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FIGURES

TABLES

6.0 EXPANDED ENGINEERING EVALUATION AND COST ANALYSIS

As requested by the Montana Department of Environmental Quality (DEQ) and the Mine Waste Cleanup Bureau (MWCB), Tetra Tech EM Inc. prepared an expanded engineering evaluation/cost analysis (EEE/CA) for the Spring Meadow Lake Site. The EEE/CA presents a detailed analysis of reclamation alternatives regulatory agencies can use for reclamation decision-making.

The reclamation process has been designed to be consistent with the requirements of the National Oil and Hazardous Substances Contingency Plan (NCP) as required by Montana's Abandoned Mined Land State Reclamation Plan (30 Code of Federal Regulations part 926) for sites where hazardous substances are, or may be, present. By following the NCP this reclamation process will also not be inconsistent with regulations for removal actions under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and may comply with the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Certain aspects of the process have been streamlined to meet the regulatory and functional needs of cleaning up relatively small abandoned mine sites. The reclamation alternatives considered for implementation at the Spring Meadow Lake Site include no action through complete reclamation activities. Reclamation alternatives presented in this EEE/CA are applicable to the contaminated solid media only; no reclamation alternatives were developed for treatment of groundwater or surface water.

6.1 INTRODUCTION

The Spring Meadow Lake Site consists of portions of Spring Meadow Lake State Park and the Montana Department of Fish, Wildlife and Parks' (FWP) Montana Wildlife Center (see Figure 6-1). Spring Meadow Lake was formed by the excavation of sand and gravel by the former Helena Sand & Gravel Company. The lake consists of an oval-shaped main lake connected to a circular-shaped north arm and an irregularly shaped east arm.

The Montana Wildlife Center (2650 Euclid Avenue) is located on a flat lying lot overlooking the lake area. Buildings on the site were constructed in 1892 by the John Stedman Foundry and Machine Company, and housed those operations through 1901. The Western Improved Wire Fence Company of the United States of America next occupied the complex, but its tenure was short-lived and the site was abandoned in 1910. The Northwestern Metals Company acquired the site that year and installed a mill to process polymetallic ores using the Baker-Burwell chlorine leaching process.

FIG6-1_SOIL CONT AREAS.dwg - DWH - 01/30/2006 - S1129.30.SMLSRI

This operation went into bankruptcy in 1915 and the property was taken over by the New York – Montana Testing and Engineering Company in 1916. This company handled testing and custom milling of gold-silver and manganese ores using various processes. It was also unsuccessful and closed in 1920. In the late 1920s, George F. Jacoby and his partner Thomas Brownlow acquired the site and the adjacent land and opened a gravel pit north of the old foundry/mill complex under the name Helena Sand and Gravel. This operation lasted until the late 1950s.

Subsequent use of the land has involved additional gravel pit operation, a construction business headquarters, and land speculation.

6.2 RECLAMATION OBJECTIVES AND GOALS

The overall objective of the Spring Meadow Lake Site reclamation project is to protect human health and the environment in accordance with the guidelines set forth by the NCP. Specifically, site reclamation must limit human and ecological exposure to mine-related contaminants and reduce the mobility of those contaminants through associated solid media and surface water exposure pathways.

A risk analysis was completed as part of the reclamation investigation (RI) discussed in Section 5. Arsenic and lead were present in elevated concentrations in some of the solid matrix samples and pose an unacceptable risk to human health and the environment. In addition, several surface water and groundwater samples also indicated elevated levels of arsenic above the human health standards.

There are currently no promulgated standards for metal concentrations in soil. The Montana DEQ has developed a conservative set of risk-based guidelines that are calculated for different contaminants using a recreational visitor exposure pathway scenario. The guidelines take into account the possibility of exposure through multiple exposure routes. Action levels for soils at Spring Meadow Lake Site have been determined based on risk assessment results generated during the RI. The soil recreational action levels for the metals of concern are listed in Table 5-16. The Montana DEQ also has surface water quality standards for aquatic life listed in Table 5-19.

6.3 SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Reclamation activities at the Spring Meadow Lake Site will incorporate federal and state cleanup requirements. The standards, requirements, criteria, or limitations that will be used to conduct reclamation activities for this site are commonly referred to as applicable or relevant and appropriate requirements (ARAR).

Two basic types of reclamation for abandoned mine sites are (1) on-site or off-site disposal (removal) with subsequent revegetation, and (2) in-place amelioration (reclamation) with subsequent revegetation. Removal is designed to eliminate a source of waste from a site and is often conducted to alleviate the most acute or toxic contaminated materials. Amelioration is designed to minimize, stabilize, or mitigate the contaminated materials to ensure a high level of contaminant reduction and to achieve successful reclamation at a site.

ARARs may be either “applicable” or “relevant and appropriate” to reclamation at a site, but not both. Applicable requirements are the standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address hazardous substances, pollutants, contaminants, activities, locations, or other circumstances found at the site. The reclamation actions envisioned should satisfy all the jurisdictional prerequisites of a requirement to be applicable to the specific activity at a site.

Relevant and appropriate requirements are the standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to hazardous substances, pollutants, contaminants, activities, locations, or other circumstances at a site, address problems or situations sufficiently similar to those encountered at a site that their use is well suited to a particular site. Factors that may be considered in making this determination, when the factors are pertinent, are presented in 40 Code of Federal Regulations (CFR) 300.400(g)(2). They include, among other considerations, examination of the purpose of the requirement and of the proposed activity, the medium and substances regulated by the requirement, the regulated actions or activities, and the potential use of resources affected by the requirement.

ARARs are divided into contaminant-specific, location-specific, and action-specific requirements. Contaminant-specific requirements govern the release of materials that possess certain chemical or physical characteristics or that contain specific chemical compounds to the environment. Contaminant-specific ARARs generally set human or environmental risk-based criteria and protocol that, when applied to site-specific conditions, result in the establishment of numerical action values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

Location-specific ARARs relate to the geographic or physical position of the site, rather than to the nature of the contaminants. These ARARs restrict the concentration of hazardous substances or the conduct of cleanup because of their location in the environment.

Action-specific ARARs are usually technology- or activity-based requirements or are limitations on actions taken with respect to hazardous substances. A specific activity will trigger an action-specific ARAR. Unlike chemical-specific and location-specific ARARs, action-specific ARARs do not, in themselves, determine the reclamation alternative. Rather, action-specific ARARs indicate how the selected reclamation activity should be completed.

Nonpromulgated advisories or guidance documents issued by federal or state governments do not have the status of potential ARARs. However, these advisories and guidance are “to be considered” (TBC) when determining protective cleanup levels, as defined in 40 CFR 300.400 (g)(3). The TBC category consists of advisories, criteria, or guidance that were developed by the United States Environmental Protection Agency (EPA), other federal agencies, or states that may be useful in developing reclamation alternatives.

Only those state standards that are more stringent than any federal standard and that have been identified by the state are appropriately included as ARARs. Duplicative or less stringent standards will be deleted as appropriate when the final determination of ARARs is presented.

ARARs are defined as only federal environmental laws and state environmental or facility siting laws. The reclamation methods and operation and maintenance must, nevertheless, comply with all other applicable laws, both state and federal. Many such laws, while not strictly environmental or facility siting laws, have environmental impacts. Moreover, applicable laws that are not ARARs because they are not environmental or facility siting laws are not subject to the ARAR waiver provisions; instead, the applicable provisions of such laws must be observed. A separate list attached to the state ARARs is a noncomprehensive identification of other state law requirements that must be observed during reclamation, operation, and maintenance.

Appendices 6-A and 6-B provide descriptions of potential federal and state ARARs, respectively, and their applicability to the Spring Meadow Lake Site. In the event of any inconsistency between the law itself and the summaries in the appendixes, the ARAR is ultimately the requirement as set out in the law, rather than the paraphrased requirement provided in this document.

6.4 IDENTIFICATION AND SCREENING OF RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS

The waste materials, or potential source materials, at the Spring Meadow Lake Site are located at areas within the approximately 20 acres of disturbed land. The four distinct waste types include subsurface soil contamination, surface soil contamination, submerged surface soil, and surface water contamination. The Spring Meadow Lake site is administratively divided into two distinct areas: (1) the Spring Meadow State Park; and (2) the Montana Wildlife Center. The developed Spring Meadow Lake State Park, including the east arm, is built around the former excavated sand and gravel pits. The Wildlife Center is developed on the original Stedman Foundry property that was used as a leaching mill, floatation mill for gold-silver and manganese ores, and for gravel mining operations. On this site, chain-link fenced pens and shelters for wildlife have been constructed. The buildings on site, the Stedman Foundry and the Machine Shop, have been placed on the National Register of Historic Places and are used by the Montana Wildlife Center as office and storage facilities. Future development of the area includes expansion of these divisions into other areas of the property. Therefore, any future development plans for both the State Park and Wildlife Center will also be addressed as the reclamation alternatives are developed. Any modifications or restrictions to future development in order to accommodate site reclamation will be noted for each alternative that is explored in more detail.

The selection of the appropriate reclamation alternative(s) for the Spring Meadow Lake Site will depend on the following: (1) the nature and types of waste materials; (2) the waste location; (3) the concentration of metals and other contaminants in the waste materials, (4) the volume of waste materials, and (5) the applicability of the reclamation alternatives. During the reclamation selection process, alternatives are developed and subjected to three phases of screening or evaluation. These phases included initial screening, alternative screening, and detailed analysis (EPA 1988). The results of the initial screening and alternative screening selection process for the Spring Meadow Lake Site are described in Sections 6.4 and 6.5. The detailed and comparative analysis of the reclamation alternatives is presented in Section 6.6, and Section 6.7 lists references.

6.4.1 Identification and Initial Screening of Reclamation Alternatives

The first step in the process for developing and analyzing reclamation alternatives for the Spring Meadow Lake Site is identifying and describing general response actions that may satisfy the reclamation objectives. General response actions are then progressively refined into technology types and process options. The process options are then screened and the retained technologies and process options are combined into potential media-specific reclamation alternatives.

After identifying the potential reclamation alternatives, the alternatives are subjected to initial screening, which is the first step in the alternative selection process. The purpose of the initial screening is to eliminate options that are not feasible from further consideration and retain those options that are potentially feasible. In addition, general response actions, technologies, and process options are evaluated for contaminated solid media only. For the Spring Meadow Lake Site, no technology evaluation has been conducted for surface water or groundwater. This decision was based primarily on the presumption that reclaiming the contaminated source materials will subsequently reduce any impacts to surface water and groundwater at the site. Separate, feasible reclamation alternatives may exist for each waste type and waste area found at the site.

General response actions, technologies, and process options potentially capable of meeting the reclamation objectives for the solid media at the Spring Meadow Lake Site are identified in Table 6-1. Response actions include no action, institutional controls, in place treatment, engineering controls, and excavation and treatment. The following paragraphs describe the results of the initial screening of the general response actions, technologies and process options for the Spring Meadow Lake Site.

6.4.1.1 No Action

Under the no action option, no reclamation actions would occur at the site. The no action response is a stand-alone response that is used as a baseline against which other reclamation alternatives are compared. The no action alternative will be retained through the detailed analysis of alternatives.

TABLE 6-1

GENERAL RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS
SOLID MEDIA
SPRING MEADOW LAKE SITE

General Response Action	Technology Type	Process Options
No Action	None	None
Institutional Controls	Access Restrictions	Fencing/Barrier
Engineering Controls	Surface Controls	Consolidation
		Grading
		Revegetation/Erosion Protection
	Containment	Earthen Cover
		Earthen and Geomembrane Cap
	On-Site Disposal	Earthen Cover
		Earthen and Geomembrane Cap
		Modified RCRA Subtitle C Repository
		RCRA Subtitle C Repository
	Off-Site Disposal	Solid Waste Landfill
		Mine Waste Repository
		Consolidated with other Mine Wastes
		RCRA Subtitle C Landfill
Excavation and Treatment	Fixation/Stabilization	Cement/Silicates
	Reprocessing	Milling/Smelting
	Physical/Chemical Treatment	Soil Washing
		Acid Extraction
		Alkaline Leaching
	Thermal Treatment	Rotary Kiln
		Vitrification
In-Place Treatment	Physical/Chemical Treatment	Soil Flushing
		Stabilization
		Dewatering
	Thermal Treatment	Vitrification

6.4.1.2 Institutional Controls

Institutional controls can be used to protect human health and the environment by precluding future access to, or development of, affected areas. In addition, these restrictions may be used to protect an implemented remedy. Potentially applicable institutional controls consist of access restrictions or land use controls. Access restrictions typically include physical barriers, such as fencing, that could prevent both human and wildlife access to the site to preclude exposure to site contamination and to protect the integrity of the remedy. Land use controls would restrict the use of the land, or specific areas, to prevent unacceptable risks to human or wildlife exposure. This may influence the future site development goals or objectives depending upon the alternatives employed.

Institutional controls are not considered feasible as a stand-alone remedy; however they could be implemented in combination with other alternatives. The site owner and managing agency, Montana Department of Fish Wildlife and Parks, with possible input from local government, would likely be responsible for enforcing any institutional controls developed as part of an alternative for the Spring Meadow Lake Site. Therefore, these entities must be involved in developing and eventually implementing any institutional controls.

These types of institutional controls do not, by themselves, achieve a specific cleanup goal. Considering the baseline risks posed by contaminants at the site, institutional controls alone are not considered adequate to mitigate these potential human health and ecological risks. However, institutional controls will be considered in conjunction with other reclamation alternatives in this evaluation.

6.4.1.3 Engineering Controls

Engineering controls are used primarily to reduce the mobility of, and exposure to, contaminants. These goals are accomplished by creating a barrier that prevents direct exposure and transport of waste from the contaminated source to the surrounding media. Engineering controls do not reduce the volume or toxicity of the hazardous material. Engineering controls typically applied include containment/capping, revegetation, runon/runoff control, and disposal in a repository. These engineering controls are discussed in the following subsections.

Surface Controls

Surface control measures are used primarily to reduce contaminant mobility and limit direct exposure. Surface controls may be appropriate in more remote areas where direct human contact is not a primary concern (in other words, where human receptors are not living or working directly on or near the site). Surface control process options include consolidation, grading, revegetating, and erosion protection. These process options are usually integrated as a single reclamation alternative.

Consolidation involves grouping similar waste types in a common area for subsequent management or treatment. Excavation during consolidation is accomplished with standard earthmoving equipment, including scrapers, bulldozers, excavators, loaders, and trucks. Consolidation is especially applicable when multiple waste sources are present at a site and one or more of the sources requires removal from particularly sensitive areas (that is, floodplain or heavy traffic). It also may be especially applicable when one large combined waste source is treated in a particular location, rather than several smaller waste sources dispersed throughout an area. Precautionary measures, such as temporary stream diversion or isolation, would be necessary for excavating materials contained in the small drainages at the site. Containment and treatment of water encountered during excavation may also be necessary.

Grading is the general term for techniques used to reshape the ground surface to reduce slopes, manage surface water infiltration and runoff, and aid in erosion control. The spreading and compaction steps used in grading are routine construction practices. The equipment and methods used in grading are similar for all surfaces, but will vary slightly depending on the waste location and the surrounding terrain. Equipment may include bulldozers, scrapers, graders, and compactors. Periodic maintenance and regrading may be necessary to eliminate depressions formed as a result of settlement, subsidence, or erosion.

Revegetation involves adding soil amendments to the waste surface to provide nutrients, organic material, and neutralizing agents and improve the water storage capacity of the contaminated media, as necessary. Revegetation will provide an erosion-resistant cover that protects the ground surface from surface water and wind erosion and reduces net infiltration through the contaminated medium by increasing evapotranspiration processes. Revegetation can also reduce the potential for direct contact. In general, revegetation includes the following steps: (1) selecting appropriate plant species, (2) preparing the seed bed, which may include deep application of soil amendments to provide acid buffering and enhance vegetation, as necessary, (3) seeding and planting, and (4) mulching and chemical fertilizing.

Erosion protection includes using erosion-resistant materials, such as mulch, natural or synthetic fabric mats, riprap, and surface water diversion ditches to reduce the erosion potential at the surface of the contaminated medium. The erosion-resistant materials are placed in areas susceptible to surface water erosion (concentrated flow or overland flow) or wind erosion. Proper erosion protection design requires knowledge of the characteristics of the drainage area, average slopes, soil texture, vegetation types and abundance, and precipitation data.

Surface controls are considered a feasible option for solid media at the Spring Meadow Lake Site and will be retained for further consideration as a reclamation alternative, or in conjunction with other alternatives.

Containment

A containment approach leaves waste materials in place and uses capping to reduce or eliminate exposure to, and mobility of, contaminated medium. Containment source control measures can be used to divert surface water from the contaminated medium and to minimize infiltration (and subsequent formation of leachate) of surface water and precipitation into the underlying contaminated medium. Infiltration can be reduced or prevented by physical barriers or by increasing evapotranspiration processes. The physical capping or covering of wastes during containment reduces or eliminates the potential health risk that may be associated with exposure (direct contact or airborne releases of particulates) to the contaminated media.

The design of the cap or cover may vary in complexity from a simple earthen cover to a multilayered cap designed to meet Resource Conservation and Recovery Act (RCRA) requirements. Factors to consider in design of the cap or cover include physical conditions of the contaminated media, leachability, site hydrogeology, precipitation, depth to groundwater, current groundwater quality, area groundwater use, and applicable groundwater standards. Stringent performance standards may not always be appropriate for the cap, particularly where the toxicity of the contaminated medium is relatively low, where the cap is intended to be temporary, where there is low precipitation, or where the waste is not leached by infiltrating rain water. Specific cap design should also consider the desired land use after construction.

Containment is considered a standard construction practice. Equipment and construction methods associated with containment are readily available, and design methods and requirements are well understood.

