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Explanation of Significant Differences:

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EXPLANATION OF SIGNIFICANT DIFFERENCES

STREAMSIDE TAILINGS OPERABLE UNIT
SILVER BOW CREEK/BUTTE AREA
(Original Portion)
NATIONAL PRIORITIES LIST SITE

SILVER BOW AND DEER LODGE COUNTIES
MONTANA

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INTRODUCTION

This document presents an explanation of significant differences from the Record of Decision (ROD) for the Streamside Tailings Operable Unit (SSTOU) of the Silver Bow Creek/Butte Area National Priorities List (NPL) Site. The ROD for this site was prepared in 1995 by the Montana Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA) (DEQ & EPA, 1995). A cooperative agreement between EPA and DEQ designates DEQ as the lead agency for Remedial Design.

Since the ROD was issued in November 1995, the principal potentially responsible party, the Atlantic Richfield Company (ARCO) prepared a work plan for remedial design (RD) (ARCO, 1997a) and submitted preliminary and intermediate design documents to the agencies (ARCO, 1997b and 1997c). Following ARCO's April 1997 refusal to continue work on the SSTOU RD, DEQ prepared the preliminary final design report, which will guide construction for Reach A, the first mile of the operable unit (Maxim et al, 1998). In the course of preparing the SSTOU design, DEQ and EPA reevaluated certain elements of the remedy as described in the ROD in light of new site information developed in the design process. For example, the estimated volume of materials that would be remediated, the cost of the remedy, and some aspects of the technical approach to remediation were reevaluated during design. These modifications identified during design represent changes in the scope and cost of the SSTOU remedy, but they do not change the fundamental approach to remediation of this operable unit. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, provides for public disclosure of the reasons for significant differences through this document. The pertinent section of CERCLA, º117(c), requires that the lead agency address post-ROD significant changes in the following instances:

> After adoption of a final remedial action plan (1) if any remedial action is taken [under sections 104 or 120], (2) if any enforcement action under section 106 is taken, or (3) if any settlement or consent decree under section 106 or section 122 is entered into, and if such action, settlement or decree differs in any significant respects from the final plan [ROD] the [lead agency] shall publish an explanation of the significant differences and the reasons such changes were made.

Interim Final Guidance on Preparing Superfund Decision Documents (EPA, 1989) clarifies the definition of "significant differences." Changes that significantly alter the scope, performance, or cost of a component of the remedy, without fundamentally changing the overall approach of the remedy as presented in the ROD, should be addressed in an explanation of significant differences (ESD). Certain of the differences below, such as the volume and cost estimates, clearly represent changes requiring an ESD, although none of them fundamentally changes the selected remedy described in the ROD. Some of the differences described below could be viewed as development of the detailed design of the selected remedy rather than changes. However, the agencies include them in this ESD to clarify the remedy as designed and to explain the basis for these important design elements.

DEQ and EPA have identified nine significant differences from the remedy described in the ROD. These differences, developed during detailed design of Reach A (the uppermost mile of the operable unit), also apply to the design and implementation of the remedy in the remainder of the SSTOU. The significant differences discussed in this ESD are the following:

1. An increase in the volume of tailings/impacted soil in the operable unit;

2. Modifications to the alignment of Silver Bow Creek and the channel profile (i.e., elevation profile);

3. Use of a temporary stream diversion during and after construction to facilitate dewatering and excavation of near-stream tailings and to enhance floodplain and streambank revegetation efforts.

4. Changes in the criteria for in-stream sediment removal as a result of other design changes;

5. Modifications to the mine waste relocation repository (MWRR) design;

6. The inclusion of sediment basins to contain contaminated overland flow run-on from off-site mine waste sources;

7. Elimination of treatment wetlands as the end land use in Subarea 1:

8. Changes in the estimated schedule to implement the SSTOU remedy; and

9. An increase in the estimated cost of the SSTOU remedy.

This ESD will be placed in the administrative record for the SSTOU. The administrative record for the SSTOU is maintained at the U.S. EPA Montana State Office, Federal Building, 301 South Park, Helena, Montana. Office hours are 8:00 to 5:00 on federal business days. The ESD will also be placed in all information repositories for the SSTOU.

SITE DESCRIPTION

The SSTOU is one of several operable units that make up the Silver Bow Creek/Butte Area NPL Site. The SSTOU comprises the geographic area of contamination along and in Silver Bow Creek between the western end of the Colorado Tailings area and the point at which Silver Bow Creek enters the Warm Springs Ponds, extending for approximately 24 river miles. As defined in the ROD, it includes the extent of fluvially deposited tailings along Silver Bow Creek, the adjacent railroad beds, which are contaminated with mine waste, and all areas in close proximity which are necessary for remedy implementation. It expressly excludes the Rocker OU.

SITE HISTORY

The principal contaminants of concern at the SSTOU are arsenic, cadmium, copper, lead, mercury, and zinc. These contaminants are present in five major media at the site: tailings/impacted soils, in-stream sediments, railroad materials, groundwater, and surface water. Tailings and other mining wastes were deposited in and along Silver Bow Creek by historic mining and milling operations and redistributed in the floodplain by occasional flooding, precipitation, snow melt, and ice jam events that have occurred since the 1870s when mining and milling commenced in the Butte/Anaconda area. Entrainment of tailings in runoff and metal loads present in groundwater and surface water further contributed to contamination of in-stream sediments. Portions of the three railroad embankments within the operable unit were constructed with mine wastes and other contaminated materials which impact the stream and the floodplain. In addition, concentrate shipped in rail cars has spilled and further contaminated the railroad beds.

EPA listed the Silver Bow Creek/Butte Area Site (original portion) on the NPL in 1983, Site investigations began in 1984. The Phase I Remedial Investigation (RI) for the entire site was conducted by DEQ, with supplemental investigations by EPA. That work was followed by a Phase II RI investigation of the SSTOU conducted by ARCO. The draft SSTOU RI report (ARCO, 1995a) defined the nature and extent of contamination to the extent necessary to identify remedial alternatives and provide information to complete the baseline human health and ecological risk assessments. The SSTOU feasibility study (FS). published by ARCO in June 1995, described the development, screening and evaluation of potential remedial alternatives (ARCO, 1995b).

EPA and DEQ issued a Proposed Plan identifying the preferred remedy for the SSTOU in June 1995. Later in 1995, the agencies modified the preferred remedy in response to public comment and issued a Record of Decision (DEQ and EPA, November 1995) identifying the selected remedy for the SSTOU. In March 1996, EPA issued a Unilateral Administrative Order (UAO) to ARCO for remedial design and remedial action, including operation and maintenance. Under the UAO, ARCO submitted draft of a Preliminary Design Report (ARCO, 1997b) and an Intermediate Design Report (ARCO, 1997c) for Subarea 1. In April 1997, ARCO stopped work on the remedial design at the site. The agencies are now completing the remedial design for the SSTOU.

SUMMARY OF SSTOU SITE RISKS

Human health and ecological risks at the SSTOU are evaluated and presented in the Draft Baseline Risk Assessment (CDM, 1994).

Human Health Risks

The SSTOU Baseline Human Health Risk Assessment evaluated three exposure scenarios to determine the health risks related to OU use by residents, workers (occupational), and recreationists. Both existing and reasonably anticipated future exposure scenarios were evaluated. Risks were divided into those that may cause cancer and those that cause adverse health effects other than cancer (non-carcinogenic risks). The primary carcinogenic risk to people living in or near the SSTOU comes entirely from potential exposure to arsenic in soil and groundwater. Elevated concentrations of arsenic can be found in tailings areas such as the Ramsay Flats and in near-stream, upper alluvial (less than 20-feet below ground surface) groundwater. Noncarcinogenic risks exceeded acceptable levels for arsenic in soils under the residential exposure scenario. As with the carcinogenic risks, the noncarcinogenic risks vary depending on the amount of contamination a person contacts. Noncarcinogenic risks related to arsenic, cadmium, copper and zinc in groundwater were found only in near-stream, upper alluvial groundwater within and directly adjacent to the floodplain. The risks posed by lead contamination in soil are generally within the acceptable range based on the risk model used in Butte.

