Pogo Mine Environmental Audit

Sumitomo Metal Mining Pogo LLC

Delta Junction, Alaska

December 19, 2016

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Abbreviations and Acronyms

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
APDES	Alaska Pollutant Discharge Elimination System
CIP	Carbon-in-Pulp
DSTF	Dry Stack Tailings Facility
EDMS	Environmental Database Management System
EPA	U.S. Environmental Protection Agency
FHP	Fish Habitat Permit
NPDES	National Pollutant Discharge Elimination System
ORTW	off-river treatment works
PA	Programmatic Agreement
Pogo	Sumitomo Metal Mining Pogo LLC
POA	Plan of Operations Approval
PoO	Plan of Operations
PSI	Periodic Safety Inspection
QAP	Quality Assurance Plan
QA/QC	quality assurance/quality control
RTP	Recycle Tailings Pond
SHPO	State Historic Preservation Officer
SOP	Standard Operating Procedure
SPCC	Spill, Prevention, Control, and Countermeasure
SRCE	Standardized Reclamation Cost Estimator
SSI	statistically significant increase
SWPPP	Stormwater Pollution Prevention Plan
TWUA	Temporary Water Use Authorizations
TWUP	Temporary Water Use Permit
USACE	U.S. Army Corps of Engineers
WAD	Weak Acid Dissociable
WMP	Waste Management Permit
WQS	water quality standards
XRF	x-ray fluorescence

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1.0 Purpose and Objectives

HDR conducted an environmental compliance audit of Pogo Mine, located near Delta Junction, Alaska, for Sumitomo Metal Mining Pogo LLC (Pogo) and the Alaska Department of Natural Resources and Alaska Department of Environmental Conservation (ADNR/ADEC). This Environmental Compliance Report outlines the audit purpose and approach, audit findings, any systematic observations, and recommendations for improvement.

Pogo Mine's Plan of Operations Approval (POA), Waste Management Permit (WMP), and Millsite lease authorizations require an environmental audit prior to renewal of the permit. The audit is to be an objective, systematic, and documented review of the conditions, operations, and practices related to permit requirements and facility management conducted under only these authorizations. The last audit was performed in 2009 by Golder (2009).

The environmental compliance audit at Pogo Mine was conducted to compare and evaluate facility operations against available permits and State regulations. Program areas and permits included in the audit scope are summarized in Table 1. The audit results will be used by Pogo and the State of Alaska to assist in updating, renewing, or issuing authorization and permits; in updating policies, plans, and procedures; and in determining compliance with permits and authorizations.

The objectives of the audit were as follows:

- assess the facility's environmental compliance performance
- identify potential corrective actions for noncompliance observations
- identify common or systematic environmental issues across the facility
- provide an overall assessment of environmental performance, including recommendations for resolving system-wide areas of noncompliance
- an overall assessment of, and recommendations for, agency oversight

2.0 Permits and Authorizations

The HDR Audit Team (Audit Team) reviewed compliance with the following State permits and authorizations listed in Table 1, as required under the POA, the WMP, and the Millsite Lease.

Table 1. Environmental Programs and Permits Included in Audit

Program Area/Permit	Site Location	Permit	Issue Date	Expiration Date
Waste Management Permit	Dry stack tailings facility, Underground mine workings, Waste rock and ore stockpiles, Recycle tailings pond, Hazardous chemical storage and containment, and Groundwater and surface water containment systems	2011DB0012	2/7/2012	2/6/2017
Plan of Operations Approval	Mine Site	F20129500	2/7/2012 (Last amended approval 12/19/2012 for Power Distribution Expansion to East Deep)	2/6/2017
Millsite Lease	Mine Site	ADL 416949	12/18/2003	Until completion of all requirements under the Plan of Operations
Rights-of-Way	Shaw Creek All-Season Access Road - exclusive access right of way.	ADL 416809	12/18/2003	15 years from time the final right-of-way issuance- 12/18/2018
	Shaw Creek All-Season Access Road - public access right-of-way.	ADL 417066	12/18/2003	15 years from time the final right-of-way issuance - 12/18/2018
Water Rights	Drinking Water Wells DW02&3	LAS 24611	4/23/2004	4/22/2024
	Gravel Pit Pond	LAS 24612	4/23/2004	4/22/2024
	Goodpaster River, off-river treatment works (ORTW) Influent	LAS 24613	4/23/2004	4/22/2024
	2 wells proposed upstream of ORTW	LAS 24614	4/23/2004	4/22/2024
	4 wells proposed at headwater Liese Creek	LAS 24615	4/23/2004	4/22/2024
	Surface water collected in RTP	LAS 24616	4/23/2004	4/22/2024
	Groundwater from underground workings	LAS 24617	4/23/2004	4/22/2024
	Rosa Creek, Caribou, Gilles, Shaw Creeks	TWUA F2016-104	7/27/16	7/26/21
	Southern Diversion Channel	TWUP F2011-130 (amended 6/14/13)	2/13/12	10/31/16
	RTP Seepage collection – 4 collection wells	TWUP F2011-131	2/28/12	2/27/17
	Dewatering underground mine	TWUP F2013-023	3/13/13	3/12/18
	Mine Process Water	TWUP F2013-143	11/05/13	11/4/2018
	Exploration Drilling	TWUA F2015-101	10/22/13	12/31/19
	Exploration Drilling	TWUA F2015-044	8/27/15	12/31/19
	Exploration Drilling	TWUA F2015-043	3/27/16	12/31/19

The Audit Team reviewed the following permits and authorizations, which represent the main regulatory drivers for the mine environmental management program:

- Plan of Operations Approval for the Pogo Mine Project:
    - PoO and PoO Appendices:
        - Quality Assurance Plan (QAP)
        - Monitoring Plan
        - Reclamation and Closure Plan/Financial Assurance
        - Dry Stack Tailings Facility (DSTF) Construction and Maintenance Plan
        - Recycle Tailings Pond (RTP) Operating and Maintenance Plan
- ADEC Waste Management Permit
    - PoO and PoO Appendices:
        - Quality Assurance Plan (QAP)
        - Monitoring Plan
        - Reclamation and Closure Plan/Financial Assurance
        - Dry Stack Tailings Facility (DSTF) Construction and Maintenance Plan
        - Recycle Tailings Pond (RTP) Operating and Maintenance Plan
- Millsite Lease
- Shaw Creek All-Season Access Road and Utility Corridor Rights-of-Way
- Water use authorizations

As agreed to by Pogo, ADNR, and ADEC, environmental related permits and plans not covered by the Audit Team review include:

- Certificate of Approval to Operate a Dam for Pogo RTP Dam (NID ID# AK00304)
- Alaska Pollutant Discharge Elimination System (APDES) Water Discharge Permit (AK0053341)
- Environmental Protection Agency (EPA) Hazardous Waste
- Spill, Prevention, Control, and Countermeasure (SPCC) Plan
- Stormwater Pollution Prevention Plan (SWPPP)
- U.S. Army Corps of Engineers (USACE) 404 Permit
- Potable Water Supply
- Sewage Treatment
- Toxics Release Inventory (TRI)
- Federal Aviation Permits
- ADEC Air Quality Control Minor Permit (AQ0406MSS03 dated December 13, 2006)

Pogo maintains an environmental database management system (EDMS) for all environmental data related to the project. Data requests were provided to the Audit Team as requested to facilitate record auditing primarily while on site. Key permits were obtained from the ADNR and

ADEC project files prior to the field audit. Pogo provided additional correspondence items as requested. The implementation of each of the document terms was checked during the field audit and found to be in compliance in general.

3.0 Approach and Methodology

The audit methodology can be generally broken into three main tasks: pre-audit activities, onsite audit, and post-audit reporting.

3.1 Pre-audit Activities

The pre-audit activities were performed prior to the facility visits. Activities included review of available project permits and plans and participation in a project kickoff meeting prior to the onsite visits.

Permit and Plan Review. The intention of the preliminary review was to obtain a high-level understanding of the applicable permits and plans in place at the time of the permit review. The Audit Team gathered available mine permits, plans, and agency authorizations from online resources, from ADEC and ADNR office visits, and from Pogo directly to ensure the latest versions were reviewed.

Project Kickoff Conference Call. A project kickoff conference call was performed on May 5, 2016, with the mine permitting team composed of ADNR, ADEC, and Alaska Department of Fish and Game (ADF&G), Pogo Environmental Lead, and the HDR Audit Team. This call provided a general overview of the assessment process, scope of permits and authorizations that the audit will address, and overall project schedule.

3.2 Onsite Audit Activities

The Audit Team performed the onsite audit of the Pogo Mine from July 14-16, 2016 and participated in the following: site kickoff meeting, site walk-through, review of provided documents, interviews, and daily debrief meetings.