Containment is considered a feasible option for solid media at the Spring Meadow Lake Site and will be retained for further consideration as a reclamation alternative or in combination with other alternatives.

On-Site Disposal

Permanent, on-site disposal is used as a source control measure and is similar to containment. The objectives of on-site disposal are the same as for containment, except that disposal includes excavation and consolidation of waste into a single, usually smaller area, and may involve installing physical barriers beneath as well as above the waste. This added barrier may be needed to provide additional protection of groundwater from potential leachate contamination.

On-site disposal options may be applied to treated or untreated contaminated materials. Treatment may become a cost-effective option as materials are excavated and moved during this process. The design configuration of an on-site repository would depend on the toxicity and type of material that requires disposal. The design could range in complexity from an earthen cover, an earthen cap with geomembrane liner, a modified RCRA Subtitle C repository, or a RCRA Subtitle C repository.

Factors to consider in design include the physical condition of the contaminated media, leachability, site hydrogeology, precipitation, depth to groundwater, current groundwater quality, area groundwater use, and applicable groundwater standards. Stringent performance standards may not always be appropriate for the repository, particularly where the toxicity of the contaminated medium is relatively low, where there is very low precipitation, or where the waste is not leached by infiltrating rain water. Desired land use after construction should also be considered in design of the repository.

Containment of water encountered drying excavated materials and during excavating may also be necessary due to the shallow groundwater at the site and the limited removal of submerged soils. Small equipment to minimize the mixing or to assist in drying of wet material may also be necessary.

A potential on-site repository area has been identified during the reclamation investigation and is shown on Figure 6-1. Therefore, on-site disposal options will be retained for further evaluation.

Off-Site Disposal

Off-site disposal involves placing excavated contaminated material in an engineered containment facility located outside the boundary of the site. Off-site disposal options may be applied to pretreated or untreated contaminated materials. Any non-Bevill exempt materials that fail to meet the Toxicity Characteristic Leaching Procedure (TCLP) criteria, if disposed of off site, would require disposal in a RCRA-permitted treatment, storage, and disposal (TSD) facility. Conversely, Bevill exempt mine waste derived from the beneficiation and extraction of ores could be disposed of in an off-site mine waste repository or disposed of as solid waste in a permitted sanitary landfill in compliance with other applicable laws.

The closest RCRA hazardous waste landfill locations are in Utah, Idaho, and Oregon. Excavation and disposal at an off-site RCRA hazardous waste landfill is considered too costly as an alternative for all mine wastes at the Spring Meadow Lake Site. Off-site disposal in a RCRA hazardous waste landfill will be retained only for mill wastes that may not be Bevill exempt; however, no non-exempt waste has been identified at the site.

Disposal of wastes at the closed Basin Creek Mine located 20 miles south of the Spring Meadow Lake Site will be considered as part of this EEE/CA. Off-site relocation at the Basin Creek Mine would involve placement of Spring Meadow wastes onto Leach Pad 1(LP1) along with other relocated mine waste prior to the final capping of Leach Pad 1. Relocation of Spring Meadow wastes with other mine waste at LP1 would coincide with ongoing mine reclamation projects.

Disposal of wastes in an off-site landfill will be considered as part of this EEE/CA. Two options are available locally; disposal at the city of Helena Landfill, and disposal at the Valley View landfill in East Helena. Each landfill is located approximately 20 miles from the Spring Meadow Lake site. The landfills would only be authorized to accept waste not classified as hazardous. As no hazardous waste has been identified on the site, this remains a viable alternative.

6.4.1.4 Excavation and Treatment

Excavation and treatment incorporate the removal of contaminated media and subsequent treatment via a specific treatment process that chemically, physically, or thermally results in a reduction in the toxicity and volume of the contaminant. Treatment processes have the primary objective of either: (1)

concentrating the metal contaminants for additional treatment or recovery of valuable constituents, or (2) reducing the toxicity of the hazardous constituents.

Excavation can be completed using conventional earth-moving equipment and accepted hazardous materials handling procedures. Precautionary measures, such as stream diversion or isolation, would be necessary for excavating materials contained in the small drainages on the site. Containment and treatment of water encountered during excavation may also be necessary.

Fixation and Stabilization

Fixation and stabilization technologies are used to treat materials by physically encapsulating them in an inert matrix (stabilization) and chemically altering them to reduce the mobility and toxicity of their constituents (fixation). These technologies generally involve mixing materials with binding agents under prescribed conditions to form a stable matrix. Fixation and stabilization are established technologies for treating inorganic contaminants. The technologies incorporate a reagent or combination of reagents to facilitate a chemical and physical reduction of the mobility of contaminants in the solid media. Lime/fly ash-based treatment processes and pozzolan/cement-based treatment processes are potentially applicable fixation and stabilization technologies.

Excavation and subsequent fixation and stabilization treatment are not considered feasible options for the Spring Meadow Lake Site because the large volume of waste makes the treatment cost prohibitive. Other feasible options can provide equal protectiveness.

Reprocessing

Reprocessing involves excavating and transporting the waste materials to an existing permitted mill or smelter facility for processing and economic recovery of target metals. Applicability of this option depends on market prices of the target metals and the willingness of an existing permitted facility to accept and process the material and dispose of the waste. Although metals have been reprocessed at active facilities in the past, permit limitations, CERCLA liability, and process constraints all limit the feasibility of this process option.

At this time, reprocessing is not considered feasible for the material at this site based on the lack of an available reprocessing facility and the expected high cost of transportation and reprocessing.

Reprocessing could become feasible in the future, however, depending on market conditions and the availability of a suitable reprocessing facility. This process is not being carried forward for detailed analysis since other options can provide equal protectiveness.

Physical and Chemical Treatment

Physical treatment processes concentrate constituents into a relatively small volume for disposal or further treatment. Chemical treatment processes act through the addition of a chemical reagent that removes or fixates the contaminants. The net result of chemical treatment processes is a reduction of toxicity and mobility of contaminants in the solid media. Chemical treatment processes often work in conjunction with physical processes to wash the contaminated media with water, acids, bases, or surfactant. Potentially applicable physical and chemical treatment process options include soil washing, acid extraction, and alkaline leaching.

Soil washing is an innovative treatment process that consists of washing the contaminated medium with water in a heap, vat, or agitated vessel to dissolve water-soluble contaminants. Soil washing requires that contaminants be readily soluble in water and sized sufficiently small so that dissolution can be achieved in a practical retention time. Dissolved metal constituents contained in the wash solution are precipitated as insoluble compounds, and the treated solids are dewatered before additional treatment or disposal. The precipitates form a sludge that would require additional treatment, such as dewatering or stabilization, before disposal.

Acid extraction applies an acidic solution to the contaminated medium in a heap, vat, or agitated vessel. Depending on temperature, pressure, and acid concentration, varying quantities of the metal constituents in the contaminated medium would be solubilized. A broader range of contaminants can be expected to be acid soluble at ambient conditions using acid extraction versus soil washing; however, sulfide compounds may be acid soluble only under extreme conditions of temperature and pressure. Dissolved contaminants are subsequently precipitated for additional treatment and disposal.

Alkaline leaching is similar to acid extraction in that a leaching solution (in this case, ammonia, lime, or caustic soda) is applied to the contaminated medium in a heap, vat, or agitated vessel. Alkaline leaching is potentially effective for leaching most metals from the contaminated media; however, removal of arsenic is not well documented.

Excavation and subsequent physical and chemical treatment are not considered feasible options because the large volume of waste makes treatment cost prohibitive. Other feasible options can provide equal protectiveness.

Thermal Treatment

Under thermal treatment technologies, heat is applied to the contaminated medium to volatilize and oxidize metals and render them amenable to additional processing and to vitrify the contaminated medium into a glass-like, nontoxic, nonleachable matrix. Potentially applicable moderate-temperature thermal processes, which volatilize metals and form metallic oxide particulates, include the fluidized bed reactor, the rotary kiln, and the multihearth kiln. Potentially applicable high-temperature thermal treatment processes include high-temperature vitrification, which melts and volatilizes all components of the contaminated medium. Volatile contaminants and gaseous oxides of sulfur are driven off as gases in the process, and the nonvolatile, molten material that contains contaminants is cooled and, in the process, vitrified.

Thermal treatment technologies can be applied to a wet or dry contaminated medium; however, the effectiveness may vary somewhat with variable moisture content and particle size. Crushing may be necessary as a pretreatment step, especially for large and variable particle sizes, such as the materials in waste rock dumps. Moderate-temperature thermal processes should be considered only as pretreatment for other treatment options. This process concentrates the contaminants into a highly mobile (and potentially more toxic) form. High-temperature thermal processes immobilize most metal contaminants into a vitrified slag that would require proper disposal. The volatile metals would be removed or concentrated into particulate metal oxides, which would likely require disposal as hazardous waste. Thermal treatment costs are extremely high compared with other potentially applicable reclamation technologies.

Excavation and subsequent thermal treatment are not considered feasible options because the large volume of waste makes treatment cost prohibitive. Other feasible options can provide equal protectiveness.

6.4.1.5 In-Place Treatment

In-place treatment involves treating the contaminated medium where it is currently located. In-place technologies reduce the mobility and toxicity of the contaminated medium and may reduce worker exposure to the contaminated materials; however, they allow a lesser degree of control, in general, than do ex situ treatment options.

Physical and Chemical Treatment

Potentially applicable in-place physical and chemical treatment technologies include stabilization and solidification, soil flushing, and dewatering.

In-place stabilization and solidification are similar to conventional stabilization in that a solidifying agent (or combination of agents) is used to create a chemical or physical change in the mobility and toxicity of the contaminants. The in-place process uses deep-mixing techniques to allow maximum contact of the solidifying agents with the contaminated medium.

Soil flushing is an innovative process that injects an acidic or basic reagent or chelating agent into the contaminated medium to solubilize metals. The solubilized metals are extracted using established dewatering techniques, and the extracted solution is then treated to recover metals or is disposed of as aqueous waste. Low-permeability materials may hinder proper circulation, flushing solution reaction, and ultimate recovery of the solution. Currently, soil flushing has been demonstrated only at the pilot scale.

Dewatering is a common pretreatment process used to extract water from a contaminated solid medium. Common dewatering options include well-field extraction, extraction trenches, surface water diversion, and gravity draining of stockpiled saturated materials. Dewatering is most effective in conjunction with additional reclamation technologies that reduce contaminant toxicity, mobility, or volume.

In-place physical and chemical treatment is not considered a feasible option because the large volume of waste at the site makes the treatment cost prohibitive. Other feasible options can provide equal or greater protectiveness.

Thermal Treatment

In-place vitrification is an innovative process used to melt contaminated solid media in place to immobilize metals into a glass-like, inert, nonleachable solid matrix. Vitrification requires significant energy to generate sufficient current to force the solid medium to act as a continuous electrical conductor. This technology is seriously inhibited by high moisture content. Furthermore, gases generated by the process must be collected and treated in an off-gas treatment system. In-place vitrification has been demonstrated only at the pilot scale, and treatment costs are extremely high compared with other treatment technologies.

In-place thermal treatment is not considered a feasible option because the large volume of waste at the site makes the treatment cost prohibitive. Other feasible options can provide equal or greater protectiveness.

6.4.2 Screening Summary and Identification of Reclamation Alternatives

A summary of the initial screening of reclamation response actions, technologies, and process options is provided in Table 6-2. The next step in the evaluation and selection process for a reclamation alternative is alternative screening. The alternative screening compares the options identified based on the NCP criteria of effectiveness, implementability, and relative costs, and eliminates alternatives to reduce the number carried forward for detailed analysis. Alternatives can be eliminated from further consideration if they do not meet the criteria of effectiveness or implementability. A second screening can be utilized if an alternative can be eliminated due to the cost being substantially higher than other alternatives and at least one other alternative is retained that offers equal protectiveness. This second level of alternative screening is effective as a method of reducing the number of options that will require a subsequent detailed analysis. This second level of screening will not be utilized because the number of alternatives is reasonable for a detailed analysis.

The reclamation response actions, technologies, and process options that were retained have been combined into the reclamation alternatives shown in Table 6-3. Five feasible reclamation alternatives were identified. All of these alternatives will be carried through to the detailed analysis.

TABLE 6-2

RECLAMATION TECHNOLOGY SCREENING COMMENTS SUMMARY
SOLID MEDIA
SPRING MEADOW LAKE SITE

General Response Actions	Reclamation Technology	Process Options	Description	Screening Comment
NO ACTION	None	Not applicable	No action	Retained for baseline comparison
INSTITUTIONAL CONTROLS	Access Restrictions	Fencing/Barrier	Install fences around waste areas to limit access	Not applicable as fencing would interfere with recreational uses of the site.
		Land Use Control	Implement restrictions to control current and future land use	Potentially effective in conjunction with other technologies; readily implementable
ENGINEERING CONTROLS	Surface Controls	Consolidation, Grading, Revegetation, Erosion Protection	Combine similar waste types in a common area; level out waste piles to reduce slopes for managing surface water infiltration, runoff, and erosion; add amendments to waste and seed with appropriate vegetative species to establish an erosion-resistant ground surface	Effectiveness is questionable since waste contains high concentrations of phytotoxic chemicals; limits direct exposure; readily implementable
	Containment	Earthen Cover	Apply soil and establish vegetative cover to stabilize surface; waste materials are left in place	Surface infiltration and runoff potential would be reduced, but not prevented; limits direct exposure; readily implementable
		Earthen and Geomembrane Cap	Install geomembrane with soil/vegetation over surface; waste materials are left in place	Surface infiltration and runoff potential would be significantly reduced, or eliminated; limits direct exposure; readily implementable
	On-Site Disposal	Earthen Cover	Excavate waste materials and deposit on site in a constructed repository with an earthen cover	Surface infiltration and runoff potential would be reduced, but not prevented; limits direct exposure; readily implementable
		Earthen Cap and Geomembrane Liner	Excavate waste materials and deposit on site in a constructed repository with an earthen and geomembrane cap	Surface infiltration and runoff potential would be significantly reduced, or eliminated; limits direct exposure; readily implementable
		Modified RCRA Subtitle C Repository	Excavate waste materials and deposit on site in a constructed Modified RCRA Subtitle C Repository	Surface infiltration and runoff potential would be significantly reduced, or eliminated; limits direct exposure; readily implementable

TABLE 6-2 (Continued)

RECLAMATION TECHNOLOGY SCREENING COMMENTS SUMMARY
SOLID MEDIA
SPRING MEADOW LAKE SITE

General Response Actions	Reclamation Technology	Process Options	Description	Screening Comment
ENGINEERING CONTROLS (Continued)	On-Site Disposal	RCRA Subtitle C Repository	Excavate waste materials and deposit on site in a constructed RCRA Subtitle C Repository	Potentially effective for all Bevill-exempt wastes; more costly and potentially more effective than Modified RCRA repository but added protection not considered necessary at this site
	Off-Site Disposal	Solid Waste Landfill	Excavate and dispose of nonhazardous solid wastes permanently in a non-RCRA facility	Potentially effective for nonhazardous materials or nonhazardous residues from other treatment process options; readily implementable
		Relocation with other Mine Wastes	Excavate waste materials, relocate, and consolidate with other mine wastes in Leach Pad 1 at the closed Basin Creek Mine	Surface infiltration and runoff potential would be effectively eliminated; limits direct exposure; readily implementable
		RCRA Subtitle C Landfill	Excavate and dispose of wastes permanently in a RCRA-permitted facility	Potentially effective, and readily implementable; but cost prohibitive and no hazardous waste identified at the site
EXCAVATION AND TREATMENT	Fixation/ Stabilization	Cement/Silicates	Incorporate hazardous constituents into non-leachable cement or pozzolan solidifying agents	Extensive treatability testing required; proper disposal of stabilized product would be required; potentially implementable, but cost-prohibitive
	Reprocessing	Milling/Smelter	Ship wastes to existing milling/smelter facility for economic extraction of metals	Potentially effective but a facility is not located in the area
	Physical/ Chemical Treatment	Soil Washing	Separate hazardous constituents from solid media via dissolution and subsequent precipitation	Effectiveness is questionable; potential exists to increase mobility by providing partial dissolution of contaminants; more difficulty encountered with wider range of contaminants
		Acid Extraction	Mobilize hazardous constituents via acid leaching and recover by subsequent precipitation	Effectiveness is questionable; sulfides would be acid soluble only under extreme conditions of temperature and pressure
		Alkaline Leaching	Use alkaline solution to leach contaminants from solid media in a heap, vat, or agitated vessel	Effectiveness is not well documented for arsenic

TABLE 6-2 (Continued)

RECLAMATION TECHNOLOGY SCREENING COMMENTS SUMMARY
SOLID MEDIA
SPRING MEADOW LAKE SITE

General Response Actions	Reclamation Technology	Process Options	Description	Screening Comment
EXCAVATION AND TREATMENT (Continued)	Thermal Treatment	Fluidized Bed Reactor/Rotary Kiln/Multihearth Kiln	Concentrate hazardous constituents into a small volume by volatilization of metals and formation of metallic oxides as particulates	Further treatment is required to treat process by-products; potentially implementable, but cost prohibitive
		Vitrification	Use extremely high temperature to melt and/or volatilize all components of the solid media; the molten material is cooled and, in the process, vitrified into a nonleachable form	Further treatment is required to treat process by-products; potentially implementable, but cost prohibitive
IN-PLACE TREATMENT	Physical/ Chemical Treatment	Stabilization	Stabilize waste constituents in place when combined with injected stabilizing agents	Extensive treatability testing required; potentially implementable, but cost prohibitive
		Solidification	Use solidifying agents in conjunction with deep soil mixing techniques to facilitate a physical or chemical change in mobility of the contaminants	Extensive treatability testing required; potentially implementable, but cost prohibitive
		Soil Flushing	Acid/base reagent or chelating agent injected into solid media to solubilize metals; solubilized reagents are subsequently extracted using dewatering techniques	Effectiveness not certain; innovative process currently in its pilot stage
	Thermal Treatment	Vitrification	Subject contaminated solid media to extremely high temperature in place; during cooling, material is vitrified into non-leachable form	Difficulties may be encountered in establishing adequate control; potentially implementable, but cost prohibitive

Note: Eliminated alternatives are shaded.

