2024 Annual BMP/PPP Review

Please provide your signature below to certify that you have reviewed and approved the May, 2024 Mine Pollution Prevention Plan.

Name/Title	Signature
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RED DOG MINE
Pollution Prevention Plan

Best Management Practices
for
Storm Water Management

Teck Alaska Incorporated
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May 2024

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1 Introduction

Teck Alaska Incorporated (Teck), in a partnership with the NANA Regional Corporation, operates the Red Dog zinc-lead mine in the Northwest Arctic Borough of Alaska, 90 miles north of Kotzebue. Red Dog is a direct employer of approximately 450 people. Another 130 people work for contractors NANA Management Services Inc., which provides camp management, housekeeping, catering and other services; and NANA/Lynden LLC, which operates trucks carrying mineral concentrates from the mine to tidewater.

This document, the Red Dog Mine Pollution Prevention Plan (PPP), describes the Best Management Practices (BMPs) that are or may be implemented to prevent or minimize the potential for the release of pollutants from the mine site to waters of the United States. The objectives of this PPP are to:

- Clearly identify the Red Dog Mine Site Pollution Prevention Team;
- Describe potential pollution sources;
- Provide an inventory of exposed materials;
- Provide a list of significant spills and leaks that have occurred at the site;
- Summarize potential pollutant sources and identify risks;
- Identify and describe pollution control measures and controls;
- Describe personnel training requirements and programs;
- Identify areas that require sediment and erosion control; and
- Describe Red Dog-specific sediment control measures

1.1 Scope and Application

This PPP is prepared in compliance with Section 304(e) of the Clean Water Act (CWA); Title 40 of the Code of Federal Regulations (CFR), Part 125, Subpart K; and Alaska Pollutant Discharge Elimination System (APDES) Permit Number AK0038652 issued by the Alaska Department of Environmental Conservation (ADEC). The mine's APDES permit stipulates the conditions under which the mine may discharge storm water to waters of the U.S. from the mine drainage area, and as a result of industrial activities and construction activities occurring at the mine site.

This document covers all facilities and activities at the Red Dog Mine site that may reasonably be expected to affect the quality of storm water discharges. The facilities and activities associated with the De Long Mountain Transportation System (DMTS), which include a port site on the Chukchi Sea south of Kivalina and an approximately 52 mile access road connecting the mine and port, are outside the scope of this PPP.

Recognizing the complexity of storm water management at Red Dog, this PPP is necessarily a "top-level" document which does not attempt to provide a detailed description of all measures undertaken for storm water management. Details are provided in supporting documents which include the Oil Discharge Prevention and Contingency Plan ("C-Plan", Section 5.9), the intranet-based Red Dog Operations Waste Information System (WIS), various Standard Operating Procedures (SOPs), inspection forms, training materials, etc. Storm water management activities are coordinated within the framework of a formal environmental management system (EMS, Section 6.2).

1.2 PPP Format

The structure of the remainder of this document is as follows:

- Chapter 2 describes the environmental setting of the mine site.
- Chapter 3 describes the major facilities and activities at the mine site.
- Chapter 4 documents the process of identifying potential sources of storm water pollution at the mine site.
- Chapter 5 describes the BMPs used to prevent or minimize storm water pollution and minimize the environmental effects of storm water discharges from the mine site.
- Chapter 6 discusses BMP implementation.

1.3 Plan Certification and Signature

In accordance with APDES Permit AK0038652, Sections I.H and IV.E, this document is certified and signed as follows:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed this 7th day of May, 2024.

____

Les Yesnik
General Manager
Teck Alaska Incorporated

2 Environmental Conditions

2.1 Climate

The climate at Red Dog is extreme, with extended, cold winters and brief summers. Air temperatures can range from as low as -50ºF in the winter to higher than 85ºF in the summer. Conditions are frequently windy. With freezing conditions prevalent through most of the year, storm water must typically be actively managed only during the months of May through September. Snow is actively managed during winter months.

Precipitation averages about 18 inches per year. February is usually the driest month and August the wettest. Snow is typically low in density and this, combined with the high winds, results in frequent whiteout conditions and extensive drifting and scouring.

Cold, dry conditions in the winter result in sublimation of ice and freeze-drying of exposed soils, making the latter highly susceptible to wind transport and air suspension. Dusting is visible at times along gravel bars in the local rivers and from gravel pads around the mine and mill sites.

2.2 Topography

The mine site is located in the De Long Mountains, a western extension of the Brooks Range. This area is characterized by narrow valleys and often steep, rugged hills of relatively low elevation. Toward the coastal plain to the south and west, the topography changes to moderately sloping hills, broad stream valleys and open expanses of tundra. The area is underlain by continuous permafrost and exhibits typical permafrost-related features, such as poorly defined surface undulations, patterned ground, thaw lakes, drainage channels and tussocks. A seasonal thaw layer (active zone) ranges from 20 inches below ground surface (bgs) in vegetated areas to 10 feet bgs in exposed rocky slopes and possibly up to 30 feet in disturbed areas.

2.3 Geology

The Aqqaluk and Qanaiyaq deposits are the areas of current mining, and the Main deposit is inactive. The deposits are strata-bound accumulations of silica rock, barite and sulfides hosted by late Mississippian to Permian age shales. Prior to mining, the deposits' mineralized zones were exposed naturally, and oxidation of the near-surface mineralization released iron as well as other metals to Red Dog Creek. Secondary precipitates of ferric iron oxy-hydroxides stained the creek gravels. The Main deposit is situated between the North and South Forks of Red Dog Creek, extending northward across Middle Fork Red Dog Creek. The Aqqaluk deposit is located north of, and immediately adjacent to, the Main deposit on the north bank of Middle Fork Red Creek. The Qanaiyaq Deposit is located about three-quarters of a mile south of the Main deposit and west of Middle Fork Red Dog Creek. A portion of the Qanaiyaq Deposit area drains to the east, to the Main Pit (Lake) and the remainder of the deposit area drains to the South Fork Red Dog Creek drainage (i.e., to the tailings impoundment).

2.4 Surface Hydrology

Red Dog Creek consists primarily of shallow, fast water riffles with a few pools in the lower reaches. Stream flows vary considerably throughout the year, with wintertime flows ranging from zero (creek completely frozen) in the upper reaches of the creek to 0.1 cubic feet per second (cfs) in the lower reaches. During the spring freshet, snow melt contributes to a rapid increase in flow, which can increase to over 50 cfs. Throughout the summer season, stream flow varies depending on precipitation, which can range from 0.1 inch to over two inches in a 24-hour period.

2.5 Water Quality

The Middle Fork of Red Dog Creek flows through the ore body, and consequently water quality has been naturally affected by the exposed minerals in the creek bed and from the surface drainage from the surrounding mineralized area. Red-brown staining of the creek bed from iron precipitates, visible from the air, led to the discovery of the deposit. This natural phenomenon is known as acid rock drainage (ARD), and is caused by chemical reactions enhanced by the bacterially-mediated oxidation of metal sulfides (mainly iron pyrite, FeS_2). This phenomenon liberates acidity, dissolved solids and trace metals into solution.

High metal concentrations – particularly iron, cadmium, lead and zinc, along with decreased levels of pH, oxygen and alkalinity and increased levels of turbidity, suspended solids and sulfates – were documented in baseline studies prior to mine development. Water quality was naturally degraded in Middle Fork – and consequently Main Stem – Red Dog Creeks. Fish use was limited to migration to North Fork Red Dog Creek via the Main Stem during high water events. Further, no fish spawning was documented in either Main Stem or Middle Fork Red Dog Creeks, and natural fish kills commonly occurred in these water bodies.

Mine development initially resulted in increased metal concentrations in surface runoff and generated several groundwater seeps that further degraded Red Dog Creek water quality. The seep water quality was poorest during the summer of 1990. The seeps were thought to be thawed ice lenses that, along with surrounding permafrost, thawed when overburden, which acted as an insulating cover, was removed during initial stages of mining. Readily soluble minerals in previously undisturbed rocks and minerals within the ice lenses were released to Red Dog Creek. The creek's discoloration increased and extended downstream as far as Ikalukrok Creek. Concentrations of dissolved zinc, lead and cadmium also increased.

