IDAHO GOLD CORPORATION

ENVIRONMENTAL ASSESSMENT

#DOI-BLM-ID-I010-2014-0011-EA

UNNAMED TRIBUTARY OF CHAMPAGNE CREEK PASSIVE WATER MANAGEMENT SYSTEM AND REMOVAL ACTIONS

PREPARED FOR:
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1.0 Introduction

This Environmental Assessment (EA) has been prepared for a proposed passive water management system (PWMS) and remediation of erosion and sediment discharges at the closed Champagne Mine in Butte County, Idaho (Figure 1). The proposed project would provide passive management of acidic water seepage adjacent to a mine waste pile into an unnamed ephemeral tributary of Champagne Creek. Erosion and sediment discharge from the mine site into the unnamed ephemeral tributary of Champagne Creek would be remediated. The project proponent is Idaho Gold Corporation. The project is located on Bureau of Land Management (BLM) land approximately 17 miles west of Arco, Idaho. This EA is prepared in accordance with the BLM's National Environmental Policy Act (NEPA) guidance set forth in Handbook H-1790-1.

1.1. Identifying and Public Contact Information

The project is listed in the BLM NEPALOG as EA: Unnamed ephemeral tributary to Champagne Creek PWMS and Removal Actions. The corresponding NEPALOG number is: # DOI-BLM-ID-I010- 2014-0011-EA. The EA is being administered from the BLM's Upper Snake Field Office, Idaho Falls District Office. The Field Office's NEPA project coordinator is:

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1405 Hollipark Drive
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1.2. Purpose and Need

The BLM has the responsibility under Federal Land Policy Management Act of 1976 (FLPMA) to respond to a request to use public lands for the construction, operation, and maintenance of a passive water management system (PWMS) associated with acidic water seepage adjacent to a mine waste pile into an unnamed ephemeral tributary of Champagne Creek in Butte County, Idaho.

The closed Champagne Mine mineral asset was acquired by Idaho Gold Corporation (IGC) from Bema Mining Co. nearly a decade ago. IGC voluntarily proposes to install a PWMS to passively manage acidic water associated with a waste rock pile into an unnamed south tributary of Champagne Creek. Champagne Creek is impacted by two known sources of acid rock drainage (ARD): primarily the Moran Tunnel, and to a much lesser degree, the south unnamed ephemeral tributary. The impacted water discharge from Moran Tunnel is listed on the CERCLIS by the Environmental Protection Agency (EPA) as Site # ID6141190037. At the Moran Tunnel, the BLM is currently evaluating improvement to an existing treatment system first constructed in 1999. The proposed action would provide treatment of ARD water and would route the water to an infiltration gallery approximately 1,000 feet from Champagne Creek.

In the vicinity of the project area, Champagne Creek is intermittent and portions of the creek exhibit surface flow only during spring runoff and significant snowmelt or precipitation events. The proposed project would contribute to improving Champagne Creek water quality toward Clean Water Act standards. Improving water quality would benefit downstream users including a ranch located 2.9 miles downstream which uses the creek water for hay irrigation. Improving water quality would also benefit biotic and watershed functions and values.

1.3. Type of Action

Issuance of a Right-of-Way Grant.

1.4. Location

The project is located in Butte County, Idaho within the BLM Idaho Falls District, Upper Snake Field Office (Figure 1). The project is located on BLM land (Section 15, Township 3 North, Range 24 East) near the unnamed ephemeral south tributary of Champagne Creek located on the east side of Champagne Road approximately 17 miles west of Arco, Idaho. The proposed water management system would be constructed near the closed Champagne Mine at an elevation of approximately 6,012 feet above mean sea level.

The project location is in the Dry-Gniessic-Schistose-Volcanic Hills Level IV (17ab), Middle Rockies Level III (17) ecoregion (EPA 2014). It is in close proximity with two other Level III ecoregion boundaries including the Idaho Batholith (16) to the west-southwest and Snake River Plain (12) to the east-southeast. The 17ab Level IV ecoregion is characterized as shrub (sagebrush) and grass vegetative cover underlain by Quaternary and Tertiary volcanics.

1.5. Conformance with Land Use Plan and Other Regulations

The proposed PWMS is located within public lands managed under the Big Lost Management Framework Plan (MFP)/ Environmental Impact Statement (1982). This plan provides for the consideration of right-of-way (ROW) applications. The plan also states as Watershed Decision 2.1, control pollution from the Last Chance Mine Group on Champagne Creek.

The proposed project is in the study area of the BLM Champagne Creek Water Quality Management Plan completed in 1989. This plan identifies and recommends multiple measures to improve the creek's water quality including the use of passive water management systems.

1.6. Resources Considered in the Impact Analysis

A 2014 BLM Interdisciplinary Team EA checklist determined the need to prepare an EA for the proposed passive water management system project. The checklist identifies the following subjects for further impact analysis in the EA:

- Access
- Land Uses
- Floodplains
- Invasive Non-native Species
- Migratory Birds
- Soil Resources
- Threatened, Endangered and Sensitive Species
- Vegetation
- Water Quality
- Wetland and Riparian Areas
- Wildlife Resources

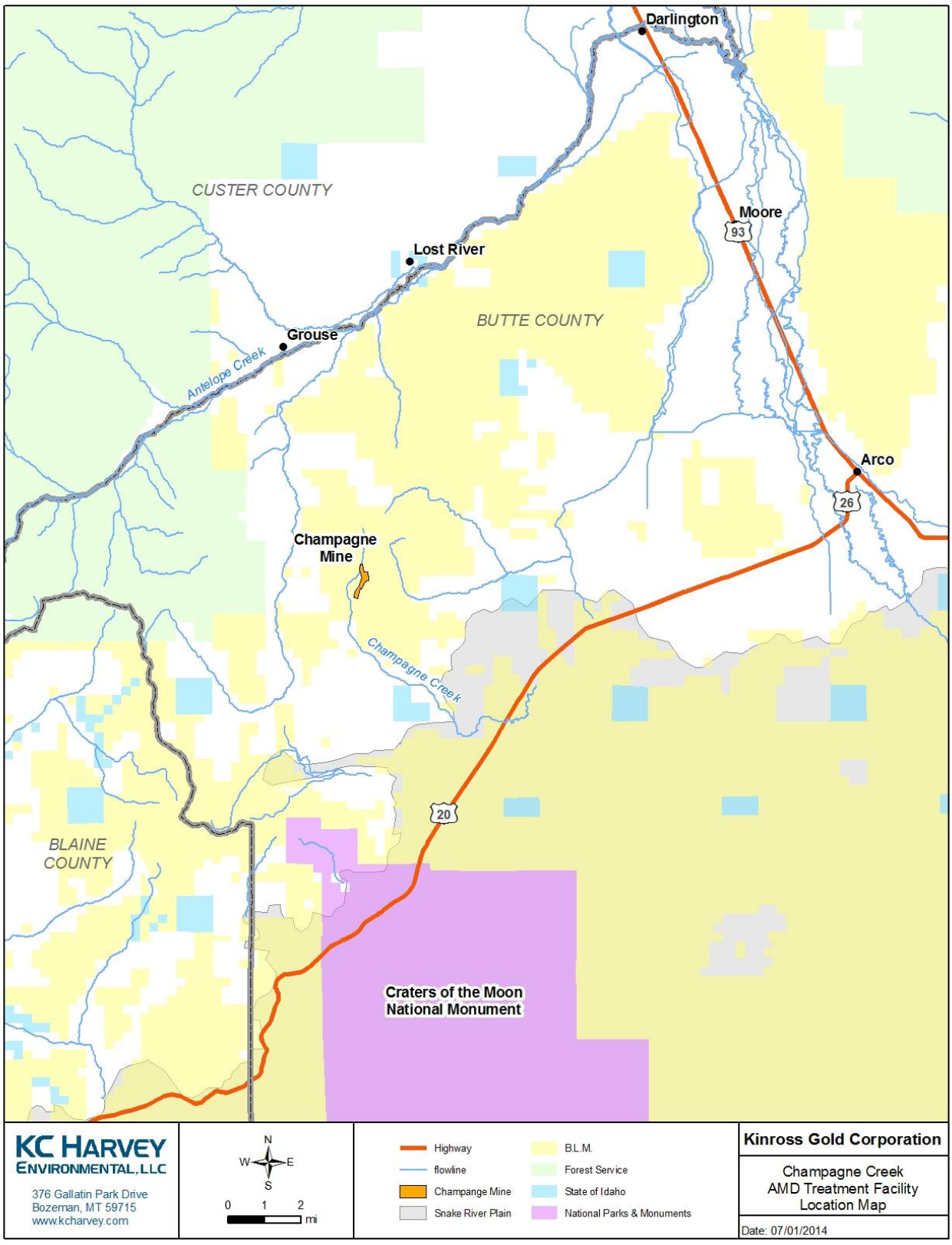

Figure 1. Location of the Champagne Mine in Butte County, Idaho.

The checklist also provided rationale for several BLM NEPA resource subjects considered not present or present but not impacted. These resource subjects include cultural, mineral, paleontological, and visual resources, wilderness, and wild and scenic rivers. These subjects require no further analysis in the EA. For Cultural Resources, the rationale explained that a Class III inventory was conducted on the project area with no cultural resources identified (BLM pers. comm. 2014a). For Mineral Resources, the rationale comment stated that the proposed action does not propose to remove minerals. For Paleontological Resources the rationale stated that the project setting in volcanic geology makes fossil preservation unlikely. Visual Resources rationale stated that the project would not dominate the viewshed of visitors and users to the area. Rationale for Wilderness and Wild and Scenic Rivers stated that none were present in the project area.

Other subjects considered not present or present but not impacted had no rationale assigned by the interdisciplinary team reviews.

2.0 Proposed Action and Alternatives

Only two alternatives were considered: the proposed action (Preferred Alternative) and the No-action Alternative.

2.1. Proposed Action

The proposed action is to grant Idaho Gold Corporation a right-of way (ROW) authorizing the use of public land in Butte County for a PWMS and facilities for the remediation of erosion and sediment discharge. The passive water management system would consist of: constructing a collection sump (about 30 feet wide by 60 feet long) at the seep area discharge; installing a conveyance pipe (about 1000 feet) with flow splitter to carry flow downstream to the treatment system; constructing a biochemical reactor (BCR), about 0.64 acres; constructing a holding/mixing tank (roughly 8 feet wide by 40 feet long by 8 feet high) to receive BCR treated water; constructing an in-ground dose tank (roughly 6 feet wide by 12 feet long by 6 feet high) and infiltration gallery (about 1.38 acres) to receive treated water from the holding tank for recharge; and remediation of sediment plume below the infiltration gallery and construction of best management practices (BMPs) to minimize future erosion and sediment deposition, potentially consisting of rip rap, gabions, and enlargement of existing sediment basins. These facilities would encumber about 2.25 total acres, more or less, as shown on Figure 2.

