundwater monitoring during operations
 - 13.2.2.1 underground mine or open pits
 - 13.2.2.1.1 purpose or objectives of the plan
 - 13.2.2.1.2 sampling locations - rationale for the location or each station or well
 - 13.2.2.1.3 constituents to be monitored
 - 13.2.2.1.4 frequency and duration
 - 13.2.2.1.5 analytical methods
 - 13.2.2.1.6 QA/QC and data validation
 - 13.2.2.1.7 reporting procedures and dates)
 - 13.2.2.2 waste dumps (as above)
 - 13.2.2.3 heap leach pads (as above)
 - 13.2.2.4 tailing impoundment (as above)
 - 13.2.2.5 surface water/stormwater diversions (as above)
 - 13.2.2.6 surface support facilities (as above)
 - 13.2.2.7 roads (as above)
 - 13.2.2.8 reference sites and other

- 13.2.3 Aquatics monitoring if potential for contaminant migration is moderate to high
- 13.2.4 Surface water/stormwater monitoring - all diversions, sediment erosion control structures
- 13.2.5 Weed monitoring and control
- 13.2.6 Air quality and dust abatement monitoring include QA/QC
- 13.2.7 Wildlife monitoring and control
- 13.2.8 Public safety
- 13.3 Currently Permitted Reclamation Plans** - See format for proposed final reclamation plans, include concurrent reclamation during major mining phases.
 - 13.3.1 Reclamation success criteria for all facilities for bond release (if applicable)
 - 13.3.2 Underground mine or open pits
 - 13.3.3 Waste dumps
 - 13.3.4 Heap leach pads
 - 13.3.5 Tailing impoundments
 - 13.3.6 Facilities
 - 13.3.7 Roads
 - 13.3.8 Surface water/stormwater diversion structures
 - 13.3.9 Any areas not covered above
- 13.4 Weed Control and Monitoring**
- 13.5 Air Quality Control and Monitoring**
- 13.6 Wildlife Control and Monitoring**
- 13.7 Contingency Plans**
- 13.8 Test Plots and Mathematical Modeling** (if applicable)
 - 13.8.1 list of existing studies
 - 13.8.2 infiltration test plots
 - 13.8.3 vegetative success test plots
 - 13.8.4 field scale leachate extraction tests (if applicable)
 - 13.8.5 mathematical modeling

APPENDIX D – SELECTED REVEGETATION REFERENCES

With the emphasis on ecosystem management and restoration, reclamation and particularly revegetation has changed over the last 10 years. For that reason the following references include the more traditional texts, Internet websites (which are subject to change), state best management practice handbooks and annual reclamation/restoration conferences. In addition to those listed here, reclamation and revegetation planning should always include consultation with experts on the National Forest in question, State Agencies responsible for mined land reclamation (including BMP Manuals), County Extension Agents, and where they exist, federal agencies like the Office of Surface Mining and the National Resource Conservation Service.

Books

Law, D. L., 1984, *Mined-Land Rehabilitation*: Van Nostrand Reinhold, 184 p.

Munshower, F. F., 1994, *Practical Handbook Of Disturbed Land Revegetation*: Lewis Publishers, 265 p.

State BMP Manuals

Most states have best management practices manuals describing reclamation, erosion control and revegetation practices for their area. These local state manuals should be consulted in addition to the ones listed below. The publications listed below represent some of the best, and most recent of this type of publication.

Best management Practices for Reclaiming Surface Mines in Washington and Oregon. Washington Division of Geology and Earth Resources, Open File Report 96-2. This publication is available on the internet at this site: http://www.wa.gov/dnr/htdocs/ger/pubs_ol.htm. This publication has also been updated and is available for purchase for \$8.00. Purchasing information can be found at <http://sarvis.dogami.state.or.us/news&events/archives/9801-REL.htm>.

Practical Guide to Reclamation in Utah. Available on the internet at this site, <http://www.dogm.nr.state.ut.us/coal/>.

