FACT SHEET
(Pursuant to Nevada Administrative Code (NAC) 445A.401)

Permittee Name: **Klondex Gold & Silver Mining Company**

Project Name: **Fire Creek Project**

Permit Number: **NEV2007104**
Review Type/Year/Revision: **Renewal 2025, Fact Sheet Revision 00**

A. Location and General Description

Location: The Fire Creek Project is located in east-central Lander County, within portions of Sections 9, 10, 14, 15, 22, 23, and 24, Township 30 North (T30N), Range 47 East (R47E); and Section 19, T30N, R48E, Mount Diablo Baseline and Meridian, approximately 37 miles east of the town of Battle Mountain, Nevada. The Project is located on a combination of public land, administered by the U.S. Bureau of Land Management, Mt. Lewis Field Office in Battle Mountain, and private land.

The Project may be accessed by automobile, from Battle Mountain, by traveling east on Interstate 80 approximately 30 miles to exit #261. Proceed south approximately 15 miles on Nevada State Route 306, through the town of Beowawe, then west on Lander County Road G-247 (10th Street), just north of the town of Crescent Valley, approximately 4.5 miles to the site. The facilities are located on the south-facing slope on the north side of Fire Creek.

General Description: The Project was initially permitted in March 2011 as the "Fire Creek Exploration Project," Water Pollution Control Permit (WPCP) NEV2007104, a "small-scale" facility (NAC 445A.377 and 445A.410) with a maximum extraction rate of up to 36,500 tons per year and a maximum 120,000 tons of extracted material over the life of the Project. A portal and decline were constructed to support test-mining activities, to access the underground mineral deposit and extract bulk samples for metallurgical testing, and to evaluate the feasibility of developing and mining the identified mineral resource. Ancillary surface components include a waste rock repository and ore stockpile (WRR) with low-permeability soil layer and solution containment system, double-lined stormwater and mine-dewatering water storage ponds with active evaporation systems, and administrative and mechanical support infrastructure. To treat groundwater pumped out of the mine workings prior to use for dust suppression, infiltration, or other approved activities, a series of water treatment systems were approved, constructed, operated, and in some cases, closed and replaced, resulting in the 2013 construction of the current Microfiltration and Reverse Osmosis Water Treatment Plant. A separate WPCP, NEV2018104, was issued in December 2018 to discharge treated dewatering water to Fire Creek southeast of the project. A major modification and renewal application approved in 2015 includes, but is not limited to, an increased mining rate to 250,000 tons of ore per year, a second waste rock facility, three additional double-lined ponds, and a revised Project name of "Fire Creek Project" (replacing the original name "Fire Creek Exploration Project"). The original

WPCP number, NEV2007104, was retained. All ore is shipped to the Permittee's Midas Project (WPCP NEV0096107) for gold recovery.

B. Synopsis

General Background: Gold exploration at Fire Creek first occurred in the early 1930's by an unknown prospector from Crescent Valley. A small adit and several prospect pits were excavated during that early tenure of the property. Limited-scope exploration drilling programs were completed under lease agreements by Southern Pacific in 1967 and Placer Development during 1974-1975. An unidentified predecessor company constructed a pre-regulation 2,000 ton heap leach test pad in 1981, which was subsequently closed. The closed heap leach pad is located within the current Project area, just north and upslope of the WRR. WPCP NEV0090026 for the Fire Creek Project was issued to Black Beauty Gold, Inc. in early 1991, and renewed by Aurenco Joint Venture in 1997. No new facilities were ever constructed under that Permit, no mining activity occurred, and WPCP NEV0090026 was cancelled at the request of Aurenco Joint Venture, effective 16 August 1999.

Klondex Gold & Silver Mining Company (Permittee; formerly Klondex Mining Co.) acquired the property and exploration drilling activities resumed in 2004. A decision was made in 2007 to drive an exploration decline, and a further decision was made in 2014 to go into full-scale mining production. Prior to this, no significant historic metal production is recorded for the immediate Project area.

The orebody is a low sulfidation, epithermal gold deposit consisting of mineralized veins and breccias, and associated disseminated mineralization in the adjacent wall rock. Mineralization is controlled by high-angle normal faults and fracture zones that strike north-northwest, with northeast-striking cross structures. The mineralization extends downward from a near-surface barren silica cap (siliceous sinter zone) into a classic bonanza ore zone at depth. The host rocks for the veins and breccias are members of a Miocene volcanic sequence including basalt and basaltic andesite flows and interbedded tuffs, which are intruded by high-angle mafic dikes. These rocks and the associated mineralization formed as part of the mid-Miocene Northern Nevada Rift intrusive and volcanic event, which created an igneous geo-structural corridor that extends north-northwestward from central Nevada into Oregon, and is comagmatic and contemporaneous with the Columbia River flood basalts of Oregon and Washington. The Northern Nevada Rift is believed to be related to the initial eruption of the hotspot that is now under Yellowstone National Park. Ore mineralization at the Project consists of gold, which may be found in the free state as electrum (a naturally occurring gold-silver alloy) or encapsulated in pyrite, and economically minor concentrations of silver in association with quartz, calcite, and pyrite. The veins and breccias exhibit a banded texture, which suggests that multiple mineralizing pulses emplaced the gold, and may account for the pyrite-encapsulated gold in some areas.

Test Mining and Exploration: Development of the mining Project required collection of bulk samples for metallurgical evaluation, completion of underground drilling to confirm and further delineate the resource, testing of proposed underground methods for mining mineralized veins and structures identified by exploration drilling from the surface, and testing of backfill methods for the test stopes and drifts using waste rock developed underground and alluvium from a surface borrow source. Bulk sample material mined in 2011 to 2015 under the small-scale Permit were shipped off-site to laboratories for metallurgical and related testing and analysis, and ultimately to the Permittee's Midas Project (WPCP NEV0096107) for gold recovery.

For the underground program, the portal was collared at a location to the west-southwest of the 1970's era operations area, which has been reclaimed, at an elevation of approximately 5,670 feet above mean sea level (AMSL). A decline measuring 14 feet wide by 14 feet high, on average, was driven from the portal to the north, with a counter-clockwise rectilinear spiral (comprised of straight sections with periodic approximately 90-degree left turns) and a 15% average downward gradient. After the fourth 90-degree left turn, the workings trend more or less straight north-northwestward to the orebody. When complete, the underground workings will include up to 10,000 feet of decline, drifts, crosscuts, drill stations, winzes, and a ventilation raise. The combined ventilation raise and secondary escape way was constructed in 2013 from near the bottom level of the decline at that time. The decline accommodates mining equipment and support infrastructure that will be used for full-scale mining operations.

2015 Major Modification and Renewal: The decision to expand the facility to a full-scale mining operation necessitated an increase in the permitted maximum production rate from 36,500 tons of ore per year to 250,000 tons of ore per year, thereby requiring a major modification of the Permit. The Permittee submitted an application for a combined major modification and renewal of the Permit in November 2014. The major modification and renewal includes the construction of a new, larger, engineered Waste Rock Storage Facility (WRSF), two new double-lined and leak-detected ponds to manage water captured by the WRSF (Seepage Collection Pond and Stormwater Pond 2), a new double-lined and leak-detected Treated Water Storage Pond, new groundwater monitoring well GW-10 located downgradient from the WRSF and ponds, and a new fueling station, core facility, and administration and Dry building. The WRSF, new ponds, and associated fluid management infrastructure are described separately in this Fact Sheet. The major modification also included the elimination of an obsolete Permit requirement for annual evacuation of Stormwater Pond 1 and the Dewatering Storage Pond. The major modification and renewal was approved in June 2015.

A Minor Modification approved by the Division in November 2016 included changing the Treated Water Storage Pond into a second Dewatering Storage Pond labeled Dewatering Storage Pond 2.

Waste Rock Characterization: For the initial small-scale Permit application, 14 waste rock samples were composited from drill core obtained within the envelope of the proposed underground workings and evaluated by McClelland Laboratories, Inc. for their potential to generate acid or liberate other constituents. Two of the waste rock samples were determined to be potentially acid generating (PAG) and the remaining 12 samples were classified as net neutralizing or non-PAG. The meteoric water mobility procedure (MWMP) leachate for all non-PAG samples exhibited a potential to mobilize arsenic at concentrations (0.011 to 0.13 milligrams per liter (mg/L)) above the Nevada Division of Environmental Protection (Division) Profile I reference value (0.010 mg/L). The leachate for four of the non-PAG samples also reported elevated antimony values (0.012 to 0.28 mg/L) above the Division Profile I reference value (0.006 mg/L).

