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Grove Gulch Sedimentation Bay Final Remedial Design Report

Woodard & Curran

SILVER BOW CREEK/BUTTE AREA NPL SITE
BUTTE PRIORITY SOILS OPERABLE UNIT

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Atlantic Richfield Company

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REVISION SUMMARY

Revision No.	Author	Version	Description	Date
Rev 0	TREC, Inc.	Draft – 30%	Issued for Agency Review	May 2020
Rev 1	TREC, Inc.	Draft – 60%	Issued for Agency Review	November 2021
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Rev 4	W&C, Inc.	Final – 100%	Issued for Approval	March 2024

LIST OF ACRONYMS AND ABBREVIATIONS

3D	three-dimensional
amsl	above mean sea level
ARAR	Applicable Relevant and Appropriate Requirements
AR	Atlantic Richfield Company
ASTM	American Society for Testing Materials
BG	Buffalo Gulch
bgs	Below Ground Surface
BMP	Best Management Practice
BPSOU	Butte Priority Soils Operable Unit
BSB	Butte Silver Bow City-County
BSB O&M Plan	Operation and Maintenance Plan for the Butte-Silver Bow Superfund Storm Water System within the Butte Priority Soils Operable Unit
BSBMSWES	Butte Silver Bow's Municipal Storm Water Engineering
BTC	Blacktail Creek
CERCLA	Comprehensive Environmental Response, Compensation, and
Liability Act CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
COC	Contaminant of Concern
DEQ	Montana Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
EVS	Earth Volumetric Studio
FEMA	Federal Emergency Management System
FEWA	Functionally Effective Wetland Area
FRESOW	Further Remedial Elements Scope of Work
GG	Grove Gulch
HEC	Hydraulic Engineering Circular
HGL	Hydraulic Gradient Line
HWL	High Water Level
MCA	Montana Contractor's Association
µg/m3	Micrograms per Cubic Meter
MS4	Municipal Separate Storm Sewer System
NCP	National Contingency Plan
NPL	National Priorities List
NWE	North Western Energy
O&M	Operations & Maintenance
PDIER	Pre-Design Investigation Evaluation
PDIWP	Pre-Design Investigation Work Plan
PM-2.5	Particulate matter that is 2.5 microns in diameter or smaller
PM-10	Particulate matter that is 10 microns in diameter or smaller
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
RA	Remedial Action

RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation Recovery Act
RD	Remedial Design
RD/RA	Remedial Design Remedial Action
RDWP	Remedial Design Work Plan
ROD	Record of Decision
RODA	Record of Decision Amendment
SAP	Sampling and Analysis Plan
SBC	Silver Bow Creek
SD	Settling Defendant
SIMOPS	Simultaneous Operations
SSWS	Superfund Storm Water System
SWMM	Storm Water Management Model
SWMP	Storm Water Management Program
SWPP	Storm Water Pollution Prevention Plan
TI	Technical Impractability
uSBC	Upper Silver Bow Creek
W&C	Woodard and Curran

1. INTRODUCTION

This report provides the 100% Remedial Design (RD) for the Grove Gulch Sedimentation Bay located within the Butte Priority Soils Operable Unit (BPSOU) of the Silver Bow Creek/Butte Area NPL Site. This report addresses the remedial design elements applicable to the Grove Gulch Sedimentation Bay outlined in Section 4.0 of the *Further Remedial Elements Scope of Work* (FRESOW) (EPA, 2020a) and the *BPSOU Record of Decision Amendment* (RODA) (EPA, 2020b) under the guidance of the *Remedial Design/Remedial Action Handbook* (EPA, 1995). Section 1 provides the purpose and objectives , a description of the site, and a description of the remedial activities for the project; Section 2 provides a description of the supporting plans and a summary of pre-design investigation data; Section 3 describes how the site will comply with identified FRESOW requirements, Remedial Action Objectives (RAOs), and outlines any applicable permits and/or third-party agreements that are required; Section 4 provides design criteria; Section 5 provides basis of design including calculations and/or modeling results; and Section 6 provides a description of site access and easements.

1.1 Purpose and Objectives

This Design Report describes the design requirements and technical parameters and documents the basis on which the Grove Gulch Sedimentation Bay design achieves the ARARs, FRESOW requirements, and engineering standards and codes. This Design Report includes a description of the design approach, along with detailed summaries of the analysis and calculations required to meet design criteria. Additionally, it includes design justifications, assumptions and supporting calculations.

1.2 Site Description

Grove Gulch Creek currently discharges ephemeral and stormwater flow to Blacktail Creek via a vegetated open channel. The Grove Gulch sub-drainage covers 5.88 square miles consisting mainly of non-urban runoff. Baseflow in Grove Gulch averages 0.43 cubic feet per second (cfs). The proposed location of the sedimentation bay and vegetated swale is on a BSB-owned property consisting of a lowland area containing delineated wetlands. The project area sits in the floodplain of both Blacktail Creek and Grove Gulch Creek and has not been developed except for a few underground utilities and nearby residential properties.

1.3 Project Description

Figure 1 provides a site map of the Grove Gulch Sedimentation Bay project area. The primary objective of the Grove Gulch Sedimentation Bay is to improve surface water quality. The system will manage stormwater to reduce contaminant loading to BTC, and subsequently, SBC. This will be achieved by the settling of metals-contaminated suspended particles in the sedimentation basin. Vegetation in the system will provide ancillary benefit by phytoremediation of dissolved phase contaminants. Additional improvement to groundwater and/or surface water quality may be achieved by removal of mine waste from the project site. The Grove Gulch Sedimentation Bay has been designed to meet the requirements of the FRESOW.

Stormwater from the GG sub-drainage will be directed to a maintainable sedimentation bay located on the eastern edge of Lexington Avenue. The sedimentation basin and vegetated swale are designed to treat a 6-month, 24-hour SCS Type I design storm from the Grove Gulch sub-drainage area; the basin is designed to have sufficient capacity to capture one acre-foot of runoff volume from the Grove Gulch watershed and will have additional sediment storage volume beyond the stormwater capacity to allow for maintenance, which will coincide with a 20-year cleanout frequency. The discharge from the sedimentation bay is to be directed through the vegetated swale prior to entering Blacktail Creek. A vegetated bypass channel will circumvent the sedimentation bay and will be capable of adequately passing peak hydraulic flows according to the BSB Municipal Stormwater Engineering Standards (BSBMSES) using the U.S. Geological Survey (USGS) regression equations to protect the design from high flow events.

An arch culvert will be installed parallel to Lexington Avenue, immediately upstream of the proposed Grove Gulch Creek diversion structure. This culvert will be sized to convey the 100-year, 24-hour, Type 1 storm event peak flow of Grove Gulch Creek. Per FEMA requirements, the culvert will not increase upstream 100-year flooding conditions. The diversion structure will divert the design 90th percentile baseflow plus the 6-month peak flow from Grove Gulch Creek to the GG stormwater sedimentation basin. The diversion weir top of wall is designed to be set at the same elevation as the stormwater sedimentation basin hydraulic grade line (HGL) to ensure that the design volume does not spill back into Grove Gulch Creek. An orifice will be located on the upstream side of the diversion channel to restrict required design flows through the basin and minimize flow through the basin for conditions greater than the 90th percentile baseflow and 6-month peak flow. Flows greater than the design flow and up to 100-year peak flow conditions will be bypassed over the diversion weir, remaining in Grove Gulch Creek.

There will be a forebay to the sedimentation basin with a volume equal to 10% of the overall basin volume. The forebay will feature a maintenance access drive, hard lined bottom of flexible paver, and retaining walls. The system design includes a pilot channel stretching from the forebay discharge to the basin outlet structure. This pilot channel will convey 90th percentile baseflow. A wetland bench above the pilot channel will convey the 90th percentile storm event. The pilot channel and wetland bench will ensure that 90% of storm events pass through the vegetated zone.

In accordance with BSBMSWES requirements and EPA guidance, the outlet structure is sized to drain the basin volume within 24 to 48 hours. The outlet structure design features a floating orifice to pass baseflow, a primary outlet plate placed at the basin 6-month high water level, a secondary redundant orifice controlled by a hand-operated butterfly valve, and a primary emergency overflow weir at the top of the outlet plate sized under the assumption that lower orifices are 100% plugged at the 6-month high-water level (HWL). The outlet structure will also feature a secondary emergency overflow weir provided in the stormwater basin berm near the outfall of the basin to convey flow through the basin during 100-year storm conditions, assuming that outlet plate orifices and the outlet structure primary spillway are obstructed. The emergency overflow weir will be located one foot above the primary overflow weir and basin HWL. The weir will be sized so that its flow depth does not exceed the minimum berm elevation in the basin. The outlet storm drain will have an outlet invert greater than or equal to the invert of the outfall channel. The outlet structure will include a trash rack to protect the primary and secondary orifice from obstruction. The outlet structure will discharge to a vegetated swale sized to convey the flow through from the

stormwater sedimentation basin during 100-year conditions. The vegetated swale will sequester additional contaminants prior to discharge to Grove Gulch Creek.

During construction of the arch culvert and diversion weir, baseflow in Grove Gulch Creek will need to be diverted around the construction area to provide a dry working surface.

1.3.1 Contaminants of Concern Source

The contaminants of concern identified in the BPSOU Record of Decision Amendment (EPA, 2020b) (ROD) include aluminum, arsenic, cadmium, copper, iron, lead, mercury, silver, and zinc for surface water; and arsenic, cadmium, copper, lead, mercury, and zinc for groundwater. The sources of these contaminants at the Grove Gulch site include onsite contaminated soils, onsite contaminated groundwater, and contaminated surface water discharging to the site from the Grove Gulch Creek subdrainage.

2. EXISTING DATA SUMMARY

2.1 Pre Design Investigation Results

The investigations associated with the *Pre-Design Investigation Work Plan* (PDIWP) (AR, 2024a) which includes the *Buffalo Gulch and Grove Gulch Soils Characterization Sampling and Analysis Plan* (AR, 2020) and the *Grove Gulch Groundwater Characterization Quality Assurance Project Plan* (*Grove Gulch GW QAPP*) (AR, 2021), were meant to fill data gaps and inform the remedial design. The pre-design investigation included soil sampling for metals content, soil texture classification, infiltration rates, and geotechnical properties, groundwater monitoring for water levels, wetland delineation, floodplain investigation, and site topographic survey, including the survey of above and underground utility locations, survey of wetland delineation boundaries, and property boundary survey.

The *Grove Gulch PDIER* (AR, 2024b) summarizes the data collected under the *PDIWP* (AR, 2024a) and provides an evaluation of how that data is applicable to the design process. Below is a summary of the evaluation, with comprehensive details provided in Appendix A of the *PDIER* (AR, 2024b).

- COC exceedances were discovered in some soils beneath the Grove Gulch sedimentation bay and vegetated swale and will require removal to the Butte Mine Waste Repository. See *Grove Gulch Remedial Action Construction Drawings* (Construction Drawings) (Sheet C2.0) for locations of identified waste.
- Elevated groundwater COC concentrations (arsenic, copper, iron, and zinc) were discovered in some of the wells installed at the Grove Gulch site in 2020.
- The 3-year high groundwater level was found to be coincident with ground surface elevation.
- The shallow groundwater discussed above and in Section 1.2.3 of the PDIER will necessitate dewatering during construction activities as well as accounting for groundwater inflow post construction. The stormwater basin outlet structure has been designed to allow by-pass when groundwater inflow occurs into the basin, as well as when upgradient baseflow is present in the Grove Gulch Creek channel.
- Groundwater mixing with stormwater in the sedimentation bay may increase dissolved phase COC concentrations.
- A confining clay layer was identified underlying much of the site causing the need to raise the bottom elevation of all site features during design. See Section 3.2 of the PDIER for further discussion.