Site Kickoff Meeting. Upon arrival at the site, the Audit Team attended a site-specific safety training, and a site kickoff meeting facilitated by Pogo Mine staff and the Audit Team. Attendees included the Pogo Environmental Team and facility and department managers. The purpose of the meeting was to review the scope and purpose of the audit, introduce personnel involved in conducting the audit, and define the schedule for the audit for tours and interviews.

Site Walk-through. The Audit Team participated in a tour of the mine, guided by the Environmental Coordinator. During the walk-through, the Audit Team viewed facilities and activities specific to the environmental permits. Field observations were discussed with the site personnel during the site walk-through and during interviews. In addition to the mine site-wide tour, individual Audit Team members toured specific facilities with facility managers or specific Environmental Team personnel with operational knowledge of the facilities and operations.

Mine operations and facilities that were inspected included the following:

- milling facilities
- filter/paste backfill plant
- blue tube and paste lines
- non-mineralized rock stockpile
- mineralized rock storage areas
- DSTF
- RTP
- fuel and materials storage facilities
- secondary containment facilities
- on-site laboratory
- off-river treatment works (ORTW)
- seepage collection wells
- Shaw Creek all-season road
- concurrent reclamation areas
- monitoring wells and flumes
- environmental sampling shack

Interviews. The Audit Team conducted interviews with Pogo Mine representatives with responsibilities of overseeing environmental regulatory requirements. The purpose of these interviews was to obtain an understanding of the environmental programs and procedures for compliance with permits and plans, and to assess how well those programs are understood and implemented.

Records and Document Review. The Audit Team reviewed applicable permits that were readily available and organized onsite. The auditors made observations of operational activities within the context of applicable permits and environmental requirements, taking note of any compliance gaps. Additional documents provided by Pogo that were reviewed included but were not limited to Standard Operating Procedures (SOPs) for some activities, waste logs, task training cards, various inspection reports, muck logs and laboratory analysis of development rock, EDMS, filing system, and ISO Environmental Management System Manual.

Daily Briefing Sessions. The Audit Team participated in a daily briefing session with Environmental Team personnel. The auditors reviewed the day's progress and any specific observations.

3.3 Post-audit Activities

Following the audit, observations were summarized in this Environmental Audit Report and interviews were conducted with agency personnel. The Audit Team interviewed various agency personnel, primarily those who manage the WMP, financial assurance, dam safety and engineering, water use authorizations, and right-of-way authorization.

4.0 Interviews

4.1 Agency Interviews

The Audit Team interviewed agency personnel regarding the following aspects of the audit purpose and Pogo's permits:

- audit scope,
- various aspects of the authorizations to understand the intent of permit language,
- request additional reporting or correspondence,
- request a status update on submitted documents,
- gather information regarding the agency perspective on the mine compliance and ongoing ability to meet obligations and agency requests, and
- to gauge adequacy of State oversight.

The regulatory agency personnel for this project were of significant help to the Audit Team on all of these accounts. Table 2 lists the interviews with agency personnel conducted by the Audit Team and includes a brief summary of the interaction.

Table 2. Audit Interviews with Agency Personnel

Name and Title	Agency or Company	Date	Summary
Tim Pilon, Engineer II	ADEC, Division of Water	Emails dated 7/7, 7/29, 9/8, 9/12	• Wildlife monitoring and reporting at the facility: "There is no requirement to record those observations. The intention is that if you don't check for wildlife activity at dumps, you won't be able to minimize or discourage it. Regarding wildlife fatalities, their permit does not require reporting…" • Tailings limits and "approximate" weekly limit in permit: "the only hard limit is a maximum of 20 million tons. The approximate values merely describe the expected rate and composition of disposal." • Where groundwater naturally exceeds water quality standards, a statistically significant increase in constituent concentration is prohibited. However, if groundwater quality does not exceed water quality standards, the statistically significant increase prohibition is void. • Defining the scope of the audit, specifically clarifying that the scope of the audit does not include reviewing sections of the Monitoring Plan that address monitoring requirements associated with permits that are out of the scope of the audit (stormwater, APDES, potable water system, etc.).
Stephanie Lovell, Large Mine Program Geologist	ADNR, Division of Mining, Land & Water	Email dated 7/22	The Audit Team had inquired about the most current financial assurance cost estimates to focus its review, where the last approved bond estimate was in 2012, however Pogo had recently updated its reclamation and closure bond estimate in 2014 by converting to a Standardized Reclamation Cost Estimator (SRCE). ADNR responded that HDR should focus on the last approved financial assurance, April 13, 2012.

Name and Title	Agency or Company	Date	Summary
Mr. Charlie Cobb, Dam Safety Engineer	ADNR	Phone Call dated 8/25/2016	C. Cobb has been involved early on and supported Mining Section with technical review of dry stack design and stability analysis. Regarding the DSTF, he suggested paying closer attention to compaction by the rollers.
Alexander Wait	ADNR, Division of Mining, Land & Water – Lands Program	Phone call 8/16/16	The first 23 miles of the Shaw Creek Road is supposed to be a public right-of-way. However, beginning approximately 0.4 miles from the Guard Shack the access road is constructed within a private easement that extends for approximately 0.5 miles before transitioning back on to State Land. The private agreements are exclusively between Teck and two separate landowners and are effective for a term of 15 years. As a result, public access and mine site access could be negatively affected once the term of the easement agreements expire in 2018.
Shina duVall	ADNR – State Historic and Preservation Office	Phone call 8/16/16	The Exclusive Easements for the Shaw Creek Road and Utility Corridor Programmatic Agreement include stipulations for compliance with the Programmatic Agreement (PA) under the Alaska Historic Preservation Act. The PA needs to be updated to include Sumitomo as the mine owner and developer; it currently identifies Teck-Pogo (Teck) as the owner. Additionally, the EPA is shown as the lead Federal Agency for the PA, which is no longer the case. The U.S. Army Corps of Engineers is now the lead Federal Agency because the EPA no longer issues a National Pollutant Discharge Elimination System (NPDES) permit for the Mine; this permit responsibility has moved to the State of Alaska under the Alaska Pollutant Discharge Elimination System (APDES) Program. The PA should be updated to reflect this change.
Richard Lessard	ADNR, Division of Mining, Land & Water – Mining Program	Phone discussion 8/22/16 and 8/26/16	Upon further review, the mine has provided timely annual rental payments. However, in 2015 the rent was supposed to be adjusted per the requirements of the lease, but this adjustment has not occurred. ADNR has sent a letter to Pogo advising them of the status for a rental adjustment.

4.2 Mine Interviews

The Audit Team interviewed various Pogo Mine personnel who are responsible for environmental management program tasks. Table 3 lists the interviews and brief summaries of the interview purpose.

Table 3. Audit Interviews with Pogo Mine Personnel

Name and Title	Role	Date	Summary
Keri DePalma, Environmental Manager	Responsible for environmental permits at mine site	7/14-16/16, additional follow-up emails	Completed access road inspection with her. Audit Team completed daily summaries with her. She was available for questions throughout site visit.
Stacy Staley, Environmental Coordinator	Responsible for ensuring all monitoring complies with permits and QAP, management of the environmental database, training, sampling, routine technical assessments of the sample collection, analysis, and data reporting	7/14-16/16, additional follow-up emails	Completed mine tour with her. Audit Team completed daily summaries with her. She was available for questions throughout site visit.
John Salzman, Environmental Coordinator	Hazardous material management	7/14/16 & 7/16/16	Discussed waste management, hazardous waste profiling, mine spills and releases and responses, and secondary containment.
John McClain, Chief Assayer	Oversees on-site laboratory testing activities	7/14/16	HDR conducted laboratory inspection and interviewed John regarding laboratory protocols, quality assurance/control, and lab waste management.
Joe Filla, Environmental Engineer	Responsible for DSTF environmental management, DSTF piezometers, paste sampling and interstitial water sampling for environmental department	7/14-16/16	Review of secondary containment operations in the mill, filter/backfill plant, and paste lines. Review reclaimed areas. Inspection of DSTF and RTP facilities.
Dave Larimer, Chief Geologist	Oversees sampling of muck to segregate mineralized from non-mineralized rock and he and his staff are responsible for flagging the development rock with proper labeling to ensure it is disposed of at proper location.	7/15/16	Development rock segregation, sampling, labeling, tour of portals and development rock and ore stockpiles.

5.0 Compliance with Permits and Authorizations

5.1 Waste Management Permit

The WMP addresses disposal of waste from the mine in the DSTF, underground mine workings, waste rock and ore stockpiles, recycle tailings pond, hazardous chemical storage and containment, and groundwater and surface water containment systems used to prevent the discharge of wastewater, reclamation and closure activities related to all the facilities, and financial responsibility.