For the 2015 major modification, 43 additional samples were selected as representative of the various geologic Formations, lithologies, and alteration types, and of the lateral and vertical extent, of the future waste rock. All 43 samples were analyzed for acid-base accounting via the Nevada Modified Sobek Procedure and net acid generation (NAG). Out of the 43 samples, 33 were determined to be PAG waste rock with ratios of acid neutralization potential to acid generation potential (ANP/AGP) ranging from 0.02 to 1.1 and sulfide sulfur percentages ranging from 1.12 to 8.21. The 10 non-PAG waste rock samples are not strongly neutralizing, but have slightly higher ANP/AGP ratios of 1.2-2.2 and lower sulfide sulfur percentages of 0.52-1.91.

Six of the 43 waste rock samples (four PAG and two non-PAG) were further evaluated using humidity cell tests (HCTs) and mineralogical evaluations. Three of the four PAG HCTs generated acid and one did not. Neither of the two non-PAG HCTs generated acid. The acid generating HCTs varied in alteration intensity and type from weak unspecified alteration to strong argillic alteration. The HCT results, and MWMP-Profile I analyses of other waste rock samples, indicate that PAG waste rock exposed to meteoric water may liberate significant concentrations of aluminum, antimony, arsenic, beryllium, cadmium, chloride, iron, magnesium, manganese, selenium, sulfate, thallium, zinc, and total dissolved solids (TDS), along with low pH. Conversely, the leachate from non-PAG waste rock typically meets most Profile I reference values, but may also exhibit sporadic low-level exceedances of arsenic, antimony, iron, manganese, selenium, and/or sulfate. Therefore, because some of the waste rock generated at the Project would otherwise have the potential to degrade waters of the State, all waste rock will either be placed on engineered containment in the WRR or WRSF, which are described below, or it will be used in cemented backfill in the underground workings. The cemented backfill helps to chemically stabilize the waste rock, because the alkaline cement adds neutralizing capacity and physically seals and encapsulates the waste rock.

Waste Rock Repository and Ore Stockpile (WRR): The WRR was constructed in 2011 to the east of the portal to accommodate waste rock generated during construction of the decline and to provide a temporary storage location for mineralized bulk sample ore material during the small-scale exploration phase of the Project. In the full-scale mining phase (after approval of the 2015 major modification), a portion of the top surface of the WRR will be used as an ore stockpile pad to hold ore temporarily (maximum estimated duration is a few weeks) until it is hauled off-site to the ore processing facility at the Midas Project (WPCP NEV0096107).

The initial decline development was expected to produce approximately 70,000 to 100,000 tons of waste rock, which was transported to the WRR in 12- to 18-ton trucks and placed in two maximum 20-foot lifts. The toe of the second lift was set back approximately 100 feet from the crest of the first lift to provide an equipment working area, enhance stability, and provide a staging area for sample material prior to its shipment off site.

Stability analysis of the WRR design generated computed static factors of safety of 1.7 and 2.1 for operational (short-term) versus closure (long-term) configurations, respectively. The computed pseudostatic factors of safety are 1.2 short-term and 1.3 long-term. For all analyses, the predicted deformation was negligible.

The tentative plan for permanent closure and reclamation of the WRR includes contouring the side slopes to a 3H:1V (horizontal to vertical) slope angle and placement of at least 3 feet of non-PAG cover material and growth media to minimize any acid generation potential of the waste rock and reduce meteoric infiltration.

The WRR is located in a natural drainage depression downgradient of the historic heap leach pad. The WRR design footprint is 'pear-shaped' in plan and measures approximately 400 feet at the widest extent and approximately 500 feet along the central axis. Because samples of some waste rock and mineralized material exhibit the potential to generate acid, the WRR was constructed with a low-permeability soil layer (LPSL) base covering the approximately 4-acre footprint, as measured within the bermed limits of the WRR. Construction included grubbing, scarification, moisture conditioning, and compaction in 6-inch thick lifts of existing native and imported soil material to 95% maximum dry density Modified Proctor (American Society for Testing and Materials (ASTM) Method D1557) to produce a minimum 12-inch thick LPSL with a recompacted permeability of less than 1 x 10^{-6} centimeters per second (cm/sec).

While the WRR was being constructed, the constructed portions of the LPSL base were required to be covered by a minimum 24-inch thick layer of waste rock prior to 01 October of each year to maintain the permeability specification during winter months. LPSL constructed between October and March required continuous covering with no more than a 72-hour time lag to avoid degradation of the LPSL permeability specification due to freeze/thaw cycles. The minimum 24-inch thick protective layer must also be maintained during any future off-loading cycles.

The ground surface on the west, north and east sides of the WRR slopes toward the interior of the WRR. Therefore, containment berms are not required, although oxide rock perimeter berms and adjacent roadways are constructed to prevent stormwater run-on. The berms and roadways divert stormwater away from the WRR and into downgradient stormwater controls.

The central axis of the WRR LPSL base was formed with an approximately 2-foot deep by 8-foot wide shallow vee-ditch. A pair of 4-inch diameter corrugated, perforated high-density polyethylene (HDPE) underdrain collection pipelines were placed in the vee-ditch and covered with drainage material encased in 8-ounce per square yard non-woven and needle-punched geotextile to convey fluid from the base of the WRR.

The underdrain collection pipelines daylight into a chevron-shaped toe collection sump, measuring approximately 70 feet wide by 25 feet long, formed in the LPSL at the interior toe of the WRR against the minimum 5-foot high downgradient toe containment berm. The 1-foot thick LPSL base of the WRR extends over the toe berm and both the berm and the sump area were covered with a layer of 80-mil textured HDPE liner. The HDPE liner extends from the collection sump area to a key trench at least 10 feet upgradient beneath waste rock. The HDPE liner is protected with a minimum 24-inch thick layer of screened riprap, having 50% of the particles greater than 8-inch diameter (D_{50} = 8-inch diameter), wherever waste rock will be placed.

Four 4-inch diameter corrugated, perforated HDPE fluid collection pipelines, placed directly on the sump liner on approximately 3-foot centers in a herringbone pattern extending at right angles 15- to 25-feet from the underdrain collection pipelines, will enhance fluid collection and conveyance within the sump area. All fluid collection pipelines in the sump area were covered with a minimum 12-inch thick layer of drainage material encased in 8-ounce per square yard non-woven and needle-punched geotextile. The two perforated HDPE underdrain collection pipelines transition with a wye connection into a solid 4-inch diameter by 8-inch diameter dual-wall HDPE pipeline at the toe berm that is booted through the berm liner to convey fluid to Stormwater Pond 1. The conveyance pipeline enters Stormwater Pond 1 approximately 15 inches below the pond crest. Conveyance pipelines incorporate secondary containment through the WRR toe berm, the Stormwater Pond 1 embankment, and along all alignments outside lined components.

The WRR collection sump design also includes a spillway to a stormwater overflow channel that will convey fluid to Stormwater Pond 1 in the event of a storm event in excess of the 100-year, 24-hour design flow. The channel was constructed at the crest of the berm on the southeast side of the collection sump as a trapezoidal channel with a minimum depth of 2 feet and a minimum 4-foot wide base. The channel subgrade was compacted to 90% maximum dry density Modified Proctor (ASTM Method D1557) to a depth of at least 8 inches and covered with a layer of 80-mil textured HDPE liner. The liner was placed in a key trench along the edges and the inlet and outlet ends were welded into the respective sump and pond liner systems.

In April 2015, the Division approved an engineering design change (EDC) modification to the Permit for a 35-foot increase in the maximum permitted top elevation of the WRR, from 5,785 feet AMSL (45-foot maximum height) to 5,820 feet AMSL (80-foot maximum height). No expansion of the approved footprint of the WRR was included in the EDC. The increase in height will accommodate at least 40,000 cubic yards of additional waste rock and/or ore above the 5,785-foot AMSL top surface approved in 2011. Set-backs between lifts will be utilized to facilitate regrading of all outer slopes of the WRR during final closure and reclamation to a maximum slope angle of 3H:1V.

New slope stability analyses were performed as part of the EDC, using Slope/W, which is part of the GeoStudio software package (Geo-Slope 2012). Slope/W uses the Morgenstern-Price method, which satisfies both force and moment equilibrium within user-defined limits. The most critical slope of the WRR, corresponding to a northwest section through the center of the WRR, was evaluated for both static and pseudostatic loads. The pseudostatic analysis simulated a horizontal acceleration equal to one half of the peak ground acceleration (PGA). The PGA value of 0.11 g (m/s^2) used in the analysis corresponds to that of an earthquake with a 475-year return period (10% probability of exceedance in 50 years). The calculated factors of safety for the 5,820-foot AMSL WRR are 1.27 for the static case and 1.25 for the pseudostatic case.

A minor modification approved by the Division in November 2016 included the addition of an ore storage pad located at the lower laydown yard. The ore storage pad includes an impermeable concrete slab, concrete-lined fluid collection sump, and fluid conveyance pipeline, which enhances the approved WRR design. The ore storage pad includes a 4-inch thick reinforced concrete slab on top of 6 inches of compacted fill, and a 12-inch thick reinforced concrete stem wall with a maximum height of 15.2 feet. The ore stockpile will not reach more than 5 feet above the stem wall and should be graded to a slope of 2H:1V. The concrete slab will be graded at 0.5% from west to east and 4% north to south towards the sump in the southeast corner of the storage pad. The ore storage pad is designed for 6,250 tons of ore at 120 pounds per cubic foot. Ore management activities will not change under this modification.