The overall rating for the Grove Gulch Wetland Assessment Area was 4.4 acres or 2.54 equivalent Functional Effective Wetland Area (FEWA) score in 2018. It received a high functional rating for water purification and production export/food chain support and moderate ratings for hydrologic support, flood flow alteration, sediment stabilization and erosion control, and aquatic diversity/abundance.

3. DESIGN CRITERIA

This section describes the applicable RAOs, FRESOW design criteria, and other sources of design criteria from the *ROD* (EPA, 2006a), *RODA* (EPA, 2020b), BSB, DEQ and FEMA. The addition of criteria from other sources provides a list of project design criteria that may be applicable to the project from those various sources. In some cases, various sources of criteria may not align with each other or with the RAOs or FRESOW requirements. In such cases, the FRESOW or RAO requirements take precedence. The design criteria selected to be applied to the design have been described in Section 5 of this report.

3.1 Further Remedial Elements Scope of Work Requirements

This section provides a summary of the requirements of the FRESOW (EPA, 2020a) applicable to the Grove Gulch Sedimentation Basin.

A sedimentation bay and vegetated swale shall be constructed by Atlantic Richfield along the eastern edge of Lexington Avenue to address stormwater from the Grove Gulch drainage area. The remedial activities are:

1. *Stormwater Sedimentation Bay and Vegetated Swale* – Construction of a stormwater sedimentation bay and vegetated swale designed to treat stormwater from the 6-month, 24-hour Type I storm from the Grove Gulch sub-drainage area.
2. *Tailings, Waste, and Contaminated Soils Excavation, Removal, and Disposal* – Removal of all tailings, waste and contaminated soils that exceed the Waste Identification Criteria in the attached Table 1, which are unsaturated by groundwater, encountered beneath the sedimentation bay and vegetated swale to the maximum observed groundwater elevation surface as recorded over the most recent 3-year monitoring period in the area.
3. *Regrading, Revegetation and Capping* – Regrading, vegetating, and constructing a cover system in any disturbed areas during construction, in accordance with the attached Table 3.

3.2 Remedial Action Objectives

The RAOs for solid media and surface water are outlined by the EPA in Section 8 of the BPSOU ROD (EPA, 2006a) as modified by the BPSOU RODA (EPA, 2020b).

3.2.1 Solid Media

The RAOs for contaminated solid media in the BPSOU from the ROD are:

- Prevent the ingestion of direct contact with, and the inhalation of, contaminated soils, indoor dust, waste rock, and/or tailings or other process waste that would result in an unacceptable risk to human health assuming current or reasonably anticipated future land uses.
- Prevent releases of contaminated solid media to the extent that they will not result in an unacceptable risk to aquatic environmental receptors.

- Prevent releases of contaminated water from solid media that would result in exceedances of the Montana State Water Quality Standards for surface water.
- Prevent releases of contaminated water from solid media that would result in exceedances of the Montana State Water Quality Standards for groundwater, except where ARAR waivers are appropriate and other means to protect from associated risks are available.
- Remediate contaminated solid media to the extent that it will not result in an unacceptable risk to human health and/or aquatic environmental receptors.
- Prevent release of contaminated water from solid media that would result in degradation of surface water, in accordance with the surface water remedial goals (RGs).

3.2.2 Surface Water

The RAOs for contaminated surface water provided in the ROD/RODA are:

- Prevent ingestion or direct contact with contaminated surface water that would result in an unacceptable risk to human health.
- Return surface water to quality that supports its beneficial uses.
- Prevent source areas from releasing contaminants to surface water that would cause the receiving water to violate surface water ARARs and RGs (or replacement standards for ARARs appropriately waived) for the BPSOU and prevent degradation of downstream surface water sources, including during storm events.
- Ensure that point source discharges from any water treatment facility (e.g., water treatment plant, wetland, etc.) meet ARARs.
- Prevent further degradation of surface water.
- Meet the EPA's modification to the 2020 BPSOU RODA (EPA, 2020b). The RODA defines the updated chronic and acute water quality standards and contingent post-construction waivers.

3.2.3 Groundwater

The RAOs for contaminated groundwater from the ROD are:

- Prevent ingestion of or direct contact with contaminated groundwater that would result in unacceptable risk to human health.
- Prevent groundwater discharge that would lead to violations of surface water ARARs and RGs for the BPSOU.
- Prevent degradation of groundwater that exceeds current standards.

3.3 Other Design Criteria

3.3.1 Butte Silver Bow Storm Water Criteria

The design of the stormwater basin will follow the Butte-Silver Bow's Municipal Storm Water Engineering Standards (BSBMSWES). As described in Section 4.11, certain variances to the BSBMSWES will be required, as approved by BSB. The key BSB stormwater criteria relevant to the Grove Gulch Sedimentation Bay design include:

- Hydrology shall be based on NOAA Atlas 2 precipitation data and hydrograph methodology. Hydrograph analyses shall be standard SCS Type I rainfall distribution resolved to 10-minute time intervals.
- Drain time for extended detention ponds is a minimum of 24 hours and up to 48 hours.
- Minimum two controlled emergency overflows – the primary overflow in the control structure and the secondary overflow at the engineered embankment.
- Crest of secondary emergency overflow shall be at least 0.5 feet above the rest of the primary overflow.
- The emergency overflow criteria from Section 8 of the HEC-22 Manual for capacity analysis shall be followed. The HEC-22 Manual requires:
    - The invert of the spillway at the outfall will be at an elevation of 0.3 meters (0.98') to 0.6 meters (1.96') above the maximum design storage elevation.
    - The emergency overflow weirs and downstream conveyance shall be designed for a minimum of the 25-year peak flow.
- Outlet structure shall be designed with debris barriers or trash racks to protect the outlet from blockage or plugging.
- Embankment material for detention ponds shall conform to the guidelines set forth in the MPWSS and the Montana State Department of Natural Resources and Conservation Dam Safety (Section 36.14.305) guidelines. Pond vegetation should be established using the materials described in these standards.
- The top of a cut embankment and the toe of a fill embankment shall be setback at least 5 feet from property lines.
- For ponds where the maximum design water depth is 3 feet deep and greater, the minimum bottom width shall be 12 feet to allow maintenance.
- The pond bottom shall be sloped at 0.5% towards the outlet for drainage to help facilitate maintenance.
- The grade of the access ramp to the bottom of the sedimentation bay shall be no steeper than 20%.
- Maximum access road grades shall be 15% and should be 15-feet wide with a clear driving width of 12-feet. Gates and/or removable bollards are required to restrict access, as

necessary, to drainage facilities. Cables and/or chains stretched across access roads are not acceptable.

- The methods set forth in Chapter 7.1.5 of the HEC-22 Manual shall be used for storm drain outfalls:

    - Flow-line or invert elevation of the proposed outlet should be equal to or higher than the flowline of the outfall.
    - The starting point for the tailwater HGL should be either the design tailwater elevation or the average of the critical depth and the height of the storm drain conduit (dc +D)/2, whichever is greater.
    - The invert of any outfalls shall discharge at the bankfull water surface elevation (2- year storm) in open channels or streams *(note that this is different than bullet #1 of the HEC-22 manual)*.

- Energy dissipation must be provided when exit velocities are in excess of 10 feet per second (ft/s).
- Minimum freeboard requirement for open channels shall be 0.5 foot below the top of bank for the design flow rate.

3.3.2 Butte-Silver Bow Public Works Criteria

Butte-Silver Bow Public Works Department requires the following criteria for installation of water service lines:

- Pipe shall be made of copper, polyethylene, polyvinyl chloride, or ductile-iron.
- If pipe extends over 100’ from the BSB main, it is recommended that nothing smaller than a 1” service line is installed from the main to the curb stop.
- Contractor shall refer to the materials specifications for installation, appurtenances, and service details.
- Trench shall be dewatered if water is encountered.
- A 10’ offset from critical infrastructure is required.
- Water service lines must be placed at a minimum depth of 6’-6”.
- Concrete reaction or thrust blocking shall be applied at all tees, plugs, valves, reducers, caps and at bends deflecting 11-1/4 degrees or more.
- All new valves shall be placed on property lines and a minimum of ten (10) feet of new pipe shall extend out of valve before coupling into existing steel mains.
- When a water pipe crosses within 18 inches to the top of a sewer pipe (sanitary and/or storm), the sewer must be installed or replaced with polyvinyl chloride PVC pressure pipe SDR21 I for 10 feet on each side of the crossing. Also, one length of the water pressure pipe is to be centered over the point of the crossing. The top of the water pipe may be

installed 18 inches or more below a sewer provided the sewer pipe is replaced or installed with pressure pipe and the pipe lengths are centered at the point of crossing as outlined above. The crossing shall be backfilled with compacted gravel for support of each pipe.

3.3.3 EPA Water Guidance

The design of the stormwater basin will follow the *EPA's Stormwater Best Management Practice Guide: Volume 1 – General Considerations* (EPA, 2004a), and *Stormwater Best Management Practice Guide: Volume 3 Basin Best Management Practices* (EPA, 2004b), unless specific rationale is described in Section 5 and deviation approved by EPA. Where the BSBMSWES does not provide guidance, the EPA guidance shall be applied. Where there is conflict between the two guidance documents, the most appropriate governance will be selected, as discussed in Section 5.

Criteria relevant to the Grove Gulch Sedimentation Bay design includes:

- Drain detention volume within 24-48 hours.
- Provide forebay storage capacity equal to approximately 10% of the storage.
- The typical cleanout cycle for a wet pond in a stabilized watershed is anywhere from 10 to 20 years.
- Consider thermal and mosquito impacts, water oxygen levels, and vegetation.

3.3.4 EDQ Criteria

The substantive requirements of the DEQ General Permit for Construction Dewatering Permit No.: MTG070000 Authorization to Discharge Under the Montana Pollutant Discharge Elimination System (DEQ, 2019) will be followed.

3.3.5 FEMA Criteria

The FEMA regulations allow for a definition and change of a regulatory floodway as "…the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." (44 CFR 59.1)

FEMA Guidance for Flood Risk Analysis and Mapping (FEMA, 2021) states the following regarding allowable increases in water surface elevation "Once a community has adopted a floodway, it must prohibit development in the floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed using standard engineering practice that the development will not result in any increase in flood levels during the base flood. FEMA defines "any" as meaning a zero increase (greater than 0.00 feet)."

3.3.6 Montana Department of Transportation Criteria

The Montana Department of Transportation Road Design Manual (MDT, 2016) was used to determine stopping and sight distances required for the intersection of Lexington Avenue and the Grove Gulch site access road to meet Montana Department of Transportation Encroachment Application requirements. According to the MDT Road Design Manual, intersection stopping

distance is determined with consideration for the effect intersection profile and alignment have on driver's sight distance.

3.3.7 Greener Clean Up Initiatives

The ASTM Standard Guide for Greener Clean Ups was used to qualitatively evaluate potential environmental impacts during completion of the Grove Gulch RA. The Greener Cleanup report, attached to the Remedial Action Work Plan (RAWP), demonstrates that many greener clean up initiatives are already embedded in the project framework.

