

Thompson Creek Mining Company



Custer County, Idaho

Clean Water Act Section 404(b)(1) Alternatives Analysis



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Acronyms/Abbreviations

amsl	above mean sea level
APOO	amended plan of operations
BLM	Bureau of Land Management
BMP	best management practices
BR	Bruno Creek
CFR	Code of Federal Regulations
CWA	Clean Water Act
EPA	Environmental Protection Agency
FLPMA	Federal Land Policy and Management Act of 1976
Forest Service	U.S. Forest Service, Salmon-Challis National Forest
Golder	Golder Associates
HDR	HDR Engineering, Inc.
JBR	JBR Environmental Consultants, Inc.
kV	Kilovolt
LEDPA	least environmentally damaging practicable alternative
M1	alternative to proposed action
M2	alternative to proposed action
M3	alternative to proposed action
MC	Mill Creek
MMPO	modified mine plan of operations
MTIS	mine tailings impoundment structure
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OHWM	ordinary high water mark
PEM	palustrine emergent wetland
PFO	palustrine forested wetland
PH	Pat Hughes Creek
TCMC	Thompson Creek Mining Company
USACE	U.S. Army Corps of Engineers
WB	West Fork Bruno Creek
WMCi	Water Management Consultants, Inc.

SUMMARY OF FINDINGS

Thompson Creek Mining Company (TCMC) is proposing to expand existing waste rock facilities and an existing tailings impoundment at its Thompson Creek Mine (see Figure 1-1). These activities would result in the discharge of fill to waters of the U.S., including 0.79 acres of stream channel and 3.36 acres of wetlands. Potential effects to waters of the U.S. are shown in Appendix A.

Wetlands are special aquatic sites. TCMC has focused its proposed action on avoiding and minimizing impacts to wetland areas by concentrating its mining activities, including tailings and waste rock disposal, in specific geographic areas that would limit effects to new areas.

TCMC evaluated multiple alternatives for the tailings impoundment expansion and the waste rock expansion. Three alternatives (M1, M2, and M3), including the “no action” alternative (M1) were moved forward for further evaluation. In comparing the two action alternatives (M2 and M3), neither stands out as the least environmentally damaging practicable alternative (LEDPA) for the tailings impoundment expansion element of the proposed action. Since all of the alternatives would result in the similar impacts, but Alternative M2 has fewer wetland and stream impacts than the Alternative M3, M2 is the preferred alternative.

TCMC considered several waste rock expansion area alternatives. Some would result in environmental effects in areas that are currently not being used for waste rock. Expanding the existing waste rock areas rather than establishing new waste rock area is the LEDPA for the waste rock expansion element of the proposed action.

1.0 INTRODUCTION

Thompson Creek Mining Company (TCMC) is proposing to expand existing waste rock facilities and an existing tailings impoundment at its Thompson Creek Mine. The Thompson Creek Mine is located near Clayton, Idaho, in Custer County (see Figure 1-1). The proposed expansion is part of a modified mine plan of operations (MMPO) that is currently being considered by the Bureau of Land Management (BLM) and the U.S. Forest Service, Salmon-Challis National Forest (Forest Service). The expansion is referred to in this alternatives analysis as the Phase 8 Mine Expansion. This alternatives analysis focuses on activity that would affect waters of the U.S.

On behalf of TCMC, in July 2010, HDR Engineering, Inc. (HDR) submitted the *Draft Wetland and Ordinary High Water Mark Delineation Report* that describes waters of the U.S. at the Thompson Creek Mine to the U.S. Army Corps of Engineers (USACE). These waters include Bruno Creek, West Fork of Bruno Creek, two small tributaries to Bruno Creek, Pat Hughes Creek, and Mill Creek (see Figure 1-2). In October 2010, HDR submitted an addendum to the original report based on a September 2010 field visit with representatives of USACE and the Environmental Protection Agency (EPA). In June 2012, HDR conducted a wetland reconnaissance of the power line corridor and delineated several small headwater wetlands tributary to upper Buckskin Creek.

Mine expansion would result in the discharge of fill to Bruno Creek, West Fork of Bruno Creek, two tributaries to Bruno Creek Pat Hughes Creek, and Mill Creek. Thus, TCMC must comply with Section 404 permitting requirements before beginning project construction in areas that support jurisdictional waters of the U.S. The proposed power line corridor will not affect any of the delineated wetlands or streams. Some of the other wetlands that were delineated in the drainages listed above will also be avoided; therefore, they are not considered impacts.

1.1 Expected Impacts to Waters of the United States

TCMC is applying for an individual Section 404 permit to authorize the discharge of fill material to Bruno Creek and its tributaries, Pat Hughes Creek and Mill Creek. As described in the permit application, project construction associated with the proposed action would discharge fill to a total of about 0.79 acres of stream channel and 3.36 acres of wetland. Expected impacts to waters of the U.S. are shown in Figure 1-3, and in Appendix A. A description of each alternative and their associated impacts to Waters of the United States is located in Section 5.0, Alternatives Analysis.

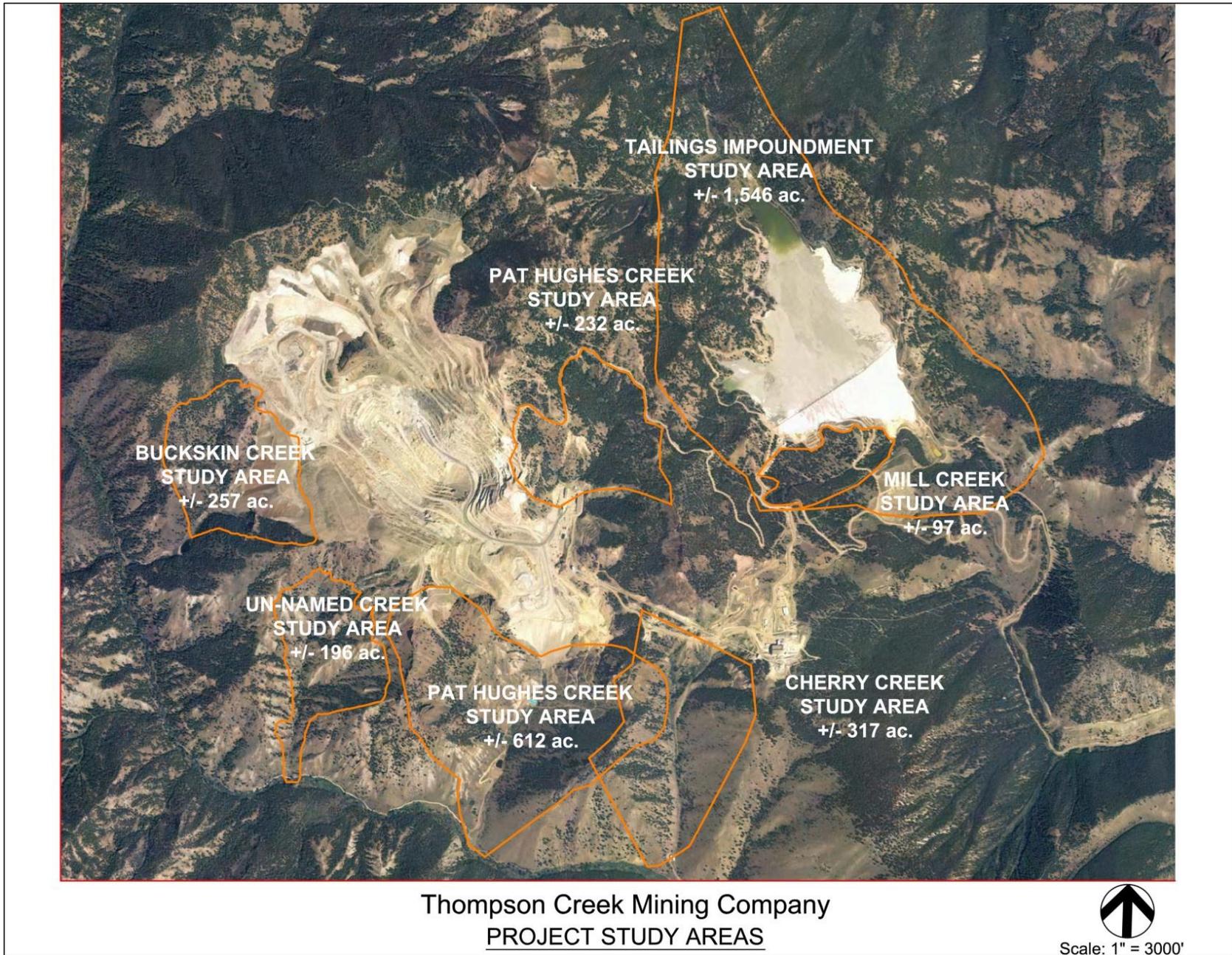
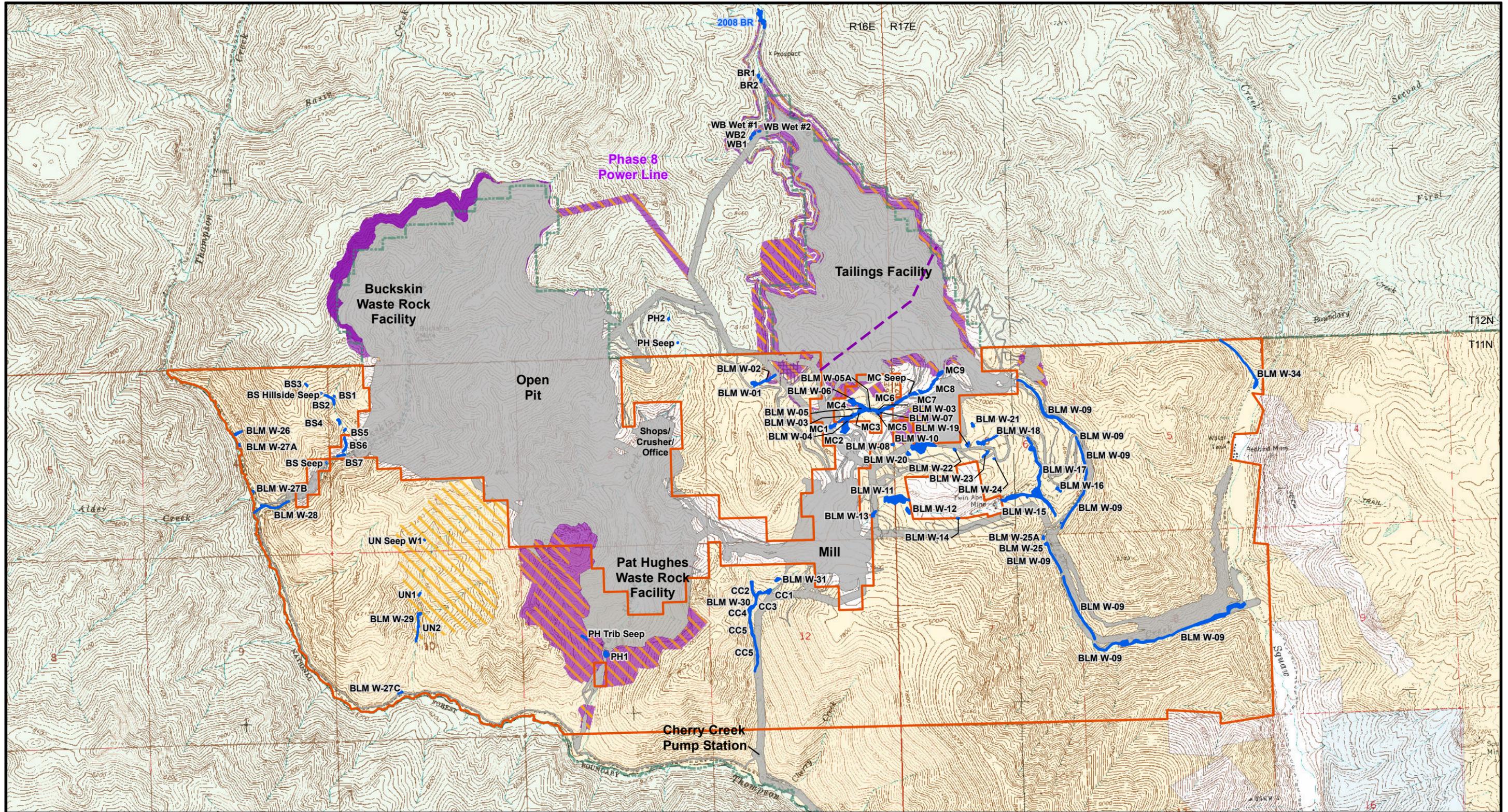


Figure 1-2. Project Study Areas

E:\drawings\Thompson Creek EIS\Figures\Chapter 3\Figure 3.9-1 Wetlands on the proposed MMPO area and selected land 092812.mxd



Legend

Selected Land	Wetlands
Existing Mining Disturbance	Land Ownership
Phase 8 Expansion Areas	Bureau of Land Management (BLM)
Alternative M2	Private
Alternative M3	State
Phase 8 Tailing Dam Re-aligned Crest	United States Forest Service (USFS)

Selected land, existing mining disturbance from Thompson Creek Mine data, polygons created by Ken Gardner.
 Ownership data is at 1:24,000 and created and maintained by the Bureau of Land Management, Idaho State Office, Geographic Sciences.
 Wetland Data from JBR (HDR) 2008 and 2009
 Topographic background from USGS 7.5' Quadrangles 1:24,000 scale.
 Coordinate system UTM Zone 11 NAD 83

Map created May 25, 2012
 Revised September 15, 2012
 By C. Pixton

No warranty is made by the Bureau of Land Management (BLM) for the use of this data for purposes not intended by the BLM.

0 1:32,000 1
 0 Miles 1
 0 Kilometers 1

Figure 1-3
Wetlands on the proposed MMPO area
and the selected land
Thompson Creek Mine Expansion EIS

The stream channel impact acreages shown in Table 1-1 are based on a width of mapped ordinary high water mark (OHWM) for each drainage and a length measured using ArcGIS.

Table 1-1. Summary of Expected Waters of the U.S. Impacts, Thompson Creek Mine, Phase 8

Location ¹	Type of Impact	Type of Water	Area Directly Affected
MTIS Expansion			
Bruno Creek, West Fork Bruno Creek, unnamed tributary & Hawks Nest	Maximum of 290.9 cubic yards of tailings and fill for new access road	Stream Channel	0.16 acres (1,753 linear feet)
		Wetland	0.17 acres
Mill Creek	Maximum of 496.1 cubic yards of tailings	Stream Channel	0.29 acre (4,397 linear feet)
		Wetland	2.93 acres
Waste Rock Disposal Area Expansion			
Pat Hughes Creek	Maximum of 588.9 cubic yards of waste rock	Stream Channel	0.34 acres (3,749 linear feet)
		Wetland	0.26 acres
TOTAL			0.79 acres stream channel 3.36 acres wetland

¹ See Figure 1-3 and Appendix A for proposed impact areas.

The calculation of the amount of material that would be discharged to each channel and the size of the affected area assumes that each channel is rectangular. The averages of the recorded dimensions were used to calculate the volume of fill. For example, the volume for a 275-foot-long segment, with an OHWM ranging from 2 to 3 feet deep, and a channel width ranging from 5 to 7 feet would be calculated as follows:

$$2.5 \text{ feet OHWM} \times 6 \text{ feet channel} \times 275 \text{ feet length} = 4,125 \text{ cubic feet (153 cubic yards)}$$

Acreages of wetlands impacted are shown in Table 1-2 and on the permit drawings in Appendix A. These impacts are based on the proposed action under Alternative M2. The direct wetland impacts are shown. (The alternatives considered are discussed in Section 5.0 of this report).