Stormwater Pond 1: The double-lined and leak detected Stormwater Pond 1 collects solution draining from the upgradient WRR. The pond was constructed with 2.5H:1V interior side slopes and 3H:1V external side slopes. The constructed pond measures approximately 115 feet by 161 feet at the interior crest elevation. As designed, the pond has an operating volume of approximately 470,000 gallons and a maximum capacity of approximately 678,000 gallons below the 3-foot design freeboard elevation. The pond can accommodate 90% of the annual precipitation reporting to the WRR footprint and 100% of the 100-year, 24-hour storm event flow runoff from the WRR. Water balance calculations for the pond require management of the pond inventory with an active evaporation system.

The active evaporation system design incorporates a 12-inch diameter HDPE riser pipe and stainless steel submersible pump located at the southeast corner of the pond. The pump can feed water, at up to 50 gallons per minute (gpm) and 50 pounds per square inch (psi) pressure, to a 3-inch diameter HDPE distribution pipeline located at the 3-foot freeboard elevation on the interior slope of the pond perimeter. The pipeline was equipped with spray nozzles, located on 40-foot centers and positioned to eliminate aerosol drift off containment during evaporation activities. Until it was eliminated with the 2015 major modification, a Permit limit required that the pond volume be reduced to near 0 gallons by 31 October of each year to maintain the conservative water balance through the November to March time period when little or no evaporation is anticipated or was modeled. The evaporation system is operated when maximum operating levels are observed based on levels marked on the pond liner. The pond level must be maintained at or below the operating volume, except during storm events and emergencies.

Stormwater Pond 1 is equipped with a 12-inch diameter HDPE overflow pipeline to protect the structural integrity of the pond in the event of stormwater flows in excess of the maximum design event. The minimum pipeline outfall elevation is approximately 3 feet above the 100-year, 24-hour storm event water surface elevation, just below the pond crest elevation. An overflow would report to an emergency riprap apron outfall area located in the natural drainage just downstream of Dewatering Storage Pond 2. Overflow from Stormwater Pond 1 is not expected; it would occur only in an emergency situation, and would represent a Permit violation and require release reporting and cleanup. The Permit requires that a minimum freeboard of 2 feet below the invert of the overflow pipeline (approximately 3 feet below the pond crest) be maintained.

The Stormwater Pond 1 design incorporates a liner system comprised of an 80-mil textured HDPE primary liner, installed textured side up, overlying a secondary 60-mil Agru HDPE Drainliner™, placed stud-side up. This construction creates a void space between the liners to convey leakage to the leakage collection and recovery system (LCRS) collection sump. The composite liner system was constructed over a subgrade compacted to 90% maximum dry density Modified Proctor (ASTM Method D1557) to a depth of at least 8 inches. The pond bottom subgrade was graded at a minimum 1% slope toward the LCRS sump to promote flow to the sump. The sump was constructed between the primary and secondary liners. It measures approximately 6 feet square by 24 inches deep, and was filled with drain rock encapsulated in geonet and a layer of 8-ounce per square yard non-woven geotextile. A 4-inch diameter HDPE riser pipe (SP1-LD) extends from the LCRS sump, up the pond slope between the primary and secondary HDPE liners, and daylights at the pond crest to allow evacuation of collected solution.

Dewatering Storage Pond: The double-lined and leak-detected Dewatering Storage Pond is located downgradient of Stormwater Pond 1. The test mining and exploration phase of decline development were originally expected to occur above the indicated groundwater elevation, however, this did not turn out to be the case, and a storage pond was needed to contain groundwater collected during excavation of the decline and mine openings. The pond was constructed with 2.5H:1V interior and external side slopes and measures approximately 160 feet by 230 feet at the interior crest elevation. The pond was designed to contain 60 days of mine dewatering at 25 gpm, plus approximately another 100,000 gallons for stormwater that would report to the pond as a result of the 100-year, 24-hour storm event, which equates to an approximate total capacity of 2.2 million gallons of water. However, revised figures included with the 2015 major modification indicate that the Dewatering Storage Pond total capacity, at the 2-foot minimum freeboard level (below the invert of the overflow pipe), is only 1.8 million gallons. Water balance calculations for the pond require management of the pond inventory with an active evaporation system, and pumping from the pond to the water treatment plant, as needed. The treated water may be used for dust suppression under this Permit..

The Dewatering Storage Pond active evaporation system is identical to that of the Stormwater Pond 1, and incorporates a 12-inch diameter HDPE riser pipe and stainless steel submersible pump located at the southeast corner of the pond. The pump can feed water, at up to 50 gpm and 50 psi pressure, to a 3-inch diameter HDPE distribution pipeline located at the 3-foot freeboard elevation on the interior slope of the pond perimeter. The pipeline is equipped with spray nozzles, located on 35- to 40-foot centers and positioned to eliminate aerosol drift off containment during evaporation activities. Until it was eliminated with the 2015 major modification, a Permit limit required that the Dewatering Pond volume must be reduced to near zero gallons by 31 October of each year to maintain the conservative water balance through the November to March time period when little or no evaporation is anticipated or was modeled.

Like Stormwater Pond 1, the Dewatering Storage Pond is equipped with a 12-inch diameter HDPE overflow pipeline to protect the pond in the event of stormwater flows in excess of the maximum design event. The minimum pipeline outfall elevation is approximately 3 feet above the 100-year, 24-hour storm event water surface elevation, just below the pond crest elevation. Any overflow will report to an emergency riprap apron outfall area located in the natural drainage just downstream of the Dewatering Storage Pond 2. Overflow from the Dewatering Storage Pond is not expected; it would occur only in emergencies, and would represent a Permit violation and require release reporting and cleanup. The Permit requires that a minimum freeboard of 2 feet below the invert of the overflow pipeline (approximately 3 feet below the pond crest) be maintained.

Other than direct precipitation, water reporting to the Dewatering Storage Pond will normally originate from seepage in the underground workings, and from underflow from the truck wash bay oil/water separator system. Airlift tests were completed for exploration drill holes in the area of the decline and associated workings. The results indicate maximum inflow rates ranging from 0 to 13 gpm. As stated above, a dewatering rate of 25 gpm was used for pond capacity and evaporation calculations to accommodate flows from both underground and other sources, such as the truck wash bay sump. Water from these sources is conveyed to the pond through a 4-inch diameter HDPE pipeline placed in a secondary containment pipeline bedded and buried in a 2-foot deep trench. However, a tee connection with a gate valve on the Stormwater Pond 1 overflow pipeline can also be used to direct flow from Stormwater Pond 1 into the Dewatering Storage Pond in the event of an emergency requiring management of excess fluid. Underground activities must cease, if necessary, to manage pond volumes within Permit limits.

Like Stormwater Pond 1, the Dewatering Storage Pond incorporates a liner system comprised of an 80-mil textured HDPE primary liner, installed textured side up, overlying a secondary 60-mil Agru HDPE Drainliner™, placed stud-side up. This construction creates a void space between the liners to convey leakage to the LCRS collection sump. The composite liner system was constructed over a subgrade compacted to 90% maximum dry density Modified Proctor (ASTM Method D1557) to a depth of at least 8 inches. The pond bottom subgrade was graded at a minimum 1% slope to promote flow to the LCRS collection sump. The sump, which was constructed between the primary and secondary liners, measures approximately 6 feet square by 24 inches deep, and is filled with drain rock encapsulated in geonet and a layer of 8-ounce per square yard non-woven geotextile. A 4-inch diameter HDPE riser pipe (DSP-LD) extends from the sump up the pond slope, between the primary and secondary HDPE liners, and daylights at the pond crest to allow evacuation of collected solution.

In May 2024, the Division approved a request for a reduction in monitoring for the Fire Creek Mine (Project) Water Pollution Control Permit (WPCP) NEV2007104. The approved request included:

- Monitoring reduction for GW-2, GW-3, GW-4, GW-7, GW-7, and GW-8 from quarterly to semi-annually (second and fourth quarter)
- Monitoring reduction for SW-1 and SW-2 from quarterly to semi-annually (second and fourth quarter)
- Monitoring reduction of the leak detection system from weekly to monthly
- Monitoring reduction in sampling of the ponds from quarterly to semi-annually (second and fourth quarter)

Waste Rock Storage Facility (WRSF): The 2015 major modification predicts that a total of approximately 570,000 tons of waste rock will be mined during the current mine plan. Approximately 30% of that waste rock (174,000 tons) will be used in cemented backfill of underground workings to support continued mining. The rest of the waste rock (399,000 tons), of which 30% is expected to be PAG and 70% is expected to be non-PAG, will be placed on the Phase I engineered WRSF, located about 1,100 feet east of the WRR. The Phase I WRSF, approved as part of the 2015 major modification, is designed to accommodate up to 500,000 tons of waste rock. The 2015 major modification also includes a conceptual design for an ultimate 3,000,000 ton WRSF, in case the mine plan is expanded in the future, but approval of a separate minor modification, including, but not necessarily limited to, a final Phase II WRSF design, would be required prior to expansion beyond the Phase I WRSF. The maximum permitted top elevation for the Phase I WRSF is 5,769 feet AMSL, which is approximately 133 feet higher than the downgradient toe of the waste rock on the WRSF.