3.4 Design Assumptions

The Grove Gulch RD incorporates the following assumptions:

- The Butte Mine Waste Repository will be available for disposal of all mine waste materials removed from the Grove Gulch project area.
- Waste materials will be conveyed to the Butte Mine Waste Repository in street-legal trucks on public streets and highways.
- Section 4 of the *Grove Gulch PDIER* demonstrates that the 3-year high groundwater level is at the ground surface.
- Waste materials outside the basin footprint will be removed rather than capped, to the extent practical as limited by existing infrastructure.
- Waste materials will be excavated at a maximum of a 2:1 (horizontal: vertical) slope as recommended by the *Grove Gulch Geotechnical Engineering Report* (Pioneer, 2024) (Geotech Report), Attachment A of the PDIER.
- Existing watermain infrastructure to the west and south of the sedimentation bay are critical infrastructure. Per BSB all excavation activities are to stay a minimum of 10' away from the existing watermains.
- No onsite materials will be used as reused backfill materials.
- Imported materials will be transported to the project site in street-legal trucks on public streets and highways.
- The project area will be secured with fencing for the duration of construction activities.
- FRESOW Table 2 Criteria D – Riparian or Sub-Irrigated Cap/Cover Systems will be used for the top 18" of backfill.
- End land use will be constructed in general accordance with the *Silver Bow Creek Conservation Area Master Plan* (LDI, 2020), which includes plantings, above ground design elements, and irrigation.
- The Grove Gulch project area will not provide public access following construction.
- Operation, Monitoring, and Maintenance will be performed by AR or its selected contractor following construction, through the Operational and Functional Period, and through the Compliance Determination Period.

- Construction will require dewatering in order to complete excavation, construction of site infrastructure, and completion of backfill and regrading activities.

3.5 Design Constraints

The following are the design constraints associated with the RD for the project site:

- The site is bounded by Lexington Avenue to the west, Interstate 15/90 to the north, and municipal waterlines to the south, west, and east. There is limited space for construction activities and stockpiling of materials.
- Limited vertical grade is available for conveying surface water flows.
- Critical infrastructure crossings and protection.
- Site is located in the 100-year floodplain of Grove Gulch Creek and therefore may become inundated during the 100-year flooding event.

3.6 Design Challenges

The following are the design challenges associated with the RD for the project site:

- Shallow groundwater conditions.
- The presence of a shallow clay layer which overlays a confined aquifer exhibiting artesian conditions.
- Contaminated groundwater in the project site.
- No electric power lines immediately adjacent to project site for long-term service.

4. DESIGN BASIS

This section presents the design basis for the Grove Gulch Sedimentation Bay. It includes a detailed description of the design approach and calculations demonstrating how the selected design criteria are achieved, or what variance from criteria is proposed. Major elements of the design are developed and presented with respect to the design criteria and project objectives. The major elements of the design include:

- Tailings, waste, and contaminated soils excavation, removal, and disposal
- Stormwater detention and retention, conveyance, and treatment; and
- Regrading, capping, and revegetation.

4.1 Excavation and Backfill

The Grove Gulch Sedimentation Bay Materials Management Plan (Materials Management Plan) (AR, 2024d) provides descriptions of how all the materials encountered at the Grove Gulch site are to be handled, including waste and other onsite materials, and provides the criteria that imported materials need to meet. The sections below provide details regarding how the requirements of the plan are implemented in the Grove Gulch Construction Drawings and Specifications.

4.1.1 Waste Removal

As the FRESOW requires and as described in the Materials Management Plan, waste beneath the stormwater basin, vegetated channel, and bypass channel footprints will be removed to the most recent 3-year high groundwater elevation or 18 inches below ground surface, whichever is greater, and hauled to an Agency approved repository for disposal, and waste remaining outside the basin and vegetated channel footprints will be removed and disposed of at the Butte Mine Waste Repository.

The Grove Gulch 3-year high elevation was calculated using the following methodology:

- Groundwater elevation data was compiled for the most recent 3-year monitoring period.
- Initially installed piezometers were placed into an aquifer showing confined effects, thus showing groundwater elevation data above the existing ground surface.
- During the additional soil sampling event, depth to groundwater was measured in each excavation borehole.
- Additional piezometers in 2020 were installed into the upper aquifer to collect groundwater elevation data to calculate the 3- year high groundwater elevation.
- Using Earth Volumetric Studio (EVS), a 3-year high groundwater surface was established across the site utilizing the water elevation data from the piezometers installed in 2020. The groundwater surface elevation varies due to the natural groundwater gradient as explained in Attachment E and Section 5.1 of the PDIER.

The analysis of the available groundwater level data from August 2020 to August 2021 showed a high groundwater elevation coincident with the existing ground surface, which was confirmed in the field by the presence of saturated ground and standing water during the installation of the piezometers in July 2020.

The RAWP Appendix C Construction Drawings delineate waste extents at the Grove Gulch project site (as compared to the FRESOW Table 1 Waste Identification Criteria); show the defined 3-year high groundwater level (coincident with the existing ground surface); and show the waste to be excavated and removed in plan and cross- section views. A 3-dimensional (3D) statistical model has been developed of the GG project area subsurface. The 3D model was created to delineate the waste extents to interpolate soil types (specifically the shallow confining clay layer), and to define the 3-year high groundwater level to inform the design of the excavation surface. As depicted on the Construction Drawings, waste below the 3-year high groundwater level (which is coincident with the ground surface) will be removed form the footprint and surrounding areas of the sedimentation bay and vegetated channel, as practically allowed by existing infrastructure[1]. This meets or exceeds the FRESOW requirement that waste above the 3-year high groundwater level within the stormwater bay and vegetated channel be removed.

Although waste was not identified beneath the bypass channel (Grove Gulch Creek downgradient of the proposed diversion/bypass structure) in the PDIER, the soil within the 100-year flooded extents of the bypass channel down to the 3-year high groundwater level or 18" deep, whichever is greater, will be removed and hauled to the project repository, as practically allowed by existing critical infrastructure. Any potential coincident waste encountered during excavation and reconstruction of the bypass channel will be removed thus meeting or exceeding the FRESOW requirements that waste above the 3-year high groundwater level within the bypass channel be removed.

The Materials Management Plan also describes the plan for handling municipal waste, hydrocarbon contaminated waste, hazardous waste, asbestos containing materials, PCBs waste materials, and other unanticipated waste, if encountered during excavation. While none of these materials are expected to be encountered during excavation, the Materials Management Plan provides the protocol for if any of the materials are encountered.

Maximum slopes of excavations will not exceed a 2:1 slope to meet the requirements of the Geotechnical Report. Excavation limits will not encroach within 10' horizontally from the existing BSB water mains to the west and south of the stormwater basin. Waste remaining adjacent to the 36-inch water line on the southern portion of the project site will be capped.

[1] From the FRESOW Section 4.1.2, "Critical infrastructure will be protected during removal construction actions, and removal of waste around those features will not be required, as determined by EPA, in consultation with DEQ."

The estimated cut from the Grove Gulch basin is 1644 BCY. All excavated materials from the Grove Gulch project area will be removed, including approximately 498 BCY of tailings, waste, and contaminated soils. No existing material will be reused onsite at the Grove Gulch site.

Triaxial strength testing was performed to define the engineering strength properties of a confining clay soil layer identified at Grove Gulch. Atterberg limits and hydrometer tests were also performed on each strength specimen. The Geotechnical Report summarizes the results. The results from the strength testing were used to assesses the uplift pressure from the confining aquifer on the clay layer above it. The uplift pressure was compared to earth's downward pressure and clay soil shear strength to evaluate integrity of the clay layer during excavation of the forebay and outlet structure (see Calculation Brief GG-023). Helical piers were designed to support various structural elements of the project due to concerns regarding the confining clay layer.

4.1.2 Engineered Cap

All material that meets the criteria for waste in Table 1 of the FRESOW, with the exception of waste that is within 10' of critical infrastructure, will be removed from site. Criteria D material meeting FRESOW Table 3 backfill criteria will be placed across the site. All excavated material is being removed from the Grove Gulch site to allow for construction materials meeting the FRESOW Tables 2 and 3 backfill criteria to be placed at the Grove Gulch site and to facilitate construction of the Grove Gulch Sedimentation Bay remedy. An engineered cap or capillary break is required over material that is not waste.

4.1.3 Riparian and Wetland Growth Media

The entire Grove Gulch project area is within the 100-year FEMA defined floodplain (see Attachment D of the PDIER), classifying it as riparian. Criteria D Riparian or Sub-irrigated Engineered Cap/Cover Systems, meeting the requirements of FRESOW Table 3, will be placed as the upper 18 inches of backfill across the project area overlaying Criteria B General Fill, as shown on the Construction Drawings.

Approximately 6047 CY of Criteria D material will be imported to the site from either the LAO stockpile, the Helehan Borrow Area, or other contractor-provided source that meets FRESOW Table 3 requirements and the requirements of the Technical Specifications.

4.1.4 Upland Growth Media

FRESOW Table 3 Criteria E material will not be placed at the project site because the entire project site is within the 100-year FEMA floodplain and thus not considered upland.

4.1.5 General Fill

General fill proposed for use at the Grove Gulch project area will meet the soil parameters of FRESOW Table 2 Criteria B General Fill and requirements of the Technical Specifications. General fill placed within the Grove Gulch project area (wetland) will be required to meet Criteria A metals criteria. Approximately 1,162 CY of Criteria B General Fill, meeting Criteria A metals criteria, will be imported to the project area from Owner supplied sources or other contractor-provided source.

4.1.6 In-stream Sediment Replacement Media

In-stream sediment replacement media proposed for use at the Grove Gulch project area will meet the requirements of FRESOW Table 2 Criteria C In-stream Sediment Replacement Media material. In-stream sediment replacement media will be placed in areas excavated under the bypass channel, which is the existing Grove Gulch Creek channel. The Construction Drawings identify the areas where this material will be placed. Approximately 181 CY of Criteria C In-stream sediment replacement media will need to be imported to the site.

4.1.7 Earthen Berms

Earthen berms will be constructed to establish the limits of the basin and for landscaping purposes. These berms must withstand periodic flooding. The volume of the Grove Gulch sedimentation basin will be 1 acre-foot, substantially smaller than the required 50 acre-feet for hazard determination per the Natural Resources and Conservation Dam Safety guidelines. Although a hazard determination is not required and although the embankment height of 5.4' is less than the 15' height associated with the minimum 8' berm top width, the NRCS Earth Dams and Reservoir requirement for a minimum 8' top width will be followed.

The Geotechnical Engineering Report recommends berms be designed with a maximum side slope of 2H:1V and overbuilding the berms by 0.5' to allow for material settling. Anticipated settling of earthen berms is accounted for in the Construction drawings in regard to freeboard of the emergency spillway. The Construction Drawings show a maximum berm side slope of 3H:1V and a freeboard of 2.0', which exceeds the Geotechnical Engineering Report recommendations. In addition, a topsoil layer, which will vary from 6" to 18" depending on vegetation and cap type, will be placed on top of compacted general fill, and "planted or seeded" in accordance with the revegetation and capping plan in the Construction Drawings.

The total fill, including the import of aggregate materials, required to achieve final grading requirements is 7853 CY. Calculation Brief GG-014 provides a summary of the earthwork balance for the project accounting for the various material that will need to be removed from the project and various material that will need to be imported to the project.