Agency Handbooks

U.S. Bureau of Land Management, 1992, *Solid Minerals Reclamation Handbook*—*Noncoal Leasable Minerals, Locatable Minerals, Salable Minerals*: U.S.

Bureau of Land Management BLM Manual Handbook H-3042-1, 1 v. For availability, contact your local BLM State Office.

1996, *Handbook of Western Reclamation Techniques*. Available from the Office of Surface Mining Reclamation and Enforcement, Western Regional Coordinating Center, The Office of Technology

Transfer, 1999 Broadway, Suite 3320, Denver, CO 80202-5733. Also available on the internet, <http://www.wrcc.osmre.gov/OTT/OTTHome.htm>

Internet Websites

The following websites contain information and links to other reclamation sites.

The **Ecosystem Restoration** website has been launched through a partnership formed between Montana State University and the U.S. Forest Service, Bureau of Land Management, Montana Department of Environmental Quality and U.S. Environmental Protection Agency. <http://ecore restoration.montana.edu/>

The **International Erosion Control Association** is a non-profit, member organization that provides education, resource information and business opportunities for professionals in the erosion and sediment control industry. They are a very good source of erosion control and revegetation training manuals, handbooks, conference proceedings and evaluations of products and practices. <http://www.ieca.org/>

At least two software programs (there are likely others), *Bio-draw* and *Erosion Draw* provide both written technical specifications and “typical” AutoCAD drawings for a range of erosion control and revegetation practices. These programs are developed and sold by Salix Applied Earthcare. Salix has a website at <http://www.salixaec.com/>.

Conferences

International Erosion Control Association (IECA) (see information above) holds annual conferences on erosion control, and revegetation. Past proceedings are available from their website <http://www.ieca.org/> as well as information on upcoming conferences.

American Society for Surface Mining and Reclamation (ASSMR) is a professional society that organizes workshops, prepares special sessions for the National meetings, and publishes handbooks and manuals relating to reclamation. A description of the papers presented annual workshops can be obtained from the following website, <http://ces.ca.uky.edu/ASMR/Index.htm>. Proceedings can be ordered from this website and also from the Office of Surface Mining Reclamation and Enforcement website described above.

For additional information, about ASSMR go to the website above or contact:

Richard Barnhisel, Executive Secretary
3134 Montavesta Rd
Lexington, KY 40502-3548
Voice or fax: (606) 335-6529
e-mail: rbarnhis@ca.uky.edu

APPENDIX E

GUIDANCE FOR EQUIPMENT SELECTION
From OSMRE 2000

<http://www.ott.wrcc.osmre.gov/library/hbmanual/bondcal.htm>

INTRODUCTION

The selection and matching of equipment for a surface mining operation is a complex task requiring a knowledge of equipment productivity for the reclamation tasks that are typically encountered. Proper selection of equipment allows completion of reclamation tasks in an efficient manner and results in the lowest possible performance bond.

Factors governing equipment productivity are capacity; cycle time (the time required to complete the operation); and site conditions such as space limitations, grades, and material characteristics that affect the performance of the machinery. Equipment selection involves evaluating the advantages and disadvantages in using different types of equipment to perform reclamation tasks. Familiarity with earthmoving equipment suitable for surface mining reclamation can be gained through review of equipment production and cost-estimating guides available from firms such as Terex, Caterpillar, Komatsu, and others. The estimator, once familiar with the uses and capabilities of various pieces of earthmoving equipment, will be faced with the task of comparing two or more combinations of equipment to determine which is the most efficient for the reclamation task at hand.

EARTHMOVING EQUIPMENT

I. Track-type Tractors

Bulldozers outfitted with either semi-universal or universal (reclamation) blades for backfilling and rough grading and straight blades for final or contour grading, are normally appropriate for reclamation activities requiring dozers. In choosing a particular dozer, the estimator must consider the volume of material to be handled, the space available to maneuver the machine and any size restrictions needed because of the quality of the access roads to the site.