However, development of the Red Dog Mine ultimately included a number of water management practices that have resulted in improved water quality in Red Dog Creek. These have included collection and treatment of mineralized water and consequent discharge of high volumes of water with lower metals concentrations. Further, the treated water now discharged to Middle Fork Red Dog Creek dilutes naturally occurring metals, moderates the pH, and lessens the toxicity of metals by increasing the hardness.

The present system prevents untreated mine drainage from entering Red Dog Creek and has notably improved water quality. However, some waters from upstream and across the valley still carry naturally elevated concentrations of metals.

2.6 Biological Resources

Vegetation varies from dry upland mat and cushion tundra to wet lowland sedge-grass marsh. Rocky areas devoid of vegetation are common.

Waterfowl and raptors are the primary birds found in the area. Brown bear, moose, Dall sheep, musk-oxen and caribou are the primary large mammals. Caribou migrate seasonally through the region.

Arctic grayling, Arctic char and various other salmon species may occur in the Ikalukrok Creek and Wulik River drainages and, as a result of the Red Dog Mine's improved water management practices – and hence improved water as quality discussed in the preceding section – Arctic grayling and Dolly Varden began and continue using Main Stem Red Dog Creek for rearing and Arctic Grayling began and continue using Main Stem for spawning. In addition to enhanced fish habitat, the improved water quality has seen development of abundant and diverse aquatic invertebrate and periphyton communities as well. Since 1998, in-depth annual biological studies by State biologists have verified the continued presence of a viable aquatic community in Main Stem Red Dog Creek.

3 Mine Site Facilities

Red Dog is an open pit mining operation that produces mineral concentrates of zinc and lead for shipment to world markets. Mine operations commenced in 1989. Major facilities at the mine site include:

- Open pit mine.
- Mined rock stockpiles.
- Ore stockpiles, primary crusher and flotation mill.
- Tailings impoundment.
- Personnel accommodations complex (PAC).
- Ancillary facilities including airport, powerhouse and fuel storage, maintenance shops, a warehouse, offices, materials handling and storage, a construction camp and fresh-water reservoir.

A layout of the major mine site facilities is shown on Figure 3. Figure 4 shows a plan of the mill site. The following sections describe the facilities within the scope of this PPP.

3.1 Mineral Resources

The defined mineral resource at Red Dog comprises three nearly co-located massive sulfide lead-zinc ore deposits: the Main Deposit, the Aqqaluk Deposit and the Qanaiyaq Deposit. The deposits are located just west of Deadlock Mountain in the De Long Mountains of the western Brooks Range, approximately 105 miles north of the Arctic Circle. They lie in the drainage of the Middle Fork of Red Dog Creek, a tributary to Ikalukrok Creek, which is a major tributary to the Wulik River, which empties into the Chukchi Sea near the village of Kivalina. Land overlying and surrounding the deposits is owned by the NANA Regional Corporation, a partner in the Red Dog Mine.

In all deposits, the valuable ore minerals sphalerite and galena (sulfides of zinc and lead respectively) are hosted in silicious black shale along with barite and iron sulfide mineralization.

Aqqaluk deposit development began in 2010 and active mining commenced in 2012, while active mining in the Main Pit ended in 2012. In 2016, development activities were initiated on the Qanaiyaq Deposit.

3.2 Mine

3.2.1 Aqqaluk Pit

The Aqqaluk Pit is located on the south facing slope north of Middle Fork Red Dog Creek, and to the north of the Main Pit (inactive). The pit is a conventional blast-loader-truck operation. The mine operates year-round. Currently, the pit is approximately 2,500 feet by 2,400 feet, and extending some 100 feet below the Middle Fork of Red Dog Creek. Nominal bench height is 25 feet. The final pit slope will determine the ultimate configuration of the pit and will influence the total quantity of waste rock to be excavated and stockpiled at the mine site.

The mine may have several actively producing benches open at a time so that multiple mining functions can be carried out simultaneously. Production drilling is conducted with down-the-hole hammer systems. Individual blasts vary in size from tens of holes to a few hundred holes. Production drills are equipped with water/ethanol down hole injection systems. The ethanol is necessary to prevent freezing of drilling water during the winter.

Blasting is carried out using a mixture of ammonium nitrate and fuel oil (ANFO) in dry holes, and an emulsion in wet holes. Explosives are stored at several locations around the mine property, according to applicable regulations.

Blasted rock is loaded into 100 ton haul trucks by 12 yard front end loaders. Ore is hauled to the various stockpiles within the main pit or on the Crusher pad, where it is stockpiled and blended to meet metallurgical criteria, before being processed. Ore handling and stockpiling activities are a significant source of fugitive dust.

Mine mobile equipment is diesel powered. All materials mined in the pit, and in the DD-2 material sites (Section 3.2.4), are considered to be “significant materials” at Red Dog (Section 4.1) and are listed in Table A.1, Appendix A.

3.2.2 Mined Rock Stockpiles

Mine waste rock (i.e., rock with sub-economic value) is hauled to a material stockpile. The main waste, oxide and marginal ore stockpiles are located on the western slope of the divide that separates the Middle and South Forks of Red Dog Creek, overlooking the tailings pond. For the purposes of this report, these three stockpiles are considered to be a single facility, termed the main waste dump (MWD). The dump contains marginal ore, barite, construction grade waste and competent mineralized overburden. The overburden stockpile straddles the topographic saddle that separates the South Fork Red Dog Creek and Bons Creek drainages. Overburden material is primarily highly weathered, non-mineralized material such as shale, stripped organic materials and materials excavated from the tailings and mill site areas during construction.

3.2.3 Qanaiyaq Deposit

The Qanaiyaq Deposit is located on the ridge top between the South and Middle Forks of Red Dog Creek, above the main waste dump. In 2016, development activities were initiated on the Qanaiyaq Deposit.

3.2.4 DD-2 Material Site

The DD-2 material sites are located to the northwest of the overburden storage area. There are two sites approximately 1,200 feet apart, connected by a road that runs along the western side of the tailings impoundment. Initially, both sites were used as borrow sites for non-mineralized construction rock. The northern site is still active while the southern site, where suitable material was exhausted, is now used as a supplemental tailings storage area, draining into the main TSF.

During the summer, the northern site may be active with drilling, blasting, loading, hauling and crushing activities. The crusher system consists of a jaw crusher, screen, cone crusher and several conveyors. A dust suppression system utilizing water is operated when the crusher is running. A portable generator, fuel tank and control room are provided.

3.2.5 Crusher and Coarse Ore Stockpile

The gyratory, or primary, crusher sits at the edge of the crusher stockpile pad, and was installed in 1998. The primary crusher is housed in a building along with associated systems including an apron feeder, baghouse and a drive assembly for the conveyor belt which transports crushed ore to the coarse ore stockpile building (COSB). The older jaw crusher, which began operation in 1989, is located near the primary crusher and is operated during maintenance of the primary crusher. The jaw crusher is located in an enclosed building which also houses a feeder and related systems, and a drive system for the conveyor belt which transfers crushed ore to the COSB.

The COSB stores crushed ore prior to milling. It has a capacity of 15,000 tonnes and feeds conveyors which transport ore from the stockpile to the mill grinding circuit. The COSB and ore conveyors are completely enclosed to minimize fugitive dust emissions.

In 2006, significant improvements were made to the crusher bag houses and in 2007, an improved dust collection system was installed in the COSB.

3.3 Mill Complex

3.3.1 Process Plant

The mill employs grinding and conventional froth flotation to recover mineral concentrates of sphalerite (zinc sulfide) and galena (lead sulfide) from crushed ore. The concentrates are shipped to smelters worldwide where the minerals are smelted and refined into zinc, lead and silver metal.

The mill complex is housed in a building that was assembled from modules shipped to the mine site during construction. Inside the mill complex, crushed ore is subjected to primary and secondary grinding, lead and zinc rougher flotation and a regrinding operation, as well as lead and zinc cleaner flotation. In the primary grinding circuit, crushed ore is mixed with process water to form a slurry which is wet-ground in semi-autogenous grinding (SAG) mills and ball mills that reduce the ore particle size to less than 50 microns (µm).