4.1.8 Groundwater Dewatering

During construction, groundwater dewatering will occur to achieve the required soil excavation depths for the Grove Gulch Remedial Action as shown on the Construction Drawings. Groundwater chemistry samples were collected at piezometers monthly from August 2020 to August 2021 in accordance with the *Grove Gulch Groundwater Characterization Quality Assurance Project Plan* (Grove Gulch GW QAPP) (AR, 2021). Results indicated elevated concentrations of some dissolved metals. Therefore, the dewatering flow may require treatment prior to discharge into Grove Gulch Creek. The design of the dewatering system, if needed, will be performed by the CMGC and the performance will be monitored per the *Final Grove Gulch Construction Monitoring Quality Assurance Project Plan* (QAPP) (Atlantic Richfield, 2024c).

For post-construction conditions, the presence of shallow groundwater during certain seasons introduces the potential for groundwater to flow into the constructed stormwater basin. This

groundwater may have elevated concentrations of arsenic and iron. This, however, is not anticipated to adversely affect surface water compliance in Silver Bow Creek (see Calculation Briefs GG-016 and GG-017).

4.2 Stormwater Storage, Treatment and Conveyance

The attached Figure 2 provides the Process Flow Diagram (PFD) for the stormwater conveyance and treatment train for the proposed stormwater sedimentation basin. The elements of the conveyance and treatment train include:

- A culvert under the drive entrance in the existing Grove Gulch Creek channel to the west of the project site.
- A diversion structure which diverts flow up to the design storm to the proposed stormwater sedimentation basin and allows larger storm events to bypass the stormwater basin.
- A vegetated channel and culvert between the diversion structure and forebay.
- A forebay upstream of the sedimentation bay.
- A proposed stormwater sedimentation bay, which includes a forebay, with required volume for sedimentation/settling purposes.
- A vegetated pilot channel and wetland bench to convey baseflow and storm flow through the basin from the forebay to the basin outlet structure.
- A trash rack before the outlet structure to screen out larger debris and a floating skimmer in the outlet structure to screen out smaller, floating debris.
- A basin outlet structure with associated flow control orifice plate to drain the basin volume over 24 to 48 hours to the vegetated swale and a device to allow the by-pass of baseflow around the stormwater flow control orifice plate. This structure also contains a primary overflow weir plate and a redundant flow control valve in the event that the flow control orifices become plugged.
- An emergency overflow spillway which conveys storm events larger than the design event to the vegetated outlet swale.
- A vegetated swale downstream of the basin outlet storm drain provides water quality benefits.
- All wastes below the reconstructed vegetated bypass channel will be removed.

4.2.1 Culvert Under Drive Entrance

A 9’7” by 4’1” open bottom arch culvert will be installed along Grove Gulch Creek just upstream of a diversion structure. The open bottom arch culvert will allow for the existing naturalized channel to remain intact as much as possible during construction. The proposed culvert will convey the 100-year, 24-hr Type 1 storm event peak flow of 132 cfs and the 90th percentile peak baseflow of 1.37 cfs without increasing upstream 100-year flooding conditions by more than 6” to conform with the FEMA requirement. Calculation Brief GG-001 provides the hydrology modeling used to determine the design flows and Calculation Brief GG-006 provides design calculations for the

culvert. The culvert will be installed in accordance with the Construction Drawings and Technical Specifications. Details regarding the operation and maintenance of the culvert are found in the Draft Grove Gulch Operation, Maintenance, and Monitoring Plan (AR, 2024e) (Grove Gulch OM&M Plan).

4.2.2 Diversion Structure

The diversion structure will be located immediately downgradient of the main drive entrance culvert; will divert flow to the forebay via a vegetated channel followed by an 18" culvert under the maintenance access road; and will be comprised of a metal diversion plate and a bypass plate. The diversion plate will divert a design flow equal to the 90th percentile baseflow of 1.37 cfs, in addition to the 6-month peak flow of 12.37 cfs for a total flow of 13.74 cfs via a low point orifice to the forebay. The top of the diversion plate will be set at the same elevation as the sedimentation bay high water elevation (HWL) so that the design detention volume does not spill over into the Grove Gulch Creek bypass channel. Flow greater than the diversion design flow will be conveyed over the bypass weir. The top of the bypass plate weir will be set at an elevation so that during 100-year peak flow condition upgradient flood conditions are not adversely impacted and so that under such conditions the diversion plate is not overtopped. See the Calculation Brief GG-007 for details regarding the required diversion structure configuration, including the bypass plate weir length and diversion plate orifice sizing. The diversion structure will be installed in accordance with the Construction Drawings and Technical Specifications.

The micro-pool that is created between the proposed main driveway culvert, the diversion plate, and the diversion weir will accumulate sediment during baseflow and storm event conditions. There will also be a micro-pool created between the diversion plate and the forebay in the vegetated channel before the 18" culvert. These sediment accumulation areas will be cleaned out via a Hydrovac truck hose from either the main access drive above the bay, the maintenance access road, or from the vegetated swale itself. A plug will be available for installation (sized according to Calculation Brief GG-007) on the diversion plate orifice, and a gate on the bypass plate to allow the diversion plate orifice to be closed and the bypass plate orifice to be opened to thus divert baseflow around the stormwater basin during maintenance activities.

4.2.3 Vegetated Channel and Culvert Between Diversion Structure and Forebay

A vegetated channel and culvert will be provided to convey design flow from the diversion structure to the forebay. The vegetated channel will be sloped at 0.5% and 5 feet wide with 5:1 side slopes (see Calculation Brief GG-027) to convey the 6-month storm. The culvert will be sloped at 0.5% and be an 18" CMP culvert (see Calculation Brief GG-026).

4.2.4 Forebay

A forebay will be provided in accordance with the EPA's Stormwater BMP Guidance, sized to be at least 10% of the overall basin volume. The forebay will have a concrete maintenance access ramp, a concrete paver bottom, and retaining walls to facilitate easy cleanout. The maintenance access ramp will be 10' wide with a maximum slope of 10%. This configuration meets the requirements of BSBMSWES. The Calculation Briefs GG-004 and GG-005 detail how the required volume was derived and how the proposed forebay configuration provides the necessary

volume. The forebay will be installed in accordance with the Construction Drawings and Technical Specifications.

The forebay outlet will consist of a removable steel plate with one 6" circular orifice. The steel plate and orifice will route a flow equivalent to the 90th percentile storm peak value, while flows up to the 6-month storm peak flow (See GG-001 Hydrology Calculation Brief) will flow over the steel plate. The steel plate orifice is designed to detain water in the forebay and manage flow from the forebay to allow for sedimentation. The sizing of the forebay outlet structure can be found in Calculation Brief GG-025. The forebay outlet plate is designed as a single steel plate with an orifice configuration stamped out. It may be switched out with a new plate with a different orifice configuration in the future if optimization is required. The original plate can be unbolted, removed, and replaced.

4.2.5 Pilot and Wetland Channel

A pilot channel through the sedimentation bay will be provided from the forebay to near the outlet structure. This pilot channel will convey the 90th percentile baseflow. A wetland bench above the pilot channel will be provided to convey the 90th percentile storm event, in accordance with regional guidance for flows to be targeted for water quality purposes. This wetland vegetated zone ensures that a large majority (90%) of the storm events will pass through it. The attached GG-001 Calculation Brief provides details on how the design flows were derived and the GG-009 Calculation Brief provides details on the conveyance capacities of the pilot channel and the wetland bench. Calculation Brief GG-009 demonstrates that armoring of the pilot channel and wetland bench is not necessary, and that wetland vegetation established via a Coir mat will be sufficient to prevent erosion of the channel and bench during establishment of vegetation. The in-basin pilot channel and wetland bench will be installed in accordance with the Construction Drawings and Technical Specifications.

4.2.6 Sedimentation Bay

The FRESOW requires that the Grove Gulch Sedimentation Bay have a volume equal to one acre-foot and account for sediment accumulation. While the FRESOW does not provide specific requirements on the sediment accumulation frequency to be designed for, a 20-year frequency will be used. The Draft Grove Gulch Remedial Design Hydrology Report (W&C, 2021) provided in Appendix C analyzes a SWMM model to determine the peak flow and inflow volume from a 6-month, 24-hour SCS Type I storm event. The resulting 6-month, 24-hour inflow volume to the Grove Gulch stormwater sedimentation basin is 0.96 ac-ft. The GG-002, GG-003, and GG-005 Calculation briefs detail how the required volume, groundwater inflow volume, and 20-year sediment accumulation were derived and how the proposed forebay and sedimentation bay configuration provides the necessary total volume of 1.04 acre-foot at a 6-month HWL of 5448.75'. The stormwater bay will be constructed in accordance with the Construction Drawings and Technical Specifications.

4.2.7 Sedimentation Bay Outlet Structure

The outlet structure will consist of a primary outlet plate that will be configured with a series of orifices located vertically throughout the operating depth of the detention pool, a floating device

to pass baseflow, a redundant butterfly valve outlet, a sump in the outlet structure and in front of the outlet plate, baseflow bypass, a primary emergency overflow weir at the top of the outlet plate, and a flume at the outlet of the structure that will be used to accurately measure basin discharge flow rates. The outlet structure will be installed in accordance with the Construction Drawings and Technical Specifications. The forebay outlet plate is designed as a single steel plate with an orifice configuration stamped out. It may be switched out with a new plate with a different orifice configuration in the future if optimization is required. The original plate can be unbolted, removed, and replaced.

A trash rack has been sized according to Calculation Brief GG-010 and will be located at the front of the outlet structure to prevent large debris from hindering the function of the discharge mechanisms. The floating skimmer on the inside of the trash rack will be a floating boom of 12" maximum height, equal to the depth of the outlet structure sump, and connected to each side of the structure. It will prevent smaller, floating debris from hindering the function of the various discharge mechanisms. The floating skimmer has been confirmed to be able to withstand and continue to function during freezing conditions.

The outlet structure primary outlet plate is sized to drain the basin volume in 24-48 hours in accordance with BSBMSWES requirements and EPA guidance (see Calculation Brief GG-010). This primary outlet plate will consist of a series of orifices spaced every 6" vertically and will be able to be reconfigured after the initial installation by swapping out different plates with new orifice configurations.

The emergency overflow weir will be in the outlet structure and shall act as one of the two controlled emergency overflows required by the BSBMSWES Section 10.12.8 requirements. The primary emergency overflow weir elevation will coincide with the basin 6-month HWL at 5448.75'. The primary overflow weir is sized assuming that the lower orifices are 100% plugged at the 6-month HWL, ensuring design redundancy during 100-year storm flooding conditions1. The attached GG-001 Calculation Brief shows how the design storms were derived, the GG-007 Calculation Brief shows how the flow through the stormwater basin during 100-year was derived, and the GG-010 Calculation Briefs show the proposed outlet plate configuration and associated discharge.

The floating baseflow bypass device will be equipped with a valve on the downgradient side of the structure to allow the restriction of baseflow discharge relative to match incoming baseflow and groundwater seep into the stormwater basin[2]. The floating baseflow bypass device has been confirmed to be able to withstand and continue to function during freezing conditions. Calculation Brief GG-010 provides a description of the flow conditions and sizing of this bypass device and associated valve.

[2] Note that this flow is not equal to the entire 100-year peak flow in the Grove Gulch Creek conveyance channel, rather the flow which is conveyed through the stormwater sedimentation basin via the diversion structure when 100-year conditions occur in the existing Grove Gulch Creek conveyance channel.

The redundant hand operated butterfly valve can be automated in the future if desired. The outlet plate structure and redundant butterfly valve will be interchangeable to allow for maintenance of the outlet plate structure, if required. Future integration details can be found in Section 5.11. The sizing of this valve can be found in Calculation Brief GG-010.