The proposed PWMS is designed to minimize impacts while providing a treatment of seepage associated with the waste rock pile. The proposed action would provide passive treatment to ARD water originating from a seep discharging into the unnamed ephemeral tributary of Champagne Creek (Figure 2). The treatment design is entirely passive relying on gravity to collect and treat impacted water before discharging into an infiltration gallery. No electric, chemical, or other sources of power or agents would be used for the proposed action.

Figure 2. Proposed location of Passive Water Management System (PWMS)

A collection sump at the seep area would capture and divert water for conveyance downslope through a buried pipe. The diverter pipe would discharge water to a constructed biochemical reactor (BCR). A flow splitter upgradient of the BCR would convey possible flows greater than design (i.e. 1 gpm) directly to the Holding/Mixing tank. The BCR would contain organic carbon media substrate to remove metals and increase pH to near-neutral. A downslope buried holding tank system would receive the BCR outflow water. The holding tank transitions into a calibrated dose tank which would then discharge water downslope to a constructed below-ground infiltration gallery. The gallery provides slow rate infiltration to complete the passive system process.

The proposed action would be constructed for low visual impact. The diverter pipe, BCR, and infiltration gallery would be buried and restored with natural soils and native vegetation. The holding tank would be buried with limited surface access. Above-ground elements including pipe clean-out structures, vents, and man-hole access would be camouflaged with natural tones to minimize visual impacts. Long term maintenance requirements would be minimal and include periodic pipe and holding tank clean-outs if needed, and replacement of the BCR system substrate as needed.

The proposed action would include additional activities to remediate a sediment plume near the confluence of the unnamed ephemeral tributary with Champagne Creek (Figure 2). The sediment plume is located approximately 1200 feet down-gradient of the proposed BCR cell adjacent to the unnamed tributary channel. Remediation would include either in-situ treatments of the sediment to improve vegetative productivity, sediment removal and off-site disposal, or combinations of both. The in-situ treatment would be an agricultural lime application for maintaining above neutral soil pH and immobilizing metals followed by a seed and fertilizer application to promote vegetation growth. Slopes and other topographic features in the immediate project area considered to be sources for eroded material contributing to the sediment plume would be addressed with erosion control treatments including seeding, erosion mats, rock armoring, and gabion installations. This may include enlarging and armoring an existing sediment basin near the sediment plume location and clean-out of existing sediment basins. If removed, both the sediment plume and the BCR media would be disposed in either one of the existing open mine pits, in the existing waste rock repository, or another BLM approved repository where it would have no future impact.

IGC is evaluating three potential access alternatives (alternatives A, B, and C) for use by construction equipment and for long term maintenance (Table 1; Figure 3). The access evaluation considers necessary requirements for equipment access and staging areas while minimizing environmental impacts.

Access Alternative A is the shortest and most direct access by following the two track road along the unnamed ephemeral tributary of Champagne Creek. Abutting the unnamed tributary channel, the existing two track access road is too narrow for larger construction equipment. Improving this access would require potential cut and fill materials and a substantial amount of tree trimming or removal along the tributary channel. Improvements to this route would need to be maintained to provide long-term access during operation and maintenance.

Access Alternative B would access the project from the north by a route through the reclaimed Champagne Mine facilities area, proceeding over the ridge and across the waste rock repository, and downslope to the project area. This alternative would reopen previously reclaimed roads, is the longest route, would result in the most ground disturbance, and involve a significant amount of cut and fill in order to allow access for equipment and materials. Due to the extent of ground

disturbance, this access would need to be reclaimed following the project. Therefore, no long-term access would be provided using this route for operation and maintenance activities.

Access Alternative C is the preferred access alternative. This alternative would use an existing two track road accessed from the Champagne Creek County Road. A relatively short (approximately 500 ft.) diversion from the existing two track road may also be used to avoid the steepest section of road and minimize impacts (see Figure 3). This route traverses a ridgeline from the Champagne Creek valley directly downslope to the project workspace. The entire alternative traverses upland hill slope habitat and requires only about 150 feet of moderate cut and fill that would not be visible from the County road. No tree removal would be necessary for Alternative C.

Table 1. Anticipated construction logistics for access alternatives.

Access Alternative	Access Construction Logistics
Alternative A	Construction equipment, materials and vehicles would access the area after construction of road improvements. Materials would be transported on construction vehicles.
Alternative B	Involves a substantial construction effort to reestablish previously reclaimed roads and would require subsequent reclamation once construction was completed. Does not provide access during operation and maintenance.
Alternative C	Construction equipment and vehicles would traverse the existing roads. Materials would be transported on construction vehicles.

In summary, the project elements of the proposed action (issuance of the ROW) include:

- Constructing a collection sump at the seep area discharge
- Installing a conveyance pipe (about 1000 feet long) with flow splitter to carry flow downstream to the treatment system
- Constructing a biochemical reactor (BCR) about 0.64 acres
- Constructing a holding/mixing tank to receive BCR treated water
- Constructing an in-ground dose tank and infiltration gallery (about 1.38 acres) to receive treated water from the holding tank for recharge
- Remediation of sediment plume below the infiltration gallery and implementation of best management practices (BMPs) (such as reseeding, installing rock armoring, gabions, and enlarging existing sediment basins) to minimize future erosion and sediment deposition
- Constructing or improving an access route
- Seeding disturbed areas with a seed mix approved by the BLM Authorized Officer
- At the end of monitoring or when the ROW is no longer needed, the ROW area would be rehabilitated, as directed by the Authorized Officer

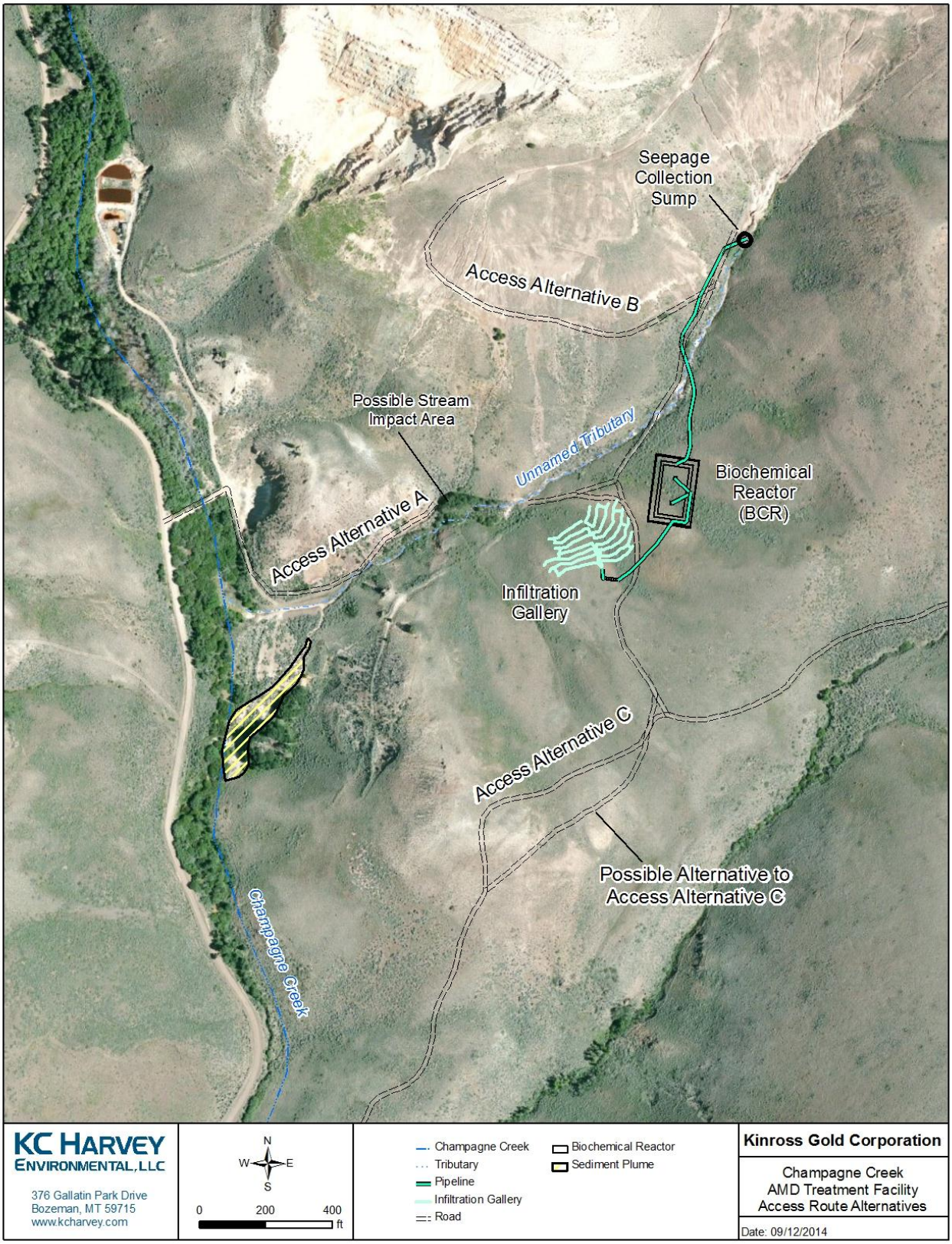

Figure 3. Three potential access alternatives.

2.2. No-action Alternative

Under the No-action Alternative, a ROW for a PWMS would not be issued. The voluntary management of the acidic seep would not occur. Seepage water would continue to impact Champagne Creek. The existing sediment plume and surrounding area erosion problems would not be remediated.

3.0 Affected Environment and Environmental Consequences

The project is located in the watershed of the small unnamed ephemeral south tributary of Champagne Creek. The general project area encompasses a seep that surfaces down-gradient of a reclaimed mine waste rock pile near the tributary headwaters, and travels downslope, mostly sub-surface, towards Champagne Creek. The project area has herbaceous vegetative cover and is dominated by upland species. The lower end of the tributary has woody riparian vegetation that is contiguous with the Champagne Creek canyon riparian zone. Project area slopes are relatively steep with a west facing aspect. The proposed project elements would be located outside, but adjacent to, the unnamed tributary channel. The project area land owner is the BLM.

The following sections describe the affected environment and anticipated environmental consequences under the Proposed Action and the No Action Alternative. These subjects were identified by the BLM Interdisciplinary Team in the EA checklist as present [potentially] impacted. Items identified as not present or present not impacted are not evaluated.

3.1. Access

Affected Environment

IGC is evaluating three potential access alternatives (see Section 2.1) for use by construction equipment and for long term maintenance (Figure 3). The access evaluation considers necessary requirements for equipment access and staging areas while minimizing environmental impacts. The access alternatives may construct new or improve existing two track road segments. Construction and improvement activities may require cut and fill materials, soil disturbance, and vegetation removal.

Environmental Consequences

Proposed Action
Anticipated consequences for the access alternatives are detailed in Table 2. Alternative A is anticipated to result in the greatest number of environmental impacts including tree removal and road cutting. Alternative B is anticipated to result in the greatest construction challenges and safety risks in addition to soil and vegetation disturbance. Alternative C is the least environmentally damaging and most practicable alternative of the three access alternatives considered.