Additionally, dozers can be equipped with a ripper for breakage of consolidated material prior to dozing. The seismic velocity of material may be used to determine whether the material can be ripped. However, because this information is rarely available in permit applications, stratigraphic information from borehole logs and cross sections must be used. Most shales, siltstones, interbedded shale and sandstone, and thin-bedded limestone can be ripped with the larger ripper-equipped dozers.

However, thick-bedded sandstone, limestone, or conglomerate formations would probably require blasting.

Other reclamation tasks in which rippers are often employed include ripping of the subbase of road and facility areas to eliminate vehicle compaction prior to topsoil replacement. Reclamation plans also require contour ripping of backfill areas prior to topsoil replacement to improve soil cohesion on slopes and/or reduce compaction. In order to achieve the necessary post-mine land use deep (3 to 4 feet) ripping may be required in areas where prime farmland soils are replaced. This compaction elimination allows the necessary root penetration for agricultural crops such as corn and is especially if scrapers are used in replacement of the rooting medium. This ripping activity is conducted with large bulldozers pulling specialty rippers and the reclamation is often estimated on a per-acre basis.

1.1. Trucks

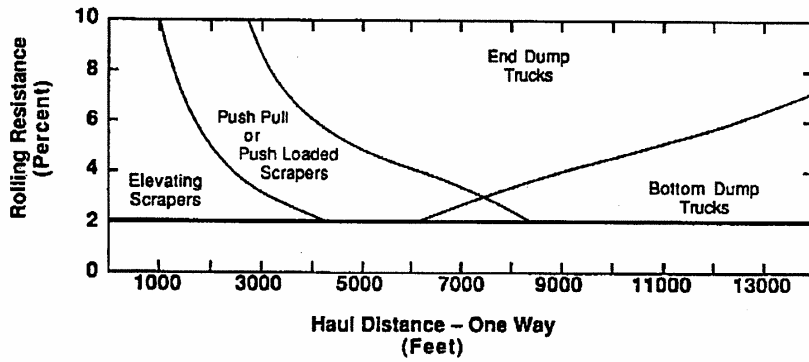
Most reclamation tasks requiring off-highway trucks can be accomplished with trucks having capacities of 35 tons (26 cubic yards) to 150 tons (100 cubic yards). Larger offroad trucks are available with greater capacities. However, these larger trucks are not commonly used in bond forfeiture site reclamation. As with dozers and loaders, selection of trucks is based on the amount of material to be handled and the space available to maneuver the truck. Generally, trucks similar to these used by the operator are the largest that can be selected because of limitations of haul road capabilities.

Bottom dump haul trucks should be considered for spreading large volumes of subsoil material needed to reclaim surface mines especially in prime farmland areas where the hauls are of 10,000 feet or more and prevention of soil compaction is critical (see Figure C-1).

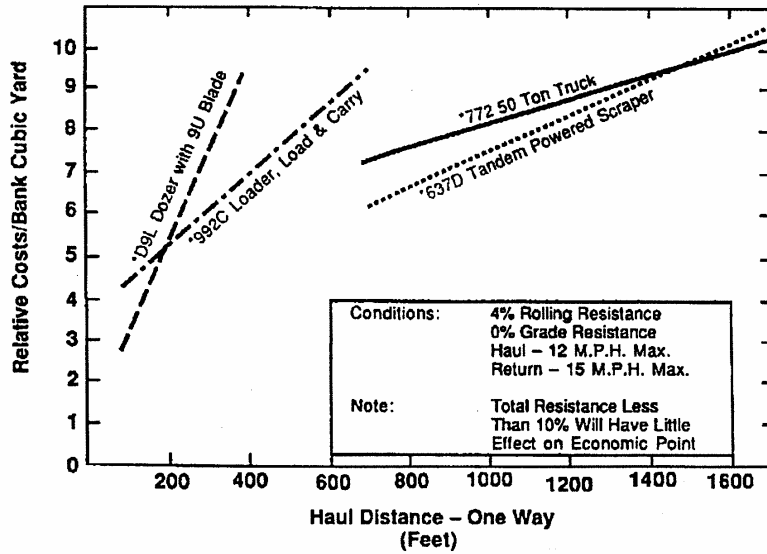
The graph shown in Figure C-2 can be used to estimate speed limits for off-highway trucks with favorable grades and good conditions (firm, smooth roadways with low rolling resistance). When the grade is not favorable (total resistance is a positive number) speed limits are not imposed. For example, for a loaded truck with a (-) 4% total resistance (grade plus rolling resistance), the maximum safe speed would be 35 mph. In comparison, for an empty vehicle with the same favorable grade, the maximum safe speed would be 40 mph.

