Permittee Name: Springer Mining Company
Project Name: Springer Tungsten Facility
Permit Number: NEV2007108
Review Type/Year/Revision: Renewal 2018, Revision 00

A. Location and General Description

Location: The Springer Tungsten Facility is located in northwest Nevada, north of the Humboldt River on the southeast flank of the Eugene Mountains, at elevations between 4,500 and 5,300 feet above mean sea level (AMSL), in north-central Pershing County. The facility is situated approximately 43 miles northeast of the town of Lovelock, within portions of Sections 1, 2, 3, 4, 10, 11, 12, 37, 38, and 40, Township 33 North (T33N), Range 34 East (R34E); Section 6, T33N, R35E; Sections 22, 23, 24, 25, 26, 27, 34, 35, and 36, T34N, R34E; and Section 31, T34N, R35E, Mount Diablo Baseline and Meridian. The site may be accessed by traveling 44 miles east from Lovelock, or 26 miles west from Winnemucca, on Interstate Highway 80 to the Mill City/Dun Glen exit 149, then approximately 8 miles north-northwest on Tungsten Road to the facility site.

General Description: The facility is designed to extract tungsten and associated minerals, with a maximum permitted production rate of 474,500 tons of ore per year. The facility is comprised of the open pit and underground mines, a flotation mill with associated grinding, cyclone, thickener, solvent extraction, ammonium paratungstate, and synthetic scheelite circuits, reagent storage areas, 2 synthetic-lined tailings impoundments, a stormwater pond, 2 waste rock storage facilities, an ore crusher and ore stockpile pads, production wells, water quality monitoring wells, and associated administrative and operational support infrastructure. It is anticipated the facility will operate in excess of 5 years and disturb approximately 384 acres of public and private land.

B. Synopsis

Background: Tungsten, primarily in the form of scheelite (calcium tungstate, CaWO4) ore, was discovered in the area by Emil Stank in 1914. Demand for the metal during World War I led to the formation of the Pacific Tungsten Company and the Nevada-Humboldt Tungsten Mines Company and subsequent development of infrastructure to support gravity concentrator mills capable of processing up to 2,125 tons of ore per day. Approximately 36,000 tons of ore were milled before the mills were shut down in 1919 following the end of the war.
The Nevada-Massachusetts Mining Company acquired the mine in December of 1919 and had absorbed both predecessor companies by 1926. Additional development included a new mill, a flotation plant, and a tailings disposal facility. Operations continued, although somewhat sporadically, from 1925 through 1958, when production again ceased due to low commodity prices. Approximately 1.8 million tons of ore were processed during the period.

The property remained inactive and was acquired by the Tungsten Mining Company, owned by the Segerstrom family, in 1970, and was subsequently leased to the General Electric Company (GE). GE completed further exploration of the property with its mining subsidiary, Utah International, Inc. (Utah), between 1972 and 1979. In 1979, GE purchased the property and Utah proceeded to develop new mining and processing facilities that included the North Sutton Shaft to access the underground mine workings, a mill, a solvent extraction (SX) plant, and a tailings disposal facility (J-183). The new mill facility also included circuits to recover by-product molybdenum disulfide (MoS$_2$) from the tungsten ore and to produce ammonium paratungstate (APT), ($\text{NH}_4$)$_{10}$(H$_2$W$_{12}$O$_{42}$)4H$_2$O, as a high-value product. Low commodity prices again led to a cessation of operations and GE placed the facility into “care and maintenance” in 1982 and sold the operation to BHP. In 1984 BHP sold the operation to Golden Predator Mines. The “stand-by” mode continued until 1994, when the underground workings were allowed to flood and the remainder of the facility was “mothballed”, with the exception of the entire gravity circuit which was purchased by Kennametal and moved to Fallon, Nevada.

In November 2006, the Springer Mining Company (SMC) and its primary asset, the Springer Tungsten Facility, were purchased as a wholly-owned subsidiary of Golden Predator Mines (US), Inc., a wholly-owned subsidiary of Golden Predator Mines, a Canadian corporation. In early 2009, with approval of the Toronto Stock Exchange, Golden Predator Mines reorganized into a company called EMC Metals Company (EMC). EMC subsequently spun off all precious metal assets to a new entity, Golden Predator Royalty and Development Company, and retained ownership of SMC. In January 2014 ownership of SMC reverted to Americas Bullion Royalty Corp. Then in April 2014, SMC was acquired by Silver Predator US Holding Corp. SMC remains the Permittee for the Springer Tungsten Facility Permit. The application of 12 December 2007 and subsequent Permit of 03 December 2008, are the first application and issued Water Pollution Control Permit for the property.

**Mining:** Tungsten ore occurs in a sequence of limestone skarn sedimentary rocks that dip steeply (75 to 90 degrees) along the contact of the Cretaceous-age granodiorite Springer Stock and Uncle Sam Stock. Initially, mill ore feed may come from an expansion of the existing George Pit, located approximately one-half mile northwest of the mill facility, on the west side of the Springer Stock. The floor of the pit is anticipated to bottom at an elevation of approximately 5,170 feet.
AMSL. The static groundwater elevation in monitor well MW-12 was measured at 5,177 feet AMSL. However, another nearby historic open pit has a pit floor elevation of approximately 5,120 feet AMSL and exhibits no evidence of penetrating the water table. Based on this information, the George Pit is not expected to intercept groundwater level and formation of a pit lake is not anticipated. As a precaution, additional boreholes will be drilled to test for water prior to the George Pit floor being excavated below an elevation of 5,190 feet AMSL.