In the froth flotation circuits, lead and zinc minerals are separated from the non-payable (gangue) minerals. Several stages of flotation are necessary to achieve high grade concentrate products with maximum recovery of payable minerals and an efficient separation of the lead and zinc minerals into their respective concentrates. The gangue minerals, referred to as tailings, are discharged in slurry form from the mill to the tailings impoundment for permanent storage. The floors of the mill and its related support facilities function as sumps to collect and contain any spillage of process water and slurry inside the buildings.

Process reagents are used for pH control and to achieve an efficient mineral separation in the flotation circuit. These reagents are considered to be “significant materials” (Section 4.1) and are listed in Table A.1, Appendix A.

Slurried Pb and Zn concentrates are filtered to approximately 8-9% moisture and transported via an enclosed conveyor to a concentrate storage building (CSB) adjacent to the mill.

Concentrate is trucked 52 miles from the CSB to the Red Dog Port site, on the Chukchi Sea, 16 miles south of Kivalina. The haul road and port are the principal components of the De Long Mountain Regional Transportation System (DMRTS), which is owned by the Alaska Industrial Development and Export Authority, and operated and maintained by Teck Alaska Incorporated. With the exception of the first segment of the haul road between the mine CSB and the tailings impoundment back dam intersection, the DMRTS is outside the scope of this PPP; storm water management for the DMRTS is documented under separate cover.

There are several other facilities that are associated with the mill, which are described in the following sections.

3.3.2 Reagent Building

The reagent building, constructed in 1996, is located to the west of the mill and is connected to it by an enclosed walkway/utilidor. The building provides temporary storage and facilities in which to mix process reagents, which are transferred to the mill via an enclosed utilidor. Process reagents are listed in Table A.1, Appendix A.

Reagents may be brought daily from cold storage. They are generally shipped in bulk bags, totes and barrels. All containers and tanks are clearly marked in accordance with MSHA guidelines and are stored according to compatibility. There are mixing and day tanks in the reagent building. Reagents are mixed with water and transferred to day tanks from where they flow to holding tanks in the mill. Day tanks typically hold one to three days' supply, depending on demand which varies with plant throughput and ore grade.

3.3.3 Concentrate Storage Building

The mine CSB is located adjacent to the mill. Filtered concentrates of lead and zinc are stockpiled inside the building while awaiting shipment to the port site. The CSB is completely enclosed and has a storage capacity of approximately 32,000 tonnes of concentrate. Concentrate haul trucks enter the building along one side and are loaded with approximately 120 tonnes of concentrate by front end loaders operating inside the CSB. Haul trucks enter and exit the building through insulated fabric doors that are closed during the loading process, to contain fugitive dust emissions.

3.3.4 Powerhouses

The powerhouses provide electric power to the Red Dog Mine site. They are located on the mill site, adjacent to the mill and CSB. Between the two powerhouses, there are eight diesel-fired generators each rated at 5,000 kilowatts (kW) electrical output. Heat is supplied to the mine site buildings by waste heat recovery units (WHRUs) that utilize diesel engine exhaust gas to heat a glycol/water mixture that is circulated by pumps.

Three 650 kW diesel generators are installed to supply emergency power. In addition, there are three 300 hp standby boilers to provide support in the event of a power failure.

3.3.5 Metallurgical Laboratory

Small quantities of ore and mill grinding and flotation products are routinely collected and tested in the metallurgical laboratory to monitor the efficiency and condition of the milling processes. Samples of the products are submitted to the analytical laboratory for chemical analyses. Analyzed samples are recycled to the milling process. The total quantity of ores and flotation products processed in the lab is on the order of 5,000 pounds annually.

Small quantities of process reagents, in addition to nitric and hydrochloric acids, are used in the metallurgical laboratory. Unused chemicals are disposed of via sink and floor drains that are plumbed to the mill tailings box, where they mix with the tailings prior to being discharged to the tailings impoundment.

3.3.6 Analytical Laboratory and Bucking Room

Rock samples are crushed and prepared in the bucking room prior to submission to the analytical laboratory for metals analysis. Samples of rock, flotation circuit composites and metallurgical samples are routinely delivered to the analytical laboratory for inorganic chemical analysis. Generally, the laboratory may process two to three tonnes of material per week, the majority of which is rock sampled from blast holes and samples submitted by the Geology department during the summer drilling programs. These samples are dried and split for analysis, with over 90% of the samples being discarded; a few pounds of samples are typically kept for long term storage each week.

3.3.7 Potable Water Treatment Plant

The potable water treatment plant provides potable water to approximately 700 people at the mine site. The plant treats raw water from the Bons Reservoir near the contractors' personnel accommodations complex (ConPAC) and supplies potable water at an average rate of approximately 65,000 gallons per day. Treatment includes polymer (flocculant) addition, two-stage sand filtering and calcium hypochlorite (chlorine) disinfection. From the treatment plant holding tank, treated water is pumped to the PAC, mill complex and services complex as well as to other small buildings within the mill site.

Less than 50 pounds of polymer (which is non-hazardous) and calcium hypochlorite, in addition to much smaller quantities of potassium hydroxide and acetic acid, are kept on hand in the potable water treatment plant. There is almost no potential for these substances to contact storm water. Polymer and calcium hypochlorite are stored in bulk in a connex in the laydown yard.

3.3.8 Sewage Treatment Plant

The sewage treatment plant (STP) was constructed in 1990 and upgraded in 1991. It is located between the PAC and the mill. Domestic waste water is collected from the PAC, mill and services complex, processed and discharged to the tailings impoundment at an average rate of approximately 16 million gallons per year. Average throughput is typically 30 gallons per minute (gpm) but this varies depending on time of day and camp population.

Waste water treatment consists of solid/liquid separation and disinfection. STP solids are collected from the waste water by two rotating strainers prior to disinfection. The solids are dewatered in an automatic press, collected and incinerated.

Calcium hypochlorite solution is added to the STP effluent for disinfection and odor control, using an automated injection system. There are generally 50 pounds or less of sodium hypochlorite stored at the STP at any given time. Bulk storage is in a connex at the laydown yard.

3.3.9 Industrial Waste Water Treatment Plant 2

The industrial waste water treatment plants (WTP1 and/or WTP2) treat excess water accumulating in the tailings impoundment and discharge treated water to Middle Fork Red Dog Creek under APDES Permit AK0038652 (Outfall 001). The plants treat and discharge seasonally during the open water season, typically May to September. They treat tailings pond water for the removal of dissolved metals, principally zinc by lime precipitation and cadmium by precipitation with sodium sulfide. The plants use high density sludge (HDS) technology, which entails partial recycle of clarifier underflow to reduce the water content of the treatment plant sludge.

Precipitation of metals begins in tanks with agitators. Flocculant is then added and the precipitated solids are separated from the treated water in a clarifier. Clarifier underflow, containing the solids, is recycled to the inlet. A bleed from the recycled underflow is discharged via pipe to the tailings impoundment. Clarifier overflow passes through sand filters before being discharged to Middle Fork Red Dog Creek.

Significant quantities of lime, sodium sulfide and flocculant are used in the WTPs. Lime is typically stored in the lime area and other WTP chemicals may be stored in bulk in connexes in the laydown yard from where they are transferred to the WTP as needed.

3.3.10 Industrial Waste Water Treatment Plant 3

Water treatment plant (WTP3), brought on-line in 2006, can treat water from the waste rock stockpile or the mine water system prior to discharging it to the tailings impoundment. The operation of WTP3 uses lime precipitation to reduce dissolved metals and TDS loading to the tailings impoundment. The plant operates during the open water season, typically late May to early October.

3.3.11 Reverse Osmosis Plant

In 2019 a Reverse Osmosis (RO) plant was installed in response to high in-creek TDS levels that were causing issues with meeting in-stream discharge limits. RO water is blended with treated water from WTP2 in order to meet discharge limits at Outfall 001 while still allowing the reduction of water volume in the tailings impoundment.

3.4 Tailings Impoundment

The tailings impoundment straddles the South Fork Red Dog Creek southwest of the mill site (Figure 5). The impoundment and its related facilities consist of an earth-filled dam with a liner on the upstream face, a lined seepage collection pond and pumpback system, tailings distribution line, reclaim barges and pumpback system, and diversion channels. The dam has been built in stages utilizing a downstream construction method

Slurried tailings, a Bevill-exempt waste stream, are delivered in a pipeline from the tailings pumpbox and deposited in the impoundment, where they are stored permanently. A portion of the tailings are stored subaerially in a beach against the upstream face of the tailings dam, but most are stored subaqueously, under the cover of ponded free water.

