Alleged Injury and Examples of Restoration Options to Address Alleged State Natural Resource Damages at or Relating to Operable Unit 3 of the Libby Asbestos Superfund Site

This report provides information and analysis in support of the State of Montana (State) and W.R. Grace & Co. (Grace)'s belief that a settlement payment of $18.5 million is sufficient to restore, replace, rehabilitate, and/or acquire the equivalent of injured natural resources within the State's trusteeship, and therefore will compensate the public for the State's claim for alleged injuries to natural resources resulting from the release of hazardous substances in or related to Operable Unit 3 (OU3) of the Libby Asbestos Superfund Site (Site).[1] This report includes an overview of the nature of the alleged injuries and service losses, with references to related studies and data; it is not an exhaustive summary of this information. This report also describes the types of restoration projects that could be implemented to compensate for losses, the types of ecological values that could be provided, and the anticipated criteria for selecting restoration projects. The settlement reflects the judgment and experience of experts for Grace and the Montana Natural Resource Damage Program ("NRDP").

The NRDP's mission is to act on behalf of the Governor of the State of Montana, the trustee, to recover damages for natural resources injured by the release of hazardous substances and to restore, rehabilitate, replace, or acquire the equivalent of the injured natural resources.

I. NATURE OF THE STATE'S ALLEGED INJURIES

Information collected at the Site under the oversight of the U.S. Environmental Protection Agency (EPA) in consultation with the Montana Department of Environmental Quality (DEQ) and other agencies pursuant to the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§ 9601 *et seq*. (CERCLA), as well as other information, has been used by the State and Grace to evaluate the nature of potential natural resource injuries and potential lost services in connection with the settlement agreement. Some of this information, including relevant background information, is summarized below. The State has not conducted a formal natural resource damage assessment (NRDA) at the Site under U.S. Department of Interior (DOI) regulations promulgated under CERCLA, 43 C.F.R. Part 11, or under the Montana Comprehensive Environmental Cleanup and Responsibility Act, 75-10-701, MCA, *et seq*. (CECRA). This document does not include all of the information that would be in an NRDA and is based on the information gathered to date.

[1] As indicated in the Settlement Agreement between the State and Grace, each Party denies the allegations of the other. Grace asserts that there are no significant natural resource damages (NRD) at or related to OU3; the State asserts that there are more significant NRD at or related to OU3. The Settlement Agreement represents a compromise that compensates the State (as trustee) for the damages that it alleges in exchange for a release of all of the State's NRD claims against Grace in or related to the Libby Asbestos Superfund Site. The Settlement Agreement to which this report is attached is solely on behalf of the State and Grace, and does not expand or limit the legal rights or obligations of any person or entity other than the State and Grace.

A. Site History and Assessment

OU3 of the Site consists of a former vermiculite mine and adjoining forested lands, located approximately 7 miles to the northeast of the town of Libby, Montana. The former mined area and immediately surrounding area are owned and managed by the Kootenai Development Company (KDC), a Grace subsidiary; other land within OU3 is managed by the U.S. Forest Service.

The former vermiculite mine was operated from the early 1920s to 1990, initially by the Zonolite Company, which sold the mine and processing facilities to a predecessor company to Grace in 1963. Historically, vermiculite from the former mine was used in insulation, feed additives, soil amendments, packaging, and construction materials. Vermiculite ore, excavated overburden (waste rock), mine tailings, and associated material from the former mine contain amphibole-type asbestos, a material in the geology in the mine area that is termed Libby amphibole asbestos (LA). Such materials also may contain non-asbestos hazardous substances.

Mining operations included blast and drag line mining and milling of ore, with ore processing taking place onsite during most of the time the mine was in operation. Both dry milling and wet milling were conducted at the mine site up to approximately 1974, after which the entire operation used wet processing (MWH 2016). In 1972, the State issued to Grace an operating permit under the Metal Mine Reclamation Act. Grace operated the mine under its permits, and performed reclamation of mined lands as they were taken out of operation (MWH 2016). Mining operations ceased completely by 1990, followed by further reclamation efforts that included demolition of mine facilities, re-contouring of the mined areas, and revegetation (MWH 2016).

In October 2002, EPA added the Libby Asbestos Superfund Site to the National Priorities List. EPA divided the site into multiple operable units. For OU3, a remedial investigation (RI) under CERCLA began in 2007. The RI was performed in phases, and included collection of more than 3,300 environmental samples for LA analysis and more than 500 samples for non-LA analysis (W.R. Grace & Co. et al. 2019). Surface water, sediment, sediment pore water, groundwater, soil, mine wastes, forest duff, tree bark, air, and fish and mammal tissue were sampled for analysis.