Ecological Risks

In Silver Bow Creek, the presence of mine waste contamination is the primary factor limiting the health of the aquatic environment. Those contaminants affect both the water quality and in-stream sediments in Silver Bow Creek and create a toxic environment for fish and most benthic macroinvertebrates. The creek is devoid of fish and has severely impacted populations of most other aquatic life forms. Concentrations of metals in surface water and sediments are well in excess of ecological effects concentrations for those parameters. The risk assessment also evaluated other physical and chemical conditions that may adversely affect the health of Silver Bow Creek, including siltation of the stream bottom, channelization, disturbance of adjacent land and streamside (riparian) habitat, nutrient loading, dissolved oxygen concentrations, and organic contamination from the Montana Pole and Treating Plant NPL Site. Although they may have some impact on Silver Bow Creek, these factors are considered to be much less significant than the mining waste contamination risk to the SSTOU environment.

SUMMARY OF ROD

The ROD describes the final remedial action for the five media of concern at the SSTOU. Much of the treated material will remain in the operable unit. Consequently, long-term management and monitoring of the operable unit are required. This section summarizes the basic elements of the remedy as presented in the ROD.

Tailings/Impacted Soils: The ROD requires removal of contaminated tailings and impacted soils from the present 100-year floodplain of Silver Bow Creek unless: (1) the particular tailings/impacted soils are not continuously or seasonally in contact with groundwater, (2) treatment of those tailings/impacted soils with Streambank Tailings and Revegetation Study (STARS) treatment can be used reliably to immobilize the contaminants, and (3) the tailings/impacted soils will not be subject to erosion and reentrainment into the stream. The volume of tailings/impacted soils, as defined by the order-of-magnitude criteria presented in the RI, was estimated to be approximately 2,500,000 cubic yards (cy). Of that amount, about 1,550,000 cy would be excavated and relocated and about 950,000 cy would be treated in place.

Excavated tailings/impacted soils are to be relocated to safe, local repositories clearly outside the 100-year floodplain as defined by CH2M Hill (1989). The excavated materials will be fully treated with lime amendments in 2-foot lifts and the local repositories are to be revegetated in accordance with the STARS technology. If appropriate repository locations cannot be found or an appropriate institutional controls/monitoring and maintenance program cannot be implemented, excavated tailings/impacted soils and other wastes would be removed to centralized, dry repositories and appropriately handled and disposed. Replacement fill is required in most locations where tailings/impacted soils are removed. Replacement fill and reconstructed streambanks will require suitable growth media having appropriate texture and particle distribution. A key to long-term bank stabilization will be establishment of mature riparian vegetation. The overall topography of the replacement fill material will be appropriately sloped toward the stream channel with the goal of creating geomorphic stability.

Because numerous repositories, containing contaminated tailings/soils treated with the STARS technology, will be located near the flood plain in several areas along the length of the stream, and because in Subarea 2 and Subarea 4 a substantial amount of tailings will be treated with the STARS technology on the edges or just outside of the flood plain, a permanent monitoring, management, and maintenance program is an integral part of the remedy.

In-Stream Sediments: The ROD requires that fine-grained sediments (defined as less than or equal to one millimeter in size) located in depositional areas be removed and placed in repositories along with the excavated tailings/impacted soil and railroad materials. The in-stream sediment volume was estimated at 73,000 cubic yards in the RI/FS and ROD. After removal of contaminated sediments, the channel bed and streambank is to be reconstructed to an appropriate slope and other critical dimensions with materials of appropriate size, shape and composition. This reconfigured bed will contain suitable bedform morphology (riffles, runs, and pools) for aquatic habitat. Stream banks will require adequate growth media to allow for immediate establishment of a healthy riparian vegetative system to protect the remedy from high flows. In-stream sediment monitoring will be performed during and after the response action to ensure that contaminated in-stream sediments have been adequately remediated.

Railroad Materials: The ROD requires excavation, treatment and/or cover of all contaminated railroad bed materials that pose a risk to human health or the environment. All concentrate spills, which are the primary human health concern for the railroad beds, will be removed and disposed in an appropriate and secure disposal facility in accordance with any applicable RCRA requirements. Railroad materials that directly impact the stream either at bridge abutments or along the streambank will be excavated and disposed in repositories along with the tailings/impacted soils and in-stream sediments. The estimated volume of excavated railroad materials in the ROD was 71,000 cubic yards. In-situ STARS technology or soil capping are expected to be appropriate for all other areas of the inactive grade presenting environmental risk. Monitoring and maintenance of the remediated railroad materials will be required to ensure that contaminant sources are not exposed as a result of erosion and do not cause future contaminant loading to the stream.

Groundwater and Surface Water: While Silver Bow Creek groundwater and surface water are primary receptors of SSTOU contamination, no separate remedial action is prescribed for these media. Remedial activities for other SSTOU media under the ROD and for sources of contaminants upstream and off-site under other cleanup actions will limit further releases to groundwater and surface water, with the goal of ultimately attaining groundwater and surface water standards within the operable unit.

Coordination and Schedule: An institutional controls, monitoring, and maintenance program is required under the ROD. Construction of the proposed remedy is to be coordinated with other cleanup or natural resource damage restoration activities along Silver Bow Creek. Releases of contaminated in-stream sediments and surface waters prior to, during, and following remedial action, which might recontaminate Silver Bow Creek, must be suitably controlled. The design and schedule of the operable unit remedy is to be coordinated with the design and installation of upstream sediment control basins. If adequate upstream control facilities are not in service at the time of initiation of construction of this remedy, then additional sediment control and treatment facilities may be provided as a part of the SSTOU remedy or other scheduling adjustments may be made.

At the time the ROD was issued, Butte-Silver Bow County and ARCO had initiated research on constructed wetlands as a potential treatment technology for municipal waste water nutrient discharge and stormwater metals contamination. In light of that research, the ROD delineated the anticipated future land use in Subarea 1 as treatment wetlands.

DESCRIPTION OF SIGNIFICANT DIFFERENCES

As described in the introductory text of this ESD, DEQ and EPA have identified nine significant differences in remedy implementation plans relative to the remedy described in the ROD. These differences evolved during the design of the upper reaches of the SSTOU. In this section each significant difference is described and the basis for the change is explained.

1. INCREASE IN TAILINGS/IMPACTED SOIL VOLUME

The estimate of tailings/impacted soil volumes stated in the ROD was based on limited RI data. Because these data were inadequate for remedial design and construction, detailed test pit sampling was conducted in Subarea 1 of the SSTOU by ARCO in 1996 and 1997. The intent of this detailed sampling was to provide a more precise identification of the volume and location of the tailings/impacted soils to be remediated. About 400 test pits on a 150-foot grid were excavated in Subarea 1, with tailings and soil materials sampled in four-inch vertical intervals. The data from this sampling were used to determine the vertical depth at which metals decreased by an approximate order of magnitude (the performance standard identified in the ROD). Using this approach, an additional 256,000 cubic yards (cy) of tailings/impacted soils were identified in Subarea 1.

The design process also confirmed that additional removal of soils would be necessary to account for the variability of the elevation of the base of the tailings/impacted soils to be removed. Remedial design test pit data from Subarea 1 show that the base of tailings surface varies in elevation to such extent that the 150-foot test pit grid was insufficient to provide the necessary confidence that the base of tailings/impacted soil was accurately mapped and that excavation to the mapped depth would remove the contaminated material from the floodplain as required by the ROD. Therefore, the designed depth of excavation was increased by 0.5 feet to ensure that at least 90 percent of the tailings/impacted soils would be removed. The increase in excavation depth to attain this confidence, required by the ROD and UAO/SOW, results in removal of an additional 121,000 cubic yards of material (Maxim, et. al., 1998). Therefore, the new volume information developed during design increased the estimated total excavation volume for Subarea 1 from the 285,000 cy estimated in the ROD to 662,000 cy.