The proposed action will impact the project area by improving access during construction and maintenance where access was previously limited. Following project completion, upgrades to access routes will also provide improved access for the general public. Some vegetation may be removed for the construction or maintenance. Following any access reclamation activities, vehicle access may be limited to particular travel routes necessary for site maintenance. Cumulative impacts may include isolated decrease in vegetation cover on the access routes.

No Action Alternative
Under the No Action alternative, no access road will be constructed or maintained. Access will not improve, the site would be inaccessible for large construction equipment, and voluntary management of the acidic seep would not occur.

Table 2. Anticipated impacts for access alternatives.

Access Alternative	Environmental Consequences
Alternative A	Construction would require tree removal, significant cut and fill, and channel encroachment. Reclamation of construction impacts would be required.
Alternative B	Slope soil and vegetation disturbance. Reclamation of construction impacts would be required.
Alternative C	Vehicle and equipment traffic over existing two track roads may require grading and improvements. Moderate ground disturbance on a localized area would be needed. Possible post-construction restoration and reseeding for maintenance use.

3.2. Air Quality

Affected Environment

The project is not located in or proximal to a U.S. Environmental Protection Area (EPA) air pollutant nonattainment zone. The BLM does not have any management designations or standards established for emissions in and around the project area. There are no existing industrial or concentrated vehicular emission sources within the project area.

The project area is located eight miles north of Craters of the Moon National Monument which is a Class I Airshed, a National Atmospheric Deposition Program monitoring site, and a long-term climate change monitoring station (NPS 2014).

Environmental Consequences

Proposed Action
Project construction would result in temporary emissions associated with combustible engines of equipment and vehicles. These emissions would be well below the EPA thresholds requiring monitoring, industrial permitting, or nonattainment implementation. The temporary construction will be isolated to the project area and will not impact air quality at the Craters of the Moon National Monument.

Temporary construction dust may occur on the selected access route as a result of vehicular and equipment traffic. The project construction contractor would be responsible for implementing dust control best management practices on the access road and in workspaces. An equipment parking and staging area established at the project construction site would minimize daily trips on Champagne Creek Road. If construction results in increased Champagne Creek Road daily traffic volumes, the Idaho Gold Corporation and construction contractor would coordinate with the BLM and Butte County to extend dust control practices onto Champagne Creek Road. Dust reduction best management practices typically include water treatment.

Project operations would not result in persistent exceedances of EPA air quality standards. The passive design of the project would not require mechanized fuel combustion for operations. The

below ground biochemical treatment reactor would be ventilated with passive air venting piping. The seepage water metal contaminants would anaerobically react and be sequestered by the organic medium as metal sulfides, while producing excess alkalinity to increase pH to near-neutral. The design capacity of the BCR to adsorb and sequester metals is 20-25 years under current conditions. After that period, the BCR substrate would be dried, removed, and replaced.

The facility piping and holding tanks may also require periodic maintenance. No excessive or unsafe levels of vapors, lead, volatile organic compounds, particulates, or sulfuric, carbon, or nitrogen oxides would occur. Anticipated vent emissions would include low and natural ambient levels of carbon dioxide, hydrogen sulfide, and nitrogen oxide.

The temporary construction and periodic maintenance impacts to air quality will not result in any cumulative impacts.

No Action Alternative
There would be no air quality impacts under the No Action Alternative from construction or maintenance. However, because the acidic seep is still present, there may be roadside dust and emission impacts from continued sampling and study events at the site using vehicles. In addition, until the sediment plume is reclaimed, the low vegetation cover on the plume may lead to wind erosion and impacted air quality.

3.3. Land Uses

Affected Environment

Grazing is the only existing BLM permitted land use in the project area. There are no other permitted or designated BLM land uses in the project area. Recreation is an assumed land use associated with all public land access.

The project is located in the active BLM Chicken Creek grazing allotment (Allotment #11028). Livestock (up to 225 cattle) are permitted within the project area between 7/1 and 10/15 (BLM pers. comm. 2014b). The allotment is comprised of multiple pastures used by two operators each with established grazing management plans. The project area is only utilized by one of the two operators. A 1999 assessment identified the Chicken Creek allotment as meeting the following Idaho standards for rangeland health (BLM 1997):

1– Watersheds	4 – Native Plant Communities
3 – Stream/Channel/Floodplain	8 – Threatened and Endangered Plants and Animals

Standard 2 (Riparian Areas and Wetlands) and Standard 7 (Water Quality) were not met but were progressing towards meeting the standards. Standard 5 (Seedings) and Standard 6 (Exotic Plant Communities) were not applicable.

Environmental Consequences

Proposed Action
The project is not anticipated to result in negative effects on land uses. Reclamation of areas disturbed by construction, burial of the flow splitter pipe, BCR, infiltration gallery, and holding tank, and subsequent native species reseeding is anticipated to have negligible effects on grazing

forage and rangeland health standards. Livestock may be temporarily displaced if timing of use were to coincide with construction activities. This situation would be temporary and have limited effect on permitted use in the area. The proposed project could result in positive effects on rangeland health standards by improving Champagne Creek water quality. This could be a beneficial cumulative effect with water quality treatment of Moran Tunnel discharge. The project would also potentially benefit downstream land use, in particular the ranch using Champagne Creek water for forage crop irrigation. There will be no cumulative impacts on land use.

No Action Alternative
Conversely, the no-action alternative would potentially result in adverse effects on rangeland health standards and downstream land uses. For example, acidic water may decrease vegetation production for grazing and water quality for livestock. Under the no-action alternative, the existing mine waste rock pile seep would continue to discharge impacted water towards Champagne Creek; the sediment plume, and the erosion potential would remain.

3.4. Floodplains

Affected Environment

The project area including Champagne Creek is located in an unmapped Federal Emergency Management Agency (FEMA) area. The BLM does not have any floodplain or special management designations for the project area. Champagne Creek and its unnamed ephemeral tributary primarily derive hydrology and stream flows from snowmelt, and secondarily from rainfall events. Groundwater seepage likely contributes as well. Riparian vegetation is common, but indicators of a well-defined floodplain are lacking due to the ephemeral and intermittent flows, and high gradient geomorphological position.

A more well-defined floodplain is evident on Champagne Creek three to four miles downstream from the project where the creek exits the canyon. This area is also unmapped by FEMA and still has a relatively high gradient channel with beaver dam complexes below the Poison Gulch confluence. Below the Poison Gulch confluence, water from Champagne Creek is used for crop irrigation at Wisdom Ranch and the stream channel and its floodplain become dry.

The Champagne Creek floodplain has been impacted for decades by historic mining materials such as waste rock, acid mine drainage, and eroded soils depositing in the floodplain. In the last ten years, some waste rock located on the south waste dump has eroded from the hillside and deposited in the Champagne Creek floodplain via the south unnamed ephemeral tributary.

Environmental Consequences

Proposed Action
The proposed action would remediate the existing sediment plume within the floodplain near the confluence of the unnamed ephemeral tributary and Champagne Creek. Over time, the cumulative impact would be improved floodplain quality. Installation of erosion BMPs would minimize deposition of sediment within the floodplain. Three access alternatives are considered to support construction. Access Alternative A would have the greatest impact on the unnamed tributary since encroachment into the floodplain would be required. Access Alternatives B and C would not be impediments nor displace drainage capacity on the unnamed tributary. No impacts to Champagne Creek floodplain capacity is anticipated as a result of the proposed project.

No Action Alternative
Under the no-action alternative, the existing historic mining materials such as waste rock, acid mine drainage, and eroded soils will continue depositing in the floodplain further degrading the floodplain quality.

3.5. Invasive and Non-native Species

Affected Environment

Invasive and non-native species of plants and animals have not been mapped or identified in any BLM special management plan, or other BLM, state, or county designation for the project area. The Idaho standards for rangeland health Standard 5 (Seedings) and Standard 6 (Exotic Plant Communities) are classified as not-applicable for the project area. Nevertheless, some invasive and non-native plants are present in the project and surrounding area. The primary invasive species is cheatgrass (*Bromus tectorum*). Cheatgrass typically grows in the understory of native sagebrush and grassland communities in the project area. Despite its presence, it is not as abundant or widespread in the project area as other areas in the region. The project area includes scattered cheatgrass patches amid desirable native species of shrubs and grasses. Besides cheatgrass, there is Canada thistle (*Cirsium arvense*) in the riparian areas and in most meadows.

Environmental Consequences

Proposed Action
The project would implement measures to minimize the spread of invasive and non-native plant species during and following construction of the preferred alternative. This includes the following construction best management practices:

- Mobilizing clean construction equipment to the project area
- Limiting and minimizing surface disturbance
- Limiting and minimizing vehicle and equipment movements to designated areas
- Stockpiling topsoil for reapplication on disturbance and constructed surfaces
- Using certified weed free seed mixes and mulches

Invasive and non-native species infestations detected as a result of construction may be subject to spot herbicide and/or reseeding treatments as needed during follow-up maintenance. Improved access routes would allow periodic control and maintenance of invasive plant infestations in the area. Reclamation efforts would decrease bare soils, improve vegetation cover, and revegetate with desired species which may lead to decreased invasive species. Cumulative impacts include improved invasive species control access and reduced infestations.

No Action Alternative
Under the No Action Alternative, the degradation of plant communities from the ARD would continue to create sites for invasive plants to establish and spread. Access would remain limited for invasive plant management efforts

3.6. Migratory Birds

Affected Environment

The land cover classification within the project area is sagebrush-grassland community. This plant community extends into the surrounding uplands. A forested riparian community along Champagne Creek extends into the lower reach of the unnamed ephemeral south tributary below the project area, within access road Alternative A. No migratory bird nesting concentrations (i.e. colonial species) were observed within or immediately adjacent to the project area. There are no documented sightings of BLM or U.S. Fish and Wildlife Service (USFWS) special status species; no special management areas, or other avifauna related occurrences documented within or adjacent to the project area. Although there are no documented sightings within or adjacent to the project area, it is still likely that BLM Special Status Species may utilize this habitat during some part of the year.

The project area provides nesting, foraging, roosting, and seasonal migration stopover habitat for migratory bird assemblages common to sagebrush-grassland and adjacent riparian habitat of the Level IV ecoregion. The primary nesting period for the project area is April 15 to July 31.

Environmental Consequences

Proposed Action
Project impacts on migratory birds are anticipated to be minimal. Project construction is scheduled for the fall of 2014 outside of the primary nesting period. Revegetating buried diverter pipe, BCR, holding tank and other disturbed construction areas would minimize habitat loss. The preferred access Alternative C would avoid habitat losses associated with tree removal in riparian areas. Cumulative impacts on migratory birds include long-term benefits from reclamation and revegetation improving vegetation for nesting, foraging and roosting over time.