Figure C-3 can be used to estimate speed limits for off-highway trucks required for safe operation on curves. Based on the road design and the curvature of the turn, the limiting speed can be applied to the curve segment of the haul. If the coefficient of friction and super-elevation are not known, the most conservative curve should be used (coefficient of friction = 0.1 and super-elevation = 0).

Figure C-1 - Application Zones for Representative Reclamation Equipment



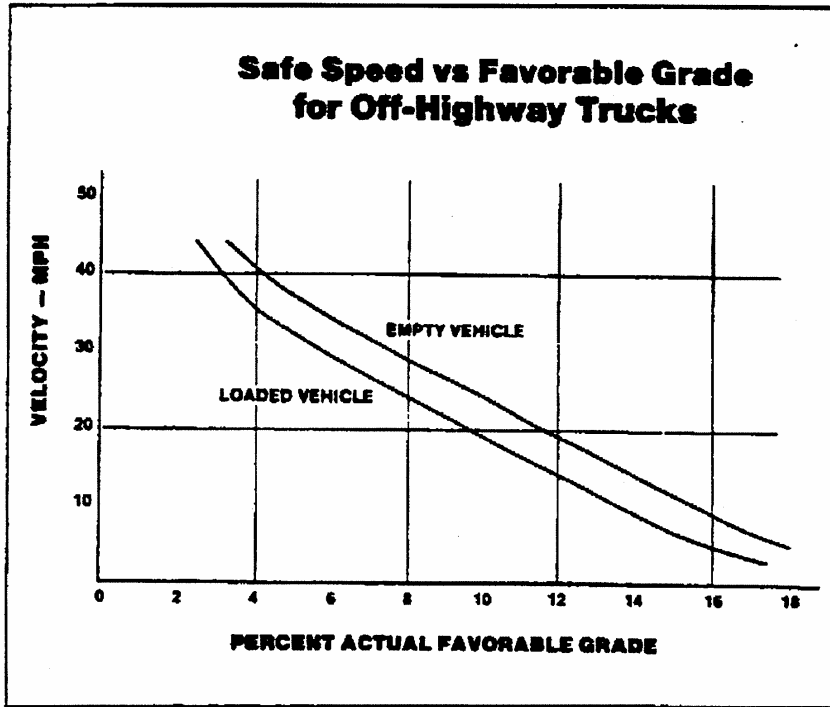
Adapted From International Harvester, 1975



Caterpillar Tractor Co., used to illustrate equipment class and does not imply endorsement by the Office of Surface Mining Reclamation and Enforcement