The WRSF will be loaded with nominal 40- to 50-foot lifts of waste rock with an individual lift maximum outer slope angle of 1.6H:1V, and minimum 40-foot horizontal set-backs between lifts to achieve a final average slope angle during operation of 2.4H:1V, which would then be re-graded to 3H:1V during closure. A slope stability analysis determined that, as designed, the WRSF would achieve a minimum static factor of safety of 1.84, and a minimum pseudostatic factor of safety of 1.25, during operation, and higher factors of safety during closure.

The footprint of the WRSF was cleared and grubbed of topsoil (stockpiled for future use during reclamation and closure), organics, and any rocks or debris greater than 3 inches in diameter. The design of the Phase I WRSF includes, from bottom up: native subgrade; fill as needed to achieve grade, compacted to 95% maximum dry density Standard Proctor (ASTM Method D698); a minimum 12-inch thick LPSL with a recompacted (95% Standard Proctor) maximum permeability of 1 x 10^{-6} cm/sec; and a minimum 18-inch thick layer of crushed limestone to serve as a filtration and neutralization layer under the PAG waste rock. If the native subgrade under the WRSF, and/or borrowed fill, cannot meet the LPSL permeability specification, a bentonite amendment will be added to meet the specification.

Although these layers were approved in the original major modification, due to an inability to compact LPSL soil to the required 1 x 10^{-6} cm/sec, and availability of limestone, the as-built was submitted with changed layers that were not approved by the Division. The layers include a Geosynthetic Clay Layer (GCL) instead of an LPSL and a 12-inch layer of random fill material with an 8-inch layer dolomite and 4-inch layer of random fill over the collection pipes. These layers are shown to have adequate drainage and therefore are not a major concern.

Because two forks of an ephemeral drainage are located within the WRSF footprint, the WRSF features a seepage collection system to help collect and convey meteoric water from the WRSF to the Seepage Conveyance Channel and Seepage Collection Pond, which are located just downgradient of the WRSF. The seepage collection system is comprised of one 4-inch diameter perforated corrugated HDPE seepage collection pipe laid in a drainage trench along the axis of the main drainage, which forks upstream into two 4-inch diameter perforated corrugated HDPE seepage collection pipes, one in each fork of the drainage. Each 4-inch diameter seepage collection pipe is encased within an 18-inch thickness of minus 2-inch drain rock that is enclosed within 12-ounce per square yard non-woven geotextile, all of which sits on top of the LPSL and beneath the crushed limestone filter layer in a narrow zone along the axis of each drainage.

At the downstream toe of the WRSF, the single 4-inch diameter perforated HDPE seepage collection pipe transitions to an 8-inch diameter solid HDPE pipe just before it boots through the single-lined middle section of the Seepage Consolidation Berm, and into the single-lined Seepage Conveyance Channel. The Seepage Consolidation Berm is approximately 70 feet long, traversing from west to east across the axis of the drainage. The height of the Seepage Consolidation Berm, as measured vertically from its downstream toe to its crest height varies from zero on either end, where it meets the native slopes, to nearly 8 feet over the axis of the drainage. The Seepage Consolidation Berm is constructed with minus 1-inch diameter random fill compacted in maximum 12-inch thick lifts to 95% maximum dry density Standard Proctor (ASTM Method D698). The 80-mil linear low-density polyethylene (LLDPE) liner covering the middle section (east to west) of the Seepage Consolidation Berm represents an upstream continuation of the liner used in the Seepage Conveyance Channel. The liner extends over the Seepage Consolidation Berm and approximately 3 feet into the WRSF, underneath the LPSL, where it terminates in a buried anchor trench. The waste rock toe on the WRSF is set back at least 10 feet from the upstream toe of the Seepage Consolidation Berm. The set-back area is designed as an additional stormwater collection area, which is filled to approximately 4 feet below the crest of the Seepage Consolidation Berm with minus 6-inch drain rock. The set-back area is designed with capacity to contain the fluid that would report to it as a result of the 25-year, 24-hour storm event while maintaining a required 2-foot minimum freeboard below the Seepage Consolidation Berm crest (and to contain the fluid from the 100-year, 24-hour storm event while maintaining a 1-foot freeboard). The set-back area between the WRSF toe and the Seepage Consolidation Berm is drained by two 6-inch diameter perforated corrugated HDPE drain pipe risers with open grated ends that daylight at the upper surface of the drain rock layer. The drain pipe risers tie into the main seepage collection pipe immediately upstream of the Seepage Consolidation Berm.

Seepage Conveyance Channel, Seepage Collection Pond, and Seepage Collection Pond Overflow Channel: The single-lined trapezoidal Seepage Conveyance Channel leads from the WRSF Seepage Consolidation Berm to the double-lined and leak-detected Seepage Collection Pond. From bottom up, the Seepage Conveyance Channel is constructed with native subgrade, a 6-inch thick liner bedding layer compacted to 95% maximum dry density Standard Proctor (ASTM Method D698), an 80-mil LLDPE liner, and an 80-mil LLDPE wear sheet (the latter in the channel bottom only). The Seepage Conveyance Channel liner represents secondary containment for the 8-inch diameter solid HDPE seepage conveyance pipe, which discharges into the Seepage Collection Pond. No leakage conveyance layer is constructed between the two geomembranes in the Seepage Conveyance Channel bottom.

The Seepage Collection Pond is a small pond (approximately 30 feet by 30 feet by 5 feet deep) designed to contain 6,700 gallons at maximum capacity when it is overflowing to the Seepage Collection Pond Overflow Channel and Stormwater Pond 2. The Seepage Collection Pond capacity represents approximately 2 days of seepage flow from the WRSF at an estimated maximum flow rate of 2 gpm. From bottom up, the Seepage Collection Pond liner system consists of: native subgrade; fill as needed to achieve grade, compacted to 95% maximum dry density Standard Proctor (ASTM Method D698); a 6-inch thick layer of liner bedding material, also compacted to 95% Standard Proctor; an 80-mil LLDPE secondary Drainliner™, placed stud-side up to provide a leakage conveyance layer; and an 80-mil LLDPE primary liner. A drain-rock-filled LCRS sump is constructed between the liners under the pond low point, and is evacuated back to the pond via a 12-inch diameter HDPE pipe (SCP-LD) that runs up the inner wall of the pond between the liners and daylights at the pond crest.

The lined walls of the Seepage Conveyance Channel, the Seepage Collection Pond, and the Seepage Collection Pond Overflow Channel are constructed at an angle of 2H:1V, with liner anchor trenches located along the channel and pond crests. No pumping and piping system has been approved to evacuate the Seepage Collection Pond; therefore, when sufficient seepage solution is present, the Seepage Collection Pond is designed to overflow to the double-lined and leak detected Seepage Collection Pond Overflow Channel. The invert of the overflow weir that connects the Seepage Collection Pond to the Seepage

Collection Pond Overflow Channel is a minimum of 2.5 feet below the pond crest, thus ensuring that the required minimum 2-foot wave-action freeboard below the pond crest shall be maintained.

The Seepage Collection Pond Overflow Channel is a primary containment channel (without a pipeline), that is constructed similarly to the Seepage Collection Pond, with a 6-inch thick liner bedding layer, 80-mil LLDPE secondary Drainliner™, placed stud-side up, and an 80-mil LLDPE primary liner. The Seepage Collection Pond Overflow Channel does not have its own dedicated LCRS; instead, any leakage through the primary liner of the Seepage Collection Pond Overflow Channel is conveyed to the Stormwater Pond 2 LCRS sump for evacuation and monitoring mixed with any leakage from Stormwater Pond 2 itself.