No Action Alternative
If the voluntary management of the acidic seep does not occur, the sediment plume and acidic seep may continue to expand and the migratory bird habitat quality and vegetation cover and diversity may decrease.

3.7. Soil Resources

Affected Environment

According to the Natural Resource Conservation Service (NRCS) Soil Survey of Butte County, Idaho, the project is located in the Howcan-Zeebar-Hutchley association, 15 to 60 percent slopes. This association has a 35 percent Howcan, 25 percent Zeebar, and 20 percent Hutchley composition. The association is well-drained with parent material from colluvium and alluvium over quartzite or andesite. The typical profile is comprised of neutral gravelly loam, very gravelly clay loam, and extremely gravelly loam. The association landform is ridges and mountain slopes.

The project is not located within or in close proximity to any BLM soil special management area, restrictions, or other classifications. Similarly, the project is not located in or proximal to other sensitive or unique soil designations.

Past disturbances of the site soils include geotechnical assessments and reclamation repairs. Additional details on soil pit data collected during the geotechnical assessments will be included in

the Design Report Appendix. In 2010, IGC entered into a Memoranda of Agreement with the BLM for completing reclamation repairs on the site. These activities included removing soil sediment (waste rock) from the unnamed tributary. This material was disposed in an existing open pit mine with the mine owners permission.

A sediment plume is present on the project site as a result of precipitation and snow melt washing sediment downslope from the reclaimed waste rock dump. The washout created an alluvial fan shaped deposition approximately 300 feet long and 50 feet wide. The sediment consists of a combination of eroded soil and fine textured waste rock material and exhibits a low pH with elevated metal concentrations. Sediment deposition is adjacent to a historic mine dump which may also have contributed sediment. The sediment plume has a maximum depth of about one foot with underlying native soils. Vegetation is present on the sediment plume; however, vegetation in an approximate 20 x 150 foot area exhibits more obvious adverse impacts.

Environmental Consequences

Proposed Action

Soil resources would be temporarily disturbed during construction including minor excavations or stripping for road access. Topsoil excavated during construction would be separated and stockpiled to protect the topsoil resource. The majority of the excavated soils would be associated with construction of the biochemical reactor and adjacent holding tank. A trencher or excavator is anticipated to be used to excavate for the flow splitter pipe trench. Trench excavated rock and soil material would be cast along both sides of the trench for use as backfill upon installation of the pipe. Soils may be compacted where equipment use is concentrated.

Removal or in-situ treatment of the sediment plume would amend soil properties, improve the growing medium, and may increase vegetation productivity. The removal of vegetation or disturbance to soil structure during construction may temporarily increase soil erosion. Soil stockpiles would be contained with erosion and sediment controls. The completed BCR, infiltration gallery, and holding tank would be reburied and covered with stockpiled topsoil. The topsoil pile would be seeded with a temporary cover crop or a weed free certified native seed mix if not replaced by the end of the season. Cumulative impacts of the proposed action would be improved soil quality on the site leading to increased vegetation growth.

Gravels and well drained soils used in the infiltration gallery construction may provide additional soil drainage to the area. The infiltration gallery would not impact soil productivity but the increased drainage may cause isolated decreases in plant productivity.

Work space and access road surface soils disturbed by equipment and vehicle movements may be subject to temporary cover or native species seeding. Project construction erosion and sediment controls are addressed below in Section 3.10 on water quality. Dust management is discussed in above in Section 3.2 on air quality.

No Action Alternative

Under the No Action Alternative, removal or in-situ treatment of the sediment plume would not occur. The potential would exist for additional sediment deposition. Impacted soils would remain on site and may further decrease vegetation cover. Temporary construction activities would not disturb soils. However, the benefits of reclamation would not be attained.

3.8. Threatened, Endangered and Sensitive Species

Affected Environment

Butte County has five species on the USFWS Idaho county list of occurrences listed under Endangered Species Act (ESA). These include the following:

- Greater sage-grouse (Centrocercus urophasianus) – Candidate species for listing
- Canada lynx (Lynx Canadensis) – listed as Threatened
- North American wolverine – (Gulo gulo luscus) – Proposed for listing
- Bull trout (Salvelinus confluentus) – listed as Threatened with designated critical habitat
- Whitebark pine (Pinus albicaulis) – Candidate species for listing

These and other species of biota are listed in the Idaho BLM Sensitive Species List (BLM 2003). Too numerous to list, the BLM list identifies plants and animals listed as BLM Special Status Species for conservation management.

A June 2014 field survey of the project area identified steep slope, arid sagebrush-grasslands within and surrounding the project area. While the project area provides potential greater sage-grouse habitat, no additional potential habitat was observed for other ESA listed species. A month earlier, the BLM completed special status plant and animal clearance reviews (BLM 2014d, e) for several proposed test pits for the project. These test pits are located in the same areas where the proposed diverter pipe, BCR, holding tank, and infiltration gallery would be constructed. The clearance form biological evaluation for animals noted that the project potentially provides habitat for sagebrush obligate species and special status animals. The clearance review findings are addressed below in environmental consequences.

Environmental Consequences

Proposed Action
The project is anticipated to have negligible effects on greater sage-grouse habitat. There are no occurrences of grouse leks in the project area. The buried project elements and other disturbed areas would be reclaimed with stockpiled topsoil and reseeded.

Both the plant and animal BLM reviews determined that the test pits would not likely adversely affect special status species or their habitats. The same determination finding is anticipated for the project. The recommendation to provide animal escape ramps from open pits and excavations would be applied to the project. Escape ramps would be established in open excavation pits during construction to allow safe egress for animals. Construction would also occur in the late summer/fall to avoid disturbance during the breeding season for migratory birds, greater sage-grouse, and other fauna. Wildlife friendly livestock exclusion fencing or other effective deterrents would be installed around the remaining above ground BCR and holding tank vent piping. The project would also provide treatment to impacted water emitting from the seep, reducing the risk of animal ingestion.

During construction, some vegetation may be removed. The removal of vegetation may impact special status species by reducing the amount of vegetation available for potential cover, nesting, and foraging. However, due to the relatively small area of disturbance and developed mitigation measures, it is expected that these impacts would not have significant adverse short term or cumulative effects on special status species and/or their habitats.

No Action Alternative
Conversely, the no-action alternative would not result in the passive water management system. Vegetation would not be temporarily removed but the possibility for further degradation of habitat remains.

3.9. Vegetation

Affected Environment

The project area is not within any BLM special management boundaries, program target areas, or other designated uses related to vegetation. The project area meets the Big Lost MFP objectives related to vegetation goals and uses on grazing, wildlife, water quality, and fire management. Timber goals and uses are not applicable to the project area.

While observed during the 2014 site survey, invasive plant species do not appear to have compromised the integrity of the project area vegetative community. A diverse, structurally intact sagebrush-grassland community is present within and surrounding the project area. Grass and forb species diversity appears to be relatively moderate. Sagebrush and other shrub species occur in patchy distributions with densities typical of the ecotype. Juniper invasion is minimal to non-existent throughout the project area. Excluding the adjacent closed mining area, disturbance is limited. Early succession sagebrush and native plant species are establishing in the reclaimed areas of the closed mine. The native plant communities standard for rangeland health was being met when it was last assessed in 1999.

Environmental Consequences

Proposed Action
Project vegetation impacts would be minimized through best management practices, reclamation and revegetation of disturbed areas. Some native vegetation would be removed or crushed during construction and access improvement activities, which would be mitigated by revegetation efforts. If access Alternative A is selected, vegetation removal may include tree species.

Given the relatively small area of impact, best management practices and mitigation efforts, native plant communities would continue to meet native plant community standards. Excavated topsoil with its seedbank would be stockpiled for backfilling, burying, and reclamation. Diverter pipe trench soils would be cast along excavated trenches and used to backfill upon installation of respective pipe sections. The stockpiled soils of the BCR and holding tank excavations would be used to bury these project elements. These and all disturbed soils would be seeded and if necessary mulched with certified weed free materials. The majority of the disturbed areas would be revegetated to minimize vegetative cover loss. Given the relatively small area of impact, best management practices and mitigation efforts, native plant communities would continue to meet native plant community standards.

No Action Alternative
Under the No Action Alternative, vegetation will not be disturbed during construction or maintenance. The sediment plume and acidic seep would continue to impact vegetation and may spread. No benefits of reclamation and revegetation would be attained.

3.10. Water Quality

Affected Environment

Improving the water quality of Champagne Creek is the primary purpose and need for the proposed action. The proposed action would complement the BLM's water quality improvement efforts at the Moran Tunnel adit.

Ground and surface water quality sampling data has been collected in the area through monitoring conducted over the last 30 or more years. Groundwater data is collected in wells of the project area, but since the wells are new, data is only available for the last one or two years. Similarly, surface water data is obtained from grab samples from the creek and tributary channels. Samples are processed at a laboratory for pH, metal concentrations, conductivity, dissolved oxygen, and other water quality parameters. See Appendix A for water quality and flow data for the unnamed ephemeral tributary and Appendix B for data for Champagne Creek's surface water just below the Unnamed, South Tributary's confluence with Champagne Creek and for Champagne Creek below the Poison Gulch confluence. See Appendix C for water quality data within the vicinity of the south, unnamed tributary (MW-3), below the beaver dam (MW-4 and MW-8) and the furthest downgradient monitoring well (MW-9).

Water seepage is visible just down gradient of the waste rock repository and enters the unnamed ephemeral tributary via surface flow at the seep. For most of the year, surface expression of the seep is intermittent for about 500 feet down gradient of the seep, and then is typically no longer visible at the surface. However, the location of surface flows changes seasonally and there are numerous indicators (sediment) of continuous surface flow to the Champagne Creek floodplain during snowmelt runoff and significant precipitation events.

Surface water, and to a lesser degree groundwater quality show a contrast when comparing sampling results taken above the historic mine area (Moran Tunnel) vs. the downstream results below Moran Tunnel. Alkaline water samples are normal for the region. For the unnamed tributary, downstream samples show an acidic pH and aluminum appears to be the biggest metal contributor to the acidity. Other measurable metals emitting from the seepage include iron, copper, zinc, and trace amounts of arsenic and cadmium. Consequently, total dissolved oxygen also decreases with the increased acidity. This acidic runoff from the project seep has negative downstream water quality consequences in Champagne Creek.

Environmental Consequence

Proposed Action

Improving water quality is the purpose and need for the project. The project is designed to remove metals and other acidic constituents from the project area seep as shown in Figure 2. The BCR is expected to treat seepage water in the unnamed ephemeral south tributary to a near neutral pH, sharply reduce metal levels, and direct the flows to a subsurface infiltration gallery where further attenuation of constituents is expected to occur.

Based on IGC experience at other sites, the treatment system is expected to reduce metal concentrations in the seep for the above-described metals by approximately 80 - 99% for the first 20-25 years of service depending on the specific metal. Replaced BCR media after this first "clean-out" will be placed in either the existing open pit mine, the existing waste rock repository, or

another BLM approved repository where it would have no additional, future impact on surface or ground water. Cumulative impacts are the long-term improvement of water quality and all biological life dependent on the water source.