EPA conducted baseline ecological risk assessments (BERAs) as part of the RI. The objective of the risk assessments was to determine the potential for current or future unacceptable risk to ecological receptors (e.g., fish, aquatic invertebrates, terrestrial plants, terrestrial invertebrates, birds and mammals) within OU3. EPA published two BERAs that were the culmination of the ecological studies. The first evaluated ecological risks potentially associated with non-asbestos hazardous substances, such as inorganics (Non-Asbestos BERA) (USEPA 2013). The second examined ecological risk potentially associated with LA (Asbestos BERA) (USEPA 2014). A summary of the risk assessments is presented in the final RI report (MWH 2016). Grace and the State considered the data collected for the BERAs and RI, as well as additional information, in their respective evaluations of potential natural resource injuries and service losses in and relating to OU3. Some of the data and analyses are discussed in greater detail in subsequent sections of this document. The State does not agree with all analyses and conclusions presented in these reports.

B. OU3 Habitats

OU3 provides a range of habitats for aquatic and upland species: creeks and their associated riparian zones, ponds, wetlands, and upland habitats.

1. Aquatic Habitats

The primary surface waters in OU3 that are most likely to have received asbestos and other non-asbestos hazardous substances released as a result of mining activities are within the Rainy Creek watershed (~46.1 km^2) and include Rainy Creek, Fleetwood Creek, Carney Creek, portions of the Fine Tailings Impoundment (FTI), the Mill Pond, and potentially the Kootenai River. Rainy Creek is divided into Upper Rainy Creek (north of the mine area) and Lower Rainy Creek. Rainy Creek flows into the Kootenai River approximately 3.9 km south of the mine area.

Fleetwood Creek flows east to west on the northern border of the mine area and through a portion of the coarse tailings pile prior to discharging to the FTI. Carney Creek lies south of the mine area and flows along the toe of the West Waste Rock Pile before joining Lower Rainy Creek just downstream of the Mill Pond. Rainy Creek and portions of both tributary creeks are perennial (USEPA 2013) and provide habitat for fish and aquatic invertebrate communities (MWH 2016). Riparian areas occur along the creeks and provide ecological benefits such as channel stability, shade for the stream, erosion control, energy flow, nutrient cycling, water cycling, hydrological function, and plant and animal habitat (USDA 1996).

In addition to the creeks, there are ponded areas in OU3, including Carney Pond, Fleetwood Pond, and the Mill Pond. The FTI includes a ponded area that varies in size depending on precipitation. The FTI (~70 acres) was established in 1972 to receive and settle mine tailings, through construction of the Kootenai Development Impoundment Dam (KDID) across Rainy Creek. Water enters the FTI from Upper Rainy Creek, Fleetwood Creek, surface runoff, and groundwater. The Mill Pond, which is located in the Rainy Creek channel downstream (south) of the KDID and just north of the confluence of Carney Creek, was constructed to supply water for mining operations and discharges into Rainy Creek. Wetlands are present on and adjacent to the FTI and portions of the other waterways, and provide similar ecological benefits and services as those provided by riparian habitats.

In addition to the physical impacts of mining operations, physical alterations of the OU3 habitats have occurred over the years due to a variety of other activities, including timbering operations, channelization for road construction, and placement of culverts and impoundments (USDA 2000).

2. Terrestrial Habitats

Upland habitats within OU3 consist primarily of the former mined area and surrounding forests.

The area disturbed by mining (including the former mined area and former tailings impoundment) covers approximately 1,100 acres of OU3 (MWH 2016). This area is characterized by native rock, soil, and vegetation, as well as waste rock and tailings resulting from past mining activities. During the period of mine operation, this area was largely unvegetated. Mining activities not only involve physical disturbance by heavy machinery and excavation, but also include removal of topsoil and placement of waste rock, which changes the physical conditions of the soil environment (e.g., Sheoran et al. 2010; Baig 1992).

Mined areas were reclaimed as mining in those areas was phased out. More extensive reclamation efforts at the former mine began in 1991 after mine closure. These efforts included hydroseeding and reforestation with pine and deciduous trees. Other reclamation efforts included regrading, trenching, and other physical measures to stabilize the mine surface.

At present, vegetative communities of the former mined area include forests, steppe shrub, and grassland habitat, with grassland and steppe shrub providing the predominant cover. Some bare soil areas exist, primarily on steeply sloped waste rock piles and other steep slopes.

Outside of the former mined area, the OU3 terrestrial habitats consist of temperate montane forests, portions of which have been historically logged. Douglas fir is the most common tree type, present at about 35% of the forested OU3 area, followed by lodgepole pine (17%) and spruce-fir (17%), with western larch forest on about 11% of the forested land area. The remaining area is populated with various deciduous species common in northwest Montana (MWH 2016). The OU3 forest outside of KDC/Grace ownership is part of the Kootenai National Forest.