Stormwater Pond 2: Stormwater Pond 2 is located just downgradient from the Seepage Collection Pond, and is connected to it via the double-lined Seepage Collection Pond Overflow Channel. Stormwater Pond 2 measures approximately 90 feet long by 70 feet wide by approximately 19 feet deep, and has a 169,000-gallon capacity while maintaining the required 2-foot minimum freeboard below the invert of the pond overflow weir, which is in turn 2 feet below the pond crest. The pond is designed to contain flow from the 25-year, 24-hour storm event while maintaining the required 2-foot minimum freeboard below the invert of the overflow weir (and to contain the 100-year, 24-hour storm event while maintaining a 1-foot minimum freeboard below the overflow weir invert). The overflow weir is designed to be used only in emergencies, because it discharges to the natural drainage downstream of the pond via a riprap apron (minimum 1-foot thick layer of riprap with D_{50} = 6-inch diameter, placed over 12-ounce per square yard non-woven geotextile), which would represent a Permit violation and require release reporting and cleanup. During normal operation, the solution in Stormwater Pond 2 is either allowed to evaporate in place or is pumped to the Dewatering Storage Ponds via a 4-inch diameter HDPE dewatering pipeline placed within an 8-inch diameter HDPE secondary pipeline. The Permit requires leak detection monitoring of the dewatering pipeline secondary pipe (DP-LD).

Stormwater Pond 2 is constructed similarly to the Seepage Collection Pond. From bottom up, the Stormwater Pond 2 liner system consists of: native subgrade; fill as needed to achieve grade, compacted to 95% maximum dry density Standard Proctor (ASTM Method D698); a 6-inch thick layer of liner bedding material, also compacted to 95% Standard Proctor; an 80-mil LLDPE secondary Drainliner™, placed stud-side up; and an 80-mil LLDPE primary liner. A drain-rock-filled LCRS sump is constructed between the liners under the pond low point, and is evacuated back to the pond via a 12-inch diameter HDPE pipe (SP2-LD) that runs up the inner wall of the pond between the liners and daylights at the pond crest. The inner and outer walls of Stormwater Pond 2 are constructed at an angle of 2H:1V, with liner anchor trenches located along the pond crest.

Treated Water Storage Pond/Dewatering Storage Pond 2: A Minor Modification approved by the Division in November 2016 converted the Treated Water Storage Pond to a second dewatering storage pond identified as Dewatering Storage Pond 2. This pond is double-lined and leak-detected pond, and was approved as part of the 2015 major modification. The pond is located immediately southeast of the Dewatering Storage Pond and was designed for temporary storage of water that met all Profile I water quality reference values prior to the water being discharged to Fire Creek (WPCP NEV2018104) or used for other approved purposes. The pond was intended to store treated water from the water treatment plant which met Profile I reference values. With this change in pond use, to contain both process and contact water, Dewatering Storage Pond 2 is authorized.

Dewatering Storage Pond 2 is approximately 220 feet long by 120 feet wide and approximately 29 feet deep. The pond has a capacity of approximately 2.1 million gallons at the 2-foot minimum freeboard level below the invert of the overflow pipe. Like Stormwater Pond 1 and the Dewatering Storage Pond, Dewatering Storage Pond 2 has a 12-inch diameter HDPE overflow drain pipe, which boots through both pond liners at the southeast pond crest and, if used, would convey overflow water to a pipe discharge location on a 12-inch thick, D_{50} = 6-inch diameter, riprap apron constructed in the normally dry natural drainage at the downstream toe of the pond embankment. With the construction of this pond, the existing 12-inch overflow drain pipe from both Stormwater Pond 1 and the Dewatering Storage Pond will be lengthened to discharge to the same riprap apron downstream of Dewatering Storage Pond 2. Overflow from the pond is not expected to exceed the pond minimum freeboard limit of 2 feet.

Dewatering Storage Pond 2 is constructed similarly to the Seepage Collection Pond and Stormwater Pond 2. From bottom up, the liner system is comprised of: native subgrade; fill as needed to achieve grade, compacted to 95% maximum dry density Standard Proctor (ASTM Method D698); a 6-inch thick layer of liner bedding material, also compacted to 95% Standard Proctor, an 80-mil LLDPE secondary Drainliner™, placed stud-side up; and an 80-mil LLDPE primary liner. The pond bottom is graded to drain toward the southwest end of the pond, where a drain-rock-filled LCRS sump is constructed between the liners under the pond low point. The LCRS sump is evacuated back to the pond via a 12-inch diameter HDPE pipe (TWP-LD) that runs up the inner wall of the pond between the liners and daylights at the pond crest. The inner and outer walls of Dewatering Storage Pond 2 are constructed at an angle of 2H:1V, with liner anchor trenches located along the pond crest.

The 2016 minor modification included the additional conveyance piping to and from Dewatering Storage Pond 2 and the rerouting of piping to Dewatering Storage Pond 2 required to authorize the use of the pond. The minor modification also included tying in to the existing outlet pipe at the northwest corner of the Dewatering Storage Pond to direct dewatering water to Dewatering Storage Pond 2.

North and South Storage Ponds and Termination of the Fire Creek Infiltration Project (WPCP NEV2013102): In November 2019, the termination of the Fire Creek Infiltration Permit and conversion of the rapid infiltration basins was approved by the Division. Because the RIBs were not performing as designed and the facility was experiencing water management issues, the Permittee decided to convert the basins into double-lined and leak-detected storage ponds to offer more storage capacity for dewatering water at the site. The North and South Storage Ponds will offer storage capacity for approximately 5.9 and 5.5 million gallons respectively.

The ponds will maintain the 2H:1V side slopes for the conversion, and a 6-inch liner bedding will be placed on the surface of the RIBs. The liner bedding will be compacted to 95% of the maximum dry density according to ASTM D698 to prepare for placement of 80-mil AGRU Drain Liner (or approved equal) overlain by an 80-mil textured HDPE liner. The AGRU Drain Liner will provide conveyance of any leakage to a collection sump located at the bottom of each pond's existing access ramp.

Each pond's collection sump will be 3 feet deep and constructed with a clean drain rock wrapped with a 12-ounce per square yard non-woven geotextile. The sumps will each have a capacity of approximately 9,000 gallons. A solid-wall, 12-inch HDPE reclaim pipe will extend down each pond's ramp between the liner system into the collection sump. The solid pipe will then transition to a 12-inch HDPE perforated pipe with an end cap along the bottom of the sump to aid in the collection of leakage, if any. A submersible pump, sleeved inside the pipe, will be used to pump out leakage from the collection sump as needed.

A pipeline will be constructed allowing Klondex to deliver contact water to the ponds. Currently, permeate water flows through an 8-inch HDPE pipeline to a diffuser vault where flows can be diverted to the RIBs or be released via a diffuser near the existing Fire Creek stream. The gate valve for the section of existing 8-inch pipeline leading from the diffuser vault to the RIBs will be closed and all treated water will be discharged to Fire Creek. A new 6-inch inside a 10-inch pipeline will be installed following the current alignment of the permeate pipeline from the mine's water treatment plant to the new storage ponds.

As of November 2019, the Permittee generates contact water at a rate of 60 gallons per minute (gpm). Contact water flow requirements in the future mine operations are not anticipated to exceed 250 gpm. The 6-inch pipeline will have adequate capacity to pump 293 gpm.

Geotube Containment Pad: In an effort to maximize the capacity of the ponds at the Fire Creek Mine, a minor modification for construction of a lined containment pad to hold up to 19 geotubes to filter slurry from the underground mine and other ponds was approved by the Division in April 2017.

The geotubes are made of polypropylene yarn, a woven engineered textile, and delivered ready for deployment by the vendor. Sizes of the geotubes may vary, but each typically has the capacity of approximately 16,000 gallons of slurry which enter each geotube separately via a single valve, spigot, and HDPE delivery pipeline. The slurry is pumped from the underground mine or the Dewatering Storage Pond via 4-inch SDR 17 HDPE pipe in 8-inch SDR 21 HDPE pipe to a flocculant (Polymer Solve 218B) dosing tank stored in an 8-foot by 20-foot conex trailer at the northeast corner of the lined containment pad. Solve 218B is dosed as needed into the slurry. Following dosing, slurry is pumped via 4-inch

HDPE pipe to the geotubes where each has its own valve and spigot that can be manually shut off when the geotube is filled. Once filled with slurry, the geotubes drain until the remnant material has become sufficiently dry as determined by the Permittee. Once dewatered, the geotube is cut open and residue is assayed. If the residue is determined to be economic, it is then be hauled to Midas for processing. Uneconomic residue is placed in the WRSF and analyzed in accordance with Part I.D.10 in the Permit.

The lined containment pad has the dimensions of approximately 82 feet by 162 feet with a depth of 4 feet and is located southwest of the Dewatering Storage Pond. The liner system consists of 6-inches of liner bedding material compacted to 95% maximum dry density Standard Proctor (ASTM Method D698), overlain with 60-mil LLDPE liner and 12-ounce non-woven geotextile. The liner will extend to the crest of the excavation on all sides and be anchored to a backfilled 24-inch trench around the perimeter of the basin. With a sloped floor at approximately 2 percent grade east towards a deeper drainage collection area, the containment pad will not store filtrate from the geotubes.