The majority of ore production will come from long-term mining of the underground workings of the North Sutton Mine. The primary access to the mine is currently the Sutton 3 Shaft but access is also possible through the Sutton 2 Adit and several smaller ventilation raises. Prior to any refurbishment and mining, the flooded underground workings must be dewatered. As measured in November 2007, the static water elevation in the Sutton 3 Shaft stood at 479 feet below the collar. Based on initial water quality analyses, dewatering water must be used in the processing circuit unless other approvals are obtained in advance from the Nevada Division of Environmental Protection (Division).

**Waste Rock Storage Facilities (WRSF):** Two waste rock storage facilities (WRSFs) are proposed; the North George Waste Rock Dump, located to receive material from the adjacent George Pit, and the North Sutton Waste Rock Dump, located to receive a limited amount of material from the adjacent underground mine. Waste rock excavated from the George Pit will be primarily comprised of hornfels with minor limestone. Backfilling of the George Pit with waste rock may occur, if deemed to be a feasible alternative as the pit footprint expands. Waste rock generated from the underground workings will be comprised of hornfels, skarn, and minor (<10%) granodiorite.

Waste rock characterization indicates that, except for the granodiorite, the majority of rock types exhibit positive net neutralizing potential (NNP) ranging from 24 to 864 and acid neutralizing potential to acid generating potential ratios (ANP:AGP) between 800:1 and 28,800:1. Based on the characterization results, these rock types do not require special handling and the waste rock facilities will be constructed to a conventional design to meet stormwater and safety concerns. Based on engineering design parameters, the WRSFs may not be constructed with side slopes steeper than 2.0 Horizontal: 1.0 Vertical (2H:1V).

Only the granodiorite, which due to a lack of access to the underground workings was sampled from the historic underground equipment yard where it was used as wearing coarse material, demonstrates characterization results at the low end of the neutral spectrum. With an ANP:AGP ratio of 0.86, the granodiorite falls below the Division threshold preferred minimum ratio of 1.2:1, and therefore is classified as potentially acid generating (PAG) material. Consequently, the Permittee has performed kinetic testing (modified humidity cell) of a sample of the equipment.
yard material. In addition, additional testing of the material from the underground workings will occur once access is possible following dewatering.

The Permittee has proposed the use of coarse tailings material as a component of underground mine backfill material to minimize tailings volume and enhance mine safety. However, based on characterization of historic tailings material utilizing the meteoric water mobility procedure (MWMP), the material may not be suitable due to results that indicate the potential for mobilization of elevated concentrations above Division Profile I reference values aluminum, arsenic, mercury, and selenium. Additional characterization and approval from the Division are required prior to the use of any tailings material in mine backfill.

**Springer Tungsten Mill:** The Springer Tungsten Mill was constructed and operated by GE between 1977 and 1982. The main concrete and steel mill building measures approximately 138 feet by 220 feet in plan and is flanked by a reagent off-loading and storage area, measuring approximately 108 feet by 168 feet, and the new SX plant, to replace the plant constructed by GE in 1981, that measures approximately 80 feet by 82 feet. The original mill reinforced-concrete foundation walls and floors have been inspected and certified for integrity. Process circuits were tested for integrity and water tightness. Upgrades to concrete floors, sumps, curbs, stemwalls, access ramps, and other process fluid containment features and containment ‘zones’ have been performed to ensure that all areas of the existing mill meet the current regulatory minimum 110% secondary containment volume requirement. All new construction is based on designs reviewed and approved in accordance with current regulatory requirements.

The mill was originally designed to process 1,300 tons of tungsten ore per day in a physical separation circuit and will be operated at a nominal 1,200 tons per day to remove the tungsten-bearing mineral scheelite from the ore. Further chemical separation will liberate tungsten from the scheelite. The primary mill product will be synthetic scheelite. The SX plant will be used for the production of dissolved APT by combining tungstate with anhydrous ammonia. Molybdenum bisulfide (Mo2S3) could also be produced as an additional by-product if the plant is modified in the future. Permit modification and fees will apply.

The beneficiation process begins with run-of-mine ore passing through primary and secondary crushers located adjacent to the mill building. Crushed ore is stored on the ore stockpile until it is conveyed to a rod mill and ball mill for grinding and further size reduction.

From the grinding circuit, the ore passes to a 2-stage flotation circuit. The first stage removes sulfide minerals from the ore slurry and the second stage concentrates the scheelite, which is retained in a thickener and surge tank prior to further processing. The waste stream tailings are pumped from the process circuit to the tailings impoundment.
The scheelite concentrate is subjected to digestion at high temperature and pressure under high pH conditions. The digestion process liberates tungstate (WO\textsubscript{4}) and allows calcium and bicarbonate to combine, precipitating calcite. The slurry is cooled in a heat exchanger and adjusted to a neutral pH by the addition of sulfuric acid, which also causes precipitation of dissolved silica that is removed with a filter press.

Molybdenum in the form of molybdate (MoO\textsubscript{4}), a natural impurity in the scheelite ore, is liberated with the tungstate and must be removed prior to synthetic scheelite or APT manufacture. The molybdate is removed by a sulfur precipitation process that uses the addition of sodium hydrosulfide (NaHS, commonly known as ‘Nash’) to form molybdenum trisulfide, which can be containerized for sale or disposed with tailings.

Once the molybdate is removed, the tungstate bearing solution can be used to manufacture either synthetic scheelite or APT. To produce synthetic scheelite, water with high pH from the addition of lime is mixed with the tungstate-bearing solution. To produce APT, the tungstate-bearing solution is passed into the SX circuit where it is combined with anhydrous ammonia to extract dissolved APT. The individual saleable dry products are produced by filtering, drying, and bagging the respective solutions in a dedicated filtering, drying, and bagging circuit.