Table 1-2. Direct Wetland Impacts, Alternative M2 and Mill Creek Reclamation/Closure

Wetland ID ¹	Acres Impacted ²	Impact Type	Wetland Type ³
BR2	0.032	MTIS Expansion	PFO
WB1	0.025	MTIS Expansion	PFO
WB2	0.108	MTIS Expansion	PFO
WBWet1	0.004	MTIS Expansion	PEM
WBWet2	0.003	MTIS Expansion	PEM
MC1 ⁴	0.217	MTIS Expansion	PEM
MC3 ⁴	0.21	MTIS Expansion	PEM
MC4 ⁴	0.796	MTIS Expansion	PEM

Table 1-2. Direct Wetland Impacts, Alternative M2 and Mill Creek Reclamation/Closure

Wetland ID ¹	Acres Impacted ²	Impact Type	Wetland Type ³
MC5 ⁴	0.127	MTIS Expansion	PEM
MC6 ⁴	0.811	MTIS Expansion	PEM
MC7 ⁴	0.153	MTIS Expansion	PEM
MC8 ⁴	0.406	MTIS Expansion	PEM
MC9 ⁴	0.203	MTIS Expansion	PEM
MC Seep ⁴	0.002	MTIS Expansion	Seep
PH Tributary Seep	0.05	Waste Rock Expansion	PEM
PH1	0.21	Waste Rock Expansion	PEM
TOTAL	3.36		

¹ See Figure 1-3 and Appendix A for proposed impact areas.

² Due to the small size of the wetlands within the analysis area, if any portion of a wetland fell within the mapped boundary of the MMPO alternative, the entire wetland was assumed to be directly affected (i.e., inundated, filled, or the hydrology cut off).

³ Cowardin et al. (1979)

⁴ Mill Creek drainage wetlands that would be disturbed under reclamation and closure activities.

BR = Bruno Creek; MC = Mill Creek; PH = Pat Hughes Creek; WB = West Fork Bruno Creek;
PEM = palustrine emergent wetland; PFO = palustrine forested wetland

1.2 Clean Water Act Section 404(b)(1) Guidelines

Section 404 provides the statutory mechanism for USACE to authorize discharges to waters of the U.S. USACE's ability to issue permits is governed, in part, by the EPA's Clean Water Act (CWA) Section 404(b)(1) guidelines. TCMC must comply with these guidelines before USACE can issue a Section 404 permit. Subpart B of the guidelines states:

No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences (40 Code of Federal Regulations [CFR] 230.10[a]).

An alternative is practicable if it is available and capable of being completed after considering cost, existing technology, and logistics in light of the overall project purposes (40 CFR 230.10[a][2]).

Project activities are considered to be either water dependent or not water dependent. Subpart B of the guidelines defines a water-dependent activity as one that requires access or proximity to or siting within a special aquatic site to fulfill its basic project purpose (40 CFR 230.10[a][3]). *Special aquatic sites* are defined as designated sanctuaries or refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes (40 CFR 230.3). An example of a project activity that is water-dependent is installation of in-water supports for a boat dock.

In some situations, a project activity could discharge fill material to a special aquatic site, but the activity itself does not require proximity to or siting within the special aquatic site. In this case, the guidelines assume that other alternatives are available and that the project activity could be moved to a different location so that it would not discharge fill material to the special aquatic site.

Where the activity associated with a discharge which is proposed for a special aquatic site (as defined in Subpart E) does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not “water dependent”), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise (40 CFR 230.10[a][3]).

Water dependency and special aquatic sites in the project area are discussed in Section 4 of this alternatives analysis document.

1.3 Purpose of the Analysis

The purpose of this alternatives analysis is to provide USACE with the information needed to determine whether the proposed action would comply with 40 CFR 230.10(a) of the 404(b)(1) guidelines. To achieve this purpose, this analysis does the following:

- Describes the proposed action (Phase 8 Mine Expansion project) and the project’s purpose and need
- Describes the activities that would discharge dredged or fill material to waters of the U.S.
- Describes regulatory considerations related to special aquatic sites, water dependency, impact avoidance, and impact minimization
- Summarizes the information contained in this report and identifies the least environmentally damaging practicable alternative (LEDPA).

USACE is responsible for formally determining whether the fill activity proposed as part of the Phase 8 expansion would comply with the above referenced guidelines. This alternatives analysis and other available data will help USACE make its permitting decision.

2.0 PROJECT DESCRIPTION

2.1 Project History

The Thompson Creek Mine is a molybdenum mine located in Custer County, Idaho. The mine is owned and operated by TCMC, which is a subsidiary of Thompson Creek Metals Company.

TCMC has mined molybdenum ore from an open pit at the Thompson Creek Mine since 1983. The molybdenum is milled into molybdenum concentrates for transportation offsite and subsequent processing. Tailings that are a residual product of milling are piped in a slurry from the mill to the tailings impoundment located in the Bruno Creek drainage.

In late 2008, TCMC submitted an amended plan of operations (APOO) to the BLM Challis Field Office, the U.S. Forest Service, Salmon-Challis National Forest (Forest Service), and other cooperating agencies for an expansion (extension of mine life to what is known as Phase 8) of the Thompson Creek Mine. TCMC submitted revised MMPOs to the BLM in October 2009 and July 2010. The information in this alternatives analysis reflects information through the July 2010 submittal.

The revised APOO describes new surface disturbance associated with Phase 8 mining, including expansion of the open pit, waste rock facilities, and the tailings impoundment. The Phase 8 expansion would disturb about 94.2 acres of private land and 352.5 acres of land administered by the federal government. The open pit expansion would be entirely on patented mining claims owned by TCMC and would not affect waters of the U.S. The pit expansion would require relocating a 25 kilovolt (kV) power line that is located on land administered by the Forest Service; this activity would also not affect waters of the U.S. The waste rock disposal expansion would be developed using existing facilities and would affect land administered by BLM in the upper Buckskin Creek drainage and in the lower Pat Hughes Creek drainage. The proposed tailings impoundment expansion would affect land administered by BLM and the Forest Service in the Bruno Creek and Mill Creek drainages. Because the Phase 8 activity would result in the discharge of fill material to waters of the U.S., implementing the APOO would require USACE authorization under the CWA, Section 404.

The Phase 8 expansion covers mine operation through about 2025. The mine would continue to produce about 30,000 tons of molybdenum ore per day and about 110,000 tons of waste rock per day.

2.2 Project Details

The proposed Phase 8 expansion includes two activities that would result in the discharge of fill to waters of U.S.:

1. Expansion of the mine tailings impoundment structure (MTIS)
2. Expansion of two waste rock storage areas.

2.2.1 Expansion of MTIS

Currently, mine tailings, which are a residual product of milling, are piped in a slurry from the mill to the tailings impoundment. The existing impoundment area is located on the upper Bruno Creek and Mill Creek drainages. TCMC is proposing to modify the existing MTIS so that it would be capable of storing all anticipated mine tailings through the end of Phase 8 (2025). The MTIS would contain about 240 million tons of tailings at a crest elevation up to 7,646 feet above mean sea level (amsl) through the current phase (Phase 7). The Phase 8 expansion would raise the fill level to about 7,742 feet amsl and result in the deposition of an additional 100 to 125 million

tons of tailings material, which would provide adequate space for the tailings produced during Phase 8.

The proposed Phase 8 tailings expansion would require modification of the existing MTIS in order to accommodate the additional 100 to 125 million tons. TCMC is proposing to modify the MTIS so that it could accommodate the expansion by

- realigning the dam centerline with construction of a starter dike near the left abutment as controlled by topography (the existing left abutment elevations are too low to *accommodate the Phase 8 raise*), and
- adding height to the remainder of the dam by raising the centerline.

As proposed, these changes and the eventual disposal of tailings would directly affect 3.1 acres of wetlands and 0.45 acres of stream channels. This includes Mill Creek drainage wetlands that would be disturbed under reclamation and closure activities, in addition to the MTIS expansion in that drainage.

To limit downstream impacts and reduce the volume of sand required for dam construction, TCMC is proposing a downstream dam slope ratio of 3H:1V to 2.75H:1V (horizontal:vertical) for the structure, as controlled by stability considerations. TCMC is also proposing to raise the existing downstream rock toe dam to further limit downstream impacts (Golder Associates and WMC 2008).

The MTIS expansion would disturb about 52 acres of additional land, including about 30 acres on federal land (Forest Service and BLM).

2.2.2 Expansion of Waste Rock Areas

Overburden consists of volcanics and meta-sedimentary material that overlies the mine's host rock. Host rock that contains less than a designated percentage of molybdenum (currently 0.03 percent), as determined by assaying blast hole drill cutting samples, is considered to be waste rock. Both overburden and waste rock must be removed to facilitate the extraction of ore. Electric cable shovels (27 or 45 cubic yard capacity) load the blasted waste materials into 190-ton diesel haul trucks, which transport the material to two currently-permitted waste rock disposal locations in the Buckskin Creek and lower Pat Hughes Creek drainages.

As proposed, the expansion of the Pat Hughes Creek waste rock area would result in the discharge of fill to 0.26 of wetlands and 0.34 acres of stream channels.

Phase 8 expansion of the waste rock facility in the Pat Hughes Creek drainage would result in the placement of waste rock on about 542 acres. Of this area, TCMC owns 270 acres and BLM administers about 273 acres.

2.3 General Hydrology

Most of the wetlands in the Phase 8 expansion area are hydrologically connected to surface water (perennial and ephemeral streams) and groundwater (seeps and springs). Bruno Creek and the West Fork of Bruno Creek are perennial streams that flow into the tailings impoundment. At certain times of year (mainly during spring snowmelt runoff) portions of the flows are diverted through a pipe around the tailings impoundment and routed into Mill Creek. Buckskin, Un-named, Cherry, and Pat Hughes creeks are headwater streams that are tributary to Thompson Creek. The upper portions of Buckskin Creek and the middle portion of Pat Hughes Creek are diverted around or under existing waste rock facilities. Mill Creek is diverted into a sediment pond at the toe of the tailings impoundment. Waters in this drainage are tributary to Squaw Creek.

2.4 General Plant Community Types

The Phase 8 expansion area contains four primary plant communities: palustrine forested wetland, palustrine emergent marsh, and upland forest and upland sagebrush / grassland.

2.4.1 Wetland Communities

The following four wetland communities are present in the study area.

Palustrine Forested Wetland. The palustrine forested wetland community commonly includes Englemann spruce, lodgepole pine, and fir in the overstory, willow in the shrub stratum and an understory composed of several sedge species, common rush Baltic rush, thalicttrum, redtop, and watercress.

Palustrine Emergent Marsh. Palustrine emergent marsh includes wetlands that range from inundated areas to seasonally saturated areas. The Palustrine emergent marsh communities commonly include sedges, rushes, spikerush, and threesquare.

Palustrine Scrub Shrub. Palustrine scrub shrub wetland community commonly includes Mountain alder, quaking aspen, and Norway spruce in the tree stratum, prickly currant and elderberry in the sapling/shrub stratum, and grasses, stinging nettles, and mosses in the herbaceous stratum.

2.4.2 Upland Communities

Two upland communities are common within the study area: forest and sagebrush /grassland. The forested upland community is the most common upland community in the study area and commonly includes white fir, grand fir, Douglas fir, lodgepole pine, snowberry, Oregon grape, Idaho fescue, elk sedge and other graminoids. The upland sagebrush/grassland community commonly includes big sagebrush, rabbitbrush, antelope bitterbrush, buckwheat, yarrow, wildrye, Kentucky bluegrass, brome and other grasses.

2.5 Function and Value of Aquatic Resources

The areas that would be impacted by the Phase 8 expansion (expansion of the MTIS, and the waste rock areas) include 9,899 linear feet of stream channel, which cover an area of 0.79 acres, and 3.36 acres of wetlands. The impacts associated with the proposed action would be the same as under alternative M3, except that alternative M3 would involve an additional 0.06 acres of disturbance of wetlands and an additional 5,607 linear feet of designated waters of the U.S. in the No Name drainage. The ecological functions of the aquatic resources in the Phase 8 expansion area are the following:

Riparian corridors provide:

- habitat for song birds
- cover for wildlife
- browse for deer
- shading for water temperature control

Wetlands adjacent to the streams or upslope corridors provide:

- sediment stabilization
- groundwater recharge during seasonal snowmelt
- groundwater discharge associated with seeps and springs
- provides habitat for small aquatic animals

2.6 Project Purpose and Need

The Federal Register advertised the *Notice of Intent to Prepare an Environmental Impact Statement and Resource Management Plan Amendment for the Proposed Modification to the Thompson Creek Mine Plan of Operations, Section 404 Clean Water Act Permit Application, and Public Land Disposal, Custer and Bannock Counties, ID* on August 3, 2010. According to that notice, the purposes of and need for the action are as follows:

The purpose of the proposed federal actions related to the MMPO is to respond to the proposal for a mine expansion and the extension of mine life. The BLM and Forest Service must determine if changes, including additions, or conditions to the MMPO are necessary prior to approval of the MMPO to meet the requirements of the BLM surface management regulations (43 CFR 3809) or Forest Service regulations (36 CFR 228A), within the context of TCMC's statutory rights under the General Mining Laws of the U.S. The purpose of the proposed 404 permit decision by the USACE is to ensure that any discharge that would be authorized by the permit would comply with the CWA and 33 CFR 320 et seq. The purpose of the proposed BLM action related to the land exchange is for the BLM to complete a land disposal if such would serve the national interest and meet the other requirements of the Federal Land Policy and Management Act of 1976 (FLPMA), and, if so, for the BLM to amend the Challis RMP to identify the selected land as suitable for disposal in compliance with the FLPMA.

The need for the proposed federal actions is related to the agencies' responsibilities under applicable federal laws and regulations to consider and respond to the MMPO, 404 permit application, and land exchange proposal.

3.0 DESCRIPTION OF ACTIVITIES TO BE PERMITTED UNDER SECTION 404 OF THE CLEAN WATER ACT

The project area supports waters of the U.S., including wetlands. The areas that would be permanently affected are shown in Appendix A. As listed in Table 1-2, fill associated with the proposed action would directly affect:

- **0.79 acres of stream**
- **3.36 acres of wetland**

As outlined in Section 1.1, the proposed expansion would result in the discharge of fill to Bruno Creek, West Fork of Bruno Creek, Mill Creek, and Pat Hughes Creek.

Bruno Creek and Tributaries. Expansion of the MTIS and related future deposition of tailings would directly affect Bruno Creek, West Fork of Bruno Creek, Hawks Nest, Unnamed Tributary (2008 Seep) and Mill Creek. Reaches of Bruno Creek would become submerged by additional tailings up to elevation of about 7,742 feet amsl. During high runoff periods (such as spring snowmelt), the water from Bruno Creek would be diverted above the tailings impoundment and routed around and discharged below the tailings impoundment back into the Bruno Creek channel. Diversions at upper Bruno Creek and the West Fork of Bruno Creek were constructed under a Nationwide Permit (NWW-2008-00579). MTIS expansion would also result in the discharge of fill to Mill Creek (which is located below the existing downstream slope of the MTIS), because the footprint of the embankment would encroach on the OHWM of the creek.

Pat Hughes Creek. The Phase 8 mine expansion would generate additional waste rock, which would require expansion of the existing waste rock areas on Pat Hughes Creek. Reaches of Pat Hughes Creek would be covered by waste rock. In accordance with the mine's approved National Pollutant Discharge Elimination System (NPDES) permit, the creeks would be routed through pipes under the waste rock areas to flow into sediment ponds before discharging back into their natural channels downstream of the waste rock areas, or piped to a water treatment plant and then to the mill for use as process water.

4.0 REGULATORY CONSIDERATIONS

4.1 Special Aquatic Sites and Water Dependency

According to the *Wetland and Ordinary High Water Mark Delineation Report, Bruno, West Fork of Bruno, Un-Named, Buckskin, Pat Hughes, Mill, and Cherry Creeks* (June 2010) and the October 2010 and 2012 addendums, there are three types of water in the project area that USACE has determined to be jurisdictional, stream channel, palustrine forested wetland (PFO), and palustrine emergent wetland (PEM). Wetlands are considered to be special aquatic sites.

As noted in Section 1.2, if an activity is not water-dependent, the 404(b)(1) guidelines assume that alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise. Based on the 404(b)(1) guidelines that define a water-dependent activity as one that requires access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (40 CFR 230.10[a][3]), the proposed Phase 8 expansion is not water dependent. The remainder of this analysis focuses on demonstrating that other alternatives were considered and were not practicable in light of cost, technology, and logistics.

4.2 Criteria Related to Cost, Technology, and Logistics

According to the 404(b)(1) guidelines, options that would not cause greater adverse environmental effects are practicable if they are available and are capable of being completed after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR 230.10[a][2]). These criteria, then, must be used in determining and evaluating practicable alternatives to the proposed project.

In addition to considering how project alternatives meet the overall project purpose, TCMC also considered the following cost, technological, and logistical criteria.