TABLE 6-3

RECLAMATION ALTERNATIVE INITIAL SCREENING SUMMARY
SOLID MEDIA
SPRING MEADOW LAKE SITE

Waste Type	Alternative Number	Alternative Description
Site-Wide Waste Mineral Processing Waste and Soils	Alternative 1	No Action
	Alternative 2	Institutional Controls
	Alternative 3	Containment (with earthen and geomembrane cap)
	Alternative 4	Excavation and On-Site Disposal in Repository (geomembrane bottom liner and earthen and geomembrane cap)
	Alternative 5	Excavation and relocation at Basin Creek Mine Leach Pad 1
	Alternative 6	Excavation and Off-site Disposal at a Solid Waste Landfill

6.5 DETAILED ANALYSIS OF RECLAMATION ALTERNATIVES

The third step in the selection process for reclamation alternatives for the Spring Meadow Lake site is the detailed analysis. The purpose of the detailed analysis is to evaluate the screened reclamation alternatives for their effectiveness, implementability, and cost in order to control and reduce toxicity, mobility, and volume of wastes at the Spring Meadow Lake site.

As required by CERCLA and the NCP, reclamation alternatives that were retained after the initial and alternative screening selection processes were evaluated individually against the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Acceptance by the supporting agencies and community are additional criteria that will be addressed after MWCB and the public review the alternative evaluations presented. These analysis criteria have been used to address the CERCLA requirements and considerations with EPA guidance (1988), as well as additional technical and policy considerations. The criteria also serve as the basis for conducting the detailed analysis and subsequently selecting the preferred reclamation alternative.

The criteria listed above are categorized into three groups, each with distinct functions in selecting the preferred alternative. These groups include:

- **Threshold Criteria** — overall protection of human health and the environment and compliance with ARARs.
- **Primary Balancing Criteria** — long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness, implementability, and cost.
- **Modifying Criteria** — state and community acceptance.

Overall protection of human health and the environment and compliance with ARARs are threshold criteria that must be satisfied for an alternative to be eligible for selection. Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; and cost are the primary balancing criteria used to weigh major trade-offs among alternative hazardous waste management strategies. State and community acceptance are modifying criteria that are formally considered after public comment is received on the proposed reclamation approach and the EEE/CA report. Each criterion is presented and described further in Table 6-4.

The final step of this analysis is a comparative analysis of the alternatives. The analysis will discuss each alternative's relative strengths and weaknesses with respect to each of the criteria, and how reasonably key uncertainties could change expectations of the relative performance. Once completed, this evaluation will be used to select the preferred alternatives. The selection will be documented in a decision document. Public meetings to present the alternatives will be conducted, and significant oral and written comments will be addressed in writing.

The reclamation alternatives that were retained after the initial and alternative screening selection processes are included in the detailed analysis. Each reclamation alternative under consideration for use at the Spring Meadow Lake site is classified as an interim or removal action, and is not considered a complete reclamation action. In addition, the reclamation alternatives are applicable to the solid media only; no reclamation alternatives were developed for treatment of groundwater or surface water.

TABLE 6-4

ANALYSIS OF SCREENED RECLAMATION ACTIVITIES
SOLID MEDIA
SPRING MEADOW LAKE SITE

THRESHOLD CRITERIA	
Overall Protection of Human Health and the Environment	**Compliance with ARARs**
• How alternative provides human health and environmental protection	• Compliance with chemical-specific ARARs • Compliance with action-specific ARARs • Compliance with location-specific ARARs • Compliance with other criteria, advisories, and guidance (TBCs)

PRIMARY BALANCING CRITERIA				
Long-Term Effectiveness and Permanence	**Reduction of Toxicity, Mobility, or Volume Through Treatment**	**Short-Term Effectiveness**	**Implementability**	**Cost**
• Magnitude of residual risk • Adequacy and reliability of controls	• Treatment process used and materials treated • Amount of hazardous materials destroyed or treated • Degree of expected reductions in toxicity, mobility, and volume • Degree to which treatment is irreversible • Type and quantity of residuals remaining after treatment	• Protection of community during removal actions • Protection of workers during removal actions • Environmental impacts • Time until removal action objectives are achieved	• Ability to construct and operate the technology • Reliability of the treatment • Ease of undertaking additional removal actions, if necessary • Ability to obtain approvals from other agencies • Coordination with other agencies • Availability of off-site treatment, storage, and disposal services and capability • Availability of necessary equipment and specialists • Availability of prospective technologies	• Capital costs • Operating and maintenance costs • Present worth cost

TABLE 6-4 (Continued)

ANALYSIS OF SCREENED RECLAMATION ACTIVITIES
SOLID MEDIA
SPRING MEADOW LAKE SITE

MODIFYING CRITERIA	
Supporting Agency Acceptance[a]	**Community Acceptance[a]**
• Features of the alternative the supporting agencies support • Features of the alternative about which the supporting agencies have reservations • Elements of the alternative the supporting agencies strongly oppose	• Features of the alternative the community supports • Features of the alternative about which the community has reservations • Elements of the alternative the community strongly opposes

Note:

[a] These criteria are being assessed primarily following pubic comment on the RI report and the expanded engineering evaluation/cost analysis.

The rationale for not directly developing alternatives for these media was based on the presumption that remediating the solid media will subsequently reduce or eliminate the potential impacts to groundwater and surface water.

6.5.1 Evaluation of Threshold Criteria

Each reclamation alternative was assessed for overall risk reduction and evaluated for compliance with ARARs in the following detailed evaluations of the threshold criteria. The exposure pathways of concern (ingestion, inhalation, and dermal) that were identified in the risk assessment were qualitatively and quantitatively evaluated to identify the risk reduction required to achieve the desired residual risk level (HQ less than 1 or risk less than 1.0×10^{-4}) to assess the threshold criteria (overall protection of human health and the environment, and attainment of ARARs). Each alternative was evaluated to ascertain the degree of risk reduction achieved, either through reduced contaminant loading to an exposure pathway or reduced surface area available for certain exposures. The resulting risk reduction estimates were then compared with one another to evaluate whether the relative risk reduction provided by a specific alternative is greater than another; these risk reductions were also compared with the reduction required to alleviate excess risk via the specific pathway or media. The risk reduction models also estimated resultant contaminant concentrations in the various media, which were then compared with medium and contaminant-specific ARARs.

Modeling estimates and assumptions were used in an attempt to quantify risk reduction and evaluate whether ARARs would be attained. Several assumptions and estimates were used in this analysis. Some of the assumptions were based on standard CERCLA risk assessment guidance, while others were based on site-specific observation and professional judgment. Many of the estimates were based on conservative or worst case scenarios, but since alternatives were compared with one another, these assumptions were consistent. The evaluation findings should, therefore, not be considered absolute; however, the relative risk reduction differences between alternatives are meaningful and can be used to evaluate this criterion.

The human health risk assessment considered the recreational receptor to be the most significant exposure pathway at the Spring Meadow Lake site under the rockhound/goldpanner (RH/GP) scenario. The on-site worker exposure scenario is considered to be the most significant exposure pathway at the Montana Wildlife Center. No potential residential scenarios exist at the Spring Meadow Lake site. The screening level risk assessments completed for the Spring Meadow Lake site identified arsenic and lead as the contaminants of concern for human exposure. For the Spring Meadow Lake scenario 400 mg/kg lead and 550 mg/kg arsenic were determined to be the maximum acceptable contaminant levels. The maximum acceptable contaminant levels for the Montana Wildlife Center were determined to be 750 mg/kg lead and 230 mg/kg arsenic.

Reduction of human health risks posed by the wastes found at the Spring Meadow Lake site is best addressed by reducing the area of exposed wastes, either by covering or removing contaminated wastes. The evaluation of methods to reduce the exposed contaminated surface area must also consider the long-term stability and eventual partial failure of cover or containment systems.

The ecological risk assessment identified three exposure scenarios as determined by EQs greater than one: (1) plant phytotoxicity to arsenic and lead; (2) deer ingestion of lead; and (3) surface water aquatic life exposure to arsenic contaminated submerged surface soil. The deer ingestion scenario would likely require a reduction in surface soil lead levels to achieve no potential risks to deer. The plant phytotoxicity scenario also requires a reduction in arsenic and lead surface concentrations or exposed surface area to achieve no phytotoxic effects (EQ less than or equal to 1). Reduction in phytotoxic effects will be achieved through exposure reduction activities associated with the human health risk exposure evaluations.

The maximum exposure concentrations for the East Arm area are: 10,400 mg/kg arsenic and 6,180 mg/kg lead. The amount of contaminant reduction required to meet recreational cleanup guidelines at the East Arm area are 95 percent for arsenic and 94 percent for lead. The maximum exposure concentrations for the Montana Wildlife Center are: 33,700 mg/kg arsenic and 16,300 mg/kg lead. The amount of contaminant reduction required to meet on-site worker cleanup guidelines at the Montana Wildlife Center are 99 percent for arsenic and 95 percent for lead. For plant phytotoxicity the concentrations must be reduced for arsenic by 99 percent and lead by 99 percent.

6.5.2 Alternative 1: No-Action

Under this alternative, no reclamation activities would be implemented. Consequently, long-term human health and environmental risks associated with the on-site contamination are assumed to remain unchanged. The no-action alternative is used to provide a baseline for comparing other alternatives and is included as required under CERCLA and the NCP.

6.5.2.1 Overall Protection of Human Health and the Environment

The no-action alternative provides no control of exposure to the contaminated materials and no reduction in risk to human health or the environment. Under this alternative, site contaminants would continue to migrate to air, groundwater, and surface water.

Protection of human health would not be achieved under the no-action alternative. Prevention of direct human exposure through the pathways of concern would not be achieved. Ingestion, dermal contact, and inhalation of soil containing metals would not be reduced. Protection of the environment would also not be achieved under the no-action alternative. Risks posed by ecological exposures through all scenarios would remain unchanged.

6.5.2.2 Compliance with ARARs

A comprehensive list of federal and state ARARs is presented in Appendices 6-A and 6-B. ARARs are divided into contaminant-specific, location-specific, and action-specific requirements. Under the no-action alternative, no contaminated materials would be treated, removed, or actively managed. Leaching and releases of contaminants to groundwater and surface water would not be reduced under this alternative and surface water standards would continue to be exceeded.

6.5.2.3 Long-Term Effectiveness and Permanence

Under the no-action alternative, no controls or long-term measures would be imposed on the contaminated materials at the site; consequently, this alternative provides no long-term effectiveness. Therefore, the no-action alternative would not be effective at minimizing risks from exposure to site wastes.

6.5.2.4 Reduction of Toxicity, Mobility or Volume through Treatment

The no-action alternative would not reduce the toxicity, mobility, or volume of the contaminated materials.

6.5.2.5 Short-Term Effectiveness

The no-action alternative would not create any short-term risks.

6.5.2.6 Implementability

The no-action alternative is readily implementable.

6.5.2.7 Costs

No direct monetary costs are associated with the no-action alternative.

6.5.3 Alternative 2: Institutional Controls

Institutional controls were retained as a reclamation alternative for the Spring Meadow Lake site. This alternative would involve maintaining current land-use of the Spring Meadow Lake site as a state park and as a wildlife rehabilitation area. Future land-use scenarios such as residential development of the Spring Meadow Lake site would be prohibited.

Institutional control measures including fencing and are not considered to be a feasible reclamation alternative for reducing exposure to contaminated soils and mineral processing wastes at the Spring Meadow Lake. More aggressive institutional controls such as fencing would significantly interfere or impact the use of the Spring Meadow Lake site as a recreational and wildlife rehabilitation area.

6.5.3.1 Overall Protection of Human Health and the Environment

This alternative would provide some protection of human health by restricting land uses that would result in greater risk.

6.5.3.2 Compliance with ARARs

There are no federal or state contaminant-specific ARARs that are required to be met for applying institutional controls at the Spring Meadow Lake site. However, leaching and releases of contaminants to groundwater and surface water would not be reduced under this alternative and exceedences of surface water standards would remain unchanged.

Occupational Safety and Health Administration (OSHA) requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, flood plains, and historical, cultural, and paleontological remains would be required.

All action-specific ARARs are anticipated to be met.

6.5.3.3 Long-Term Effectiveness and Permanence

Under the institutional controls alternative, land use controls at the Spring Meadow Lake site are considered to have long-term effectiveness so long as these measures are maintained and enforced.

6.5.3.4 Reduction of Toxicity, Mobility or Volume through Treatment

Waste toxicity, mobility, and volume are not reduced under the institutional controls alternative.

6.5.3.5 Short-Term Effectiveness

There is no construction phase associated with this alternative; therefore, no short-term impacts exist.

6.5.3.6 Implementability

This alternative is both technically and administratively feasible, and could be implemented immediately.

6.5.3.7 Costs

The estimated total present worth cost for Alternative 2 (institutional controls) is $11,267.05. Table 6-5 present the costs associated with implementing this alternative. The total cost includes the present value of 30 years of annual maintenance and monitoring costs, in addition to the capital costs.

TABLE 6-5
COST ESTIMATE
ALTERNATIVE 2
INSTITUTIONAL CONTROLS
SPRING MEADOW LAKE SITE

Cost Item	Quantity	Unit	Unit Cost (a)	Cost
Capital Costs				
Land Use Controls. Deed Restrictions	1	LS	$ 5,000.00	$ 5,000.00
Subtotal Construction Costs				$ 5,000.00
Construction Contingencies	Percent of Construction Costs =		0%	$ -
Engineering Design and Construction Oversight	Percent of Construction Costs =		0%	$ -
TOTAL CAPITAL COSTS				$ 5,000.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	1	EA	$ 500.00	500.00
Site Maintenance	Percent of Construction Costs =		0%	$ -
Subtotal O&M Costs				$ 500.00
O&M Contingencies			1%	$ 5.00
Total Yearly O&M Cost				$ 505.00
Present Worth of O&M Costs Based on 30 Year Life @ 7%		PW FACTOR	12.41	$ 6,267.05
TOTAL PRESENT WORTH				**$ 11,267.05**

(a) Unit costs are based on professional judgment.

Notes:
LS = Lump Sum
CY = Cubic Yard
SY = Square Yard
LF = Lineal Feet
% = Percent
EA = Each
PW = Present Worth

6.5.4 Alternative 3: Containment

This alternative would include containing wastes on site. Containing wastes in place would involve surface control measures and the construction of a multilayer geotextile and soil cap. The containment steps would include the following: (1) consolidating and regrading the materials; (2) capping the area; and (3) revegetating the disturbed areas and the cap. Storm water and other surface control measures would also be implemented to minimize potential erosion. Specific site-wide containment steps would include the following:

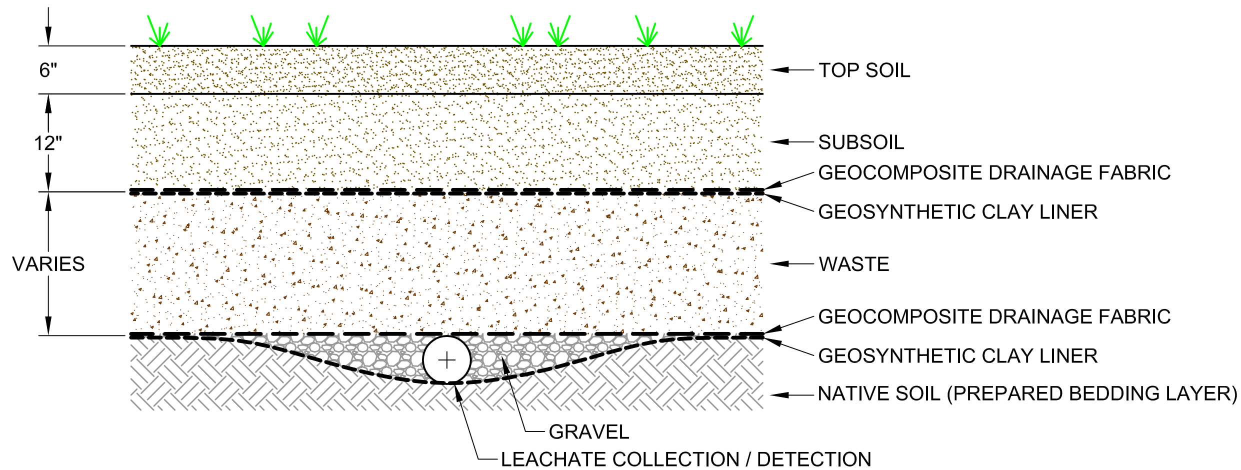
- Montana Wildlife Center and East Arm area: Contaminated soils and mineral processing wastes within the Montana Wildlife Center and in isolated waste areas in the East Arm area would be excavated and consolidated with other wastes. Consolidated wastes would subsequently be graded, compacted and contained with an earthen and geomembrane cap. Slopes and drainage pathways would be graded to blend with natural contours and topography to allow for positive drainage.

- Spring Meadow Lake Submerged Soils: Contaminated submerged surface soil along the shoreline of Spring Meadow Lake would be excavated and consolidated with other wastes away from the lake and then capped with an earthen and geomembrane cap. This would be done to isolate the submerged soil from human and ecological contact.