Design activities have not been initiated for the remaining three subareas, so detailed information about actual volumes of tailings in those subareas is not available. However, based on knowledge gained during the design of Subarea 1, the agencies anticipate that some increase in volumes of tailings over that estimated in the ROD will be found. The increase in the downstream subareas is not expected to be as great as in Subarea 1. Because of different soil chemistry in the downstream areas, the tailings/impacted soils visually are more distinct from the underlying natural soils, and the agencies believe that there has been less migration of contaminants below the tailings. The agencies' current projection is that, in each of the other subareas, an additional 30 percent to 80 percent over the ROD-estimated tailings/impacted soils will have to be excavated and placed in repositories and an additional 10 percent to 40 percent over the ROD-estimated tailings/impacted soils will have to be treated in-situ with the STARS technology.

The increase in the volume of tailings/impacted soils affects other design elements as well. An increase in the amount of excavation is required, resulting in an increase in the amount of storage capacity required for the MWRRs. In addition, the volume of backfill material needed to reconstruct the floodplain increases in order to meet the lines and grades of a geomorphically stable configuration. All of these items directly impact the overall cost of the remedy.

At the time of ROD issuance, DEQ and EPA recognized that there was considerable uncertainty associated with the estimate of the volume of tailings/impacted soils in the SSTOU. The initial efforts of the RD were directed to reducing that uncertainty. Even with the significant increase in volumes now defined, the agencies have determined that the remedial approach selected in the ROD, i.e., primarily excavation and placement of floodplain tailings/impacted soils into controlled local repositories, with limited use of in-situ treatment of tailings, remains the most cost-effective alternative that provides acceptable overall protection of human health and the environment and that complies with applicable or relevant and appropriate requirements (ARARs), except where waived.

2. MODIFICATIONS TO STREAM CHANNEL GRADE AND ALIGNMENT

The ROD requires that, after excavation and backfilling of the floodplain area, the channel bed and streambanks be reconstructed to provide a geomorphically stable system. It did not explicitly provide for changes in channel slope and channel location that might be needed to establish a geomorphically stable channel. At the direction of DEQ, Mussetter Engineering Inc. (MEI) undertook a study of the upper Silver Bow Creek drainage to evaluate design criteria for creating a geomorphically stable channel. In its study, MEI identified and evaluated:

1. The man-made and natural controls, the bed and overbank sediment gradations, and other geomorphic characteristics of Silver Bow Creek;

2. The hydrologic conditions for which the stream channel is to be designed, including the frequency, magnitude and duration of flood and non-flood flows;

3. The stream's hydraulic characteristics (i.e., velocities, flow depths, shear stresses) for the expected range of flows;

4. The estimated composition and amount of upstream and lateral sediment supply under existing and anticipated future conditions; and

5. The sediment-transport dynamics of the stream, including the potential for significant short-term and long-term aggradation (stream bed deposition) and degradation (stream bed erosion).

MEI's Channel Stability Analysis report (MEI & Inter-Fluve, 1997) synthesized the above information to provide guidelines for selecting appropriate criteria for stream channel design in Subarea 1. The MEI report recommended that the channel grade (elevation, or steepness of slope) of Silver Bow Creek be changed to eliminate the more severe aggradational and degradational reaches. Included in these changes were bridge modifications that would establish new vertical control and eliminate some aggradational potential. This report also recommended changes in planform (lateral position) of the stream in order to provide appropriate sediment transport capacity or to protect infrastructure.

Inter-Fluve, Inc. developed a conceptual design for Subarea 1 of the SSTOU that made more specific recommendations for channel grade and alignment changes consistent with the MEI recommendations (Inter-Fluve & MEI, 1998). Inter-Fluve developed potential alternative grade and alignment changes to Silver Bow Creek that would provide varying degrees of improved channel stability. Often the most satisfactory grade and alignment changes from a stability viewpoint provide additional cost benefits. The proposed grade changes generally require a decrease in elevation of the channel bed and an attendant decrease in floodplain elevations and reduced requirement for floodplain backfill. In addition, the clean soils obtained during excavation of the new channel can be used for floodplain backfill. This design therefore results in some cost savings by reducing the amount of fill material that must be purchased and imported for floodplain reconstruction. For example, the excavation requirement for Reach A of Subarea 1 is 166,400 cubic yards of tailings/impacted soils and 20,500 cubic yards of clean material in order to obtain the most satisfactory channel grade. However, only 75,000 cubic yards of imported backfill will be required to reconstruct the floodplain because the channel and floodplain will generally be designed to lower elevations.

DEQ and EPA have adopted the design recommendation for channel grade and alignment changes for the reasons identified above. This approach provides the most cost-effective way to comply with the ROD requirement that the reconstructed channel be designed as a geomorphically stable, naturally meandering alluvial system to the degree possible. Other approaches, such as using extensive reaches of riprap to control the stream's reaction to unstable gradients, would have required considerable additional long-term maintenance.

3. UTILIZATION OF TEMPORARY STREAM DIVERSION

The ROD requires that contaminated in-stream sediments and saturated contaminated tailings/ impacted soils be excavated and relocated to MWRRs. Although the ROD anticipated that various approaches to dewatering the excavation area would be considered and potentially utilized, it did not explicitly provide for the construction of a temporary stream diversion to support and enhance dewatering and other remediation elements. During the Subarea 1 remedial design, DEQ's technical consultants conducted additional evaluations of dewatering approaches, particularly during the pilot test of dewatering and streambank reconstruction techniques. As a result of those evaluations, it became clear that utilizing a temporary diversion of the stream channel during and after construction would greatly simplify near-stream excavation and backfill work and would enhance the ability of the floodplain and streambank revegetation to establish successfully. Stream diversion techniques evaluated during RD included use of fabric- or rock-lined channels and steel or plastic conduits to safely handle various possible flow conditions.

During excavation and backfilling of the stream channel and near-stream saturated areas, some method of localized dewatering of the excavation area is required. The dewatering activities can be greatly simplified and enhanced by keeping existing streamflows out of the excavation area. This can be accomplished by diverting the existing stream flow and drying out the existing stream channel prior to and during excavation. If relatively long reaches of the stream channel construction area can be dried out, general excavation and haul equipment mobility and access is improved and simplified by reducing stream crossings and the need for built-up access roads in wet areas. Risks associated with potential washout of the exposed excavation area also can be reduced by routing high-streamflow precipitation or runoff events through the diversion channel during the construction period. After construction is complete, base flows can be routed to the newly constructed channel, while high flows continue to be diverted around the reconstructed floodplain.

After the floodplain and stream channel are recontoured, the streambanks and floodplain will be seeded and planted to establish appropriate vegetation consistent with the requirements of the ROD. In the arid Montana climate, it often takes several growing seasons for reseeded areas to establish healthy vegetation that can withstand erosive forces from rainfall runoff and stream flows. With the reconstruction of the streambank of an active stream, such as Silver Bow Creek, that experiences a wide range of flow conditions, including erosive high flows during spring runoff, establishing durable streambank vegetation can be difficult. If the flow through the reconstructed channel can be regulated to prevent high flows from occurring during the period of vegetation establishment, the success of the revegetation can be greatly improved and the risk of streambank failure substantially reduced. The temporary diversion, of the stream to accommodate high flow events can accomplish that regulation of flow.

For the reasons identified above, the agencies adopt the use of temporary stream diversions, where appropriate, as an element of the SSTOU remedy. Decisions on the use and design of diversions for each stream reach will be based on design and construction needs for that particular reach. Stream diversion will not be appropriate for all reaches. For example, in some reaches the floodplain is too narrow to accommodate a diversion. The need for the diversion to accommodate construction work or revegetation, the design flow rate for the diversions, the sizing of riprap or other erosion-resistant material, the location and configuration of the channel, the duration of the use of the diversion, and other key design elements will be decided on a reach-specific basis.