**Reagent Storage:** Reagents will be stored in a dedicated, reinforced-concrete, secondary containment area located on the south side of the main Springer Mill building. The Reagent Storage area will be roofed but open on all sides to allow easy access by delivery vehicles. The storage area will be ringed with a minimum 2-foot high reinforced-concrete, secondary containment stemwall and internally subdivided by additional stemwalls into six discrete secondary containment “zones” in which the individual reagent primary containment storage tanks will be located. Each “zone” will be equipped with a dedicated sump and evacuation pump and designed to effectively segregate reactive chemicals both for containment and spill clean-up purposes, if needed. All concrete joints will be constructed with flexible waterstops and sealant as appropriate.

Reagents anticipated for storage in the facility include, but may not be limited to, sodium hydrosulfide, fatty acid flotation collector, sodium silicate, fuel oil, sulfuric acid, caustic soda, ammonia, and hydrogen peroxide.

**Event Pond:** An emergency stormwater collection pond, the Event Pond, will be constructed into the hillside approximately 1,500 feet downgradient of the Springer Tungsten Mill. The pond design is roughly semi-circular in plan and measures approximately 170 feet by 300 feet by about 10 feet maximum depth. The pond is designed to collect the solution from a major spill in the mill or flow reporting to the mill watershed area of approximately 7.0 acres as the result of the 100-year 24-
hour storm event. The pond storage capacity is approximately 10.1 acre-feet (3.3 million gallons) with 2 feet of freeboard remaining and approximately 12.3 acre-feet (4.0 million gallons) at the pond crest.

The pond design incorporates a liner system comprised of a single layer of 60-mil high density polyethylene liner (HDPE) liner placed over a layer of Geosynthetic Clay Layer (GCL). The pond is not leak detected. Solution may be conveyed by gravity from the pond via a 4-inch diameter HDPE pipeline booted through the base liner and tied into the nearby tailings slurry pipeline for discharge to the IWT Impoundment. The conveyance pipeline is encased in lean concrete where it passes through the liner boot and the pond embankment. A valve on the discharge pipeline can be used to control flow to the slurry pipeline. Because of its single-liner construction, the event pond has a 20-day limit for storage of process solution.

**Tungsten Tailings and Reclaim Solution Management:** Two synthetic-lined, earthen embankment tailings storage facilities, the IWT Tungsten Tailings Impoundment (short-term tailings disposal facility) and the J-183 Tungsten Tailings Impoundment (also referred to as the ‘WT’ Impoundment), are approved to manage tailings material. The IWT Tungsten Tailings Impoundment will be constructed first to contain approximately 1 million tons of tungsten tailings that will be generated during a period of approximately 30 months from the initial start-up of the mill. The J-183 Tungsten Tailings Impoundment, constructed for GE in 1982, will be upgraded at a later date, in accordance with approved designs and a schedule of compliance, and used for the long-term deposition of tailings. Both facilities will be operated as subaerial tailings deposition facilities. Each impoundment is designed with an underdrain solution collection pond. Tailings slurry and reclaim solution conveyance pipelines are located in a common, synthetic-lined Pipeline Corridor (see below).

**IWT Tungsten Tailings Impoundment:** The IWT Tungsten Tailings Impoundment (IWT) has not yet been constructed, but will be located approximately 3,500 feet downgradient of the Springer Tungsten Mill. The IWT will consist of a primary 80-foot high earthen embankment constructed as a sidehill dike configuration in an area of uncontrolled, historic tailings deposition. The primary embankment will be partitioned into an upper and lower cell by a 25-foot high internal dike. Early construction of the internal dike will allow deposition of tailings into the upper cell (Phase I) while construction of the lower cell (Phase II) and the remainder of the primary embankment is completed. Construction of the Phase II cell is anticipated to be completed within six months of Phase I construction. The upstream and downstream primary embankment and internal dike slopes are designed with a 3H:1V configuration to enhance stability. Deposition will merge the Phase I and Phase II cells during the life of the impoundment.
The embankment foundation and basin area is to be cleared and grubbed to a depth of 6 to 9 inches. Following clearing the foundation footprint will be scarified, moisture conditioned, and proof rolled. The embankment is designed with 3 zones: the upstream Zone 1 constructed of structural fill, the Zone 2 centrally located Chimney Drain and downstream Blanket Drain, and the downstream Zone 3 random embankment fill.

Zone 1 structural fill is comprised of native silty or clayey sand material with 100% passing 4 inches and between 10% and 20% minus 200 mesh. Zone 1 material is to be placed in maximum 10-inch thick loose lifts compacted to within 2% of optimum moisture content and 92% maximum Modified Proctor density (ASTM Method D1557).

Zone 2 drain material is clean, natural dune and tailings sand material with a maximum particle size of 3/8-inch diameter and no more than 5% passing the 200 mesh sieve. Zone 2 material is to be placed in loose lifts, 6 inches thick, and compacted to 92% maximum modified Proctor density (ASTM Method D1557).

Zone 3 random fill material is a well-graded mixture of soil and rock with a maximum particle size of 6 inches. Zone 3 material is to be placed in loose lifts no more than 12 inches thick compacted to an 92% maximum modified Proctor density (ASTM Method D1557). When material is too coarse to be tested, the engineer may design a platform and determine the number of passes required by the available compaction equipment to achieve a non-yielding fill of equivalent density. Any Zone 3 fills to receive liner material will be dressed with Zone 2 fill and smooth drum rolled in preparation for liner placement.

Slope stability analysis of the primary embankment design indicates the construction meets or exceeds all minimum Division factor of safety criteria for both static and pseudo-static (seismic) conditions. Although not separately evaluated, the internal dike will have an equal or greater factor of safety due to its construction with the same foundation materials as used in the primary embankment and its lower overall height.

