INTERIM ACTION PLAN

Monte Cristo Mining Area
Silverton, WA

July 2015
Washington Department of Ecology
Toxics Cleanup Program
Central Regional Office
Union Gap, WA

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1.0 INTRODUCTION

This Interim Action Plan (IAP) addresses interim cleanup of privately owned parcels, listed below, within the Monte Cristo Mining Area (Site), Facility Site Identification # 2251399. The parcels are located over 4 miles up the Monte Cristo Road from Barlow Pass on the Mountain Loop Highway near Silverton, in Snohomish County, Washington, *See* Figures 1 and 2. This IAP is required as part of the Site cleanup process under the Model Toxics Control Act (MTCA), Ch. 70.105D Revised Code of Washington (RCW), implemented by the Washington State Department of Ecology (Ecology). The interim action decision is based on the *Engineering Evaluation/Cost Analysis, Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington*, CES, April 2010 and other relevant documents in the administrative record (see section 1.3).

Privately Owned Parcels:

- Junction Placer No. 1 (part) - 10010000001900
- Senate Mill - 10010000004700
- Monte Cristo Mill - 10010000007900
- Cadet Mill - 10010000004400
- Rainy Mine - 10010000004200

This IAP outlines the following:

- Interim action cleanup levels for the Site that are protective of human health and the environment (and could potentially constitute cleanup levels for a final remedy);
- Brief summary of other alternatives;
- General description of proposed action and summary of rationale for selection of proposed action;
- Applicable state and federal laws; and
- Schedule for implementation.

1.1 DECLARATION

Ecology has selected this interim remedy because it will reduce a threat to human health and the environment, thus satisfying WAC 173-340-430(1)(a). The interim action will correct a problem that will cost substantially more to address if remedial action is delayed, thus satisfying WAC 173-340-430 (1) (b). The interim action does not foreclose reasonable alternatives for the final cleanup action, thus satisfying WAC 173-340-430 (3)(b).

1.2 APPLICABILITY

Interim action cleanup levels specified in this IAP are applicable only to the Monte Cristo Mining Area Site. They were developed as a part of an overall remediation process under Ecology oversight using the authority of MTCA, and should not be considered as setting precedents for other sites.

1.3 Administrative Record

The documents used to make the decisions discussed in this interim action plan are on file in the administrative record for the Site. Major documents are listed in the reference section. The entire administrative record for the Site is available for public review by appointment at Ecology's Central Regional Office, located at 1250 West Alder Street, Union Gap, WA 98903. The United States Department of Agriculture – Forest Service (USFS) maintains a separate information repository per the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Results from applicable studies and reports are summarized to provide background information pertinent to the IAP. These studies and reports include:

- *Site Inspection Report Monte Cristo Mining Area Mt. Baker-Snoqualmie National Forest*, CES, December 2007.
- *Engineering Evaluation/Cost Analysis, Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington*, CES, April 2010.
- *Monte Cristo Mining Area, Phase 1 Spatial Analysis Summary Report, Snohomish, Washington, Prepared for Washington State Department of Ecology, April 20, 2011, 17330-33*. Hart Crowser, Inc.
- *Monte Cristo Mining Area, Remedial Investigation Phase 2, Summary Report, Prepared for Washington State Department of Ecology, May 31, 2012, 17800-06*. Hart Crowser, Inc.
- *Removal Action Memorandum Non-Time Critical Removal Action Monte Cristo Mining Area (MCMA) Site Mt. Baker-Snoqualmie National Forest Snohomish County, Washington*, USFS, September 2012.
- *Explanation of Significant Differences, Non-Time Critical Removal Action, Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington.* USFS, 2015.

1.4 Cleanup Process

Under MTCA, a "cleanup action" is a remedial action, other than an interim action, taken at a site to eliminate, render less toxic, stabilize, contain, immobilize, isolate, treat, destroy, or remove a hazardous substance in compliance with the cleanup action selection requirements of WAC 173-340-360, among other regulations. *See* WAC 173-340-200 (defining "cleanup action"). An "interim action" is an action that only partially addresses the cleanup of a site. WAC 173-340-430(1). For instance, an interim action might achieve cleanup standards for a portion of the site, while not satisfying the requirements for a cleanup action for the entire site, or it might provide for a partial cleanup that does not achieve cleanup standards, but reduces a threat or corrects a problem that may become substantially worse (or cost substantially more to address) in the future. *See* WAC 173-340-430(1), (2).

The intention of the interim action described in this IAP is to achieve future cleanup standards, established in a final cleanup action plan, for contaminated soil located on the parcels described in Section 1.0. The interim action described in this IAP does not establish cleanup standards for contaminated surface water, sediments, or soil outside the parcels identified in Section 1.0.

Remedial action under the MTCA process requires the preparation of specific documents either by the Potentially Liable Person (PLP) or by Ecology. These procedural tasks and resulting documents, along with the MTCA section that requires their completion, are listed below with a brief description of each task.

- Remedial Investigation and Feasibility Study (RI/FS) – Washington Administrative Code (WAC) 173-340-350
  The RI/FS documents the investigations and evaluations conducted at the Site from the discovery phase to the RI/FS document. The document undergoes public comment. Similarly under CERCLA, an RI/FS is prepared to support a final remedy (response action) decision.
- Interim Action Plan (IAP) - WAC 173-340-430(7)
  The IAP describes the interim action and how it will meet the criteria for an interim action. Some IAPs set interim action cleanup levels and standards for the Site, and selects the remedial actions intended to achieve these cleanup levels. The document undergoes public comment. For CERCLA removal actions (equivalent to MTCA interim actions), similar documents are referred to as a Site Inspection (SI) and Engineering Evaluation/Cost Analysis (EE/CA). The SI collects and presents information on the nature and extent of contamination, and the risks posed by the contamination. The EE/CA presents and evaluates Site removal action alternatives and proposes a preferred removal action alternative.
- Engineering Design Report, Construction Plans and Specifications - WAC 173-340-400
  The report outlines details of the selected remedial action, including any engineered systems and design components from the IAP. These may include construction plans and specifications with technical drawings. Public comment is optional.
- Operation and Maintenance Plan(s) - WAC 173-340-400
  These plans summarize the requirements for inspection and maintenance of remedial actions. They include any actions required to operate and maintain equipment, structures, or other remedial systems.
- Interim Action Report - WAC 173-340-400
  The Interim Action Report is completed following implementation of the interim action, and provides details on the cleanup activities along with documentation of adherence to or variance from the IAP.
- Compliance Monitoring Plan - WAC 173-340-410
  Compliance Monitoring Plans provide details on the completion of monitoring activities required to ensure the interim action is performing as intended. It is prepared by the PLP and approved by Ecology.

2.0 SITE BACKGROUND

2.1 SITE HISTORY

The Monte Cristo Mining Area (MCMA) has a rich history starting with discovery of a metal-bearing load by Joseph Pearsall in 1889. Numerous claims were soon staked, mines were developed, and by 1893 the Everett & Monte Cristo Railroad and United Concentration

Company concentrator were completed. By the summer of 1897, the district reached peak production running ore from the Mystery/Pride complex, Comet, Justice, Golden Cord, and Rainy Mines through the 300 tons/day concentrator. Plagued by geography, the railroad was destroyed by flooding, resulting in numerous mines falling into receivership. By 1899, the Rockefeller Syndicate, operating as the Monte Cristo Mining and Concentrating Company (MCM&CC), gained controlling interest of the mines. The following year MCM&CC restored rail service. In 1903, the American Smelting and Refining Company (ASARCO) purchased the Everett smelter and Monte Cristo mines and closed the mines two months later. In 1905, the Wilmans brothers (who coined the mining district "Monte Cristo" in 1890s) purchased the mines. The last production from the Monte Cristo mines occurred in the summer of 1907. According to available records, total production from the Monte Cristo mines was estimated to be no less than 300,000 tons of ore.

In 2009, Ecology and the USFS received funding through a bankruptcy settlement with ASARCO to clean up hazardous substances released to the environment from historical mining practices. Ecology listed the Site on the state's Hazardous Sites Lists in 2004. The USFS began assessing the Site in 2003, culminating in issuance of a *Non-time Critical Removal Action Memorandum* (NTCRA) in 2012. The USFS documented the release of hazardous substances to the environment on both National Forest Land and privately owned land (Figures 1 and 2). The USFS has decision-making authority for CERCLA removal actions on National Forest Land. Hazardous substances released to the environment on privately owned land are under the decision-making jurisdiction of Ecology. Ecology is issuing an interim action plan at this time to facilitate a comprehensive removal action that addresses both National Forest Land and privately owned land, with the USFS as the lead agency implementing the removal action.

2.2 SITE INVESTIGATIONS

Beginning in 2002, multiple environmental investigations have been conducted in the MCMA. Below are the investigations that are relevant to this interim action and the USFS Non-Time Critical Removal Action (NTCRA):

- An Abbreviated Preliminary Assessment (APA) was conducted by the Forest Service on the Concentrator in 2002 and on Mystery Mine in 2003.

- The Washington Department of Natural Resources (DNR) investigated metal contamination in Mystery, Justice, Pride of the Mountains (POM), Pride of the Woods (POW), and New Discovery Mines in 2003.