C. Hazardous Substances Associated with Alleged Natural Resources Injuries

Due to proximity to the mine and associated access roads, the aquatic and terrestrial habitats of the Rainy Creek watershed have been exposed to LA and other non-asbestos constituents released from the mine area. Although some remediation has occurred, a final remedy has not been selected for OU3, and remediation of the entire forested watershed area within OU3 has not occurred and may not occur. Therefore, surface waters within the Rainy Creek Watershed in OU3 remain exposed to LA fibers and other non-asbestos contaminants. Depending on their concentrations and other circumstances, these constituents have the potential to adversely affect the aquatic, riparian, and terrestrial species that reside or forage in these habitats, and thereby result in natural resource injury. Natural resource injury caused by the release of a hazardous substance could be the source of natural resource damages, as defined under CERCLA, CECRA, and related guidance.

The Non-Asbestos BERA (USEPA 2013), Asbestos BERA (USEPA 2014), and RI report (MWH 2016) identified a number of hazardous substances released from the Site mining and milling activities and present within OU3 at concentrations that could pose risk to ecological receptors and/or exceed Circular DEQ-7 Montana Numeric Water Quality Standards (DEQ-7 Standards) or Residential Regional Screening Levels (RSLs). These substances include:

- Aluminum,
- Barium,
- Chromium,
- Cobalt,
- Copper,
- Iron,
- Lead,
- Manganese,
- Nickel,
- Selenium,
- Vanadium,
- Gross alpha, and
- LA.[2]

In addition, screening-level toxicity benchmarks were exceeded in one or more Site media (soil and sediment) for:

- Antimony,
- Benzo(b)fluoranthene,
- Benzo(k)fluoranthene,
- Cadmium,
- Fluoride,
- Mercury,
- Naphthalene,
- Nitrogen as nitrite,
- Thallium, and
- Asbestos.

Site investigations conducted as part of the RI and BERAs were used by EPA to assess the degree to which these constituents were present in OU3 and posed ecological risk. The RI and BERAs provide data with which to assess the range of possible natural resource damages in OU3. The data collected for these studies are referenced below in the context of potential types of natural resource injuries and service losses.

D. Per Se Injuries

Under the DOI NRDA regulations, natural resource injury is defined to exist when concentrations of hazardous substances are in excess of certain quality standards under the

[2] Regardless of whether there is a relevant standard for LA concentrations in the surface water, for purposes of this report, measured concentrations of LA in surface water are compared to DEQ-7 standards and maximum contaminant levels based on effects from exposure to chrysotile asbestos. DEQ-7 does not provide an aquatic life standard.

circumstances specified in the regulations (see 43 C.F.R. § 11.62); this is sometimes referred to as "per se" injury.

A review of the available data collected as part of the RI demonstrates the potential per se injuries described below.

1. Surface Water

As part of its screening analysis, the Non-Asbestos BERA identified the potential for risk to aquatic receptors from barium in surface water (USEPA 2013). In addition, concentrations above chronic DEQ-7 Standards for aquatic life for total lead and total iron were observed in surface water samples from Fleetwood Pond (MWH 2016). Dissolved aluminum was detected in one seep sample from the Site at a level of 110 ug/L. All other dissolved aluminum results were non-detects.[3]

Surface water was sampled in the Asbestos BERA (USEPA 2014) for LA. Results for water are typically expressed as million fibers per liter (MFL). Though there is no specific surface water quality standard for LA, for purposes of this report, the results were compared with EPA's maximum contaminant level (MCL) and the DEQ-7 Standard for surface water for asbestos fibers of 7 MFL.[4] All of the following results are from the RI (see, e.g., Table 5-17a):

- In Upper Rainy Creek, 48 samples were collected from three locations. LA was below the 7 MFL criterion in all samples, though LA was detected in two locations.
- In Fleetwood Creek and Fleetwood Pond, 46 surface water samples were collected at three stations; concentrations of LA >10 µm ranged from 0 MFL to 289 MFL.[5] Six samples were above 7 MFL in Fleetwood Creek and Fleetwood Pond (13% of the samples).
- In Carney Creek and Carney Pond, 72 surface water samples were collected at five stations; concentrations of LA >10 µm ranged from 0 MFL to 26 MFL.[6] Three samples were above 7 MFL in Carney Creek and none in Carney Pond (4% of the samples). An additional 21 samples were collected from seven seep locations near Carney Creek; concentrations of LA >10 µm ranged from 0 to 32 MFL.
- In Lower Rainy Creek, 263 samples were collected at 11 stations; concentrations of LA >10 µm ranged from 0 MFL to 66 MFL. Twenty-five samples were above 7 MFL in Lower Rainy Creek (10% of the samples).