5.1.1 Dry Stack Tailings Facility

The DSTF is limited to a maximum of 20 million tons of inert solid waste (Waste Management Permit 1.2.1). As of 1st Quarter of 2016, 3,477,564 tons of rock (mineralized and non-mineralized) and 6,160,648 tons of tailings have been placed in dry stack. Therefore, almost

half of the design storage space is available to take more waste rock and tailings (complies with Waste Management Permit 1.5.4). According to Waste Management Permit 1.5.3, Pogo shall adhere to the Pogo DSTF Construction and Maintenance Plan:

- Wind-blown tailings were not observed but measures (water truck to spray water) were available at the site if needed.
- Diversion canals seem to function well to minimize run-on water from entering the DSTF from upgradient sources of surface and groundwater. Green rock was placed as a drainage layer under the DSTF after clearing and grubbing of natural ground and provides an effective route for groundwater to pass under the dry stack.
- Some water ponding is observed on the DSTF at a location where tailings are deposited. Grading could be improved to prevent ponding of water.
- Temporary piles were kept relatively low and no stability issues were created. Liquefaction of DSTF is not likely as there are no saturated zones.
- Acid generating rock cells were entombed in tailings to prevent acid rock drainage conditions.

Pogo appears to be generally in compliance with the DSTF Construction and Maintenance Plan, PoO, and WMP with regard to the DSTF; however a few minor deficiencies were identified as described below.

Based on discussions with Pogo personnel, Shell 2 and Shell 3 construction were completed in 2012. As per WMP Section 1.5.9, the permittee “must submit to the department within 90 days after completing construction of a significant modification to an existing component the as-built drawings, summary of construction quality activities, and final operating plans”. The annual reporting includes as-builts for each year; however construction quality activities and the 2012 version of the operating plan was not available for construction of Shell 2 (composite shell) and Shell 3 (outer shell), which may qualify as a “significant component”. It is recommended that Pogo develop as-built drawings and a summary of the construction quality activities to document these features of the facility.

The Plan of Operations (PoO) states bi-annual survey records of the DSTF, truck loads, and tonnage data are recorded. The Audit Team reviewed these records, which are being maintained. The PoO also states that annual as-built surveys are scheduled for September for the annual site as-built drawing. The Audit Team reviewed annual reports from 2011, 2012, 2013, 2014, and 2015. The annual reports included as-builts of the facility in compliance but did not contain cross-sections of the facility to verify progress of construction. The Audit Team did verify the latest DSTF layout during the site visit. It is recommended that Pogo complete cross sections along with their annual as-built drawings that display annual progress.

According to WMP monitoring requirements, visual monitoring and documentation of the disposal facilities is required on a weekly basis, checking for signs of damage or potential damage from settlement, ponding, leakage, erosion, or operations at the site. Weekly monitoring records of the DSTF were not available, though monthly monitoring inspection reports were available and reviewed by the Audit Team. Monthly visual monitoring reports included very limited information. It is recommended that inspections be performed weekly to be

in compliance with the WMP, and that more effort be placed into documentation of the visual inspections, which can only be observed if inspection reports contain occasional notes beyond checking form boxes.

The Audit Team reviewed the waste log that records trucks of floatation tailings, mineralized and non-mineralized rock that is disposed of at the DSTF and underground, and the miscellaneous waste placed either into the DSTF or underground (e.g., filter press waste and Water Treatment Plant Sludge). The WMP limits the DSTF to "20 million tons of inert solid waste, consisting of approximately 12,500 tons per week of floatation tailings and 10,000 tons per week of waste rock…" In an interview with ADEC, the approximation for the weekly limit does not represent a permit limit and describes the expected rate and composition of disposal. When the WMP is revised, ADEC may consider editing Section 1.2.1 to reflect the intent of including these weekly rates. Pogo annual reports provide the tonnage of floatation tails and mineralized development rock disposed at the DSTF, but do not include the non-mineralized development rock tonnage disposed at the facility. It is unclear how the agency will track total tonnage at the facility without these data, and therefore it is recommended that the non-mineralized development rock tonnage be provided in annual reports.Three holes containing seven vibrating wire piezometers were installed in the DSTF to track water pressure. According to the Monitoring Plan and QAP, the data are downloaded monthly. The QAP does not address the protocol for data management from the transducers. It is recommended that, at a minimum, reference to a separate SOP be included in the QAP. The QAP or the SOP should describe the data collection programing of the data logger, the equipment, frequency and process for data download, where data will be stored and how it will be managed, how data drift will be reviewed and corrected, and data correction for barometric pressure.

5.1.2 Recycle Tailings Pond

According to WMP limitations (WMP Section 1.2.6), groundwater in compliance monitoring wells (MW03-500, MW03-501, and MW03-502) must not exceed upper tolerance limit (also referred to as trigger value) concentrations for the eight constituents listed in Table 1 of the WMP. Bedrock monitoring wells MW03-500, MW03-501, and MW03-502 were replaced with alluvial wells MW12-500, MW12-501, and MW12-502 in 2012 after a well collapsed. The permit reference to the well names needs to be revised when the permit is renewed. The sample frequency is required to be in conformance with the Monitoring Plan and QAP, which state that these wells will be monitored quarterly. The Audit Team reviewed analytical results from these three monitoring wells and found monitoring frequency to be consistent with the Monitoring Plan and QAP and groundwater quality to be compliant with the WMP limitations for the RTP zero discharge facility (no concentrations exceeded the upper tolerance limit concentrations for the eight constituents listed in Table 1 of the WMP).

The QAP states that these three monitoring wells will also be monitored for water quality standards (WQS) (QAP Section 17.0). The QAP also says they will monitor for a statistically significant increase (SSI) above the WQS and an SSI above background water quality. Pogo's annual reporting has regularly provided the comparison of compliance monitoring results against the trigger values, as required.

According to WMP Section 1.6.2.1 “visual monitoring of the facility” is required on a weekly basis. It is unclear in the WMP what is intended by “the facility”; however, later section 1.6.9.4 requires “inspections of the RTP” in conformance with the current Certificate of Approval to Operate a Dam, which requires monthly visual monitoring. According to Tim Pilon with ADEC, the WMP Section 1.6.2.1 is applicable to “…waste disposal-related facilities. That includes containment and disposal sites, such as the DSTF for waste rock and tailings, secondary containment structures associated with the mill and blue tube, the DSTF diversion ditch…”. The RTP Operations and Maintenance Plan includes required visual inspection of the RTP on a monthly basis. In practice, Pogo performs RTP visual monitoring monthly, including the dam crest and face, spillway, flume, and the seepage collection. The Audit Team reviewed the RTP monitoring records. Pogo is compliant with the WMP required monitoring, although monthly visual monitoring reports included very limited information. It is recommended that additional effort be placed into documentation of the visual monitoring, which can only be observed if inspection reports contain occasional notes beyond checking form boxes. It is recommended that the WMP revision consider clarification of Section 1.6.2.1 for which facilities are intended for visual inspection. Section 1.6.2.1 of the WMP uses the term “facility” (singular), and the term “visual monitoring”, while later Section 1.6.9.4 uses “inspections” with regard to the RTP. This language leads the reader to interpret that the RTP should be monitored on a weekly basis along with other disposal-related facilities and that Section 1.6.9.4 is pertinent to the Periodic Safety Inspection (PSI) required in the Dam Permit (not visual monitoring).

Based on Waste Management Permit item 1.6.9.4, Pogo is to “Conduct inspections of the RTP in conformance with the current Certificate of Approval to Operate a Dam issued by ADNR, Divisions of Mining, Land and Water, Dam Safety and Construction Unit”. The last PSI was completed in 2014. An updated PSI was completed in summer of 2016 and will be available after this audit report is complete. Further review of the PSI is not within the scope of the audit.

Based on visual observations the RTP seems to be in compliance with approved designs. The seepage collection system is functional and pumps back into the RTP. Monitoring equipment is protected from elements in a shed and is in good working condition. Assuming the 2016 PSI is approved by Dam Safety and Construction Unit and confirms the safety of RTP, Pogo appears to be compliant with the WMP, PoO, and RTP Operating and Maintenance Manual, but it is recommended that as-built reports be improved.

The WMP states that wash water from vehicle maintenance can go to the RTP if the water runs through an oil water separator (OWS) first. The Audit Team completed a site visit at the maintenance shop and confirmed that the wash water runs into an OWS.

5.1.3 Secondary Containment

This section addresses WMP requirements for secondary containment and the Audit Team’s findings.

According to WMP Section 1.4.1 information on engineering changes to the mill, waste treatment processes, monitoring wells, etc. must be submitted to the department. The Audit Team conducted visual inspection of the mill, filter/backfill plant, paste pipeline, and bulk storage tank areas and also interviewed Pogo personnel regarding engineering changes since the last

audit. The Audit Team verified that Pogo has submitted engineering plans to ADNR/ADEC for approval of such changes. The Audit Team reviewed drawings for the paste pipeline system and no deficiencies were identified.