4. CHANGES IN STREAM SEDIMENT REMOVAL CRITERIA

The ROD required that fine-grained (less than one millimeter) in-stream sediments in depositional areas be excavated and placed in MWRRs. This criterion, based on assumptions that the source of sediments of this size fraction in the depositional areas would primarily be near-stream tailings materials that eroded into the stream and that the sediment contaminant concentrations would be well correlated with tailings contaminant concentrations, was specified as an alternative to a performance standard based on contaminant concentration. To identify the depositional areas and verify their contamination characteristics, ARCO undertook an in-stream sediment sampling program for Subarea 1 in 1996. These data were presented in the Intermediate Design Report (ARCO, 1997c). ARCO's analysis of the data found no significant correlation between metals contamination and either the type of the depositional feature (e.g., channel bar, side bar, point bar) or the grain size distribution of the material. Since the agencies were unable to define an acceptable procedure for identifying and removing contaminated in-stream sediments, the ROD requirement must be modified and new design criteria developed to address the stream sediments.

The agencies subsequently evaluated the possibility of defining a simple depth of excavation, utilizing an approach similar to that used for floodplain tailings/impacted soils. Additional data collected by DEQ's contractors (Maxim, 1998a) are summarized in Table 1. These data indicate that in-stream metals contamination, although distributed throughout differing depositional forms, is confined to relatively shallow depths. Based on data from four boreholes drilled within the existing stream channel to a depth of 10 feet below the stream bed surface, relatively elevated concentrations were observed in certain metals in the shallow depths in some borings, with a marked decrease in arsenic and metals concentrations below the three foot depth.

TABLE 1
STREAMBED SEDIMENT SAMPLING RESULTS (1)
Subarea 1 - SSTOU Remedial Design

Lower Depth (in)	Soil Class (2)	pH (s.u.)	Arsenic	Cadmium	Copper	Lead	Mercury	Zinc
			Total Concentration (milligrams/kilogram)					
12	GP	4.8	<2	21	767	70	<0.2	1330
30	ML	5.9	11	19	3150	200	1.5	2570
36	ML	5.2	<2	14	787	150	<0.2	1040
42	GP	5.4	<2	<2	671	66	<0.2	860
18	SM	6.6	<2	2	30	50	<0.2	2340
30	SP	7.0	<2	6	9	50	<0.2	573
48	SW	5.6	<2	<2	30	20	<0.2	424
54	SP-SM	5.5	4	<2	30	<20		220
66	SP-SM	6.2	6	<2	46	53	<0.2	270
30	SM	6.8	<2	17	677	56	<0.2	662
36	SM	6.8	<2	14	1460	93	<0.2	877
42	SM	7.2	<2	<2	58	30	<0.2	75
60	SP-SM	7.0	<2	<2	51	40	<0.2	100
36	SP	6.4	36	91.8	836	240	<0.2	1480
42	SP	6.5	3	24	45	30	<0.2	230
48	SP	6.5	4	4	230	40	<0.2	376
54	SP	6.2	12	2	57	30	<0.2	250
60	SP	5.2	12	2	13	40	<0.2	70

(1)- Data from Maxim, 1998a

(2)- Classification according to the Unified Soil/Classification System
GP = poorly graded gravel: ML = silt or silt with sand: SM = silty sand; SP = poorly graded sand;
SW = well graded sand; SM = poorly graded sand with silt.

< = less than the detection limit

This limited data set is assumed to be representative of the whole channel, since the data from shallow intervals correlate well with the larger data set collected by ARCO in 1996. In all samples submitted for analysis from these borings, including those from the shallowest depths, arsenic and metals concentrations were less than the order-of-magnitude tailings criteria used to define the tailings/impacted soils that must be removed from the floodplain.

The agencies' efforts to develop revised criteria for addressing in-stream sediments at the SSTOU was conducted concurrently with the evaluation of potential modifications to the stream channel grade and alignment discussed in ESD Item 2 above. The two evaluations were combined and the following new set of criteria for addressing contaminated in-stream sediments was proposed.

1. Due to the relocation of the stream channel in portions of the operable unit, much of the existing stream channel will be abandoned. In reaches where the old channel is to be abandoned, the existing contaminated sediments within the old channel will be treated as all other floodplain tailings/impacted soils. If these materials are identified as tailings/impacted soils under the order-of-magnitude removal criteria, then they will have to be excavated and placed into MWRRs. In general, in Subarea 1 these materials meet the requirements for being below the order-of-magnitude decrease in contaminant concentrations and will not be removed as tailings/impacted soils, but will remain in place. As part of

the reconstructed floodplain, they will no longer be in direct contact with Silver Bow Creek surface water and will not impact the aquatic environment.

2. In areas where the existing stream channel will be reconstructed in the same location, the direct contact of the surface water and the aquatic receptors with the streambed materials necessitates that the contaminated stream sediments be removed. Existing in-stream sediments will be excavated to a minimum depth of one foot and placed in a MWRR. The new channel bed will be constructed with clean fill material. If channel construction requires additional excavation to meet new channel grade requirements, excavated material from deeper depths that is determined to have metals concentrations below the order-of-magnitude removal criterion will not be placed in a MWRR, but rather will be used for floodplain backfill. In Subarea 1, all materials to be excavated at depth to meet channel grade requirements are below the order-of-magnitude criterion and will be used for general backfill.

The design of excavation approaches to meet these in-stream sediment removal requirements will depend in part on the streambed characteristics in specific reaches. For example, in parts of Subareas 2, 3, and 4, the stream channel is composed of significant reaches of alluvial cobbles in addition to depositional pools and point bars containing fine-grained sediments. Additional sampling of subsurface conditions and characteristics in the stream channel will be necessary to design detailed removal specifications for the downstream subareas consistent with the removal criteria above.

The agencies adopt the new criteria to replace the in-stream sediments removal criteria defined in the ROD. The new criteria provide an acceptable approach addressing contaminated in-stream sediments that is cost-effective and consist with other elements of the SSTOU remedial design. It particularly complements the stream gradient and alignment changes identified in this ESD. The agencies have determined that the revised criteria are more protective than the prior ROD criteria because (1) the new criteria address the entire Silver Bow Creek channel in the SSTOU, rather than just depositional areas, (2) the original criteria were found not to define adequately those contaminated sediments requiring removal, and (3) the stream bed of the new Silver Bow Creek channel will be constructed of clean, imported materials and the stream will be more stable geomorphically, reducing potential reentrainment of and exposure to contaminated materials in the stream.

5. MODIFICATIONS TO MINE WASTE RELOCATION REPOSITORY (MWRR) DESIGN

Addition of Soil Cover to MWRR

The ROD specified that the MWRRs would be revegetated in accordance with STARS technology which uses lime application to neutralize acidity, minimize metal migration, and enhance plant growth. As part of DEQ's decision process for determining the location and construction of MWRRs, Maxim (1998b) produced an Alternatives Analysis for Mine Waste Relocation Repositories report which analyzed various repository settings and designs. The primary purpose of this effort was to determine which designs would minimize potential contaminant loading to groundwater and prevent violations of groundwater quality standards and other ARARs identified in the ROD. In the analysis, Maxim determined that addition of a 1.5-foot to 2.0-foot thick soil cover is necessary to improve protectiveness of groundwater in comparison with utilization of only a simple STARS treatment approach with no cover soil. The soil cover would lessen the amount of infiltration into the waste and thereby reduce the production of metals-enriched leachate. The reduction in leachate would occur because:

1. It was more certain that a good vegetative cover could be developed if the vegetation was planted in uncontaminated, suitable backfill material. The improved vegetation increases evapotranspiration, which directly reduces infiltration; and

2. The backfill material is generally finer textured than the tailings/impacted soil and therefore transmits water less easily to the waste.

These conclusions are consistent with conclusions in the earlier STARS studies, which found that there was better success in establishing vegetative cover and metals immobilization with the use of a topsoil cover.

To make this determination on the infiltration properties of the different MWRR designs, Maxim used the Hydrologic Evaluation of Landfill Performance (HELP) model which calculates water migration based on properties of the soils, vegetation, and climate data. A simple STARS design, without cover soil, was found to have an average leachate percolation rate of 2.2 inches per year. Use of an imported soil cover reduced the percolation rate to 0.6 inches per year. Because of concerns that near-stream repositories would have potential for affecting groundwater quality, DEQ and EPA chose to minimize the potential impact by selection of the soil cover design.