- Snohomish Health District and Ecology conducted a Site Hazard Assessment (SHA) in 2004.

- The Forest Service conducted two additional APAs in 2006: one for Sidney Mine, and the other was a combined assessment of Pride of the Woods, New Discovery, and Pride of the Mountains Mines.

- A Site Investigation (SI) was conducted in 2007 by Cascade Earth Sciences (CES) to inspect Mystery and Justice Mines, the Concentrator, Ore Collector, and the Assay Shack.

- An Engineering Evaluation/Cost Analysis (EECA) was prepared by CES in 2010 for a proposed Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Removal Action in the MCMA.

- Data Gap Investigation was published by CES for the MCMA in January, 2011.

- Ecology compiled and validated environmental data collected in previous studies to perform a preliminary spatial analysis in 2010 for the purpose of directing environmental data needs for the ongoing Remedial Investigation. Published by Hart Crowser in 2011.

- Ecology conducted an inventory and preliminarily evaluation of mines and prospects the USFS had not assessed, and collected additional background soil samples to support Ecology's Remedial Investigation. Published by Hart Crowser in 2012.

2.3 Physical Site Characteristics

2.3.1 Site Location

The MCMA is located in Township 29 North, Range 11 East, within the Mt. Baker-Snoqualmie National Forest in Snohomish County, Washington, near the west-center margin of the Henry M. Jackson Wilderness Area (Figure 1).

The MCMA is situated within extremely rugged terrain in the Cascade Mountains, with elevations ranging upward from approximately 2,755 feet above mean sea level (amsl) at the historic Monte Cristo Townsite. The high-elevation portion of the MCMA is drained by Glacier Creek and Seventysix Creek, and the headwaters of both creeks exceed 6,000 feet amsl. The confluence of these streams at the Townsite marks the beginning of the South Fork of the Sauk River (SFSR), which flows 6.8 miles northwest to Monte Cristo Lake.

2.3.2 Topography and Climate

The MCMA is steep mountainous terrain consisting of deep, U-shaped glacial valleys and rugged, high-elevation ridges. It is drained by the SFSR watershed, including Glacier and Seventysix Creeks that flow predominantly north-northwest from the Cascade Mountains crest. Glacier Basin in the upper MCMA consists of steep talus slopes, cliffs, alpine glaciers, and glacial lakes.

The climate in Snohomish County, characterized by warm, semi-dry summers and cool, moist winters, varies depending on elevation and distance from the Cascade Mountains summit. Precipitation increases and temperatures decrease as elevation rises to the summit of the Cascade Mountain Range.

Climate data were compiled from the Western Regional Climate Center (WRCC) web site (http://www.wrcc.dri.edu/) at the Desert Research Institute. The WRCC lists Monte Cristo as a climate data station (ID # 455539; now closed) for two periods of time: 1895 to 1902 and 1964 to 1976. Data for the older period were poorly documented, and the recent data were not available. Data from two Washington monitoring stations that are in terrain and at elevations similar to Monte Cristo, located 22 to 26 miles to the southeast were examined. The stations include the Scenic (ID # 457379; WRCCa, 2006) at an elevation of 2,221 feet amsl (monitoring data 1948 to 1970) and Stevens Pass (ID # 458089; WRCCb, 2006) at an elevation of 4,070 feet amsl (monitoring data 1950 to 1994). Data from the two monitoring stations and relevant climatic information are summarized as follows:

- Total average precipitation ranges from approximately 81.5 to 90 inches per year.
- Total average snowfall at the two stations range from 296 to 494 inches per year.
- The maximum average monthly snow depths occurs in March; 47 inches at Scenic and 103 inches at Stevens Pass.
- On the average, 6.5 inches of precipitation, primarily as rain, are received at the stations during July, August, and September.
- The average minimum monthly temperatures from December through February range from 19° to 22° Fahrenheit (F).
- The average maximum daily temperature of approximately 66°F occurs in July.

2.3.3 GEOLOGY, SOILS, AND HYDROGEOLOGY

CES 2011--

> The western and southern portions of the MCMA are dominated by early Tertiary extrusive rocks identified as "*Extensional volcanic rocks*" (Tev), also referred to in earlier digital maps as the *Barlow Pass volcanics*. The eastern and northern parts of the MCMA are mainly underlain by middle Tertiary intrusive rocks named the "*Snoqualmie family intrusives*" (Tcas), also identified in earlier digital maps as granodioritic and granitic rocks of the *Grotto batholith*. Church and others (1983) note that Grotto batholith (Snoqualmie family intrusives) intruded along the Straight Creek Fault (see below), and the Barlow Pass volcanics (Extensional volcanic rock) are the principal host for ore minerals in the mining district. Lying between these two units and cropping out along a north-south trend are early Cretaceous (older) metamorphic rocks named "Darrington Phyllite" (Ked).
>
> Superimposed on the bedrock of the MCMA are the pronounced effects of Pleistocene glaciation as well as historic and on-going erosion. The snowfields and small alpine glaciers visible on the flanks of some peaks in Glacier Basin and the upper reaches of Seventysix Gulch are the remnants of a long period of glaciation during which large glaciers carved the pre-existing landscape into deep, U-shaped valleys that now characterize the area. Due to glaciation, the peaks and steep flanks of the mountains and upper valleys have only a thin to essentially non-existent regolith; largely unvegetated exposures of bedrock and talus dominate these upper elevations. Much of the bedrock in the lower elevations of the MCMA is covered by Tertiary to Quaternary sedimentary materials, mainly unconsolidated sediments from various sources, including alluvium and colluvium (Qa, Qu), talus (Qt), Alpine glacial

deposits (Qag), glacial outwash (Qvr), and landslide deposits of various ages (QTl). These sedimentary/alluvial deposits cover much of the valley bottoms and lower slopes of the mountains. The veneer of the alluvial deposits often masks the underlying bedrock making identification of rock type or establishing the outcrops of mineralized structures difficult. It is noteworthy, however, that some types of alluvium are excellent sources for construction materials.

The MCMA is bisected by a complex, north-northwest-trending set of faults that lie in the convergence zone between two, sub parallel, regional fault zones - the northwest-trending Darrington-Devils Mountain Fault on the west and the north-trending Straight Creek Fault on the east (Tabor and others, 1993, 2002; Haugerud and Tabor, 2009). The northwest-trending, convergence zone fault set, particularly notable along the course of and parallel to Seventysix Creek, apparently bifurcates (splits) from north to south in the head waters of Seventysix Creek, at the core of the MCMA which is also affected by cross-cutting faults. Church and others (1983) also noted that a major structural feature known as the Glacier Peak transverse structural belt may also intersect the core of the MCMA. It is well known that significant mineral deposits are typically associated with complex structural intersects such as these because the major fracture zones provide pathways of weakness, "plumbing," for transport of hydrothermal fluids from deeper sources.

The Justice, Golden Cord, Mystery, Pride of the Woods, New Discovery, and Pride of the Mountains Mines, which develop a northeast-trending, northwest-dipping shear zone, comprise the most productive deposits in the District. The zone is exposed either underground or on the surface over a strike length of 5,800 feet, varies in width from less than 1 foot to over 20 feet, and contains quartz veins and lenses which pinch and swell sporadically along both strike and dip. Varying amounts of the following minerals were observed in one or more veins and lenses at mine sites in the MCMA: pyrite, pyrrhotite, arsenopyrite, sphalerite, galena, chalcopyrite, stibnite, bornite, and lesser amounts of azurite, boulangerite, chalcocite, hematite, malachite, marcasite, realgar, orpiment, and numerous unknown sulfosalts. Granodiorite, andesite, and tonalite country rock bordering the quartz veins is sheared, bleached, limonite-stained and contains disseminated sulfide minerals (DNR 2003). Metal concentrations are much lower in the country rock than in the veins.

The MCMA is located within the SFSR watershed and includes the Glacier Creek and Seventysix Creek sub-watersheds. A review of the Ecology's well log database indicates that there are no wells located within a 4-mile radius of the MCMA (CES, 2008a). The hydrogeology within the intrusive granodiorite/tonalite and extrusive extensional volcanics (basalt and rhyolite) that host the deposits is unknown; however, it is probable that groundwater flows preferentially along the permeable bedrock-overburden contact and lesser flow probably occurs in the bedrock fracture system. Groundwater levels are highly variable and dependent on precipitation and snow melt events. Snow melt, as well as water from mine portals higher on mountainsides, appear to infiltrate into talus and other thin, coarse regolith and flow along bedrock into the alluvial deposits of the valley bottoms.

3.0 REMEDIAL INVESTIGATION/SITE INSPECTION

A site inspection was performed to assess the nature and extent of contamination in soil, as described in CES 2007 and CES 2011. This interim action covers five private parcels (Figures 1 and 2) evaluated by the USFS: Junction Placer No. 1 (part), Senate Mill, Monte Cristo Mill, Cadet Mill, and Rainy Mine. These mine or mill parcels contain hazardous substances, Table 1, that have come to be located on the respective property from facilities identified as the United Companies Concentrator, Comet Mine Tram Terminal, Ore Collector, Haulage Way and Rainy Mine in the USFS NTCRA (Figure 2).