The results tended to reflect seasonal variation. Concentrations were generally highest during high flows such as spring runoff.

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[3] The reporting limit for dissolved aluminum in surface water was 90 µg/L, which is above the DEQ-7 aquatic life chronic standard for dissolved aluminum of 87 µg/L.
[4] The 7 MFL criterion applies only to fibers greater than 10 microns (10 µm) in length.
[5] The contractor reported that the sample result of 289 MFL in Fleetwood Pond (and duplicate sample result of 219 MFL) is suspect, as it is an order of magnitude higher than the next highest sample of 28 MFL at that location and was collected through a method that might have introduced higher sediment concentrations in the sample.
[6] Resampling following the 26 MFL result, at the same location about 6 weeks later, had a 0 MFL result. The next highest sample at that location was 7.5 MFL.

Some of the above conditions, if all criteria under the DOI regulations were met, would be defined as surface water injury. This report does not determine whether any of these conditions satisfy the DOI regulatory definition, but this information was used in evaluating the scope of potential injuries.

Concentrations of LA in reference ponds and creeks in and around OU3 tended to be below detection or very low. The Asbestos BERA reports that LA fibers in the Kootenai River were low and not different between samples from upstream and downstream of the confluence of Rainy Creek.

2. Groundwater

LA was analyzed in groundwater samples as part of the RI (MWH 2016). Groundwater sampling was conducted in 8 shallow wells and 6 bedrock wells, with most wells sampled 2 to 3 times for a total of 20 shallow well samples and 14 bedrock samples. Two samples from the shallow groundwater wells showed LA concentrations above 7 MFL. The two results above 7 MFL may reflect sampling anomalies[7] and sampling issues and detections in equipment rinse blanks led to adjustment of the groundwater results (Appendix I to the RI [MWH 2016]); further samples were not collected.

Fewer samples were collected for non-asbestos contaminants. Samples for non-asbestos contaminants showed some elevated concentrations of site contaminants compared to screening levels established for assessment of potential drinking water exposures in people. Iron and manganese Residential RSLs for tap water (non-regulatory criteria) were exceeded in groundwater samples (USEPA 2013), and the DEQ-7 Standard and EPA MCL for gross alpha was exceeded in one groundwater sample from a bedrock well (USEPA 2013; MWH 2016).

Some of the above conditions, if all criteria under the DOI regulations were met, would be defined as groundwater injury. This report does not determine whether any of these conditions satisfy the DOI regulatory definition, but this information was used in evaluating the scope of potential injuries.

3. Sediment Pore Water

LA was measured in instream sediment pore water at Lower Rainy Creek and reported in the RI (MWH 2016). LA concentrations up to 623 MFL were measured in pore water (fibers >10 µm).[8] On average, LA concentrations were greater in pore water samples than in surface water samples collected from the same locations in Lower Rainy Creek. The data indicate that biological

[7] "Elevated LAA levels are thought to be related to suspended sediment in the water at the time of sampling, given that the other samples collected from both piezometers had significantly lower LAA levels. In addition, sampling pump issues were noted during the April 2015 sampling…" (MWH 2016, Table 5-16b, p. 312)

[8] Pore water sample concentrations were variable across replicate samples and across samples collected during the sample durations (MWH 2016).

resources could be exposed to higher levels of hazardous substances in pore water compared to surface water.

Non-asbestos contaminants were not analyzed in sediment pore water, which the parties have considered.

4. Sediment

In stream sediment, concentrations above screening level ecotoxicological benchmark values are not a per se injury, but indicate the potential for injury to the surface water in Montana as the State's water quality standards are based on measurements that include a fraction of suspended sediments. Sediment was analyzed in the Asbestos BERA by first sieving and grinding samples to reduce particle size to ≤250 μm and identifying LA fibers based on optical characteristics using polarized light microscopy. Visual area estimates are subjective, and results are considered semi-quantitative. Results are associated with bins of approximate ranges in percentages; Bin A represents non-detect samples, Bin B1 is <0.2% LA, B2 is 0.2% to <1% LA, and C is ≥1% LA.

Sediment samples from Lower Rainy Creek, Fleetwood Creek, Carney Creek, the FTI, and the Mill Pond contained LA fibers above detection (USEPA 2014). Sample results were highest in Carney Creek adjacent to the mine area and in Rainy Creek below the FTI. Most samples from Upper Rainy Creek were non-detect (Bin A). A total of 62 sediment samples collected in the above areas were in Bin C and ranged from 1% to 10% LA fibers.

Several non-asbestos analytes exceeded threshold effect concentrations (TECs) and/or sediment-based wildlife benchmarks in site sediments, as reported in the Non-Asbestos BERA (USEPA 2013) and summarized in Table 1, below. The TECs and other toxicity benchmark values are typically used in the screening stage of an ecological risk assessment to identify the potential for ecological risk.