Cost. Practicable alternatives must not add substantially to operation and maintenance (O&M) of the Thompson Creek Mine. TCMC would expect to increase O&M costs to cover this phase of mining.

Technology. Practicable alternatives must not rely on new technology or changes in technology that add excessive (and costly) O&M. Practicable alternatives should focus on and/or improve on technologies currently used at the Thompson Creek Mine.

Logistics. Logistics is the management of the flow of goods, information and other resources in a cycle between the point of origin and the point of consumption in order to meet the requirements of customers. Logistics involve the integration of elements, such as information, inventory, transportation, and material handling.

For an alternative to be practicable, it must allow for or support the following logistical considerations:

- The alternative must be consistent with the APOO
- The alternative must not result in a reduction in the monthly or yearly molybdenum production rate; production and distribution targets must be met
- The alternative must not adversely affect the quality of the mining product
- The alternative must not compromise the safe operation of the mining activity
- The alternative must not result in excessive hauling distances

4.3 Actions to Minimize Adverse Effects

Section 230.10(d) of the 404(b)(1) guidelines states that “no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which would minimize potential adverse impacts of the discharge on the aquatic ecosystem.” These steps are described in Subpart H of the guidelines (Sections 230.70 through 230.77) and address the location of the discharge, the material to be discharged, control of the material following discharge, the method of dispersion, available technological assistance, plant and animal populations, and human use.

The primary way that TCMC proposes to minimize effects is by designing an expansion of existing facilities instead of establishing new facilities. The expanded tailings and waste rock facilities would be configured to accommodate expected tailings and waste targets through 2025. A primary feature of the design would be human safety, but the expansion would also be designed to prevent adverse impacts to the environment. Materials would be deposited gradually, and TCMC would monitor the tailings and waste rock sites on approved time intervals. In addition to keeping records on the operation of the sites, this regular monitoring would ensure that the fill activities do not expand beyond the permitted boundary and do not indirectly affect resources outside of the permitted fill areas.

TCMC is avoiding and minimizing potential impacts to waters of the U.S. by focusing on keeping operations consolidated in one geographic location and expanding existing facilities rather than establishing new ones. Because TCMC owns much of the land upon which it operates the Thompson Creek Mine, it has historically focused on expanding its operations within the existing operational area. This approach has enabled TCMC to not only operate efficiently, but also avoid and minimize potential environmental effects beyond the active mining area, including impacts to waters of the U.S.

In addition to ongoing avoidance and minimization, TCMC has committed to the following:

- Timing discharges to minimize impacts. For example, material would not be placed such that it would disturb regular inundation patterns of wetland complexes outside the tailings impoundment or waste rock areas or during periods when water or wind could carry sediment from the tailings impoundment or waste rock areas to adjacent aquatic features.
- Not placing the fill in a manner that changes the hydrologic function of wetland complexes beyond or outside the area subject to fill. Maintaining the regular inundation patterns of the wetlands adjacent to the tailings impoundment or waste rock areas.
- Installing and maintaining permanent best management practices (BMPs) that would ensure protection of aquatic features that would not be directly affected by the fill activity.
- Using appropriate machinery that is properly maintained and staffed when placing fill material.
- Designing drainage to avoid hydrologic interruption of wetlands and creeks outside of the fill areas.

5.0 ALTERNATIVES ANALYSIS

5.1 404(b)(1) Alternatives Study Area

TCMC has mining claims on 3,160 acres. Of this area, TCMC owns about 2,300 acres. The remaining land is owned by the federal government and administered by two different agencies: BLM and the Forest Service.

Because it must maintain its mining operations within the claim area, the 404(b)(1) study area is the existing 3,160-acre Thompson Creek Mine area. TCMC has historically focused on keeping its operations consolidated on the existing property, thus avoiding expanding operations onto adjacent federal land, or purchasing additional property elsewhere. Extending operations outside of this claim area is not reasonable from a permitting, cost, and operations perspective.

5.2 Alternatives to the Proposed Activity and Alternatives Screening

While developing the APOO and the Phase 8 expansion, TCMC considered options to achieve the project purpose and need within the alternatives study area. The following discussions address alternatives to the MTIS expansion and the waste rock area expansions.

5.2.1 MTIS Expansion

In 2007, Golder Associates (Golder) and Water Management Consultants, Inc. (WMCI) prepared a technical memorandum that identified the three most feasible layout alternatives capable of storing the Phase 8 tailings at the existing tailings impoundment within the Bruno Creek site. TCMC did not consider a new tailings impoundment in any other drainage on the property in order to keep the tailings confined to the already-disturbed area. Additionally, the proximity of a new impoundment in a different drainage would not be as logistically compatible with the existing mine pit and could require the construction of additional roads or other infrastructure. The alternatives for expanding the existing MTIS are discussed in Table 5-1.

Table 5-1. MTIS Expansion Considered Alternatives

Alternative	Description
Alternative M1 – No Action	<p>Alternative M1 is the “no action” alternative in which TCMC would complete its operations through Phase 7 of the approved plan of operations, including mine reclamation, with none of the other (action) MMPO alternatives being approved. There are previously permitted (1980) areas of waste rock storage on federal land that will not be used to complete Phase 7 (and are not proposed to be used under any of the MMPO alternatives). These areas are available because TCMC extracted more ore and less waste rock than originally planned. Using these areas for Phase 8 would not be economically, environmentally, or technically desirable. TCMC has no plans to use these areas as part of either Phase 7 or Phase 8. Therefore, these previously permitted areas will not be disturbed in Phase 7 and consequently are not analyzed under Alternative M1.</p> <p>Alternative M1 would not create any new disturbance; therefore, there would be no new direct or indirect effects to wetlands. There are undisturbed wetlands within the mapped disturbance footprint of Phase 7, but these wetlands are located adjacent to linear features, such as power lines, reclaimed roads, pipelines, fiber optics, and undisturbed areas in the vicinity of waste rock facilities.</p> <ul style="list-style-type: none">• Under Alternative M1, there would be no direct or indirect effects to streams determined to be waters of the U.S.

Table 5-1. MTIS Expansion Considered Alternatives

Alternative	Description
<p>Alternative M2 – MMPO as Submitted by TCMC</p>	<p>In December 2008 and January 2009, TCMC submitted MMPOs to BLM, the Forest Service, and other cooperating agencies. TCMC submitted a revision to the MMPO in October 2009 (TCMC 2009). The MMPO describes Phase 8 of mining operations (Alternative M2).</p> <p>Alternative M2 includes the following not included in Alternative M1:</p> <ul style="list-style-type: none"> • A section of power line would be relocated; • The open pit would be deepened and widened (into previously disturbed ground) to mine Phase 8 ore; • The Buckskin and Pat Hughes waste rock facilities would be expanded and used to store Phase 8 waste rock; • The tailings embankment would be raised and the tailings impoundment expanded to store the tailings produced from milling Phase 8 ore; and • The long-term water management plan (part of the reclamation plan) would be modified because of the size and configuration of the Phase 8 facilities). <p>Under Alternative M2, there would be additional surface disturbance on 94.2 acres of TCMC land and 352.5 acres of federal lands as compared to Alternative M1. Alternative M2 would result in the fill or burial of wetlands within the MMPO area totaling 3.36 acres, comprised of 3.192 acre PEM and 0.172 acre PFO wetlands. This would be a permanent, direct effect on wetlands within the proposed MMPO area. Under Alternative M2, 9,899 feet of streams designated as waters of the U.S. within the analysis area would be buried by the expansion of waste rock facilities or inundated by the expansion of the tailings impoundment, or otherwise directly affected during closure and reclamation activities.</p>
<p>Alternative M3 – No Name Waste Rock Facility</p>	<p>This alternative is similar to Alternative M2, except that the No Name waste rock facility would contain approximately 115 million tons of waste rock on 345 acres of currently undisturbed BLM land. The facility would include a downgradient sedimentation pond. The location is economically favorable for waste rock storage due to the proximity of the No Name drainage to the open pit and a level loaded haul. Accordingly, under Alternative M3, less waste rock would be placed in the Buckskin and possibly the Pat Hughes waste rock facilities, and these facilities would have smaller overall footprints. As compared to Alternative M2, Alternative M3, would involve an additional 0.06 acres of disturbance in wetlands and an additional 5,607 linear feet of designated waters of the U.S. subject to a 404 permit from the USACE.</p>

Golder and WMCI developed these alternatives assuming a 3H:1V (horizontal:vertical) ratio downstream dam slope, a crest width of 30 feet, an upstream dam slope of 8H:1V ratio, 12 feet of freeboard, and a beach slope of 0.5 percent downslope of the dam. Both action alternatives (M2 and M3) would accommodate the same amount of fill. Alternatives M2 and M3 would result in the same amount of potential effects on waters of the U.S. as a result of the MTIS expansion.

The preferred alternative MMPO is Alternative M2. This option, like Alternative M3, could accommodate storage of all expected tailings through Phase 8 in one location, eliminating the need to develop a new tailings impoundment downstream or within another drainage. Extensive information is available through geotechnical, geological, and hydrological studies of the Bruno Creek drainage area and can be used to reduce the required scope of new studies and the associated cost.

5.2.2 Waste Rock Storage Expansion

TCMC is proposing to expand its existing waste rock storage areas in the Upper Buckskin watershed and Pat Hughes Creek watershed to accommodate the waste rock that it expects will be produced through the end of Phase 8 (2025). TCMC is proposing to expand these areas rather than establish new waste rock facilities. The existing sites are favorable because they have good haul road accessibility (e.g., they are close to the mine pit and the roads have a gentle gradient), have low mineral potential, and are geotechnically stable.

As alternatives to the proposed sites, TCMC considered three alternatives to expanding the existing storage areas. These alternatives include the following:

- Basin Creek Waste Rock Facility – TCMC proposed this new facility as part of the 2008 MMPO, but removed it from the subsequent 2009 MMPO revision because of logistical issues (grades not conducive to hauling, proximity to mine pit), and because it would disturb an area that is not part of any active mining operations. This new waste rock facility would disturb about 327 acres of land administered by the Forest Service. JBR Environmental Consultants, Inc's (JBR) 2011 alternatives analysis found that establishing a new waste rock facility would cause mining disturbance in a currently unaffected watershed and would require a long uphill haul.
- Lower Buckskin Waste Rock Facility – TCMC considered this area for waste rock disposal in the original 2008 MMPO and 2009 revision. As originally proposed, this waste rock facility could have accommodated 180 million tons of waste rock, thus potentially reducing the final height of the existing waste rock facilities (in the Upper Buckskin and Pat Hughes watersheds). However, the results of an initial stability analysis of this area showed that the amount of material that could be deposited in this area would need to be reduced from the original proposal. Because of the reduced volume and additional stabilization measures that would probably be needed, constructing this alternative is not economically feasible. Furthermore, TCMC could design the Upper Buckskin facility to accommodate all of the waste rock that would have been deposited in both the Lower and Upper Buckskin areas. Because of the economic infeasibility and ability to accommodate the waste rock in the Upper Buckskin area, the Lower Buckskin area was eliminated from further consideration in a 2010 MMPO revision.
- Upper Pat Hughes Waste Rock Facility – TCMC proposed this new facility as part of the 2008 MMPO, but removed it from a subsequent 2009 MMPO revision. This facility could accommodate 50 million tons of waste rock on 125 acres of undisturbed federal land (75 acres administered by BLM and 50 acres administered by the Forest Service). While using this area would reduce the height and lateral expansion of the existing waste rock storage areas in Upper Buckskin watershed and a different part of the Pat Hughes watershed, TCMC removed this site from consideration because the waste rock could be accommodated at expanded existing facilities.

6.0 SUMMARY

As described in this document, TCMC is proposing two types of activities that would result in a discharge of fill to waters of the U.S. at its Thompson Creek Mine in Custer County, Idaho. These activities include the following:

- Expansion of a tailings impoundment area
- Expansion of waste rock storage areas

These activities would result in the discharge of fill to 0.79 acres of stream channel and 3.36 acres of wetlands.

Wetlands such as those that would be affected by the proposed action are special aquatic sites. TCMC has focused on avoiding and minimizing impacts to wetland areas by concentrating tailings storage and waste rock disposal in specific geographic areas. The proposed expansions would avoid affecting new areas.

TCMC considered three feasible layout alternatives capable of storing the Phase 8 tailings at the existing tailings impoundment within the Bruno Creek site and four alternatives for the waste rock expansion. The tailings impoundment alternatives would result in the same types and magnitude of effects to waters of the U.S., including wetlands. When the alternatives are compared, none of the alternatives stands out as the LEDPA since both the alternatives would result in the same impacts.

The waste rock expansion area alternatives that TCMC considered would result in environmental effects in areas that are currently not being used for waste rock. Expanding the existing waste rock areas rather than establishing new waste rock areas is the LEDPA for the waste rock expansion element of the proposed action.

7.0 REFERENCES

[USFWS] U.S. Fish and Wildlife Service

- 1979 Cowardin, L.M., V. Carter V., F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service Report No. FWS/OBS/-79/31. Washington, D.C.

[Golder and WMC] Golder Associates and Water Management Consultants, Inc.

- 2007 Final Phase 8 Expansion Alternatives Evaluation, Bruno Creek Tailings Impoundment, Thompson Creek Mine, Idaho. Technical Memorandum to B. Doughty, Thompson Creek Mining Company. April 24.
- 2008 Design Report Thompson Creek Phase 8 Tailings Expansion Project. Prepared for Thompson Creek Mining Company. March.

[HDR] HDR Engineering, Inc.

- 2010 Draft Wetland and Ordinary High Water Mark Delineation Report. July.
- 2010 Wetland and Ordinary High Water Mark Delineation Report, Addendum #1. October.

[JBR] JBR Environmental Consultants, Inc.

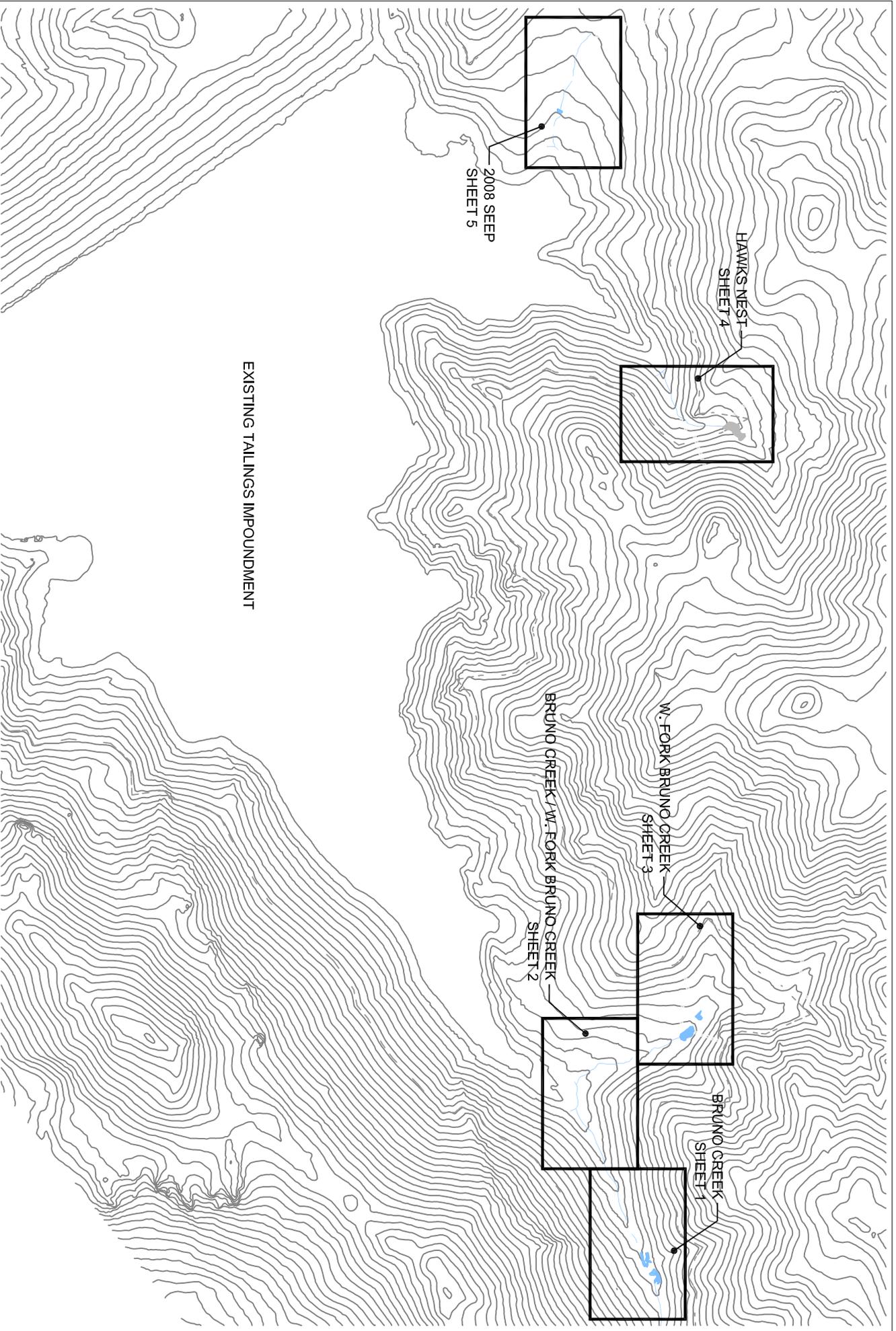
- 2011 Draft Alternatives Analysis Report, Thompson Creek Mine EIS. Prepared for U.S. Department of Interior Bureau of Land Management. March 20.