3.1 SOIL

Soil is the primary affected media, based on the elevated concentrations of metals present in mine waste (waste rock, ore, tailings, and mill concentrates), *See* Table 1. Concentrations of hazardous substances, primarily metal and metal-like elements, found at Site mines and facilities exceed natural background and human health or ecological criteria, CES 2010 and Hart Crowser 2011.

3.1.1 UNITED COMPANIES CONCENTRATOR

The Concentrator and Tailings are located in SE¼ Sec 21, T 29 N, R 11 E, WM (longitude 121^{o} 23' 20" W, latitude 47^{o} 59' 04" N) at an elevation of approximately 2,880 feet amsl. The site lies between Glacier Creek and the Forest Service Glacier Basin Trail and can be easily reached via the trail about ¼ mile upstream from the Townsite. Most of the mill foundation is on land administered by the Forest Service; however, the area between the foundation ruins and Glacier Creek, including soils/materials (tailings) containing hazardous substances, is on privately owned land, *See* Figures 2 and 3.

The five-story, 300-tons-per-day United Concentration Gravity Mill, also referred to as the United Companies Concentrator (Concentrator), was completed and began operating in 1894, ceased processing ore in 1912, and was dismantled in 1917. The mill used a series of crushers and rolls to liberate ore minerals from host rock and water-washed jigs to develop a concentrate that was sent to the Everett, Washington smelter. This type of gravity processing is inefficient and tends to yield metal-rich tailings. The Concentrator is positioned about 100 feet above the south bank of Glacier Creek, and tailings are irregularly distributed along the stream bank west of the Concentrator and between Forest Service Glacier Basin Trail (# 719) and the creek. Tailings were either discharged directly into the stream (Wolff, et al., 2003), into a small bunker (Written Communication, Johanson, 2009) or onto a tailings spill area along the south bank of the stream. An 8,100 bank cubic yards (bcy) mixture of tailings, contaminated soil, and waste rock up to about 5 feet to 7 feet thick was delineated in that area, and an additional <100 bcy of Dangerous Waste was identified around the Concentrator during the SI (CES, 2008a).

3.1.2 COMET MINE AERIAL TRAM TERMINAL

The Comet Terminal, which straddles the Glacier Basin trail (Forest Service Trail 719), is associated with the Comet Mine, *See* Figures 2 and 4. The tramway terminus, referred to here as the "Comet Terminal," is located on the south side of the Haulage Way about midway between the Ore Collector to the east and the Concentrator to the west. Johnson, et al. (1983a) reported that the Comet Mine produced from 1893 to 1895. The average grade of subeconomic resources delineated by Johnson, et al. (1983a) at the Comet Mine was 0.137 ounces (oz) gold per ton, 2.24 oz silver per ton, 3.15 percent arsenic, 0.99 percent lead, and 1.22 percent zinc. Ore grades suggest that rocks shipped through the Comet Terminal were high in arsenic and several heavy metals.

High concentrations of hazardous substances are present in many of the features and area that constitute the Comet Terminal. The highest concentrations occur in the apparent ore stockpiles and/or spillage areas between Forest Service Trail 719 on the up-hill side and the Haulage Way on the down-hill side; although some "high concentration" piles are present both up-hill and down-hill from the core area of contamination. A total of 11 piles of various shapes and sizes were mapped in the Comet Terminal. Volumes and surface areas of the piles were calculated using basic geometry for cones and rectangles. Seven of the piles are of similar size and shape, roughly 4 ft high cones with a base of about 10 ft. Each small pile is estimated to have a volume of about 4 bcy, and the combined total of the small piles is estimated to be 28 bcy. The four larger piles ranged in volume from about 16 to 140 bcy. The total volume of all 11 piles at the Comet Terminal is estimated to be about 235 bcy. Given the erratic distribution of hazardous substances present on other portions of the facility, removal of the top 0.5 ft of soil may also be prudent. Removal of 0.5 ft of the entire surface area of the Comet Terminal, 36,000 sq. ft, would add 667 bcy resulting in a total estimated removal of approximately 900 bcy.

3.1.3 HAULAGE WAYS

The Haulage Ways include an approximately 2,500-foot-long surface network of primitive roadways (1,800 feet) and railroad (700 feet) utilized to transport ore from the Ore Collector to the Concentrator and tailings area (Figure 2). Spillage of coarse- to fine-grained rock along these routes has left a sporadic thin veneer of materials with high concentrations of hazardous substances. The SI reported a cumulative volume of 200 bcy along the total length of the haulage routes (CES, 2008a).

3.1.4 ORE COLLECTOR

The Ore Collector is located in the SW¼ Sec 22, T 29 N, R 11 E, WM (longitude 121° 23’ 02” W, latitude 47° 59’ 01” N) at an elevation of 3,005 feet amsl. The site lies between Glacier Creek and the old Forest Service road and can be reached via the Forest Service Glacier Basin Trail, *See* Figures 2 and 5. The Ore Collector consists of the collapsed remains a tramway terminal ore storage facility on which stockpiled ore remains and around which ore was spilled. The site was mapped and sampled during the SI (CES, 2008a), and it was calculated that 1,800 bcy of coarse ore and 700 bcy of finely-crushed ore remain on the site.

3.1.5 RAINY MINE

The Rainy Mine is located in SW¼ Sec 22, T 29 N, R 22 E, WM (longitude 121° 22’ 59” W, latitude 47° 59’ 02” N) at an elevation of 2,960 feet amsl, *See* Figures 2 and 5.

Surface features observed include a partly-caved adit with a flooded open cut and a two-level waste rock dump that is thickly vegetated. The property was developed by an 855-foot-long adit, that trends north 32° east at the portal, and a 210-foot-deep shaft which accessed four levels according to an unidentified 1915 mine map (Johnson, et al., 1983a). A raise was driven from the working level to the surface 80 feet into the adit from the portal (Northwest Underground Explorations, 1997). However, no evidence of the shaft collar was found in the heavily vegetated area where it is projected to be during the site examination by CES. The adit portal is unstable and partially-collapsed with a pile of caved rock 6 feet high by 6 foot wide behind which water is impounded. Beyond the partial portal collapse, the adit appears to be about 6 feet high by 5 feet wide; further underground examination was considered to be too dangerous. Drainage water apparently flows through the collapsed rock pile at the portal and into a sink hole in the open cut (flow rate of 0.045 gpm on 8/21/2008); the only evidence of a shaft collar shown on a surface map as being directly in front of the adit portal (Johnson, et al., 1983a). Glacier Creek is approximately 40 feet down slope from the ponded water. Northwest Underground Explorations (1997) also reported that the shaft collar was boarded over and covered with dirt, which would constitute a safety hazard. The two-level waste rock dump present at the site is puzzling because the adit portal and apparent (collapsed or covered) shaft collar appear to be on the lower dump level at the base of the upper dump level. A search of the heavily vegetated upper dump level and surrounding area found no evidence of additional workings. It is noteworthy that the south face of the dump, facing Glacier Creek, appears to have experienced significant erosion by high flow conditions in the creek.

The waste rock dump volume was calculated by two methods: volume of underground workings, and the geometry of the dump. The estimates were very close; therefore, it is concluded that the dumps contain a minimum of 3,300 bcy of waste rock minus erosion by Glacier Creek, which may have been as much as 200 bcy.

3.2 RISKS TO HUMAN HEALTH AND THE ENVIRONMENT

Potential receptors include humans and terrestrial ecological receptors. Terrestrial ecological receptors include plants and animals exposed to impacted media, as well as secondary food chain consumers such as birds and mammals. Risk to ecological receptors is the primary driver in establishing site cleanup levels.

Evaluation of risks to human receptors conducted as part of the EE/CA identified seasonal resident as the maximally exposed individual. Arsenic is the contaminant of potential concern (COPC) responsible for the greatest non-carcinogenic and only contaminant responsible for carcinogenic risk to human health due to ingestion of soil and waste rock.

Evaluation of risk to ecological receptors conducted as part of the EE/CA identified numerous exceedances of background concentrations and ecological risk-based screening concentrations (ERBSCs), or lack of ERBSCs, for the COPCs. In addition, due to the relatively low soil pH, it was concluded in the EE/CA that COPCs are likely available for uptake. The most significant risk posed to plants and invertebrates; and reduced to non-existent impacts to more mobile and wide-ranging wildlife species.

3.3 SUMMARY OF EXPOSURE PATHWAYS

For a COPC to present a risk to human health and/or the environment, the pathway must be complete from the COPC to the receptor. The COPC to receptor pathways are discussed by medium in this section.

Soil

The pathways that may allow COPCs in soil to reach receptors include: (1) human direct contact with COPCs in soil via the dermal contact or ingestion pathways; and (2) terrestrial ecological contact with COPCs in soil and secondary biological food chain/consumption pathways.

The soil pathway is complete.

Soil and soil like material (waste rock, tailings, etc.) contain concentrations of metals and metal like elements at concentrations that exceed background and human health or ecological screening criteria.