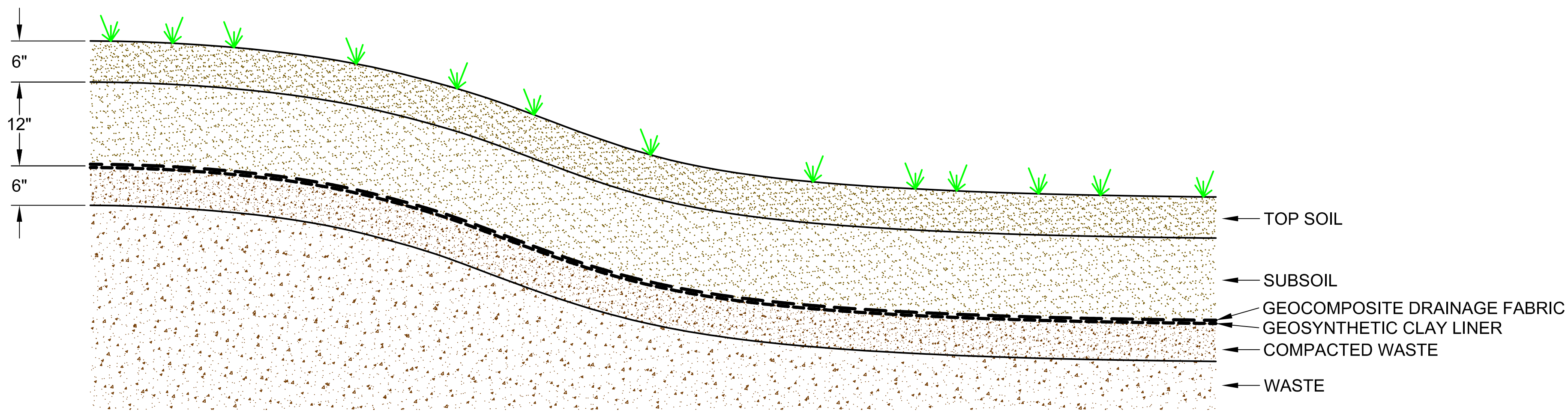
  In all applicable waste areas, surface control measures would use selective grading, coversoil application, and revegetation activities to reestablish drainage channels, minimize erosion, and help establish self-perpetuating plant communities. Consolidation involves pushing and hauling the waste into common and smaller areas.

The waste areas would be regraded and recontoured to reestablish surface water drainage channels, minimize erosion, and achieve positive drainage away from capped areas and towards the lake. Slopes steeper than about 4:1 would be regraded to small terrace benches, dozer basins, and pits to minimize soil erosion and enhance revegetation efforts.

Installation of an earthen and geomembrane cap would include a 6-inch layer of compacted soil or fine-grained waste cushion, a geomembrane or geosynthetic clay liner, and a geocomposite drainage layer, all beneath the 18-inch earthen cap (see Figure 6-2).



MODIFIED RCRA SUBTITLE C REPOSITORY



EARTHEN AND GEOMEMBRANE CAP

1 0 1 2
SCALE IN FEET

Tetra Tech EM Inc.

Spring Meadow Lake
Helena, Montana

FIGURE 6-2
REPOSITORY AND CAP
CONCEPTUAL DESIGN

Revegetation of the area would likely take place during the fall season. The seed mixture and fertilizer would be simultaneously drilled into the prepared seed beds. Mulch would be applied to promote temporary protection of the disturbed erodible surfaces. Some of the steeper slopes may require seeding with a hydromulch seeder followed by covering with soil erosion control blankets. Selected areas may be interseeded with bare-root or containerized shrub and tree species. Biodegradable jute netting, or the most appropriate erosion control mat, would be anchored over newly seeded areas with slopes greater than 2.5 to 1 to provide additional stabilization until the vegetation becomes established. Also, any temporary roads constructed at the site would be reclaimed after the field activities are completed.

6.5.4.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide an additional level of protection beyond that provided by institutional control measures (Alternative 2) by further reducing the threat of direct contact with the waste material, as well as reducing the risk of airborne exposure. Containing waste and subsequent revegetation would stabilize the surface by providing additional erosion protection, and decrease the infiltration of precipitation and surface water runoff that may leach contaminants to the groundwater.

The threat of direct human and ecological exposure in the East Arm area, Montana Wildlife Center and to Spring Meadow Lake submerged soils would be virtually eliminated by this alternative over the long term, contingent upon proper maintenance of earthen and vegetative caps. The addition of an earthen and geomembrane cap would further reduce the threat of direct human exposure as compared to surface control measures alone. Water quality would also be improved and fish exposure would be reduced by the removal and capping of the submerged soils. Ingestion and dermal contact, and inhalation of soil containing arsenic, lead, and manganese would be reduced to acceptable levels. Environmental and ecological exposures through all scenarios including deer ingestion of lead and plant phytotoxicity would also be virtually eliminated over the long term. Releases of contaminants due to precipitation leaching would be significantly reduced by the earthen and geomembrane cap.

Due to the risk analysis being based on recreational use and to ensure that human health standards are not exceeded, future use of the land should be restricted to recreational uses.

6.5.4.2 Compliance with ARARs

There are no federal or state contaminant-specific ARARs that are required to be met for containing contaminated mine wastes in place at the Spring Meadow Lake site. However, leaching and releases of contaminants to groundwater and surface water would be significantly reduced because the primary waste sources of concern would be physically isolated using an earthen and geomembrane cap. These actions are expected to satisfy federal and state surface water and groundwater standards including maximum contaminant levels (MCL) and human health standards (HHS) over the long term.

OSHA requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, floodplains, and historical, cultural, and paleontological remains would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the benificiation and extraction of ores and are, therefore, assumed to be exempt from federal government regulation through RCRA as hazardous waste. In addition, revegetation requirements contained in the Surface Mining Control and Reclamation Act would be met. State of Montana dust suppression and control requirements are applicable for earth-moving activities associated with this alternative for the control of fugitive dust emissions; these requirements would be met through water application to roads receiving heavy vehicular traffic and to excavation areas, if necessary.

6.5.4.3 Long-Term Effectiveness and Permanence

Under this alternative, the cap would require periodic inspection to ensure that the vegetation becomes established and continues to perform as designed. Consequently, long-term monitoring and maintenance would be required, especially monitoring and maintenance of revegetated slopes at the site since areas would be susceptible to erosion. The soil cover would be the component most vulnerable to any damage or degradation that might occur. The soil cover would be susceptible to settlement, surface water ponding, erosion, and disruption of cover integrity by vehicle and foot traffic, deep-rooting vegetation, and burrowing animals. The actual design life of the cap is not certain; however, since the cap would be periodically inspected, the required maintenance could be determined and implemented. In addition, institutional controls would be required to prevent land uses incompatible with the reclaimed site. Specifically, land uses that would compromise the waste cover should be precluded.

The long-term effectiveness of covering or capping the waste in place would be enhanced by determining the proper cover or cap design and appropriate grading layout, and by selecting the appropriate plant species for revegetation. Long-term effectiveness would likely be improved by selecting appropriate site adapted plant species for the revegetation seed mixture.

6.5.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The objective of this alternative is to reduce contaminant mobility; the volume or toxicity of the contaminants would not be physically reduced. Consolidating and containing the waste would stabilize these sources and reduce contaminant mobility from surface water and wind erosion with an increased risk reduction compared to institutional control measures alone (Alternative 2). The mobility of the contaminants is expected to be reduced to an extent that would result in an overall risk reduction from all pathways and routes of exposure.

The earthen and geomembrane cap would provide protection from surface water infiltration. Depending on the stability of the liner on steeper slopes; the drainage layer directly above the flexible membrane liner would effectively transport surface water infiltration away from waste materials. A drainage ditch would be installed at the bottom of the contoured area to capture any potential surface water infiltration from above the geomembrane liner. In addition, gases would not likely be generated by the inorganic waste materials; therefore, venting would not be required.

6.5.4.5 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. These potential short-term impacts would be mitigated during the construction phase. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur due to the relatively large volumes of waste requiring consolidation and grading. Control of fugitive dust emissions would be provided by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed.

Short-term impacts to the surrounding community are expected to be minimal. A measurable short-term impact to the surrounding community would include increased vehicular traffic and associated safety hazards in the vicinity of the Spring Meadow Lake in association with the construction. Dust generation may occur in the vicinity of Spring Meadow Lake and water application to the roads in the area may be necessary. Some recreational and professional use of the Spring Meadow Lake site would likely be interrupted or impacted during excavation and construction activities.

6.5.4.6 Implementability

This alternative is both technically and administratively feasible, and could be implemented within one field season. The consolidation, regrading, and revegetation require conventional construction practices; materials and construction methods are readily available. It is assumed that local sources for the earthen borrow material and coversoil (or suitable plant-growth media) are available. Also, design methods and requirements are well documented and understood. Installation of the geomembrane liner would require the services of a contractor experienced in the proper installation of specialized caps and liners.

The areas of Spring Meadow Lake have been identified as having submerged soil contamination in addition to supporting a significant population and variety of aquatic wildlife. Special concern would be needed during excavation of wet soil material in Spring Meadow Lake in order to minimize damage or disturbance to the excavation and surrounding areas. This is necessary not only to protect the aquatic wildlife inhabiting the lake, but to also minimize disruption to the professional/recreational activities on site. Construction activities would likely be limited to the use of small equipment working from the Spring Meadow Lake bank to minimize the amount of disturbance and invasiveness of excavation activities. Dewatering and/or dredging any section of Spring Meadow Lake would not be considered feasible or appropriate techniques for use.

Components or factors which could potentially prolong the implementation of this alternative as planned include: (1) locating adequate earthen borrow and coversoil (or suitable plant-growth media) sources; (2) controlling fugitive dust emissions and storm water discharge during reclamation activities; (3) addressing landowner concerns; and (4) addressing concerns involving regular recreational use. However, these concerns are applicable to other reclamation alternatives being considered for the site.

6.5.4.7 Costs

The estimated total present worth cost for Alternative 3 (containment in place with an earthen cap and geomembrane liner) is $820,991.97. Table 6-6 present the costs associated with implementing this alternative. The total cost includes the present value of 30 years of annual maintenance and monitoring costs, in addition to the capital costs.

Conceptual Design and Assumptions

The following assumptions were used to develop costs directly and to calculate associated costs for this alternative:

- Approximately 8 acres would be prepared as part of construction activities. Preparation would include clearing, grubbing, and installation of stormwater controls. Existing trees along the edge of the east arm would be left in place. Waste would be excavated around trees in such a manner as to minimize damage to the roots.
- Approximately 3,400 cubic yards (cy) of submerged soils and isolated wastes would be excavated and consolidated with other wastes.
- Approximately 29,200 square yards of waste surface would be re-graded and covered with a geomembrane cap. (The graded and contoured area must be smooth enough to allow the installation of the cap and to maximize the integrity of the cap).
- An 18-inch soil cover would be placed over the geomembrane cap. Approximately 14,600 cy of off-site soils (borrow and cover) would be imported to cover the geomembrane cap. Soil borrow and coversoil sources are assumed located within a 5.0-mile radius of the site and would not require permitting.
- Excavated submerged soil and isolated waste areas would be backfilled to original grade with imported common borrow and covered with 6 inches of imported cover soil. A total of 3,400 cy of imported soil would be required. Surfaces would be graded and blended to match existing contours and topography.
- An erosion control fabric lined drainage ditch would be installed to control drainage around the capped area.
- A total of 8 acres of disturbed ground, including excavated areas, staging areas and haul roads would be revegetated with plant species appropriate for the Spring Meadow Lake site.
- Access roads within the site would be improved to allow unobstructed access for heavy equipment. Any temporary roads constructed at the site would be obliterated and reclaimed after the field activities were completed.

TABLE 6-6
COST ESTIMATE
ALTERNATIVE 3
CONTAINMENT WITH AN EARTHEN AND GEOMEMBRANE CAP
SPRING MEADOW LAKE SITE

Cost Item	Quantity	Unit	Unit Cost (a)	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1	LS	$ 50,000.00	$ 50,000.00
Site Preparation and Storm Water Control	8	Acre	$ 1,000.00	$ 8,000.00
Road Improvement	1	Mile	$ 5,000.00	$ 5,000.00
Excavate and Consolidate Waste	3,400	CY	$ 3.00	$ 10,200.00
Geomembrane Cap	29,200	SY	$ 12.00	$ 350,400.00
Site Grading	29,200	SY	$ 1.00	$ 29,200.00
Drainage Ditch	700	LF	$ 4.00	$ 2,800.00
Offsite Soil Borrow	12,500	CY	$ 4.00	$ 50,000.00
Offsite Cover Soil	5,500	CY	$ 8.00	$ 44,000.00
Fertilize, Seed, and Mulch	8	Acre	$ 1,500.00	$ 12,000.00
Cleanup and Demobilization	1	LS	$ 10,000.00	$ 10,000.00
Subtotal Construction Costs				$ 571,600.00
Construction Contingencies	Percent of Construction Costs =		15%	$ 85,740.00
Engineering Design and Construction Oversight	Percent of Construction Costs =		15%	$ 85,740.00
TOTAL CAPITAL COSTS				$ 743,080.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	1	EA	$ 500.00	500.00
Site Maintenance	Percent of Construction Costs =		1%	$ 5,716.00
Subtotal O&M Costs				$ 6,216.00
O&M Contingencies			1%	$ 62.16
Total Yearly O&M Cost				$ 6,278.16
Present Worth of O&M Costs Based on 30 Year Life @ 7%		PW FACTOR	12.41	$ 77,911.97
TOTAL PRESENT WORTH				**$ 820,991.97**

(a) Unit costs are based on recent bids for similar work at other Montana abandoned mine reclamation projects and professional judgment.

Notes:
LS = Lump Sum
CY = Cubic Yard
SY = Square Yard
LF = Lineal Feet
% = Percent
EA = Each
PW = Present Worth

6.5.5 Alternative 4: Excavation and On-Site Disposal in a Repository

Under this alternative, waste materials at the site would be excavated and disposed of in one on-site repository. The steps include the following: (1) excavating and preparing the repository subgrade, (2) installing liner and leachate collection system, (3) excavating and consolidating the waste materials in the repository, (4) backfilling, grading, and placing cover soil over the excavated areas; (5) capping the waste with an a geocomposite liner and an 18-inch thick earthen cap, and (6) revegetating the repository cap and the disturbed areas. The available space in the East Area would be large enough to site a repository to store all contaminated soils and mineral processing waste excavated from the Spring Meadow Lake site (see Figure 6-1). Due to the relatively flat topography of the Eastern Area, an on-site repository would likely need to be above ground to allow for adequate drainage of leachate from the repository.

Wastes would be graded and compacted as they are placed in the repository. A geocomposite liner and 18 inches of soil cover would be placed over the waste (see Figure 6-2).

After the soil cover is placed over the waste, the repository slopes would be graded to 3 to 1 slopes or less, while maintaining an 18-inch minimum soil cover depth, to minimize surface erosion potential. Next, the disturbed areas would be prepared for revegetation, including the removal areas and the repository cap. Submerged soil areas and the Foundry area would be backfilled to original grade. The excavated areas would be graded to match the contour of the land surface and cover soil would be applied to the disturbed areas.

Revegetation would likely take place during the fall of the year. The seed mixture and fertilizer would be simultaneously drilled into the prepared seed beds. Mulch would be applied to promote temporary protection of the disturbed erodible surfaces.

Heavy equipment would be required on site to implement this alternative efficiently. Multiple large-capacity haul trucks, bulldozers, front-end loaders, excavators, and compactors would be needed to construct the repository and excavate and haul the material. Smaller-capacity equipment, such as skid-steer loaders, backhoes and small haul trucks would be employed in space-restrictive areas.

6.5.5.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide a means of reducing or eliminating the threat of direct contact with the waste material as well as reducing the risk of airborne exposure and soil ingestion. In addition, isolating the waste would provide environmental protection by limiting the infiltration of precipitation and surface water that may leach contaminants to the groundwater.

The threat of direct human exposure would essentially be eliminated by this alternative. The potential for ingestion, dermal contact, and inhalation of soil containing arsenic and lead would be eliminated over the long term. Risks would be reduced to acceptable levels for recreational land uses. Due to the risk analysis being based on recreational use and to ensure that human health standards are not exceeded, future use of the land should be restricted to recreational uses.

Protection of the environment would be achieved under this alternative. Ecological exposures through all scenarios including deer exposure to arsenic and lead through ingestion of surface salts, phytotoxic concentrations of metals, and exposure of aquatic organisms to arsenic in submerged soils would also be reduced to acceptable levels or possibly eliminated.

6.5.5.2 Compliance with ARARS

There are no federal or state contaminant-specific ARARs that are required to be met for containing contaminated mineral processing waste at the Spring Meadow Lake site. However, removal of the specified waste and disposal in a constructed repository are expected to satisfy federal and state surface water and groundwater standards including MCL and HHS. The contaminants would not be expected to leach to surface water or groundwater because the primary waste sources of concern would be physically isolated from groundwater using soil and liner cap.

Implementation of this alternative is expected to satisfy air quality regulations because encapsulating the waste would stabilize the materials with respect to fugitive emissions.

OSHA requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase of the project.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, floodplains, and paleontological resources would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the beneficiation and extraction of ores and are, therefore, assumed to be exempt from federal government regulation through RCRA as hazardous waste. In addition, revegetation requirements contained in the Surface Mining Control and Reclamation Act would be met. State of Montana dust suppression and control requirements are applicable for earth-moving activities associated with this alternative for the control of fugitive dust emissions; these requirements would be met through water application to roads receiving heavy vehicular traffic and to excavation areas, if necessary.

6.5.5.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of the repository is dependent upon proper maintenance, including long-term monitoring and routine inspections, to ensure that the system performs as designed. The repository cap would be the component most vulnerable to any damage or degradation that might occur. Multilayered caps are susceptible to erosion, settlement, and disruption of the cover integrity by vehicles, deep-rooting vegetation, and burrowing animals. Multilayer caps are also susceptible to ponding of surface water. The actual design life of the repository is not certain; however, since the repository would be periodically inspected, the required maintenance could be determined and implemented. In addition, institutional controls would be required to prevent land uses incompatible with the reclaimed site. Specifically, land uses that would compromise the repository cap should be precluded.