[TCMC] Thompson Creek Mining Company

- 2008 Amended Plan of Operations
- 2008 Mine Plan of Operations
- 2009 Revised Mine Plan of Operations
- 2010 Revised Mine Plan of Operations

Appendix A

Permanent Impact Mapping



EXISTING TAILINGS IMPOUNDMENT

Thompson Creek Mining Company
BRUNO CREEK STUDY AREA

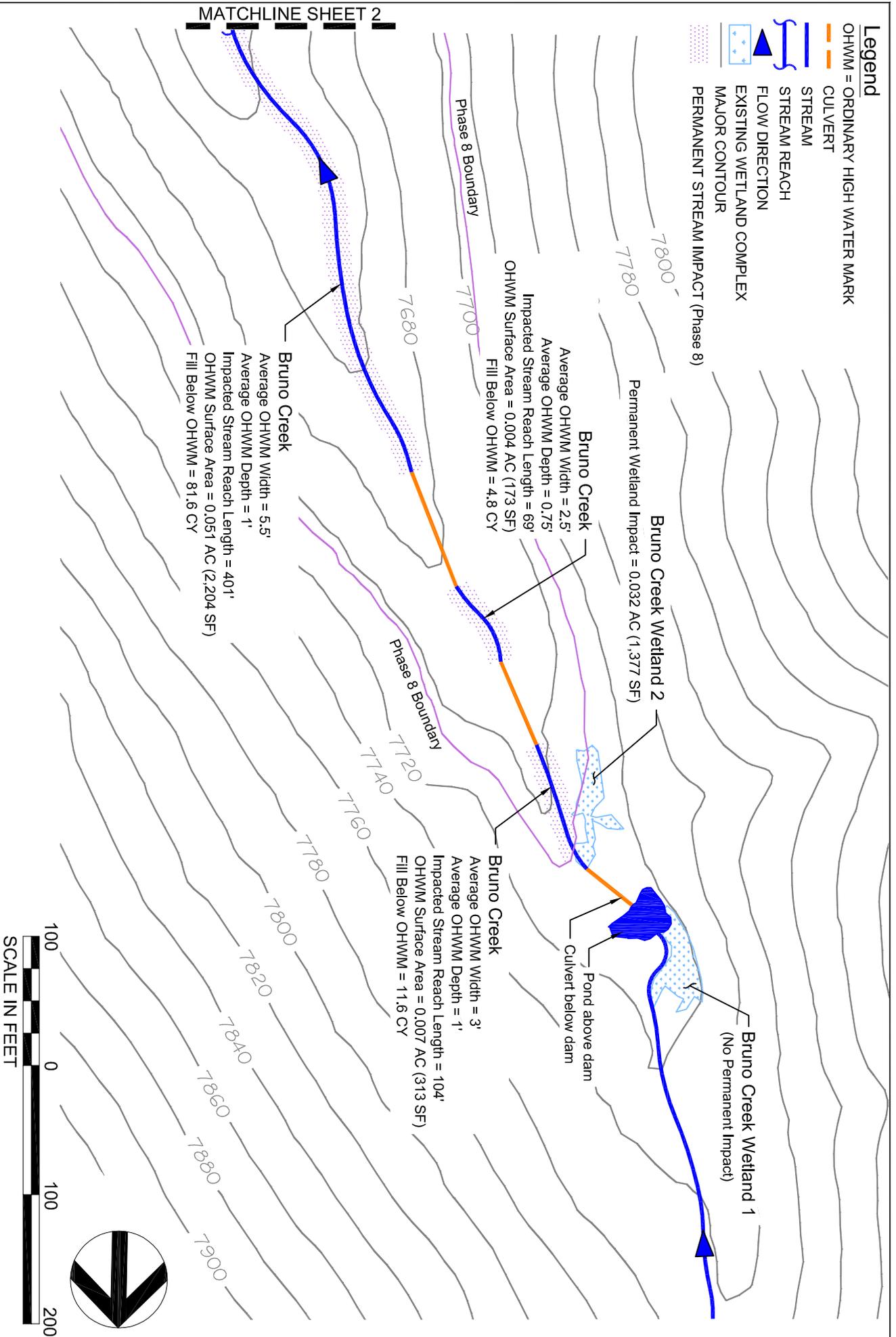
Site Reference Map



Scale: N.T.S.

Legend

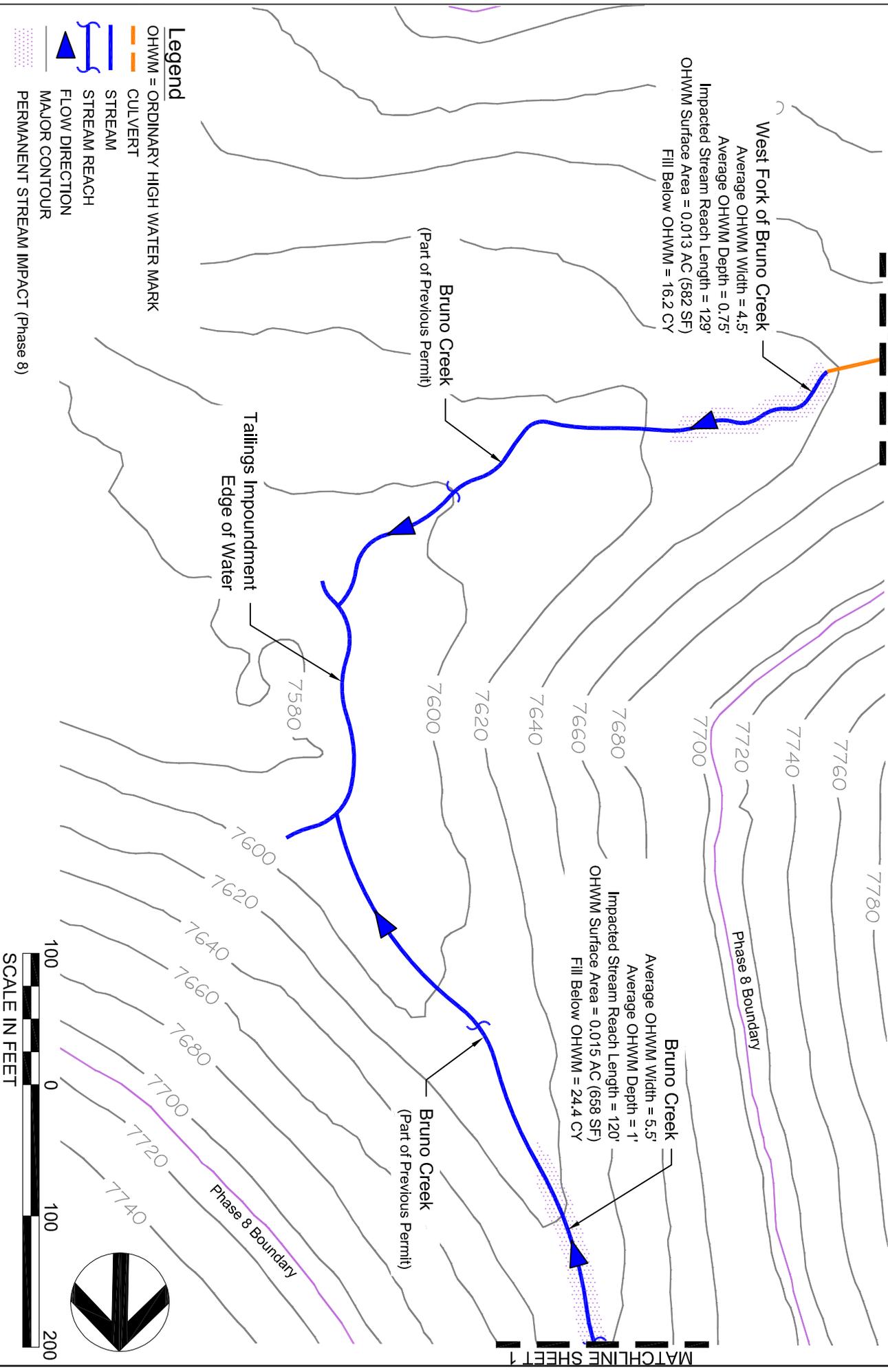
- OHWM = ORDINARY HIGH WATER MARK
- CULVERT
- STREAM
- STREAM REACH
- FLOW DIRECTION
- EXISTING WETLAND COMPLEX
- MAJOR CONTOUR
- PERMANENT STREAM IMPACT (Phase 8)



Bruno Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.062 AC (2,690 SF)
 Total Fill Below OHWM: 98.0 CY
 Total Wetlands Permanent Impacts: 0.032 AC (1,377 SF)

Thompson Creek Mining Company
 Section 25, Township 12 North, Range 16 East
BRUNO CREEK

Applicant: Thompson Creek Mining Company
 Waterway: Bruno Creek
 Custer County, Idaho
 Date: June 3, 2013



Bruno Creek Permanent Impacts
 Total Surface Area Impacts: 0.028 AC (1,240 SF)
 Total Fill Below OHWM: 40.6 CY

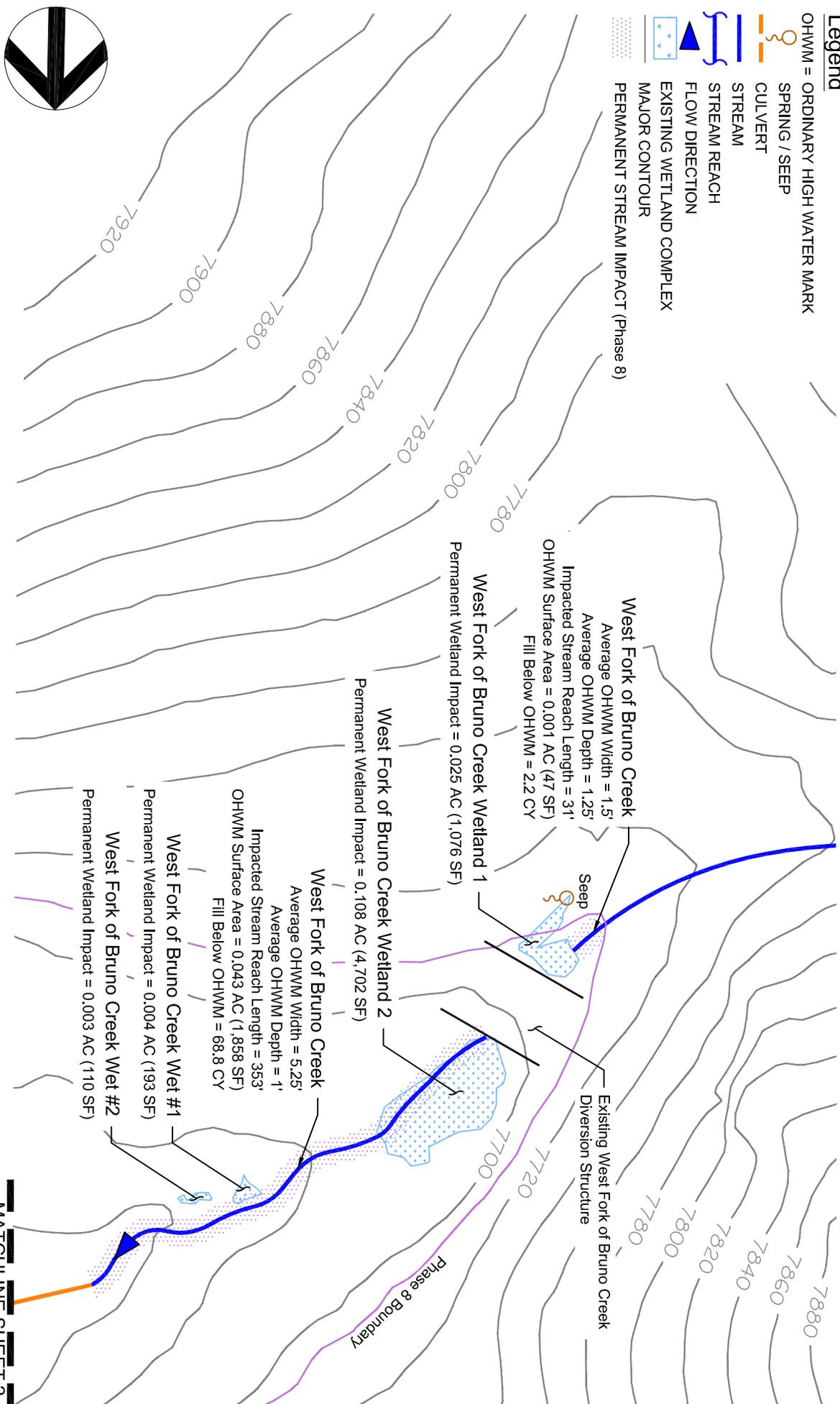
Thompson Creek Mining Company

Section 25, Township 12 North, Range 16 East
BRUNO CREEK & WEST FORK OF BRUNO CREEK

Applicant: Thompson Creek Mining Company
 Waterway: Bruno Creek
 Custer County, Idaho
 Date: June 3, 2013

Legend

- OHWM = ORDINARY HIGH WATER MARK
- SPRING / SEEP
- CULVERT
- STREAM
- STREAM REACH
- FLOW DIRECTION
- EXISTING WETLAND COMPLEX
- MAJOR CONTOUR
- PERMANENT STREAM IMPACT (Phase 8)



West Fork of Bruno Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.044 AC (1,905 SF)
 Total Fill Below OHWM: 71.0 CY
 Total Wetlands Permanent Impacts: 0.140 AC (6,081 SF)

West Fork of Bruno Creek
 Average OHWM Width = 1.5'
 Average OHWM Depth = 1.25'
 Impacted Stream Reach Length = 31'
 OHWM Surface Area = 0.001 AC (47 SF)
 Fill Below OHWM = 2.2 CY

West Fork of Bruno Creek Wetland 1
 Permanent Wetland Impact = 0.025 AC (1,076 SF)

West Fork of Bruno Creek Wetland 2
 Permanent Wetland Impact = 0.108 AC (4,702 SF)

West Fork of Bruno Creek
 Average OHWM Width = 5.25'
 Average OHWM Depth = 1'
 Impacted Stream Reach Length = 353'
 OHWM Surface Area = 0.043 AC (1,858 SF)
 Fill Below OHWM = 68.8 CY

West Fork of Bruno Creek Wet #1
 Permanent Wetland Impact = 0.004 AC (193 SF)

West Fork of Bruno Creek Wet #2
 Permanent Wetland Impact = 0.003 AC (110 SF)