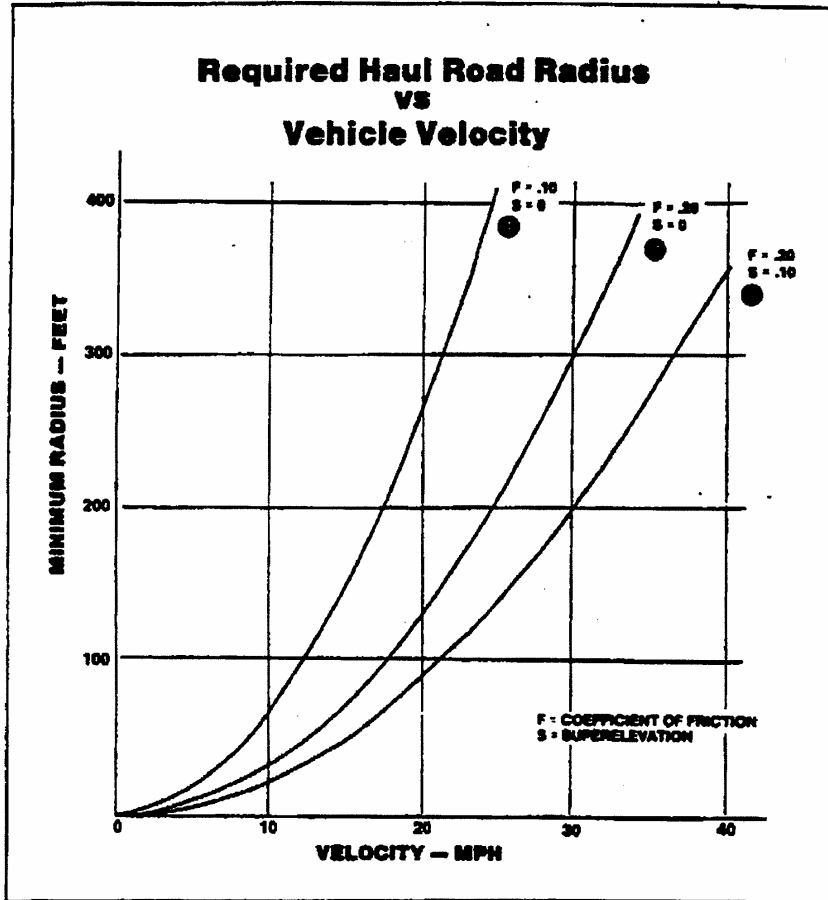
Adapted From Haley, 1974

Figure C-2 - Safe Downhill Speeds for Off-Highway Equipment.



Source: Vehicle Simulation (VEHSIM) Program User Manual, page E-1, Caterpillar, Inc., 1993.

Figure C-3 - Safe Speeds for Off-Highway Equipment on Curved Road Segments



Source: Vehicle Simulation (VEHSIM) User Program Manual, page F-2, Caterpillar, Inc., 1993 .

111. Excavators

Because of their ability to excavate solid bank material--such as shaley bedrock and compacted fill material--and to work in confined areas, there are certain applications where hydraulic excavators may substitute for wheel loaders. Two types of excavators are used, the front excavator shovel and the backhoe. The front shovel is used to excavate above-grade material while the hydraulic backhoe will excavate below grade. Both machines are useful in reclamation where backfill material must be obtained from the solid bank state or a compacted fill. Backhoes also are useful in cleaning sediment from diversion ditches and siltation structures. The estimator must be careful to ensure that the excavator matches the haul trucks to be used so that excavator loading cycles are minimized.

IV. Scrapers

Scrapers are used for some reclamation activities. Maneuvering space and the volume of material to be moved will dictate the size of the scraper to be selected. If push-pull scrapers are used in pairs, no pushers will be required. However, where large scraper fleets are employed or pusher dozer tasks, such as site cleanup, are available to fill wait times, the non-push-pull scrapers/pusher dozers combination may be more productive.

Conventional (single-engine) scrapers may be economically substituted for tandem powered units where grades and rolling resistance are low. Elevating or self-loading scrapers may be used where soft, fine-grained, or unconsolidated materials free of hard rock are encountered. Elevating scrapers have an advantage of working alone without support equipment (other than haul road maintenance) and are well suited for work requiring the flexibility to adjust to small variations in the cut and fill. They have traditionally been used for fine or finish grading. Tandem-powered scrapers can be operated independently if the materials loaded are soft and loading is downhill. However, due to the earthmover's inability to completely fill the bowl in this mode of operation, capacity should be reduced by one-third. When selecting auxiliary equipment, the estimator must determine the requirements for dozer pushers. There must be a match between the scraper selected, the dozer used, and the style of push loading. Generally, track dozers are used as pushers.