According to WMP Section 1.4.2, Pogo must provide and maintain secondary containment for all process piping and chemical mix tanks containing hazardous or toxic materials. The Audit Team conducted visual inspections of secondary containment systems in the mill, filter/backfill plant, paste pipeline, and bulk storage tanks and also interviewed Pogo personnel regarding secondary containment systems. In general, secondary containment systems were found to be in place for the above listed areas.

The Audit Team found secondary containment in place for exterior (outside buildings) bulk storage tanks. For bulk storage tanks associated with the Pogo SPCC Plan, the secondary containment for bulk storage containers appear to be of sufficient volume to be 110 percent of the largest tank (the Audit Team reviewed calculations in the SPCC Plan). Pogo's practice is to inspect secondary containment systems for accumulation of precipitation, and if no sheen is observed, personnel pump or drain the accumulated water into the ground. If a sheen is observed, then stormwater within the secondary containment is pumped by a contractor and hauled offsite for recycling (oil waste) or disposal. The management of stormwater in secondary containment is a challenge, particularly in winter when snow accumulates and can reduce the storage volume of the secondary containment system. The Audit Team recommends that Pogo place roof structures over secondary containment areas to limit precipitation entering secondary containment. While covering secondary containment with a roof is not a regulatory requirement, it would ensure sufficient secondary storage capacity in the winter months and greatly reduce stormwater management of secondary containment.

The Audit Team reviewed Pogo monthly spill reports to ADEC from August 2013 through June 2016. The majority of spills were from mobile vehicles where secondary containment was not feasible, or spills that occurred within secondary containment, where there was no release to the environment. Noted large spills are described below:

- On May 7, 2015, Pogo witnessed a release of paste outside the splice house (CV002) near the 1690 Portal. Approximately 90,000 gallons of paste was released; no surface water was impacted as the viscous paste material did not flow far from the release point. While secondary containment was in place for the paste line (blue tube), the splice house itself did not have sufficient storage capacity to contain the paste when the pipeline failed. The Audit Team reviewed the corrective action taken by Pogo, which included removal of the splice house and construction of a secondary containment dike system below the blue tube, where the pipeline leaves secondary containment piping and enters the portal (Photo 8, Appendix C). The Audit Team reviewed the calculations supporting the size of the secondary containment, which are adequate, and Pogo has increased the frequency of line inspections. The corrective action appears sufficient to manage any future spills.
- On February 1, 2016, Pogo reported a release of approximately 3,500 gallons of paste at the #2 Paste line from the plant to the 2150 portal. The line broke into the containment

area, thus demonstrating adequate secondary containment, and the system worked as designed.

According to WMP Section 1.4.3, secondary containment of all hazardous substances must be impermeable to those stored hazardous substances. The Audit Team conducted visual inspection of secondary containment systems in the mill, filter/backfill plant, paste pipeline, and bulk storage tanks and also interviewed Pogo personnel regarding secondary containment systems and general construction. Based on visual inspection and review of the SPCC Plan, the Audit Team generally found that secondary containment surfaces were impermeable for hazardous substances being stored (see below comment). Materials are either plastic liner (HDPE or PVE) or concrete, but at several dike systems, Pogo personnel were uncertain of the material type of the impervious surface.

For most of the exterior secondary containment dikes, it is Pogo practice to fill in the secondary containment bottoms with gravel. In some cases, vegetation was observed growing in the gravel (Photo 7, Appendix C). The Audit Team's concerns with filling in the dikes with gravel are:

- It can be more difficult to remove accumulated stormwater
- It creates greater generated waste materials in the event of a spill (requires removing impacted gravel for disposal, versus just pumping out the spill liquid)
- The gravel takes up storage containment space
- It is not possible to visually observe the condition of the secondary containment impervious surface, as required in the SPCC Plan (e.g., liner tear).

If the dike bottoms are HDPE or concrete, then it is recommended Pogo remove gravel from within the dike bottoms (unless the gravel is used to support vehicle traffic). If the bottoms are PVC, then the gravel should be retained as cover to protect from UV light if roof structures are not installed.

Hazardous waste generated at the mine is temporarily stored at the Hazardous Waste Storage area, which is fenced, with locked gate and secondary containment. Similar to the bulk oil tank dikes, the secondary containment area was backfilled with gravel, thus the condition of the secondary containment impervious surface (reported to be HDPE) could not be inspected. Furthermore, a release of hazardous waste into the secondary containment would require the removal of the impacted gravel, creating additional hazardous waste. The Audit Team understands that Pogo has plans to replace this storage area with a new storage area that will be roofed and will have a visible secondary containment system.

According to WMP 1.4.4, Pogo must design all process piping and chemical mix tanks to allow for routine inspection for leaks. The Audit Team conducted visual inspection of process piping and chemical mix tanks in the mill, filter/backfill plant, paste pipeline, and bulk storage tanks and also interviewed Pogo personnel regarding piping and tanks. Process piping and mix tanks appeared to allow for routine visual inspection. In 2009 the auditors indicated that the Carbon-in-Pulp (CIP) storage tank, located outside the paste plant, and overhead process delivery system lines from the mill to the paste plant do not have adequate secondary containment. The 2016 Audit Team found that the CIP tank was replaced with a new double walled tank and that

the process lines have secondary containment as well as a containment dike and remote cameras that provided operators with visual view of the exterior area piping.

According to the WMP, mineralized waste rock must be disposed of in either the DSTF or underground. Waste rock segregation is described further in Section 5.3.1.7. During the mine tour, the Audit Team observed an unlined, above ground mineralized rock stockpile located under the Blue Line south of the Mill Bench, identified by Pogo personnel as graphitic ore. The PoO states in Section 5.3 that excess ore is stored in this temporary surface stockpile when necessary and this temporary stockpile has a high turnover rate to reduce the oxidation potential. Graphitic ore needs to be processed in a slightly different manner than typical ore, and therefore it is being stockpiled. Interviews with Chief Geologist and Environmental personnel indicated that there was no known timeframe for processing this ore or changing the storage location, and that it may be stockpiled in this location indefinitely. While it is unclear how long the existing ore stockpile has been at this unlined location, and neither the permit nor PoO specify acceptable above ground storage time limits, the personnel's impression that the material may be stored at the unlined location indefinitely appears in conflict with the PoO and the intent of the WMP. It is recommended that Pogo relocate this mineralized stockpile to the lined, above ground mineralized pad near the 1525 portal or consider lining the ore pad near the 1690 portal if stockpiling will be an ongoing practice. It is noted that according to ADNR as of its October 13, 2016 site inspection, the ore had been removed from that location.

5.1.4 Disposal Restrictions

As per Section 1.2.2 of the WMP, a specific list of materials may not be disposed into the DSTF, underground, or any ADEC Department-approved inert solids waste landfill, unless specifically approved by the Department in writing. Pogo currently does not have a solid waste landfill. Materials are either disposed of at the DSTF or underground, or are burned in an incinerator, or the burn pit, or stored in dumpsters and hauled offsite for disposal or recycling. The Audit Team inspected these disposal facilities, waste logs, and burn pit inspection logs and also interviewed the incinerator operator. The Audit Team did not observe any restricted materials being disposed of improperly, and Pogo personnel had ample knowledge regarding restricted waste handling. Table 4 describes how each of these restricted wastes are handled.

Table 4. Restricted Waste Disposal

WMP Section Number	WMP Restricted Wastes	Pogo Practice	Audit Team Information Resource
1.2.2.1	Other than interstitial waters entrained in the tailings or paste backfill tailings, treated or untreated process water with a constituent concentration exceeding WQS in 18 AAC 70	Other than interstitial water, no process waters are disposed at the DSTF. Process water is treated and recycled or managed through APDES program.	Interviews (Staley and Salzman)
1.2.2.2	Chemical containers with fewer than three rinses, and discarded, unused chemicals	Containers are rinsed and shipped offsite for recycling or disposal	No containers observed in DSTF; interviews (Staley and Salzman)
1.2.2.3	Uncombusted household waste	Shipped off site for disposal	Interviews (Staley and Salzman)
1.2.2.4	Laboratory waste other than wash waters, neutralized acids, and neutralized bases; however, disposal or recycling of refinery slag, fire assay crucibles, and cupels through the grinding and leaching circuit is permitted.	Laboratory waste for CN testing is stored in 1000 gallon underground storage tank and periodically pumped to the CN detoxification system and becomes part of the liquid stream. Laboratory wash water is sent to sanitary sewer. After use, assay crucibles and cupels are classified as hazardous waste and are temporarily stored at the hazardous waste storage area and are shipped off site for disposal. No lab waste goes to the DSTF.	Interviews (Staley and McClean)
1.2.2.5	Sewage solids that are untreated or have less than 10% solids by weight	No sewage solids are disposed at the DSTF. Solids are shipped offsite.	Interviews (Staley and Salzman)
1.2.2.6	Asbestos waste	Asbestos, if encountered, is shipped off site for disposal.	Interview (Salzman)
1.2.2.7	Hazardous waste, as defined by 40 CFR 261, and radioactive material, explosives, strong acids, etc.	Hazardous waste is stored in hazardous waste storage area and shipped off site for disposal in accordance with RCRA requirements.	Interview (Salzman)
1.2.2.8	Fuels, oil, transformers, paint, equipment, and packing material • Glycol and solvents • Batteries • CIP tailings, which have not been subjected to cyanide detoxification	No containers or evidence of chemicals, or solid waste observed in DSTF. Batteries, solvents, and related chemicals are stored in waste storage building and periodically shipped off site for disposal or recycling. CIP tailings are only sent to the DSTF when cyanide detoxification is verified through on-site testing.	Interview (Salzman)

5.1.5 Laboratories and Sample Analysis Procedures

According to WMP Section 1.3.2.1, each laboratory performing the weak acid dissociable (WAD) cyanide analyses must establish its own method detection limit (MDL) according to procedures set forth in 40 CFR Part 136. Pogo uses several contract laboratories for testing of environmental samples; this information needs to be updated in the latest version of the QAP. The Audit Team reviewed 2015 laboratory reports and Pogo *2015 Annual Activity and*

Monitoring Report and found that the contract laboratory conducted MDL studies for cyanide (and other constituents) following 40 CFR Part 136 procedures.