DEQ and EPA have adopted the modified MWRR design described above because the utilization of soil cover on MWRRs, is necessary to assure that rainfall and snowmelt infiltration into the MWRRs and potential contaminant migration are minimized. This is accomplished by covering the MWRR with less permeable soils that will also enhance establishment of more intensive vegetative cover.

Investigation of Potential Use of Additional Amendments Below the MWRR to Attenuate Arsenic

Prior studies of methods to neutralize and immobilize metals, in tailings have suggested that arsenic mobility may not be controlled satisfactorily by lime amendment approaches. In its evaluation of potential repository designs (Maxim, 1998b), Maxim conducted a series of laboratory tests to investigate the potential for leachate containing elevated concentrations of arsenic to be generated as water passed through the lime-amended tailings/impacted soils in the unlined MWRRs. Varying rates of water were introduced to amended tailings samples in the laboratory, and the resulting concentrations of arsenic and metals in the leachate were determined. This information was used to predict potential changes that may occur to the quality of groundwater beneath an MWRR based on certain assumptions about the physical setting of the repository, the distance to groundwater, and the physical and chemical characteristics of the intervening materials between the base of the lime-amended wastes in the repository and the water table. These simulated laboratory tests indicated that arsenic, but not other contaminants, has a potential to impact the quality of groundwater beneath the repository. The study left some uncertainty as to whether arsenic concentrations above the Montana Circular WQB-7 water quality standard might result in certain locations.

In an effort to address the potential impacts of arsenic on groundwater, DEQ is investigating the potential for incorporating an arsenic attenuating layer in the subgrade of SSTOU MWRRs. An iron-based arsenic attenuating process was used to adsorb arsenic dissolved in groundwater at the Rocker Operable Unit. DEQ has contracted with Montana State University to conduct preliminary bench scale trials to determine the adsorption potential of certain commercially available products, DEQ intends to continue this bench scale research and, if the results of these tests are promising, incorporate this mechanism into the design of MWRRs.

DEQ and EPA are modifying the ROD to allow for the addition of an arsenic-attenuating material at the base of specific MWRRs because use of the attenuating material may be necessary in certain locations to attain the ROD ARARs for protection of groundwater.

Potential Use of Consolidated Tailings Repositories

An additional option that will be considered and may be adopted in the design process for tailings/impacted soils removed from certain areas will be consolidation of the removed tailings with existing off-site tailings deposits which will remain in place. The agencies may determine during detailed design for the lower reaches that some tailings/impacted soils can be efficiently consolidated with existing tailings deposits in areas near the SSTOU, such as the Opportunity Ponds. The decision to consolidate such wastes rather than construct local waste repositories in those areas may be based on benefits such as eliminating the need to acquire additional lands for new repositories, reducing costs of repository construction, reducing lime requirements, reducing future monitoring and maintenance costs, and reducing the amount of currently uncontaminated land and groundwater impacted by repositories.

6. ADDITION OF SEDIMENT BASINS TO CONTROL RUN-ON OF OFF-SITE CONTAMINATED SEDIMENTS

The ROD anticipated that sediment loads from upstream source areas would have potential to recontaminate the remediated SSTOU and proposed coordination with other operable unit remedial activities to ensure that recontamination would not occur. It was assumed in the ROD that sedimentation basins would be constructed in Butte to control those sources. Construction of facilities to control runoff from the major sources on the Butte Hill is currently underway under the Priority Soils Operable Unit of the Silver Bow Creek/Butte Area NPL Site. However, the issue of potential recontamination of the floodplain from upland areas adjacent to the SSTOU was not addressed in the ROD. Ultimately, the upland areas will be addressed as part of the Butte Non-Priority Soils Operable Unit, but work on that site is not yet underway. Contaminated run-on, particularly from the Neversweat-Washoe railroad line immediately north of the Silver Bow Creek floodplain in Subarea 1, will need to be controlled through construction and maintenance of sediment basins. Because this effort was not identified as a potential remedial measure in the ROD, the construction of these sediment basins constitutes a significant difference.

During remedial design of Subarea 1, seven locations were identified where run-on of contaminated materials from the Neversweat-Washoe line would impact the remediated floodplain. Mapping of waste materials in the railroad line embankment determined which tributary drainages could be affected, and Maxim designed sediment basins in each of these drainages to trap sediment. The basins were sized to settle material from the 10-year, 24-hour rainfall event using the methods in the Montana Sediment and Erosion Control Manual (DEQ, 1996). Larger flow events will be passed through rock-lined spillways. The structures are intended to remain in place until the Butte Non-Priority Soils Operable Unit is remediated.

Although design investigations of the downstream subareas of the SSTOU have not been conducted, it is possible that the SSTOU remedy also may need to control similar run-on from other contaminated areas adjacent to the remainder of the OU. DEQ and EPA therefore adopt the utilization of run-on control sediment basins as potential necessary components of the SSTOU remedy for all subareas in order to provide protection of the remediated floodplain until off-site contaminant source areas are addressed under other cleanup actions

7. ELIMINATION OF TREATMENT WETLANDS AS DESIGNATED END LAND USE FOR SUBAREA 1

The ROD specified that the end land use for Subarea 1 would be treatment wetlands. This designation was in response to public comments on the Proposed Plan. ARCO and Butte-Silver Bow County were initiating research on the use of treatment wetlands to control stormwater metals contamination and municipal waste water nutrient discharge. If such treatment could be developed, ARCO and Butte-Silver Bow County indicated a desire to use at least a portion of Subarea 1 as treatment wetlands to treat contamination from upstream, off-site sources. The ROD allowed for that end land use after removal of contaminated tailings/impacted soils.

At the time of the remedial design for Subarea 1, plans for implementation of treatment wetlands had not been developed, and it is uncertain whether any portion of Subarea 1 would be needed for wetlands treatment systems. Therefore, the design for Reach A of Subarea 1 does not incorporate treatment wetlands. Any implementation of future wetlands treatment systems would have to be constructed separately from the remedial action for Subarea 1. Therefore, the end land use of Subarea 1 is not designated as treatment wetlands, but can be any land use consistent with the requirements of the ROD and the goals of the remedial design.

8. CHANGES IN THE ESTIMATED SCHEDULE TO IMPLEMENT THE REMEDY

The ROD estimated that the SSTOU remedy could be implemented in four to six years. During the design process, the agencies reevaluated the approach to scheduling the construction of the remedy and have revised the schedule to provide for a 12-year construction period. This has been done for a number of reasons. The primary reason is to avoid the significant risk of having large reaches of reconstructed streambank and floodplain exposed to potential erosion during high flow conditions. By limiting the length of stream reconstructed in each year, the agencies will limit the amount of unvegetated banks and floodplain exposed at any one time. If approximately two miles of stream are reconstructed each year, a maximum of two miles will be exposed with no vegetation during any one year. If construction were to be compressed into a 4-year schedule, approximately six miles of newly constructed, unvegetated streambank and floodplain would be exposed each year. Additional reasons to approach the project with a more conservative schedule include the following:

- to allow upstream sediment and water treatment controls to be placed into service before implementing the remedy on Silver Bow Creek to minimize the risk of recontamination from upstream sources;

- to evaluate the stability of the new streambanks in the upper reaches of Silver Bow Creek in response to high flow conditions and implement design modifications and improvements as appropriate in the lower reaches later in the project;

- to break the construction work into more easily managed units of two to three miles of stream at a time to improve quality control rather than attempt to have very large major construction projects over a short period; and

- to reduce the impact of construction on local communities by reducing the size of the construction operation at any one time.

For the reasons identified above, the agencies have adopted the revised schedule for construction of the SSTOU selected remedy. Operation and maintenance are expected to continue in perpetuity.