No Action Alternative
Under the no-action alternative, no improvements to Champagne Creek's water quality from the south, unnamed tributary would occur.

3.11. Wetland and Riparian Areas

Affected Environment

Wetlands and riparian habitats are limited in the project area. Herbaceous wetland species within or immediately adjacent to the project area are scattered with minimal coverage. There are live willows species (*Salix* spp.) near the head of the unnamed tributary. Champagne Creek and the lower end of the unnamed south tributary have a well-defined riparian vegetative community dominated by quaking aspen. Approximately 20 years ago, the unnamed ephemeral tributary was dominated by a mixture of willow, quaking aspen, and herbaceous riparian-wetland communities. Over time, the acidic water seepage appears to have eliminated many of the riparian plants in the upper half of the drainage (BLM 2014c).

Champagne Creek is in the major watershed of the Snake River. Champagne Creek exhibits a dis-continuous surface flow through the project area and down gradient. Champagne Creek receives more flow from Posion Gulch about two miles above the ranch. Stream water is diverted onto hay fields at the ranch. Downstream of the ranch a channel is no longer easily defined, and any remnant channel "disappears" into the extensive down gradient lava flows. With the lack of consistent flows or connectivity in Champagne Creek and distant proximity to USACE jurisdictional extent, all wetlands and waters in the project region would likely be non-jurisdictional under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Jurisdiction would ultimately require verification from the USACE if wetlands or waters were in the project area and affected by dredge or fill activities.

Wetlands in the area would be regulated by the BLM in accordance with Executive Order 11990 on wetlands and no-net loss. Surrounding wetlands, streams, and riparian oversight is provided through BLM guidance, policy and management plans.

Environmental Consequences

Proposed Action
The project elements are located outside of and upslope from the Champagne Creek and unnamed ephemeral south tributary riparian vegetation zone. The preferred access Alternative C would avoid impacting trees and vegetation in the riparian zone of the unnamed tributary. The access Alternative A would require tree trimming or removal and vegetation clearing in the riparian zone of the unnamed tributary.

The proposed project would improve wetland and riparian areas by reducing or eliminating acidic water seepage. Cumulative impacts include plant communities becoming more productive and expanding. Associated wildlife usage of the wetland and riparian area may increase as water quality and vegetation improves.

No Action Alternative
Under the No Action Alternative, riparian plants would continue to be negatively impacted due to the acid water seepage. This would result in continued impacts to the wetland and riparian area vegetation community abundance and distribution, and to wildlife along the unnamed tributary.

3.12. Wildlife Resources

Affected Environment

Threatened, endangered, and sensitive species are addressed in Section 3.8, and migratory birds in 3.6. Sagebrush-grassland habitat is present within and surrounding the project area. Woody tree and shrubby riparian habitat is present immediately downslope of the project area along Champagne Creek. Wildlife assemblages in the project area are typical to the region. There is little to no existing development in the surrounding area, minimizing fragmentation. The closed mine has been reclaimed where wildlife movements are unimpeded. Champagne Creek is likely a corridor for wildlife movement. The project area provides seasonal habitat for ungulates moving to and from higher or lower elevations.

The project area is not within or in close proximity to designated state or BLM management or seasonal restricted areas related to wildlife. Project area wildlife related management objectives in the Big Lost MFP include general statements supporting habitat management, enhancement and improvement, and public use and access. Public access for hunting, trapping, and passive wildlife activities are allowed in accordance with state and federal regulations, and BLM policies.

Environmental Consequences

Proposed Action
The project is not anticipated to result in habitat fragmentation, wildlife movement disruption, or long term aversion of the project area following construction. The project would provide treatment to acidic water emitting from the seep, reducing the risk of wildlife ingestion. Cumulative impacts will be minimal.

No Action Alternative
Conversely, the no-action alternative would not result in treatment of this risk.

4.0 Cumulative Effects

This section of the document discloses the incremental impact that the Proposed Action Alternative and the No Action Alternative are likely to have when considered in the context of impacts associated with past, present, and reasonably foreseeable future actions that have occurred, or are likely to occur, in the area.

The Cumulative Impact Assessment Area (CIAA) for this analysis includes the southern portion of the Chicken Creek pasture within the Chicken Creek allotment. The boundary of the CIAA was determined based upon watershed boundaries and other uses within the area (Figure 4). The CIAA consists of approximately 1,924 acres located in Butte County (Table 3). Unless otherwise noted, this landscape unit defines the bounds of the cumulative analysis for the resources affected by the Proposed Action and the No Action Alternative. The proposed project on the Unnamed Tributary to Champagne Creek (approximately 2.25 acres) accounts for less than 1% of the CIAA.

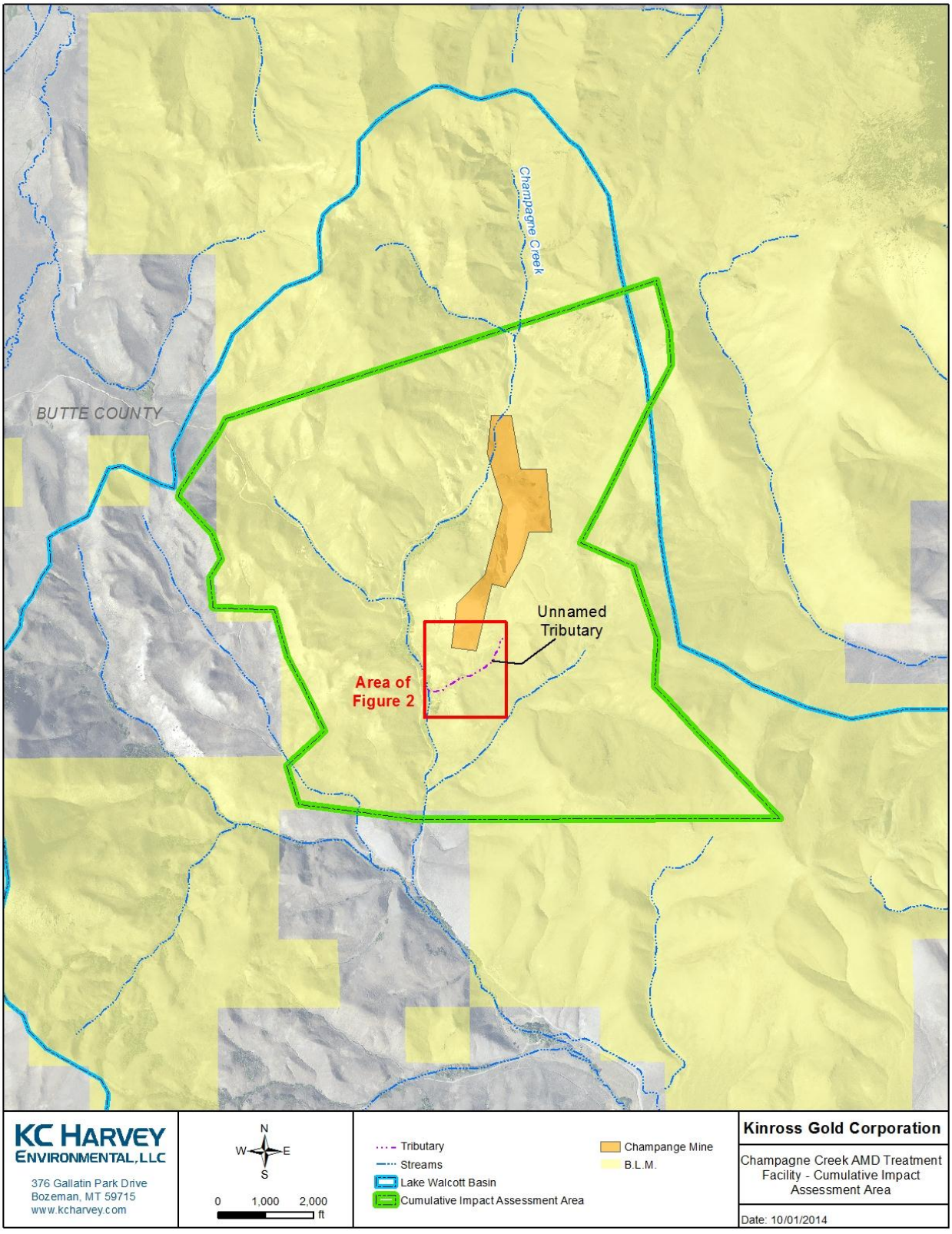

Figure 4. Unnamed Tributary Cumulative Impact Assessment Area.

Table 3. Surface Management Status within the Unnamed Tributary CIAA.

Bureau of Land Management	1,821 acres
Private Property	103 acres

Precipitation within the CIAA is primarily 8-12 inches annually, however at higher elevations precipitation can range from 12-16 inches. The CIAA includes a large continuous, ecologically unique landscape consisting of a substantial proportion of vegetation influenced by clay loam, cobbly silt loam, and gravelly loam to very cobbly loam textures in the upland areas; vegetation within the riparian/meadow communities is influenced by loam textures. The upland vegetation communities are a mosaic of mountain big sagebrush and low sagebrush in the overstory and bluebunch and Idaho fescue in the understory. The riparian/meadow communities include aspen, Booth's willow, Geyer willow, yellow willow, coyote willow, Nevada bluegrass, alpine timothy, and meadow barley.

Six different vegetation communities are found across the CIAA; annual grassland (1.8 acres), herbaceous wetland (28.4 acres), montane grasslands (4.1 acres), montane shrubland (0.9 acres), sagebrush shrubland (1869.1 acres), and semi-desert perennial grassland (19.6 acres). The proposed project is located in the sagebrush shrubland community.

4.1. Past and Present Actions

Past and present actions that have occurred in the watershed have impacted the human environment to varying degrees. These actions include infrastructure development (e.g. road-building, mining and range improvement projects), wildfire, invasive species, and livestock grazing (Table 4). Although these actions probably do not account for all of the impacts that have or are likely to occur in the Unnamed Tributary CIAA, GIS analysis, agency records, and professional judgment suggest that they have contributed to the vast majority of cumulative impacts that have occurred in the assessment area.

Table 4. Past and Present Actions within the Unnamed Tributary CIAA.

Type of Activity	Past and Present Actions
Infrastructural Developments	
Roads- paved, maintained gravel, and 2-track	Approximately 6.3 miles with a 12 foot disturbance footprint, affecting approximately 9.2 acres.
	Road density is 3.1 road miles/mile^2 in CIAA
Moran Tunnel Treatment System Footprint	Approximately 6.0 acres including treatment ponds, impacted area below the treatment ponds, beaver ponds, parking area, rock borrow hillsides and roads.
Past mining activities and associated reclamation projects (including treatment within the Unnamed Tributary)	Approximately 125.5 acres
Range Improvements	Fences: 7.6 miles
	Assuming 4 feet of disturbance along fence lines, there are 3.7 acres disturbed as a result of the existing fence lines in the CIAA.
Wildfire	
55 Recorded Wildfires between 1980 – 2011	66.7 acres
Invasive Species	
Annual grasses	1.8 acres
Livestock Grazing	
Number of Allotments	The CIAA consists of a portion of 1 pasture within 1 allotment. The entire area of the CIAA is grazed, other than portions of the riparian area and the Moran Tunnel treatment system that are fenced out.
Rangeland Health Assessments	The Chicken Creek Allotment is currently making progress towards meeting Idaho Standards for Rangeland Health.