In addition, the EE/CA identified *that an unknown, but substantial, volume of waste rock and concentrator tailings have been introduced into the surface water system and transported downstream an unknown distance. Two waste rock dumps at mines included in the EECA-DGI show direct evidence of erosion and transport by local streams. Contaminated materials eroded from the Rainy Mine waste rock dump (est. 200 bcy) by Glacier Creek and the Sidney Mine waste rock dump (est. 800 bcy) by Seventysix Creek were probably transported well downstream, as little to no evidence of local re-deposition was observed. As noted above, waste rock at both mines contains high concentrations of a range of hazardous substances. The larger portion of tailings from the Concentrator were more than likely deposited in Glacier Creek and transported downstream during flood events.* Weathering processes result in the soil pathway contributing to the surface water and sediment pathways.

Groundwater

The pathways that may allow COPCs in groundwater to reach receptors are unknown.

CES 2007 and CES 2011 evaluated sediment pore water; however, it is difficult to determine if the samples represent groundwater before it discharges onto surface water, or groundwater diluted by surface water, Hart Crowser 2011. The EE/CA did not identify any drinking water wells or wellhead protection areas within a 4-mile radius of the MCMA. Therefore, the groundwater pathway is incomplete; however, the groundwater pathway may be complete for human and ecological receptors via the surface water and/or sediment pathways.

Surface Water and Sediment

The pathways that may allow COPCs in surface water and sediment to reach receptors are: (1) human consumption of surface water and organisms; (2) human consumption of surface water;

(3) human ingestion of resident fish; (4) aquatic organism consumption of surface water; and (5) aquatic organism contact with surface water and sediment.

The pathway is complete. The surface water and sediment pathways are not directly addressed in this interim action. However, isolating contaminated soils is expected to reduce contribution to surface water and sediments.

Surface water and sediments from Monte Cristo Lake, South Fork Sauk River, Seventysix Gulch, Glacier Creek, and drainage from mine adits contain metals and metal like elements at concentrations that exceed background and human health or ecological screening criteria.

Air

The pathway that may allow COPCs in air to reach receptors is inhalation of particulate matter.

The air pathway is complete.

The inhalation pathway is a minor pathway of exposure because most metals are not volatile and soil conditions prevent significant contributions to the wind-borne particulate load.

4.0 INTERIM CLEANUP STANDARDS

For cleanup actions (final site remedies), MTCA requires the establishment of cleanup standards for individual sites. The two primary components of cleanup standards are cleanup levels and points of compliance. Cleanup levels determine the concentration at which a substance does not threaten human health or the environment. All environmental media that exceeds a cleanup level is addressed through a remedy that prevents exposure. Points of compliance represent the locations on the site where cleanup levels must be met.

Interim actions under MTCA do not have to comply with the requirement to meet cleanup standards. *Compare* WAC 173-340-430(7) with WAC 173-340-360(2). However, for interim actions intended to achieve cleanup standards for a portion of a site, such as the interim action described in this IAP, potentially applicable cleanup standards must be established. These cleanup standards will not become final until a cleanup action plan is prepared for the entire Site. *See* WAC 173-340-430(1).

4.1 OVERVIEW

The process for establishing interim action cleanup levels involves the following:

- Incorporating state and federal laws, Section 4.1 and Appendix D of CES 2010;
- Assessing cross-media contamination, Section 4.0 of CES 2007 and Table 2;
- Conducting human health and ecological risk assessments, Section 3.0 of CES 2010; and
- Assessing natural background concentrations, Section 5.1 of Hart Crowser 2012 and Table 2.

4.2 Terrestrial Ecological Evaluation

WAC 173-340-7490 requires a terrestrial ecological evaluation (TEE) to determine the potential effects of soil contamination on ecological receptors. A practitioner can end the ecological consideration process by either documenting an exclusion using the criteria set forth in WAC 173-340-7491, conducting a simplified TEE procedure as set forth in WAC 173-340-7492, or conducting a site-specific TEE as set forth in WAC 173-340-7493.

The Site does not qualify for an exclusion from the TEE procedures; therefore, relevant chemical concentration numbers listed in WAC 173-340-900 Table 749-2 are adopted as proposed interim action cleanup levels as set forth in WAC 173-340-7492(1)(d).

4.3 Site Cleanup Levels

Proposed interim action cleanup levels, Table 2, were developed by selecting the lowest criteria of MTCA Method A unrestricted, Method B soil ingestion, Method B soil ingestion and direct contact, Method B protection of surface water, and ecological indicator soil concentrations for protection of terrestrial plants and animals. In cases where screening criteria are less than the natural background concentration, the proposed interim cleanup level defaulted to natural background. Table 2 presents potential screening levels, calculated natural background concentrations, and proposed cleanup levels for soil for the eleven metals (including antimony, arsenic, barium, cadmium, copper, lead, mercury, nickel, selenium, thallium, and zinc) identified as chemicals of potential concern (COPC).

4.4 Indicator Hazardous Substances

WAC 173-340-703 allows Ecology to eliminate from further consideration those hazardous substances that contribute a small percentage of the overall threat to human health and the environment. The remaining hazardous substances serve as the indicator hazardous substances for purposes of defining site cleanup requirements.

Arsenic and lead, *See* Table 2, are the soil indicator hazardous substances for this action based on their prevalence in soil across the Site, overall contribution of risk to human health and ecological receptors, and physiochemical characteristics.

4.5 Point of Compliance

The MTCA Cleanup Regulation defines the point of compliance (POC) as the point or points where cleanup levels shall be attained. Once cleanup levels are met at the point of compliance, the Site is no longer considered a threat to human health or the environment.

WAC 173-340-740(6) and 7490(4)(b) give the point of compliance requirements for soil. The standard point of compliance for direct contact is soil within 15 feet of the ground surface throughout the entire site. This standard point of compliance applies to soil on the Site.

5.0 Selection of Interim Action

5.1 Remedial Action Objectives

The remedial action objectives describe the actions necessary to protect human health and the environment through eliminating, reducing, or otherwise controlling risks posed through each exposure pathway and migration route. To develop the objectives one must evaluate the characteristics of the contaminated media, the characteristics of the hazardous substances present, migration and exposure pathways, and potential receptor points.

Evaluation of risk to human receptors was conducted by CES using USEPA guidance, tables and formulas, CES 2010. The EE/CA identified the seasonal resident and recreational visitors as the maximally exposed individual.

The terrestrial ecological risk is the "driver" in setting cleanup levels for the selected interim action.

Historical activities on the property have contaminated the soil with numerous metals and metal like contaminants of concern (COCs). Potentially complete exposure pathways for COCs in soil include:

- Human direct contact via dermal contact or ingestion; and
- Terrestrial ecological direct contact, and secondary biological food chain/consumption.

The following remedial action objective should address the significant potential exposure pathways:

- Prevent direct contact or ingestion of contaminated soil by humans or ecological receptors.

5.2 Interim Action Alternatives

The EE/CA evaluated five alternatives that are applicable to the proposed interim actions on private land in Tables 21, 22, and 24 of CES 2010. This section describes the interim action alternatives developed and the MTCA criteria used to evaluate the alternatives. Each of the considered alternatives includes a combination of one or more of the following remedial actions:

Mine Waste Alternatives
- No Action
- Cover Construction
- Soil Removal
- Off-Site Disposal
- Consolidation and Cap Construction
- Monitoring and Maintenance
- Institutional controls

These remedial actions were combined to develop five interim action alternatives, each intended to address contaminated soil on the parcels listed in Section 1.0. Alternatives 3, 4, and 5 include revegetation of the excavated areas. For a detailed explanation and description of the alternatives refer to the EE/CA, CES 2010.

5.2.1 Mine Waste Alternative 1: No Action

5.2.2 Mine Waste Alternative 2: Institutional Controls

- Fencing and environmental covenant on deed.

5.2.3 Mine Waste Alternative 3: Mine Waste Cover In Place

- Construction of cover; Institutional controls; and Compliance monitoring and maintenance of engineered caps.

5.2.4 Mine Waste Alternative 4: Removal and Disposal in MCMA Repository

- Excavation of impacted materials; Construction of repository; Consolidation of impacted material at repository (near Heps Hill); Construction of cap for repository; Institutional controls for repository; Compliance monitoring and maintenance of engineered caps.

5.2.5 Mine Waste Alternative 5: Removal and Off-Site Disposal

- Excavation of impacted materials and Disposal at Subtitle D landfill.

5.3 Regulatory Requirements

The MTCA Cleanup Regulation sets forth the minimum requirements and procedures for selecting a cleanup action. A cleanup action must meet each of the minimum requirements specified in WAC 173-340-360(2), including certain threshold and other requirements. This IAP applies these cleanup action criteria to the proposed interim action alternatives, since the proposed interim is intended to achieve cleanup standards for a portion of the Site. This section outlines these cleanup action requirements and procedures as set forth in the regulation. Section 5.4 provides an evaluation of the interim action alternatives with respect to these criteria.

5.3.1 Threshold Requirements

WAC 173-340-360(2)(a) requires that the cleanup action shall:

- Protect human health and the environment;
- Comply with cleanup standards (see Section 4.0);
- Comply with applicable state and federal laws (see Section 5.3.4); and
- Provide for compliance monitoring.