A structural Key Trench, measuring 16 feet wide and 5 feet deep is to be constructed at the base of the primary embankment at the interface between the upstream Zone 1 embankment fill and the Zone 2 Chimney Drain. A separate Toe Drain will be constructed at the toe of the downstream Blanket Drain. The drains are constructed within the primary embankment, parallel to the downstream toe. Each drain is designed with a perforated 3-inch diameter HDPE solution collection pipeline encased in aggregate fill drain rock placed along the downgradient edge of each structure. The drain rock consists of rounded or crushed minus 3/4-inch and plus 3/8-inch diameter gravel placed in a single uncompacted layer wrapped with 12 ounces per square yard (oz/yd²) geotextile. The perforated collection pipelines, located within the gravel pack in the eastern and western portion of each drain,
collect any fugitive solution, which is conveyed to the IWT Underdrain Collection Pond via 3-inch diameter solid, HDPE pipelines.

The IWT is a fully synthetic-lined impoundment. The lined areas of the Phase I and Phase II cells are approximately 13.5 and 13.6 acres, respectively. The IWT liner system is designed with a textured 60-mil HDPE liner placed on a soil bedding layer constructed over a prepared subgrade. The liner is placed with the textured side up as a worker and wildlife safety measure. A 12-inch thick drainage blanket, comprised of a layer of sand placed on top of the synthetic liner, contains an underdrain solution collection system comprised of 3-inch diameter perforated, single-wall HDPE pipelines, placed on 20-foot centers in a herringbone pattern. Collected solution reports to 4-inch diameter, solid, dual wall HDPE header pipelines that convey solution to the IWT Underdrain Collection Pond.

The Phase I and Phase II cell solution collection systems are segregated. The Phase I header pipeline is booted through the impoundment liner and encased in lean concrete where it penetrate the internal dike. Both the Phase I and Phase II header pipelines are booted and encased in concrete where they pass in parallel through the primary embankment to the Underdrain Collection Pond.

During the first 6 to 9 months of impoundment operation, valves located on the underdrain solution collection header pipelines and the tailings slurry deposition dropbars located on the internal dike and the west impoundment slopes will be used to manage tailings placement and cover the entire impoundment basin and underdrain blanket with a protective layer of tailings. Following this initial management period, the dropbars will be removed from the internal dike and deposition from dropbars located on the west side of the impoundment will be used to ‘push’ the supernatant pool to the northeast corner of the impoundment and enhance tailings consolidation. The design supernatant pool should cover a maximum area of about 4 acres to a depth of 4 to 8 feet above the tailings mass and with minimum freeboard of 2 feet below the impoundment crest. Reclalm solution is recovered from the supernatant pool with a barge-mounted submersible pump. All underdrain solution collection header pipeline valves are located in lockable vaults to reduce the potential for vandalism or inadvertent modification of a valve setting.

The IWT design includes the installation of vibrating wire piezometers in areas of the impoundment that could be subject to elevated hydraulic head. Three piezometers, placed in a line perpendicular and central to the downstream embankment toe, monitor the interface between the embankment foundation subgrade and the overlying base of the embankment; two stacked pairs of piezometers, with one piezometer above the synthetic liner within the underdrain blanket and one piezometer below the synthetic liner within the bedding sand layer, monitor two locations along the toe of the main upstream embankment slope; and three stacked pairs of piezometers, with one piezometer above the synthetic liner
within the underdrain blanket and one piezometer below the synthetic liner within the bedding sand layer, monitor three locations along the northeast corner of the impoundment beneath the supernatant pool area.

**IWT Underdrain Collection Pond:** Tailings underdrain solution from the IWT reports to the double-lined and leak-detected IWT Underdrain Collection Pond. The pond, located adjacent to the downgradient IWT embankment toe, measures approximately 100 feet by 120 feet in plan and approximately 10 feet deep. The pond is designed to contain the 48-hour power-loss flow from the IWT of approximately 350,000 gallons. A 2-foot design freeboard provides an additional 24-hour power-loss capacity of approximately 180,000 gallons. These calculations were based on an assumed 70 gallons per minute (gpm) underdrain flow from the Phase I (upper) cell and 53 gpm underdrain flow from the Phase II (lower) cell. Underdrain solution reports to the pond through the two 4-inch diameter HDPE solution header pipelines, which are encased in concrete to the pond crest.

The pond double liner system is comprised of 60-mil HDPE primary and secondary liners with a layer of HDPE geonet between the liners to serve as a leakage collection and recovery system (LCRS). Fugitive solution is collected and conveyed by the LCRS to a subgrade leak detection sump located at the south end of the pond. The sump measures approximately 8-feet square by approximately 2 feet deep and is filled with ¾-inch diameter drain gravel encased in 12 oz/yd² geotextile. The sump may be evacuated through a 6-inch diameter polyvinyl chloride (PVC) inclined riser pipe that daylights at the pond crest. The pond liner is secured in an anchor trench on the pond crest and to the header pipeline concrete encasement with a wedge anchor and neoprene gasket. Header pipeline control valves are located in an 18-inch square precast locking valve box located upstream of the pond.

Reclaim solution collected in the IWT Underdrain Collection Pond will be pumped back to the surface of the IWT through a 4-inch diameter surface pipeline with a submersible pump. Reclaim solution is pumped from the IWT with a barge-mounted submersible pump to a horizontal centrifugal pump installed in a small building located on the northeast corner of the IWT. The horizontal pump boosts the flow into the Tungsten Reclaim Solution Pipeline for conveyance to the process water head tank located at the mill. Pumping occurs on an intermittent frequency at a rate of approximately 400 gpm.