9. INCREASE IN ESTIMATED COST TO IMPLEMENT REMEDY

While preparing the Preliminary Final Design Report for Reach A of Subarea 1, DEQ determined that the cost estimates utilized in the FS and the ROD seriously understated the overall costs of the Streamside Tailings OU remedy. The level of cost underestimation became apparent as DEQ's design engineers prepared detailed cost estimates for the various components of the Reach A design. To correct the deficiencies in the earlier estimates, DEQ carefully constructed a new cost estimate for the entire SSTOU, building on and updating earlier cost estimates, and utilizing new information regarding the volumes of tailings/impacted soils and the final design concepts and approaches developed during the Reach A design. DEQ's revised cost analysis has been reviewed and approved by EPA. The revised cost estimates are presented in the in Tables 2 through 5.

Table 2 presents the summary calculation of total present worth for the SSTOU remedy. DEQ currently estimates that the remedy will require approximately $98.14 million to construct and that construction will occur over a 12-year period. The present worth of construction is estimated at about $76.09 million in 1998 dollars, assuming a net discount rate of 4% (investment rate of return of 7% less inflation rate of 3%). Total operation and maintenance (O&M) costs. including funds reserved to cover O&M in perpetuity, are estimated at approximately $8.73 million, with a present worth of about $4.04 million in 1998 dollars. Total present worth for construction and O&M is estimated at approximately $80.13 million in 1998 dollars.

Table 3 presents the detailed construction cost estimate for the combined tailings/impacted soils and in-stream sediments remedies, since these two media are addressed together in the current RD/RA approach. Table 4 presents the detailed railroad remedy cost estimate. Table 5 presents the detailed estimate for annual O&M costs for the SSTOU. These three tables represent DEQs best estimate of the cost to implement the SSTOU remedy as currently designed. Additional costs necessary to meet protectiveness requirements, such as improved MWRR design elements, are incorporated into the revised estimate. Cost savings achieved through design, such as less expensive approaches for addressing in-stream sediments, channel stability, and backfill needs, are also incorporated into the revised cost estimate.

TABLE 2

CONSTRUCTION AND O&M SCHEDULE AND PRESENT WORTH CALCULATION

STREAMSIDE TAILINGS OPERABLE UNIT

SILVER BOW CREEK/BUTTE AREA NPL SITE

AUGUST 1998

Investment Rate of Return = 7%

Inflation Rate = 3%

Net Discount Rate = 4%

	Subarea 1			Subarea 2			Subarea 3			Subarea 4			Total			
	Tailings	Railroad	O&M	Tailings	Railroad	O&M	Tailings	Railroad	O&M	Tailings	Railroads	O&M	Tailings	Railroad	O&M	Total
Year																
1(1998)	4,000,000	100,000	-	-	-	-	-	-	-	-	-	-	4,000,000	100,000	-	4,100,000
2	8,400,000	360,000	74,000	-	-	-	-	-	-	-	-	-	8,400,000	360,000	74,000	8,834,000
3	8,500,000	360,000	94,000	-	-	-	-	-	-	-	-	-	8,500,000	360,000	94,000	8,954,000
4			94,000	9,000,000	220,000	-	-	-	-	-	-	-	9,000,000	220,000	94,000	9,314,000
5			89,000	9,100,000	220,000	74,000	-	-	-	-	-	-	9,100,000	220,000	163,000	9,483,000
6			69,000	9,100,000	220,000	94,000	-	-	-	-	-	-	9,100,000	220,000	163,000	9,483,000
7			69,000			94,000	6,000,000	600,000	-	-	-	-	6,000,000	600,000	163,000	6,763,000
8			69,000			89,000	6,100,000	600,000	77,000	-	-	-	6,100,000	600,000	235,000	6,935,000
9			69,000			69,000			80,000	8,700,000	-	-	8,700,000	-	218,000	8,918,000
10			82,000			69,000			80,000	8,800,000	60,000	74,000	8,800,000	60,000	305,000	9,165,000
11			82,000			69,000			70,000	8,800,000	60,000	94,000	8,800,000	60,000	315,000	9,175,000
12			57,000			69,000			70,000	8,800,000		94,000	8,800,000		290,000	9,090,000
13			47,000			82,000			72,000			89,000			290,000	290,000
14			42,000			82,000			72,000			69,000			265,000	265,000
15			42,000			57,000			72,000			69,000			240,000	240,000
16			42,000			47,000			65,000			69,000			223,000	223,000
17			42,000			42,000			60,000			69,000			213,000	213,000
18			42,000			42,000			40,000			82,000			206,000	206,000
19			42,000			42,000			40,000			82,000			206,000	206,000
20			42,000			42,000			37,000			57,000			178,000	178,000
21			42,000			42,000			37,000			47,000			168,000	168,000
22			42,000			42,000			37,000			42,000			163,000	163,000
23			42,000			42,000			37,000			42,000			163,000	163,000
24			35,000			42,000			37,000			42,000			156,000	156,000
25			35,000			42,000			37,000			42,000			156,000	156,000
26			35,000			42,000			37,000			42,000			156,000	156,000
27			35,000			35,000			37,000			42,000			149,000	149,000
28			35,000			35,000			37,000			42,000			149,000	149,000
29			35,000			35,000			37,000			42,000			149,000	149,000
30			35,000			35,000			25,000			42,000			137,000	137,000
Perpetuity			875,000			875,000			625,000			875,000			3,250,000	3,250,000
Total Expenses	20,900,000	820,000	2,435,000	27,200,000	660,000	2,330,000	12,100,000	1,200,000	1,818,000	35,100,000	120,000	2,148,000	95,300,000	2,800,000	8,731,000	106,831,000
Subarea Subtotals			24,155,000			30,190,000			15,118,000			37,368,000			checksum	106,831,000
1998 Present Worth	19,168,896	749,033	$1,233,064	22,364,637	542,760	$1,095,037	9,016,717	894,366	$820,181	23,270,236	79,609	$896,118	73,820,484	2,266,666	4,044,399	80,130,640
Subarea Subtotals			21,150,991			24,002,424			10,731,263			24,245,862			checksum	80,130,540