Annual inflow to the tailings pond includes storm water in the form of direct precipitation and runoff from the land surfaces around the impoundment. Non-storm water inputs include the process water which is discharged along with the tailings from the mill, vehicle wash water and treated domestic waste water. Excess storm water accumulating in the pond is treated for removal of dissolved metals prior to being released to Middle Fork Red Dog Creek under APDES Permit AK0038652, as described in the previous section.

3.5 Ancillary Facilities

Due to the remote nature of the mine site, project facilities include infrastructure not normally associated with mining facilities. The major ancillary facilities are described in the sections that follow.

3.5.1 Personnel Accommodations Complex

The personnel accommodations complex, or PAC, is located adjacent to the mill and connected to it by an elevated, enclosed walkway. The PAC houses 511 people and includes kitchen and laundry facilities. It was constructed in 1989 and expanded in 1997 and 2019.

There are no industrial activities at the PAC. Domestic effluent is pumped to the STP for treatment.

3.5.2 Airport

A paved airstrip capable of handling commercial jet aircraft is located approximately three miles SSW of the mill, in the Bons Creek watershed. The paving of the Red Dog airstrip in 2006 and other recent upgrades, including the development of a global positioning system (GPS) guided landing system, require the use of de-icing solutions to maintain the safe flight requirements of the Federal Aviation Administration (FAA). The de-icing solutions chosen by Teck (50% potassium acetate solution for runway de-icing and 88% propylene glycol solution for aircraft de-icing) are considered the aviation industry standard for environmentally-friendly products. The annual usage of de-icing solutions will vary depending on weather conditions. De-icing solutions will be handled, applied, treated, and disposed in accordance with BMPs set forth in the Teck Alaska Airlines 737 Aircraft De-icing SOP. The usage of both deicing solutions will be logged and reported to the Environmental Department. Application of these solutions will only be conducted by personnel that are properly trained and aware of the BMP requirements for these solutions.

The airstrip is used year-round to transport personnel, equipment, supplies and perishables to and from the mine site. Including overruns at each end, the airstrip is approximately 6,000 feet long and is located on a ridge between Buddy Creek and Bons Creek, parallel to the port access road. A small borrow pit is located near the south end of the airstrip.

Typically, the airstrip accommodates approximately 15 weekly flights, including cargo aircraft, charter passenger jets to and from Anchorage and flights to and from Kotzebue and other regional villages.

3.5.3 Maintenance Shops

The Maintenance Department performs scheduled, preventive, and unscheduled maintenance, repairs, fabrication and vehicle washing. There are two shops, the mine maintenance shop that services all mobile equipment, and the mill maintenance shop that services stationary mill equipment. Standard procedures for both shops are similar. All maintenance tasks, inventory records, maintenance logs and schedules are tracked by computer.

The maintenance shops are enclosed and constructed on concrete floors which drain to floor sumps. Maintenance personnel routinely handle significant quantities of fuel, oil and other lubricants, battery acid, antifreeze and cleaning products. All shop personnel have had spill training. Spills are cleaned up promptly and spilled material is unlikely to escape the containment of the building.

Concrete aprons outside the maintenance bay doors are considered containment components of the building. The aprons are used as a staging and knock off pads for mobile equipment that is awaiting service and may be leaking fluids.

Maintenance supervisors are responsible for notifying the Surface crew supervisor when the staging pads require cleaning. The surface crew supervisor is responsible for proper disposal of the material.

Hazardous waste from the shops is recovered, drummed and shipped offsite in accordance with the Resource Conservation and Recovery Act (RCRA) (Section 3.5.7).

3.5.4 ConPAC

The construction personnel accommodations complex (ConPAC) is located on a gravel pad across the port access road from the airstrip, above the fresh water Bons Reservoir in the Bons Creek watershed. The camp is owned by Teck and is operated seasonally as required depending on construction and exploration activity. The camp comprises personnel living quarters with 144 beds, a temporary exploration tent camp with 42 beds, sewage and water treatment facilities, a backup generator and an equipment staging yard. An additional 66-bed temporary camp is being added in 2024 (Figure 9).

A 500-gallon day tank stores diesel for backup power generation. There are no hazardous waste storage, used oil storage, landfill, or mining activities at the camp. The current treated domestic effluent management practice is to haul domestic effluent from the camp to the Red Dog Mine STP for treatment under APDES Permit AK0038652.

3.5.5 Services Complex

The services complex is located on the mill site adjacent to the mill and CSB. The complex includes a warehouse, the analytical lab & bucking room, the heavy equipment & light vehicle shops, and administrative personnel offices.

3.5.6 Fresh Water (Bons) Reservoir

A fresh water reservoir (Bons Reservoir) and pumping system are located in the Bons Creek watershed near the airport. Bons Reservoir was created by constructing a dam across Bons Creek. Fresh water is collected from sumps located immediately downstream of the reservoir and pumped to the ConPAC and mill site.

3.5.7 Materials Handling and Storage

3.5.7.1 Explosives Storage Areas

Explosives ingredients – i.e., emulsions, water gels, cast boosters, electric and non-electric caps, dynamite, etc. – may be stored in several explosives storage areas built on gravel pads throughout the mine site. Storage area locations and quantities in storage are governed by the regulations of several agencies including at least MSHA, BATF and DOT.

Ammonium Nitrate (AN) is stored in bulk form inside shipping containers near the overburden stockpile area. These containers are emptied into a silo system at the Emulsion plant. The AN in these silos is mixed with water, urea, surfactant (DN11), glass Microballoons, and fuel oil to create an Ammonium Nitrate Emulsion (ANE) at the plant which is stored in adjacent silos. AN from the AN silos and ANE from the plant is loaded into blasting bulk trucks used for loading blastholes around the mine site.

Pre-mixed ANFO is also stored in bags inside shipping containers at the defunct gas exploration pads North of the mine water diversion dam (Figures 3 & 5).

3.5.7.2 Laydown Yard

The laydown yard, located along the east side of the tailings impoundment about a mile from the mill site, is the major bulk materials storage facility at the mine site. The yard is used as cold storage for reagents, other mill supplies, large heavy equipment parts, drums packaged for off-site shipment and other miscellaneous supplies and wastes that can tolerate freezing conditions. All materials except oversize items are stored inside shipping connexes, which are watertight by design. Drums of various fuels, oils, and other petroleum based-products are generally stored on drum docks placed on HDPE-lined secondary containment. The laydown yard includes cold and warm storage warehouses, and a portion of the area is used for the temporary storage of hazardous waste awaiting shipment to offsite disposal.

3.5.7.3 Fuel Storage

The Red Dog operation consumes some 40,000 gallons of diesel fuel daily for power generation, equipment operation and vehicle use. Fuel is shipped by barge to the port site during the summer and transported to the mine site daily in a tanker truck.

Diesel is stored in four tanks (Tanks #1, #2, #3 and #4) located in the southeast area of the mill site. Tank #1 and #2 capacities are 200,000 gallons each, #3 has a capacity of 1.1 million gallons and tank #4 has a capacity of 1.0 million gallons. Fuel storage tanks are above ground and constructed of welded steel. They meet the standards set by federal and state laws, including the C-plan, and are equipped with secondary containment, alarms and leak detection systems. Storm water accumulating within the containment berms is checked visually for a sheen, and if no sheen is present, water is drained from the containment to upland areas or gravel pads in such a manner that erosion or sedimentation is prevented.

Diesel fuel is distributed from Tank #3 and #4 by pipeline to Tank #1 and #2, which supply the fuel dispensing island and the power plant.

Helicopter pads may be designated southeast of the overburden stockpile and west of the ConPAC, or next to the incinerators on the “incinerator pad”. Helicopter fuel storage may be in 55 gallon drums on secondary containment pallets, or in a fuel bladder or ISO/ISO-type storage tank. Storm water accumulating within secondary containment is checked visually for a sheen and, if no sheen is present, water is drained from the containment to upland areas or gravel pads in such a manner that erosion or sedimentation is prevented.

3.5.7.4 Solid Waste Management

Solid waste is managed in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA) and the Alaska Solid Waste Management regulations (18 AAC 60). Teck’s policies and practices for waste management are detailed in the Waste Information System. Operational control is provided by Standard Operating Procedures (SOPs) that are in use in work areas.