5.3.2 Other Requirements

In addition, WAC 173-340-360(2)(b) states that the cleanup action shall:

- Use permanent solutions to the maximum extent practicable;
- Provide for a reasonable restoration time frame; and
- Consider public concerns

WAC 173-340-360(3) describes the specific requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable. A permanent solution is defined as one where cleanup levels can be met without further action being required at the Site other than the disposal of residue from the treatment of hazardous substances. To determine whether a cleanup action uses permanent solutions to the maximum extent practicable, a disproportionate cost analysis (DCA) is conducted, Tables 29 and 30 of CES 2010. This analysis compares the costs and benefits of the cleanup action alternatives and involves the consideration of several factors, including:

- Protectiveness;
- Permanent reduction of toxicity, mobility and volume;
- Cost;
- Long-term effectiveness;
- Short-term risk;
- Implementability; and
- Consideration of public concerns.

The DCA represents a test to determine whether incremental costs of a given alternative over a lower-cost option exceed the incremental degree of benefit achieved by the higher cost alternative. The most practicable permanent solution is identified as the baseline cleanup action alternative evaluation.

WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame, as required under subsection (2)(b)(ii). The factors that are used to determine whether a cleanup action provides a reasonable restoration time frame are set forth in WAC 173-340-360(4)(b) and include:

- Potential risks posed by the site to human health & the environment;
- Practicability of achieving a shorter restoration time frame;
- Current Site use and nearby resources that are or may be affected by the Site;
- Potential future use of the site and nearby resources that are or may be affected by the Site;
- Availability of alternative water supplies;
- Likely effectiveness and reliability of institutional controls;
- Ability to control and monitor migration of hazardous substances;
- Toxicity of hazardous substances; and
- Natural processes that reduce contaminant concentrations and are documented to occur.

5.3.3 Cleanup Action Expectations

WAC 173-340-370 sets forth the following expectations for the development of cleanup action alternatives and the selection of cleanup actions. These expectations represent the types of cleanup actions Ecology considers likely results of the remedy selection process; however, Ecology recognizes that there may be some sites where cleanup actions conforming to these expectations are not appropriate.

- Treatment technologies will be emphasized at sites with liquid wastes, areas with high concentrations of hazardous substances, or with highly mobile and/or highly treatable contaminants;
- To minimize the need for long-term management of contaminated materials, hazardous substances will be destroyed, detoxified, and/or removed to concentrations below cleanup levels throughout sites with small volumes of hazardous substances;
- Engineering controls, such as containment, may need to be used at sites with large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable;
- To minimize the potential for migration of hazardous substances, active measures will be taken to prevent precipitation and runoff from coming into contact with contaminated soil or waste materials;
- When hazardous substances remain on-site at concentrations which exceed cleanup levels, they will be consolidated to the maximum extent practicable where needed to minimize the potential for direct contact and migration of hazardous substances;
- For sites adjacent to surface water, active measures will be taken to prevent/minimize releases to that water; dilution will not be the sole method for demonstrating compliance;
- Natural attenuation of hazardous substances may be appropriate at sites where 1) source control is conducted to the maximum extent practicable, 2) leaving contaminants on-site doesn't pose an unacceptable risk, 3) there is evidence that natural degradation is occurring and will continue to occur, and 4) appropriate monitoring is taking place; and
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.

5.3.4 Applicable, Relevant, and Appropriate, and Local Requirements

WAC 173-340-710(1) requires that all cleanup actions comply with all applicable state and federal law. It further states that the term "applicable state and federal laws" shall include legally applicable requirements and those requirements that the department determines "…are relevant and appropriate requirements." This section discusses applicable state and federal law, relevant and appropriate requirements, and local permitting requirements which were considered and were of primary importance in selecting cleanup requirements. If other requirements are identified at a later date, they will be applied to the cleanup actions at that time.

MTCA provides an exemption from the procedural requirements of several state laws and from any laws authorizing local government permits or approvals for remedial actions conducted under a consent decree, order, or agreed order, and for remedial actions conducted by Ecology

(RCW 70.105D.090). However, the substantive requirements of a required permit must be met. The procedural requirements of the following state laws are exempted:

- Ch. 70.94 RCW, Washington Clean Air Act;
- Ch. 70.95 RCW, Solid Waste Management, Reduction, and Recycling;
- Ch. 70.105 RCW, Hazardous Waste Management;
- Ch. 77.55 RCW, Construction Projects in State Waters;
- Ch. 90.48 RCW, Water Pollution Control[1]; and
- Ch. 90.58 RCW, Shoreline Management Act of 1971.

WAC 173-340-710(4) sets forth the criteria that Ecology evaluates when determining whether certain requirements are relevant and appropriate for a cleanup action. Section 4.0 and Appendix D of CES 2010 lists the state and federal laws that contain the applicable or relevant and appropriate requirements that apply to the cleanup action at the Site. Local laws, which may be more stringent than specified state and federal laws, will govern where applicable.

5.4 Evaluation of Cleanup Action Alternatives

The EE/CA evaluated five remedial alternatives. This section describes the remedial alternatives developed and the MTCA criteria used to evaluate the alternatives. MTCA regulation (WAC 173-340-360) prescribes the criteria to evaluate remediation alternatives. The purpose of the evaluation is to identify the advantages and disadvantages of each alternative and, thereby, assist in the decision-making process. The EE/CA used this process to identify the preferred alternative.

5.4.1 Threshold Requirements

5.4.1.1 Protection of Human Health and the Environment and Compliance with Cleanup Standards

Alternatives 3, 4 and 5 reduce or eliminate risk from contaminated soil through removal or capping waste material. Alternative 3 reduces human health risk by reducing direct contact and fugitive dust, but is not effective at reducing ecological risk by preventing exposure to burrowing animals or plants. Alternatives 4 and 5 will eliminate exposure pathways and protect human health and the environment. Only Alternative 5 will comply with cleanup standards by disposal of dangerous waste off-site.

5.4.1.2 Compliance with State and Federal Laws

The selected cleanup levels are consistent with MTCA. Additionally, local, state and federal laws related to environmental protection, health and safety, transportation, and disposal apply to each proposed alternative. During remedial design, the selected alternative will be designed to comply with applicable, relevant, and appropriate requirements.

[1] Federally-delegated NPDES permit requirements are not subject to MTCA's permit exemption pursuant to an Ecology determination under RCW 70.105D.090(2).

5.4.1.3 Provision for Compliance Monitoring

Alternatives 3, 4, and 5 require compliance monitoring; therefore, all alternatives will meet this provision.

5.4.2 OTHER REQUIREMENTS

5.4.2.1 Use of Permanent Solutions to the Maximum Extent Practicable

MTCA places preference on permanent solutions to the maximum extent practicable based on a disproportionate cost analysis (DCA). DCA criteria include protectiveness, permanence, effectiveness over the long-term, management of short-term risks, technical and administrative implementability, and consideration of public concerns. The referenced section of MTCA further specifies that where alternatives are equal in benefits, the least costly alternative will be selected, provided the MTCA threshold and other requirements are met.

- Protectiveness

Alternative 5 prevents exposure through removal of all impacted material exceeding proposed cleanup levels. Alternative 4 prevents exposure through consolidation and capping. Both alternatives would achieve full protectiveness immediately upon completion. However, Alternative 5 was judged to be more protective of human health and the environment and meets the MTCA evaluation criteria. Alternative 3 will reduce risk to human health from direct contact and fugitive dust, but does not control leaching, infiltration, and does not prevent animals from burrowing into cover; therefore, Alternative 3 is not protective.

- Permanent Reduction of Toxicity, Mobility and Volume

None of the alternatives reduce the toxicity or volume of contaminants. Alternatives 5 and 4 control contaminant mobility by removal or stabilizing and capping of impacted material, respectively.

- Cleanup Costs

Costs are approximated based on specific design assumptions for each alternative. Although the costs provided by consultants are estimates based on design assumptions that might change, the relative costs can be used for this evaluation. The estimated cost for implementing Alternative 5 ($3,300,000) is over 40% greater than the cost for Alternative 4 ($1,400,000) over a 30-year time-frame. For a detailed description of the costs involved with each alternative at each mine feature, please refer to the EE/CA.

- Long-Term Effectiveness

Long-term effectiveness includes the degree of certainty that the alternative will be successful; the reliability of the alternative for the expected duration of hazardous substances remaining on site at concentrations that exceed cleanup levels; the magnitude of residual risk with the alternative in place; and the effectiveness of controls required to manage treatment residues or remaining wastes. Long-term effectiveness of Alternative 5 is higher than Alternative 4 since Alternative 4 depends on continual maintenance.

- Short-Term Risk

Short-term risks for Alternative 1 is non-existent, and minimal for Alternative 2. Short-term risks for Alternatives 3 and 4 are high due use of a heavy-lift helicopter and to be managed by following a construction health and safety plan and implementing other construction best practices. The off-site disposal component of Alternative 5 is inherently more risky because of its reliance on over-the-road transport of waste material to a landfill.

- Implementability

Alternative 1 is easy to implement. Alternatives 2 and 3 are very difficult to implement due to steep terrain, remote locations, and lack of cover material. Alternatives 4 and 5 are difficult to implement due to steep terrain and remote locations, but cover material for cap construction more easily obtained. The ability to restore disturbed areas for Alternatives 3, 4, and 5 may be low because of the availability of soil for cover, short growing season, and harsh conditions.

- Consider Public Concerns

Ecology will address public concerns during the public comment period required for this proposed interim action plan.