The flume installed on the downgradient side of the outlet structure and discharge mechanisms will allow for accurate measurement of flow and an accessible water quality sampling point for performance monitoring purposes. Conduits will be provided from the outlet structure to monitoring equipment housing to assist with maintenance of flow meter and automatic sampling equipment tubing.

4.2.8 Emergency Overflow Spillway

An emergency overflow spillway will be provided in the sedimentation bay berm to convey flow during 100-year and greater conditions[3], exceeding the BSBMSWES requirement for 25-year flows. This design of this emergency overflow spillway assumes that the outlet plate orifices and the outlet structure primary overflow weir are 100% clogged, ensuring redundancy of design. The spillway will be located at an elevation 1.0' above the primary overflow weir and basin HWL, per BSBMSWES Section 10.12.8 requirements. The spillway will be sized so that its flow depth does not exceed the minimum berm elevation in the basin. At the design flow condition, water in the sedimentation basin will be approximately 1 foot below the minimum top of berm elevation. The attached Calculation Brief GG-012 provides details on the spillway calculations. The emergency overflow spillway will be installed in accordance with the Construction Drawings and Technical Specifications.

4.2.9 Vegetated Swale

The vegetated swale is sized to convey the baseflow and design storm event flow through the stormwater sedimentation basin during 100-year conditions1. The Calculation Brief GG-013 provides model results for the vegetated swale capacity. Calculation Brief GG-013 demonstrates that wetland vegetation established via a coir mat will be sufficient to prevent erosion of the channel and bench during design flow events. The channel will have vegetation, appropriate for the hydrologic zone and ancillary COC sequestration, selected for water quality benefits. The vegetated swale will be constructed in accordance with the Construction Drawings and Technical Specifications.

4.2.10 Management of Groundwater Inflow

Groundwater inflow to the stormwater basin, associated pilot channel, and vegetated swale will continue to occur post-construction. While arsenic, copper, cadmium, iron, and zinc exceed BPSOU ROD/RODA groundwater water quality standards in some of the project site piezometers, as shown in Section 5.2 of the PDIER, the post-construction groundwater inflow is not expected

[3] This flow matching will be accomplished with monthly readings taken of the flow rate out of the basin during dry conditions and the baseflow bypass valve adjusted to match this outflow rate. Further details are provided in the Grove Gulch OM&M plan.

to impact surface water compliance at the BPSOU surface water points of compliance. Calculation Brief GG-017 provides an evaluation of the potential impacts of groundwater inflow at the site. The captured groundwater will pass through the outlet structure and vegetated swale. Given the higher iron concentrations in the groundwater, which occasionally exceed BPSOU ROD/RODA water quality criteria, the seep into the basin may cause some staining of the outlet structure but will not impact the function of the basin or outlet structure.

4.2.11 Floodplain Management

A hydraulic analysis was performed to model the proposed Grove Gulch Sedimentation Bay Remedial Action and determine its impacts on the water surface elevations of Grove Gulch Creek. The no-rise analysis shows that the proposed project does not increase the FEMA Base Flood Elevation when analyzing the Base Flood Discharge; therefore, the Grove Gulch Project meets the No-Rise requirements established by Congress in the Code of Federal Regulations 44 CFR § 60.3 (D 3). Further details of the hydraulic analysis can be found in the Grove Gulch Sedimentation Bay Remedial Action No-Rise Analysis (W&C, 2024).

4.3 Basin Liner System

No liner will be installed at the Grove Gulch basin, since it is not required to be lined by the FRESOW.

4.4 Structure Elements

The diversion structure will have custom metal walls to contain and divert design flows, while bypassing flows that exceed the design storm. Structural footers will be associated with weirs and outlet structures. Calculation Brief GG-008 provides an evaluation of the structural element sizing and detailing for the diversion structure.

The forebay will have cast-in place retaining walls with structural footers as well as block-rock retaining walls. Calculation Brief GG-008 provides an evaluation of the structural element sizing and detailing for the forebay.

The outlet structure will have cast-in place retaining walls with structural footers. Calculation Brief GG-008 provides an evaluation of the structural element sizing and detailing for the outlet structure.

Block-rock retaining walls will be constructed in and around the Grove Gulch Sedimentation Bay to aid in grading of site access, diversion structure, and sedimentation bay. The main block-rock retaining walls will be the headwalls for the main drive entrance culvert. These block-rock walls will have an aggregate base course installed prior to the installation of the block-rocks. Calculation Brief GG-008 provides an evaluation of the structural element sizing and detailing for block-rock retaining walls.

The site access, diversion structure, forebay, outlet structure, and block-rock retaining walls will be installed in accordance with the Construction Drawings and Technical Specifications.

4.5 Maintenance Access

The maintenance approach from Lexington Avenue to a gravel maintenance parking lot and turn around area to the west of the outlet structure will be provided via a gravel drive a minimum 15' wide and with a maximum 15% grade, meeting BSB Municipal code, to accommodate BSB maintenance vehicles and provide adequate space for the vehicles to turn around or back out safely. Per the Geotech Report, the gravel access drives, gravel parking lot, and turn-around area at the outlet structure shall be a minimum of 9" thick. Calculation Brief GG-015 provides the truck turning movements for a light duty truck and trailer to the parking lot to the west of the outlet structure and for a BSB Hydrovac truck to the turn-around area at the outlet structure. The calculation brief also demonstrates how the maintenance access gate is located so that a BSB truck and trailer can pull into the drive entrance and unlock the gate without the trailer protruding into Lexington Avenue.

A concrete access ramp will be provided into the forebay to provide skid steer access to the bottom of the forebay.

4.6 Erosion Control

Measures to control erosion and sediment for the Grove Gulch project area will consist of revegetation, streambank stabilization, and construction of temporary BMPs. During the implementation of the Grove Gulch Remedial Action, Atlantic Richfield's contractor will submit a Storm Water Pollution Prevention Plan (SWPPP) that will meet the substantive requirements of the Montana Pollutant Discharge Elimination System (MPDES) permits.

4.7 End Land Use

The Grove Gulch project area has been designed consistently with remaining Silver Bow Creek Conservation Area (SBCCA) project sites. The Grove Gulch project area will includes landscape grading, native plantings, block rock retaining walls, and site lighting. The security gate and monitoring housing structure maintain similar design and materials as remaining SBCCA End Land Use (ELU) features. No public access will be permitted at the Grove Gulch project area. The aforementioned features will be installed in accordance with the Construction Drawings and Technical Specifications.

4.7.1 Vegetation

Native trees, shrubs, forbs, and wetland plantings will be planted and seeded in and around the Grove Gulch Sedimentation Bay. The planting design will encourage diversity and extend existing plant communities. Wetland plantings will be planted within the basin to aid in the storm water treatment process. Plantings have been selected as appropriate for the various zones: wetland, transitional, and upland.

4.7.1.1 Wetland Plantings

The sedimentation bay will be planted with wetland species selected to aid in stormwater treatment processes. The selection of wetland plants will include considerations for plants that slow hydraulics and provide continuous organic matter inputs to their environment. Wetland plant

selection has weighed ability to increase metal adsorption and absorption sites, sedimentation, and biogenic precipitation sites for long-term functionality. Wetland plantings contribute to the overall visual appeal of the sedimentation bay and contribute to biodiversity and wildlife habitat. Selected wetland plantings and their corresponding zones are provided on the Construction Drawings.

4.7.1.2 Upland Plantings

The upland area around the basins will be planted with native upland plant species including grasses and woody species. Some upland woody species will be planted, and the remaining grasses will be hydro mulched. Selected upland plantings and their corresponding zones are provided on the Construction Drawings.

4.7.2 Irrigation

An irrigation system will be installed to improve plant establishment. The system will be operated for a minimum of 2-years to establish upland plants and to ensure survival of wetland plants during dry periods.

Water for the irrigation system will be provided via a tap of the existing waterline to the west of the stormwater basin. A stub-in with curb box and stop to the water main running perpendicular to Lexington Avenue on the southern boundary of the site will be required. A water meter will be installed per BSB code on the private side of the service line.

4.7.3 Irrigation Controller and Monitoring Equipment Housing

Housing for the irrigation controller and the monitoring equipment will be provided with a Safe-T Cover enclosure. The housing at the outlet structure is also sized to provide for future smart controls. Irrigation controls will be exteriorly mounted on the housing for the monitoring equipment. Calculation Brief GG-019 provides the rationale for the housing box sizing based on the equipment demands.

4.7.4 Site Lighting

Site lighting will be installed near the entry gate, forebay, and outlet structure to provide lighted access for maintenance purposes during low-light conditions. Electricity will be supplied by solar panels. The solar panels for the site lighting will supply power for the lights and for nearby monitoring equipment and irrigation controller, with batteries for each to be provided in the associated housing boxes. Calculation Brief GG-021 provides the electrical loading demands and solar supply calculations for the selection of the electrical components and as illustrated in the Construction Drawings and Technical Specifications.

4.8 Electrical Supply

The long-term monitoring equipment, automation and controls, site lighting, and irrigation equipment will be electrically powered solar panels installed on the site lighting poles. Battery banks will provide power during low-light conditions.

4.9 Automation and Controls

If deemed necessary following the Operational and Functional Period, automation and controls may be considered to improve performance of the GG Sedimentation Bay. These devices could include 1) an Opti RTC stormwater management system operating independently of remaining BPSOU systems, or 2) immediate integration of the Opti RTC stormwater management system with the BPSOU SCADA automated system. These devices would be housed in the monitoring equipment and controls housing at the outlet structure. Calculation Brief GG-019 provides the rationale for the sizing of the housing accounting for possible future addition for both options.

4.10 Operations and Maintenance Considerations

Operation and maintenance considerations have been accounted for in the design. The applicable elements of the design include:

- The width and slope of maintenance access drives in accordance with BSB requirements, which will allow ready access to the various project elements for maintenance and monitoring personnel.
- Vegetation and boulders at the top of the forebay walls will discourage monitoring personnel, maintenance personnel, and the general public from going near the walls.
- Railings and locked gates around the outlet structure will restrict and deter public access.
- Stoops and ladders leading down to a concrete stoop, which will allow cleaning of the outlet structure trash racks, sump, boom, outlet plates, redundant valve, baseflow bypass device, and flume.
- Native vegetation has been selected to reduce the maintenance and water needed to sustain the vegetation.

Sediment accumulation within the forebay is anticipated to require cleanout twice per year (see Calculation Brief GG-003). The primary equipment for cleanout will be a skid-steer accessing the forebay from the maintenance access ramp. A side wall (the height of the axel height of a BSB skid-steer plus 6” along the access ramp) will be provided to allow for safe access. The forebay may also be cleaned out using a Hydrovac truck. The maintenance parking lot directly to the east of the outlet structure has been sized to allow access and turnaround of a BSB truck and trailer, which provides a longer total vehicle length and therefore worse case truck turning movement as compared to only a Hydrovac truck (see Calculation Brief GG-015). Specific operation and maintenance details for the forebay are found in the Grove Gulch OM&M Plan.

Sediment accumulation within the stormwater basin is anticipated to require cleanout once every 20-years (see Calculation Brief GG-003). The main basin will be accessed via a skid-steer from near the forebay with an exit point near the outlet structure. This will allow a skid steer to clean out the main pilot channel and adjacent wetland areas. Specific operation and maintenance details for the stormwater basin are found in the Grove Gulch OM&M Plan.