Dumpsters for solid waste collection are located throughout the mine site. Although their locations vary, they can usually be found by the PAC kitchen loading dock, by the warehouse loading dock, by the north end of the CSB, the north side of the heavy equipment shop and administrative offices and billeting rooms. The dumpsters are marked as burnable waste and non-burnable waste. Each employee is responsible for depositing solid waste in the appropriate container. The Surface Crew transports the dumpsters to the landfills or incinerator as required.

Two incinerators are located along the east side of the tailings impoundment, north of the laydown yard. The incinerators are used for burning putrescible wastes, dewatered STP solids, hot-drained oil filters and oily absorbent pads, paper and other combustible non-hazardous solid waste. Diesel fuel is burned to preheat the incinerators and a 500 gallon diesel storage tank is located adjacent to the incinerator. Incinerator ash is landfilled.

There are two solid waste landfills at the mine site. One is adjacent to the incinerators and has been closed (inactive). The other is in the main waste dump (active). The active landfill is used for the disposal of incinerator ash and other permissible wastes. The active landfill is operated by the Surface Crew under permits specifying covering, grading, working face size, etc., and according to documented SOPs. At the end of mine life, the active landfill will be properly closed by the Mine Department.

A training and awareness program ensures that hazardous wastes are segregated and managed according to Resource Conservation and Recovery Act (RCRA) regulations.

3.6 Site Security

The mine site is not readily accessible to the general public. The airstrip is private and is not accessible for public use without prior permission. The property is not fenced, but signs prohibiting unauthorized entry are posted along the access road and at the property boundaries, and automatic lighting has been installed at strategic locations around the site. Overland access is generally limited to snow machine travel – or, possibly, but not likely, to non-mechanized means of travel – as the mine site is not connected to any other public road system.

The facility has safety officers who are responsible for the safety and security of personnel. Law enforcement responsibilities are delegated, as needed, to Alaska State Troopers in Kotzebue.

4 Identification of Potential Storm Water Pollutants

The Red Dog Mine site is complex with many potential effects of site facilities and activities on storm water. The following steps were undertaken to classify these interactions and to identify potential storm water pollutants (PSWPs) associated with them:

1. An inventory was prepared of significant materials stockpiled, stored and handled at the mine site.

2. The mine site was divided into sectors based on activity and drainage.

3. For each sector, potential interactions between significant materials and storm water were identified and evaluated to determine those with the potential to cause pollution associated with the discharge of storm water from the mine site. The

assessment considered the management of non-storm water discharges and the history of reportable spills at the mine site.

This chapter describes the identification and evaluation process, and lists the potential storm water pollutants at the Red Dog Mine site. Best management practices are described in the following chapter.

4.1 Significant Materials Inventory

An inventory of “significant materials” (40 CFR 122.26(b)(12)) that have the potential to be released with storm water discharges has been developed for the Red Dog Mine site. Significant materials at Red Dog include mined rock in various forms; fuel and other liquid and solid chemicals transported to the site as required for project operation; wastes such as domestic effluent and incinerator ash that are disposed of on site, and hazardous wastes that are stored prior to being shipped off site for disposal at a licensed facility. The significant materials inventory is provided in Table A.1, Appendix A.

Inventory quantities are considerable at Red Dog for two reasons. First, all mined rock is considered significant material, and is stored in large quantities at various locations at the mine site. Second, significant quantities of fuel, process reagents and other materials must be stored at the mine site as they can only be shipped to site during the brief open water season, generally July to October.

4.2 Activity Sectors

To facilitate the evaluation of PSWPs and BMPs, the Red Dog Mine site was divided into activity sectors. Sectors are loosely classified based on the activities within them, the significant materials present, the direction of surface drainage and the extent to which drainage may be controlled by Red Dog through passive or active means. The major sectors are shown on Figure 5,**Error! Reference source not found.** and described below:

- Mine: the area which includes the Main Pit (inactive), the Aqqaluk Pit (active), and the Qanaiyaq Deposit (active). Storm water from both pits is ultimately conveyed to the tailings impoundment. Qanaiyaq drains partially to the mine water collection system (MWCS) and partially to the tailings impoundment.

- Mined Rock Stockpiles: most runoff from the waste rock, marginal ore and oxide waste stockpiles drains directly to the tailings impoundment; some reports to the tailings impoundment via pumping through the Main Pit and MWCS.

- Overburden Storage: the overburden storage area straddles the divide between the Bons Creek and South Fork Red Dog Creek drainages. To the south of the divide, a drainage control and pumpback system is in place, and is designed to intercept drainage from the overburden storage area that might otherwise enter the upper reaches of Bons Creek and return it to the tailings impoundment.

- DD-2 Material Site: currently an additional storage area for tailings, drains via a channel to the tailings impoundment.

- Tailings Impoundment: receives all potentially contaminated drainage from the mine and mill sites. Runoff from the downstream face of the tailings Main Dam and dam seepage are recovered and pumped back into the impoundment.

- Mine Site South: ancillary infrastructure including the airport, construction camp, Bons Reservoir and concentrate haul road, that do not drain to the tailings impoundment but rather to Bons and/or Buddy Creek.

Figure 5 shows, by color coding, the means of surface drainage control for each sector, as follows:

- Green areas gravity drain to the tailings impoundment naturally or with passive intervention (e.g., ditching).

- Blue areas drain to the tailings impoundment with active intervention (pumping).

- Red areas that do not drain to the tailings impoundment, but to Bons/Buddy Creek or to Red Dog Creek drainages downstream of the mine site.

Receiver and the use of passive or active intervention are important considerations inasmuch as they relate to the intensity of activity required under applicable BMPs, e.g. frequency of inspections and preventive maintenance.

4.3 Potential Storm Water Pollutants

In this document, potential storm water pollutants (PSWPs) are defined as those likely to be present in storm water discharges associated with industrial activity at the Red Dog Mine site. This definition is consistent with Red Dog's APDES Permit AK0038652, and with EPA guidance on PPP development.

PSWPs were identified using a risk-based approach, as follows:

1. For each mine site sector, distinct facilities and activities were identified.

2. For each facility, potential interactions (possible sources of storm water pollution) between significant materials and storm water were identified, under both normal operating conditions and abnormal conditions (i.e., spills or other unplanned incident).

3. Water pollutants associated with each interaction were identified.

4. For each interaction, a quantitative assessment of the relative risk of polluting storm water was conducted. This assessment was based on the general toxicity of the material involved, the quantity available to cause pollution, the likelihood of contact with storm water and the probability of occurrence of the interaction (APDES Permit AK0038652, Sections I.H.2.b.(iii) and H.2.e). The result was a ranking, on a scale of 1 to 5, of the risk of each interaction causing pollution to storm water discharged from the mine site. Pollutants associated with interactions ranked 1 or higher on the risk scale were designated as PSWPs.

The risk ranking procedure is described in more detail in Appendix B. Table B.1 shows the results of the risk ranking and lists the PSWPs that have been identified at the Red Dog Mine site.

4.4 Non-Storm Water Discharges

Non-storm water discharges include:

- Water which drains from the mine beneficiation area and is conveyed to the tailings treatment facilities and discharged through Outfall OO1.
- Water used in the mill (process water), which is discharged with tailings to the tailings impoundment as a Bevill-exempt waste, and which may be recycled to the mill as process makeup water;
- Vehicle wash water, which mixes with storm water and is discharged to the tailings impoundment;
- Domestic waste water from the PAC, mill and offices, which is treated and discharged to the tailings impoundment; and
- Fire suppression system water

4.5 Past Spills and Leaks

Red Dog Mine's EMS system includes SiteLine, an online database under which all spills that occur on the property are inventoried and catalogued. Spills that have the potential for significant impacts, or reoccurring similar incidents such as hydraulic hoses failures, may trigger root cause analysis and corrective action in attempt to reduce the number of spills.

An inventory of significant reportable spills and leaks is included as Appendix C. Spill information was used for identifying PSWPs, and to help quantify the likelihood of occurrence of interactions associated with abnormal operating conditions (Table B.1).

5 Storm Water Best Management Practices

This chapter describes the storm water BMPs that Teck implements at Red Dog.