A hazard quotient (HQ) is the ratio of the hazardous substance concentration in the exposed media compared to some toxicity benchmark or quality criterion. HQ values represent the maximum detected concentration divided by the toxicity benchmark, so a maximum HQ value greater than 1 indicates the maximum sediment concentration exceeded the toxicity benchmark. Calculated HQ values for OU3 sediment ranged from <1.0 to 54 for several non-asbestos analytes. Of the analytes with HQ values greater than 1, aluminum, barium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc were also found to exceed sediment concentrations measured in reference samples.

Table 1. Hazard Quotient Values for Analytes that Exceeded Sediment Screening Values

Analyte	**Maximum HQ for TEC-Based Benchmark**	**Maximum HQ for Sediment-Based Wildlife Benchmark**
Aluminum	**1.6**	NC
Arsenic	*0.72*	**5.1**
Barium	NC	**23**
Cadmium	**1.0**	*0.07*

Analyte	Maximum HQ for TEC-Based Benchmark	Maximum HQ for Sediment-Based Wildlife Benchmark
Chromium	**16**	**9.7**
Cobalt	NC	**1.8**
Copper	**5.5**	**54**
Lead	**2.8**	**3.3**
Manganese	**20**	**43**
Mercury	*0.56*	**1.6**
Nickel	**6.4**	**3.2**
Selenium	NC	**1.5**
Vanadium	NC	**46**
Zinc	*0.78*	**1.1**
Benzo(b)fluoranthene	**1.4**	*0.011*
Benzo(k)fluoranthene	**1.2**	*0.0094*
Naphthalene	**16**	*0.017*

Notes: **BOLD** – sediment concentrations exceeded toxicity benchmark and were statistically greater than reference sediment concentrations; **BOLD** (no shading) – sediment concentrations exceeded toxicity benchmark but were statistically equal to or less than reference sediment concentrations; *Italics* – sediment concentrations did not exceed toxicity benchmark (HQ ≤ 1); HQ – hazard quotient; NC – not calculated, no screening value; TEC – threshold effect concentration; Data from Non-Asbestos BERA (USEPA 2013).

The Non-Asbestos BERA does not evaluate antimony in Site sediments, though antimony was detected in Site ponds and these data are reported in the OU3 RI. Antimony concentrations in two samples (one from Carney Creek Pond [4 mg/kg] and one from the FTI Pond [5 mg/kg]) exceeded the TEC (2 mg/kg) and the probable effect concentration (4 mg/kg).

Exposure to contaminated sediment can affect the growth and survival of invertebrates and limit the habitat available for colonization. In addition, biological resources higher in the food web potentially could be at risk from exposure to contaminants from eating contaminated invertebrates or from incidental ingestion of sediment while foraging. The studies in the EPA BERAs, noted below, evaluated such endpoints.

E. EPA Studies Performed to Evaluate Ecological Risk

The Asbestos BERA and Non-Asbestos BERA examined the potential risks to a variety of ecological receptors from LA and non-asbestos hazardous substance concentrations in soil. The following site-specific studies were conducted as part of the BERAs to evaluate the extent to which hazardous substances in surface water, sediment, and soil may pose risk to ecological receptors in OU3:

- Laboratory juvenile trout toxicity tests (non-asbestos contaminants)
- In situ juvenile trout toxicity tests
- In situ egg/alevin trout toxicity tests
- Resident trout lesion study
- Resident trout population study

- H. azteca (benthic invertebrate) sediment toxicity test
- C. tentans (benthic invertebrate) sediment toxicity test
- Resident benthic macroinvertebrate population study
- Laboratory tadpole sediment toxicity tests
- Resident frog lesion study
- Resident mouse lesion study
- Literature-based evaluation of sensitivity of birds to LA relative to small mammals

The results of these studies, along with EPA's habitat evaluations, weight of evidence evaluation, and analysis of uncertainties, are detailed in the BERAs.

F. Summary of Potential Natural Resource Injuries and Service Loss at or related to OU3

The data collected as part of the RI and BERA investigations indicate that natural resources within OU3 are exposed to LA and a subset of other non-LA hazardous substances. Past, present, and future injured OU3 resources could include:

- Small, large, and aquatic-dependent mammals
- Birds
- Fish
- Reptiles and amphibians
- Aquatic invertebrates
- Terrestrial invertebrates
- Terrestrial and aquatic plants
- Wetland and upland habitats.