In addition, revegetation of the excavated areas and the repository cap would stabilize the land surface by providing erosion protection from surface water and wind erosion, and would reduce net infiltration through the media by increasing the evapotranspiration process. Determining the proper grading layout for the area, selecting good quality soil cover, and selecting the appropriate plant species for revegetation would enhance the long-term effectiveness of this alternative. Long-term effectiveness would likely be improved by selecting appropriate site adapted plant species adapted to short growing seasons.

6.5.5.4 Reduction of Toxicity, Mobility or Volume through Treatment

The objective of this alternative is to provide a reduction in contaminant mobility although the waste is not treated. The volume or toxicity of the contaminants would not be physically reduced. Placing the mineral processing waste in a repository would stabilize the source area and reduce and possibly eliminate contaminant mobility from surface water and wind erosion through the use of impermeable liners that encapsulate the mineral processing waste. A drainage ditch would be installed at the bottom of the contoured area to capture any potential surface water infiltration from above the geomembrane liner. The mobility of the contaminants would be reduced to an extent that would result in an overall risk reduction from all pathways and routes of exposure.

6.5.5.5 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. These potential short-term impacts would be mitigated during the construction phase. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur due to waste consolidation and grading. Control of fugitive dust emissions would be provided by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. Short-term impacts to people residing or recreating in the vicinity of the site are expected to be minimal. A measurable short-term impact to the surrounding area would include increased vehicular traffic, associated safety hazards, and potential dust generation in the vicinity of Spring Meadow Lake and the Montana Wildlife Center in association with construction. Some recreational and professional use of the Spring Meadow Lake would be interrupted or impacted during excavation and construction activities.

6.5.5.6 Implementability

Depending upon the availability of an on-site are for a repository, this alternative is technically and administratively feasible, and could be implemented within one field season. The construction of a repository with a multilayered cap is considered a conventional construction practice; materials and construction methods are readily available. Constructing the repository may require the services of a contractor experienced in the proper component installation procedures. Also, design methods and requirements are well documented and understood.

Components or factors which could potentially prolong the implementation of this alternative as planned include: (1) locating a repository area on-site, (2) locating adequate earthen borrow and coversoil (or suitable plant-growth media) sources; (3) controlling fugitive dust emissions and storm water discharge during reclamation activities; (4) addressing landowner concerns; and (5) addressing concerns involving regular recreational use. However, most of these concerns are applicable to other reclamation alternatives being considered for the site. The availability of an on-site repository area is uncertain at this time.

6.5.5.7 Costs

The estimated total present worth cost for Alternative 4, excavation and on-site disposal in an earthen and geomembrane capped repository, is $950,320.28. Table 6-7 presents the itemized capital and operations and maintenance costs associated with implementing this alternative.

Conceptual Design Assumptions

The following assumptions were used to develop costs directly and to calculate associated costs for this alternative:

- Access roads through the site would be improved to allow unobstructed access for heavy equipment. Any temporary roads constructed at the site would be obliterated and reclaimed after the field activities were completed.

- Approximately 12 acres would be prepared as part of construction activities. Preparation would include grubbing and installation of stormwater controls. Existing trees along the edge of the east arm would be left in place. Waste would be excavated around trees in such a manner as to minimize damage to the roots.

- A repository with a total surface area of approximately 2.5 acres would be prepared on site. Approximately 6,050 cy of soil would be excavated from the repository area and used later for the cap.

- A bottom geocomposite liner would be installed in the repository consisting of a geosynthetic clay liner and a geocomposite drainage fabric.

- A leachate collection and removal system would be installed in the repository consisting of PVC drain pipes surrounded by a three-inch thick layer of washed, coarse gravel. An evaporation tank would be installed to collect all leachate. The evaporation tank would be surrounded by a chain link fence.

- An estimated 34,300 cy of contaminated soil, mineral processing wastes, and submerged soils would be excavated, consolidated and compacted in the repository using excavators, scrapers and dozers.

TABLE 6-7
COST ESTIMATE
ALTERNATIVE 4
ON-SITE MODIFIED RCRA REPOSITORY WITH GEOMEMBRANE LINER AND EARTHEN AND GEOMEMBRANE CAP
SPRING MEADOW LAKE SITE

Cost Item	Quantity	Unit	Unit Cost (a)	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1	LS	$ 55,000.00	$ 55,000.00
Site Preparation and Storm Water Control	12	Acre	$ 1,000.00	$ 12,000.00
Road Improvement	1	Mile	$ 5,000.00	$ 5,000.00
Repository Excavation and Base Preparation	6,050	CY	$ 2.50	$ 15,125.00
Repository Geomembrane Liner	12,100	SY	$ 12.00	$ 145,200.00
Leachate Collection System Piping	500	LF	$ 8.00	$ 4,000.00
Leachate Collection and Disposal Tank	1	LS	$ 4,000.00	$ 4,000.00
Waste Excavation, Hauling and Compaction	34,300	CY	$ 3.00	$ 102,900.00
Repository Geomembrane Cap	12,100	SY	$ 12.00	$ 145,200.00
Repository Cap Soil	6,050	CY	$ 3.00	$ 18,150.00
Run-on/Run-off Ditches	700	LF	$ 4.00	$ 2,800.00
Offsite Soil Borrow	17,200	CY	$ 4.00	$ 68,800.00
Cover Soil	5,600	CY	$ 8.00	$ 44,800.00
Fertilize, Seed, and Mulch	12	Acre	$ 1,500.00	$ 18,000.00
Chain Link Fence	160	LF	$ 20.00	$ 3,200.00
Woven Wire Farm Fence	1,360	LF	$ 6.00	$ 8,160.00
Cleanup and Demobilization	1	LS	$ 10,000.00	$ 10,000.00
Subtotal Construction Costs				$ 662,335.00
Construction Contingencies	Percent of Construction Costs =		15%	$ 99,350.25
Engineering Design and Construction Oversight	Percent of Construction Costs =		15%	$ 99,350.25
TOTAL CAPITAL COSTS				$ 861,035.50
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	1	EA	$ 500.00	500.00
Site Maintenance	Percent of Construction Costs =		1%	$ 6,623.35
Subtotal O&M Costs				$ 7,123.35
O&M Contingencies			1%	$ 71.23
Total Yearly O&M Cost				$ 7,194.58
Present Worth of O&M Costs Based on 30 Year Life @ 7%		PW FACTOR	12.41	$ 89,284.78
TOTAL PRESENT WORTH				**$ 950,320.28**

(a) Unit costs are based on recent bids for similar work at other Montana abandoned mine reclamation projects and professional judgment.

Notes:
LS = Lump Sum
CY = Cubic Yard
SY = Square Yard
LF = Lineal Feet
% = Percent
EA = Each
PW = Present Worth

- A repository cap would be installed consisting of a geosynthetic clay liner and geocomposite drainage fabric. The geocomposite cap would be covered with 18 inches of imported cover soil removed from the repository prior to construction totaling approximately 6,050 cy.

- An erosion control fabric lined ditch would be installed to control run-on/run-off around the repository.

- Excavated areas at the East Arm area and Montana Wildlife Center (approximately 7 acres) would be backfilled with imported common borrow to approximately 50 percent of the total amount of removed material or 17,200 cy. Surfaces would be graded and blended to match existing contours and topography then covered with 6-inches of imported cover soil (5,600 cy). It is assumed that borrow soil and coversoil sources are located within a 5.0-mile radius of the site and would not require permitting.

- A total of 12 acres of disturbed ground, including excavated areas, staging areas and haul roads would be revegetated with plant species appropriate for the Spring Meadow Lake site.

- A woven wire fence would be installed around the repository to minimize potential vehicular or foot traffic. The total length of fence required to surround the repository would be approximately 1,360 linear feet. A chain link fence of approximately 160 linear feet would be installed around the leachate tank.

6.5.6 Alternative 5: Excavation and Relocation with Other Mine Wastes at Basin Creek Mine LP1

Under this alternative, mineral processing wastes and contaminated soils at the Spring Meadow Lake site would be excavated and consolidated with other mine wastes off-site. The steps include the following: (1) improving access roads within the Spring Meadow Lake site; (2) excavating and hauling waste materials to Basin Creek Mine LP1 and consolidating the materials with other mine wastes at LP1; (3) backfilling, grading, and placing cover soil over the excavated areas; and (4) revegetating the disturbed areas at site. The haul route to LP1 currently considered feasible includes hauling through Helena, then by Interstate 15 south to Basin, then by the Basin Creek Road to LP1. Hauling wastes via Ten Mile Creek and the town of Rimini is not presently considered feasible due to conflicts with EPA remediation and construction activities in these areas.

The disturbed areas would be prepared for revegetation, including the removal areas, staging areas and soil borrow areas. The excavated areas would be graded to match the contour of the land surface and, if necessary, cover soil would be applied to the disturbed areas.

Revegetation would likely take place during the fall of the year. The seed mixture and fertilizer would be simultaneously drilled into the prepared seed beds. Mulch would be applied to promote temporary protection of the disturbed erodible surfaces.

Heavy equipment would be required on site to implement this alternative efficiently. Multiple large-capacity haul trucks, bulldozers, front-end loaders, excavators, and compactors would be needed to excavate and haul the material.

Any saturated material excavated from Spring Meadow Lake would either be dried prior to being transported, or transported in covered trucks with lined, leak-proof beds.

6.5.6.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide a means of reducing or eliminating the threat of direct contact with the waste material as well as reducing the risk of airborne exposure and soil ingestion. In addition, removing the waste from the site and isolating the waste at LP1 would provide environmental protection by limiting the infiltration of precipitation and surface water that may leach contaminants to the groundwater.

The threat of direct human exposure would essentially be eliminated by this alternative. The potential for ingestion, dermal contact, and inhalation of soil containing arsenic and lead would be eliminated over the long term. Risks would be reduced to acceptable levels for recreational land uses. Due to the risk analysis being based on recreational use and to ensure that human health standards are not exceeded, future use of the land should be restricted to recreational uses.

Protection of the environment would be achieved under this alternative. Ecological exposures through all scenarios including deer exposure to lead through ingestion of surface salts, and plant phytotoxicity would also be reduced to acceptable levels or possibly eliminated.

6.5.6.2 Compliance with ARARS

There are no federal or state contaminant-specific ARARs that are required to be met for consolidating contaminated mineral processing waste at LP1. However, removal of the specified waste and relocation at LP1 are expected to satisfy federal and state surface water and groundwater standards including MCL and HHS. The contaminants would not be expected to leach to surface water or groundwater because the primary waste sources of concern would be removed from the site and physically isolated from groundwater at the Basin Creek Mine using a liner system and a liner cap.

Implementation of this alternative is expected to satisfy air quality regulations because waste would be removed from the site and encapsulating the waste would stabilize the materials with respect to fugitive emissions.

OSHA requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase of the project.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, floodplains, and paleontological resources would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the benificiation and extraction of ores and are, therefore, assumed to be exempt from federal government regulation through RCRA as hazardous waste. In addition, revegetation requirements contained in the Surface Mining Control and Reclamation Act would be met. State of Montana dust suppression and control requirements are applicable for earth-moving activities associated with this alternative for the control of fugitive dust emissions; these requirements would be met through water application to roads receiving heavy vehicular traffic and to excavation areas, if necessary.

6.5.6.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of this alternative is dependent upon proper maintenance, including long-term monitoring and routine inspections, to ensure that the system performs as designed. Mine wastes would be capped at LP1 and the cap would be the component most vulnerable to any damage or degradation that might occur. Multilayered caps are susceptible to ponding of surface water, erosion, settlement, and disruption of the cover integrity by vehicles, deep-rooting vegetation, and burrowing animals. The actual design life of LP1 is not certain; however, since LP1 would be periodically inspected, the required maintenance could be determined and implemented. In addition, institutional controls would be required to prevent land uses incompatible with the reclaimed site. Specifically, land uses that would compromise the LP1 cap should be precluded.

In addition, revegetation of the excavated areas would stabilize the land surface by providing erosion protection from surface water and wind erosion, and would reduce net infiltration through the media by increasing the evapotranspiration process. Determining the proper grading layout for the area, selecting good quality soil cover, and selecting the appropriate plant species for revegetation would enhance the long-term effectiveness of this alternative. Long-term effectiveness would likely be improved by selecting metal tolerant plant species adapted to short growing seasons.

6.5.6.4 Reduction of Toxicity, Mobility or Volume through Treatment

The objective of this alternative is to provide a reduction in contaminant mobility although the waste is not treated. The volume or toxicity of the contaminants would not be physically reduced. Consolidating the mineral processing waste in with other mine waste at LP1 would eliminate the solid media from the source area and reduce contaminant mobility through surface water and wind erosion. The contaminated material in LP1 would be stabilized through the use of impermeable liners that encapsulate the mineral processing waste. The mobility of the contaminants would be reduced to an extent that would result in an overall risk reduction from all pathways and routes of exposure.

6.5.6.5 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. These potential short-term impacts would be mitigated during the construction phase. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur due to waste excavation, hauling, and relocation. Control of fugitive dust emissions would be provided by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. Short-term impacts to people residing or recreating in the vicinity of the site are expected to be minimal. A measurable short-term impact to the surrounding area would include increased vehicular traffic, particularly through the city of Helena and the town of Basin, associated safety hazards, and potential dust generation at the Spring Meadow Lake and Basin Creek Mine in association with construction. Some recreational and professional use of the Spring Meadow Lake would be interrupted or impacted during excavation and construction activities.

6.5.6.6 Implementability

This alternative is technically feasible, and could be implemented within one field season. The excavation of mineral processing waste and relocation in LP1 is considered a conventional construction practice; materials and construction methods are readily available. Also, design methods and requirements are well documented and understood.

Components or factors which could potentially prolong the implementation of this alternative as planned include: (1) locating adequate earthen borrow and coversoil (or suitable plant-growth media) sources; (2) controlling fugitive dust emissions and storm water discharge during reclamation activities; (3) addressing landowner concerns; and (4) addressing concerns involving regular recreational use. However, these concerns are applicable to other reclamation alternatives being considered for the site. An additional concern specifically related to this alternative would be scheduling excavation activities concurrent with the completion of other construction activities at LP1. Construction at LP1 is expected to be completed by the fall of 2006 and relocation after that time may not be possible.

6.5.6.7 Costs

The estimated total present worth cost for Alternative 5, excavation and relocation in LP1 at the Basin Creek Mine, is $1,359,671.39. Table 6-8 presents the itemized capital costs and operation and maintenance costs associated with implementing this alternative.

Conceptual Design Assumptions

The following assumptions were used to develop costs directly and to calculate associated costs for this alternative:

- Access roads through the site would be improved to allow unobstructed access for heavy equipment. Any temporary roads constructed at the site would be obliterated and reclaimed after the field activities were completed.

- Approximately 8 acres would be prepared as part of construction activities. Preparation would include grubbing and installation of stormwater controls. Existing trees along the edge of the east arm would be left in place. Waste would be excavated around trees in such a manner as to minimize damage to the roots.

TABLE 6-8
COST ESTIMATE
ALTERNATIVE 5
OFF-SITE RELOCATION AT BASIN CREEK MINE LEACH PAD 1
SPRING MEADOW LAKE SITE

Cost Item	**Quantity**	**Unit**	**Unit Cost (a)**	**Cost**
Capital Costs				
Mobilization, Bonding & Insurance	1	LS	$ 90,000.00	$ 90,000.00
Site Preparation and Storm Water Control	8	Acre	$ 1,000.00	$ 8,000.00
Road Improvement	1	Mile	$ 5,000.00	$ 5,000.00
Waste Excavation and Loading	34,300	CY	$ 2.00	$ 68,600.00
Waste Transportation to LP 1	34,300	CY	$ 20.00	$ 686,000.00
Offsite Soil Borrow	17,200	CY	$ 4.00	$ 68,800.00
Cover Soil	5,600	CY	$ 8.00	$ 44,800.00
Fertilize, Seed, and Mulch	8	Acre	$ 1,500.00	$ 12,000.00
Cleanup and Demobilization	1	LS	$ 10,000.00	$ 10,000.00
Subtotal Construction Costs				$ 993,200.00
Construction Contingencies	Percent of Construction Costs =		15%	$ 148,980.00
Engineering Design and Construction Oversight	Percent of Construction Costs =		15%	$ 148,980.00
TOTAL CAPITAL COSTS				$ 1,291,160.00
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	1	EA	$ 500.00	500.00
Site Maintenance	Percent of Construction Costs =		0.5%	$ 4,966.00
Subtotal O&M Costs				$ 5,466.00
O&M Contingencies			1%	$ 54.66
Total Yearly O&M Cost				$ 5,520.66
Present Worth of O&M Costs Based on 30 Year Life @ 7%		PW FACTOR =	12.41	$ 68,511.39
TOTAL PRESENT WORTH				**$ 1,359,671.39**

(a) Unit costs are based on recent bids for similar work at other Montana abandoned mine reclamation projects and professional judgment.

Notes:
LS = Lump Sum
CY = Cubic Yard
SY = Square Yard
LF = Lineal Feet
% = Percent
EA = Each
PW = Present Worth

- An estimated 34,300 cy (58,300 tons) of contaminated soil and mineral processing wastes would be excavated and hauled approximately 55 miles (one way) to LP1 via the town of Basin using highway haul trucks.

- Excavated areas at the East Arm area and Montana Wildlife Center (approximately 7 acres) would be backfilled with imported common borrow to approximately 50 percent of the total amount of removed material or 17,200 cy. Surfaces would be graded and blended to match existing contours and topography then covered with 6-inches of imported coversoil (5,600 cy). It is assumed that borrow soil and coversoil sources are located within a 5.0-mile radius of the site and would not require permitting.