It is anticipated that the outlet structure will need to have sediment, debris, and trash cleaned out periodically, on an as-needed basis. An access drive for a Hydrovac truck will be provided to the

outlet structure along the west side of the stormwater basin to allow for easy cleanout of the sump area in front of the outlet plate. The outlet structure interior will be accessible by stairs to both the inlet and outlet sides of the structure, including to the trash rack and floating skimmer. Specific operation and maintenance details for the outlet structure are found in the Grove Gulch OM&M Plan.

4.10.1 Long-Term Monitoring

To provide performance monitoring of the stormwater basin, flow and water quality immediately upgradient of the diversion structure and downgradient of the outlet structure will be monitored. With the goal of the monitoring data informing basin inflow and outflow Total Suspended Solids (TSS) and COC loading over time, and the resulting basin TSS and COC treatment efficiency, monitoring equipment will be installed to monitor the following parameters:

- water flow rates via continuous flow meters
- water quality for the BPSOU COCs and TSS via automatic water samplers; and
- turbidity and conductivity via a continuous water quality meter.

Further details regarding the monitoring equipment and monitoring quality assurance protocol will be provided in the annual update of the *BPSOU Site-Wide Surface Water Monitoring QAPP* (AR, 2023) once the basin construction is completed. The sampling and monitoring equipment will be stored in housing near the inlet and outlet with electric supply provided as described above. The conduit for the monitoring equipment tubing, actuator cables, and meter cables will be installed by the selected RA contractor according to the Construction Drawings.

Monitoring both the forebay and outlet structure will allow for TSS and COC loading determinations and removal efficiency determinations. How this information will be used to trigger various maintenance investigation and/or activities is described in the Grove Gulch OM&M Plan.

Full details for O&M procedures are provided in the Draft Grove Gulch OM&M Plan. The Draft Grove Gulch Sedimentation Bay OM&M Plan will be integrated within a program-wide SBCCA OM&M Plan.

4.11 Variances

Once variance has been requested from the BSBMSWES. The variance request approval from BSB can be found in Appendix F and includes:

- The BSBMSWES requires that storm water conveyance features have a slope of at least 0.5%. Some features of the Forebay at the Grove Gulch site will have slopes less than 0.5%.

5. ACCESS AND EASEMENT REQUIREMENTS

5.1 Access Requirements

No access permit is necessary for the permanent access to the site from the BSB owned and operated Lexington Avenue. The attached Calculation Brief GG-016 shows the requirements of 385’ for southbound traffic and 360’ for northbound traffic for sight distance for entering and exiting the access drive onto Lexington Avenue. No vegetation or boulders taller than 36” will be installed within the site triangle. This will provide a clear line of sight to the minimum sight distances stated above (see GG- 015 Calculation Brief). Montana Department of Transportation concurrence of this access approach is in Appendix G. Temporary access to the site during construction will be provided via Delaware Ave. from the south. Details of these access points are provided in the Construction Drawings.

5.2 Easement Requirements

Section 7 of the BSBMSWES provides requirements for easements for maintenance access to culvert, channels, and stormwater facilities. However, since the proposed stormwater sedimentation basin is entirely within BSB property there is no need for easement. Temporary access to the site during construction will be provided via a pre-existing public easement from the south, along Delaware Ave

6. REFERENCES

EPA, 1995. *Remedial Design/Remedial Action Handbook, EPA 540/R-95/059. U.S. Environmental Protection Agency June 1995.*

BSB, 2003. *Storm Water Management Program for the Butte MS4. Prepared by Water & Environmental Technologies for Butte Silver Bow Public Works. March 2003.*

EPA, 2004a. *Stormwater Best Management Practice Design Guide: Volume 1 General Considerations. EPA/600/R-04/121. U.S. Environmental Protection Agency. September 2004.*

EPA, 2004b. *Stormwater Best Management Practice Design Guide: Volume 3 Basin Best Management Practices. EPA/600/R-04/121B. Environmental Protection Agency and Michael L. Clar, et.al. September 2004.*

EPA, 2006a. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Record of Decision. Environmental Protection Agency. September 2006.*

EPA, 2006b. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Groundwater Technical Impracticability Zone. Environmental Protection Agency. September 2006.*

BSB, 2011. *Butte-Silver Bow's Municipal Storm Water Engineering Standards. Butte Silver Bow Public Works Department. March 2011.*

EPA, 2011. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Unilateral Administrative Order. Environmental Protection Agency. July 2011.*

BSB, 2015. *Material Specifications for: Water Mains, Water Service Lines, and Firelines. Butte Silver Bow Public Works Department. 2015.*

Montana Department of Transportation (MDT). 2016. *Road Design Manual. September 2016.*

BSB, 2018. *Operation and Maintenance Plan for the Butte-Silver Bow (BSB) Superfund Storm Water System (SSWS) within the BPSOU ("BSB" O&M Plan"). Superfund Division. June 2018*

BSB, 2019. *Local Weather and Climate. co.silverbow.mt.us/483/Local-Weather-Climate. Butte Silver Bow City-County. Accessed June 2019.*

Montana Department of Environmental Quality, 2019. *Circular DEQ-7 Montana Numeric Water Quality Standards. Montana Department of Environmental Quality Water Quality Planning Bureau. June 2019.*

DEQ, 2019. *General Permit for Construction Dewatering Permit No.: MTG070000 Authorization to Discharge Under the Montana Pollution Discharge Elimination System. Montana Department of Environmental Quality. November 2019.*

EPA, 2020a. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Final Remedial Elements Scope of Work. February 2020.*

EPA, 2020b. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Record of Decision Amendment. February 2020*

EPA, 2020c. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Compliance Determination Plan. February 2020.*

EPA, 2020d. *Consent Decree for the Butte Priority Soils Operable Unit. Partial Remedial Design/Remedial Action and Operation and Maintenance. U.S. Environmental Protection Agency. Available at https://www.co.silverbow.mt.us/2161/Butte-Priority-Soils-Operable-Unit-Conse.*

Land Design Inc (LDI) 2020. *Silver Bow Creek Conservation Area Master Plan. March 2020.*

Atlantic Richfield, 2020. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Draft Buffalo Gulch and Grove Gulch Soils Characterization Sampling and Analysis Plan (SAP). September 2020.*

Atlantic Richfield, 2021. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Final Grove Gulch Groundwater Characterization Quality Assurance Project Plan. January 2021.*

W&C, 2021. *Draft Grove Gulch Remedial Design Hydrology Report Modeling. May 2021.*

BSB, 2021. *Butte-Silver Bow, Montana Municipal Code. July 2021*

FEMA 2021. *Guidance for Flood Risk Analysis and Mapping. November 2021.*

W&C, 2024. *Grove Gulch Sedimentation Bay Remedial Action No-Rise Analysis. March 2023.*

Atlantic Richfield, 2023. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. BPSOU Site-Wide Surface Water Monitoring QAPP. July 2023.*

Atlantic Richfield, 2024a. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Final Grove Gulch Sedimentation Bay Pre-Design Investigation Work Plan (PDIWP). March 2024.*

Atlantic Richfield, 2024b. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Final Grove Gulch Sedimentation Bay Pre-Design Evaluation Report (PDIER). March 2024.*

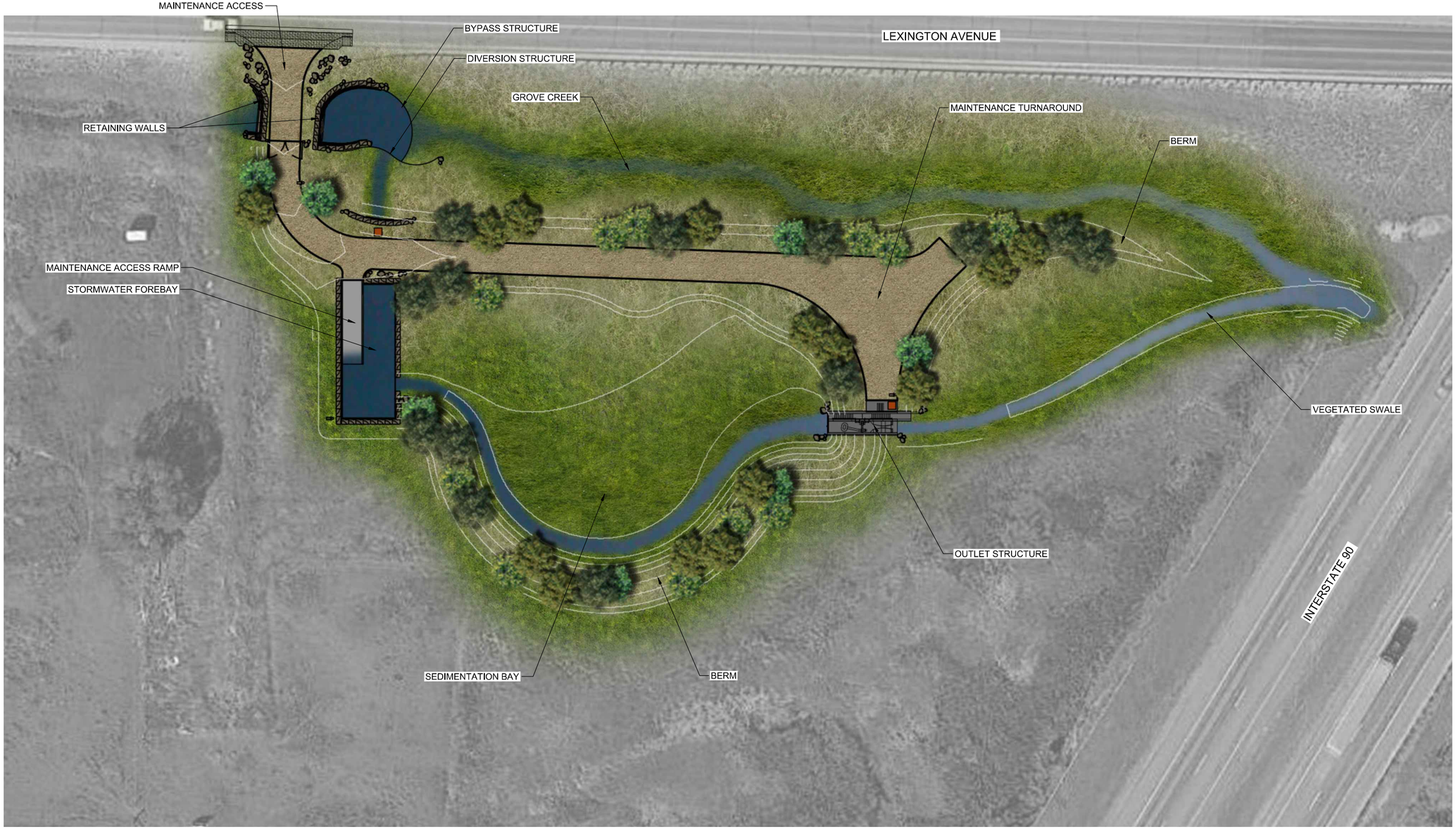
Atlantic Richfield, 2024c. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Final Grove Gulch Construction Monitoring Quality Assurance Project Plan (QAPP). March 2024.*

Atlantic Richfield, 2024d. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Grove Gulch Sedimentation Bay Materials Management Plan. March 2024.*

Atlantic Richfield, 2024e. *Silver Bow Creek/Butte Area NPL Site. Butte Priority Soils Operable Unit. Draft Grove Gulch Operations, Maintenance and Monitoring Plan. March 2024.*