5.1 Drainage Control

Together, drainage control and water treatment are the most important BMP for storm water control at the Red Dog Mine site. The basic principles for site drainage control are that (1) contaminated and potentially contaminated water will be directed to the tailings impoundment, and (2) uncontaminated water should be diverted around the mine site facilities into natural watercourses. Excess water accumulating in the tailings impoundment is treated for pH adjustment and removal of dissolved metals prior to being discharged under permit to Middle Fork Red Dog Creek (Section 3.3.9, Section 5.2).

Drainage control is accomplished through both active measures, e.g., those that involve pumping, and passive measures, typically ditching, as described below and detailed in the Mine Drainage SOP.

5.1.1 Mine (Open Pit)

The main drainage route through the pit and the Aqqaluk and Qanaiyaq deposits is Middle Fork Red Dog Creek. Water in the upper reaches of the creek and its tributaries is conveyed through – and isolated from – the pit operation in the lined and piped RDC diversion, and re-enters the natural creek channel below the MWCS dam.

Mine water is collected in the MWCS via a number of BMPs which may include drainage channels, trenches, French drains, pit or other pumps, etc. The diverted MWCS water is pumped to the retaining basin contained by the MWCS dam and is ultimately pumped to the tailings impoundment. These facilities are shown on Figure 6.

The RDC diversion was constructed above the grade of the MWCS and other pit water management structures, to prevent potential contamination of the RDC diversion water.

Three major tributaries that enter the pit area are collected by pipeline or lined channels and routed into the lined RDC diversion. The Connie Creek diversion collects water 700 feet upstream of the RDC diversion confluence, Shelly Creek is diverted approximately 3,100 feet upstream of the RDC diversion confluence. Rachael Creek is captured by the RDC diversion approximately 1,000 feet upstream of the main pit. Surface runoff from the surrounding areas downstream of these collection points is diverted to the MWCS.

The RDC diversion was constructed in 1990 and 1991. In 1995, it was extended upstream 1,400 feet to exclude collection of drainage from Hilltop Creek (which drains the Qanaiyaq Deposit). Hilltop Creek now drains to a mine water channel which reports to the Main Pit (i.e., the MWCS). This extension has proven effective in reducing metals contamination in Red Dog Creek to levels below those recorded prior to mine development.

In 1998, the MWCS retaining basin was re-excavated to remove accumulated solids, and the capacity of the pumpback system was increased to accommodate peak flows after two unplanned discharges of water from the retaining basin.

The Mine Operations group is responsible for construction and maintenance of the mine water management facilities.

5.1.1.1 Mine Water Pumpback System

A series of pumps transports the mine water from the MWCS retaining basin to the tailings impoundment. Four operating groups are responsible for operation of this facility. Mill Maintenance is responsible for mechanical maintenance (pumps, pipes, etc.). Electrical and Instrumentation (E&I) maintains the electrical components of the system. Mill Operations monitors the system's operation (e.g., flows and water levels) on a daily basis. Mine Operations is responsible for the dam, diversions, cribbed retaining wall, and the retaining basin.

Water levels are measured by level detectors and the pumps are controlled by a programmable logic controller (PLC). Basin water level and status of pumps can be monitored from the mill control room. Various high level alarms alert operators when the water level in the retaining basin is approaching action levels.

During the winter, flows are at their lowest, averaging about 310,000 gallons per day (gpd). This flow is handled by two pumps installed inside a corrugated metal pipe sump structure. Water is pumped from the retaining basin to the tailings impoundment via an insulated, heat-traced pipeline. An emergency generator is permanently located at this facility to provide backup power in the event of main-power failure. Spare pumps are available in case of a mechanical or electrical failure of deployed pumps.

During the summer period between May and September, flows are highly variable. As many as six additional pumps are operated to augment the two winter pumps. The six additional pumps are stationed over the cribbed retaining basin wall where they can be lowered into the sump when needed, generally during periods of high flow associated with freshets, and summer rainstorms.

Further detail pertaining to the operation of the mine water pumpback system is outlined in the Operations and Maintenance Manual Mine Water Diversion Dam and the Drainage Management SOP.

5.1.2 Mined Rock Stockpiles

MWD drainage (ARD water) – which would otherwise flow or seep directly into the tailings impoundment – is captured in a system of French drain structures and recovery sumps installed at the base of, and parallel to (aligned generally north/south), the foot of the MWD. From the French drains, captured ARD water flows to one of a series of recovery sumps from where it is then pumped to a storage/surge tank. From the tank, captured ARD water is then pumped to WTP3, WTP1, or the MPL where it undergoes HDS treatment to reduce metals concentrations and TDS before being discharged to the tailings impoundment. Any uncaptured flow is directed to the tailings impoundment.

5.1.3 Aqqaluk Pit

Mine water from the Aqqaluk Pit is pumped to the Main Pit, from where it is pumped to the MWCS retaining basin (from where it is ultimately pumped to the tailings impoundment). Shelly Creek, immediately southeast of Aqqaluk, is diverted by pipe to the RDC diversion as depicted in Figure 7. Sulfur Creek is isolated and protected from the active mining area by a series of diversion channels, berms, sumps and the appropriate grading of road surfaces as depicted in Figure 7.

5.1.4 Qanaiyaq Deposit

The Qanaiyaq Deposit straddles the topographic saddle separating the South Fork and Middle Fork Red Dog Creek drainages. Exposed surfaces, for the most part, are rock outcroppings which produce very little sediment. Since mine development activities were initiated in early 2016, diversion channels and appropriately graded roads have been constructed to ensure that mine water is directed to either the tailings impoundment drainage or to the mine water diversion located below Hilltop Creek – which reports to the Main Pit, i.e., to the MWCS, as depicted in Figure 8. As mine development progresses and active mining is eventually begun, appropriate BMPs (Section 5.4) will continue to be implemented as appropriate.

5.1.5 DD-2 Material Site

The DD-2 material site is in the tailings impoundment catchment basin. Drainage from the site was originally diverted via a channel over the topographic saddle south of the impoundment into the Bons Creek watershed. Since one of the borrow pits is now being used to store equipment, as a precaution the diversion channel was blocked and the portion of it receiving storm water from DD-2 now drains into the tailings impoundment.

5.1.6 Mill Site and Laydown Yard

The gravel pad under the mill complex and PAC is graded such that surface drainage flows either directly into the MWCS retaining basin or into a channel that skirts the west side of the pad and ultimately is pumped into the tailings impoundment.

The laydown yard is adjacent to the tailings impoundment and any storm water runoff from it flows by gravity into the tailings pond.

5.1.7 Tailings Impoundment

Potentially contaminated site drainage is directed to the tailings impoundment, as described in the previous sections. Efforts have been made to divert run-on from undisturbed parts of the tailings impoundment catchment basin away from the pond. The southern portion of the DD-3 diversion channel continues to flow toward Bons Creek, and collects surface flow from an undisturbed hillside south of DD-2, which is partially in the tailings impoundment catchment basin. Further north, the DD-1/DD-4 diversion channel was constructed on the east-facing slope above the tailings impoundment, to divert run-on into Middle Fork Red Dog Creek below the tailings dam.

Tailings dam seepage and storm water runoff from the downstream face of the tailings dam are collected in a lined impoundment and pumped back into the tailings impoundment. The seepage pumphouse is equipped with three pumps as well as a backup generator, in the event of main-power failure. An additional pumpback system has been installed below the seepage impoundment, to recover potential seepage from the seepage impoundment itself.

5.1.8 Areas Not Draining to Tailings Impoundment

The following storm water flows at the mine site do not drain to the tailings impoundment:

- airport drainage, to Buddy Creek and Bons Creek;
- construction camp drainage to Bons Creek and Bons Reservoir;
- access roads along Red Dog Creek below the MWCS and tailings impoundment seepage pumpback systems;
- the RDC diversion.

5.2 Water Treatment

Runoff that flows by gravity or is pumped into the tailings impoundment mixes with process water discharged from the mill in the tailings pond. Excess storm water accumulating in the tailings impoundment is treated for removal of dissolved metals (Section 3.3.9) and discharged to Middle Fork Red Dog Creek under APDES Permit AK0038652.