Livestock grazing has a long history in the region dating back to the late 1800's. Livestock grazing remains a primary use in the CIAA, although at lower levels of use than the first half of the 20th century. Ranching and livestock grazing are generally dispersed activities with areas of more intensive use near water, when exclusion fences are not in place, and livestock handling facilities. There are fences used to manage livestock grazing across the landscape.

Recreation use is primarily a dispersed activity in the CIAA. Motorized vehicle use, upland bird hunting, big game hunting, and target shooting are the main recreational pursuits in the CIAA. As the popularity of all-terrain vehicles has increased over the last 15 years, new roads and trails have been created across the CIAA. Though there is only about 6.3 miles of existing motorized roads and trails, new user-built trails are discovered every year.

The CIAA has a long and rich mining history dating back to the original Hornsilver Mine opening up in 1883, followed by the Last Chance Mine in the mid-1880's. Silver, copper and zinc were the primary metals mined. In the late 1920's, the Hornsilver Consolidated Mining Company opened up the Moran Tunnel, a crosscut tunnel built to intersect the Last Chance workings. This tunnel was used until 1946. In the mid 1980's to early 1990's Idaho Gold Corporation mined out the North Pit and South Pit just east of Upper Champagne Creek for silver and gold. Waste rock overlying North Pit was placed in the South Waste Dump at the head of the unnamed tributary drainage. This waste dump was not shaped or contoured to shed water very well, and consequently stored water and the water table formed a spring at the lower end of the dump, prompting this proposed action. After North Pit was mined out, overburden above South Pit was placed in North Pit. Through a

Memorandum of Agreement (MOA), from 2010 to 2012 Idaho Gold Corporation reshaped the south waste dump, draining the dump after incorporating topsoil, stabilized the ephemeral unnamed tributary channel with rock gabions, and built a treatment ditch on the lower end of the tributary.

4.2. Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions include continuation of the past and present actions as described above, additional disturbance at the Moran Tunnel treatment area, and the development of a travel management plan for the area. The level and character of livestock grazing is anticipated to remain consistent into the foreseeable future.

Infrastructure development is not anticipated to continue to increase in the foreseeable future. Any further development of infrastructure is expected to occur only within current disturbance footprints.

Recreation visitors have developed new roads and trails over the past 15 years and continue to create new roads and trails in the allotment and adjacent public lands. The BLM will conduct Travel Management Planning for the Chicken Creek allotment during future travel management planning activities. This would allow a comprehensive approach to the ground management and administration of travel and transportation networks of roads, primitive roads, trails, and areas. It's reasonably foreseeable that there would be specific road, primitive road and trail designations (i.e., limited to designated routes, limited to type or mode of travel, limited to time or season of use, limited to authorized or permitted vehicles or users).

There are no other known primary activities proposed on public lands in the CIAA, however the area has an active mining history and plans of development may be submitted in the future. One exploration notice was submitted a few years ago but actual exploration activities did not take place. Invasive species and wildfire continue to be primary threats that cannot be anticipated in frequency or intensity. Impacts associated with wildfire are the greatest threat (USFWS 2010) to sage-grouse in the CIAA. Managing for healthy habitats in the CIAA provides the most protection against invasive species and resiliency to disturbances such as wildfire.

4.3. Impacts Associated with Past, Present, and Foreseeable Future Actions

Past and present actions have resulted in varying degrees of impact to the resources considered in the analysis. Observable impacts are higher for infrastructure development which has resulted in direct habitat loss and fragmentation within the CIAA. These actions have altered the native vegetation and introduced non-natural elements of form, line, and color that have altered and would continue to alter the characteristics of the visual landscape.

Infrastructure development has increased over time, and a portion of the CIAA has been developed for roads and a treatment system for AMD water draining from Moran Tunnel and from the unnamed tributary. These developments have resulted in a minor loss of sagebrush habitat, and a loss of connectivity between remaining sagebrush habitats within the CIAA. These structures have increased the perching habitat for avian predators in the area. The existing roads and trails create a small amount of soil compaction and erosion, and may be vectors for the spread of noxious weeds. However, they provide access for the public to large expanses of public lands for hunting and all-terrain vehicle riding in the CIAA.

Documented fires have impacted approximately 66.7 acres or 3.5 percent of the CIAA from 1980 to the present. No intensive rehabilitation treatments were prescribed for these fires.

Drought is a recurring, unpredictable, environmental feature. Drought has been defined by the Society of Range Management as: "(1) a prolonged chronic shortage of water, as compared to the norm, often associated with high temperatures and winds during spring, summer, and fall; and (2) a period without precipitation during which the soil water content is reduced to such an extent that plants suffer from lack of water" (Bedell, 1988). Impacts associated with drought can be widespread. All plants and animal species depend on water. When drought occurs, available forage for consumption as well as habitat can be damaged. Potential environmental impacts include but are not limited to: loss or destruction of fish and wildlife habitat, lowering of water levels in reservoirs, lakes and ponds, loss of wetlands, and increased threat of wildfires. Some additional impacts include wind and water erosion of soils, reduced shoot and leaf growth, reduced reproductive potential, induced senescence, and plant death (National Drought Mitigation Center, 2013).

Periods of extended drought likewise impact the CIAA. Based on climatic data collected near Arco, Idaho, precipitation has been reported below the long-term average in 6 of the past 10 years, with greater than 20 percent below average. While this may not be representative of the entire CIAA it is an indication of the amount of drought that has occurred within portions of the CIAA. Drought impacts the CIAA by providing less water to natural features such as Upper Champagne Creek and the natural springs at the head of the unnamed tributary, providing less water to dilute AMD.

Unmanaged livestock (cows and sheep) grazing in the first half of the 20th century resulted in altered ecological conditions in the CIAA. As livestock grazing became more carefully managed in the area, the ecological health of the rangelands improved. The entire CIAA is being improved to ensure the proper functioning of ecological processes and continued productivity and diversity of native plant species. These healthy uplands are providing suitable habitat to support a wide variety of wildlife species, including several game and nongame species, special status species and migratory birds.

The U.S. Fish and Wildlife Service (USFWS) identified primary and other threats to Greater sage-grouse in its 12-Month Findings for Petitions to List the Greater Sage-Grouse as Threatened or Endangered (USFWS 2010). The primary cause of sage-grouse population decline identified by the USFWS was fragmentation of sagebrush habitats due to: habitat conversion for agriculture or urbanization, infrastructure within sagebrush habitats (power lines, communication towers, fences, roads, railroads, etc.), wildfire and energy development (specifically roads and energy related infrastructure). Other important threats included: inadequate regulatory mechanisms, invasive plants (annual grasses and noxious weeds), climate change, collisions (with fence, power lines, etc.), conifer invasion, contaminants, disease (West Nile virus), poorly managed livestock grazing, hunting, mining, predation, prescribed fire/vegetation treatments, recreation (OHV use) and water developments (USFWS 2010). It is often the cumulative impact of various disturbances that have the greatest effect on sagebrush ecosystems, rather than any single disturbance (Knick et al. 2011). Table X above includes the known impacts occurring within sage-grouse PPH within the Unnamed Tributary CIAA.

Wildfire, infrastructure, activities associated with livestock grazing and past mining activities provide the greatest cumulative impact to sage-grouse within the CIAA. When combined with all other identified impacts, about 11 percent of PPH in the CIAA have been disturbed by one or more activities. Aside from the direct impacts of habitat alteration, these disturbances may alter sage-grouse behavior causing them to avoid impacted habitats or displace populations to more suitable areas. This project, being only 2.25 acres in size, and about half of which is already disturbed by the test pits and undeveloped roads, would have minimal impacts on the Greater sage grouse.

4.4. Contribution of the Alternatives to the Cumulative Impacts in the CIAA

Alternative A – Proposed Action

Alternative A would contribute very little to the collective impact associated with past, present and reasonably foreseeable future actions. Disturbance activities would occur primarily within previous disturbance footprints. The area of the proposed infiltration gallery has had limited disturbance activities occurring in the past, however the proposed footprint (approximately 2.25 acres) accounts for only 0.1% of the CIAA. Additionally, these areas would mostly be reclaimed once construction activities have been completed. The disturbance activities would contribute a minor change to the collective impact relative to non-natural elements of form, line, and color within the landscape. The number of road miles within the area would increase as a result of implementing Alternative A. The amount of suitable habitat for wildlife species that occur in the CIAA would remain about the same. The actions described in Alternative A would not substantially alter the current or expected future conditions of natural resources in the CIAA.

Alternative B – No Action

Alternative B would contribute very little to the collective impact associated with past, present and reasonably foreseeable future actions. Livestock use would remain at current levels, and there would be no new structural developments which would contribute change to the collective impact relative to non-natural elements of form, line, and color within the landscape. The number of road miles within the area would not increase as a result of implementing Alternative B. The amount of suitable habitat for wildlife species that occur in the CIAA would remain about the same. The actions described in Alternative A would not substantially alter the current or expected future conditions of natural resources in the CIAA.

5.0 Proposed Mitigation

Proposed project mitigation would occur primarily with construction and secondarily through design to avoid and minimize impacts. Design impact avoidance and minimization measures include the following:

- Locating the project elements outside of the channel of the unnamed ephemeral south tributary, associated riparian vegetation (trees and shrubs), on relatively level slopes
- A preferred access route that avoids impacts to riparian vegetation and the need for cut and fill materials in and adjacent to the unnamed south tributary channel
- Remediation of the sediment plume using in-situ, removal and disposal, or both using an adaptive approach that minimizes disturbance
- Burying and revegetating the diverter pipe, BCR, and holding tank near or at grade to minimize visual impacts and habitat loss
- Using earthtone colors on remaining above ground project elements including vent piping to minimize visual impacts
- Applying erosion control BMPs using an adaptive approach to minimize impacts while providing effective solutions
- Project construction would occur during the late summer and fall to avoid wildlife reproduction seasons.
- Escape ramps would be constructed in open trenches and excavations during construction to provide safe egress for animals.

- Disturbed areas would be reclaimed and reseeded following construction.
- Wildlife friendly livestock exclusion fencing or other barriers such as boulders would be constructed or placed around all remaining above-ground project elements including vent piping and holding tank.