On-site Environmental Laboratory

Pogo maintains an on-site laboratory that is used for assay testing and also for routine testing of cyanide. The Audit Team conducted an assessment of the laboratory and the findings are presented in Appendix A. The on-site laboratory is responsible for running ore assays, WAD cyanide testing for the detoxification circuit, and also testing tailings for sulfides, arsenic, and metals. The laboratory also has atomic absorption spectrophotometer and x-ray fluorescence (XRF) for measuring metals and non-metals elements.

The laboratory management, operations, and waste management were found to be within general acceptable practices for environmental testing laboratories (see checklist in Appendix A). The laboratory, however, is lacking a comprehensive quality assurance plan that covers the basic elements of quality assurance and quality control for procedures, methods, and instruments. The laboratory operation could be addressed in the QAP or as a separate document. Because the laboratory provides data that are essential for the management of the DSTF and overall gold processing, it is recommended that a laboratory specific quality assurance plan be prepared and implemented and that the mine QAP be updated to reflect the on-site laboratory's testing activities, sample handling, and general quality assurance/quality control (QA/QC). Based on the Audit Team's inspection, the laboratory has implemented QA/QC procedures, but documentation is lacking. It is recommended that the laboratory develop a QAP that follows EPA guidance (e.g., EPA QA/G-5, Guidance for Quality Assurance Project Plans).

The laboratory manager provided the Audit Team with a copy of the Pogo WAD cyanide test method. The laboratory uses a colorimetric method with picric acid. While the method provides sufficient details for the analysts to run the test, no approved method citation is provided (the document is an internal written test method and it is unclear where the method came from; no literature and agency approved method citations are provided). Most WAD cyanide in liquids follows SM4500-CN G and is approved by the EPA for National Pollutant Discharge Elimination System (NPDES) compliance. While Pogo's testing is for DSTF management and in-house processing information, it is recommended that the method be tied to a reference. The Audit Team was able to identify a method that is similar to the method used by Pogo:

> Lamarino, P.F. 1989. The direct spectrophotometric determination of cyanide with picric acid reagent. JRGRL June 1 1989.

Because this is not an EPA, SM, or ASTM method, it is recommended that Pogo conduct a precision evaluation by periodically (e.g., twice per year) having a subsample analyzed by a contract laboratory that uses a standard method to compare results and ensure that the on-site laboratory results are comparable to more generally acceptable methods. Furthermore, it is recommended that Pogo consider additional quality control in processing cyanide samples, specifically:

- Verification of calibration curve by running an independent calibration check with each sample run
- Periodically run a matrix spike and matric spike blank to check for interferences
- Run a laboratory control standard (3rd party provided standard sample) to assess method accuracy.

The development rock segregation program relies on analysis of arsenic and sulfur of sludge (cuttings) samples generated by blasthole drilling or muck samples. The analysis is conducted in the on-site laboratory by wavelength dispersive XRF. The XRF equipment is a Rigaku Supermini 200, which is three years old. Decontamination of the XRF machine consists of dust removal through air blowing and vacuum every other month. Detection limits for arsenic and sulfur are sufficiently lower than the regulatory limits (20 mg/kg and 0.02% respectively). The XRF is operated by personnel who have been trained on the job. No training manual or formal program is available, but hands-on training is provided under the supervision of an experienced personnel. SOPs for XRF startup and detailed maintenance checks are used. Calibration is performed daily, and calibrations records were observed. Pellets resulting from the XRF analysis are collected in a 5-gallon bucket until full and disposed of in the DSTF and logged on the waste log. It is recommended that the QAP be updated to reflect the on-site laboratory's testing activities, sample handling, and laboratory quality control samples.

Sample Preparation Shack

The Audit Team inspected Pogo's environmental sample preparation shack and an audit checklist with comments is presented in Appendix B. The shack is used for storage of laboratory supplied sample containers, sample coolers, refrigerator for temporary storage of samples and reagents, freezer for ice, storage of reagents, storage and calibration of field meters (e.g., pH meter), storage of sample preservative chemicals (e.g., nitric acid), and storage of field sampling equipment and supplies. In general, the building was clean, with equipment and supplies well maintained. The following recommendations are made:

- Several SOPs were observed in the shack (pH meter use and conductivity meter), while other applicable SOPs where not available (e.g., SOPs for sample chain-of-custody). It is recommended that Pogo create a master SOP list for environmental sampling and tests. This list should be included in the QAP and also made available in the sample preparation shack. Furthermore, appropriate sampling, sample handling, and field equipment SOPs should be maintained in a binder at the shack and made available to field personnel.
- Ensure that reagent expiration dates are tracked; do not use past the expiration date.
- A temperature log should be maintained for the refrigerator if it is used for storage of permit compliance samples. Either a continuous reading thermometer that records data that can be downloaded to a computer or manually read temperature and record the results (usually a daily reading is sufficient). Part of the standard SOP for sample handling is temperature control and monitoring and recording temperature is a standard practice.

- An update to the QAP has been recommended, and the update should address activities associated with the sampling shack including handling of reagents, calibration of meters, and decontamination of field equipment.

5.2 Right-of-Way Agreements

5.2.1 Shaw Creek All-Season Access Road

Access to the mine is provided by a 49.5-mile long all-season gravel surface road that begins at the end of Shaw Creek Road. The access road begins at the Pogo Security Shed and traverses the Shaw Creek Hillside and then over the Shaw Creek / Goodpaster watershed divide to the mine site. The road has a top width of approximately 25 feet, although for about half of the length of the road (26.5 miles), the road width is narrowed by safety berms placed along the outer edge. The safety berms are in place to meet a Mine Safety and Health Administration Requirement. The road contains single lane bridges over perennial flowing streams. In addition to bridges, numerous cross drainage culverts convey surface water flow from smaller perennial flowing streams and seasonal drainages. The culverts vary in size based on the drainage size but generally range from 36 inches to 48 inches. No fish passage culverts are located on the road. Streams containing fish are crossed using a bridge.

The access road is divided by two separate right-of-way agreements. The first 23 miles of the access road is a public right-of-way to ANDR (ADL# 417066), and the remaining 26.5 miles are a private exclusive right-of-way to Teck-Pogo (ADL#416809). During the life of the mine, the first 23 miles of the road is restricted to Pogo Mine-related uses and approved commercial timber harvesting. After the mine closes, the first section of the access road will not be reclaimed and will remain open to public use. The remaining 26.5 miles beginning on the west side of Gilles Creek and ending at the mine site is restricted to Pogo Mine related uses and will be reclaimed upon closure of the mine. The right-of-way width is the disturbance footprint associated with the finished road (estimated at 100 feet).

Prior to entering onto the access road all travelers must check in at the Pogo Security Gate where they must watch a safety video and are issued necessary safety equipment such as safety vests, wheel chalks, and VHF radios. Travelers on the road are required to call in their mile marker position every 5 miles and at specific locations on the road as indicated by roadside signs. Additionally, opposing traffic also maintains radio communication and it is common practice for drivers to stop while opposing traffic passes. When buses are within 10 miles, opposing traffic is required to pull off the road until the bus passes their position. The buses have the highest priority right-of-way. They do not stop or pull off for any other traffic. These procedures are in place to protect the concentration of crew on board the buses. There are also signs along the road that indicate the distance to the next roadside pullout. Pullouts are used to allow opposing traffic to pass and for safety purposes if the road suddenly becomes impassable because of weather conditions. Most of the roadside pullout areas are former material sites, none of which were active at the time of the of site visit.