To the extent that injury occurred, the following categories of resource services, among others, could theoretically have been reduced:

- Habitat services for biological resources, such as habitat for feeding and reproduction
- Fishing, particularly recreational fishing below the ordinary high-water mark per Montana stream access laws (§23-2-301, MCA, *et seq*.)
- Drinking water supply (to the extent relevant)
- Non-consumptive uses such as wildlife viewing and photography and other outdoor recreation activities below the ordinary high-water mark per Montana stream access laws (§23-2-301, MCA, *et seq*.)
- Primary and secondary contact recreational activities such as swimming and boating below the ordinary high-water mark per Montana stream access laws (§23-2-301, MCA, *et seq*.)
- Option and existence values.

II. TYPES OF RESTORATION PROJECTS AND RESULTANT SERVICES

The natural resource damages component of the Settlement between Grace and the State was negotiated and executed on a cash-out basis, with funds paid to the State over a period of 10 years. No particular project or projects are required by the Settlement, no particular project has been identified by the State at the time of this Report, and the projects ultimately implemented by the State may differ from the examples provided below, but the State must use settlement funds for restoration projects and support therefor, including costs for State restoration plan development and implementation, and administrative, program, legal, technical and all other related costs, to the extent lawful under CERCLA or CECRA. The State intends and anticipates using Settlement funds in connection with projects that provide natural resource and other benefits in and around OU3.

The following sections describe various types of exemplary restoration projects that may be constructed to benefit and improve aquatic and terrestrial natural resources and the services they provide. Additional types of restoration projects may also be considered. Other restoration actions selected to implement previous State NRD settlements at other sites can be found within the restoration plans for those sites, which are available on NRDP's website. Nothing in this report is intended to bind any party to a specific injured resource or particular type of project.

A. Aquatic Habitat Improvement Restoration Projects

Potentially injured resources identified at the Site include fish and other aquatic biota. A variety of restoration projects could be implemented to restore lost services. Below is a summary of types of aquatic habitat improvement projects that would restore aquatic ecological services.

In addition to the specific service benefits described below, the illustrative aquatic restoration activities all generally provide improved water quality, thereby providing favorable habitat to increase populations of in-stream biota. This should benefit upland predators that rely on stream food sources. Restoration of aquatic ecological resources ultimately benefits the entire ecosystem through increased biodiversity and results in enhanced recreational opportunities. Many of the restoration activities described below have been implemented in projects in the Kootenai and adjacent watersheds with significant success.

The selection of any specific creek restoration activities could be geographic (to prioritize a specific watershed or a specific creek segment to be identified, potentially including within OU3 once remediation has been completed) in accordance with the criteria outlined in Section III.

1. Riparian Improvement

Riparian improvement projects include revegetation, reducing livestock access, removing/enhancing roads, streambank stabilization, floodplain restoration, reconstructing stream channel(s), constructing floodplain wetland cells, woody debris placement, microtopography creation, bank treatment, seeding and mulching, and planting. These types of projects can provide a host of services. Revegetation of the riparian area reduces contaminant mobility by providing filtration of overland flow and reduces sedimentation by providing soil stabilization. Vegetation provides habitat cover for both upland and in-stream species, and limits surface water temperature fluctuations by providing shade. Floodplain restoration projects, including reconnecting the floodplain area and constructed wetlands, reduce erosion and subsequent sedimentation by reducing flow velocities, and provide opportunities for natural stream channel changes over time. Road removal and streambank stabilization projects, often supported by and conducted in conjunction with revegetation and floodplain restoration, reduce sedimentation (Yochum 2018) and can lead to an overall improvement in habitat conditions, thereby contributing to more robust and abundant populations of fish and wildlife. Engineered floodplains and riparian plantings also may improve groundwater quality by providing filtration of runoff and reducing overland flow, thereby encouraging groundwater recharge.

2. In-Stream Habitat Improvements and Channel Modifications

In-stream habitat improvement and channel modification activities can create habitat for biota by providing variable structures and improved channel flow. Modifying stream morphology by adding meanders and creating variable pool-riffle-run habitat directly improves habitat for fish (particularly trout) and invertebrates. Installing boulders, woody debris, and other large structures creates shelter and resting areas for fish that mimic natural features in streams and rivers. These features also create cover and reduce flow velocity to provide habitat for invertebrates (Wohl et al. 2015). These kinds of habitat improvements would advance and restore more natural hydraulic conditions and restore natural sediment transport processes, thereby improving water quality. The improvement and addition of habitat through stream channel modifications should result in increased fish and invertebrate populations, providing both ecological and recreational benefits.

3. Fish Passage

Conceptual fish passage projects include restoration activities such as removal of fish passage barriers in creeks and streams and addition of screens to reduce fish access to artificial diversions. These types of habitat improvements would benefit a variety of native and other fish species.