- A total of 8 acres of disturbed ground, including excavated areas, staging areas and haul roads would be revegetated with plant species appropriate for the Spring Meadow Lake site.

6.5.7 Alternative 6: Excavation and Off-Site Disposal

Under this alternative, mineral processing wastes and contaminated soils at the Spring Meadow Lake site would be excavated and disposed of off-site at the city of Helena Landfill (Alternative 6a) or the Valley View Landfill near East Helena (Alternative 6b). The steps include the following: (1) improving access roads within the Spring Meadow Lake site; (2) excavating and hauling waste materials to the selected landfill; (3) backfilling, grading, and placing cover soil over the excavated areas; and (4) revegetating the disturbed areas at the site.

The disturbed areas would be prepared for revegetation, including the removal areas, staging areas and soil borrow areas. The excavated areas would be graded to match the contour of the land surface and, if necessary, cover soil would be applied to the disturbed areas.

Revegetation would likely take place during the fall of the year. The seed mixture and fertilizer would be simultaneously drilled into the prepared seed beds. Mulch would be applied to promote temporary protection of the disturbed erodible surfaces.

Heavy equipment would be required on site to implement this alternative efficiently. Multiple large-capacity haul trucks, bulldozers, front-end loaders, excavators, and compactors would be needed to excavate and haul the material.

Any saturated material excavated from Spring Meadow Lake would either be dried prior to being transported, or transported in covered trucks with lined, leak-proof beds.

6.5.7.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide a means of reducing or eliminating the threat of direct contact with the waste material as well as reducing the risk of airborne exposure and soil ingestion. In addition, removing the wastes from the site and isolating the waste in a landfill would provide environmental protection by limiting the infiltration of precipitation and surface water that may leach contaminants to the groundwater.

The threat of direct human exposure would essentially be eliminated by this alternative. The potential for ingestion, dermal contact, and inhalation of soil containing arsenic and lead would be eliminated over the long term. Risks would be reduced to acceptable levels for recreational land uses. Due to the risk analysis being based on recreational use and to ensure that human health standards are not exceeded, future use of the land should be restricted to recreational uses.

Protection of the environment would be achieved under this alternative. Ecological exposures through all scenarios including deer exposure to lead through ingestion of surface salts, and plant phytotoxicity would also be reduced to acceptable levels or possibly eliminated.

6.5.7.2 Compliance with ARARS

There are no federal or state contaminant-specific ARARs that are required to be met for excavating and disposing of contaminated mineral processing wastes in an approved off-site landfill. However, removal of the specified waste and disposal in an off-site facility is expected to satisfy federal and state surface water and groundwater standards including MCL and HHS. The contaminants would not be expected to leach to surface water or groundwater because the primary waste sources of concern would be removed from the site.

Implementation of this alternative is expected to satisfy air quality regulations because the waste would be removed from the site.

OSHA requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase of the project.

Location-specific ARARs are expected to be met without any conflicts. Contacts with appropriate agencies regarding wetlands, floodplains, and paleontological resources would be required.

All action-specific ARARs are anticipated to be met including the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. The mining wastes were derived from the beneficiation and extraction of ores and are, therefore, assumed to be exempt from federal government regulation through RCRA as hazardous waste. In addition, revegetation requirements contained in the Surface Mining Control and Reclamation Act would be met. State of Montana dust suppression and control requirements are applicable for earth-moving activities associated with this alternative for the control of fugitive dust emissions; these requirements would be met through water application to roads receiving heavy vehicular traffic and to excavation areas, if necessary.

6.5.7.3 Long-Term Effectiveness and Permanence

This alternative achieves long-term risk reduction by transporting the contaminated mineral processing wastes to facilities that specialize in treatment, storage and disposal of nonhazardous wastes. Once materials from the Spring Meadow Lake site have been transported to a landfill, they may commingle with foreign materials.

Revegetation of the excavated areas would stabilize the land surface by providing erosion protection from surface water and wind erosion, and would reduce net infiltration through the media by increasing the evapotranspiration process. Determining the proper grading layout for the area after removal, selecting good quality soil cover, and selecting the appropriate plant species for revegetation would enhance the long-term effectiveness of this alternative. Long-term effectiveness would likely be improved by selecting site-adapted perennial plant species adapted to short growing seasons.

6.5.7.4 Reduction of Toxicity, Mobility or Volume through Treatment

The objective of this alternative is to provide a reduction in contaminant mobility although the waste is not treated. The volume or toxicity of the contaminants would not be physically reduced. Placing the mineral processing waste in a landfill would eliminate the solid media from the source area and reduce contaminant mobility through surface water and wind erosion. The source area of the contaminants would be reduced to an extent that would result in an overall risk reduction from all pathways and routes of exposure.

6.5.7.5 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with removal would likely be short term and minimal. These potential short-term impacts would be mitigated during the removal phase. On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air and water quality impacts to the surrounding environment may occur due to waste excavation and regrading activities. Control of fugitive dust emissions would be accomplished by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable short-term impact to the surrounding area would include increased vehicular traffic, particularly through the city of Helena,, associated safety hazards, and potential dust generation in the vicinity of Spring Meadow Lake in association with construction. Activity associated with excavation is expected to impact use of the site as a recreational area. These impacts will be mitigated through the use of safety warnings and barriers and the use of water to control dust emissions.

6.5.7.6 Implementability

This alternative is technically feasible, and could be implemented within one field season. Excavation, transport, and disposal of contaminated soils are considered conventional construction practices; materials and construction methods are readily available. Excavation, transport, and disposal of materials are readily implementable and may be accomplished using local resources. Also, design methods and requirements are well documented and understood.

Components or factors which could potentially prolong the implementation of this alternative as planned include: (1) locating adequate earthen borrow and coversoil (or suitable plant-growth media) sources, (2) controlling fugitive dust emissions and storm water discharge during reclamation activities, (3) addressing landowner concerns, and (4) addressing concerns involving regular recreational use.

6.5.7.7 Costs

The estimated total present worth cost for Alternative 6, excavation and off-site disposal in a licensed landfill, is $2,324,448.92 (Alternative 6a) or $2,642,278.19 (Alternative 6b). Table 6-9 (Alternative 6a) and 6-10 (Alternative 6b) present the itemized capital costs and operation and maintenance costs associated with implementing this alternative.

TABLE 6-9
COST ESTIMATE
ALTERNATIVE 6a
OFF-SITE DISPOSAL AT THE CITY OF HELENA LANDFILL
SPRING MEADOW LAKE SITE

Cost Item	Quantity	Unit	Unit Cost (a)	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1	LS	$ 90,000.00	$ 90,000.00
Site Preparation and Storm Water Control	8	Acre	$ 1,000.00	$ 8,000.00
Road Improvement	1	Mile	$ 5,000.00	$ 5,000.00
Waste Excavation and Loading	34,300	CY	$ 2.00	$ 68,600.00
Waste Transportation to the City Landfill	34,300	CY	$ 8.05	$ 276,115.00
Landfill Tipping Fee	58,310	Ton	$ 19.00	$ 1,107,890.00
Offsite Soil Borrow	17,200	CY	$ 4.00	$ 68,800.00
Cover Soil	5,600	CY	$ 8.00	$ 44,800.00
Fertilize, Seed, and Mulch	8	Acre	$ 1,500.00	$ 12,000.00
Cleanup and Demobilization	1	LS	$ 20,000.00	$ 20,000.00
Subtotal Construction Costs				$ 1,701,205.00
Construction Contingencies	Percent of Construction Costs =		15%	$ 255,180.75
Engineering Design and Construction Oversight	Percent of Construction Costs =		15%	$ 255,180.75
TOTAL CAPITAL COSTS				$ 2,211,566.50
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	1	EA	$ 500.00	500.00
Site Maintenance	Percent of Construction Costs =		0.5%	$ 8,506.03
Subtotal O&M Costs				$ 9,006.03
O&M Contingencies			1%	$ 90.06
Total Yearly O&M Cost				$ 9,096.09
Present Worth of O&M Costs Based on 30 Year Life @ 7%		PW FACTOR =	12.41	$ 112,882.42
TOTAL PRESENT WORTH				**$ 2,324,448.92**

(a) Unit costs for disposal based on landfill quotes. Unit costs are based on recent bids for similar work at other Montana abandoned mine reclamation projects and professional judgment.

Notes:
LS = Lump Sum
CY = Cubic Yard
SY = Square Yard
LF = Lineal Feet
% = Percent
EA = Each
PW = Present Worth

TABLE 6-10
COST ESTIMATE
ALTERNATIVE 6b
OFF-SITE DISPOSAL AT VALLEY VIEW LANDFILL (EAST HELENA)
SPRING MEADOW LAKE SITE

Cost Item	Quantity	Unit	Unit Cost (a)	Cost
Capital Costs				
Mobilization, Bonding & Insurance	1	LS	$ 90,000.00	$ 90,000.00
Site Preparation and Storm Water Control	8	Acre	$ 1,000.00	$ 8,000.00
Road Improvement	1	Mile	$ 5,000.00	$ 5,000.00
Waste Excavation and Loading	34,300	CY	$ 2.00	$ 68,600.00
Waste Transportation to Valley View Landfill	34,300	CY	$ 8.05	$ 276,115.00
Landfill Tipping Fee	58,310	Ton	$ 23.00	$ 1,341,130.00
Offsite Soil Borrow	17,200	CY	$ 4.00	$ 68,800.00
Cover Soil	5,600	CY	$ 8.00	$ 44,800.00
Fertilize, Seed, and Mulch	8	Acre	$ 1,500.00	$ 12,000.00
Cleanup and Demobilization	1	LS	$ 20,000.00	$ 20,000.00
Subtotal Construction Costs				$ 1,934,445.00
Construction Contingencies	Percent of Construction Costs =		15%	$ 290,166.75
Engineering Design and Construction Oversight	Percent of Construction Costs =		15%	$ 290,166.75
TOTAL CAPITAL COSTS				$ 2,514,778.50
Yearly Operation and Maintenance (O&M) Costs				
Site Inspections	1	EA	$ 500.00	500.00
Site Maintenance	Percent of Construction Costs =		0.5%	$ 9,672.23
Subtotal O&M Costs				$ 10,172.23
O&M Contingencies			1%	$ 101.72
Total Yearly O&M Cost				$ 10,273.95
Present Worth of O&M Costs Based on 30 Year Life @ 7%		PW FACTOR =	12.41	$ 127,499.69
TOTAL PRESENT WORTH				**$ 2,642,278.19**

(a) Unit costs for disposal based on landfill quotes. Unit costs are based on recent bids for similar work at other Montana abandoned mine reclamation projects and professional judgment.

Notes:
LS = Lump Sum
CY = Cubic Yard
LF = Lineal Feet
% = Percent
EA = Each
PW = Present Worth

Conceptual Design Assumptions

The following assumptions were used to develop costs directly and to calculate associated costs for these alternatives:

- Access roads through the site would be improved to allow unobstructed access for heavy equipment. Any temporary roads constructed at the site would be obliterated and reclaimed after the field activities were completed.

- Approximately 8 acres would be prepared as part of construction activities. Preparation would include grubbing and installation of stormwater controls. Existing trees along the edge of the east arm would be left in place. Waste would be excavated around trees in such a manner as to minimize damage to the roots.

- An estimated 34,300 cy (58,300 tons) of contaminated soil and mineral processing wastes would be excavated and hauled approximately 13 miles (one way) to either the city of Helena Landfill (Alternative 6a), or the Valley View Landfill (Alternative 6b).

- Excavated areas at the East Arm and Montana Wildlife Center (approximately 7 acres) would be backfilled with imported common borrow to approximately 50 percent of the total amount of removed material or 17,200 cy. Surfaces would be graded and blended to match existing contours and topography then covered with 6-inches of imported coversoil (5,600 cy). It is assumed that borrow soil and coversoil sources are located within a 5.0-mile radius of the site and would not require permitting.

- A total of 8 acres of disturbed ground, including excavated areas, staging areas and haul roads would be revegetated with plant species appropriate for the Spring Meadow Lake site.

6.6 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares the reclamation alternatives retained for the Spring Meadow Lake site. The retained alternatives include: (1) Alternative 1 - No Action, (2) Alternative 2 - Institutional Controls, (3) Alternative 3 - Containment, (4) Alternative 4 - Excavation and On-Site Disposal in a Repository, (5) Alternative 5 - Excavation and Off-Site Relocation at Basin Creek Mine Leach Pad 1, and (6) Excavation and Off-site Disposal at a Solid Waste Landfill. The comparison focuses on the two threshold criteria (the relative protectiveness of human health and the environment and the estimated attainment of ARARs) and the primary balancing criteria. The following sections discuss the relative ability of each alternative to meet the threshold criteria.

6.6.1 Threshold Criteria

For the Spring Meadow Lake site, Alternatives 1, 2, 3, 4, 5, and 6 have all been retained. Baseline conditions at the site as represented by Alternative 1, the no action alternative, are not protective of human health and the environment. Alternative 2 would prevent land uses that result in exposures to site contaminants that lead to greater risk but would not reduce current risks and would still allow off-site migration of contaminants due to erosion. Therefore, Alternative 2 is not considered protective of human health and the environment.

Alternative 3 is considered protective of human health and the environment because installation of an earthen cap with liner/geocomposite layer would isolate contaminated mineral processing wastes from contact with potential receptors, and it would reduce the potential for dust inhalation and off-site exposure via erosion. Alternatives 4, 5, and 6 are considered protective of human health and the environment because wastes would be effectively isolated either on-site or off-site.

Alternatives 3, 4, 5 and 6 would comply with ARARs by isolating the contaminated materials from contact with potential receptors, reducing releases to surface water, and reducing the potential for leaching of metals into groundwater. Chemical-specific ARARs may not be met under Alternative 2 because releases of site contaminants would remain unchanged.

Alternatives 1 and 2 are the least expensive as they have no (Alternative 1) or minimal (Alternative 2) costs associated with implementation. Alternative 3 (consolidation and combined geomembrane and earthen cover) has an estimated cost of $820,991.97. Alternative 4 (on-site repository with geomembrane and earthen cap) has an estimated cost of $950,320.28. Alternative 5 (off-site relocation at Leach Pad 1) has an estimated cost of $1,359,671.39. Alternative 6a (off-site disposal at the city of Helena Landfill) and Alternative 6b (off-site disposal at the Valley View Landfill) have an estimated cost of $2,324,448.92 and $2,642,278.19 respectively. Table 6-11 summarizes the comparative analysis of these five alternatives.

TABLE 6-11
COMPARATIVE ANALYSIS OF ALTERNATIVES
SOLID MEDIA
SPRING MEADOW LAKE SITE

Assessment	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**	**Alternative 6**
Criteria	**No Action**	**Institutional Controls**	**Containment**	**Excavation and On-Site Disposal**	**Excavation and Off-Site Relocation at LP1**	**Excavation and Off-Site Disposal**
Overall Protectiveness						
Public Health, Safety, and Welfare	No reduction in risk.	Human exposures expected to be reduced but not eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.
Environmental Protectiveness	No protection offered.	Ecological exposures expected to be reduced but not eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.	Exposures expected to be eliminated.
Compliance with ARARs						
Chemical-Specific	Some surface water standards currently exceeded.	Chemical-specific ARARs may not be met.	Chemical-specific ARARs would be met over long-term.	Chemical-specific ARARs would be met.	Chemical-specific ARARs would be met.	Chemical-specific ARARs would be met.
Location-Specific	None apply.	Location-specific ARARs would be met.	Location-specific ARARs would be met.	Location-specific ARARs would be met.	Location-specific ARARs would be met.	Location-specific ARARs would be met.
Action-Specific	None apply.	Action-specific ARARs would be met.	Action-specific ARARs would be met.	Action-specific ARARs would be met.	Action-specific ARARs would be met.	Action-specific ARARs would be met.
Long-Term Effectiveness and Permanence						
Magnitude of Residual Risk	No reduction in COC levels in any environmental media.	No reduction in COC levels in any environmental media, except by natural attenuation..	Contaminated materials remain on site. Significant risk reduction and greater reduction than Alternative 2.	Contaminated materials remain on site. Marginal additional risk reduction over Alternative 3.	Contaminated materials removed from site. Marginal additional reduction of Alternative 4.	Contaminated materials removed from site. Risk reduction similar to Alternative 5.
Adequacy and Reliability of Controls	No controls over any on-site contamination, no reliability.	Reliability of fence depends upon long-term maintenance. Erosion could cause off-site migration of COCs.	Reliability of caps dependent, in part, upon long-term maintenance.	Reliability of caps dependent, in part, upon long-term maintenance. More reliability than Alternative 3.	Wastes removed from site. Minimal site maintenance required. Similar reliability as Alternative 4.	Wastes removed from site. Minimal site maintenance required. Similar reliability as Alternatives 4 and 5.

TABLE 6-11 (Continued)
COMPARATIVE ANALYSIS OF ALTERNATIVES
SOLID MEDIA
SPRING MEADOW LAKE SITE

Assessment	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**	**Alternative 6**
Criteria	**No Action**	**Institutional Controls**	**Containment**	**Excavation and On-Site Disposal**	**Excavation and Off-Site Relocation at LP1**	**Excavation and On-Site Disposal**
Reduction of Toxicity, Mobility, and Volume through Treatment						
Treatment Process Used and Materials Treated	None.	No treatment process.	No treatment process.	No treatment process.	No treatment process.	No treatment process.
Volume of Contaminated Materials Treated	None.	No treatment process.	No treatment process.	No treatment process.	No treatment process.	No treatment process.
Expected Degree of Reduction	None.	No treatment process.	No treatment process.	No treatment process.	No treatment process.	No treatment process.
Short-Term Effectiveness						
Protection of Community During Reclamation Action	Not applicable.	No site construction activities.	Fugitive emissions control may be required during construction.	Similar to Alternative 3.	More than Alternatives 3 and 4 due to significant truck hauling involved. Protection expected to be sufficient.	Similar to Alternative 5. Significant truck hauling involved. Protection expected to be sufficient.
Protection of On-Site Workers During Removal Action	Not applicable.	No site construction activities.	More construction hazards than Alternative 2. Protection expected to be sufficient.	Similar to Alternative 3.	More hazards than other alternatives due to significant truck hauling involved. Protection expected to be sufficient.	Similar to Alternative 5. Significant truck hauling involved. Protection expected to be sufficient.
Time Until Removal Action Objectives are Achieved	Not applicable.	One field season.	One field season.	One field season.	One field season.	One field season.