Note All expenditures considered end of year

esd-cost xls

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<IMG SRC 98116B>

TABLE 5
ANNUAL OPERATIONS AND MAINTENANCE COST ESTIMATE

STREAMSIDE TAILINGS OPERABLE UNIT
SILVER BOW CREEK/BUTTE AREA NPL SITE
AUGUST 1998

Year	Stream Diversion	Floodplain Remedy	Streambanks	Borrow Areas	Repositories	Railroad Berm	Weed Control	Long-term Monitoring	Total
Per Subarea, Subareas 1,2,4									
1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	$5,000	$7,000	$3,000	$5,000	$2,000	$2,000	$15,000	$35.000	$74,000
3	$10,000	$17,000	$3,000	$5,000	$7,000	$2,000	$15,000	$35,000	$94,000
4	$10,000	$17,000	$3,000	$5,000	$7,000	$2,000	$15,000	$35,000	$94,000
5	$10,000	$17,000	$3,000	$0	$7,000	$2,000	$15,000	$35,000	$89,000
6	$10,000	$2,000	$3,000	$0	$2,000	$2,000	$15,000	$35,000	$69,000
7	$10,000	$2,000	$3,000	$0	$2,000	$2,000	$15,000	$35,000	$69,000
8	$10,000	$2,000	$3,000	$0	$2,000	$2,000	$15,000	$35,000	$69,000
9	$10,000	$2,000	$3,000	$0	$2,000	$2,000	$15,000	$35,000	$69,000
10	$0	$2,000	$18,000	$0	$2,000	$10,000	$15,000	$35,000	$82,000
11	$0	$2,000	$18,000	$0	$2,000	$10,000	$15,000	$35,000	$82,000
12	$0	$2,000	$18,000	$0	$2,000	$5,000	$15,000	$15,000	$57,000
13	$0	$2,000	$8,000	$0	$2,000	$5,000	$15,000	$15,000	$47,000
14 thru 23	$0	$2,000	$8,000	$0	$2,000	$0	$15,000	$15,000	$42,000
24 and after	$0	$5,000	$10,000	$0	$5,000	$0	$15,000	$0	$35,000
Subarea 3									
1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2	$2,000	$7,000	$8,000	$5,000	$2,000	$3,000	$15,000	$35,000	$77,000
3	$5,000	$7,000	$8,000	$5,000	$2,000	$3,000	$15,000	$35,000	$80,000
4	$5,000	$7,000	$8,000	$5,000	$2,000	$3,000	$15,000	$35,000	$80,000
5	$5,000	$2,000	$8,000	$0	$2,000	$3,000	$15,000	$35,000	$70,000
6	$5,000	$2,000	$8,000	$0	$2,000	$3,000	$15,000	$35,000	$70,000
7	$0	$2,000	$13,000	$0	$2,000	$5,000	$15,000	$35,000	$72,000
8	$0	$2,000	$13,000	$0	$2,000	$5,000	$15,000	$35,000	$72,000
9	$0	$2,000	$13,000	$0	$2,000	$5,000	$15,000	$35,000	$72,000
10	$0	$2,000	$8,000	$0	$2,000	$3,000	$15,000	$35,000	$65,000
11	$0	$2,000	$3,000	$0	$2,000	$3,000	$15,000	$35,000	$60,000
12	$0	$2,000	$3,000	$0	$2,000	$3,000	$15,000	$15,000	$40,000
13	$0	$2,000	$3,000	$0	$2,000	$3,000	$15,000	$15,000	$40,000
14 thru 23	$0	$2,000	$3,000	$0	$2,000	$0	$15,000	$15,000	$37,000
24 and after	$0	$2,000	$5,000	$0	$3,000	$0	$15,000	$0	$25,000

There are two key reasons that the SSTOU remedy cost estimate has been substantially increased during the remedial design process. First, the SSTOU FS and ROD underestimated the volume of tailings/impacted soils within the OU. This issue is discussed in detail in ESD Item 1 above. In Subarea 1 alone, the volume of tailings delineated during detailed RD is 130 percent larger than that estimated in the FS and ROD. DEQ anticipates that the degree of disparity between the RD and FS/ROD volume estimates will decrease in the downstream reaches of Silver Bow Creek. Without detailed design information for downstream subareas, the agencies now anticipate an approximate 30 to 80 percent increase in the volumes of tailings/impacted soils over the estimates used in the FS/ROD. For the purposes of the cost estimate, an approximate 50 percent increase is assumed. Second, to better estimate the full cost of the remedy, the current cost estimate includes a number of additional cost items that DEQ expects will be incurred during construction. Such items include utility relocation, fencing, security, flagging and traffic control, railroad crossings, surveying, construction dewatering, and purchase and import of fill material. In addition, a construction contingency, to account for potential costs undiscovered until construction is underway, is also included. Other cost items underestimated in the FS/ROD include repository construction, engineering design, construction oversight, and revegetation.

A detailed comparison of the 1995 SSTOU ROD cost estimate and the current RD/RA cost estimate is included as Table 6. The table presents only nondiscounted construction costs (not present worth). The ROD estimates are the maximum cost scenario for the selected remedy and they have been increased by 3 percent per year for three years to adjust them to 1998 dollars for comparison purposes. Overall, the difference between the current RD/RA cost estimate and the ROD cost estimate is approximately $49.21 million, in 1998 dollars.

Cost Consequences of Changes in Volume Estimate

The FS/ROD estimated the volume of tailings/contaminated soils in the OU at approximately 2.55 million cubic yards (cy). The present estimate of tailings/contaminated soils is approximately 3.81 million cy. This represents approximately a 50 percent increase in contaminated materials that must be addressed at the OU. In developing its revised cost estimate, DEQ reviewed in detail all line item cost elements and estimates that approximately $17 million of the additional $49.21 million of SSTOU remedy costs are necessary to address the increased volume of tailings now identified or assumed at the OU. This figure was developed by comparing the difference in total construction cost using current volume estimates with that using FS/ROD volume estimates, with the calculation based on DEQ's current estimates of unit costs and ancillary costs, as well as current design criteria.

Costs Not Included or Underestimated In FS/ROD Documents

The original cost estimates in the FS/ROD were primarily based on the ARCO analysis of costs presented in the FS Appendix F-3 (ARCO, Draft Cost Estimate Methodology for Streambank Tailings Removal and In-Situ Treatment, May 23, 1994, with appended technical memoranda). In finalizing the FS and ROD, the agencies made minor modifications to the ARCO analysis, primarily to eliminate duplication of costs that occurred when media-specific components were assembled into site-wide alternatives for comparison purposes. The agencies did not comment extensively on or require modifications to the ARCO cost analysis. As long as the costs were applied consistently across the various alternatives, the agencies believed that the analysis w accurate enough to adequately compare relative cost differences among the various alternatives.

Cost line items included in the current SSTOU cost estimate are shown in Table 6. The line items have been grouped into three categories: (1) those that were not specifically included in the ROD cost estimate, (2) those that generally were underestimated in the ROD compared to the current estimate, and (3) those that appear to have been overestimated in the ROD compared to the current estimate. All construction costs identified in the ROD and the current cost estimate are included. Operation and maintenance costs are not included.

The first group of line items in Table 6 were not found in the cost estimate spreadsheets in the FS/ROD, although some of the backup analysis by ARCO indicates that at least a portion of these costs were considered in the "construction support" category of ARCO's estimate. However, DEQ has concluded that since the construction support category as a whole was underestimated in the FS/ROD analysis, all costs in the first group of line item costs are considered by DEQ to be "new costs" not included in the original ROD estimate. A total of $32.73 million in new costs are included.

TABLE 6
COMPARISON OF CONSTRUCTION COST ESTIMATES (1995 ROD vs. 1998 RD/RA)

STREAMSIDE TAILINGS OPERABLE UNIT
SILVER BOW CREEK/BUTTE AREA NPL SITE
AUGUST 1998

Construction Cost Estimate Line Item	ROD Cost Estimate (1995$)	ROD Cost Estimate (1998s)[a]	RD/RA Cost Estimate (1983)	Cost Estimate Difference [b]
Cost Elements Not Included in ROD				
Utility Relocation/Protection	$0	$0	$200,000	$200,000
Security	$0	$0	$720,000	$720,000
Fencing	$0	$0	$578,000	$578,000
Traffic Control	$0	$0	$1,638,000	$1,638,000
Construction Railroad Crossings	$0	$0	$250,000	$250,000
Bridge Replacement	$0	$0	$80,000	$80,000
Construction Dewatering	$0	$0	$1,333,600	$1,333,600
Surveying	$0	$0	$1,497,600	$1,497,600
Stream Channel Bed Construction	$0	$0	$4,235,000	$4,235,000
Debris Disposal	$0	$0	$220,000	$220,000
Stream Diversion	$0	$0	$2,107,080	$2,107,080
Purchase/Exc,avate/Haul Borrow Material	$0	$0	$7,235,900	$7,235,900
Construction Contingency	$0	$0	$12,577,124	$12,577,124
Potential Historic Preservation Mitigation	$0	$0	$60,000	$60,000
Subtotal	$0	$0	$32,732,304	$32,732,304
Cost Elements Underestimated in ROD				
Erosion Control	$72,146	$78,836	$423,000	$344,164
Tailings Hauling	$1,800,864	$1,967,853	$6,334,850	$4,366,997
Fill Placement/Grading	$2,480,612	$2,710,632	$4,109,250	$1,398,618
Streambank Reconstruction	$4,863,520	$5,314,500	$8,045,000	$2,730,500
Floodplain Revegetation	$1,467,095	$1,603,134	$2,115,000	$511,866
Repository Construction	$3,252,053	$3,553,606	$10,275,840	$6,722,234
MobilizationlDemobilization	$1,828,221	$1,997,746	$3,144,281	$1,146,535
DesigniConstruction Oversight	$5,190,461	$5,671,757	$16,630,796	$10,959,039
Railroad Remediation	$1,969,764	$2,152,414	$2,846,149	$693,735
Subtotal	$22,924,736	$25,050,478	$53,924,166	$28,873,688
Cost Elements Overestimated in ROD				
Site Clearing and Grubbing	$2,594,480	$2,835,058	$1,128,000	($1,707,058)
Sediment Control Basins	$368,456	$402,622	$318,000	($84,622)
Tailings/Sediments Excavation	$6,966,120	$7,612,067	$5,146,000	($2,466,067)
STARS	$5,443,355	$5,948,101	$3,735,500	($2,212,601)
Construction Overhead [c]	$4,570,551	$4,994,364	$0	($4,994,364)
Institutional Controls	$750,000	$819,545	$0	($819,545)
Road Construction	$1,161,640	$1,269,355	$1,160,000	($109,355)
Subtotal	$21,854,602	$23,881,112	$11,487,500	($12,393,612)
Total Construction Costs	$44,779,338	$48,931,590	$98,143,970	$49,212,380