Seep

Existing West Fork of Bruno Creek
 Diversion Structure

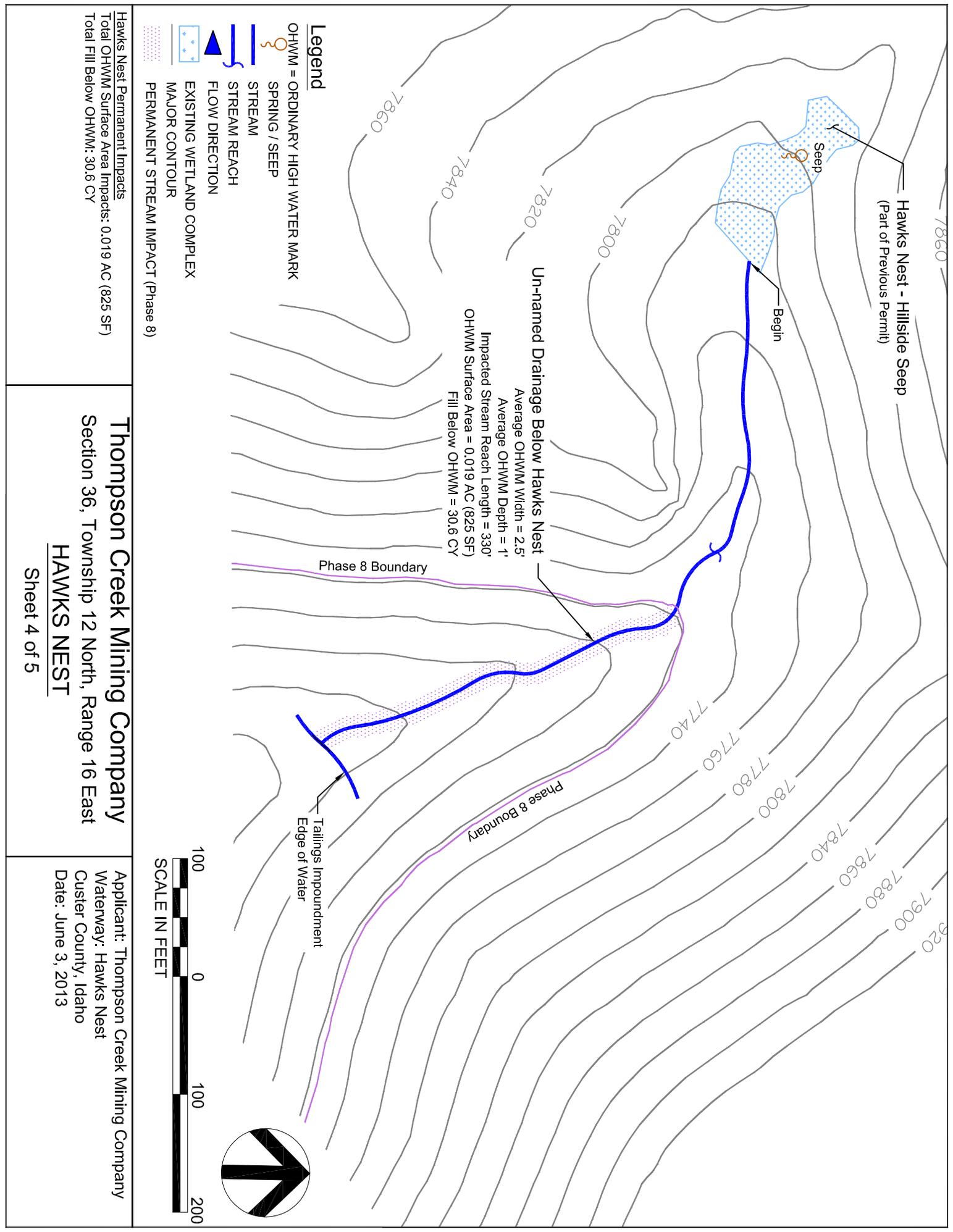
Phase 8 Boundary

MATCHLINE SHEET 2

Thompson Creek Mining Company
 Section 25, Township 12 North, Range 16 East
WEST FORK OF BRUNO CREEK

Sheet 3 of 5

Applicant: Thompson Creek Mining Company
 Waterway: West Fork of Bruno Creek
 Custer County, Idaho
 Date: June 3, 2013



Hawks Nest - Hillside Seep
(Part of Previous Permit)

Begin

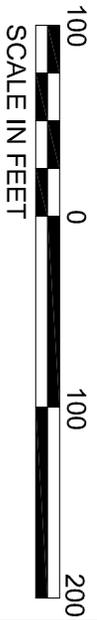
Un-named Drainage Below Hawks Nest
 Average OHWM Width = 2.5'
 Average OHWM Depth = 1'
 Impacted Stream Reach Length = 330'
 OHWM Surface Area = 0.019 AC (825 SF)
 Fill Below OHWM = 30.6 CY

Phase 8 Boundary

Phase 8 Boundary

Tailings Impoundment
Edge of Water

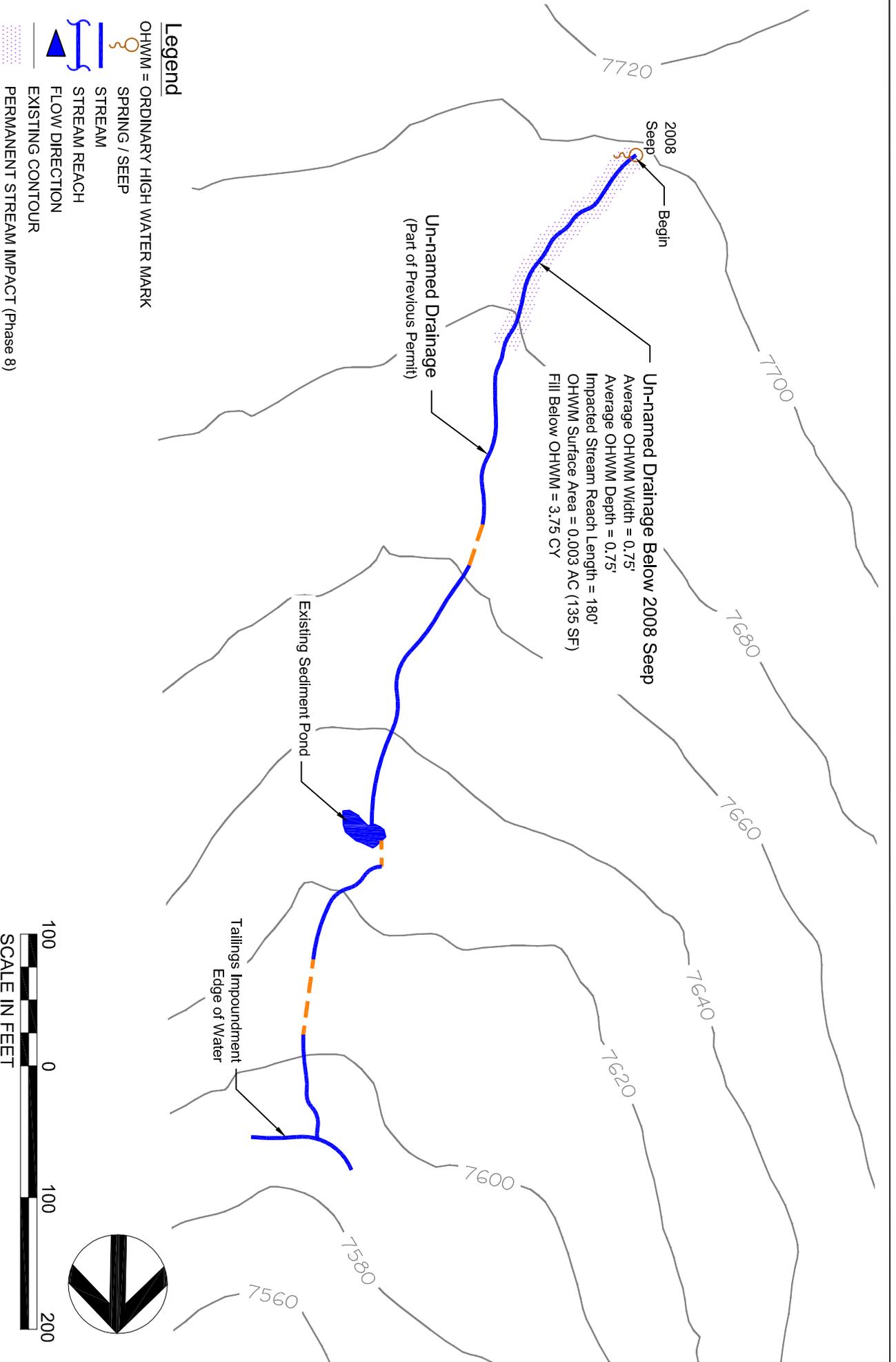
- Legend**
- OHWM = ORDINARY HIGH WATER MARK
 - SPRING / SEEP
 - STREAM
 - STREAM REACH
 - FLOW DIRECTION
 - EXISTING WETLAND COMPLEX
 - MAJOR CONTOUR
 - PERMANENT STREAM IMPACT (Phase 8)



Hawks Nest Permanent Impacts
 Total OHWM Surface Area Impacts: 0.019 AC (825 SF)
 Total Fill Below OHWM: 30.6 CY

Thompson Creek Mining Company
 Section 36, Township 12 North, Range 16 East
HAWKS NEST
 Sheet 4 of 5

Applicant: Thompson Creek Mining Company
 Waterway: Hawks Nest
 Custer County, Idaho
 Date: June 3, 2013

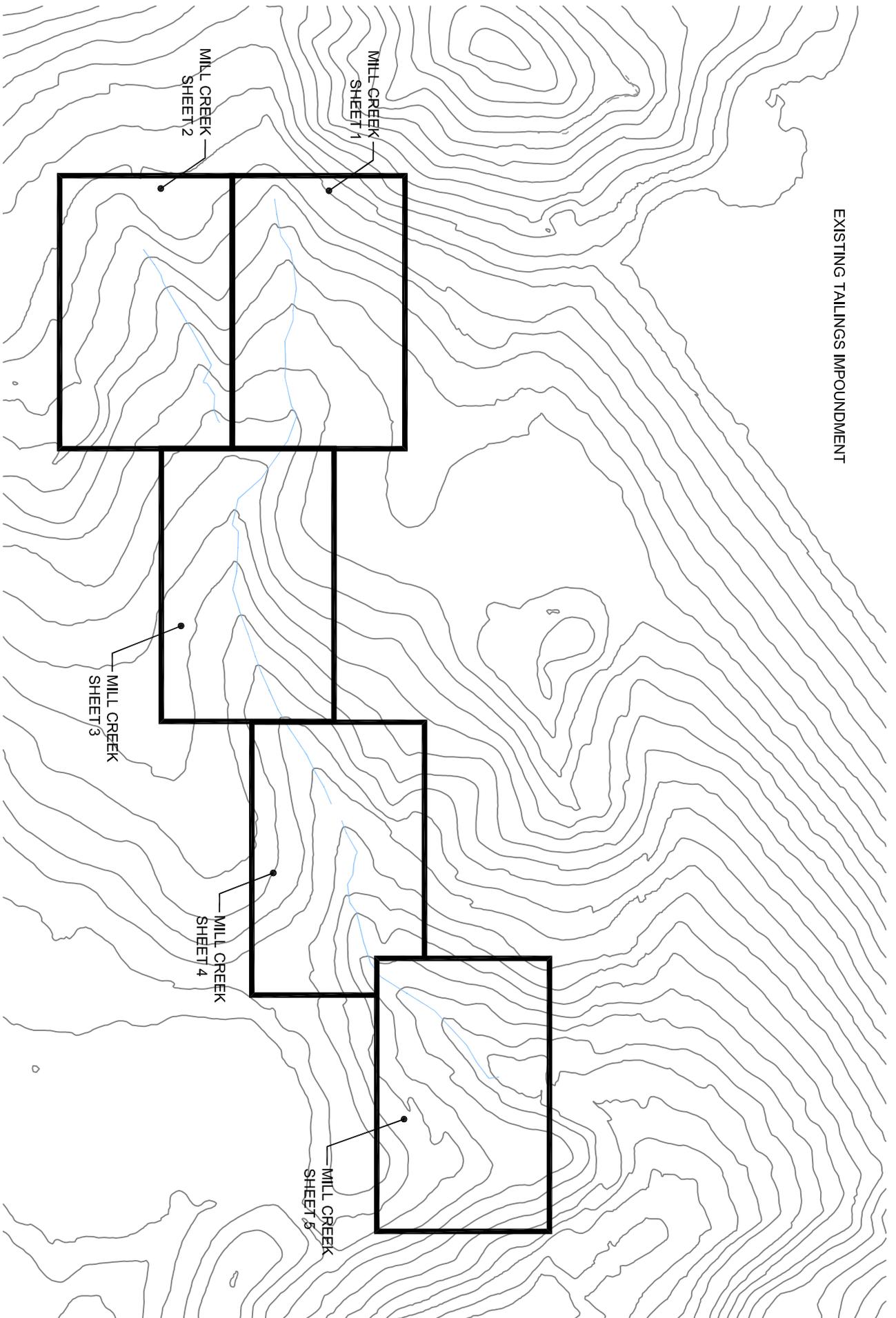


2008 Seep Permanent Impacts
 Total Surface Area Impacts: 0.003 AC / (135 SF)
 Total Fill Below OHM: 3.75 CY

Thompson Creek Mining Company
 Section 36, Township 12 North, Range 16 East &
 Section 1, Township 11 North, Range 16 East
2008 SEEP
 Sheet 5 of 5

Applicant: Thompson Creek Mining Company
 Waterway: 2008 Seep
 Custer County, Idaho
 Date: June 3, 2013

EXISTING TAILINGS IMPOUNDMENT

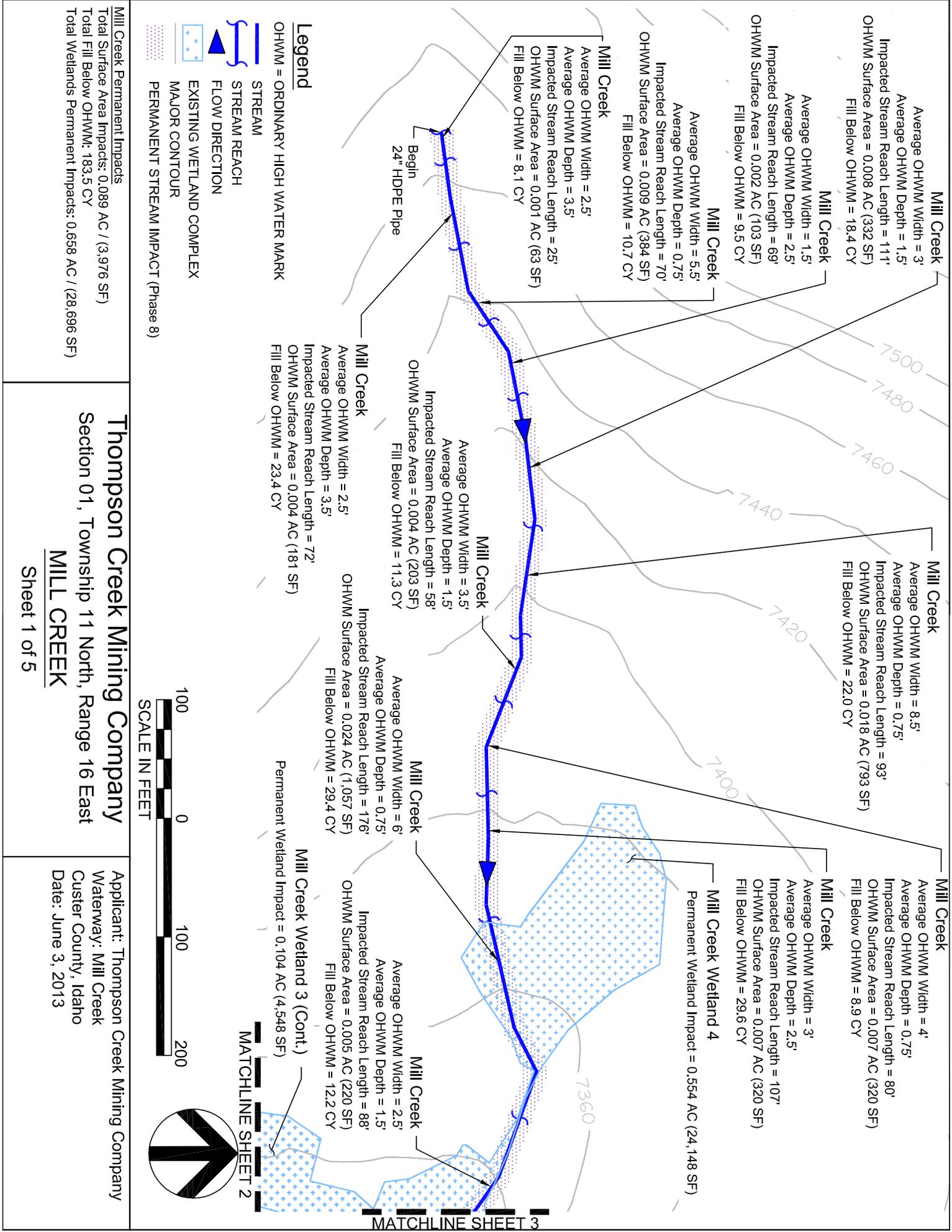


Thompson Creek Mining Company
MILL CREEK STUDY AREA

Site Reference Map



Scale: N.T.S.