5.4.2.2 Provide a Reasonable Restoration Time Frame

Alternatives 3, 4, and 5 provide for a reasonable restoration time-frame. One can complete the proposed cleanup alterative within no more than two construction seasons. The interim action is complete at the end of construction with the exception of long-term monitoring for maintenance. Baring problems with capping, the risk is reduced after construction is complete.

5.4.3 INTERIM CLEANUP ACTION EXPECTATIONS

WAC 173-340-370 outlines specific cleanup action expectations and are described in Section 5.3.3. Alternatives 4 and 5 address these expectations in the following manner:

- Alternatives 4 and 5 include source control measures through the targeted removal of accessible contaminated soils. Soil removal effectively removes or reduces the overall threat to human health and the environment. These actions meets the following cleanup expectations:
  - Engineering controls, such as containment, may need to be used at sites with large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable.
  - When hazardous substances remain on-site at concentrations that exceed cleanup levels, they will be consolidated to the maximum extent practicable

where needed to minimize the potential for direct contact and migration of hazardous substances.
  - To minimize the need for long-term management of contaminated materials, hazardous substances will be destroyed, detoxified, and/or removed to concentrations below cleanup levels throughout sites with small volumes of hazardous substances.
  - To minimize the potential for migration of hazardous substances, active measures will be taken to prevent precipitation and runoff from coming into contact with contaminated soil or waste materials.
  - For sites adjacent to surface water, active measures will be taken to prevent/minimize releases to that water; dilution will not be the sole method for demonstrating compliance.
  - Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.

The following cleanup expectations are not applicable to the Site:

- Treatment technologies will be emphasized at sites with liquid wastes, areas with high concentrations of hazardous substances, or with highly mobile and/or highly treatable contaminants.
- Natural attenuation of hazardous substances may be appropriate at sites where 1) source control is conducted to the maximum extent practicable, 2) leaving contaminants on-site doesn’t pose an unacceptable risk, 3) there is evidence that natural degradation is occurring and will continue to occur, and 4) appropriate monitoring is taking place.

5.5 Decision

Based on the analysis described above, Alternative 4 was selected as the proposed interim action for the Monte Cristo Mining Area, with off-site disposal of dangerous waste. The alternative, combined with off-site disposal of dangerous waste, meets each of the minimum requirements for remedial actions and provides a greater long-term effectiveness for achieving cleanup objectives.

6.0 Selected Remedial Action

Following the above MTCA analysis, DCA, and discussions with the United States Department of Agriculture Forest Service (USFS) Alternative 4, with off-site disposal of dangerous waste, was identified as the proposed alternative for remedial action, pending public review. Alternative 4 addresses protection of the human health direct contact exposure pathway and terrestrial ecological receptors. The estimated cost for Alternative 4 based on the assumptions made in the EE/CA is $3,300,000 (-35 to +50 percent); a detailed cost estimate is presented in Table 5.

An Engineering Design Report (EDR) and project design documents (*Removal Action Work Plan, January 2015*, and *Explanation of Significant Differences,* 2015) were developed by the USFS. The USFS’s EDR and project design documents serve as the construction documentation for this interim action.

Ecology has made a preliminary determination that the proposed interim action is protective of human health and the environment, will attain federal and state requirements that are applicable or relevant and appropriate, complies with cleanup standards, and provides for compliance monitoring.

Field construction is scheduled for the 2015 construction season. Monitoring is required until the Site meets MTCA requirements for demonstrating that remediation is complete.

7.0 References Cited

CES 2007. *Site Inspection Report, Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest*. December 2007. Cascade Earth Sciences.

CES 2010. *Engineering Evaluation/Cost Analysis, Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington*. April 2010. Cascade Earth Sciences.

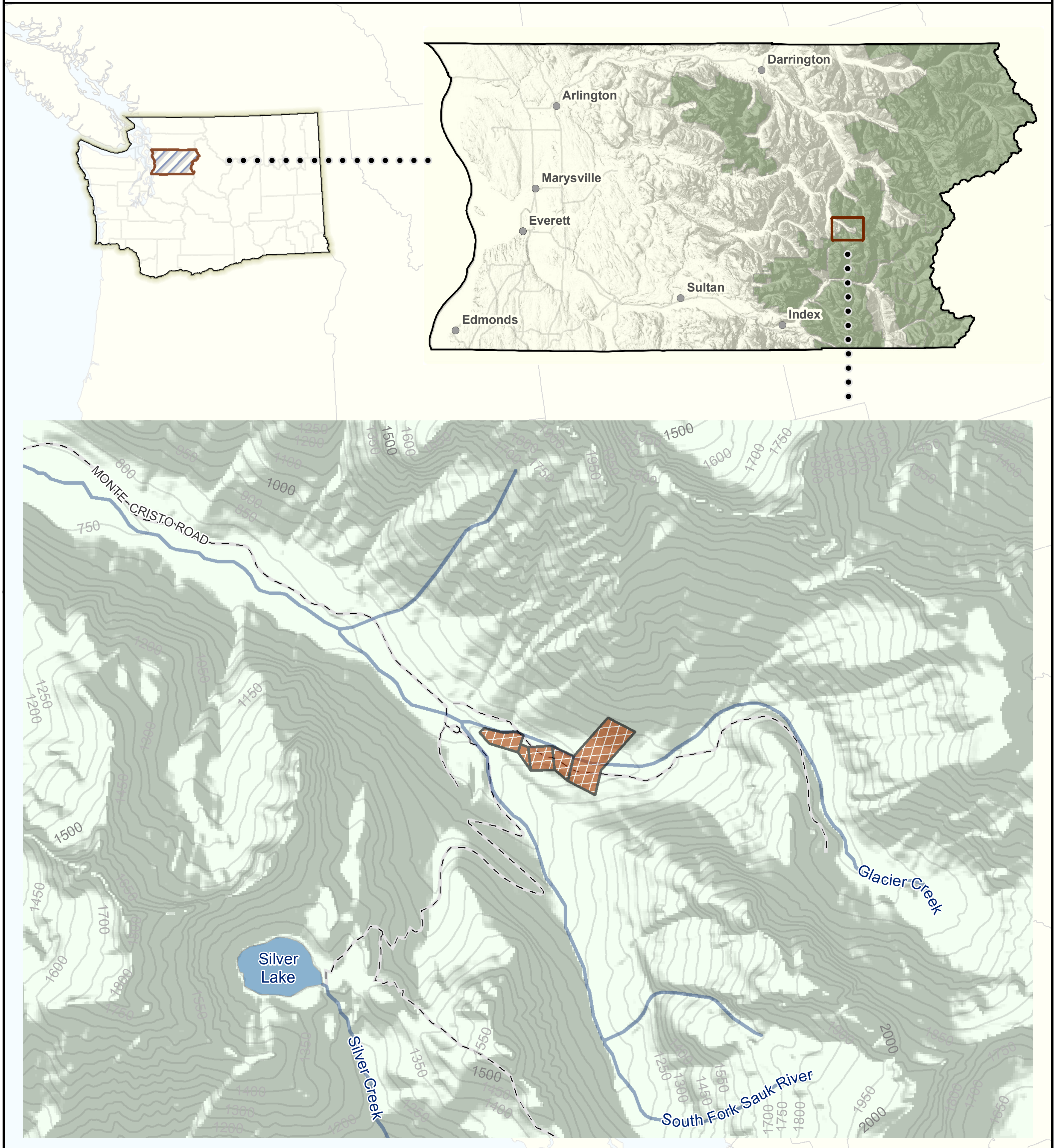
CES 2011. *Technical Memorandum: Removal Action – 2011 Data Gap Investigation, Geology and Mineralized Veins and Shear Zones in the Monte Cristo Mining Area*. December 5, 2011. Cascade Earth Sciences.

DNR 2003. *Inactive and Abandoned Mine Lands – Mystery and Justice Mines, Monte Cristo Mining District, Snohomish County, Washington*. OFR 2003-7. April 2003.

Hart Crowser 2011. *Monte Cristo Mining Area, Phase 1 Spatial Analysis Summary Report, Snohomish, Washington, Prepared for Washington State Department of Ecology, April 20, 2011, 17330-33*. Hart Crowser, Inc.

Hart Crower 2012. *Monte Cristo Mining Area, Remedial Investigation Phase 2, Summary Report, Prepared for Washington State Department of Ecology, May 31, 2012, 17800-06*. Hart Crowser, Inc.