TABLE 6-11 (Continued)
COMPARATIVE ANALYSIS OF ALTERNATIVES
SOLID MEDIA
SPRING MEADOW LAKE SITE

Assessment Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Containment	Alternative 4 Excavation and On-Site Disposal	Alternative 5 Excavation and Off-site Relocation at LP1	Alternative 6 Excavation and Off-site Disposal
Implementability						
Ability to Construct and Operate	No construction or operation involved.	No difficulties anticipated.	Some difficulties expected with excavation in Spring Meadow Lake. Dewatering, surface water diversions possibly necessary.	Space available on site for repository. Otherwise similar to Alternative 3.	Sufficient repository space at the LP1 repository. Otherwise similar to Alternative 4.	Some difficulties expected with excavation in Spring Meadow Lake. Dewatering, surface water diversions possibly necessary.
Ease of Implementing More Action if Necessary	Does not inhibit other actions from taking place at the site.	Easily implemented, if determined to be necessary (waste removal, stabilization, armoring, or other methods)	Waste materials located under earthen caps (or earthen caps with liners) not readily accessed without destroying caps.	Waste materials located within repository not readily accessed without destroying cap and liner. Other site activities outside of repository easily implemented such as additional armoring/ stabilization, or other methods.	Similar to Alternative 4.	Easily implemented such as waste removal, stabilization, armoring, or other methods.
Availability of Services and Capacities	Not applicable.	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.
Availability of Equipment and Materials	Not applicable.	None Required	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.	Available locally and within the state.
Cost						
ESTIMATED TOTAL PRESENT WORTH COST	**$0.00**	**$11,267.05**	**$820,991. 97**	**$950,320.28**	**$1,359,671.39**	**$2,324,448.92 (6a)** **$2,642,278.19 (6b)**

6.6.2 Summary

Alternatives 4, 5, and 6 provide the greatest protection of human health and the environment, compliance with ARARs, long-term effectiveness, reduction in mobility, and short-term effectiveness. Implementability of Alternative 4 depends upon sufficient space being available at the Spring Meadow Lake site for construction of the proposed repository with a minimum capacity of 34,300 cy. Implementability of Alternative 5 also depends upon the availability of Leach Pad 1 at the Basin Creek Mine. Alternative 5 is about 43 percent more expensive than Alternative 4; most of this additional cost is associated with waste hauling. Alternative 6a is about 145 percent more expensive than Alternative 4 and 71 percent more expensive than Alternative 5. Alternative 6b is the most expensive alternative and is about 178 percent more expensive than Alternative 4 and 94 percent more expensive than Alternative 5. Most of the additional costs for Alternative 6 are associated with the landfill tipping fees.

Alternative 3 also provide protection of human health and the environment, compliance with ARARs, short-term effectiveness, and implementability. Long-term effectiveness of Alternative 3 is considered to be less than Alternatives 4, 5, and 6 because the waste is remains on site and does not have the additional containment afforded by a bottom liner. Alternative 3 is about 14 percent less costly than Alternative 4, about 40 percent less costly than Alternative 5, about 65 percent less costly than Alternative 6a, and about 69 percent less costly than Alternative 6b.

Alternative 2 would not provide overall protection of human health and the environment because off-site releases of contaminants through air, surface water, and groundwater would continue.

6.6.3 Preferred Reclamation Alternative

A preferred alternative will be selected after appropriate agencies have reviewed the presented alternatives and public feedback has been received and considered.

6.7 REFERENCE CITED

U.S. Environmental Protection Agency (EPA). 1988. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCA)." U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

APPENDIX 6-A

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

APPENDIX 6-A — FEDERAL ARARs
CONTENTS

1.0 INTRODUCTION

DEQ/MWCB has provided a document describing ARARs for reclamation of abandoned mine sites. The federal ARARs, advisories, and guidance for reclaiming the Spring Meadow Lake site are presented below.

2.0 FEDERAL CONTAMINANT-SPECIFIC ARARS

2.1 CLEAN AIR ACT (APPLICABLE)

Section 109 of the Clean Air Act (42 USC § 7409) and implementing regulations found in 40 CFR Part 50 set national primary and secondary ambient air quality standards. National primary ambient air quality standards define levels of air quality that are necessary, with an adequate margin of safety, to protect the public health. National secondary ambient air quality standards define levels of air quality that are necessary to protect public welfare from any known or anticipated adverse effects of a pollutant. The standards for particulate matter in 40 CFR § 50.6 are applicable for reclamation alternatives for the Spring Meadow Lake site, particularly for the excavation, earth moving, regrading, and potential transport of the fine-grained materials. These standards must be met both during the design and implementation phases of the reclamation activities.

<u>Particulate Matter</u>

The ambient air quality standard for particulate matter of less than or equal to 10 micrometers in diameter (PM-10) is 150 micrograms per cubic meter, 24-hour average concentration; 50 micrograms per cubic meter, annual arithmetic mean for particulate matter of less than or equal to 10 micrometers in diameter.

In addition, state law provides an ambient air quality standard for settled particulate matter. Particulate matter concentrations in the ambient air shall not exceed the 30-day average: 10 grams per square meter. Administrative Record of Montana (ARM) § 16.8.818 (applicable).

2.2 RESOURCE CONSERVATION AND RECOVERY ACT (APPLICABLE)

Under 40 CFR Part 261, Subpart D, defines the solid wastes (mining-related wastes) which are subject to regulations as hazardous wastes. This requirement is applicable to reclamation alternatives at the Spring Meadow Lake site that involve the treatment, storage, or disposal of hazardous wastes in a solid waste management unit (such as a surface impoundment, waste pile, land treatment unit, or landfill). The limits specified for groundwater protection are the same as the maximum contaminant levels (MCL) for those substances as defined in Section 2.4.

2.3 CLEAN WATER ACT (RELEVANT AND APPROPRIATE)

The Federal Clean Water Act (33 USC §§ 1387) as amended by the Water Quality Act of 1987 (Public Law 100-4 § 103) provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. EPA regulations require states to establish antidegradation requirements. EPA has provided guidance to the states for this purpose ("Water Quality Criteria Summary"; Quality Criteria for Water 1986 - Update 2 EPA; May 1, 1987).

At this time, EPA is relying on the State standards. EPA reserves the right to identify federal water quality criteria as ARARs for this action, if appropriate.

40 CFR Part 122 establishes the National Pollutant Discharge Elimination System (NPDES). The substantive requirements of general permits for storm water discharges from construction are relevant and appropriate. See 57 Fed. Reg. 41236, September 9, 1992. Montana has an EPF-approved State program (MPDES) that is discussed in the State ARARs section.

2.4 SAFE DRINKING WATER ACT (RELEVANT AND APPROPRIATE)

The Safe Drinking Water Act (SDWA) has established the maximum contaminant levels (MCL) for chemicals in drinking water distributed in public water systems. SDWA MCLs are not applicable to the reclamation activities at the site because the groundwater and surface water at the site are not a public water supply. The SDWA MCLs are relevant and appropriate at the Spring Meadow Lake site even though the groundwater and surface water are not currently part of a public water system. The Preamble to the National Oil and Hazardous Substance Contingency Plan (NCP) clearly states that the MCLs are relevant and appropriate for groundwater that is a current or potential source of drinking water (55 Fed. Reg. 8750 [March 8, 1990]) and is further supported by requirements of the NCP, 40 CFR § 300.430(e)(2)(i)(B). MCLs developed under the SDWA generally are ARARs for current or potential drinking water sources.

Standards for potential contaminants of concern at the Spring Meadow Lake site are:

Chemical	MCLs	Human Health Standards[a]
Antimony	6 (µg/L)	6 (µg/L)
Arsenic	10 (µg/L)	18 (µg/L)
Cadmium	5 (µg/L)	5 (µg/L)
Copper	1,300[b] (µg/L)	1,300 (µg/L)
Chromium (Total)	100 (µg/L)	100 (µg/L)
Cyanide	200 (µg/L)	200 (µg/L)
Lead	15[b] (µg/L)	15 (µg/L)
Mercury	2 (µg/L)	0.05 (µg/L)

Note:

a = DEQ Circular WQB-7 (January 2004)
b = Action level, not an MCL

The EPA has granted to the State of Montana primacy in the enforcement of the SDWA. Thus, the law commonly enforced in Montana is the state law. The state regulations substantially parallel the federal law.

3.0 FEDERAL LOCATION-SPECIFIC ARARS

3.1 NATIONAL HISTORIC PRESERVATION ACT (APPLICABLE)

This statute and implementing regulations (16 USC § 470, 36 CFR Part 800, 40 CFR 6.310[b]), require federal agencies or federal projects to take into account the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in, or eligible for, the Register of Historic Places. Compliance with this ARAR requires consultation with the State Historic Preservation Officer (SHPO), who can identify historic properties and assess whether proposed clean-up actions at the Spring Meadow Lake site will impact these resources.

3.2 ARCHEOLOGICAL AND HISTORICAL PRESERVATION ACT (APPLICABLE)

This statute and implementing regulations (16 USC § 469, 40 CFR § 6.301[c]) establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. This requires a survey of the site for covered scientific, prehistorical or archaeological artifacts. Preservation of appropriate data concerning the artifacts is hereby identified as an ARAR requirement, to be completed at the Spring Meadow Lake site during the implementation of the reclamation activities.

3.3 HISTORIC SITES, BUILDINGS AND ANTIQUITIES ACT (APPLICABLE)

This Act (16 USC §§ 461 et seq.; 40 CFR § 6.301[a]) states that "[i]n conducting an environmental review of a proposed EPA action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR § 62.6(d) to avoid undesirable impacts upon such landmarks." "National natural landmarks" are defined under 36 CFR § 62.2 as:

> Area(s) of national significance located within [the U.S.] that contain(s) an outstanding representative example(s) of the nation's natural heritage, including terrestrial communities, aquatic communities, landforms, geological features, habitats of natural plant and animal species, or fossil evidence of development of life on earth.

Under the Historic Sites Act of 1935, the Secretary of the Interior is authorized to designate areas as National Natural Landmarks for listing on the National Registry of Natural Landmarks. A survey has been conducted at the Spring Meadow Lake site in order to determine whether potential natural landmarks are present.

3.4 PROTECTION OF WETLANDS ORDER (APPLICABLE)

This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11990) mandates Federal agencies and the potentially responsible party (PRP) to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. For this project, jurisdictional wetland identification has not been performed; however, wetlands are not likely to exist on the Spring Meadow Lake site. Compliance with this ARAR requires consultation with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife

Service to determine the presence and extent of wetlands and to ascertain the means and measures necessary to mitigate, prevent, and compensate for project related losses of wetlands.

3.5 ENDANGERED SPECIES ACT (APPLICABLE)

This statute, and implementing regulations (16 USC §§ 1531-1543, 50 CFR § 402, and 40 CFR § 6.302[h]), require that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.

Compliance with this requirement involves consultation with the U.S. Fish and Wildlife Service, resulting in a determination as to whether there are listed or proposed species or critical habitats present at the Spring Meadow Lake site, and, if so, whether any proposed activities will impact such wildlife or habitat. At this time no threatened or endangered species or critical habitat has been identified on the site.

3.6 RESOURCE CONSERVATION AND RECOVERY ACT (APPLICABLE)

The requirements set forth at 40 CFR § 264.18(a) and (b) provide that: a) any hazardous waste facility must not be located within 61 meters (200 feet) of a fault; and b) any hazardous waste facility within the 100-year floodplain must be designed, constructed, operated, and maintained to avoid washout. Any discrete disposal or storage facilities, which remain on site as part of reclamation alternatives at the Spring Meadow Lake site must meet these standards.

4.0 FEDERAL ACTION-SPECIFIC ARARS

4.1 HAZARDOUS MATERIALS TRANSPORTATION ACT (APPLICABLE)

The Hazardous Materials Transportation Act (49 USC §§ 1801-1813), as implemented by the Hazardous Materials Regulations (49 CFR Parts 10, 171-177), regulates the transportation of hazardous materials. The regulations may be applicable to reclamation alternatives at the Spring Meadow Lake site, if non-exempt (Bevill) hazardous mining waste is transported off site, via public highways on site, or by rail.

4.2 RESOURCE CONSERVATION AND RECOVERY ACT

Criteria for Classification of Solid Waste Disposal Facilities Practices (Applicable)

The criteria contained in 40 CFR Part 257 (Subtitle D) are used in accordance with RCRA guidance in determining which practices pose a reasonable probability of having an adverse effect on human health or the environment. RCRA Subtitle D establishes criteria which are, for the most part, environmental performance standards that are used by states to identify unacceptable solid waste disposal practices or facilities.

Regulation 40 CFR Part 257.3-2 provides for the protection of threatened or endangered species.

Regulation 40 CFR Part 257.3-3 provides that the facility shall not cause the discharge of pollutants into waters of the United States; this includes dredged or fill materials.

Regulation 40 CFR Part 257.3-4 states that a facility or practice shall not contaminate underground drinking water beyond the solid waste boundary.

Standards Applicable to Transporters of Hazardous Waste (Applicable)

The regulations in 40 CFR Part 263 establish standards that apply to persons that transport hazardous waste within the U.S. If any hazardous waste is transported from the Spring Meadow Lake site via rail-line or public highway, these regulations will be applicable.

Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (Applicable)

The regulations in 40 CFR Part 264 establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste. These standards could be applicable to reclamation alternatives at the Spring Meadow Lake site that incorporate the treatment, storage or disposal of hazardous waste on site.

A. Releases from Solid Waste Management Units

The regulations in 40 CFR 264, Subpart F, establish requirements for groundwater protection for RCRA-regulated solid waste management units (such as waste piles, land treatment units, and landfills). Subpart F provides for three general types of groundwater monitoring: detection monitoring, compliance monitoring, and corrective action monitoring. Monitoring is required during the active life of a hazardous waste management unit.

B. Closure and Post-Closure

40 CFR Part 264, Subpart G, establishes that hazardous waste management facilities must be closed in such a manner as to: a) minimize the need for further maintenance; and b) control, minimize or eliminate, to the extent necessary, to protect public health and the environment, post-closure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.

C. Waste Piles

Regulation 40 CFR Part 264, Subpart L, applies to owners and operators of facilities that store or treat hazardous waste in piles.

D. Land Treatment

The requirements of 40 CFR Part 264, Subpart M, regulate the management of "land treatment units" that treat or dispose of hazardous waste; these requirements would be relevant and appropriate for any land treatment units established at the site.

E. Landfills

Regulation 40 CFR Part 264, Subpart N, applies to entities that dispose of hazardous waste in landfills. The regulations specify appropriate liner systems and leachate collection systems for landfills, run-on and run-off management systems, and wind dispersal controls for landfills. These regulations set forth specific requirements for landfill monitoring and inspection, surveying and recordkeeping, and closure and post-closure care.

4.3 CLEAN WATER ACT (RELEVANT AND APPROPRIATE)

33 USC 1251 Section 404 establishes requirements to regulate the discharge of dredged and fill materials into waters of the United States. The substantive requirements of general permits or individual permits for construction activities that may compromise water quality are relevant and appropriate.

40 CFR Part 122 establishes the NPDES. The substantive requirements of general permits for storm water discharges from construction are relevant and appropriate. See 57 Fed. Reg. 41236, September 9, 1992. Montana has an EPA-approved State MPDES that is discussed in the State ARARs section.

4.4 SURFACE MINING CONTROL AND RECLAMATION ACT (RELEVANT AND APPROPRIATE)

This Act (30 USC §§ 1201-1326) and implementing regulations found at 30 CFR Parts 816 and 784 establish provisions designed to protect the environment from the effects of surface coal mining operations, and to a lesser extent, non-coal mining. These regulations require that revegetation be used to stabilize soil covers over reclaimed areas. The reclamation performance standards are relevant and appropriate to reclaimed mine sites.

APPENDIX 6-B

STATE OF MONTANA APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

APPENDIX 6-B — STATE ARARS
CONTENTS

1.0 INTRODUCTION

DEQ/MWCB has provided a draft document describing ARARs for abandoned mine sites. State of Montana ARARs specific to the Spring Meadow Lake site are presented below.

2.0 MONTANA CONTAMINANT-SPECIFIC ARARS

2.1 MONTANA WATER QUALITY ACT (APPLICABLE)

Under the state Water Quality Act, §§ 75-5-101 et seq., MCA, and ARM 17.30.601 et seq., the legislature has promulgated regulations to preserve and protect the quality of surface waters in the state. These regulations classify state waters according to quality, place restrictions on the discharge of pollutants to state waters, and prohibit the degradation of state waters. The requirements listed below are applicable water quality standards with which any reclamation activity must comply.

<u>Surface Water Quality Standards and Procedures (Applicable)</u>

ARM 17.30.637 (Applicable), which prohibits discharges containing substances that will:

(a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;

(b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;

(c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;

(d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life;

(e) create conditions which produce undesirable aquatic life.