**Tungsten Tailings Slurry Pipeline:** Tungsten tailings are conveyed from the tungsten mill to the IWT in an 8-inch diameter standard dimension ratio (SDR)-11 HDPE Tungsten Tailings Slurry Pipeline located in the Pipeline Corridor (see below). The tailings slurry will consist of 30 to 40 percent solids in process water. The slurry flow rate, based on open-channel flow, will be approximately 550 gpm and, based on the solids content, convey up to 4,000 tons per day of tailings to the IWT. The slurry pipeline will be placed on a 6-inch thick layer of minus ¾-inch
aggregate on the liner in the base of the Pipeline Corridor. A minimum 2-foot thick cover of bedding material will minimize pipeline movement due to temperature changes.

**Tungsten Reclaim Solution Pipeline:** Reclaim solution will be pumped to the tungsten mill head tank for use as make-up water through the 8-inch diameter, Schedule 40, welded steel Tungsten Reclaim Solution Pipeline located in the Pipeline Corridor (see below). Pumping of solution will be intermittent at a rate of up to 400 gpm. The reclaim pipeline will be placed on a 6-inch thick layer of minus ¾-inch aggregate on the liner in the base of the Pipeline Corridor. A minimum 2-foot thick cover of bedding material will minimize the potential for freezing of the pipeline and eliminate the need to drain the pipeline of solution between pumping periods.

**Pipeline Corridor:** The Tungsten Tailings Slurry Pipeline and the Reclaim Solution Pipeline are located in a lined Pipeline Corridor. The Pipeline Corridor follows the alignment of the 1982 tailings pipeline from the Springer Tungsten Mill to the IWT.

The Pipeline Corridor is a channel measuring 10 feet wide and excavated to a depth of 3 feet. The channel is lined with a single layer of smooth 60-mil HDPE placed on a prepared subgrade compacted to 92% modified Proctor density (ASTM Method D1557). A layer of 12 oz/yd² geotextile protects the synthetic liner from damage by the 6-inch thick layer of bedding material placed along the centerline of the corridor and the minimum 2-foot thick layer of type II aggregate cover material that minimizes movement of the slurry pipeline and prevents freezing of the reclaim pipeline.

A wye constructed in the channel, at a point adjacent to the Event Pond, will allow any stormwater or other open channel flows to discharge into the Event Pond for collection and management. The main channel and contained pipelines will terminate at the northeast corner of the IWT until the J-183 is constructed. The design of the channel will allow any spills from the pipelines to report by gravity to either the Event Pond or the IWT.

**IWT Stormwater Diversion Channel:** The IWT is protected from storm event run-on flows by an engineered, dedicated, unlined stormwater diversion channel. The IWT Stormwater Diversion Channel is approximately 3,650 feet long and wraps in an arc around the west side of the impoundment from the northeast corner to the south corner. As a conservative safety measure, the IWT channel was designed to convey flow associated with the probable maximum precipitation (PMP) event (calculated as 9 inches of precipitation that occurs during a 24-hour period in September) reporting to the mapped and modeled 668 acre upgradient watershed basin. The trapezoidal channel has an 8-foot-wide base and, with 2H:1V side slopes, the depth ranges from just under 3 feet to a maximum of 8 feet.
channel is designed with drop sections armored with D$_{50}$ 24-inch diameter riprap for erosion control.

**J-183 Tungsten Tailings Impoundment:** The J-183 Tungsten Tailings Impoundment (J-183), located approximately 2 miles downgradient of the Springer Tungsten Mill, is an existing facility designed by Jacobs Engineering Group in 1981 and constructed for GE in 1982. After approximately six months of intermittent operation and the deposition of approximately 70,000 tons of tailings material in the facility, GE ceased operations at the site. The J-183 will be upgraded, in accordance with approved designs and schedule of compliance requirements, prior to anticipated future use following acquisition from the Bureau of Land Management of a required right-of-way for an extension of the Pipeline Corridor to the facility.

The existing J-183 impoundment consists of a ring dike main embankment constructed as a monolithic structure using compacted soils excavated from within the impoundment area. The J-183 main embankment is an oval shape, aligned with the long axis approximately north-south, with a footprint that covers approximately 170 acres. Due to the natural slope of the ground (approximately 1.5%), the height of the main embankment ranges from a maximum of 26 feet at the downstream (southern) end to a minimum of 2 feet at the upstream (northern) end. The existing J-183 is divided into a northern one-third area and southern two-thirds area by an east-west earthen dike. The northern area was constructed with a clay layer and used as an evaporation pond; the southern area was an unimproved earthen basin used for tungsten tailings storage. The interior and exterior slopes of the main embankment are constructed at 2.5H:1.0V and the crest width measures 15 feet.

An inspection completed in May 2007, found the main embankment to be in good structural condition, with some erosion at the edges of the crest and on the side slopes. The erosion will be corrected as part of the new construction.

The proposed J-183 upgrades include reconfiguring the impoundment by: 1) dividing the northern area into two Mine Water Storage Cells with construction of a north-south internal earthen dike; 2) creating two new Tungsten Tailings Storage Cells by cutting the southern area roughly in half with an east-west internal earthen dike and further subdividing the northern half of the new area into an east and west cell with a north-south internal earthen dike; 3) lining the entire facility; and 4) removing an existing gabion spillway. The upgraded J-183 will be a fully-lined facility. The southern third of the impoundment area, within the original J-183 main embankment, will be left for future construction after the initial 3 to 5 years based on need.

The interior slopes of the main embankment, adjacent to the new tailings and mine water cells, and the slopes of all new internal dikes will be regraded or constructed, as applicable, to a flatter 3H:1V slope to accommodate liner installation and widen the crest to 25 feet for vehicle safety berm construction. The balance of the main
embankment will be regraded to the flatter slope as additional cells are constructed. The internal dikes will also be constructed to a maximum elevation 4 feet lower than the main embankment elevation. The two tailings cells will accommodate approximately 2.1 years of tailings production or approximately 890,000 tons at the permitted 1,200 tons per day mill processing rate.