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Notes [a] 1998$ calculated by compounding ROD 1995$ by 3% per year for 3 years
[b] Cost estimate difference = RD/RA estimate (1998$) - ROD estimate (1998$)
[c] RD/RA estimate includes construction overhead in line item unit costs

The FS/ROD also significantly underestimated certain construction, engineering design, and construction oversight costs. These are shown as the second group of line item costs in Table 6. DEQ believes that the tailings/impacted soils construction line items were underestimated primarily because they were based on inaccurate volume estimates. Design and oversight costs were underestimated because they are calculated as a percentage of total construction costs, which was underestimated. The FS/ROD also underestimated the cost for remediation of contaminated railroad berm materials. A remedy element not anticipated in the FS/ROD is the construction and maintenance of sedimentation basins in Subarea 1 to control contaminated run-on from Neversweat - Washoe railroad berms located outside of the SSTOU. The need for these basins is discussed in ESD Item 6 above. Cost increases also result from the use of more realistic estimates for design and construction oversight for the railroad materials remedy. As shown in Table 6, the revised cost estimate includes an additional $28.87 million in previously underestimated costs from the FS/ROD estimate.

The FS/ROD also overestimated certain line item costs, in comparison with the current estimate. They appear as overestimated line items simply because they account for costs that are included in other line items in the current DEQ estimate. To account accurately for the overall difference in the current cost estimate from the estimate in the FS/ROD, the overestimated costs in the third group of line hems in Table 6 are deducted from the cost increases presented in the other two groups of line items. The overestimated amount is $12.39 million.

Operation and Maintenance Costs

The ROD estimated the present worth of long-term operation and maintenance (O&M) at $2.71 in 1995 dollars. The present worth calculation was based on a 7 percent discount rate over 30 years as required by EPA guidance on preparing RODs. Adjusting for inflation, the ROD estimate is equivalent to approximately $2.96 million in 1998 dollars. DEQ currently estimates the present worth of long-term O&M at approximately $4.04 million. The current estimate utilizes a more reasonable net discount rate of 4 percent and also includes estimated costs beyond the typical 30-year period to account for anticipated perpetual O&M at the SSTOU. The increase in present worth for O&M over that presented in the ROD is therefore approximately $1.09 million.

REVIEW OF REMEDY SELECTION IN LIGHT OF NEW INFORMATION

DEQ and EPA have also reviewed the alternative selection process in the ROD to determine if one of the other evaluated alternatives should be selected in light of new information. Seven OU-wide alternatives, comprised of various combinations of media-specific remedial approaches, were considered in the ROD. Alternative 1 (no action) and Alternative 2 (primarily in-situ treatment of contaminated materials in the floodplain) were found to be totally inadequate in terms of meeting threshold protectiveness and applicable or relevant and appropriate requirements (ARARs). Alternative 3 (partial relocation and partial in-situ treatment) and Alternative 4 (partial removal and partial in-situ treatment) were considered to be more protective than Alternatives 1 and 2, but also did not adequately comply with protectiveness and ARARs requirements. Alternatives 3 and 4 were equally protective, with Alternative 4 being the more expensive of the two. Modified Alternative 5 (more extensive partial relocation with limited in-situ treatment) was the selected alternative. Alternative 6 (more extensive partial removal with limited in-situ treatment) was similar to Alternative 5 in protectiveness, but was more expensive. Alternative 7 (total removal) met the threshold criteria, but was considerably more expensive than the selected remedy.

The only ESD differences that directly affect the evaluation of the alternatives are the revised volume and cost estimates. After consideration of these new estimates, the agencies have determined that the selected alternative, as modified by the other changes in this ESD, remains the appropriate remedy for the SSTOU.

Generally, the relative cost comparison between the selected remedy and the other alternatives does not change greatly as a result of the revised cost estimates. For example, there is no significant change in the relative cost difference between the selected remedy and the next most promising, lower-cost alternative, Alternative 3. Under the selected remedy, approximately two-thirds of the OU's tailings/impacted soils would be excavated and placed into repositories and one-third treated in situ by STARS technology. Under Alternative 3, approximately two-thirds would be treated in situ by STARS and one-third relocated into repositories. Based on cost estimates in the ROD, Alternative 3 was expected to be 13 percent less costly than modified Alternative 5, the selected remedy ($40 million vs. $46 million). Utilizing DEQ's current estimated volumes and unit costs, the present worth for Alternative 3 is now projected to be approximately $67.8 million. When compared to the estimated present worth of $80.1 million for the selected remedy, the relative cost difference between the two alternatives remains about the same (Alternative 3 is 15 percent less costly).

All other analyses in the ROD concerning relative overall effectiveness and compliance with ARARs of all of the alternatives remain unchanged. Alternatives 1 and 2 were totally inadequate in meeting protectiveness requirements. Alternatives 3 and 4 would not adequately comply with floodplain and solid waste ARARs because of their heavy reliance on in-situ STARS treatment near the stream. Likewise, the in-situ STARS treatment of tailings in near-stream locations would not be consistent with the criteria identified in the ROD for the application of the STARS technology and the necessary ARAR waiver. Alternatives 6 and 7 have equal or better protectiveness compared to the selected remedy, but are more expensive. While there may be areas where removal rather than relocation may be cost effective and may be included in the remedy (see discussion of consolidation with off-site tailings in ESD Item 5 above), the increased costs generally weigh against cost-effectiveness of these more expensive alternatives. DEQ and EPA have determined that, even with the new information developed during design and with the additional cost noted in this ESD, the selected alternative, as modified by this ESD, is the appropriate remedy under CERCLA and the National Contingency Plan.

SUPPORT AGENCY COMMENTS

EPA concurs in and adopts the changes and decisions identified in this document for the reasons explained above.

PUBLIC PARTICIPATION ACTIVITIES

DEQ and EPA strive to have full involvement by the public in all SSTOU activities. During the two-year remedial design process, design meetings were open to the public and representatives of local government and local interest groups routinely participated in those meetings.

This ESD and the information utilized to develop the ESD have been placed in the SSTOU administrative record. The administrative record is located at the U.S. EPA Montana Operations Office, Federal Building, 301 South Park, Helena, Montana. Office hours are 8:00 to 5:00 on federal business days. In addition, the ESD is placed in the SSTOU information repositories at the following locations:

Anaconda	Hearst Free Library	DeerLodge	Grant-Kohrs Ranch
Bozeman	MSU Renne Library		Deer Lodge Public Library
Butte	Silver Bow Library	Helena	DEQ Office, 2209 Phoenix Ave.
	Montana Tech Library		State Library
	EPA Office	Missoula	Missoula Public Library
	CTEC Office		UM Mansfield Library
			Clark Fork Pend Oreille Coalition

AFFIRMATION OF THE STATUTORY DETERMINATIONS

Considering the new information that has been developed and the changes that have been made to the selected remedy, DEQ and EPA believe that the selected remedy, as modified by this Explanation of Signification Differences, remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to this remedial action or involves appropriate waivers of these requirements, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

<IMG SRC 98116C>

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