A 6-inch perforated HDPE pipe will be laid atop the liner within the excavation to facilitate drainage. The liner and pipe will be buried beneath 4 feet of 2-inch drain rock. Filtrate in the drainage collection area will boot through the liner and flow by gravity via 10-inch HDPE pipe within an 18-inch diameter SDR 21 HDPE sleeve into the Dewatering Storage Pond. The containment pad is designed to contain the meteoric runoff based on the 25-year, 24-hour storm event of 1.94 inches.

Stormwater Diversions: The upgradient Main Diversion Channel, constructed to withstand the 100-year, 24-hour storm event design, protects the WRR, Stormwater Pond 1, Dewatering Storage Pond, and Dewatering Storage Pond 2 from upgradient watershed-derived stormwater flows. The unlined 3H:1V trapezoidal channel was constructed with a minimum 2.5-foot depth and minimum 6-foot base width. The channel subgrade was grubbed, scarified, moisture conditioned, and recompacted to a minimum 90% maximum dry density Modified Proctor (ASTM Method D1557) to a depth of at least 8 inches. The prepared subgrade was covered with a layer of 8-ounce per square yard non-woven geotextile protected with a minimum 12-inch thick layer of D_{50} = 3-inch diameter riprap. The Main Diversion conveys storm flow to the west where it discharges to Fire Creek across an armored distribution apron constructed with a minimum 15-inch thick layer of D_{50} = 6-inch diameter riprap.

The 2015 major modification extends the unlined Main Diversion Channel upgradient to the east, immediately upslope of the footprint of the ultimate 3,000,000 ton WRSF, to capture stormwater runoff from the 100-year, 24-hour storm event and divert it around the west side of the Fire Creek Project area. The 2015 extension features 2H:1V inner and outer side slopes, a minimum 3-foot wide flat bottom, and a minimum 4-foot channel depth.

Earthen East and West Interim Diversion Channels are constructed upslope of the Phase I WRSF footprint (within the footprint of the ultimate WRSF) as temporary diversions to minimize stormwater capture by the Phase I WRSF prior to the possible future expansion of the WRSF to its ultimate footprint. The interim diversions are designed to convey the 25-year, 24-hour storm event. The East Interim Diversion and West Interim Diversion channels meet on a broad topographic rib on the north (upgradient) perimeter of the Phase I WRSF, and each diverts stormwater around its own side of the Phase I WRSF. Both diversions transition from gently sloping upper channels along the northern perimeter of the Phase I WRSF to steeply sloped diversion “chutes” along the east and west sides of the WRSF. The upper channels are simple v-ditches with 2H:1V side slopes and minimum 3-foot depth. The East Interim Diversion Chute and West Interim Diversion Chute are designed with average longitudinal slopes of 24.50% and 15.75%, respectively. The chutes feature 2H:1V side slopes, a 4- or 5-foot-wide bottom, and an 18-inch minimum depth above an 18-inch thick armoring layer of D_{50} = 9-inch diameter riprap. Portions of the East Interim Diversion Chute that are constructed partly using fill, rather than entirely of cut construction, incorporate a geosynthetic clay layer (GCL) sheet between the compacted fill and the overlying riprap. The diversion chutes both discharge to a single energy dissipation apron constructed in the natural ephemeral drainage approximately 75 feet downstream of the Stormwater Pond 2 embankment. The energy dissipation apron consists of a 60-inch thick layer of D_{50} = 30-inch diameter riprap.

The Division approved an EDC in January 2017 for two temporary sediment diversion v-ditches located upgradient of the perimeter of Stormwater Collection Pond 2 on the drainage’s east and west sides in order to mitigate sediment runoff from upland areas adjacent to Stormwater Pond 2, assumed to contribute to the frequently overflowing Stormwater Collection Pond 2. The diversions are only required until the vegetation is established in areas disturbed during the WRSF’s construction and will tie into the existing interim chutes proceeding at a 0.5% slope from the WRSF. Since the existing interim diversions are designed for a larger upland area than the sediment control diversions, the sediment control diversions are sized conservatively.

The Western Dump Perimeter Diversion Channel was constructed to capture flow along the west side of the WRR footprint and convey it to the WRR toe collection sump. The trapezoidal channel has 3H:1V side slopes and measures a minimum 5 feet deep and 4 feet across the bottom. The channel was constructed with a minimum 12-inch thick LPSL, with a compacted permeability of less than 1 x 10^{-6} cm/sec, protected by a layer of 8-ounce per square yard non-woven geotextile and a minimum 15-inch thick layer of D_{50} = 6-inch diameter riprap.

Stormwater flows from a small catchment area on the eastern side of the WRR, between the access road and Stormwater Pond 1, are collected and diverted away from the components into a natural drainage through a small ditch identified as the Eastern Dump Perimeter Channel and Diversion. The ditch is a trapezoidal channel with 1.5H:1V side slopes and was constructed with a minimum 12-inch thick LPSL with a compacted permeability of less than 1 x 10^{-6} cm/sec, protected by a layer of 8-ounce per square yard non-woven geotextile and a minimum 12-inch thick layer of D_{50} = 6-inch diameter riprap to handle the modeled stormwater flows.

Water Treatment Systems: A number of water treatment plants and processes have been approved and used since the Permit was first issued, for the purpose of improving the quality of water in various portions of the fluid management system to the point that it could be discharged to the environment without creating the potential for degradation of surface water or groundwater. The water being treated has been obtained from a variety of sources, including dewatering water pumped from the underground workings, stormwater collected by the WRR, the WRSF, and various ponds, and brine waste streams generated by the water treatment plants themselves. Each approved water treatment plant is described below. As of the 2015 major modification, all water treatment plants except the 2013 Microfiltration and Reverse Osmosis Water Treatment Plant have been permanently closed and removed from the site, because they did not perform to expectations. As of the 2025 renewal, this remains the same.

<u>Nalco® Portable Reverse Osmosis (RO) Water Treatment Plant:</u> A minor modification was approved in early November 2011, authorizing the placement and operation of a portable RO plant for treatment of excess volumes of groundwater encountered in the process of advancing the exploration decline. The quantity of water requiring removal was greater than originally anticipated, enough so as to potentially exceed the design operating capacity of the Dewatering Storage Pond and the ability to dispose of the water with the active evaporation system. In addition, some water comes into contact with blasting agents in the underground workings, which results in an exceedance of the established nitrate + nitrite Profile I reference value (10 mg/L) for discharge of dewatering water outside of approved containment. The exceedance precludes the use of mine dewatering water that has contacted mining operations in dust suppression activities.

The Nalco® portable RO plant was permanently closed and removed in 2012.

<u>AquaMove® Mobile Water Treatment Plant:</u> The installed Nalco® portable RO plant required frequent and expensive membrane replacement and experienced lengthy downtime periods due to the variability of the Dewatering Pond water characteristics. Therefore, a minor modification was approved in May 2012 for installation of an AquaMove® Mobile Water Treatment Plant (AquaMove® System). Initially, the AquaMove® System was to be operated in tandem with the installed RO plant. Once the AquaMove® System was fully operational, the RO plant was to be removed and the AquaMove® System would be operated alone until a longer term water treatment or water quality mitigation process could be implemented.

The AquaMove® System was expected to produce a permeate discharge of 60 to 72 gpm and a respective reject (‘brine’ water) discharge of 13 to 25 gpm, depending on actual throughput rate, water quality, and system efficiency. Due to difficulties meeting Profile I reference values for nitrate + nitrite and total nitrogen, the nanofiltration membranes were replaced in September 2012 with RO membranes. The treated water typically met all Profile I reference values, but the permeate discharge rate was lower than desired at approximately 30 to 45 gpm, and the RO membranes needed frequent replacement due to a large amount of suspended sediment in the untreated water.

The AquaMove® Mobile Water Treatment Plant was permanently closed and removed by 2014.

Microfiltration and Reverse Osmosis (MF/RO) Water Treatment Plant: In March 2013, the Division approved an EDC modification to the Permit for construction of a new MF/RO Water Treatment Plant to be located just west of Stormwater Pond 1. The MF/RO Water Treatment Plant was designed to operate concurrently with, but independently from, the existing AquaMove® System. The MF/RO Water Treatment Plant was designed to treat a maximum of 100 gpm with 69-77% recovery, producing a treated permeate stream of up to 69-77 gpm and reject streams of 1-8 gpm (MF unit) and 15-30 gpm (RO unit).