Slope stability analysis of the J-183 main embankment design indicates the construction, to the approved design 4,260 feet AMSL maximum crest elevation, meets or exceeds all Division minimum factor of safety criteria for both static and pseudo-static (seismic) conditions. Although not separately analyzed, the internal dikes will have an equal or greater factor of safety due to construction with the same foundation materials as used in the main embankment and the lower overall height.

**Mine Water Storage Cells:** The two northern-most cells in the J-183 will initially be used as Mine Water Storage Cells. The northwest cell is identified as Mine Water Storage Cell 1 and the northeast cell as Mine Water Storage Cell 2. The combined capacity of the two cells will be approximately 96 million gallons. The cells will be used primarily to manage water generated during pre-production dewatering of the flooded underground mine workings. The cells have been sized to accommodate the maximum anticipated dewatering water volume, although concurrent consumption in the mill should reduce the potential volume stored in the cells. The Mine Water Storage Cells may be used for a period of no more than 3 years and must be evacuated annually for inspection of the cell liner and any required repair. Current planning is for the Mine Water Storage Cells to be converted to tailings storage cells in accordance with designs to be submitted and approved in advance.

Construction of the containment system upgrade for the mine water cells will consist of grubbing the upper 6 inches of soil and stockpiling the material for future reclamation activities. The base of the cell area will be regraded to approximately a 0.25% grade to the southwest corner of each cell, moisture conditioned and drum rolled. A low permeability soil layer (LPSL), installed over the prepared base, will be constructed by amending the base 6 inches of the regraded surface soils and compacting them to a minimum 92% modified Proctor (ASTM Method D1557) dry density followed by placement of an 8-inch thick loose layer of clay-amended soil compacted to create a minimum 12-inch thick LPSL with a maximum permeability of $1 \times 10^{-6}$ centimeters per second (cm/sec).

The internal dike will be constructed of harvested soils placed in maximum 8-inch thick loose lifts compacted to within 2% of optimum moisture content to 90% of maximum modified Proctor density (ASTM D Method 1557). The internal dike will have 3H:1V side slopes and have a maximum crest elevation 1-foot lower than the main embankment crest elevation. A 4-inch diameter HDPE pipeline, equipped with a gate valve and encased in lean concrete placed through the base of the internal dike will allow gravity transfer of water from the upgradient Mine Water
Storage Cell 2 to the downgradient Mine Water Storage Cell 1. Two 4-inch diameter HDPE pipelines valves are located at the low point of Cell 1 to allow future connection of the underdrain solution header pipelines, encased in lean concrete, through the internal dike and Tungsten Cell 1 when the water storage cells are converted to tailings cells. The pipelines are equipped with blind flanges on the water storage cell side to prevent flow into the downgradient tailings cell prior to conversion.

The single liner for the cells is a layer of textured, 60-mil HDPE installed with the textured side up for enhanced safety of personnel and wildlife. The liner is attached with a field-fabricated boot to all pipelines that penetrate the liner. The liner will be tied into an anchor trench located approximately 3 feet beyond the crest edges of the internal dikes to provide for placement of pipelines within containment. The exposed area of the crest between adjacent liner anchor trenches will be covered with a 1-foot thick layer of aggregate road base to facilitate light vehicle access.

A schedule of compliance (SOC) item was added to the Permit with the 2015 renewal requiring a design upgrade of the mine water storage cells to meet the minimum design criteria for ponds per NAC 445A.435.1 or a determination that the dewatering water will have no potential to degrade waters of the State.

**Tungsten Tailings Storage Cells:** The two central cells in the J-183 will be used for long term tungsten tailings storage. The west-central cell is identified as Tungsten Cell 1 and the northeast cell as Tungsten Cell 2. The combined capacity of the two cells will be approximately 890,000 tons of tailings, which will provide approximately 2.1 years of storage at the nominal mill design processing rate of 1,200 tons per day.

Construction of the containment system upgrade for the J-183 tungsten tailings cells will consist of grubbing the upper 6 inches of soil and stockpiling the material for future reclamation activities. The base of the cell area will be regraded to approximately a 0.5% grade toward the southern embankment of each cell, moisture conditioned, and drum rolled. In lieu of a LPSL, a 6-inch thick layer of fine, clean, bedding sand is to be placed and compacted on the prepared subgrade.

A 12-inch thick drainage blanket, comprised of a layer of sand placed on top of the synthetic liner, contains an underdrain solution collection system comprised of 3-inch diameter perforated, single-wall HDPE pipelines, placed on 20-foot centers in a herringbone pattern. A layer of 12 oz/yd² geotextile will be placed on the drainage blanket prior to the discharge of tailings. Collected solution reports to 4-inch diameter solid, dual wall, HDPE header pipelines that convey solution to the J-183 Underdrain Collection Pond.

The internal dike and the downgradient embankment dike will be constructed of harvested soils placed in maximum 8-inch thick loose lifts compacted to within 2%...
of optimum moisture content to 90% of maximum modified Proctor density (ASTM Method D1557). The dikes will have 3H:1V side slopes and have a maximum crest elevation 4 feet lower than the main embankment crest elevation.