5.2.2 Electrical Transmission Line

Electrical power is provided to the mine by a 43-mile long 138kV transmission line. The right-of-way for the transmission line begins at approximately 3 miles from the start of the access road. The right-of-way is 125 feet wide and generally follows the access road, although the line does leave the road alignment for about 4.5 miles near Caribou Creek. A substation supports a tie in connection to the Golden Valley Electrical Association (GVEA) transmission line that parallels the Trans-Alaska Pipeline corridor.

The transmission line is carried by wooden H-Frame poles which are spaced approximately 1,000 feet apart. Vegetation in the right-of-way is cleared near ground level to keep the power lines clear of vegetation and to help protect it from wildfires. Vehicles and clearing equipment that operate within the right-of-way must prevent ground disturbances that will expose mineral soil to thermal degradation and erosion.

5.2.3 Operational Standards

The right-of-way agreements for the Shaw Creek Access Road and transmission line include operational standards which are summarized below:

- The road is to be maintained and operated on a year-round basis.
- Best management practices will be used to keep sediment from entering waterbodies.
- Reasonable precautions will be taken to prevent and suppress forest, brush, and grass fires.
- Survey monuments, witness corners, reference monuments, mining claim posts, bearing trees, and un-surveyed lease corner posts shall be protected from damage.
- The rights-of-way shall be maintained in a neat, clean, and safe condition, free from any solid waste, debris, or litter.
- No fuel or hazardous substances shall be stored in the rights-of-way.
- There shall be no interference with generally allowed uses of State lands adjacent to the rights-of-way.
- Vehicles and clearing equipment that operate within the right-of-way must prevent disturbances that will expose the mineral soil to thermal degradation and erosion.
- Teck-Pogo will comply with the stipulations of the Programmatic Agreement By and Among the EPA, the U.S. Army Corps of Engineers, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer (SHPO) Regarding the Pogo Gold Mine Project.

5.2.4 National Historic Preservation Act

The right-of-way agreements for the access road and transmission line require compliance with the National Historic Preservation Act including the stipulations of the Programmatic Agreement (PA) for the Pogo Gold Mine Project, dated August 12, 2003. The EPA is identified as the lead federal agency in the PA because the agency prepared the Environmental Impact Statement

and at the time issued a discharge permit under NPDES and in accordance with the Clean Water Act. The USACE is also identified as a federal permitting agency in the PA.

On October 31, 2012 ADEC assumed full authority to administer the wastewater and discharge permitting for the State of Alaska. As a result, EPA no longer maintains a discharge permit that is issued to the Pogo Gold Mine Project and as such, the USACE is now the lead federal agency for the project and the associated PA. Additionally, the PA is an agreement between the *Teck-Pogo* and Signatories of the PA. The current owner of the Pogo Mine is Sumitomo Metal Mining Pogo LLC and is not identified in the PA. Because of these discrepancies, coordination between the PA's Signatories and Sumitomo should occur to determine if the PA needs be updated to reflect the current owner of the mine (i.e., Sumitomo) and the current lead federal agency (i.e., USACE).

The PA requires a reasonable and good faith effort to identify historic properties within each project activity or component's Area of Potential Effects, which includes the access road and utility corridor. This includes identification efforts such as background research, consultation, ethnographic research, oral history interviews, field surveys, probabilistic sampling, subsurface testing, and other tasks. In accordance with the PA, a qualified archeologist has been contracted by Pogo to conduct cultural resource field surveys within the road and transmission line rights-of-way. The archeological contractor also develops annual reports which are provided to the ADNR SHPO.

In the early spring 2014, vegetation clearing efforts within the transmission line occurred before a survey for archeological resources could occur, which resulted in the disturbance of archaeological sites. As a result of this occurrence and to protect sensitive areas on land managed by Pogo, signs identifying "Environmentally Sensitive Areas" have been placed at several locations within the right-of-way to prevent the future disturbance of wetlands and archaeological sites (see Appendix C for photographs).

5.2.5 Assessment Results

The entire Shaw Creek Access Road was driven by the Audit Team and the Pogo Environmental Manager. Inspections occurred at all five bridges, a representative number of actively flowing culverts and "dry" cross drainage culverts, roadside material sites, and at locations along the road corridor where erosion and sedimentation was evident. Inspection results are provided in the following subsections and photographs are provided in Appendix C.

5.2.5.1 GENERAL OBSERVATIONS

Overall, the Shaw Creek Access Road is in good condition and is routinely maintained to provide safe year-round access to the mine. The driving surface of the road is well maintained with adequate gravel thickness and good drainage and there is little to no wash-boarding, corrugating, or pot-holing. At the time of the inspection, a water truck was on the road performing dust control and a road-grader and roller were conducting routine preventative maintenance.

There is evidence of erosion and sedimentation occurring on the shoulder of the road in areas with highly erodible soils (i.e., sand) and in cut-fill transition areas located on a grade. Bridge surfaces were in good shape with no obvious signs of excessive wear or distress. However,

some bridges had obvious signs of erosion near the abutments and in one instance at Shaw Creek the scour protection for one of the bridge abutments was completely washed out and in need of repair.

Cross drainage culverts were in good condition. There were no indications of corrosion, overtopping, scour, erosion or other damage at culvert locations observed during the time of the inspection.

5.2.5.2 BRIDGES

Bridges are located at the Goodpaster River, Shaw Creek, Gilles Creek, Caribou Creek, and West Keystone Creek. All of the bridges are single lane and, with the exception of the Goodpaster River Bridge, all other bridges provide a clear span over flowing waters. The sections below provide a description of each bridge. ADF&G issued Fish Habitat Permits (FHP) for the construction of each bridge. The FHPs continue to cover bridge maintenance activities. The FHP number for each bridge is provided below. Photographs showing all of the bridges are located in Appendix C.

- **Goodpaster River Bridge** – The Goodpaster River Bridge (FHP No. FH03-III-0331) is the longest bridge on the access road (390 feet) and is supported by six bridge spans and three in-water piers. The driving surface of the bridge is concrete and was in good condition at the time of the inspection. Deck drains were clear and there were no obvious signs of distress (i.e., cracking or spalling). Some large woody debris has accumulated on each of the three bridge piers but at the time of inspection was not causing water flow problems beneath the bridge. Scour protection at both abutments was in good condition with no signs of scour and there was mature vegetation between the toe of the scour protection and the river bank.

- **Shaw Creek Bridge** – The Shaw Creek Bridge (FHP No. FH03-III-0335) is a wood decked clear span bridge. The driving surface of the bridge was in fair condition and bridge rails were in good condition at the time of the inspection. A small amount of sedimentation has been washing off of the road and depositing on the flanks of the bridge abutments, though none appeared to be reaching Shaw Creek. The scour protection on the west (i.e., downstream right) bridge abutment was heavily degraded and has been almost completely washed away. The geotextile material at the abutment was exposed across the face. Scour protection at the east abutment was also impacted and had exposed geotextile and obvious signs of erosion, though it was not as degraded. Scour protection at the Shaw Creek Bridge abutments is recommended for repair as soon as possible to avoid potentially dangerous degradation of the bridge abutments and road grade during the next major flood event. It is noted that according to ADFG Division of Habitat Trip Report from September 20, 2016, the riprap had been repaired under the Shaw Creek Bridge.

- **Gilles Creek Bridge -** The Gilles Creek Bridge (FHP No. FH03-III-0332) is a wood decked clear span bridge. The driving surface of the bridge was in fair condition and bridge rails were in good condition at the time of the inspection. A minor amount of scour was occurring at the stream bank adjacent to both bridge abutments, but it has not reached the bridge abutments. There was minimal scour protection under the Gilles Creek Bridge, and is the Audit Team observed no immediate need for repairs. However, consideration should be given to proactively preventing additional erosion at the bridge abutments.

  The western approach to the Gilles Creek Bridge is also experiencing erosion on the shoulder of the road. Shoulder erosion is being caused by Jersey Barriers here and at other locations throughout the road corridor. The barriers direct runoff along the edge of the road to low spots, which results in erosion. This type of erosion could be addressed at problem locations using best management practices for stormwater erosion and sediment control.

  At the time of the inspection, water was being withdrawn from Gilles Creek for dust control on the road. The intake was screened and water was being pumped into a water truck.

- **Caribou Creek** - The Caribou Creek Bridge (FHP No. FH03-III-0333) is a wood decked clear span bridge. The driving surface of the bridge was in fair condition and bridge rails were in good condition at the time of the inspection. Erosion at the bridge abutments was minimal, with some minor amounts of scour and erosion occurring at the stream bank under the bridge. No immediate concerns were observed by the Audit Team at the Caribou Creek Bridge.

  Water withdraw is occurring at Caribou Creek, as indicated by the presence of a pump located near the stream bank at the bridge. However, no active water withdraws were occurring at the time of the inspection.