Safety speed limitations presented in Figures C-2 and C-3 should also be applied to the downhill and road curve haulage segments.

V. Motor Graders

Motor graders (motor patrols) can be used in a wide variety of reclamation tasks, but they are used primarily for haul road maintenance. In some instances, it may be cost effective to use a grader as a substitute for a track dozer for final grading, light leveling work, and diversion ditch construction. Graders used for surface mining can be equipped with a rear-mounted ripper or scarifier.

EQUIPMENT SELECTION OVERVIEW

When making the initial decision about what types of equipment -- for example, dozers versus scrapers--are needed for each earthmoving activity, the estimator should refer to *Worksheet 3*, the Material Handling Plan Summary Sheet. If the one-way haul distance is less than 500 feet, bulldozers of appropriate size will be the optimum equipment for the job in most cases. If the distance is between 500 and 1,000 feet, then scrapers will probably be optimal, assuming underfoot conditions and operating room allow their use and the material does not contain large boulder-size rocks. For distances over 1,000 feet, off-road trucks with compatible wheel loaders or hydraulic shovels become more efficient. Generally, as rolling resistance increases scrapers tend to be less efficient and trucks should be used. As the distance increases to a mile, truck-loader combinations are usually optimal.

After the type of equipment is initially selected, the equipment size must be determined. To do this, the estimator should note the volume and characteristics of material to be moved and the underfoot conditions. The larger pieces of equipment are more appropriate for moving large amounts of materials. Most equipment manufacturers can provide performance books that contain information to guide model selection. When in doubt, select a model and calculate the cost of the job. Next, make the same calculation using a smaller model and again using a larger model. With a little experience, the proper type and size of equipment can usually be determined in the first iteration. However, it is generally good practice to try another iteration with different-sized equipment to make certain that optimal equipment has been selected.

Table C-1 lists advantages and disadvantages of earthmoving equipment typically employed in reclamation of mine sites. Reclamation equipment can also be rated by the suitability to perform backfilling and grading tasks and topsoil removal and replacement (see Tables C-2 and C-3). The influence of haul distance and rolling resistance on the proper selection of reclamation equipment is illustrated in-Figure C-1.

Table C-1.--Advantages and Disadvantages of Reclamation Equipment

Excavators

Wheel Loaders:

1. Can give high production.
2. Larger sizes can handle all types of material, including large blocky material.
3. When haul distance is less than 800 feet, can operate independently.
4. Have high mobility.
5. Production decreases in poor conditions.

Hydraulic Front Shovels:

1. Can give high production.
2. Can handle all types of material, including large blocky material.
3. Usually require supporting equipment.
4. Have a limited mobility.

Hydraulic Backhoes:

1. Have the ability to dig well below and above grade (i.e., to trim an unstable highwall).
2. Can function in less rigid operating conditions than shovels.
3. May or may not require supporting equipment.
4. Are normally used for handling softer material, but larger units can perform mass excavation of rock.
5. Have a limited mobility.

Scrapers:

1. Have excellent mobility.
2. Are limited to fairly soft and easily broken material for good production, although material up to a 2-foot diameter can be handled.
3. Usually require either pusher tractors or a push-pull team mate for loading assistance.

4. Usually operated without supporting disposal equipment when the distance to the dump area is less than one mile.

Bulldozers:

1. Are economically limited to a push distance of 500 feet.
2. Do not require roads.
3. Production decreases rapidly as grade increases.
3. Can operate in poor underfoot conditions.

Haulers

Rear Dump Trucks:

1. Require good roads to minimize do costs.
2. Can negotiate steep ramps.
3. Usually economically limited to a haul distance of 3 miles.
4. Can handle coarse, blocky material.

Bottom Dump Trucks:

1. Require good roads to minimize tire costs.
2. Are fast and have a greater economic haul distance than rear dump trucks.
3. Are better suited for long, level hauls.
4. Requires free-flowing materials.
5. Can spread dumped material into furrows, reducing disposal-grading requirements.