The Tungsten Cell 2 underdrain solution header pipeline, encased in lean concrete, passes through the base of the internal dike to allow gravity flow of underdrain solution from the upgradient Tungsten Cell 2 through the downgradient Tungsten Cell 1. The two ‘future’ underdrain solution header pipelines from the upgradient Mine Water Storage Cells and the two underdrain solution header pipelines from Tungsten Cell 2 and Tungsten Cell 1 – four pipelines in total – are encased in lean concrete and pass through the southwest corner of the Tungsten Cell 1 downgradient embankment. The pipelines will convey underdrain solution to the J-183 Underdrain Collection Pond. Each pipeline is equipped with a gate valve in a lockable vault located a short distance downstream of the embankment toe. The lockable vault should reduce the potential for vandalism or inadvertent modification of a valve setting. The valves will be used to control tailings deposition during the early stages of impoundment operation.

During the first six months of impoundment operation, valves located on the underdrain solution collection header pipelines and the tailings slurry deposition drop bars will be managed to initiate tailings deposition at the southwest corner of Cell 1 and create a northeast sloping beach that will slowly move the Cell 1 supernatant pool to the northeast corner of the cell. In the long term and to maximize the density of the tailings mass and promote long-term solids settlement, tailings will be deposited around the entire perimeter of the tailings cell. Once stabilized, the Cell 1 supernatant pool will measure about 4 acres in area and will have an operating depth of 4 to 6 feet above the tailings mass with a minimum freeboard of 2 feet below the main impoundment crest. Reclaim solution is recovered from the Cell 1 supernatant pool with a barge-mounted submersible pump.

Construction of the liner system in Tungsten Tailings Cell 2 may be delayed until the Cell 2 storage capacity is needed. SOC requirements may apply. When completed, initial tailings deposition will be from the southeast corner of the cell to create a northwest sloping beach to push the Cell 2 supernatant pool to the northwest corner. In the long term and to maximize the density of the tailings mass and promote long-term solids settlement, tailings will be deposited around the entire perimeter of the tailings cell. Once stabilized, the Cell 2 supernatant pool will measure about 4 acres in area and will have an operating depth of 4 to 6 feet above the tailings mass with a minimum freeboard of 2 feet below the main impoundment crest. Reclaim solution will be recovered from the Cell 2 supernatant pool with a second barge-mounted submersible pump.

The J-183 design includes the installation of vibrating wire piezometers in areas of the impoundment that could be subject to elevated hydraulic head. Four
piezometers, placed roughly equidistant along the centerline and parallel to the toe of the Tungsten Cell 1/Cell 2 downgradient embankment dike monitor the interface between the embankment foundation subgrade and the overlying base of the embankment fill; and four stacked pairs of piezometers, with one piezometer above the synthetic liner within the underdrain blanket and one piezometer below the synthetic liner within the bedding sand layer, monitor one location along the toe of the upstream internal dike and one location beneath the supernatant pool area for each cell.

**J-183 Underdrain Collection Pond:** Tailings underdrain solution from the J-183 reports to the lined and leak-detected J-183 Underdrain Collection Pond. The pond, will be located approximately 750 feet downgradient of the Tungsten Cell 1/Cell 2 downgradient embankment dike toe and within the footprint of the historic J-183 main embankment. The pond measures approximately 100 feet by 200 feet in plan and approximately 10 feet deep. The design capacity of the pond is 164,600 cubic feet (approximately 1.2 million gallons), with a 2-foot freeboard, which will accommodate the underdrain solution volume generated by a 68-hour power loss at the design 150 gpm underdrain flow rate calculated for the two J-183 tailings cells. The 2-foot freeboard brings the pond capacity to 227,360 cubic feet (approximately 1.7 million gallons) at the pond crest, which can accommodate the additional flow from a 10-year, 24-hour event. Underdrain solution can report to the pond through the four 4-inch diameter HDPE solution header pipelines, which are encased in concrete to the pond crest. Until the Mine Water Storage cells are reconfigured as tailings storage cells, only two pipelines will be active.

The underdrain pond double liner system is comprised of 60-mil HDPE primary and secondary liniers with a layer of HDPE geonet between the liniers to serve as a LCRS. Fugitive solution is collected and conveyed by the LCRS to a subgrade leak detection sump located at the south end of the pond. The sump measures approximately 8-feet square by approximately 2 feet deep and is filled with ¾-inch diameter drain gravel encased in 12 oz/yd² geotextile. The sump may be evacuated through a 6-inch diameter PVC inclined riser pipe that daylights at the pond crest. The pond liner is secured in an anchor trench on the pond crest and to the header pipeline concrete encasement with a wedge anchor and neoprene gasket. A gate valve for each solution header pipeline is located in an 18-inch square precast locking valve box located approximately 800 feet upgradient of the pond.

Reclaim solution collected in the J-183 Underdrain Collection Pond will be pumped back to the surface of the J-183 through a 4-inch diameter surface pipeline with a submersible pump. Solution can be directed back to either active cell supernatant pool. Water from the Mine Water Storage Cells can also be pumped to the supernatant pools to provide additional make-up water for the mill. Reclaim solution is pumped from each J-183 supernatant pool with a barge-mounted submersible pump to a horizontal centrifugal pump installed in a small building located on the north side of the J-183. The horizontal pump boosts flow to the IWT.
Impoundment booster pump station where the solution is pumped on to the Tungsten Reclaim Solution Pipeline for conveyance to the process water head tank located at the mill. Pumping occurs on an intermittent frequency at a rate of approximately 400 gpm.

**Extension of the Pipeline Corridor and Reclaim and Slurry Pipelines:** Upgrade construction at the J-183 will also include extending the Pipeline Corridor from the IWT to the J-183 along the historic slurry and reclaim pipeline right-of-way. The corridor will be extended a distance of approximately 6,500 feet from the IWT and constructed to the same specification as approved for construction of the original IWT section. The 8-inch diameter, SDR-11 HDPE Tungsten Tailings Slurry Pipeline and the 8-inch diameter, Schedule 40 welded steel Tungsten Reclaim Solution Pipeline will be extended at the same time and also be constructed and placed within the corridor to the same original approved design and specifications.