Pioneer Technical Services, 2024. *Grove Gulch Geotechnical Engineering Report. Pioneer Technical Services. March 2024.*

Figures



30' 0 30' 60'

BAR SCALE
1" = 30'

100% PLAN SUBMITTAL (ISSUED FOR CONSTRUCTION)

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REV	DESCRIPTION	DATE
5	100% PLAN SUBMITTAL (FOR CONSTRUCTION)	03.01.2024
4	100% PLAN SUBMITTAL	01.12.2024
3	95% PLAN SUBMITTAL	08.11.2023
2	60% PLAN SUBMITTAL	11.24.2021
1	30% PLAN SUBMITTAL	12.18.2020

DESIGNED BY: LDI | CHECKED BY: SR
DRAWN BY: ---- | X-GG-CONCEPTUAL ELU.dwg

CONCEPTUAL END LAND USE
(PROJECT OVERVIEW PLAN)

ATLANTIC RICHFIELD COMPANY
BUTTE, MT

GROVE GULCH REMEDIAL ACTION
PLAN BUTTE PRIORITY SOILS
OPERABLE UNIT

JOB NO.:2013
DATE: 03.01.2024
SCALE: 1:30
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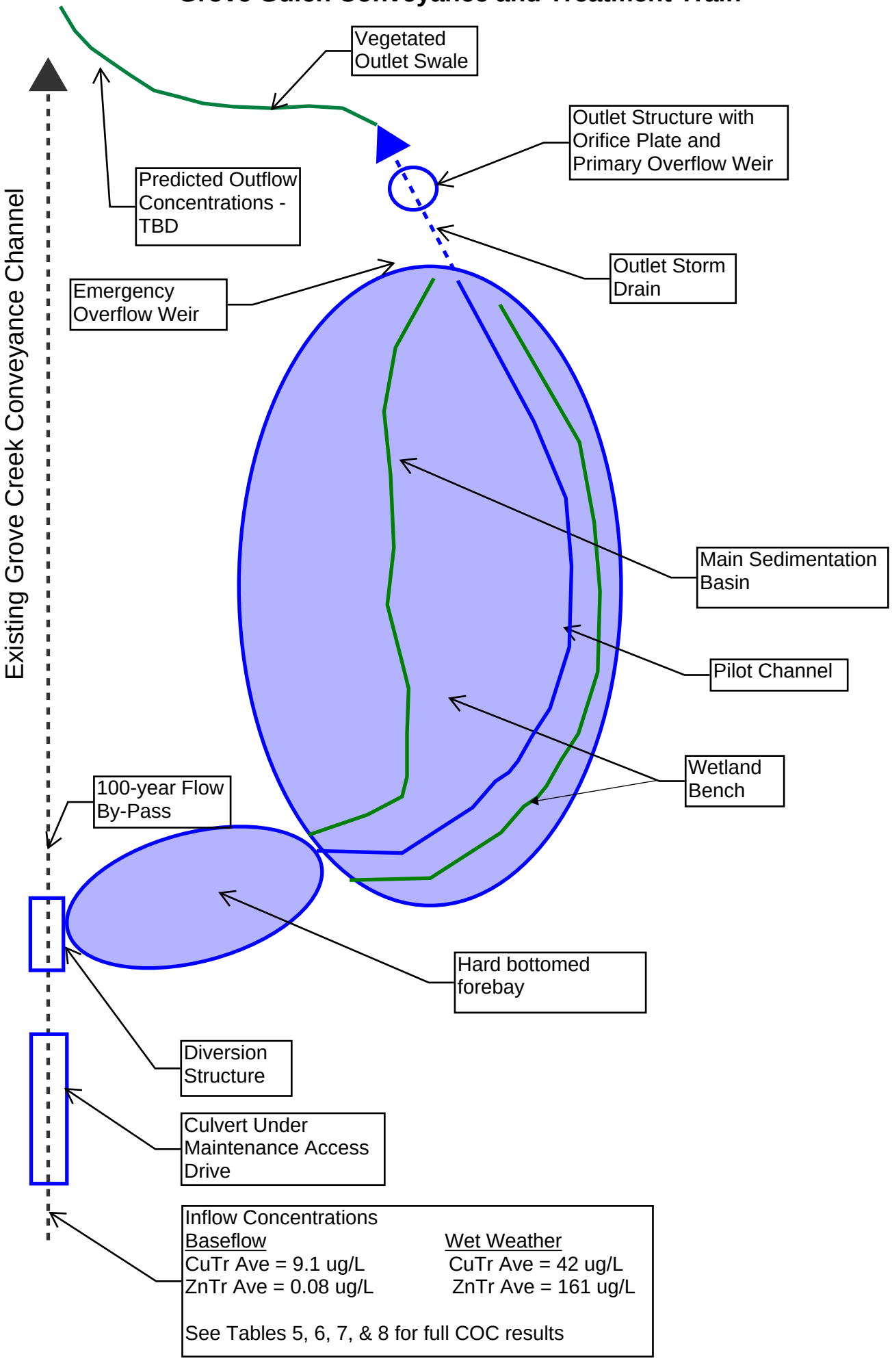
Figure 2 - Preliminary Flow Diagram (PFD)
Grove Gulch Conveyance and Treatment Train



Tables

Table 1

Grove Gulch Sedimentation Bay

Further Remedial Elements Scope of Work (FRESOW) Requirements Checklist

FRESOW Requirement Category	FRESOW Requirement Sections	FRESOW Requirement	How Requirement is Met	Location in Submittal Documents
Stormwater Sedimentation Bay and Vegetated Swale - Stormwater Volume	Section 4.0, list number 1	***Stormwater Sedimentation Bay and Vegetated Swale*** – Construction of a stormwater sedimentation bay and vegetated swale designed to treat stormwater from the 6-month, 24-hour Type I storm from the Grove Gulch sub-drainage area.	Stormwater sedimentation bay has a design volume of 1.09 acre-feet, exceeding the 1.0 acre-foot plus sediment storage requirement. Stormwater sedimentation bay is designed to accommodate 12.37 cfs, equal to the 6-month, 24-hour, type 1 storm peak flow from the Grove Gulch sub-drainage area.	Calculation Brief GG-003 (Calculation Briefs are attached to the Design Report (an attachment to the Remedial Action Work Plan (RAWP)) describes the maximum anticipated sediment volume accumulation over a 20-year period to be 0.04 acre-feet, when added to the FRESOW Section 3.1.1 one acre-foot required storage, results in a total required storage volume of 1.04 acre-feet. The O&M Plan defines the cleanout frequency to be after 6" of sediment is accumulated in the Forebay. Calculation Brief GG-005 describes how the basin provides a total of 1.09 acre-feet of storage volume, exceeding the required volume. Calculation Brief GG-001 defines the peak flow from the 6-month, 24-hour, type 1 storm from the Grove Gulch sub-drainage area as 12.37 cfs. Calculation Briefs GG-007, GG-009, GG-010, GG-011, GG-013, GG-025, GG-026, and GG-027 demonstrate how each element of the sedimentation bay and vegetated swale is designed for the 6-month, 24-hour, Type I storm peak flow of 12.37 cfs.
	Section 4.1.1, first paragraph, second sentence	The bay shall be sized to capture **one acre-foot** of runoff volume from the Grove Gulch watershed.		
	Section 4.1.1, first paragraph, third sentence	Additional sediment storage volume beyond the stormwater capacity shall be included to maintain system performance and coincide with the O&M cleanout frequency, which shall be defined during the design.		
Stormwater Sedimentation Bay and Vegetated Swale - General Stormwater Requirements	Section 4.1.1, first paragraph, first sentence	Stormwater from the Grove Gulch sub-drainage (which reports to Blacktail Creek at surface water monitoring point GG-01) shall be directed to a maintainable (concrete, or similar) sedimentation bay located on the eastern edge of Lexington Avenue.	A forebay has been added on the upstream side of the sedimentation bay to enhance accumulation of sediment prior to reaching the sedimentation bay. Flexible concrete pavers will be installed at the bottom of the forebay to allow for efficient sediment removal.	Sheet C2.4 of the Grove Gulch Construction Plans (attachment to the RAWP) depicts the location and layout of the forebay, Sheet CD1.2 provides a detail for the concrete paver forebay bottom, and Sheets CD1.4 and CD1.5 provide specific forebay details.
	Section 4.1.1, second paragraph, first sentence	The sedimentation bay shall be engineered and managed according to site ARARs, and the applicable requirements of Butte-Silver Bow's Municipal Stormwater Engineering Standards (BSBC 2011).	Butte-Silver Bow's Municipal Stormwater Engineering Standards are identified and a description of how they are met in the Design Report.	Section 3.2.1 of the Design Report provides a description of Remedial Action Objectives and how they are met. Section 3.3.1 of the Design Report provides a description of how Butte-Silver Bow's Municipal Stormwater Engineering Standards are met.
	Section 4.1.1, second paragraph, third and fourth sentence	Discharge from the bay shall be directed through a vegetated swale prior to entering Blacktail Creek (see Figure GG-1). The vegetated swale shall be designed to the 6-month 24-hour storm for treatment purposes.	The vegetated swale is located downstream of the sedimentation bay and has been designed to convey the portion of the 100-year design storm that is routed through the sedimentation bay, exceeding the FRESOW requirement to size the channel for the 6-month, 24-hour storm event.	Calculation Briefs GG-001 and GG-013 demonstrate how the channel is designed to convey flow during the 100-year, 24-hour storm flow conditions. Sheet C2.4 of the Grove Gulch Construction Plans depicts the location of the downstream vegetated channel, Sheet CD1.2 provides a typical detail for the channel, and Sheet L1.04 depicts the vegetation to be planted in the channel.
	Section 4.1.1, second paragraph, fifth sentence	A vegetated bypass channel circumventing the sedimentation bay shall be sized, at a minimum, to adequately pass peak hydraulic flows in accordance to Butte-Silver Bow's Municipal Stormwater Engineering Standards (BSBC 2011) using the USGS regression equations to protect the design from high flow events.	Butte-Silver Bow's Municipal Stormwater Engineering Standards (BSBC 2011) require at least the 25-year storm be passed thru stormwater channels. The bypass weir is designed to convey the 100-year design storm event. The downgradient bypass channel has been designed and will be reconstructed to convey the 100-year design storm event, per the USGS regression equation.	Calculation Brief GG-006 demonstrates how the existing channel downgradient of the diversion/bypass flow control structure conveys the 100-year design storm event (BSB requirements are for conveyance of at least the 25-year design storm event), and Calculation Brief GG-007 demonstrates how the bypass weir plate has been sized to convey the 100-year design storm event. Sheet C2.4 of the Grove Gulch Construction Plans depicts the location of the existing Grove Gulch Creek channel and the bypass weir, and Sheets CD1.4 and CD1.5 provide details of the bypass weir steel plate.