- **West Keystone Creek Bridge** - The West Keystone Creek Bridge (FHP No. FH03-III-0334) is a wood decked clear span bridge. The driving surface of the bridge was in fair condition and bridge rails were in good condition at the time of the inspection. Erosion at the west bridge abutment was minimal. Some scour and erosion is occurring at the east abutment though it was not clear if rip-rap simply sloughed off the face of abutment from a slope failure or was washed off by a high flow event. However, the east side abutment had a minimal amount of rip-rap scour protection. The stream bank was stable had an abundance of vegetation. The Audit Team observed no immediate need for repairs. However, consideration should be given to proactively preventing additional erosion at the bridge abutments.

5.2.5.3 CULVERTS

Many locations throughout the road corridor contain cross drainage culverts. A majority of the culverts were dry at the time of the inspection. Photographs of drainage culverts visited during the audit are included in Appendix C. The only culvert observed with active flow was at Wolverine Creek and water flow was low at the time of the inspection. All of the culverts were in good condition with no obvious signs of corrosion, overtopping, or scour.

5.2.5.4 MATERIAL SITES

Roadside material sites were inspected, none of which were active at the time of the inspection and no issues were observed.

5.2.5.5 ROAD BANK EROSION AND SEDIMENTION

The Audit Team observed erosion and sedimentation at several localized areas within the road corridor. The soils along the road corridor are largely composed of sand, which is highly erodible. Areas where the road transitions from a cut to fill are experiencing the greatest levels of erosion and sedimentation. Additionally, barriers placed along the road are also contributing to localized erosion along the edge of the driving surface. The barriers cause water to accumulate alongside of the road surface, which then runs to a low spot causing erosion at the road surface and fill embankment, as well as sedimentation at the base of the road embankment. At least one location, at Gold Hub Creek, heavy erosion of the road bank that needs immediate attention was observed, see photos in Appendix C.

Because most of the problems are localized and relatively small in scale, best management practices for runoff, erosion, and sediment control could be employed to address these conditions.

5.2.5.6 RIGHT-OF-WAY EASEMENTS

All 23 miles of the access road are supposed to be a public right-of-way to ANDR (ADL# 417066). During an interview, ADNR identified a concern that a section of the access road was constructed on two private easements rather than on State-owned land. According to ADNR, there are two private easement agreements, one between Teck-Pogo and Andrew Fowler and one between Teck-Pogo and Lisa Fowler. The agreements are good for 15 years beginning on December 31, 2003 (ending on December 31, 2018). The easement agreements will need to be extended if the access to the mine is needed after December 31, 2018. Furthermore, when the roadway easements do expire, ADNR is concerned that public access to the access road could be prevented by the private landowners (see Figure 1).

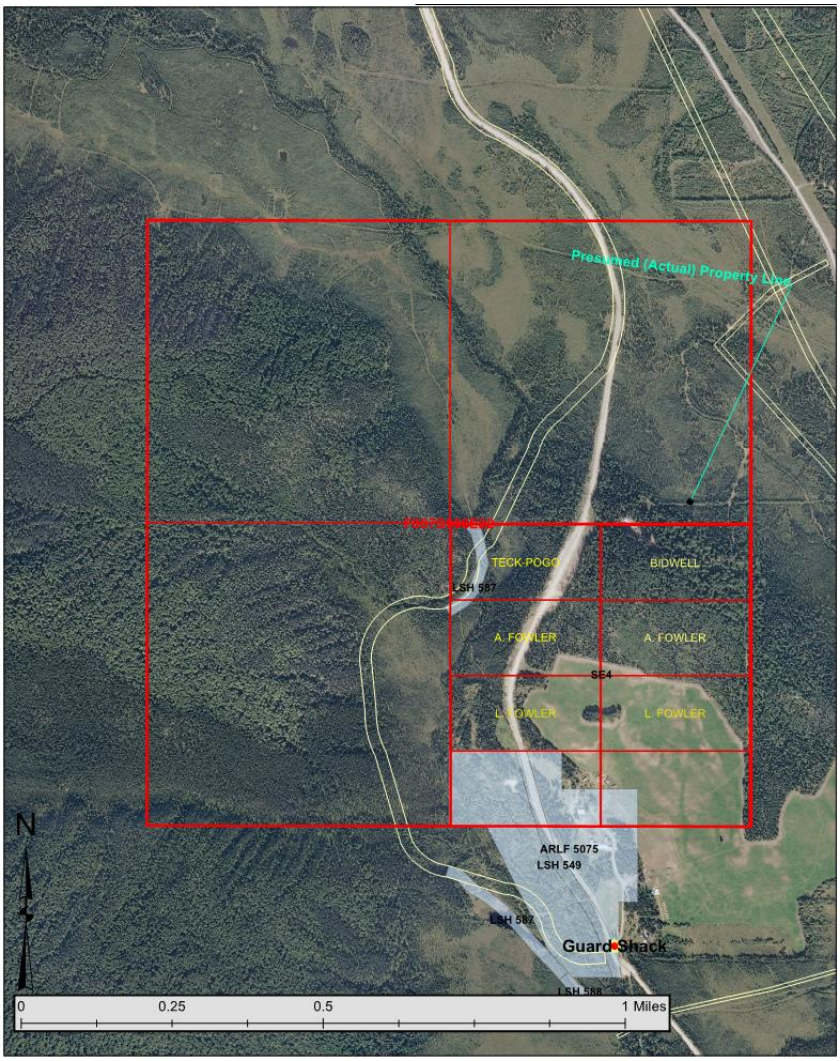

Figure 1. Map Showing Private Easements (map provided by ADNR)

5.3 Plan of Operations Approval

This section addresses the POA, and primarily focuses review on the PoO, which generally consists of the PoO and associated appendices. The POA includes the following project documentation:

- PoO and PoO Appendices:
    - Monitoring Plan,
    - Quality Assurance Plan,
    - Reclamation and Closure Plan/Financial Assurance,
    - DSTF Construction and Maintenance Plan, and
    - RTP Operating and Maintenance Plan.

With the exception of where references to the WMP are noted, references to the documents reviewed as part of the POA are considered to be a reference to the PoO.

Mine operations continue to be performed consistent with the PoO and associated appendices. Dumps, stockpiles, and haul roads are maintained in a stable configuration that minimizes the potential for erosion. Placement of tailings on the DSTF appears to be in compliance with permit conditions. The diversion ditch liner appears to be working as intended to capture and divert water.

5.3.1 Monitoring Program

The most recent QAP available for review is dated November 2013. As discussed in other sections of this Audit Report, the QAP requires an update to reflect current practices. While some required QAP revisions are identified within the document, a full list of QAP revision recommendations is provided in Appendix D.

The QAP Section 2.5.3 on Data Assessment and Reporting states that samples that are not received by the contract laboratory within the allowable holding time or when they are improperly preserved are considered invalid data, and that invalid data are flagged and/or removed from the active databases. According to the Pogo Environmental Coordinator that serves as the Quality Assurance Officer, Pogo maintains laboratory data flags as they come into the electronic database system from the laboratory; however the data is not removed from the data set as invalid. In the quarterly and annual reporting, no data flags were observed within the historic data tables provided. It is recommended that the data flags be included in reporting and the QAP be revised to reflect that such data will not be considered invalid.

The QAP Section 2.5.1 requires that contract laboratory performance periodically be monitored by auditing the laboratory, submitting split samples, reference samples, and blind audit samples to multiple laboratories. This was last completed in 2012 when split samples were submitted to Analytica and Energy laboratories and the results were compared. It is recommended that the QAP be revised to incorporate specific timeframes for the audits, and that an audit be completed of the contract labs currently being used.

5.3.1.1 GEOTECHNICAL

Based on a review of the design documents, as-builts, OMS Manual (which includes the emergency action plan), last available PSI, and a visual inspection of the facility, the RTP Dam and the DSTF area appear to be in general compliance with the related permits.

According to the PoO and DSTF Construction and Maintenance Plan, geotechnical monitoring is conducted at the shell area to confirm dry stack compaction. This monitoring includes geotechnical testing such as Standard Proctor Test, particle size distribution and Atterberg Limits, and in-situ density and moisture content using a Troxler nuclear gauge. The Audit Team reviewed the 2012 Annual Activity and Monitoring Report and found Pogo constructed and completed shells 2 and 3 in 2012. The Audit Team reviewed the geotechnical testing completed in 2012 on Shells 2 and 3 in compliance with the PoO and Construction and Maintenance Plan. Shell 1, which is still under construction, is rockfill only and therefore the geotechnical tests are not applicable. For rockfill Shell 1, the DSTF Construction and Maintenance Plan requires compaction in 3-foot lifts with three passes by a D7 Dozer. Pogo was not performing such

activity during the Audit Team's site visit. In an interview, Mr. Charlie Cobb, ADNR Dam Safety Engineer, suggested that after observing construction of Shell 1 of the DSTF, his conclusion was that Pogo needs to put a main focus on the compaction close to the downstream face.