Removal of barriers and enhancement of passage structures such as culverts and fish ladders can directly benefit fish survival and spawning by enabling fish to regain access to diverse habitats and additional food sources. Restored access to spawning habitat should result in a direct increase in fish numbers, which would benefit imperiled species and increase recreational fishing opportunities by increasing fish populations and expanding accessible fishing areas. Limiting access to unsuitable habitat by placing screens on irrigation and power diversions can also encourage fish to instead utilize appropriate habitats for foraging and spawning. This should increase survival and reproduction rates for fish, especially trout (Yochum 2018).

B. Terrestrial Habitat Improvement Restoration Projects

Activities can be implemented to improve upland terrestrial habitat and benefit ecological resources in the surrounding area. Example projects include selective removal of non-native plant species and/or planting of native trees and vegetation in OU3 and surrounding forest areas.

1. Native Planting and Removal of Non-Native Species

Planting native trees and vegetation has direct benefits for not only the immediate area, but globally as well. Planting in burned, logged, or other denuded areas restores habitat for wildlife, giving birds, mammals, and reptiles improved nesting/burrowing, foraging, and hunting opportunities. Invertebrates will also benefit from increased access to food and shelter, as well as improved soil health. Trees also sequester carbon, reducing atmospheric carbon dioxide levels that contribute to global climate change (Dumroese et al. 2019).

Native planting and removal of non-native species activities in targeted areas would result in increased opportunities for multiple recreational uses in forested areas. Forest planting also improves surface water quality and has the potential to improve groundwater quality, through increased soil stabilization and filtration and reduction of evaporation from soil.

C. Recreational Fishing

A replacement recreational fishing project for potential lost recreational use could include acquisition of land and construction of a fishing access site or other recreational access site in Lincoln County in cooperation with Montana Fish Wildlife, and Parks or a local governmental entity. It would be constructed in accordance with then-current construction and design requirements for fishing access sites.

III. CRITERIA FOR SELECTING RESTORATION PROJECTS[9]

Prior to use of funds, a restoration plan would be developed and adopted by the Governor after adequate public notice and opportunity for hearing and consideration of all public comment. The DOI regulations, 43 C.F.R. § 11.82(a), provide that a reasonable number of possible alternatives for the restoration, rehabilitation, or replacement of the injured natural resources be developed and considered. The overall goal of the restoration plan is to identify actions that singly or in combination restore, rehabilitate, replace, or acquire the equivalent of injured natural resources or lost services such that they can provide the level of services available under baseline conditions. Restoration in areas where remedial action will be implemented typically follows implementation of the remedial action and is intended to provide restoration beyond that provided by the remedial actions. Additional data collection and analysis may be needed to evaluate the priority of the different restoration actions.

The Natural Resource Damage Program (NRDP), which acts on behalf of the Governor as trustee, typically develops a restoration plan in consultation with the Montana Department of

[9] The criteria described in this Section III are intended to provide a synopsis of the State's process for evaluating and selecting potential restoration projects. This Section does not, however, fully define that process or otherwise affect in any way the State or the Governor's authority and discretion established by law.

Fish, Wildlife and Parks, local government (e.g., Libby and Lincoln County, the local Water Quality Protection District), watershed groups and non-profits, other agencies, and the public. A recent example of this process is outlined in the *East Helena Asarco Smelter Final Restoration Plan and Environmental Assessment Checklist* (NRDP 2019), available at [11.04.2019-East-Helena-Restoration-Plan-Signed-by-Gov.pdf (dojmt.gov)](). NRDP would follow a similar process and gather restoration action ideas from all relevant entities from their planning documents, meetings, and a public solicitation for project ideas. The criteria outlined below are taken from the *East Helena Asarco Smelter Final Restoration Plan and Environmental Assessment Checklist.*

In developing possible alternatives for the restoration, replacement, rehabilitation, or acquiring the equivalent of the injured natural resources or services, NRDP anticipates evaluating the alternatives under the following criteria, which meet the requirements of CERCLA and CECRA, and the provisions of 43 C.F.R. § 11.82. In addition, NRDP also anticipates evaluating the additional "policy criteria" outlined at the end of this section. These criteria have been developed by the State to promote State of Montana goals.

Technical Feasibility: This criterion evaluates the degree to which a restoration action employs well-known and accepted technologies and the likelihood that the action will achieve its objectives. Actions that are technologically infeasible will be rejected. However, actions that are innovative or that have some element of uncertainty as to their results may be approved. Different actions will use different methodologies with varying degrees of feasibility. Accordingly, application of this criterion will focus on an evaluation of an action's relative technological feasibility.

Relationship of Expected Costs to Expected Benefits: This criterion examines whether the costs of an action to restore, rehabilitate, replace, and/or acquire equivalent resources are commensurate with the benefits provided. In doing so, the costs associated with a restoration action, including costs other than those needed simply to implement the action, and the benefits that would result from an action, will be determined. Application of this criterion is not a straight cost-benefit analysis, nor does it establish a cost-benefit ratio that is by definition unacceptable. Quantifying the benefits of a project will sometimes require collection of additional data or information and additional analysis.