In the MF/RO Water Treatment Plant, water pumped from either the Dewatering Storage Pond or Stormwater Pond 1 is treated with sodium hypochlorite bleach, ferric chloride, and sulfuric acid as needed to oxidize and precipitate iron, manganese, and other metals in an 8.5-foot diameter, 5,000-gallon, polyethylene Raw Water Tank. The water is then pumped through the MF unit in a mobile truck-trailer-mounted MF/RO container to remove suspended particles, including, but not necessarily limited to, pulverized rock, drilling additives, and precipitated iron, manganese, aluminum, and silica. Waste solution from the MF unit flows into another 8.5-foot diameter, 5,000-gallon, polyethylene MF Waste Tank, from which it is pumped, along with an organic anionic polymer flocculant additive, through a fabric geotube to dewater the MF solid waste sludge. The geotube is housed in a 30-cubic yard, epoxy-coated, steel filter bin containment. The MF sludge is placed on the WRR or hauled offsite for proper disposal, as warranted based on periodic analyses required in the Permit. The rejected geotube filtrate water is returned to Stormwater Pond 1. An antiscalant, sodium bisulfite, and sulfuric acid are then added, as needed, to the MF-treated water, and it is pumped through the RO unit in the MF/RO trailer. The RO unit removes dissolved ions, including arsenic, antimony, sulfate, nitrate, total nitrogen, and TDS. After the RO step, the water is pH adjusted with sodium hydroxide, as warranted, to meet the Profile I pH reference range of 6.5 to 8.5 SU, and is pumped to the two Permeate (treated water) Storage Tanks. The brine reject solution from the RO unit may be conveyed either to Stormwater Pond 1 or to two 8.5-foot diameter, 5,000-gallon, polyethylene RO Brine Storage Tanks for proper offsite disposal at an authorized facility.

Bulk chemical storage and other components of the MF/RO Water Treatment Plant are housed in a heated tent building adjacent to the MF/RO trailer. The tent building was constructed on a bermed containment pad, measuring approximately 40 feet by 60 feet, consisting of, from bottom to top: 6 inches of minus 1-inch crushed structural fill compacted to 90% maximum dry density Modified Proctor (ASTM Method D1557); a single 60-mil HDPE liner; and a 12-inch thick overliner layer of minus 1.5-inch diameter non-angular gravel, which was also compacted to 90% maximum dry density Modified Proctor (ASTM Method D1557). The structural fill and non-angular gravel were imported from offsite commercial gravel pits. The liner berms around the perimeter of the secondary containment were constructed with 12-inch diameter horizontal HDPE pipe resting on compacted structural fill and overlain with the 60-mil HDPE liner to maximize usable space. The tent building secondary containment is graded to drain to Stormwater Pond 1 via a pipe ditch lined with 60-mil HDPE. Together, the tent building secondary containment and Stormwater Pond 1 provide in excess of the required 110 percent capacity of the largest primary vessel in the tent building. All chemical reagents have their own dedicated secondary containment structures separate from the tent building containment to eliminate the potential for concentrated reagent spillage draining into Stormwater Pond 1.

The trailer-mounted MF/RO unit sits within a separate 60-mil HDPE-lined bermed secondary containment, measuring approximately 9.5 feet by 60 feet, located on the west side of the tent building containment, and is connected to it via a short 60-mil HDPE-lined pipe ditch. The MF/RO secondary containment construction is identical to that of the tent building secondary containment, except its liner berms are supported entirely with structural fill rather than HDPE pipe. The MF/RO secondary containment provides in excess of the required 110 percent capacity of the largest primary vessel.

The two 5,000-gallon Permeate Tanks and the two 5,000-gallon RO Brine Storage Tanks are located south of the tent building in a separate 60-mil HDPE-lined secondary containment, measuring approximately 10 feet by 42 feet, with construction identical to the MF/RO secondary containment. Tanker trucks that haul the waste RO brine offsite for proper disposal provide their own temporary secondary containment while filling up adjacent to the brine tanks.

List of Approved Chemicals for Use in Water Treatment Systems: The following chemicals have been approved for use in water treatment systems at the Project: sodium hypochlorite, sulfuric acid, RoCide IS2 (biocide), Vitec 4000 (antiscalant), Vitec 7000 (antiscalant) sodium bisulfite, sodium hydroxide, citric acid, hydrochloric acid, organic anionic polymer (flocculant), ferric chloride, Hydrex 4109, Hydrex 6142, Hydrex 6701, Hydrex 6781, Hydrex 2939, Hydrex 3250, Hydrex 3951, Hydrex 1569, Hydrex 3251,Cationic Polymer Solve 9248, Cationic Polymer Solve 137, Chargepac™ 9500, Drewfloc™ 2425, System Floc-360, Barafloc, and Alcomer 24 UK, or equivalents.

All other chemicals must have prior Division approval before being brought or used onsite.

Petroleum-Contaminated Soil (PCS) Management: The Permittee is not authorized to dispose or treat PCS on the mine site. PCS may be temporarily stored in a reinforced concrete PCS temporary holding pad structure prior to shipment to an off-site disposal facility authorized to receive the material. The PCS temporary holding pad design was reviewed and approved as part of the Permit application, but the pad has not yet been constructed. Until the PCS temporary holding pad is constructed, PCS must be temporarily contained in a leak-tight roll-off bin or equivalent prior to timely shipment to an authorized off-site facility.

The approved PCS temporary holding pad design will accommodate 60 cubic yards of PCS material in a design-maximum 10-foot high angle-of-repose stockpile. Disposal must occur when the stockpiled material reaches the maximum design height or quarterly, whichever occurs first. The holding pad structure will be located near the decline portal. The structure will include a 30-foot by 35-foot PCS containment pad, a drive on-drive off access ramp, a 30-foot by 10-foot sediment trap, and a 30-foot by 5-foot fluid sump. The containment pad construction includes a 5.5-foot high stemwall on all sides except for the location of the access ramp side, which can accommodate a Caterpillar 966H wheel loader or equivalent; the sediment trap and fluid sump will be constructed with a 4-foot high stemwall, except for a drive on-drive-off access ramp located on the upgradient side of the sediment trap, which can accommodate a Caterpillar 272C skid-steer loader or equivalent. The sediment trap and fluid sump will be constructed approximately 3.5 feet below grade.

The base of the PCS temporary holding pad will be sloped at a minimum 2% grade toward a 36-inch wide, reinforced steel bar drainage grate built into the downgradient stemwall. Fluid that drains from the stored PCS will pass through the grate and into the adjacent sediment trap. The base of the sediment trap is sloped away from the access ramp at a minimum 7% grade to a 10-foot by 10-foot sump area. A 1.5-foot deep weir will be cut into the top of the stemwall at the sediment trap sump location to allow decant fluid to pass into the adjacent fluid sump.

C. <u>Receiving Water Characteristics</u>

Groundwater in the Project area generally flows from the front of the Shoshone Range eastward toward the central part of the basin in Crescent Valley, a terminal playa. The Project area is bounded by ephemeral drainages that flow south and east in response to major precipitation events and periods of snowmelt. These drainages and two springs flow into Fire Creek, a perennial stream on the south side of the Project that flows eastward and typically infiltrates into the alluvium (runs dry) near the entrance to the canyon, approximately 1 mile southeast of the Project. Downstream of the canyon, Fire Creek is an ephemeral drainage, which is typically dry, but periodically flows all the way to the playa in Crescent Valley during flood events.

The two main groundwater hosts are the volcanic bedrock and the alluvial basin sedimentary fill. Seasonal groundwater recharge occurs in the basin fill along the west edge of Crescent Valley and in the bedrock of the upper pediment slope on the east flanks of the Shoshone Range. Alluvium along the pediment slope is also recharged during heavy precipitation years. Discharge from Crescent Valley occurs primarily through evapotranspiration, although regional hydrologic modeling performed by Barrick Cortez Inc., regarding its Pipeline and Cortez Hills mines located further south in Crescent Valley (WPCPs NEV0000023, NEV0093109, NEV0095111, and NEV2007106), suggests that some groundwater flows northward from Crescent Valley toward the Humboldt River.

At the Fire Creek Project, bedrock groundwater depth and flow appear to be compartmentalized and controlled by geologic structures, but a general southeasterly gradient is observed at the Project. Groundwater flows artesian at the water supply well PW-1, located on the west side of the main Project area; however, in two exploration drill holes (FC-0629 and FC-0630) completed in the vicinity of the WRR footprint, bedrock groundwater was intercepted at elevations of 5,309 and 5,514 feet AMSL, which indicates a groundwater depth greater than 200 feet below the WRR toe elevation of 5,730 feet AMSL. The static water elevation in monitoring well GW-2, located a short distance southeast, and downgradient, of Dewatering Storage Pond 2, and approximately 1,500 east of water supply well PW-1, was 5,467 feet AMSL in 2014, or 188 feet below ground surface (bgs). The static water elevation is deeper further east in downgradient monitoring well GW-3, located east of the Fire Creek canyon mouth and approximately 5,500 feet east of GW-2. The static water elevation in GW-3 was 4,883 feet AMSL in 2014, or approximately 480 feet bgs.