Mill Creek
 Average OHWM Width = 3'
 Average OHWM Depth = 1.5'
 Impacted Stream Reach Length = 111'
 OHWM Surface Area = 0.008 AC (332 SF)
 Fill Below OHWM = 18.4 CY

Mill Creek
 Average OHWM Width = 1.5'
 Average OHWM Depth = 2.5'
 Impacted Stream Reach Length = 69'
 OHWM Surface Area = 0.002 AC (103 SF)
 Fill Below OHWM = 9.5 CY

Mill Creek
 Average OHWM Width = 5.5'
 Average OHWM Depth = 0.75'
 Impacted Stream Reach Length = 70'
 OHWM Surface Area = 0.009 AC (384 SF)
 Fill Below OHWM = 10.7 CY

Mill Creek
 Average OHWM Width = 2.5'
 Average OHWM Depth = 3.5'
 Impacted Stream Reach Length = 25'
 OHWM Surface Area = 0.001 AC (63 SF)
 Fill Below OHWM = 8.1 CY

Mill Creek
 Average OHWM Width = 8.5'
 Average OHWM Depth = 0.75'
 Impacted Stream Reach Length = 93'
 OHWM Surface Area = 0.018 AC (793 SF)
 Fill Below OHWM = 22.0 CY

Mill Creek
 Average OHWM Width = 3.5'
 Average OHWM Depth = 1.5'
 Impacted Stream Reach Length = 58'
 OHWM Surface Area = 0.004 AC (203 SF)
 Fill Below OHWM = 11.3 CY

Mill Creek
 Average OHWM Width = 2.5'
 Average OHWM Depth = 72'
 Impacted Stream Reach Length = 72'
 OHWM Surface Area = 0.004 AC (181 SF)
 Fill Below OHWM = 23.4 CY

Mill Creek
 Average OHWM Width = 6'
 Average OHWM Depth = 0.75'
 Impacted Stream Reach Length = 176'
 OHWM Surface Area = 0.024 AC (1,057 SF)
 Fill Below OHWM = 29.4 CY

Mill Creek
 Average OHWM Width = 4'
 Average OHWM Depth = 0.75'
 Impacted Stream Reach Length = 80'
 OHWM Surface Area = 0.007 AC (320 SF)
 Fill Below OHWM = 8.9 CY

Mill Creek
 Average OHWM Width = 3'
 Average OHWM Depth = 2.5'
 Impacted Stream Reach Length = 107'
 OHWM Surface Area = 0.007 AC (320 SF)
 Fill Below OHWM = 29.6 CY

Mill Creek Wetland 4
 Permanent Wetland Impact = 0.554 AC (24,148 SF)

Mill Creek
 Average OHWM Width = 2.5'
 Average OHWM Depth = 1.5'
 Impacted Stream Reach Length = 88'
 OHWM Surface Area = 0.005 AC (220 SF)
 Fill Below OHWM = 12.2 CY

Mill Creek Wetland 3 (Cont.)
 Permanent Wetland Impact = 0.104 AC (4,548 SF)

Mill Creek
 Average OHWM Width = 2.5'
 Average OHWM Depth = 1.5'
 Impacted Stream Reach Length = 88'
 OHWM Surface Area = 0.005 AC (220 SF)
 Fill Below OHWM = 12.2 CY

- Legend**
- OHWM = ORDINARY HIGH WATER MARK
 - STREAM
 - STREAM REACH
 - FLOW DIRECTION
 - EXISTING WETLAND COMPLEX
 - MAJOR CONTOUR
 - PERMANENT STREAM IMPACT (Phase 8)



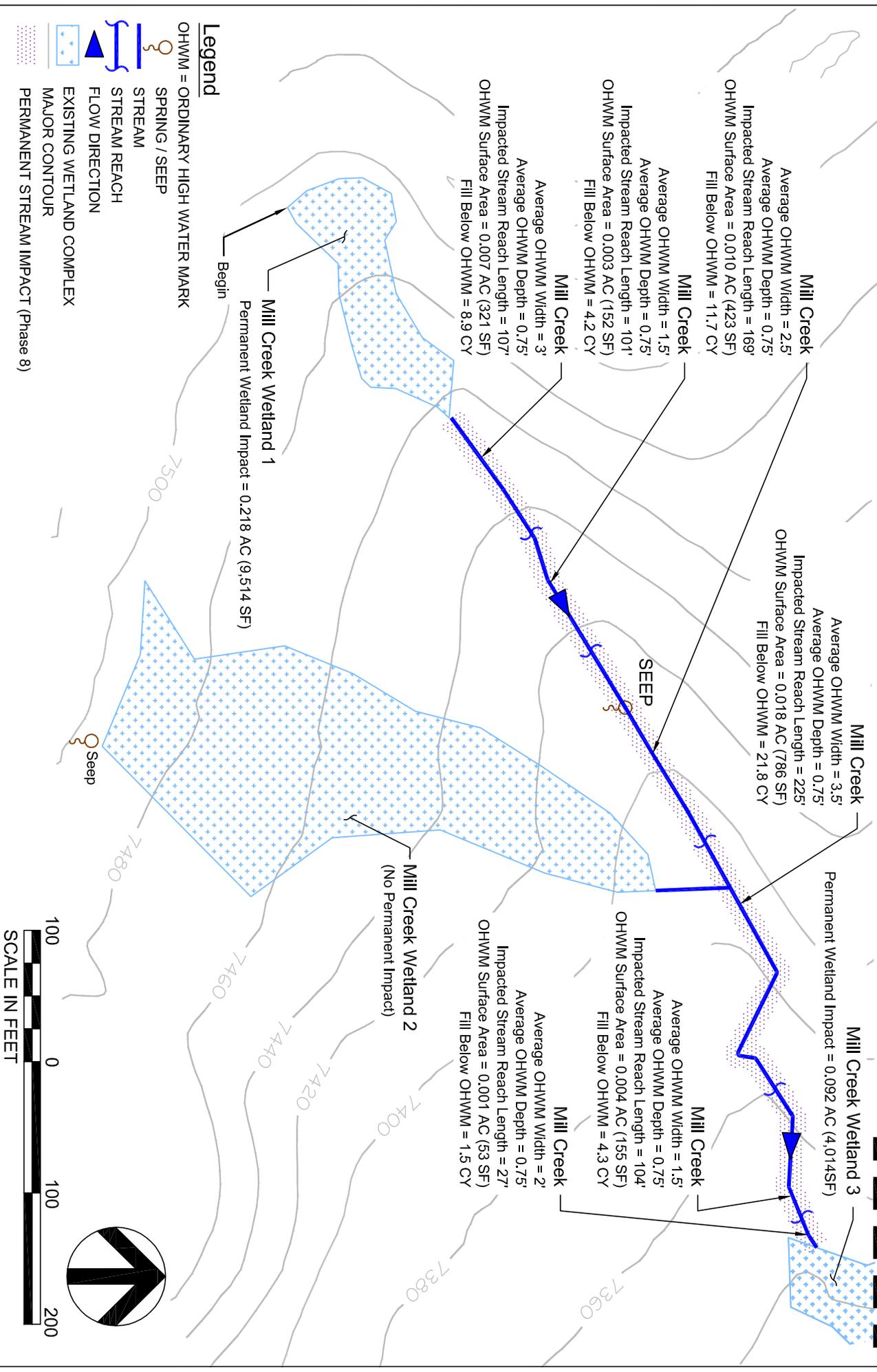
Mill Creek Permanent Impacts
 Total Surface Area Impacts: 0.089 AC / (3,976 SF)
 Total Fill Below OHWM: 183.5 CY
 Total Wetlands Permanent Impacts: 0.658 AC / (28,696 SF)

Thompson Creek Mining Company
 Section 01, Township 11 North, Range 16 East
MILL CREEK
 Sheet 1 of 5

Applicant: Thompson Creek Mining Company
 Waterway: Mill Creek
 Custer County, Idaho
 Date: June 3, 2013

MATCHLINE SHEET 2

MATCHLINE SHEET 3



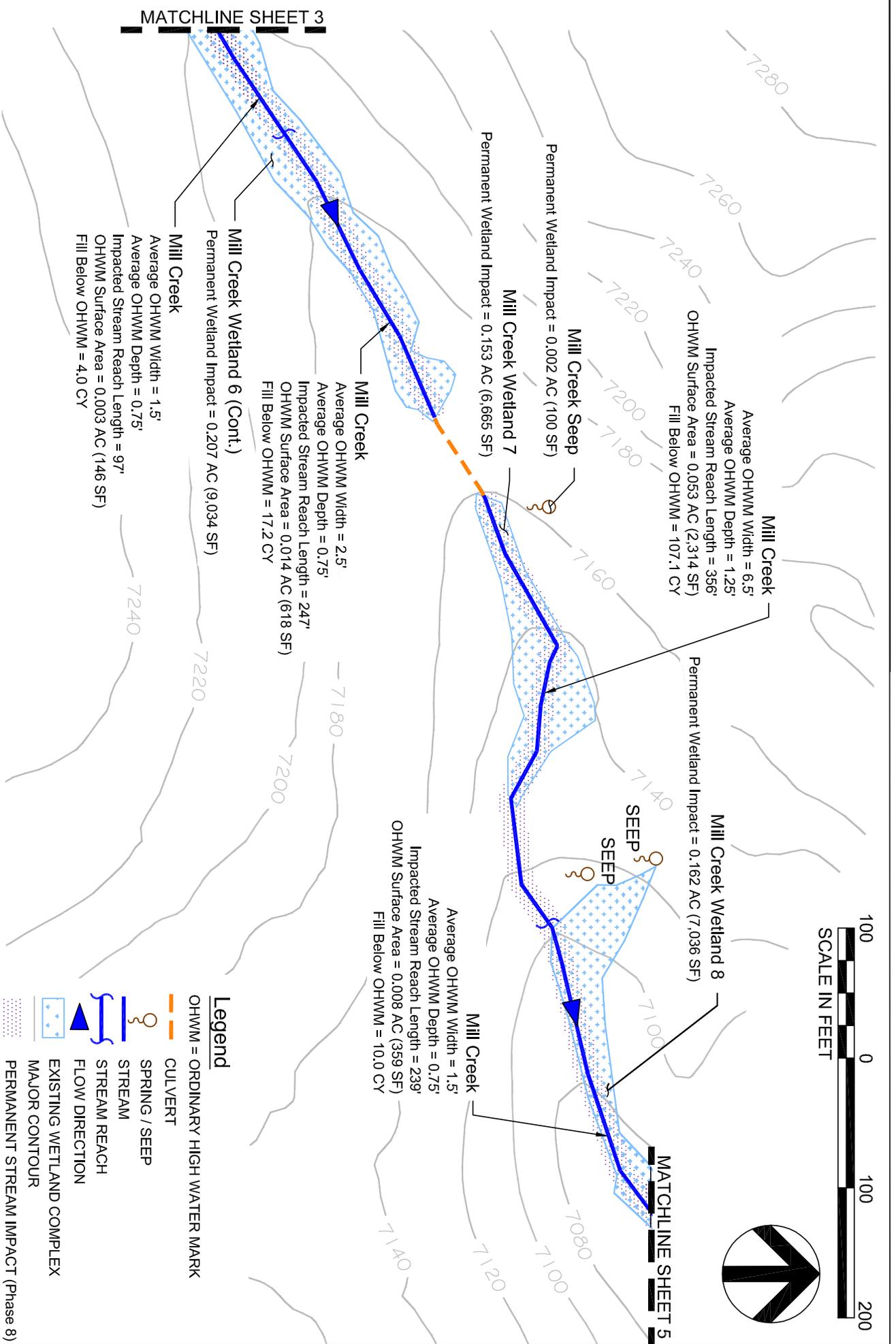
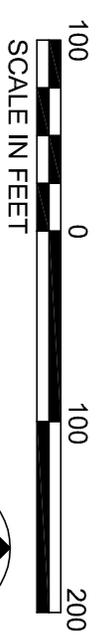
- Legend**
- OHWM = ORDINARY HIGH WATER MARK
 - SPRING / SEEP
 - STREAM
 - STREAM REACH
 - FLOW DIRECTION
 - EXISTING WETLAND COMPLEX
 - MAJOR CONTOUR
 - PERMANENT STREAM IMPACT (Phase 8)



Mill Creek Permanent Impacts:
 Total OHWM Surface Area Impacts: 0.043 AC (1,890 SF)
 Total Fill Below OHWM: 52.4 CY
 Total Wetlands Permanent Impacts: 0.310 AC (13,528 SF)

Thompson Creek Mining Company
 Section 01, Township 11 North, Range 17 East
MILL CREEK
 Sheet 2 of 5

Applicant: Thompson Creek Mining Company
 Waterway: Mill Creek
 Custer County, Idaho
 Date: June 3, 2013

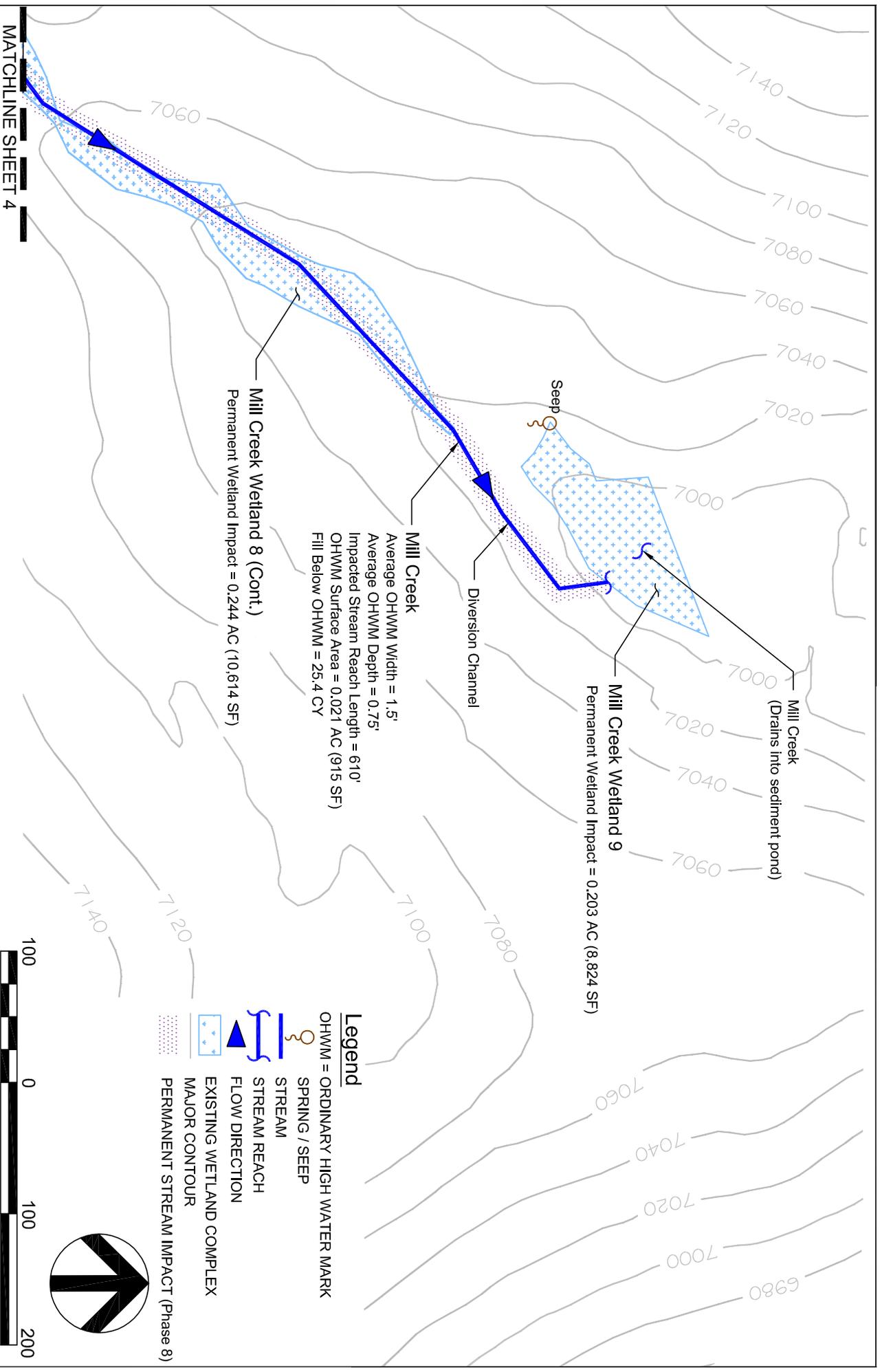


Mill Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.078 AC (3,437 SF)
 Total Fill Below OHWM: 138.3 CY
 Total Wetlands Permanent Impacts: 0.524 AC (22,835 SF)