The APDES permit stipulates a maximum total water discharge volume at outfall 001 of 2.418 billion gallons per year (bgy). The actual amount discharged depends on seasonal and annual variations in precipitation, and is constrained by limitations in treatment plant capacity and total dissolved solids (TDS) concentration in receiving waters.

Treatment plant effluent is typically in compliance with all APDES permit limits. The HDS system is considered best available control technology (BACT) for the treatment of process water and mine drainage. Nevertheless, Teck is currently studying treatment options to reduce the TDS in the tailings pond and the treatment facility effluent.

Teck operates the treatment plant to ensure TDS concentrations at points in the receiving waters of Red Dog Creek and Ikalukrok Creek are at all times below maximum acceptable concentrations. Red Dog has developed a sophisticated system for monitoring flows and conductivity (which has a known relationship to TDS) in receiving waters. Receiving water data are used to “flow pace” the discharge rate to maintain in-stream limits.

In-stream TDS limits were established in cooperation with the Alaska Department of Fish & Game (ADF&G) and are based mainly on avoiding impacts to spawning fish in Red Dog Creek and Ikalukrok Creek. During the discharge season, receiving water quality is monitored intensively, and fisheries studies are undertaken. The fisheries work is carried out by ADF&G biologists.

In 2019 a Reverse Osmosis plant was installed in order to assist in meeting the discharge water quality guidelines. RO and treated water are blended prior to discharge into RDC to ensure end-of-pipe limits are met.

5.3 Blasting Practices

Best blasting practices (Section I.H.2.i.(vi) of APDES Permit AK0038652) are implemented through Section 1.3 of the facility’s Blasting Operations SOP (Qualtrax ID 4058) as well as through various SiteLine tasks in order to ensure minimal environmental impact. Blast holes are loaded based on the general location and condition of the individual hole (e.g., whether the hole is a dry hole or a wet hole). The mixture of ammonium nitrate fuel oil and emulsion varies based on the condition and location of the hole, and the overall blast pattern. Stemming practices are used to control fly rock and loaded holes are not left longer than 5 days to minimize impacts to pit water quality. Other detailed blasting practices to minimize environmental impacts are described in the Blasting Operations SOP (Qualtrax ID 4058).

5.4 Erosion and Sedimentation Control

Mitigation of erosion and sedimentation is achieved mainly by drainage control and water treatment, as described in Sections 5.1 and 5.2. Additional measures for control of erosion and sedimentation are applied on an as-needed basis, principally to areas that do not drain to the tailings impoundment (Section 5.1.8). Such measures may include, as appropriate:

- Erection of silt fences;
- Placement of fiber rolls to reduce sediment loadings to streams;
- Placement of rolled erosion control product (RECP);
- Construction of water bars;
- Revegetation of disturbed areas;
- Small-scale diversion of clean water around disturbed areas;
- Appropriately graded road surfaces to direct/divert/convey water;
- Road side channels or berms to direct/divert/convey water;
- Other channels, berms or swales to direct/divert/convey water
- Maintenance of naturally-occurring vegetative buffers;
- Establishment of engineered vegetative buffers
- French drains, or French drain-type structures
- Powered pumps

5.5 Fugitive Dust Control

Fugitive dust emissions may be significant at Red Dog, due to the combination of large-scale materials handling and climatic conditions including high winds and freeze drying of exposed soil materials during the winter. Mineralized fugitive dust at Red Dog represents a potential threat to storm water and receiving water quality. The major potential sources of fugitive dust at the mine site are blasting operations, rock handling operations in the pit, ore and concentrate haulage, handling of ore and waste at the stockpiles, the coarse ore stockpile building (COSB), the concentrate storage building (CSB) and beached tailings in the tailings impoundment.

A variety of measures are in place to control or minimize fugitive dust emissions. These include engineering controls such as full enclosure of the coarse ore stockpile, concentrate storage piles, conveyors and transfer points; baghouses and other engineering controls in the crushers, watering of roads during dry periods in the summer, application of dust suppressant agents to the concentrate haul road and airstrip, and application of binding agents to the tailings beach.

Particulate air emissions have been identified as one of nineteen unique significant aspects under Red Dog's environmental management system (EMS). Continuous performance improvement in fugitive dust control is sought through management of fugitive dust control efforts, as part of a formal environmental management program. Red Dog's EMS is described in Section 6.2.

5.6 Waste Management

Solid and hazardous wastes are managed according to the Resource Conservation and Recovery Act (RCRA) and the Alaska Solid Waste Management regulations (18 AAC 60). Waste management policies and practices are summarized in Section 3.5.7.4 and are detailed in Red Dog's Waste Information System. Operational control over waste management activities is provided by Standard Operating Procedures (SOPs) that are in use in operating areas.

5.7 Good Housekeeping

Teck implements good housekeeping practices throughout the mine site to maintain a clean and orderly work environment. Materials are stored carefully and containers are labeled per applicable regulations, and an up-to-date chemical inventory is maintained. Routine cleanup operations are scheduled in most work areas and employees are trained in good housekeeping practices. In addition, a "spring cleanup" is conducted each year in late May or early June, once the snow has melted, to identify and dispose of trash and scrap items that may have been covered by snow during the winter months.

5.8 Preventive Maintenance

Periodic preventive maintenance (PM) is conducted in all work areas to prevent or reduce mechanical failures. PM activities may be calendar driven (carried out on specific dates regardless of equipment usage) or run-time driven (carried out when a preset threshold of equipment usage is reached). Specific PM information is maintained by the Maintenance Department on a computer inventory and maintenance software program. This program includes automatic maintenance work order (MWO) generation for PM activities, inventory records, maintenance logs and maintenance schedules. The PM cycle is re-initiated automatically when an MWO is closed by the maintenance planner. At present, electronic PM records are retained indefinitely. This policy could change in the future but in any event, records will be retained for at least one year following the expiry of APDES Permit AK0038652.

Scheduled preventive maintenance is supplemented by routine operational inspections – which are conducted between scheduled PM activities in order to detect problems that could lead to failures(Section 5.9.1).

5.9 Inspections

Inspection requirements (as described in APDES Permit AK0038652 Sections I.H.3 and I.H.4) are implemented through the Mine PPP Inspection SOP as well as through various SiteLine tasks. These requirements include the following:

- Routine monthly inspections of areas susceptible to leaks, spills and other problem areas, including spill response equipment, visual evidence of storm water pollution and evaluation of storm water control measures.

- Twice yearly identification of areas affected by storm water discharges associated with construction or exploration activities, and evaluation of BMPs in place to control storm water in these areas.

- Weekly during the months of May, June, July, August, September, and October, and within 24 hours of 24-hour rain events of 0.5 inches or greater, inspection of disturbed areas of the construction or exploration sites exposed to precipitation, outside of the area that drains into the tailings impoundment.

Teck complies with these minimum requirements and may exceed them in some instances.

5.9.1 Routine Operational Inspections

Red Dog operating departments conduct routine inspections within their own work areas. These regular inspections are the responsibilities of the superintendents in charge of each department (Mine, Mill, Maintenance and Materials Management and Safety & Health). Routine inspections address facilities that convey or otherwise may manage storm water, in addition to facilities and/or activities where an unplanned event could result in impacts to storm water.

Inspection frequencies vary but are typically daily to weekly, depending on risk and, in some cases, time of year. For the purposes of this SWPPP, the three most critical areas for operational inspections are where active intervention (pumping) is required to direct a moderately to highly hazardous PSWP to the tailings impoundment, as follows:

1. Tailings dam seepage recovery and pumpback,
2. MWCS retention basin and pumpback system, and
3. Overburden stockpile seepage recovery and pumpback system.

In each of these three areas, operational inspections are conducted daily, with more comprehensive inspections conducted weekly, monthly or quarterly.

Inspection of the MWCS and tailings dam seepage recovery and pumpback systems is the responsibility of the Mill Department. Mill checklists include the water treatment plants, main seepage pumps, small seepage pumpback, reclaim barges, MWCS main pumps, small over dam pumpback and tailings discharge line.

Inspection of the mine water pumpback system, and the overburden stockpile seepage recovery and pumpback system, is the responsibility of the Mine Department. Mine checklists include the tailings dam and seepage impoundment, freshwater dam, MWCS diversion dam and pumpback, and overburden stockpile diversion system.