Table C-2.-Reclamation Equipment Rating-Regrading and Backfilling

<u>LEGEND</u>		<u>EQUIPMENT</u>				
1	Should be considered					
2	May be considered					
3	May be considered under certain conditions					
4	May be considered--special situations					
-	Should not be considered					
		Dozers	Graders	Scrapers	Front-End Loader	Front-End Loader & Trucks
Spoil Configuration	High Peaks	1	-	2	3	3
	Moderate Peaks	1	3	1	1	2
	Low Peaks	1	1	1	1	1
Transport Distance	50'-150'	1	2	1	1	-
	150'-300'	1	-	1	1	-
	300'-500'	2	-	1	2	4
	500'-1000'	-	-	1	3	1
	1000'	-	-	1	-	1
Final Surface Contour	Flat & Smooth	1	1	1	3	-
	Flat & Rough	1	2	1	2	-
	Steep & Smooth	1	-	-	3	-
	Steep & Rough	1	-	-	2	-

Source: Modified from Skelly and Loy, 1975.

Table C-3.--Reclamation Equipment Rating--Topsoil Removal and Replacement

		LEGEND							
		1	2	3	4	-			
		Should be considered		May be considered		May be considered under certain conditions		May be considered--special situations	
		Should not be considered							
		Dozers	Front-End Loaders	Scrapers		Shovel & Truck	Front-End Loader & Truck		
			Elevating	Full-Power	With Push Tractor				
Topsoil Thickness (Removal)	0'-2'	1	1	1	1	1	-	1	
	2'-5'	1	1	1	1	1	4	1	
Haul Distance	0-300'	1	1	2	2	1	-	-	
	300'-500'	2	2	1	1	1	-	-	
	500'-1000'	-	-	1	1	1	4	3	
	1000'-1500'	-	-	1	1	1	4	2	
	1500'-5000'	-	-	2	2	2	4	1	

Source: Modified from Skelly and Loy, 1975.

Skelly and Loy, "Economic Engineering Analysis of U.S. Surface Coal Mines and Effective Land Reclamation," U.S. Bureau of Mines Contract Report No. S0241049, 1975.

APPENDIX F

RECLAMATION BOND SUMMARY SHEET

**(TO DEMONSTRATE APPLICATION OF INDIRECT COST
PERCENTAGES TO OVERALL RECLAMATION COST)**

EXAMPLE RECLAMATION BOND SUMMARY SHEET

MIDAS TOUCH MINING CORPORATION
GILDED LILY MINE RECLAMATION COST ESTIMATE

Date:

Draft:

DIRECT COSTS

TASK 1: Interim Operation and Maintenance =	\$800,000	
TASK 2: Hazardous Materials Removal and Disposal =	\$350,000	
TASK 3: Water Treatment =	\$1,200,000	
TASK 4: Demolition and Disposal of Structures and Equipment =	\$500,000	
TASK 5: Earthwork =	\$2,225,000	
TASK 6: Revegetation =	\$185,000	
TASK 7: Mitigations =	\$80,000	
TASK 8: Long-Term O & M =	<u>\$850,000</u>	
Total Direct Costs Tasks 1 thru 8 (\$) =		\$6,190,000

INDIRECT COSTS *

Engineering Redesign (@ 5%) =	\$309,500	
Mob/Demob (@ 10%) =	\$619,000	
Contractor's Costs (@ 30%) =	\$1,857,000	
Agency Project Mgmt. (@ 6%) =	\$371,400	
Contingencies (@ 30%) =	<u>\$1,857,000</u>	
Total Indirect Costs (\$) =		<u>\$5,013,900</u>
TOTAL DIRECT AND INDIRECT COSTS (excluding inflation) =		\$11,203,900
<u>Inflation:</u> Cost Escalation @ 3% per year over 5 Years =		<u>\$1,784,781</u>
TOTAL GILDED LILY MINE RECLAMATION BOND (\$) =		\$12,988,681

* Note: Indirect cost percentages are specific to this example problem.