Thompson Creek Mining Company
 Section 06, Township 11 North, Range 17 East
MILL CREEK
 Sheet 4 of 5

Applicant: Thompson Creek Mining Company
Waterway: Mill Creek
 Custer County, Idaho
Date: June 3, 2013

- Legend**
- OHWM = ORDINARY HIGH WATER MARK
 - CULVERT
 - SPRING / SEEP
 - STREAM
 - STREAM REACH
 - FLOW DIRECTION
 - EXISTING WETLAND COMPLEX
 - MAJOR CONTOUR
 - PERMANENT STREAM IMPACT (Phase 8)



Mill Creek
 Average OHWM Width = 1.5'
 Average OHWM Depth = 0.75'
 Impacted Stream Reach Length = 610'
 OHWM Surface Area = 0.021 AC (915 SF)
 Fill Below OHWM = 25.4 CY

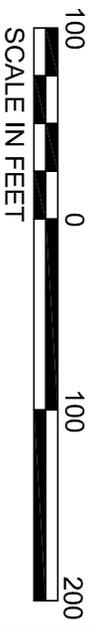
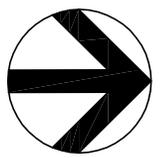
Mill Creek Wetland 8 (Cont.)
 Permanent Wetland Impact = 0.244 AC (10,614 SF)

Mill Creek Wetland 9
 Permanent Wetland Impact = 0.203 AC (8,824 SF)

Mill Creek
 (Drains Into sediment pond)

MATCHLINE SHEET 4

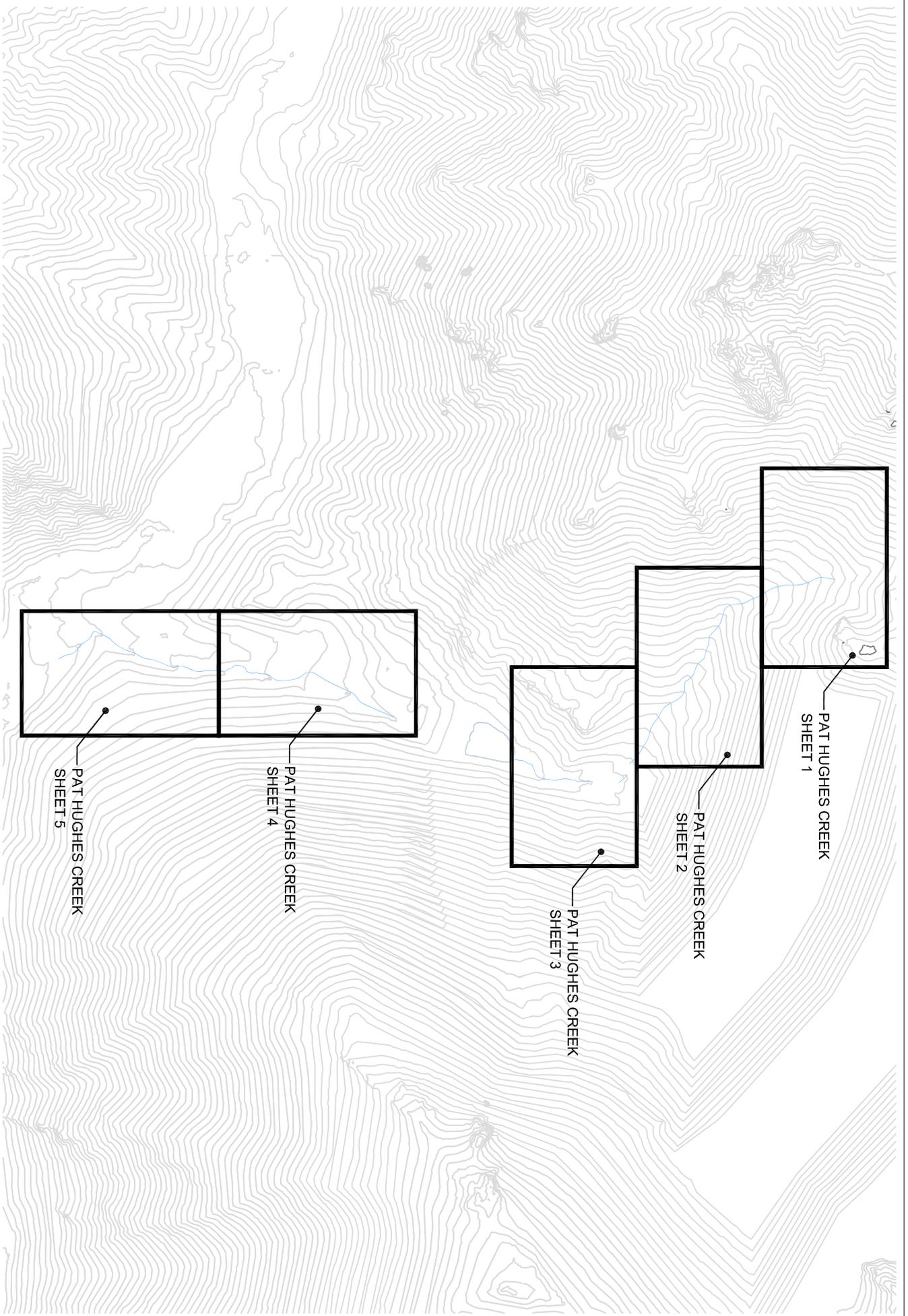
- Legend**
- OHWM = ORDINARY HIGH WATER MARK
 - SPRING / SEEP
 - STREAM
 - STREAM REACH
 - FLOW DIRECTION
 - EXISTING WETLAND COMPLEX
 - MAJOR CONTOUR
 - PERMANENT STREAM IMPACT (Phase 8)



Mill Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.021 AC (915 SF)
 Total Fill Below OHWM: 25.4 CY
 Total Wetlands Permanent Impacts: 0.447 AC (19,438 SF)

Thompson Creek Mining Company
 Section 08, Township 11 North, Range 17 East
MILL CREEK
 Sheet 5 of 5

Applicant: Thompson Creek Mining Company
 Waterway: Mill Creek
 Custer County, Idaho
 Date: June 3, 2013

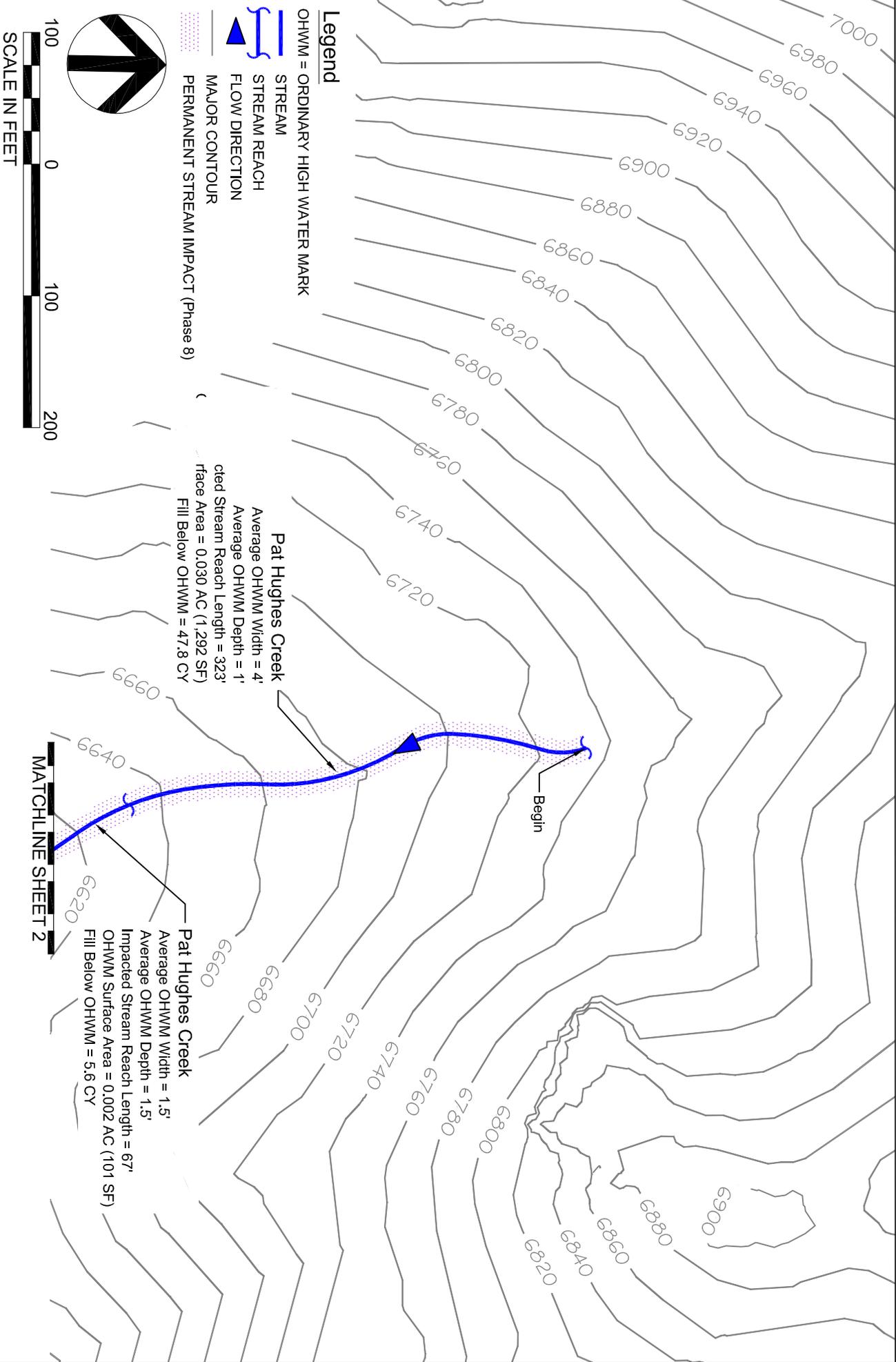


Thompson Creek Mining Company
PAT HUGHES CREEK STUDY AREA

Site Reference Map

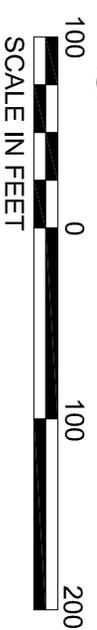


Scale: N.T.S.



Legend

- OHWM = ORDINARY HIGH WATER MARK
- STREAM
- STREAM REACH
- FLOW DIRECTION
- MAJOR CONTOUR
- PERMANENT STREAM IMPACT (Phase 8)



Pat Hughes Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.032 AC (1,393 SF)
 Total Fill Below OHWM: 53.4 CY

Pat Hughes Creek
 Average OHWM Width = 4'
 Average OHWM Depth = 1'
 cited Stream Reach Length = 323'
 rface Area = 0.030 AC (1,292 SF)
 Fill Below OHWM = 47.8 CY

Pat Hughes Creek
 Average OHWM Width = 1.5'
 Average OHWM Depth = 1.5'
 Impacted Stream Reach Length = 67'
 OHWM Surface Area = 0.002 AC (101 SF)
 Fill Below OHWM = 5.6 CY

MATCHLINE SHEET 2

Thompson Creek Mining Company
 Section 11, Township 11 North, Range 16 East
PAT HUGHES CREEK

Sheet 1 of 5

Applicant: Thompson Creek Mining Company
 Waterway: Pat Hughes Creek
 Custer County, Idaho
 Date: June 3, 2013

MATCHLINE SHEET 1

Pat Hughes Creek

Average OHWM Width = 1.5'
Average OHWM Depth = 1.5'
Impacted Stream Reach Length = 180'
OHWM Surface Area = 0.006 AC (270 SF)
Fill Below OHWM = 15.0 CY

End of Defined Channel

Pat Hughes Creek

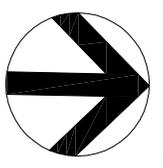
Average OHWM Width = 3.5'
Average OHWM Depth = 1'
Impacted Stream Reach Length = 324'
OHWM Surface Area = 0.026 AC (1,134 SF)
Fill Below OHWM = 42.0 CY

Pat Hughes Creek Tributary Seep 1

Permanent Wetland Impact = 0.045 AC (1,940 SF)

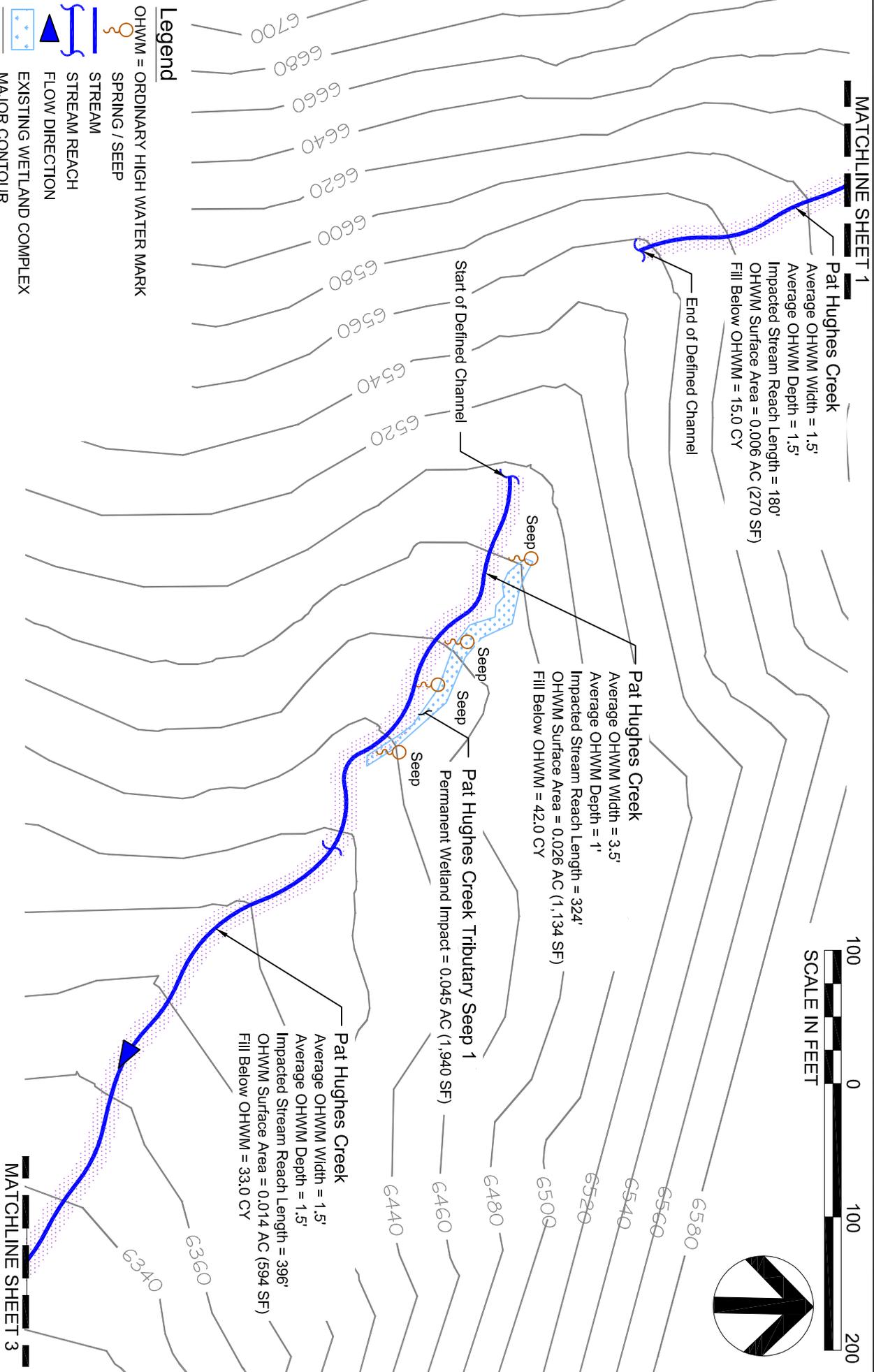
Pat Hughes Creek

Average OHWM Width = 1.5'
Average OHWM Depth = 1.5'
Impacted Stream Reach Length = 396'
OHWM Surface Area = 0.014 AC (594 SF)
Fill Below OHWM = 33.0 CY