Inspection of secondary containment is the responsibility of Maintenance and Materials Management. Checklists completed by the Surface Crew include a secondary containment log and secondary containment pumping sheet.

Spill response equipment is inspected monthly by the Safety and Health Department, as stipulated in the Oil Discharge Prevention and C-Plan.

5.9.2 Twice Yearly Inspections

Twice yearly inspections are conducted by Environment personnel, supported as necessary by Operations. Inspections are generally carried out at spring breakup (usually late May) and near the end of the open water season, in September. These inspections are documented. Corrective action tasks and completion of the corrective actions associated with the twice annual inspections are tracked in the Red Dog Environmental Management system as an Internal Audit.

5.9.3 Open Water Season Inspections

The weekly inspections, which focus on construction and exploration areas that do not drain to the tailings impoundment, are conducted by Environment personnel, supported as necessary by Operations. These inspections are documented. Corrective measures identified as the result of the inspections are to be undertaken within 30 days of the inspection.

5.10 Spill Prevention and Response

Red Dog has in place a C-Plan, conforming to AS 46.04 and 18 AAC 75, and approved by ADEC. The C-Plan is certified by a Professional Engineer and incorporates a Facility Response Plan (FRP) and Spill Prevention Control and Countermeasure (SPCC) Plan, per 40 CFR 112. The C-Plan has also been approved by the U.S. Coast Guard under 33 CFR 154.

The C-Plan details Teck's programs for prevention of and response to spills of oil and other hazardous substances. Primary responsibility for document preparation and agency approvals lies with the Environment Department; implementation is the responsibility of Safety & Health and the Response Chief.

5.11 Training Programs

5.11.1 Job-Specific Training

Job-specific trainers at Red Dog are qualified to instruct employees on environmental issues specific to their job. The trainers have completed a training program for teaching the subjects within their area. Instructors are required to demonstrate competent instructional skills and knowledge of the applicable subject matter. Training manuals are reviewed by the Environment Department for inclusion of environmental issues.

5.11.2 General Environmental Training

In addition to job-specific training, all Teck employees receive annual MSHA training which includes environmental training. Environmental training includes the following categories:

- Environmental management system
- Permits and regulatory compliance
- Water quality

- Air quality
- Waste management
- Wildlife protection
- Spill prevention, response and reporting

5.11.3 Spill Prevention and Response Training

Spill prevention training is given to all employees annually. Additional prevention training is given to specific departments on an as-needed basis in areas where there are recurring spills. On-the-job training is performed on tank farm alarms and response procedures, fuel tank inspections and valve inspection procedures.

Teck has an Emergency Response Team that is trained to respond to emergencies, including major spills, at Red Dog. The C-Plan (Section 5.10) is fully exercised every three years. At a minimum, emergency and spill response personnel receive at least 40 hours of training, including the following:

- Classification, identification and verification of known and unknown materials by using field survey instruments and equipment.
- Selection and proper use of specialized chemical personal protective equipment.
- Performing advance control, containment and confinement operations within the capabilities of the resources and personal protective equipment available.
- Understanding basic chemical and toxicological terminology and behavior.
- Potential health and fire hazards associated with spill response activities.

6 Best Management Practices Implementation

6.1 Best Management Practices Committee

Implementation of BMPs for storm water management is the overall responsibility off the BMP Committee. The BMP Committee consists of the following positions or their designees:

- Manager, Tailings and Environment
- Manager, Operations and Maintenance Execution
- Manager, Integrated Operations and Improvement
- Superintendent, Supply Chain Management
- General Supervisor, Mine Operations
- General Supervisor, Mill Operations
- Principal Engineer
- Surface Crew Supervisor
- Response Chief
- Environmental Coordinator – Stormwater (Committee Chair)

The duties of the Committee Chair are to:

- Develop the draft PPP;
- Develop the final PPP with consensus from the BMP Committee, and;
- Chair BMP Committee meetings.

The BMP Committee will:

- Review and comment on the draft PPP, calling attention to any inaccuracies or deficiencies, and offering suggestions for improvements.
- Assist in PPP implementation as it pertains to their department's responsibilities.
- Advise the committee chair of any process or operational changes in their respective departments that may require consideration in the PPP, and meet to revise the plan as necessary.
- Meet annually to review the adequacy of the PPP and its implementation, including potential and actual problem areas.

- Incorporate the PPP into EMS audits.

6.2 Environmental Management System (EMS)

Teck has developed and implemented a formal environmental management system (EMS) encompassing all operations at the mine and port sites, and selected contractor activities. The EMS is designed to be conformant to the ISO 14001 EMS standard.

EMS development included a comprehensive exercise to identify and rank Red Dog's environmental aspects[1]. A total of 1,258 environmental aspects were identified across all work areas and activities. Of these, 234 were ranked as "significant"[2] on the basis of a risk assessment.

For the purposes of prioritizing management activities in the form of environmental management programs, the significant aspects were grouped according to category into "unique" environmental aspects, that is, aspects associated with a common activity and/or environmental impact. There are 19 unique significant aspects at Red Dog, associated both with abnormal conditions (e.g., a spill or other environmental incident) and normal operating conditions.

Storm water runoff is a unique significant aspect under both abnormal and normal conditions and as such, will be managed and tracked as part of a formal environmental management program. Several other significant environmental aspects can be directly or indirectly related to storm water management and potential effects on receiving water quality. These are listed below:

- Acid mine drainage (AMD) generation.
- Acid rock drainage (ARD) generation.
- Emissions to air – particulates (mist and fugitive dust).
- Handling and storage of dangerous substances.
- Hazardous waste generation.
- Land disturbance.
- Leaks and spills to land.
- Leaks and spills to water.
- Management of waste with special considerations.

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[1] An environmental aspect is defined in the ISO 14001 Standard as an "element of an organization's activities, products or services that can interact with the environment".

[2] Significant aspect is defined in the ISO 14001 Standard as an environmental aspect that has or can have a significant environmental impact.

- Physical stability.

- Solid waste generation.

- Waste water discharge – point source.

The fact that so many environmental aspects may interact with or affect storm water underscores the importance and complexity of storm water management at the site.

The EMS provides a structured framework for managing significant aspects as they relate to storm water management and many other priority issues.

6.3 PPP Documentation

6.3.1 Plan Location and Public Access

A copy of this PPP will be maintained in the office of the Manager, Environment, at the Red Dog Mine site, along with a copy of APDES Permit AK0038652. The PPP shall be made available to all Teck managers, staff, employees and contractors with a need to know.

The PPP is available to the public by request through the permitting authority (Alaska Department of Environmental Conservation, Fairbanks, AK).

6.3.2 Recordkeeping and Reporting

Records of inspections, corrective actions and preventive maintenance, spill reports and BMP Committee meeting minutes will be maintained at the Red Dog Mine site, for at least one year after the expiry of APDES Permit AK0038652.

6.3.3 Director-Required Plan Modifications

Any change required by the permitting authority shall be made within 30 days, unless otherwise provided by the notification. In addition, Teck shall submit a certification signed in accordance with EPA guidelines, report number 832/R-92-006, Section 2.6.2, to the EPA Director that the requested changes have been made.

6.3.4 Plan Amendments

This PPP will be amended:

- Whenever material changes to project operation, or new construction or exploration activities, are undertaken that could affect the potential for the discharge of pollutants to waters of the U.S.; and

- If it is demonstrated through routine monitoring, inspections, audits or environmental incidents, that the PPP is ineffective in achieving its stated objectives.

Plan amendments necessitated by new construction or exploration activities will be made at least seven days prior to the commencement of the activities. All PPP amendments will be reported to ADEC, AK. EPA and ADEC have the right to disapprove any such changes within 60 days' notice of the amendments, after which time such changes shall be deemed approved.

6.3.5 Annual Reports

In accordance with APDES Permit AK0038652, Section I(H)(6), page 29, Teck shall submit an annual report to the EPA and ADEC. The report is submitted by February 10 of each year, for the previous year, and summarizes the following:

- Scope of BMP inspections,
- Personnel conducting inspections,
- Inspection dates,
- Corrective actions taken,
- Description of the quality and quantity of storm water discharged,
- Construction activities during the year,
- Employee training conducted during the year, and
- Plan modifications made during the year.

Mine PPP May 2024 (1)

Final Audit Report 2024-05-31

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