**J-183 Stormwater Diversion Channel:** The J-183 is protected from storm event flows by an engineered, dedicated, unlined stormwater diversion channel. The J-183 Stormwater Diversion Channel is comprised of West and East branches that wrap in an arc around to the southwest and southeast corners from approximately the center point of the north side of the impoundment. As with the IWT Stormwater Diversion Channel, the J-183 channel was designed to convey flow associated with the PMP event reporting to a pair of mapped and modeled upgradient watershed basins that total 765 acres in area. The West Trapezoidal Channel measures approximately 3,600 feet in length, from the flow line high point on the north side of the embankment, and has a 2-foot-wide base and an average depth of 2 feet with 3H:1V side slopes. The East Trapezoidal Channel measures approximately 4,600 feet in length, from the flow line high point on the north side of the embankment, and also has a 2-foot-wide base and 3H:1V side slopes, but an average depth of 2.5 feet. Based on modeling of channel flow velocities, no armoring with riprap is required for erosion control in either segment of the channel.

**Potable Water Treatment Plant:** A potable water treatment plant has been proposed to remove exceedances of arsenic, iron, and manganese from water used for potable water at the facility from production wells WW#3 and WW#4. The treatment plant will utilize a ferric chloride reagent, at a dosage rate of 5 to 10 milligrams per liter (mg/L), as an adsorbant followed by microfiltration to treat an average 7,500 gallons per day to separate the drinking water product from the colloidal discharge water product. The discharge water will be conveyed via an HDPE surface pipeline for disposal in the tailings impoundments. Submittal of engineering designs for review and approval, prior to construction of the potable water treatment plant, are Permit SOC item requirements.
C. Receiving Water Characteristics

In the Project area, no surface water occurs within a 1-mile radius of the process facilities. The closest permanent surface water, the Humboldt River, is approximately 2.5 miles downgradient of the J-183 Tungsten Tailings Impoundment. Other local drainages only report flow in response to storm events.

Two springs, SP-2 and SP-3, are located within a 1-mile radius and upgradient of the Springer Tungsten Mill. Spring SP-4 is located approximately 1.15 miles upgradient of the mill and spring SP-1 is located approximately 1.25 miles cross-gradient and east-northeast of the mill. Water quality samples from SP-1 and SP-2 report constituent concentration levels that meet the Division Profile I reference values except for an exceedance for total dissolved solids (1,120 mg/L) in SP-1 and exceedances of chloride (462 mg/L), sulfate (1,050 mg/L) and total dissolved solids (2,480 mg/L) in SP-2. None of the springs generate significant flow and all may be dry at certain times of the year. The Permit requires routine monitoring of all four springs for Profile I analysis.

Groundwater in the Project area has been identified in both alluvial sediments, which occur as basin and valley fill, and in bedrock exposed in the adjacent mountain ranges and beneath the alluvium. Recharge to the bedrock is principally from precipitation in the mountain ranges. Recharge to the alluvium is from surface recharge in the form of direct precipitation and runoff into ephemeral drainages, recharge from bedrock springs into the alluvial veneer, and subsurface recharge at the contact between bedrock and alluvium.

Bedrock groundwater has been identified generally in the higher elevation portions of the Project area beneath the George Pit, the North Sutton Mine underground workings, the Springer Tungsten Mill, and the IWT Tungsten Tailings Impoundment. Bedrock groundwater occurs at a depth of 479 feet below the collar of the underground workings, at a depth of 449 feet in a drillhole adjacent to the mill, and at a depth of 349 feet in a drillhole upgradient of the IWT. However, potentially perched water has been identified at a depth of only 13 feet adjacent to the open pit. The general bedrock groundwater flow gradient direction is south-southeast. Based on analysis of water quality samples collected in 2007 from upgradient and cross-gradient monitoring wells, bedrock groundwater chemistry in some wells exceeds the Division Profile I reference values for chloride (259 to 476 mg/L), sulfate (911 to 978 mg/L), and total dissolved solids (1,070 to 2,380 mg/L). Groundwater samples from the underground workings also report exceedances for the Division Profile I reference standard for iron (32.6 to 33.4 mg/L), which may be an artifact due to anaerobic or reducing conditions in the water sampled.

Alluvial groundwater has been identified in drillholes generally at the lower Project area elevations beneath the J-183 Tungsten Tailings Impoundment but also downgradient beneath the IWT. Alluvial groundwater occurs at a depth of 168 feet
below the IWT and at depths of 33 to 168 feet in the floodplain downgradient of the J-183. The general alluvial groundwater flow gradient direction is south-southwest. Based on analysis of water quality samples collected in 2014 from upgradient, downgradient, and cross-gradient monitoring wells, alluvial groundwater chemistry may exceed the Division Profile I reference values for aluminum (8.8 mg/L maximum), arsenic (0.055 mg/L maximum), manganese (0.32 mg/L maximum), and sulfate (770 mg/L).

In April 2010, the Division approved a reduction in monitoring frequency from quarterly to semiannual during the second and fourth quarters only. The variance was granted due to the delay in site construction. Upon initiation of facility construction or other operational activities, the quarterly monitoring requirement in the Permit will once again be effective.

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 sent to the Lovelock Review-Miner for publication. 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 of public notice. 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, any affected 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 issue the renewed 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, it must operate under a standard of performance which authorizes no discharge(s) except for those accumulations resulting from a storm event beyond that required by design for containment.

The primary method for identification of escaping process solution will be placed on required routine monitoring of leak detection systems as well as routinely sampling downgradient monitoring well(s) 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 (the 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: Natasha Zittel
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