Table 1

FRESOW Requirement Category	FRESOW Requirement Sections	FRESOW Requirement	How Requirement is Met	Location in Submittal Documents
Tailings, Waste, and Contaminated Soils Excavation, Removal, and Disposal	Section 4.0, list number 2	Removal of all tailings, waste and contaminated soils that exceed the Waste Identification Criteria in Table 1 of Appendix 1, which are unsaturated by groundwater, encountered beneath the sedimentation bay and vegetated swale to the maximum observed groundwater elevation surface as recorded over the most recent 3-year monitoring period in the area shown on Figure GG-1.	The Grove Gulch project area, located within a FEMA delineated floodplain, has been characterized as a wetland, with the groundwater surface concurrent with the ground surface on a seasonal basis. No removal of tailings, waste, or contaminated soils is required if they are 1) saturated, or 2) beneath the 3-year high groundwater elevation. Tailings, waste, and contaminated soils within the footprint and beneath the sedimentation bay and vegetated swale, not adjacent to critical infrastructure, will be removed beneath the 3-year high groundwater elevation to the extent necessary to construct the remedial elements. Tailings, waste, and contaminated soils encountered within the footprint of the bypass channel will be removed during excavation and reconstruction of the bypass channel. The bypass channel will be excavated to the deeper of the 3-year high groundwater elevation or 18" below ground surface, as restricted by adjacent critical infrastructure. Additional tailings, waste, and contaminated soils within the anticipated area of disturbance, will be removed to facilitate construction of the remedial elements and promote construction efficiency. No additional tailings, waste, or contaminated soils, which would be unsaturated and above the 3-year high groundwater elevation, have been identified beyond these extents. No additional tailings. waste, or contaminated soils will be removed from within the Grove Gulch project area. Tailings, waste, and contaminated soils removed during the work will be disposed of at the Butte Mine Waste Repository. No on-site materials are proposed for reuse at Grove Gulch.	Pre-design investigation extents were defined in approved Quality Assurance Project Plans (QAPPs). Soil samples were collected within the investigation extents under approved QAPPs. The validated sampling results are provided in the Data Summary Report (DSR); the results are compared to the Waste Identification Criteria with horizontal and vertical extents of waste defined via a 3D model as described in the Pre-Design Evaluation Report (PDIER); and the excavation to remove the identified waste extents defined in the Grove Gulch Construction Plans (see Sheets C2.0 through C2.3). The 3-year high groundwater evaluation is provided in Section 5.1 of the PDIER. During site investigation from August 2020 thru June 2021, the groundwater elevation was measured to be coincident with the ground surface. A groundwater elevation coincident with the ground surface is the maximum groundwater elevation that can be achieved. Additional monitoring, over any time duration, will not produce data that results in a different determination of the maximum groundwater elevation at Grove Gulch. Excavation material within the bypass channel is depicted in the Grove Gulch Construction Plans Sheet C2.0 and replacement of the excavated material with Criteria C and D material is depicted on Sheets C2.9, C2.10, C2.11, and C3.0.
	Section 4.1.2, first paragraph, first sentence	If tailings, wastes and contaminated soils that exceed the Waste Identification Criteria in Table 1 of Appendix 1 are encountered within the footprint of the sedimentation bay, swale, and/or bypass channel to Blacktail Creek, then these wastes shall be removed down to the maximum observed groundwater elevation as recorded over the most recent 3-year monitoring period.		
	Section 4.1.2, second paragraph, fourth sentence	Tailings, waste, and contaminated soils encountered outside of the sedimentation bay within the floodplain will be removed and disposed of as described in the paragraph below. The horizontal extent of vegetated swale and bypass channel excavation is limited to the design flow channel widths with additional accommodation of excavation layback as dictated by the angle of repose of the material being removed that allows placement of clean fill material in and around the channel.		
	Section 4.1.2, second paragraph, sixth sentence	Critical infrastructure will be protected during removal construction actions, and removal of waste around those features will not be required, as determined by EPA, in consultation with DEQ.	Municipal waterlines on the west and south sides of the projects site will be protected with a 10 foot buffer maintained around these waterlines, per BSB requirements. A layback slope of 1.5:1 from the 10 foot offset is proposed for contractor implementation, as recommended in the project Geotechnical Report.	Critical infrastructure is defined in Section 1.3.4 of the Grove Gulch Materials Management Plan. The Geotechnical Report is Attachment A of the PDIER. Sheet C2.0 of Construction Plans depicts the critical infrastructure and defines the 10 foot offset.
	Section 4.1.2, Second paragraph, seventh sentence	Pre-design investigation sampling shall be used to refine the location of the removal area based on Appendix 1 criteria.	Resultant data obtained during pre-design investigations was integrated into Earth Volumetric Studios (EVS) to delineate the distribution of wastes at the Grove Gulch site, including areas that fall outside of the sedimentation bay and vegetated swale. Construction drawings have been developed that require removal of these identified wastes.	Soil samples were collected in the project area per agency approved PDIWP and agency approved QAPPs; the sampling results are provided in the DSR; the results compared to the Waste Identification Criteria with horizontal and vertical extents of waste defined via a 3D model are described in the Pre-Design Evaluation Report; and the excavation plan to remove the identified waste extents is defined in the Construction Plans (see sheets C2.0 through C2.3).
	Section 4.1.2, third paragraph, first sentence	Unless suitable for use as backfill (under Appendix 1, Table 2), removed tailings waste and contaminated soils shall be segregated and disposed of at a repository approved by EPA in consultation with DEQ, which is not located in the SBC-Above the Confluence or Blacktail Creek areas.	No onsite reuse material is proposed for backfill at Grove Gulch. All excavated material will be removed and transported to the Butte Mine Waste Repository for disposal.	Materials Management Plan, Section 3 (Backfill Material Characterization and Reuse Plan)
	Section 4.1.2, third paragraph, third sentence	All other municipal wastes, if encountered at the Grove Gulch area, shall be segregated and disposed of at an appropriate permitted facility by the SDs.	No municipal wastes were identified in the PDIER. A contingency waste plan has been developed in the event unanticipated wastes are encountered.	Materials Management Plan, Section 2.2 (Waste Management Plan)

Table 1

FRESOW Requirement Category	FRESOW Requirement Sections	FRESOW Requirement	How Requirement is Met	Location in Submittal Documents
Regrading, Revegetation, and Capping	Section 4.0, list number 3	Regrading, vegetating, and constructing a cover system in any areas disturbed during construction, in accordance with Table 3, of Appendix 1 and as shown on Figure GG-1.	All disturbed areas will be covered with at least 18" of material meeting Table 3 requirements for Criteria D - Riparian or Sub-Irrigated Engineered Cap/Cover Systems.	Sheet C3.0 of the Grove Gulch Construction Plans depicts the 18" of Criteria D material placement.
	Section 4.1.2, second paragraph, second sentence	If tailings, waste, and contaminated soils are encountered outside of the sedimentation bay outside the floodplain then they will be capped using cover system requirements of Table 3 of Appendix 1. The horizontal extent of sedimentation bay excavation is limited to the exterior wall of the sedimentation bay with additional accommodation of excavation layback as dictated by the angle of repose of the material being removed.	The entire Grove Gulch project site is within the FEMA delineated floodplain; no tailings, waste, or contaminated soils at the defined Grove Gulch site occur outside of the floodplain. No capping outside of the Grove Gulch site is necessary. All identified waste within the project limits of disturbance, not adjacent to critical infrastructure, is being removed and disposed of at the Butte Mine Waste Repository. Proposed excavation extends beyond the horizontal extent of the sedimentation bay.	Sheet C3.0 of Grove Gulch Construction Plans
	Section 4.1.3, first paragraph, second sentence	If wastes are encountered outside of the sedimentation bay in the Grove Gulch area, outside the floodplain, then they will be capped using the cover system requirements of Table 3, Criteria D of Appendix 1.		
	Section 4.1.3, first paragraph, first sentence	Regrading shall be conducted on the areas outside of the sedimentation bay, and swale, and channel as needed to provide operation and maintenance access, and to support appropriate vegetation.	Maintenance access is provided from Lexington Avenue by gravel access drive. The gravel access drive parallels the western edge of the forebay and sedimentation bay leading to the outlet structure and vegetated swale.	Sheet C2.4 of Grove Gulch Construction Plans depicts the location of the gravel access drive and the slope down to the vegetated swale.
Institutional Control Considerations	Section 4.2, first paragraph	Through the planning and design process, certain institutional controls shall be identified and described in the remedial design plan. The implementation of any institutional control for this area will involve a cooperative effort among local government, state government, SDs, and other stakeholders, and shall be the responsibility of the SDs. Potential institutional controls may include motorized and non-motorized travel restrictions, sensitive area exclosures, and future site development restrictions. Fencing or other access restrictions may also be identified.	Institutional Controls will be consistent with BPSOU ICIAP (2019). No public access will be provided at Grove Gulch. A gate at the only access point to the site will be provided and signs will be posted to deter public access. An Operation and Maintenance Plan is provided which provides the institutional controls necessary to operate and maintain the sedimentation bay.	Sheet C5.0 of the Grove Gulch Construction Plans depicts the location of the access gate and public restriction signs. The Draft Operations, Monitoring, and Maintenance Plan (attachment to RAWP) provides details for operation and maintenance procedures.
Additional Project Requirements & Information	Section 4.3, list number 1, third sentence	***Other Waste or Impacted Materials:*** Contingency excavation and disposal planning shall be evaluated during the project design phase.	No non-metals wastes were identified in the PDIER, however a contingency waste plan has been developed for any contingency (unanticipated) wastes encountered.	Materials Management Plan, Section 2.4 (Waste Management Plan)
	Section 4.3, list number 2	***Engineering Design:*** Detailed design of the stormwater sedimentation bay and associated vegetated bypass and treatment swales and associated regrading and vegetative soil cover plans.	The detailed design of the sedimentation bay and vegetated bypass and treatment swales are shown in the Grove Gulch Construction Plans.	Grove Gulch Construction Plans (attachment to RAWP)
	Section 4.3, list number 3	***Excavation and Disposal Feasibility:*** The expected quantities of site materials for disposal shall be further investigated to select an appropriate repository location.	All excavated material is being removed and transported to the Butte Mine Waste Repository. Anticipated excavation quantities are provided in the Design Report as well as the Excavation and Disposal Analysis of the Materials Management Plan.	Materials Management Plan, Sections 2.1.3 and 2.1.4. (Waste Management Plan).
	Section 4.3, list number 4	***Backfill Material Characterization and Reuse Plan:*** A sampling and analysis plan shall be developed to further delineate existing site soils that may be characterized and reused as suitable backfill material in accordance with Table 2 of Appendix 1, so long as such site materials do not exceed the Waste Identification Criteria in Table 1 of Appendix 1. If onsite materials do not exceed the Waste Identification Criteria in Table 1 of Appendix 1, the material may be used onsite as general fill provided it meets all other requirements for general fill in Table 2 of Appendix 1 (e.g., texture, pH). Blending of waste material and clean material will not be allowed. All waste exceeding Waste Identification Criteria in Table 1 of Appendix 1 will be disposed of off-site.	Grove Gulch site investigation was completed per agency approved Pre-Design Investigation Work Plans and Quality Assurance Project Plans. No onsite material is proposed for reuse at Grove Gulch. All excavated material will be removed and transported to the Butte Mine Waste Repository for disposal. Import materials will be sampled to confirm they meet both FRESOW and technical specification requirements.	Materials Management Plan, Section 3 (Backfill Material Characterization and Reuse Plan). Import Material sampling requirements are provided in the Construction Monitoring QAPP Section 4.1 Step 7 and Technical Specification 01 45 00.
	Section 4.3, list number 5	***Geotechnical Conditions:*** EPA, in consultation with DEQ, may require geotechnical investigation to adequately characterize subsurface conditions in areas of the sedimentation bay, vegetated swale, diversion structures, discharge structures or other structural features. SDs may also propose such investigation in design documents.	A geotechnical investigation was performed and results are summarized in the Grove Gulch Geotechnical Report.	Grove Gulch Geotechnical Report (attachment to PDIER)