Cost-effectiveness: This criterion evaluates whether a particular restoration action accomplishes its goal in the least costly way possible. As outlined in the natural resource damage regulations, cost-effectiveness means that when two or more activities provide the same or a similar level of benefits, the least costly activity providing that level of benefits will be selected (43 C.F.R. § 11.14(j)). To apply this criterion in a meaningful fashion, all of the benefits a restoration action would produce must be considered, not just cost; otherwise, the focus would be too narrow. Take the example of a restoration action that would fully restore a given resource in a short period of time compared to another restoration action that would restore the same resource at less cost but over a longer period of time. Considering only that the second action is less expensive than the first action ignores the benefits resulting from a relatively shorter recovery period. In this example, since an accelerated recovery time is a benefit, it would need to be factored into a determination of cost-effectiveness.

Results of Response Actions: This criterion would consider the results or anticipated results of CERCLA response actions underway or planned in OU3 after selection of the final remedy by EPA. Evaluation of this criterion requires assessment of response actions at an adequate level of detail in order to make projections as to their effects on natural resources and services. For restoration alternatives within OU3, this criterion will include consideration of:

- What may be necessary in the way of restoration of resources and services in light of the ongoing and planned response actions.
- The degree of consistency between a restoration action and the response action(s).

Adverse Environmental Impacts: This criterion weighs whether, and to what degree, a restoration action will result in adverse human or physical environmental impacts. Specifically, NRDP will evaluate significant adverse impacts that could arise from the restoration action, short term or long term, direct or indirect, including those that involve resources that are not the focus of the project. To do so, the dynamics of a restoration action and how that action will interact with the environment must be understood.

Recovery Period and Potential for Natural Recovery: This criterion evaluates the merits of a restoration action in light of whether the resource is able to recover naturally (i.e., without human intervention) and, if a resource can recover naturally, how long that will take. Given that the final response action at OU3 has not been determined, the NRDP will consider the recovery period following response actions to evaluate potential restoration projects in OU3. (The term “recovery period” refers to a return to “baseline,” as both of those terms are defined in 43 C.F.R. 11.14.)

Human Health and Safety: This criterion evaluates the potential for a restoration action to have adverse effects on human health and safety. Such a review will be undertaken not only to judge a particular action but also to determine if protective measures should be added to the restoration action to ensure safety.

Federal, State, and Tribal Policies, Rules and Laws: This criterion considers the degree to which a restoration action is consistent with applicable policies of the State of Montana and applicable policies of the federal government and Tribes (to the extent the State is aware of those policies and believes them to be applicable and meritorious). In addition, a restoration action must be implemented in compliance with applicable laws and rules.

Policy Criteria

In addition to the above legal criteria, NRDP applies the following policy criteria when considering prospective restoration projects.

Normal Government Function: This criterion evaluates whether a restoration action involves activities for which a governmental agency would normally be responsible or that would receive funding in the normal course of events and would be implemented if recovered natural resource damages were not available. Settlement funds may be used to augment funds available to government agencies, if such cost sharing would result in the implementation of a restoration action that would not otherwise occur through normal government function. Based strictly on this criterion, a project involving activities that would fall within normal government responsibilities may be ranked lower than a restoration action that does not fall within this category.

Price: NRDP will evaluate whether the land, easements, water rights, or other property interests proposed to be acquired are being offered for sale at or below fair market value. Consideration of this criterion will likely require NRDP to conduct its own appraisal of the property. If the appraisal process for an acquisition was not subject to initial State review and approval, NRDP will, at a minimum, conduct a review appraisal and may conduct a full appraisal.

Location: Restoration actions are generally geographically restricted. In this case, the State has agreed to prioritize restoration actions within Lincoln County (in which OU3 is located), subject to NRDP's required administrative decision-making process.

Environmental Review

An environmental review of the implementation of the restoration plan is also required to evaluate impacts of proposed State action on the physical and human environment pursuant to the requirements of the Montana Environmental Policy Act, §§ 75-1-101, MCA, *et seq*. (MEPA). As part of its analysis of impacts to human health and safety, NRDP will determine if protective measures should be added to the restoration plan alternatives to ensure safety.

Public Comment

Upon a full evaluation of the information collected through the above process and an evaluation of the above criteria, including a comparative analysis, NRDP will identify a preferred alternative and put the draft restoration plan out for public comment. NRDP will consider all public comment before making a recommendation to the Governor for the final restoration plan. 42 U.S.C. § 9611 and § 75-10-713, MCA.

IV. RESOURCES

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