Proposed construction impact avoidance and minimization measures include:

- Installing erosion and sediment controls in accordance with BLM construction requirements
- Mobilizing clean vehicles and equipment to the project to minimize invasive and non- native plant dispersal
- Stockpiling excavated topsoil for reapplication upon completion of construction
- Reseeding disturbed areas with certified weed free materials
- Limiting construction traffic to designated areas to minimize soil compaction, dust, and vegetation disturbance
- Applying dust control measures if needed
- Avoid ground-disturbing activities during the nesting period from April 15th to June 30th

The BLM would be notified if any resources are discovered during construction including cultural resources, threatened endangered or sensitive species, wildlife conflicts, and hazards.

Post construction activities would be limited to long-term facility maintenance access. The project access road (Access Alternative C) would be used for vehicles and equipment needed to clean the holding tank, replace the BCR treatment media, and conduct repairs as needed.

6.0 List of Preparers

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Appendix A: Water quality and flow data for the unnamed ephemeral tributary.

Table A- 1. Flow Data for Unnamed Tributary in South Drainage, Champagne Creek (Last updated 09/03/2014)

Date	Upper Site seep flow (gpm) below Lower Transition Basin	Lower Site flow (gpm) above treatment ditch and Champagne Creek
05/25/2010		20 (est.)
06/03/2010		12
06/17/2010		10
07/08/2010		6.5
08/13/2010		2.6
09/13/2010		3 (est.)
09/16/2010		3.2
10/27/2010		1.3
03/31/2011	5.7	
05/19/2011	6.8	
06/08/2011	5.6	
06/14/2011	5.2	
06/21/2011	4.8	5.0
07/07/2011	4.3	
07/14/2011	4.3	
07/26/2011	3.6	
07/27/2011		3.9
08/11/2011		4.0
08/12/2011		0.0 (had dug in channel)
09/19/2011	3.1	2.6
10/13/2011	2.8	
11/17/2011	2.5	
05/09/2012	2.0	
05/15/2012	2.0	
05/23/2012	2.2	
06/06/2012	2.0	
06/26/2012	2.0	0
07/24/2012	1.5	
09/26/2012	1.25	0
10/01/2012	1.2	0
06/06/2013	1.2	0
06/13/2013	1.3	0
08/08/2013	1.1 (est.)	0
05/09/2014	0.71	0
05/22/2014	0.70	0
06/02/2014	0.63	0

Based on past flow data from Champagne Creek below Poison Gulch, if you look at a rough average of 0.45 cfs (202 gpm), and a rough average of 10 gpm for the unnamed drainage, Champagne Creek below Poison Gulch has a flow roughly 20 times greater than this unnamed drainage.

Table A- 2. Unnamed South Tributary at Upper Seep just below Waste Dump (All concentrations in mg/L except for pH; metal samples from preserved, unfiltered samples)

Date	Sampler	Q (gpm)	SO4	TDS	pH	Al	As	Cd	Cr	Cu	Fe	Hg	Ni	Ag	Zn
05/19/11	Kinross	6.8	14,800	18,600	2.7	1570	0.04	1.33	0.820	11.6	719.	<0.0002	8.10	<0.02	50.5
10/13/11	Kinross	2.8	16,700	19,300	2.7	1440	<0.06	1.04	0.190	8.30	1240.	<0.0002	6.62	<0.05	43.7
05/23/12	Kinross	2.2	13,700	16,500	2.8	1360	<0.01	0.87	0.34	6.65	1140	<0.0002	5.84	<0.01	41.3

Note: This station is in Butte County.

Table A- 3. Unnamed South Tributary at Lower Station just above Treatment Ditch (All concentrations in mg/L except for pH; metal samples from preserved, unfiltered samples)

Date	Sampler	Q (gpm)	SO4	TDS	pH	Al	As	Cd	Cr	Cu	Fe	Hg	Ni	Ag	Zn
05/19/11	Kinross		7780	11,100	2.9	868	0.03	0.740	0.350	5.35	232	<0.0002	5.60	<0.02	29.6
10/13/11	Kinross		8990	9340	3.0	633	<0.06	0.530	0.04	2.50	124	<0.0002	5.08	<0.05	25.0
05/23/12	Kinross		4840	6210	3.3	435	<0.01	0.277	<0.05	1.06	5.85	<0.0002	4.13	<0.01	18.3

Note: This station is in Butte County.

Appendix B: Champagne Creek's surface water data for area below the unnamed south tributary's confluence with Champagne Creek and for Champagne Creek below the Poison Gulch confluence.

Table B- 1. Champagne Creek below Beaver Dam (Total metal concentrations in mg/L from preserved, unfiltered samples; ND = not detected;)

Date	Sampler	Q (cfs)	EC (umhos/cm.)	W Temp (° F)	pH	Al	As	Cd	Cr	Cu	Fe	Hg	Ni	Ag	Zn
1980-1990 ave.	Various				6.52		0.04	0.03	<0.01	0.89	19.54	<0.0003	<0.05	0.0014	2.68
06/04/81	BLM	0.48	740	64.4	7.0										
03/15/90	BLM	0.11	875	44.	6.4										
08/30/90	BLM				7.1										
03/13/91	BLM				6.2										
11/14/91	BLM				6.5										
06/17/92	BLM				6.5										
09/10/92	BLM				7.0										
09/22/93	BLM				6.4										
07/26/95	BLM				6.2										
05/19/99	BLM				6.25										
10/28/99	BLM			51.8	6.72	3.94		0.047	0.001	1.55	7.21				1.75
11/16/99	BLM				6.71	5.46		0.049	0.001	2.02	5.52				1.73
03/11/00	BLM				6.51	1.54		0.045		0.865	3.18				2.87
04/27/00	BLM				6.45	3.27		0.051		1.47	6.80				3.02
05/18/00	BLM				6.32	5.50		0.064		2.64	8.16				3.14
06/28/00	BLM			52.3	6.21	0.94				0.457	3.02				1.61
07/24/00	BLM			50.9	6.35	0.18				0.08	1.84				0.258
08/22/00	BLM			49.1	6.70	0.11				0.074	2.25				0.162
09/27/00	BLM			51.3	7.90	0.76				0.194	4.39				0.229
06/28/01	BLM			57.9	5.50	0.4				0.18	0.8				2.9
07/27/01	BLM			51.4	5.85	0.54				0.189	1.51				3.54
08/14/01	BLM			56.8	6.01	0.22				0.092	2.33				3.48
09/07/01	BLM			46.0	6.60	0.19				0.092	0.889				0.355
10/15/01	BLM			41.5	6.70	0.05				0.034	2.33				0.082
05/28/02	BLM			52.5	5.81	0.2				0.14	1.2				2.89
06/17/02	BLM			50.2	6.08	0.45				0.14	1.3				3.65
07/15/02	BLM			52.7	6.01	0.5				0.14	2.8				3.87
08/12/02	BLM			50.0	6.13	0.5				0.13	2.9				3.42
09/16/02	BLM			50.0	5.97	0.8				0.15	5.3				2.99
10/16/02	BLM			48.0	5.92	0.2				0.06	4.6				2.23
11/30/04	Hedin				6.9	0.1				0.04	8.6				1.63
04/28/05	Hedin				6.83	0.58				0.15	0.78				7.73
05/23/05	Hedin	1.0 est.		51.8		7.39				0.18	3.55				1.62
10/31/05	BLM				6.2	1.1				0.33	1.26				5.66
05/17/06	BLM		950	50.0	5.3	5.7				2.47	6.03				3.86

Date	Sampler	Q (cfs)	EC (umhos/cm.)	W Temp (° F)	pH	Al	As	Cd	Cr	Cu	Fe	Hg	Ni	Ag	Zn
06/19/08	BLM			51.8		1				0.42	1.7				7.9
08/19/08	BLM			50.0		1				0.5	5.3				4.3
05/25/10	BLM					1.5				1.4	0.3				7.6
09/16/10	BLM		1450	48.2		38.8				1.53	16.6				6.82
10/27/10	BLM	0.33 est.		46.4		2.05				1.35	1.59				6.45
05/19/11	BLM					24.9				2.09	5.95				6.59
06/21/11	BLM					3.96				1.89	2.39				5.34
07/27/11	BLM					1.91				2.01	0.34				6.26
09/19/11	BLM					3.26				2.30	1.80				5.66
04/09/12	BLM					2.52				2.31	1.31				6.17
05/15/12	BLM					1.94				2.24	1.03				5.97
06/06/12	BLM					2.17				1.87	1.10				5.69
07/12/12	BLM					1.88				1.77	1.46				5.59
08/15/12	BLM					1.34				1.35	1.68				5.06
03/06/13	USGS		1680												
06/06/13	BLM		1564	55.6	5.61	3.64				3.60	0.94				10.2
07/01/13	BLM		1400			2.70				3.02	2.51				8.91
06/18/14	BLM	DRY													
07/21/14	BLM	DRY													

Note: This station is in Butte County; UTM = 299828E, 4829034N.

Table B- 2. Champagne Creek below Poison Gulch above Ranch (Total metal concentrations in mg/L from preserved, unfiltered samples; ND = not detected)

Date	Sampler	Q (cfs)	EC (umhos/cm.)	W Temp (° F)	pH	Al	As	Cd	Cr	Cu	Fe	Hg	Ni	Ag	Zn
1980-1990 ave.	Various				7.7		0.013	<0.005	<0.05	0.01	0.82		<0.05	<0.001	0.054
05/21/81		0.40	700	53.6	8.5										
08/30/90	BLM	0.4 est.			8.2		<0.005	<0.005	<0.05	0.02	0.64	<0.0005	0.03	0.010	0.010
03/13/91	BLM				7.7		<0.005	<0.005	<0.10	<0.01	0.64	0.0005	0.02	<0.005	0.006
05/02/91	BLM	0.41	430	46.4											
11/14/91	BLM			41.0	7.7		<0.005	0.008	<0.10	<0.01	0.18	<0.0005	<0.02	<0.005	0.028
06/17/92	BLM				8.0		<0.005	0.006	<0.10	<0.01	<0.05	<0.0005	<0.02	<0.005	<0.005
09/10/92	BLM				8.1		<0.005	<0.005	<0.05	0.03	<0.05	0.001	<0.02	<0.005	<0.005
09/22/93	BLM	0.60	600				<0.005	0.021	<0.05	0.08	0.85	<0.0005	0.09	<0.005	2.87
07/26/95	BLM	1.57	580	61.7	7.7		0.025	<0.005	<0.05	0.10	0.71	<0.0005	<0.02	0.006	0.198
06/29/99	BLM				8.32		0.005	0.01	0.005	0.642	7.33				0.465
07/29/99	BLM				8.07	0.456	0.002	0.004	ND	0.153	1.36	ND	ND	ND	0.183
08/18/99	BLM					0.952	0.002	0.012	ND	0.551	2.53	ND	0.016	ND	0.468
10/28/99	BLM			47.5	8.05	0.527		0.004	ND	0.159	1.3				0.14
11/16/99	BLM			44.6	8.00	0.225		0.003	ND	0.069	0.77				0.099
03/11/00	BLM			38.5	8.06	0.08		0.002	ND	0.02	0.542				0.092
04/27/00	BLM				8.09	0.166		0.002		0.041	0.722				0.076
05/18/00	BLM				7.98	ND		0.002		0.027	0.596				0.059
06/28/00	BLM			61.0	7.95	0.21				0.03	1.07				0.04
07/24/00	BLM			59.5	8.00	0.19				0.03	0.89				0.361
08/22/00	BLM			62.4	7.60	0.13				0.029	ND				0.039
09/27/00	BLM			51.3	7.90	0.17				0.024	1.16				0.034
06/28/01	BLM			65.3	8.02	0.1				0.01	0.6				0.03
07/27/01	BLM			61.3	8.08	0.151				0.015	0.706				0.020
08/14/01	BLM			63.3	8.15	0.113				0.012	0.574				0.017
09/07/01	BLM	0.18		46.3	9.83	0.248				0.024	1.28				0.048
10/15/01	BLM			41.7	8.02	0.08				0.011	1.12				0.026
05/28/02	BLM	0.65		58.3	7.35	ND				ND	0.7				0.03
06/17/02	BLM			66.0	7.68	ND				0.007	0.54				0.021
07/15/02	BLM			67.5	7.62	0.03				0.009	1.28				0.014
08/12/02	BLM			61.5	7.89	0.10				0.017	1.91				0.031
09/16/02	BLM			55.2	7.74	0.05				0.009	0.65				0.014
10/16/02	BLM			47.5	6.71	0.02				0.007	0.81				0.015
04/28/05	Hedin				7.9	<0.01				<0.01	0.53				0.03
05/23/05	Hedin			53.6		0.19				0.01	0.56				0.23
10/31/05	BLM				7.6	ND				ND	0.51				0.12