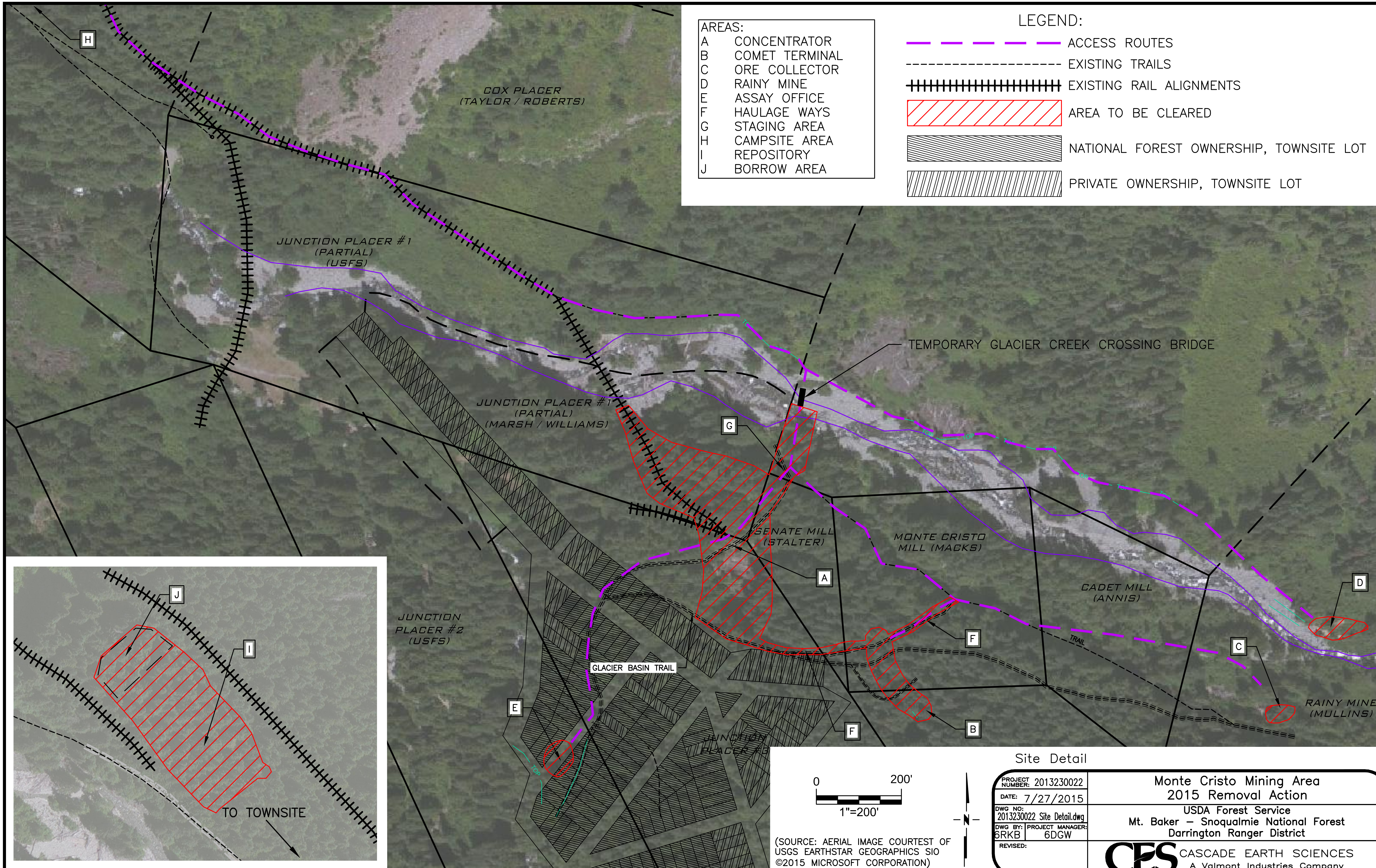
Monte Cristo Mining Area, Snohomish County, WA



Parcels Pertaining to Interim Action Plan

0 0.5 1 Miles

DEPARTMENT OF ECOLOGY
State of Washington



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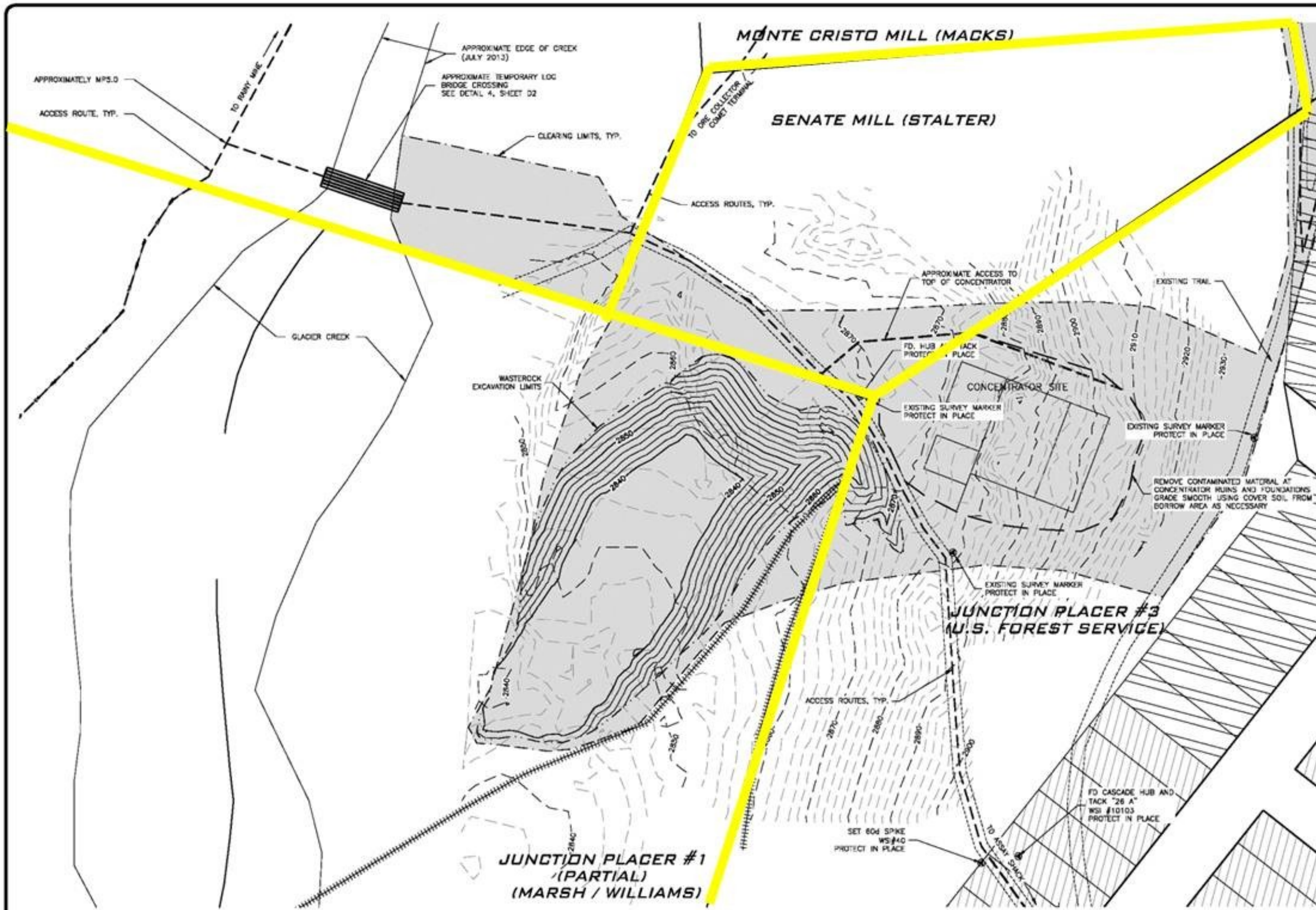


LEGEND:

- ANTICIPATED CLEARING LIMITS
- EXCAVATION LIMITS
- ACCESS ROUTES
- EXISTING TRAIL
- TOWNSITE LOT OWNED BY USFS
- TOWNSITE LOT PRIVATELY OWNED
- EXISTING SURVEY MONUMENT
- EXISTING SIGN, REMOVE AND REPLACE AS NEEDED
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR

NOTES:

1. REMOVE APPROXIMATELY 8200 CY OF CONTAMINATED TAILINGS AS DIRECTED BY THE ENGINEER AND HAUL TO REPOSITORY.
2. AFTER CLEANUP, BLEND WITH SURROUNDING TERRAIN OR SHAPE TO AND CONTOUR TO ILLUSTRATE HISTORIC FEATURES.
3. ACTUAL FINISHED GRADE MAY NEED TO BE MODIFIED AS DETERMINED BY TESTING FOR CONTAMINANT CONCENTRATIONS.