Legend

- OHWM = ORDINARY HIGH WATER MARK
- SPRING / SEEP
- STREAM
- STREAM REACH
- FLOW DIRECTION
- EXISTING WETLAND COMPLEX
- MAJOR CONTOUR
- PERMANENT STREAM IMPACT (Phase 8)



Pat Hughes Creek Permanent Impacts
Total OHWM Surface Area Impacts: 0.046 AC (1,998 SF)
Total Fill Below OHWM: 90.0 CY
Total Wetlands Permanent Impacts: 0.045 AC (1,940 SF)

Thompson Creek Mining Company
Section 11, Township 11 North, Range 16 East
PAT HUGHES CREEK

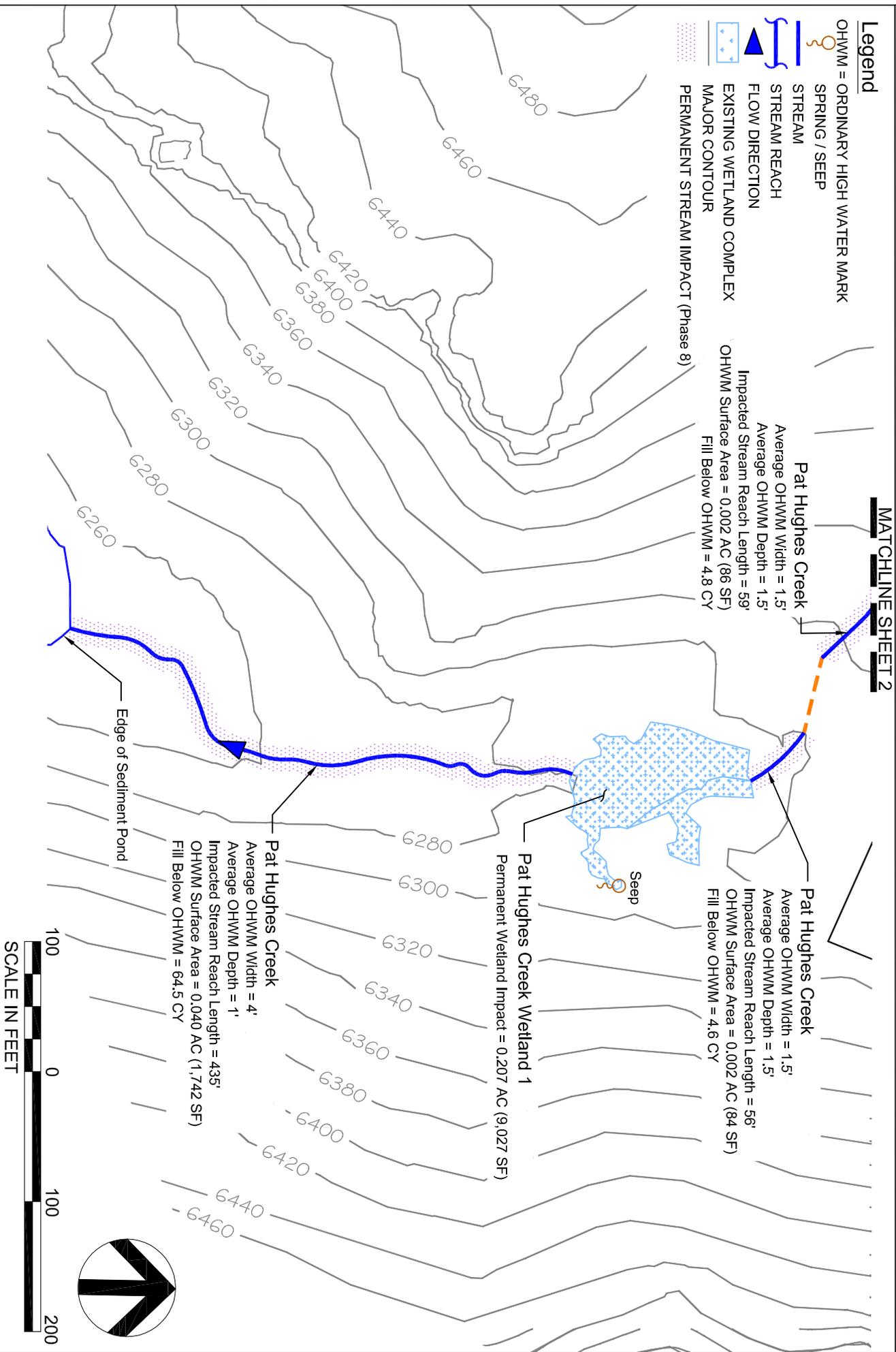
Sheet 2 of 5

Applicant: Thompson Creek Mining Company
Waterway: Pat Hughes Creek
Custer County, Idaho
Date: June 3, 2013

Legend

- OHWM = ORDINARY HIGH WATER MARK
- SPRING / SEEP
- STREAM
- STREAM REACH
- FLOW DIRECTION
- EXISTING WETLAND COMPLEX
- MAJOR CONTOUR
- PERMANENT STREAM IMPACT (Phase 8)

MATCHLINE SHEET 2



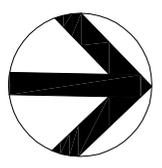
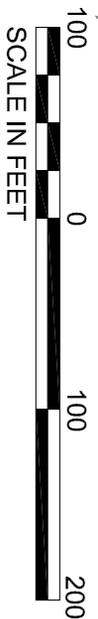
Pat Hughes Creek
 Average OHWM Width = 1.5'
 Average OHWM Depth = 1.5'
 Impacted Stream Reach Length = 59'
 OHWM Surface Area = 0.002 AC (86 SF)
 Fill Below OHWM = 4.8 CY

Pat Hughes Creek
 Average OHWM Width = 1.5'
 Average OHWM Depth = 1.5'
 Impacted Stream Reach Length = 56'
 OHWM Surface Area = 0.002 AC (84 SF)
 Fill Below OHWM = 4.6 CY

Pat Hughes Creek Wetland 1
 Permanent Wetland Impact = 0.207 AC (9,027 SF)

Pat Hughes Creek
 Average OHWM Width = 4'
 Average OHWM Depth = 1'
 Impacted Stream Reach Length = 435'
 OHWM Surface Area = 0.040 AC (1,742 SF)
 Fill Below OHWM = 64.5 CY

Edge of Sediment Pond

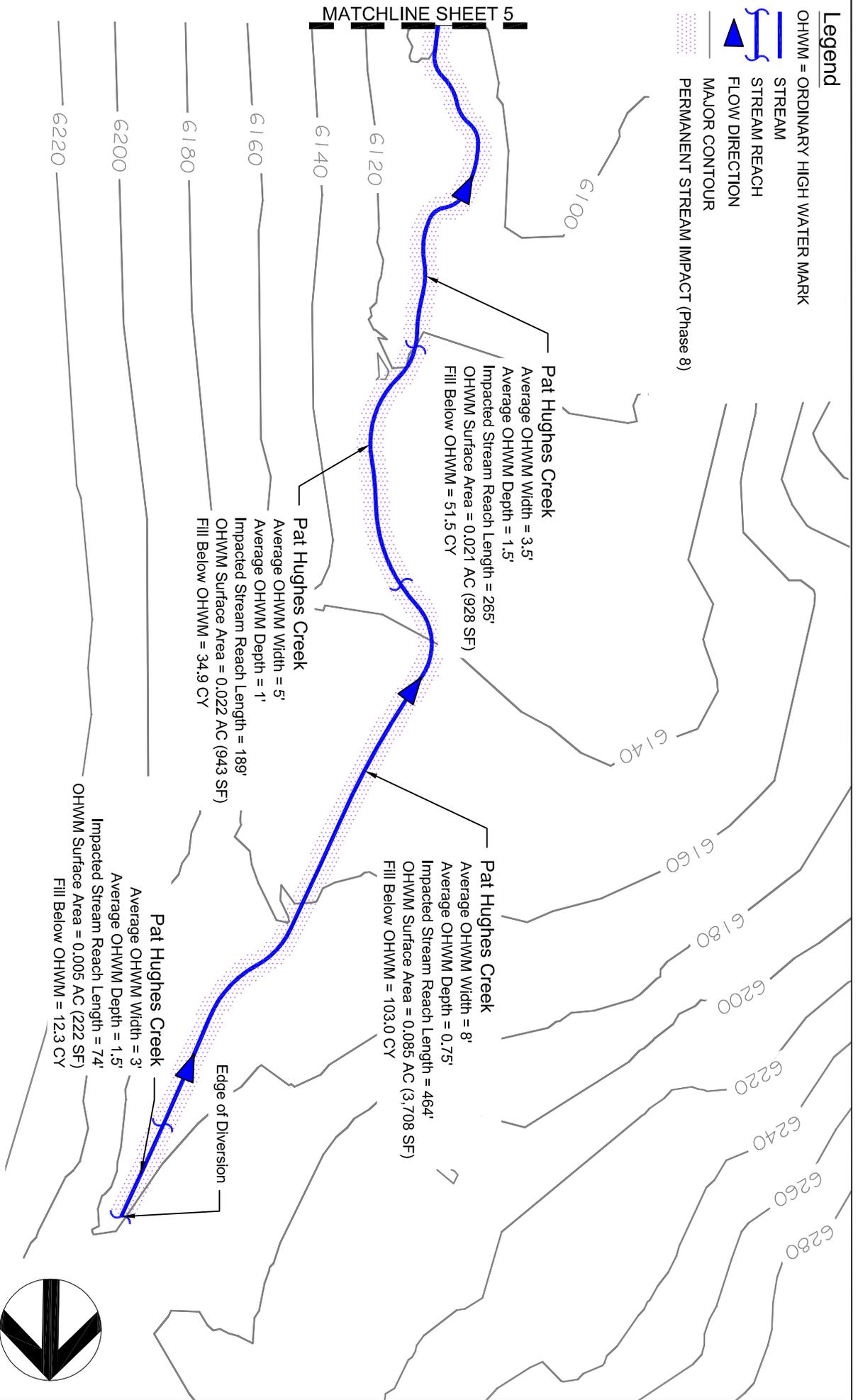


Pat Hughes Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.044 AC (1,912 SF)
 Total Fill Below OHWM: 73.9 CY
 Total Wetlands Permanent Impacts: 0.207 AC (9,027 SF)

Thompson Creek Mining Company
 Section 11, Township 11 North, Range 16 East
PAT HUGHES CREEK

Applicant: Thompson Creek Mining Company
 Waterway: Pat Hughes Creek
 Custer County, Idaho
 Date: June 3, 2013

- Legend**
- OHWM = ORDINARY HIGH WATER MARK
 - STREAM
 - STREAM REACH
 - ▲ FLOW DIRECTION
 - MAJOR CONTOUR
 - PERMANENT STREAM IMPACT (Phase 8)

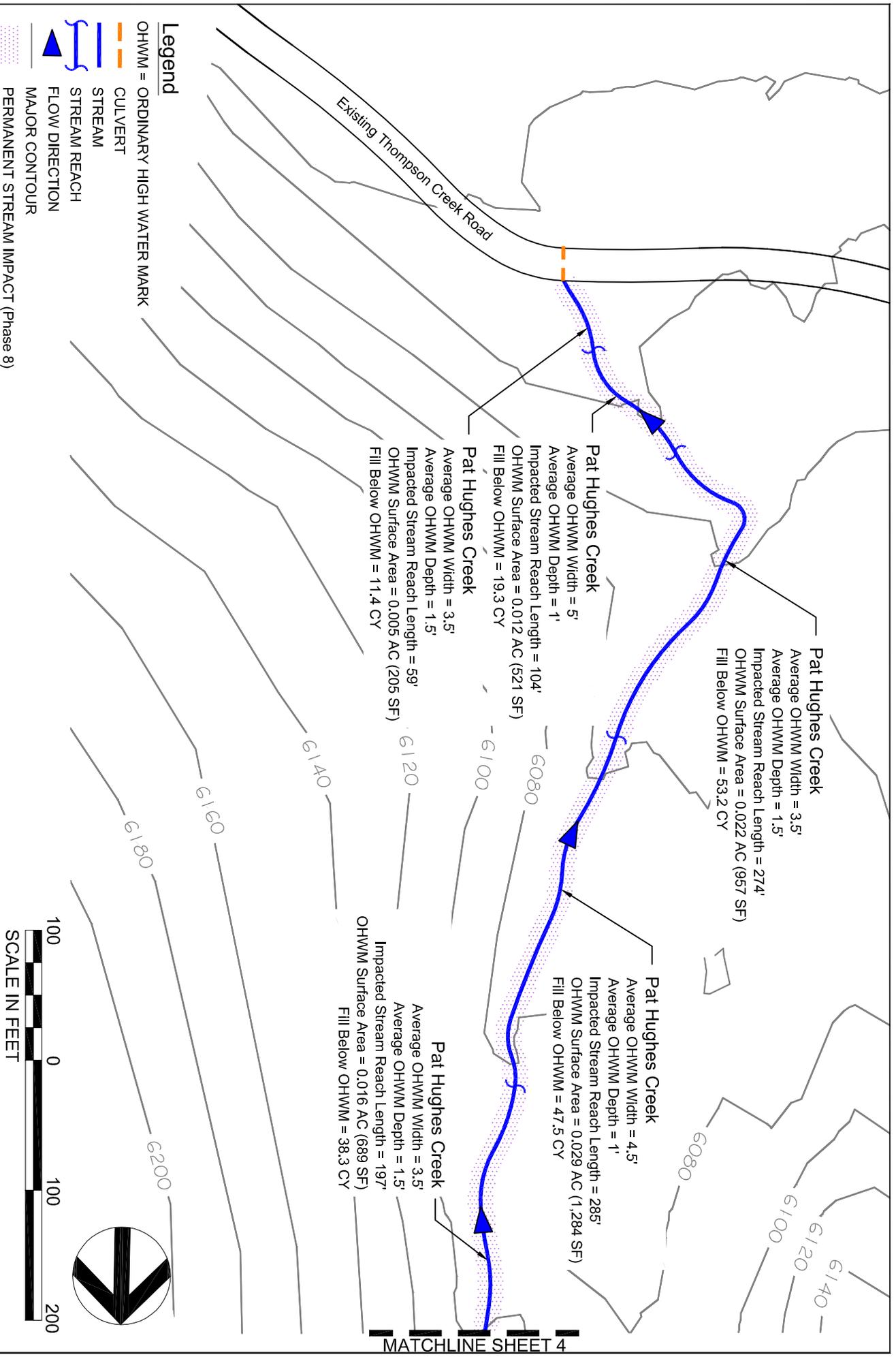


Pat Hughes Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.133 AC (5,801 SF)
 Total Fill Below OHWM: 201.7 CY

Thompson Creek Mining Company
 Section 11, Township 11 North, Range 16 East
PAT HUGHES CREEK

Sheet 4 of 5

Applicant: Thompson Creek Mining Company
 Waterway: Pat Hughes Creek
 Custer County, Idaho
 Date: June 3, 2013



Pat Hughes Creek Permanent Impacts
 Total OHWM Surface Area Impacts: 0.084 AC (3,656 SF)
 Total Fill Below OHWM: 169.7 CY

Thompson Creek Mining Company
 Section 11, Township 11 North, Range 16 East &
 Section 14, Township 11 North, Range 16 East
PAT HUGHES CREEK
 Sheet 5 of 5

Applicant: Thompson Creek Mining Company
 Waterway: Pat Hughes Creek
 Custer County, Idaho
 Date: June 3, 2013