Date	Sampler	Q (cfs)	EC (umhos/cm.)	W Temp (° F)	pH	Al	As	Cd	Cr	Cu	Fe	Hg	Ni	Ag	Zn
05/17/06	BLM		800	54.5	7.8	0.6				0.16	0.67				0.54
06/19/08	BLM					ND				ND	0.2				0.04
07/15/08	BLM					ND				ND	0.3				0.04
08/19/08	BLM			55.4		0.03				0.03	0.2				0.14
09/16/10	BLM	0.6 est.	900	48.2		0.17				<0.01	0.93				0.12
10/27/10	BLM			37.4		0.22				<0.01	0.98				0.16
05/19/11	BLM					2.03				0.14	0.74				0.54
06/21/11	BLM					1.82				0.12	0.74				0.54
07/27/11	BLM	1.46 est.				0.04				0.02	0.37				0.26
09/19/11	BLM					0.25				0.01	1.02				0.063
04/09/12	BLM	1.30				0.13				<0.01	0.52				0.046
05/15/12	BLM					0.07				<0.01	0.40				0.026
06/06/12	BLM					0.04				<0.001	0.21				0.021
06/29/12	BLM	0.51	420												
07/12/12	BLM					0.06				<0.001	0.37				0.014
08/15/12	BLM					0.10				<0.01	0.73				0.017
06/06/13	BLM	0.29	622	55.8		0.11				<0.01	0.30				0.01
07/01/13	BLM	0.03	580			<0.10				<0.01	0.23				0.01
08/08/13	BLM					4.19				0.12	7.37				0.37
09/11/13	BLM					0.25				<0.01	0.55				0.02
06/18/14	BLM					0.15				<0.01	0.83				0.01
07/21/14	BLM	DRY													

Note: This station is in Butte County; UTM = 292128E, 4827130N.

Appendix C: Water quality data within the vicinity of the south unnamed tributary (MW-3), below the beaver dam (MW-4 and MW-8) and the furthest downgradient monitoring well (MW-9).

Table C- 1. Champagne Creek Ground Water Well Data—MW-3

Well ID	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3
Well Sample Method	Grab		Grab		Grab	Purged	Grab	Grab	Grab
Sample Date	10/13/12	06/06/13	06/26/13	07/11/13	08/08/13	09/13/13	05/22/14	06/18/14	07/21/14
Metal									
Al	Dry		65.2		8.51	160	75.9	65.4	56.7
As	Dry								
Cd	Dry								
Cu	Dry		0.12		0.02	0.27	0.16	0.19	0.22
Fe	Dry		1.15		7.65	56.0	0.49	0.91	1.48
Zn	Dry		3.48		0.33	5.74	3.80	3.27	3.47
Field pH						4.12	5.32		
W Temp (deg. C)						12.6			
Field Cond (umhos/cm)						3460			
DO (mg/L)							6.65		
ORP									
TOC-GWE mmt/DOW fr TOG	Dry/**33.89**	28.29/**33.89**	29.18/**33.89**	33.12/**33.89**	32.59/**33.89**	35.42/**33.89**	27.15/**33.89**	29.96/**33.89**	33.15/**33.89**
TOC-TOG	**2.73**	**2.73**	**2.73**	**2.73**	**2.73**	**2.73**	**2.73**	**2.73**	**2.73**
TOG-BOW	**33.89**	**33.89**	**33.89**	**33.89**	**33.89**	**33.89**	**33.89**	**33.89**	**33.89**
TOG-GWE = (TOC-GWE mmt) – (TOC-TOG)	Dry	25.56	26.45	30.39	29.86	32.69	24.42	27.23	30.42
HtWinWellfrBOW = (TOG-BOW) – (TOG-GWE)	Dry	8.33	7.44	3.5	4.03	1.20	9.47	6.66	3.47

Note: Bold = fixed, constant data; all well depth data in feet; all results in mg/L; * = Filtered
TOC = Top of Metal Casing;
TOG = Top of Ground;
BOW = Bottom of Well;
GWE = Ground Water Elevation; **mmt** = measurement;
DOW = Depth of Well from Ground; **fr** = from;
HtWinWellfrBOW = Height of Water in Well from the Bottom of Well

Table C- 2. Champagne Creek Ground Water Well Data—MW-4

Well ID	MW-4	MW-4	MW-4	MW-4	MW-4	MW-4	MW-4	MW-4	MW-4	MW-4
Well Sample Method	LFP	Grab	Grab	Grab	Grab	Purged	Purged	Purged	Purged	Purged
Sample Date	10/11/12	10/13/12	06/06/13	06/26/13	07/01/13	07/11/13	08/08/13	09/11/13	06/18/14	07/21/14
Metal										
Al	14.8	3.42				42.7	23.3	8.43	14.4	35.5
As	0.0062	<0.0030								
Cd	<0.0020	<0.0020								
Cu	0.03	0.019				0.05	0.02	<0.01	0.01	0.03
Fe	24.9	4.25				50.3	24.4	7.47	13.5	35.9
Zn	0.105	0.0339				0.22	0.15	0.09	0.12	0.24
Field pH	6.8									
W Temp (deg. C)	10.78		8.0							
Field Cond (umhos/cm)	1126		1130		1100					
DO (mg/L)	8.04									
ORP	100.7									
TOC-GWE mmt/DOW fr TOG		7.3/**20.45**	4.80/**20.45**	6.00/**20.45**	6.46/**20.45**	6.73/**20.45**	8.40/**20.45**	/**20.45**	6.42/**20.45**	8.48/**20.45**
TOC-TOG	**2.35**	**2.35**	**2.35**	**2.35**	**2.35**	**2.35**	**2.35**	**2.35**	**2.35**	**2.35**
TOG-BOW	**20.45**	**20.45**	**20.45**	**20.45**	**20.45**	**20.45**	**20.45**	**20.45**	**20.45**	**20.45**
TOG-GWE = (TOC-GWE mmt) – (TOC-TOG)		4.95	2.45	3.65	4.11	4.35	6.05		4.07	6.13
HtWinWellfrBOW = (TOG-BOW) – (TOG-GWE)		15.55	18.00	16.80	16.34	16.10	14.40		16.38	14.32

Note: Bold = fixed, constant data; all well depth data in feet; all results in mg/L; * = Filtered
TOC = Top of Metal Casing;
TOG = Top of Ground;
BOW = Bottom of Well;
GWE = Ground Water Elevation; **mmt** = measurement;
DOW = Depth of Well from Ground; **fr** = from;
HtWinWellfrBOW = Height of Water in Well from the Bottom of Well

Table C- 3. Champagne Creek Ground Water Well Data—MW-8

Well ID	MW-8	MW-8	MW-8
Well Sample Method	Purged*	Purged	Purged
Sample Date	09/12/13	06/18/14	07/21/14
Metal			
Al	0.012	8.26	44.6
As			
Cd	0.0002		
Cu	0.006	<0.01	0.05
Fe	0.01	7.23	45.5
Zn	0.006	0.04	0.14
Field pH	7.3		
W Temp (deg. C)	15.2		
Field Cond (umhos/cm)	940		
DO (mg/L)	5.8		
ORP			
TOC-GWE mmt/DOW fr TOG		**7.63/50**	**9.80/50**
TOC-TOG	**~2.8**	**~2.8**	**~2.8**
TOG-BOW	**50**	**50**	**50**
TOG-GWE = (TOC-GWE mmt) – (TOC-TOG)		4.83	7.0
HtWinWellfrBOW = (TOG-BOW) – (TOG-GWE)		45.2	43.0

Note: Bold = fixed, constant data; all well depth data in feet; all results in mg/L; * = Filtered
TOC = Top of Metal Casing;
TOG = Top of Ground;
BOW = Bottom of Well;
GWE = Ground Water Elevation; **mmt** = measurement;
DOW = Depth of Well from Ground; **fr** = from;
HtWinWellfrBOW = Height of Water in Well from the Bottom of Well

Table C- 4. Champagne Creek Ground Water Well Data—MW-9

Well ID	MW-9	MW-9	MW-9
Well Sample Method	Purged*	Purged	Purged
Sample Date	09/11/13	06/18/14	07/21/14
Metal			
Al	0.07	0.62	0.78
As			
Cd	0.0001		
Cu	0.006	<0.01	<0.01
Fe	0.16	0.30	0.53
Zn	0.002	<0.01	<0.01
Field pH	7.3		
W Temp (deg. C)	9.8		
Field Cond (umhos/cm)	1310		
DO (mg/L)	4.2		
ORP			
TOC-GWE mmt/DOW fr TOG	**/50.2**	**28.78/50.2**	**32.46/50.2**
TOC-TOG		**~2.8**	**~2.8**
TOG-BOW	**50.2**	**50.2**	**50.2**
TOG-GWE = (TOC-GWE mmt) – (TOC-TOG)		25.98	29.66
HtWinWellfrBOW = (TOG-BOW) – (TOG-GWE)		24.2	20.6

Note: Bold = fixed, constant data; all well depth data in feet; all results in mg/L; * = Filtered
TOC = Top of Metal Casing;
TOG = Top of Ground;
BOW = Bottom of Well;
GWE = Ground Water Elevation; **mmt** = measurement;
DOW = Depth of Well from Ground; **fr** = from;
HtWinWellfrBOW = Height of Water in Well from the Bottom of Well