Yellow Line = Select Property Boundary

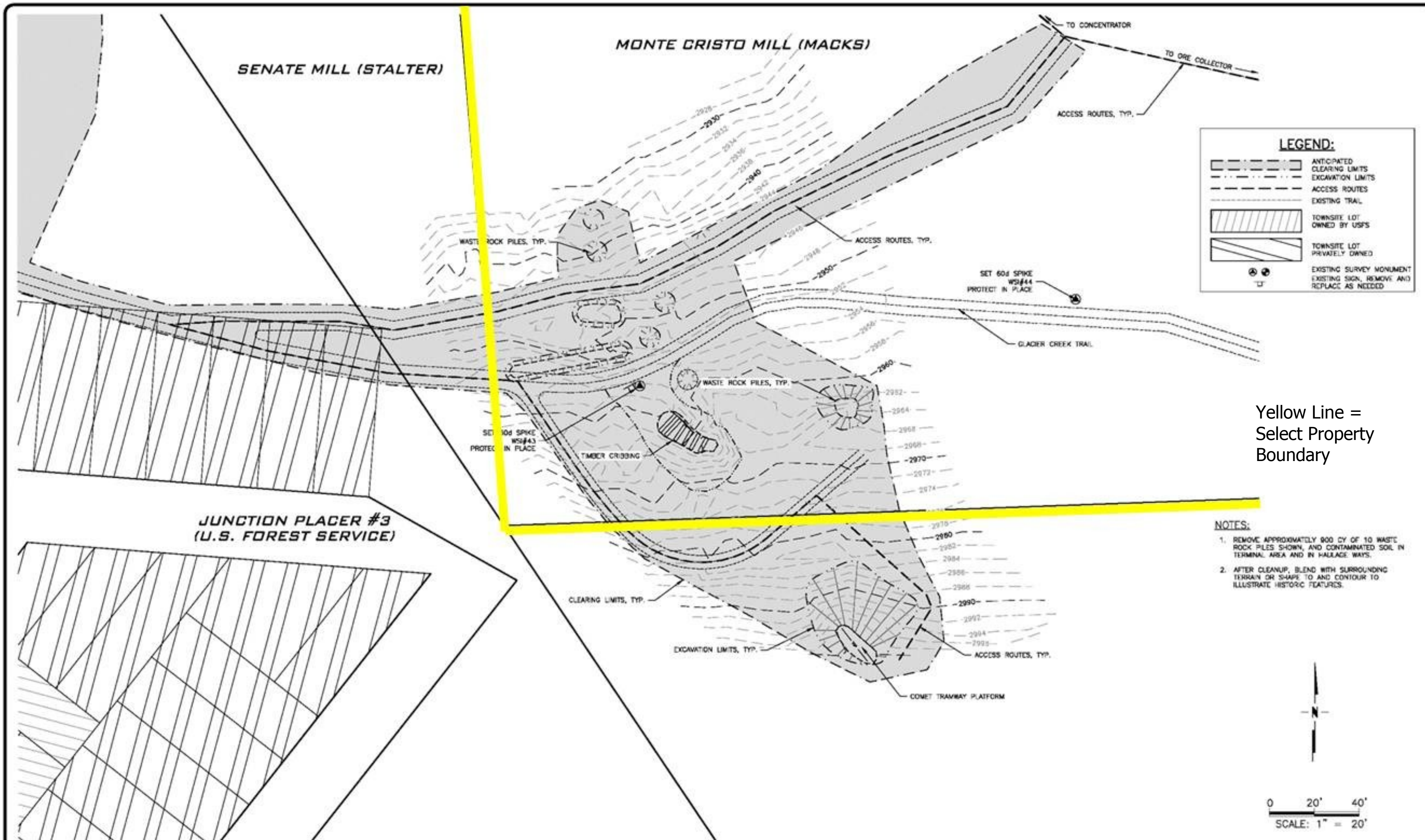
USDA Forest Service
Mt. Baker – Snoqualmie National Forest
Darrington Ranger District

REV #	DESCRIPTION	BY	DATE
	95% DESIGN SUBMITTAL		

DES. BY TLO
DRG. BY RKB
CHK. BY JEW
DATE 1/14/2015
JOB No. 2013230022

CES
CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322 FOR NATIONAL OFFICE LOCATIONS

CONCENTRATOR SITE PLAN
MONTE CRISTO MINING AREA REMOVAL ACTION



Yellow Line = Select Property Boundary

NOTES:

1. REMOVE APPROXIMATELY 900 CY OF 10 WASTE ROCK PILES SHOWN, AND CONTAMINATED SOIL IN TERMINAL AREA AND IN HAULAGE WAYS.
2. AFTER CLEANUP, BLEND WITH SURROUNDING TERRAIN OR SHAPE TO AND CONTOUR TO ILLUSTRATE HISTORIC FEATURES.

USDA Forest Service
Mt. Baker – Snoqualmie
National Forest
Darrington Ranger District

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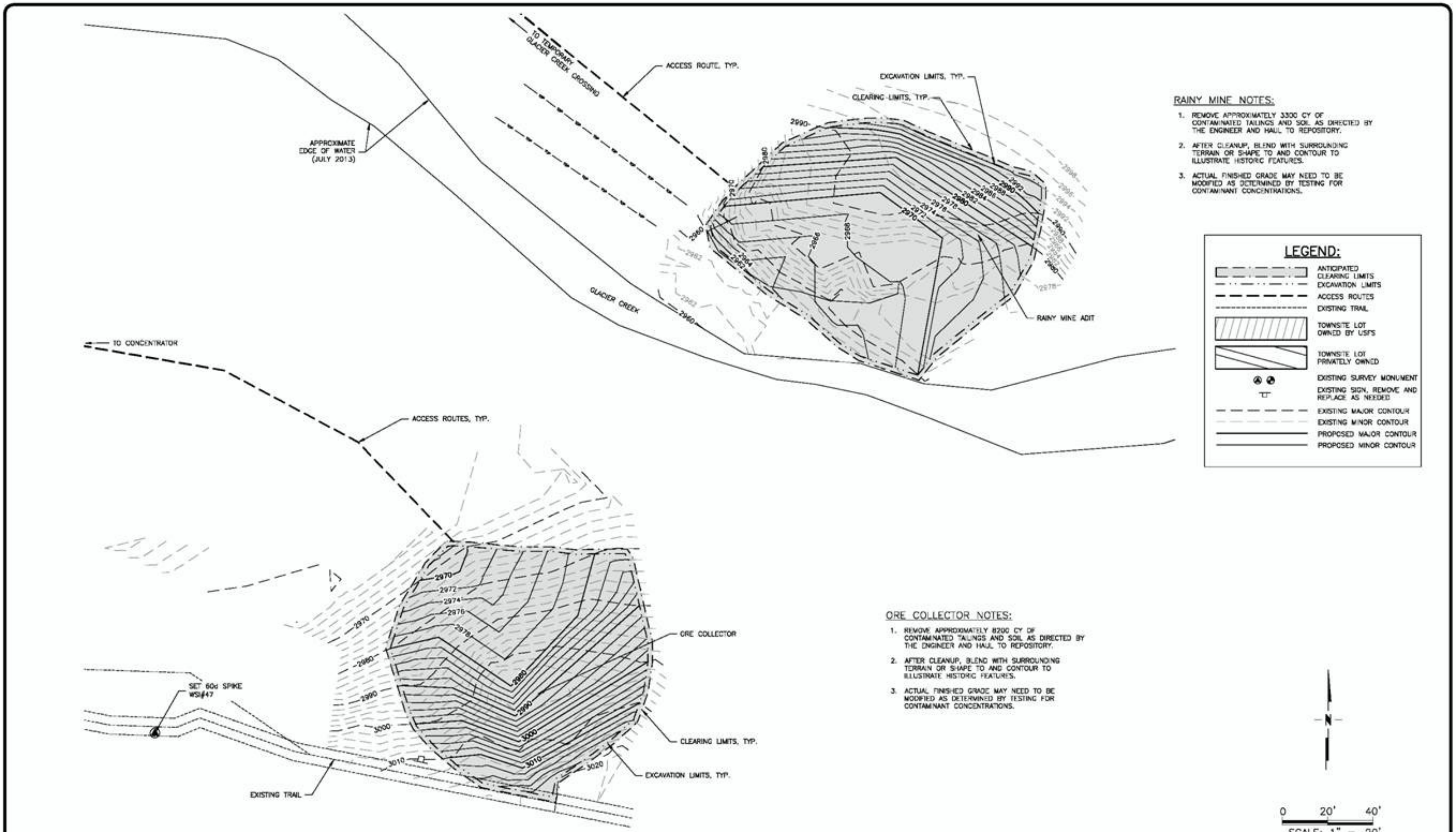
COMET TERMINAL
SITE PLAN

MONTE CRISTO MINING AREA
REMOVAL ACTION



RAINY MINE NOTES:

1. REMOVE APPROXIMATELY 3300 CY OF CONTAMINATED TAILINGS AND SOIL AS DIRECTED BY THE ENGINEER AND HAUL TO REPOSITORY.
2. AFTER CLEANUP, BLEND WITH SURROUNDING TERRAIN OR SHAPE TO AND CONTOUR TO ILLUSTRATE HISTORIC FEATURES.
3. ACTUAL FINISHED GRADE MAY NEED TO BE MODIFIED AS DETERMINED BY TESTING FOR CONTAMINANT CONCENTRATIONS.

ORE COLLECTOR NOTES:

1. REMOVE APPROXIMATELY 8200 CY OF CONTAMINATED TAILINGS AND SOIL AS DIRECTED BY THE ENGINEER AND HAUL TO REPOSITORY.
2. AFTER CLEANUP, BLEND WITH SURROUNDING TERRAIN OR SHAPE TO AND CONTOUR TO ILLUSTRATE HISTORIC FEATURES.
3. ACTUAL FINISHED GRADE MAY NEED TO BE MODIFIED AS DETERMINED BY TESTING FOR CONTAMINANT CONCENTRATIONS.

USDA Forest Service
Mt. Baker – Snoqualmie
National Forest
Darrington Ranger District

REV #	DESCRIPTION	BY	DATE
	95% DESIGN SUBMITTAL		

DES. BY TLO
DRG. BY RKB
CHK. BY JEW
DATE 1/14/2015
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FOR NATIONAL OFFICE LOCATIONS

ORE COLLECTOR AND RAINY MINE SITE PLAN

MONTE CRISTO MINING AREA REMOVAL ACTION