Based on the above data, a groundwater inflow rate of approximately 20 gpm, encountered during construction of the decline, was significantly greater than anticipated. Contact water collected in other underground sumps (e.g., UC-2, US-3, etc.) has contacted underground roads and drilling areas, and commonly exceeds Profile I reference values for nitrate + nitrite, total nitrogen, and occasionally for aluminum, arsenic, antimony, iron, manganese, sulfate, TDS, and/or high pH. Contact water may also contain petroleum contamination from underground mine equipment. Contact water must be treated prior to being discharged to Fire Creek (WPCP NEV2018104) or being used for surface dust suppression, whereas "non-Contact" water may be discharged to Fire Creek or used for dust suppression without treatment, provided that it meets all Profile I reference values.

Groundwater wells MW-1 (identified as GW-1 for permitting purposes) and PW-1, located upgradient and cross-gradient of the WRR, respectively, have been sampled since the fourth quarter of 2007. Sample results have reported generally good quality water with slight background exceedances of the Division Profile I reference values for iron (maximum 0.96 mg/L), manganese (maximum 0.63 mg/L), and pH (maximum 8.8 SU). The downgradient bedrock monitoring wells GW-2 and GW-3, which were installed in 2011 as a Permit requirement, also both exhibit good water quality, meeting all Profile I reference values, except for slightly elevated background manganese in GW-3. The construction of GW-3 was delayed several months beyond the timeframe specified in the Permit due to archeological investigations and clearance activities required by the U.S. Bureau of Land Management. Monitoring well GW-10, located immediately south and downgradient of Stormwater Pond 2, was approved as part of the 2015 major modification. An EDC was approved by the Division in April 2015 to install new upgradient monitoring wells, GW-7 approximately 3200 feet southeast of GW-1 and GW-8 approximately 3,200 feet northwest of GW-1, because of an obstruction in the GW-1 casing. GW-1 will continue to be sampled as long as possible, but the obstruction has prevented determination of water elevation since the first quarter of 2013.

Alluvial groundwater has not been encountered in monitoring wells in the Project area, but is likely present within shallow alluvial deposits along Fire Creek. Fire Creek, which flows east-southeastward along the south side of the facility, and two surface springs that feed Fire Creek, were routinely sampled and analyzed for Division Profile I parameters from 2006 to 2011, prior to Permit issuance. The springs, SS-1 and SS-2, are located approximately 4,500 feet cross-gradient to the west and upgradient to the northwest, of the facility, respectively. Surface water monitoring points SW-1 and SW-2 for Fire Creek itself are located upstream to the southwest (cross-gradient for groundwater), and downstream to the southeast (downgradient) of the facility, respectively.

The Permit does not require analyses of springs SS-1 and SS-2, because they are cross-gradient and upgradient of the facility. However, the historic upstream and downstream monitoring points on Fire Creek, SW-1 and SW-2, respectively, are included in the Permit. Upon issuance in 2011, the Permit established a new parameter list, the Surface Water Toxic Materials Profile, for Fire Creek surface water analyses. The Surface Water Toxic Materials Profile includes selected inorganic toxic parameters for which aquatic life and/or livestock beneficial use water quality standards are specified at NAC 445A.1236. For each parameter, the Permit applies the more restrictive water quality standard (aquatic life or livestock) to Fire Creek. For aquatic life standards, the Permit uses the 96-hour-average standards, except for silver, which has only a one-hour-average standard; however, if only one analysis is performed during the specified time interval, then the standard applies to the single analytical result. The non-aquatic-life surface water standards established in the Permit apply to single analytical results without averaging. The Permittee may request a change in a Permit water quality standard if it can be demonstrated that a pre-construction background value exceeded the standard.

As part of the 2015 major modification, the name of the Surface Water Toxic Materials Profile was simplified to the Surface Water Profile, and additional parameters were added. Boron, total chromium, and fluoride were added so the Permit would include all parameters for which livestock beneficial use standards are established, and pH and TDS were added with appropriate standards for consistency with other surface water bodies in the State that have water quality standards. In addition, total alkalinity, bicarbonate, calcium, magnesium, potassium, and sodium were added to the Surface Water Profile, but without associated water quality standards, as general indicators of water quality and character, and to allow checks for internal consistency of analyses with regard to major ions and TDS. Prior to the 2015 major modification, the Permittee had already been performing voluntary analyses for most of the new parameters.

For the period of record prior to Permit issuance and mining (2006 to 2011), the Permittee provided Profile I analyses in the Permit application for Fire Creek surface water at SW-1 and SW-2, and springs SS-1 and SS-2. Although Profile I reference values do not apply to the Fire Creek surface water, the analytical results are summarized below for general information. From 2006 to 2011, the upstream Fire Creek water (SW-1) exhibited no concentrations elevated above Profile I reference values, although pH was as high as 8.5 SU. The downstream Fire Creek water (SW-2) exhibited elevated pH (up to 9.3 SU) and sporadic elevated aluminum (maximum 1.9 mg/L) and iron (maximum 2 mg/L) concentrations. For the same period of record, springs SS-1 and SS-2 both exhibited neutral to slightly alkaline pH to a maximum of 8.5 SU. SS-1 exhibited sporadic concentrations above Profile I reference values for aluminum (maximum 0.42 mg/L) and manganese (maximum 0.343 mg/L). SS-2 also exhibited sporadic elevated aluminum (maximum 1.6 mg/L), iron (maximum 2.9 mg/L), and manganese (maximum 0.31 mg/L).

After Permit issuance in March 2011, SW-1 and SW-2 analyses have met most of the Fire Creek water quality standards established in the Permit, with pH in the range of 7.2-8.6 SU and TDS in the range of 220-260 mg/L; however, both SW-1 and SW-2 have exhibited sporadic exceedances of the aquatic life standard for sulfide (2.0 micrograms per liter (µg/L)), with values up to 300 µg/L at SW-1 and up to 160 µg/L at SW-2. The sulfide exceedances do not appear to be related to the mining operation, because the concentrations have been higher upstream of the facility than downstream. SW-2 has also occasionally exhibited low-level exceedances of the 1,000 µg/L aquatic life standard for iron.

D. Procedures for Public Comment

The Notice of the Division's intent to issue a Permit authorizing the facility to construct, operate and close, subject to the conditions within the Permit, is being published on the Division website: https://ndep.nv.gov/posts/category/land. The Notice is being mailed to interested persons on the Bureau of Mining Regulation and Reclamation mailing list. Anyone wishing to comment on the proposed Permit can do so in writing within a period of 30 days following the date the public notice is posted to the Division website. The comment period can be extended at the discretion of the Administrator. All written comments received during the comment period will be retained and considered in the final determination.

A public hearing on the proposed determination can be requested by the applicant, any affected State or intrastate agency, or any interested agency, person or group of persons. The request must be filed within the comment period and must indicate the interest of the person filing the request and the reasons why a hearing is warranted.

Any public hearing determined by the Administrator to be held must be conducted in the geographical area of the proposed discharge or any other area the Administrator determines to be appropriate. All public hearings must be conducted in accordance with NAC 445A.403 through NAC 445A.406.

E. Proposed Determination

The Division has made the tentative determination to renew the Permit.

F. Proposed Limitations, Schedule of Compliance, Monitoring, Special Conditions

See Section I of the Permit.

G. Rationale for Permit Requirements

The facility is located in an area where annual evaporation is greater than annual precipitation. Therefore, the facility must operate under a standard of performance which authorizes no discharges, except for those accumulations resulting from a storm event beyond that required by design for containment, or discharges regulated and authorized by another Permit (WPCP NEV2018104) issued by the Division.

The primary method for identification of escaping fluid will be placed on required routine monitoring of leak detection systems as well as routine sampling of monitoring wells and surface water. Specific monitoring requirements can be found in the Water Pollution Control Permit.

H. Federal Migratory Bird Treaty Act

Under the Federal Migratory Bird Treaty Act, 16 U.S. Code 701-718, it is unlawful to kill migratory birds without license or permit, and no permits are issued to take migratory birds using toxic ponds. The Federal list of migratory birds (50 Code of Federal Regulations 10, 15 April 1985) includes nearly every bird species found in the State of Nevada. The U.S. Fish and Wildlife Service is authorized to enforce the prevention of migratory bird mortalities at ponds and tailings impoundments. Compliance with State permits may not be adequate to ensure protection of migratory birds for compliance with provisions of Federal statutes to protect wildlife.

Open waters attract migratory waterfowl and other avian species. High mortality rates of birds have resulted from contact with toxic ponds at operations utilizing toxic substances. The Service is aware of two approaches that are available to prevent migratory bird mortality: 1) physical isolation of toxic water bodies through barriers (e.g., by covering with netting), and 2) chemical detoxification. These approaches may be facilitated by minimizing the extent of the toxic water. Methods which attempt to make uncovered ponds unattractive to wildlife are not always effective. Contact the U.S. Fish and Wildlife Service at 1340 Financial Boulevard, Suite 234, Reno, Nevada 89502-7147, (775) 861-6300, for additional information.

Prepared by: TJ Mohammed
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Revision 00: Renewal and boiler plate update