ARM 17.30.637 also provides that leaching pads, tailing ponds, or water, waste, or product holding facilities must be located, constructed, operated and maintained to prevent any discharge, seepage, drainage, infiltration, or flow which may result in pollution of state waters, and a monitoring system may be required to ensure such compliance. No pollutants may be discharged and no activities may be conducted which, either alone or in combination with other wastes or activities, result in the total dissolved gas pressure relative to the water surface exceeding 110 percent of saturation.

Reclamation alternatives for the Spring Meadow Lake site should be evaluated with respect to the "prohibitions" set out in 17.30.637.

Montana Groundwater Pollution Control System (Applicable)

ARM 17.30.1006 (Applicable) classifies groundwater into Classes I through IV based upon its specific conductance and establishes the groundwater quality standards applicable with respect to each groundwater Classification.

If determined to be Classes I through III groundwater based on its specific conductance, the groundwater at the site must meet the beneficial uses and standards for that class. Concentrations of substances in groundwater within these classes may not exceed the human health standards for groundwater listed in department Circular WQB-7. In addition, no increase of a parameter may cause a violation of § 75-5-303 MCA, (nondegradation). For concentrations of parameters for which human health standards are not listed in WQB-7, ARM 17.30.1006 allows no increase of a parameter to a level that renders the waters harmful, detrimental or injurious to the beneficial uses listed for that class of water. For standards for Class IV groundwater, see ARM 17.30.1006.

ARM 17.30.1011 (Applicable) provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless the requirements of 75-5-303(3) MCA are met.

2.2 CLEAN AIR ACT (APPLICABLE)

Air quality regulations pursuant to the Act, §§ 75-2-101 et seq., MCA, are discussed below.

ARM 17.8.206 (Applicable) establishes sampling, data collection, recording, analysis, and transmittal requirements to ensure compliance with ambient air quality standards.

ARM 17.8.220 (Applicable) specifies that no person shall cause or contribute to concentrations of particulate matter in the ambient air such that the mass of settled particulate matter exceeds the following 30-day average: 10 grams per square meter, 30-day average, not to be exceeded.

ARM 17.8.222 (Applicable) specifies that no person shall cause or contribute to concentrations of lead in the ambient air which exceed the following: 90-day average–1.5 micrograms per cubic meter of air, 90-day average, not to be exceeded.

ARM 17.8.223 (Applicable) specifies that no person may cause or contribute to concentrations of PM-10 in the ambient air which exceed the following standard:

1. 24-hour average: 150 micrograms per cubic meter of air 24 hour average, with no more than 1 exceedence per year expected.

2. Annual average: 50 micrograms per cubic meter of air, expected annual average, not to be exceeded.

ARM 17.8.210-214 (Applicable) describes ambient air standards that are promulgated for carbon monoxide, hydrogen sulfide, nitrogen dioxide, sulfur dioxide, and ozone. If emissions of these compounds were to occur at the site in connection with any response action, these standards would be applicable.

3.0 MONTANA LOCATION-SPECIFIC ARARS

3.1 ENDANGERED SPECIES ACT (APPLICABLE)

Sections 87-5-106, 107, 111, and 201, MCA describe nongame wildlife in need of management that should be protected in order to maintain and, to the extent possible, enhance their numbers. These sections identify prohibited acts, and penalties.

ARM 12.5.201 (Applicable) lists specified endangered species.

3.2 FLOODPLAIN AND FLOODWAY MANAGEMENT ACT (RELEVANT AND APPROPRIATE)

Section 76-5-401, MCA, and ARM 36.15.601, 602, 603, and 604 (Relevant and Appropriate) specifies types of uses and structures that are allowed without permits, allowed with permits, or prohibited in the designated 100-year floodway and floodplain. Uses prohibited anywhere in either the floodway or the floodplain include, but are not limited to: (1) solid and hazardous waste disposal; and (2) storage of toxic, flammable, hazardous, or explosive materials.

Section 76-5-402, MCA, (Relevant and Appropriate) specifies factors that must be considered in allowing diversions of the stream, changes in place of diversion of the stream, flood control works, new construction or alteration of artificial obstructions, or any other nonconforming use within the floodplain or floodway.

Floodplain Management Regulations (Relevant and Appropriate)

ARM 36.15.605, 36.15.703, and 36.15.602(5)(b) (Relevant and Appropriate) effectively prohibit the placement of mine waste repositories within the 100-year floodplain and require that mine wastes be stockpiled outside the floodway. In the floodway, additional provisions apply, including prohibition of: (1) a building for living purposes or place of assembly or permanent use by human beings; (2) any structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway; and (3) the construction or permanent storage of an object subject to flotation or movement during flood level periods.

For the substantive conditions and restrictions applicable to specific obstructions or uses, see the following applicable regulations:

- Excavation of material from pits or pools – ARM 36.15.602(1)
- Water diversions or changes in place of diversion – ARM 36.15.603
- Flood control works (levees, floodwalls, and riprap must comply with specified safety standards) – ARM 36.15.606
- Road, streets, highways and rail lines (must be designed to minimize increases in flood heights) – ARM 36.15.701(3)(c).
- Structures and facilities for liquid or solid waste treatment and disposal (must be floodproofed to ensure that no pollutants enter flood waters and must be allowed and approved only in accordance with DEQ regulations. ARM 36.15.701(3)(d).
- Residential structures – ARM 36.15.702(1)
- Commercial or industrial structures – ARM 36.15.702(2)

3.3 SOLID WASTE MANAGEMENT ACT (APPLICABLE)

Several regulations promulgated under the Solid Waste Management Act, §§ 75-10-201 et seq., MCA, specify requirements that apply to location of any solid waste management facility.

Solid Waste Management Regulations (Applicable)

ARM 17.50.505 (Applicable) provides that a facility for the treatment, storage or disposal of solid wastes: (1) must be located where sufficient acreage of suitable land is available for solid waste management; (2) may not be located in a 100-year floodplain; (3) may be located only in areas which will prevent the pollution of ground and surface waters and public and private water supply systems; (4) must be located to allow for reclamation and reuse of the land; (5) drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas; and (6) where underlying geological formations contain rock fractures or fissures which may lead to pollution of the ground water or areas in which springs exist that are hydraulically connect to a proposed disposal facility, only Class III disposal facilities (those containing completely inert wastes) may be approved.

4.0 MONTANA ACTION-SPECIFIC ARARS

4.1 GROUNDWATER ACT (APPLICABLE)

Section 85-2-505, MCA prohibits the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

Section 85-2-516, MCA states that within 60 days after any well is completed, a well log report must be filed by the driller with the Bureau of Mines and Geology.

ARM 17.30.641 (Applicable) provides methods for sampling and analysis of water to determine quality.

ARM 17.30.646 (Applicable) requires that bioassay tolerance concentrations be determined in a manner specified in the regulation.

ARM 36.21.670-678 and 810 (applicable) specifies requirements for abandoning groundwater monitoring wells.

4.2 WATER QUALITY ACT (APPLICABLE)

Section 75-5-605, MCA, makes it unlawful to cause pollution of any State waters or to place or cause to be placed any wastes in a location where they are likely to cause pollution of any State waters.

Montana Pollutant Discharge Elimination System (MPDES) (Applicable)

The MPDES standards are set out in 17.30.1201, et seq.

ARM 17.30.1203 (Applicable) adopts and incorporates the provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements in MPDES permits. Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, that is, for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case-by-case basis using best professional judgment (BPJ). See CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7.

ARM 17.30.1342-1344 (Applicable) Sets the substantive requirements for all MPDES and NPDES permits, including the requirement to properly operate and maintain all facilities and systems of treatment and control.

Nondegradation of Water Quality (Applicable)

The Water Quality Act and regulations also include nondegradation provisions which require that waters which are of higher quality than the applicable classification be maintained at that high quality, and discharges which would degrade that water are prohibited. Montana's standard for nondegradation of water quality is applicable for all constituents for which pertinent portions of affected surface waters are of higher quality than the I classification. If any reclamation activity constitutes a new source of pollution or an increased source of pollution, the nondegradation standard requires the degree of waste treatment necessary to maintain the existing water quality for constituents that are of higher quality than the applicable classification.

ARM 17.30.705 (Applicable) applies nondegradation requirements to any activity of man which would cause a new or increased source of pollution to state waters. This section indicates when exceptions to nondegradation requirements apply, except that in no event may such degradation affect public health, recreation, safety, welfare, livestock, wild birds, fish and other wildlife or other beneficial uses.

ARM 17.30.1011 (Applicable) provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless degradation is allowed under ARM 17.30.701 et. seq.

Storm Water Runoff (Applicable)

ARM 17.30.1341(i) (Applicable) requires a Storm Water Discharge General Permit for storm water point sources. Generally, the permits require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health and the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, additional protection may be required.

ARM 17.24.633 (Applicable) states that all surface drainage from a disturbed area must be treated by the best technology currently available..

4.3 HAZARDOUS WASTE MANAGEMENT ACT (APPLICABLE)

Section 75-10-401, MCA, et seq. and ARM Title 17, Chapter 54 establishes requirements for the generation, transportation, treatment, storage, and disposal of hazardous wastes.

4.4 SOLID WASTE MANAGEMENT ACT (APPLICABLE OR RELEVANT AND APPROPRIATE)

Several regulations promulgated under the Solid Waste Management Act, §§ 75-10-201 et seq., MCA, are discussed in the federal section of ARARs, because the state implements that federal program.

Solid Waste Management Regulations (Applicable)

ARM 17.50.505 (Applicable) sets forth standards that all solid waste disposal sites must meet.

ARM 16.14.506 (Applicable) specifies design requirements for landfills.

ARM 17.50.511 (Applicable) set forth the general and specific operation and maintenance and design requirements for solid waste management systems.

ARM 17.50.523 (Applicable) specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.

ARM 17.50.530 (Applicable) sets forth the closure requirements for landfills.

ARM 17.50.531 (Applicable) sets forth post closure care requirements for Class II landfills.

Section 75-10-206, MCA allows variances to be granted from certain solid waste regulations if failure to comply with the rules does not result in danger to public health and safety or compliance with specific rules would produce hardship without producing benefits to the health and safety of the public that outweigh the hardship.

4.5 MONTANA STRIP AND UNDERGROUND MINE RECLAMATION ACT, MONTANA METAL MINING ACT, AND MONTANA METAL MINE RECLAMATION ACT (RELEVANT AND APPROPRIATE)

The Spring Meadow Lake site is a foundry/mill site. Regulations promulgated under Montana's Strip and Underground Mine Reclamation Act, §§ 82-4-201 et seq., MCA, Metal Mining Act, §§ 82-4-301 et seq., and Metal Mine Reclamation Act, §§ 82-4-336 provide detailed guidelines for addressing the impacts of mine reclamation activities and earth moving projects and may be relevant and appropriate for addressing these impacts in MWCB reclamation projects.

- §§ 82-4-231, MCA - Requires operators to reclaim and revegetate affected lands. Operators must grade, backfill, topsoil, reduce high walls, stabilize subsidence, control water, and minimize erosion, subsidence, landslides, and water pollution.

- §§ 82-4-233, MCA - Operators must plant vegetation that will yield a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of self-generation..

- ARM 17.24.501(3)(a) and (b) and (4) - Backfill must be placed so as to minimize sedimentation, erosion, and leaching of acid or toxic materials into waters as, approved by DEQ.

- ARM 17.24.519 - Regraded areas may be monitored for settling. Results may be used to alter reclamation techniques

- ARM 17.24.631(1), (2), (3)(a), and (b) - Disturbances to the prevailing hydrologic balance will be minimized. Changes in water quality and quantity, in the depth to groundwater and in the location of surface water drainage channels will be minimized. Pollution minimization and prevention measures must be used including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.

- ARM 17.24.633 - Surface drainage from a disturbed area must be treated by the best technology currently available (BCTA), before leaving the permit area.

- ARM 17.24.634 - Disturbed drainage basins will be constructed in conformity with the requirements set out in the regulations.

- ARM 17.24.635-637 - Sets forth requirements for permanent diversions.

- ARM 17.24.638 - Sediment control measures must designed, constructed and maintained as set out in this regulation.

- ARM 17.24.639 - Sets forth location requirements for construction and maintenance of sedimentation ponds.

- ARM 17.24.640 - Discharges from sedimentation ponds, diversions, and impoundments must be controlled to reduce erosion and enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

- ARM 17.24.641 – Sets out practices required to prevent drainage of acid or toxic forming spoil material into ground and surface water.

- ARM 17.24.643-646 - Establishes provisions for surface water monitoring.

- ARM 17.24.701-703 – Establishes requirements for removal, redistributing, handling and stockpiling of soil for reclamation.

- ARM 17.24.711 - Requires that a diverse, effective and permanent vegetative cover of the same seasonal variety and utility as the vegetation native to the area of land to be affected must be established.

- ARM 17.24.713 - Seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed preparation.

- ARM 17.24.714 – Practices such as mulch and cover crop must be used until adequate permanent cover can be established.

- ARM 17.24.716 - Methods of revegetation must be approved by DEQ.

- ARM 17.24.717 - The planting of trees or shrubs must be approved by DEQ.

- ARM 17.24.718 - Soil amendments must be used as necessary to establish a permanent vegetative cover.
- ARM 17.24.721 - Specifies conditions under which rills or gullies must be stabilized.
- ARM 17.24.723 - States that operators shall conduct periodic monitoring of vegetation, soils, and wildlife to demonstrate compliance.
- ARM 17.24.724 - Specifies that revegetation success must be measured by comparison with approved unmined reference areas or technical standards.
- ARM 17.24.726 - Sets the required methods for measuring and evaluating vegetation data.
- ARM 17.24.731 - Provides that for the revegetated area and the reference area the DEQ may require comparative chemical analyses.
- ARM 17.24.751 – Establishes requirement to prevent jeopardy of threatened or endangered species and establishes requirements regarding powerlines, roads, and structures for protection of wildlife.
- ARM 17.24.761 - Specifies fugitive dust control measures which will be employed during excavation and construction activities to minimize the emission of fugitive dust.

4.6 CLEAN AIR ACT (APPLICABLE)

Air Quality Regulations (Applicable)

Dust suppression and other similar actions may be necessary to control the release of substances into the air as a result of excavation, earth moving, regrading, and potential transport of mine wastes both off- and on-site. The ambient air standards for specific contaminants and for particulates are set forth in the federal contaminant-specific section above. The levels of certain substances that may not be exceeded are identified in the Air Quality section of the contaminant-specific state ARARs. Additional air quality regulations under the state Clean Air Act, §§ 75-2-101 et seq., MCA, are discussed below.

ARM 17.8.304 (2) (Applicable) specifies that visible air contaminant emissions into the outdoor atmosphere from a source installed before 12/23/68 shall not exhibit an opacity of 40 percent or greater averaged over six consecutive minutes.

ARM 17.8.308(4) (Applicable) requires that any new source of airborne particulate matter that has the potential to emit less than 100 tons per year of particulates shall apply best available control technology

(BACT); any new source of airborne particulate matter that has the potential to emit more than 100 tons per year of particulates shall apply lowest achievable emission rate (LAER).

ARM 17.8.308 (2), (3), (Applicable) specifies that there shall be no production, handling, transportation, or storage of any material, used on any street, road, parking lot, or operation of a construction site or demolition project unless reasonable precautions are taken to control emissions of airborne particles. Emissions shall not exhibit an opacity exceeding 20 percent or greater averaged over six consecutive minutes.

ARM 17.8.604 (Applicable) lists certain wastes that may not be disposed of by open burning.

ARM 17.24.761(2)(a), (e), (h), (j), and (k) (Applicable) requires that fugitive dust control measures be employed in reclamation operations.

4.7 NOXIOUS WEEDS (APPLICABLE)

Section 7-22-2101(7)(a), MCA defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (i) as a statewide noxious weed by rule of the department; or (ii) as a district noxious weed by a board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM 4.5.201 through 204 and must be managed consistent with noxious weed management criteria developed under § 7-22-2109(2)(b), MCA.

5.0 OTHER MONTANA LAWS

The following laws may apply to actions being conducted at the Spring Meadow Lake site. While not an exhaustive list, they are included because they identify related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ARARs because they are not "environmental or facility siting laws." As applicable laws other than ARARs, they are not subject to ARAR waiver provisions.

The administrative/substantive distinction used in identifying ARARs applies only to ARARs and not to other applicable laws. Thus, even the administrative requirements (for example, notice requirements) of these laws must be complied with in this action. Similarly, fees that are based on something other than issuance of a permit are applicable.

5.1 MONTANA SAFETY ACT (APPLICABLE)

Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

5.2 EMPLOYEE AND COMMUNITY HAZARDOUS CHEMICAL INFORMATION ACT (APPLICABLE)

Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

5.3 WATER RIGHTS

Section 85-2-101, MCA, declares that all waters within the State are the State's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with when using or affecting waters of the state. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, of Montana law provides that a person may only appropriate water for a beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefore except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation.

Section 85-2-311, MCA, specifies the criteria which must be met in order to appropriate water.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

5.4 GROUNDWATER ACT

Section 85-2-516, MCA, states that within 60 days after any well is completed a well log report must be filed by the driller with the Bureau of Mines and Geology.

5.5 WATER WELL CONTRACTORS

37-43-301, MCA provides that any person who drills or otherwise constructs water wells must have a state licensed water well contractor in charge of construction.

ARM 36.21.403, 36.21.405, 36.21.406 and 36.21.411 provide requirements for water well contractors, contents of a water well contractor's license, and bonding requirements for water well contractors.

5.6 CONSTRUCTION STANDARDS

ARM 36.21.601 through 36.21.680 set forth water well construction standards.

5.7 OCCUPATIONAL HEALTH ACT OF MONTANA

The Occupational Health Act, §§ 50-70-101, MCA, are applicable protections for employees working at abandoned mine sites.

ARM § 16.42.102 establishes maximum threshold limit values for air contaminants for categories of workers.