5.3.1.2 GEOCHEMICAL

Dry Stack Tailings

The QAP describes geochemical testing required to detect trends in the tailings or rock that indicate acid producing potential from the DSTF. The QAP states that samples will be collected monthly, composited quarterly by the contract laboratory, and analyzed to represent the DSTF active area of mineralized development rock placement (PC002). The Audit Team reviewed the Pogo Mineralized Waste Rock (Red Rock) PC002 Geochemistry Sample Collection SOP, which covers protocol for collection of mineralized waste rock samples. The Audit Team reviewed analytical reports and confirmed that samples are submitted to ALS Chemex on a quarterly basis for compositing, acid base accounting (ABA), mercury, and metals analysis. While sampling was not observed, the SOP is compliant with the Monitoring Plan and QAP. The mineralized rock analyses are meeting the target range of greater than 1.4 for the Neutralization Potential/Acid Potential ratio.

The QAP states that the monthly grab sample of flotation tailing solids (PC003-solids) is to be collected by mill personnel from the filter feed underflow. The Audit Team reviewed the Pogo Floatation Tailings (PC003) Sample Collection SOP, which covers protocol for collection of solid tailings samples. Pogo also maintains a Task Training Card to document that samplers have been trained by the Environmental Department to safely and correctly collect the PC003-solids geochemistry samples. The Audit Team reviewed analytical reports and confirmed that samples are submitted to ALS Chemex on a quarterly basis for ABA, mercury, and metals analysis in compliance with the QAP and Monitoring Plan. While sampling was not observed, the SOP is compliant with the Monitoring Plan and QAP, and the Audit Team reviewed the log sheet of each grab sample. The floatation tailings material analyses are meeting the target range of greater than 1.4 for the Neutralization Potential/Acid Potential ratio.

Table 11.3 in the QAP provides hold times for analyses, and the hold time listed for ABA analysis is 28 days. There is typically no holding time for ABA analysis; therefore, this should be updated in the QAP.

Flotation Tailings Interstitial Water

The flotation tailings interstitial water sampling requirement is described in the Monitoring Plan and QAP. The Audit Team reviewed the Pogo Floatation Tailings (PC003) Sample Collection SOP, which covers sampling the floatation tailing interstitial water (PC003). Pogo also maintains a Task Training Card to document that samplers have been trained by the Environmental Department personnel to safely and correctly collect the PC003 interstitial water geochemistry samples. The Audit Team reviewed analytical reports to confirm that interstitial water samples are being sent to Energy Lab for analysis of metals and additional constituents as listed in Table 4.4 in the Monitoring Plan in compliance with the QAP and Monitoring Plan. The tailings

interstitial water analyses are meeting the operating target range of the constituents analyzed (Table 4.4 in the Monitoring Plan).

The program is conducted in accordance with the sampling and analytical specifications presented in the QAP. The required QA/QC samples consist of one annual field duplicate and one annual field blank each for the tailings and development rock. Records indicate that the annual tailings duplicates have been collected,

5.3.1.3 GROUNDWATER

The groundwater monitoring program was evaluated according to the requirements described in the WMP, QAP, and Monitoring Plan. The Audit Team reviewed the monitoring plans, the monitoring data, quarterly and annual monitoring reports, and the QAP and also interviewed the Pogo Environmental Coordinator. Groundwater monitoring wells were observed at all locations, except the location of MW99-216.

RTP Monitoring

The permit states that groundwater monitoring for the RTP (MW12-500, MW12-501, and MW12-502) must not exceed the upper tolerance limits (also referred to as trigger values) provided in the WMP (Table 1). In addition, the permit requires adherence to all WQS (18 AAC 70 Alaska Water Quality Standards). The reporting requirements in the permit state that the graphing must indicate trends as well as the margin of compliance with limits, and specifies that graphs must include the applicable permit limit or WQS. Annual reporting by Pogo includes:

- a brief narrative
- graphs showing concentrations over time (the 2015 annual report shows data going back to 2011)
- graphs displaying WQS and graphs displaying trigger permit limits
- the historical data in table format (the 2015 annual report provides data from 2011-2015)

Pogo reporting includes the required reporting components listed in the permit. Chloride, sodium, and nitrate concentrations are consistently above the permit trigger limits in each of the wells downgradient of the RTP. The narrative of the annual report calls out these exceedances.

The QAP description of RTP well monitoring states that Pogo will monitor for: an exceedance of a water quality standard and the permit trigger limits; a statistically significant increase (SSI) in concentration above the WQS; and an SSI above background in water quality. However, annual reports from Pogo do not address sampled water quality compared to background water quality. The background values are not provided within the report, nor is there comparison or discussion of a statistical analysis comparing compliance monitoring data against WQS or against background water quality. The Pogo Environmental Team stated that graphs were considered to be statistical comparisons.

Therefore, Pogo is compliant with the WMP monitoring requirements, but is not following the QAP. It is recommended that Pogo either initiate inclusion of the background values in the reporting tables and graphs, and where exceedances in the background or WQS are observed,

complete statistical analysis to monitor for a SSI, or revise the QAP to be consistent with the current practice by removing the SSI evaluations.

DSTF and Ore Zone Monitoring

The permit states that groundwater monitoring for the ore zone and DSTF (MW04-213, MW11-216, MW11-001A, and MW11-001B) must not demonstrate an SSI in constituent concentrations above background or exceed WQS. The reporting requirements in the permit state that the graphing must indicate trends as well as the margin of compliance with limits, and specifies that graphs must include the applicable permit limit or WQS. Annual reporting by Pogo includes:

- a brief narrative
- graphs showing concentrations over time (the 2015 annual report shows data going back to 2011)
- the WQS displayed on the graph
- the historical data in table format (the 2015 annual report provides data from 2011-2015)

Pogo reporting includes the required reporting components (WMP Section 1.7) listed in the permit. However, the reporting does not address analysis of the data compared to background water quality, which is a permit limitation. In communication with ADEC, the intent for the water quality limit for SSI over background is for cases where groundwater may naturally exceed WQS. For example, at MW04-213, an ore zone monitoring well, there are concentrations of arsenic that are consistently above the WQS, which is noted in the narrative and shown graphically. Most sampling dates appear consistent with the background arsenic concentrations, though the background values are not provided within the report. In November 2015, the arsenic concentration for this ore zone well was above both the WQS and baseline mean and maximum values; however, there is no comparison or discussion of an SSI analysis with background water quality. It is unclear if the concentration of arsenic is an SSI above background since it was not analyzed in the reporting. Similarly, there are a handful of instances over the last five years where constituents exceed WQS and no SSI evaluation above background values has been completed. These include manganese, total dissolved solids, sulfate, copper, and cadmium at ore zone wells, and copper and nitrate at DSTF wells. However, in all instances, there are no consistent trends of concentrations over WQS and background that illustrate a groundwater quality concern. The Pogo Environmental Team stated that graphs were considered to be statistical comparisons; however, background values are not provided on the graphs.

The QAP description of ore zone and DSTF well monitoring states that Pogo will monitor trends in groundwater quality, with no mention of comparison against background water quality or of statistical analysis for SSI.

Therefore, it is recommended that Pogo initiate inclusion of the background values in the reporting tables and graphs, and where exceedances in the WQS are observed, complete statistical analysis to assess SSI over background per the permit requirement for DSTF and ore zone monitoring wells. It is also recommended that the QAP be revised to reflect analysis

necessary to comply with the permit, including specific statistical tests and methods that will be completed to evaluate an SSI.

Groundwater Sampling Procedure

The QAP states that groundwater samples will be collected after three bore volumes have been purged from the wells and temperature, conductivity, and pH parameters have stabilized. The QAP does not define the percent difference value for stabilization. The Audit Team reviewed the groundwater sampling field data sheets. An example form is provided as Attachment 1. The field data sheet has a table to assist the samplers in calculating the purge volume following the standard procedure for purging three bore volumes from the well prior to sample collection. The table in the field data sheet provides a "volume constant" that the samplers multiply to the feet of water in the well bore to calculate one bore volume. The field data sheet provides an erroneous volume constant (1.35) for the 6-inch diameter wells (should be 1.47). Samplers using the embedded table values results in purging less volume than three bore volumes (on the attached field data sheet the team purged 22 gallons less than a full three bore volumes).

It is recommended that a percent difference for the field water quality parameter stabilization during purging be defined in the QAP (e.g., stabilized when values between readings differ less than 5 percent).

In reviewing field data sheets and water quality data from groundwater sampling similar to the one in Attachment 1, the Audit Team observed dissolved oxygen concentrations that are relatively high for groundwater (8-12 mg/L). Dissolved oxygen in groundwater is typically low (<4 mg/L). It was recommended to Pogo that the dissolved oxygen probe may be recording in error and data may potentially need to be flagged if they find that the probe was inaccurate.

In the Appendix G of the annual reporting (historic data in table format), no data are provided in the water elevation column for MW11 (MW11-001A and MW11-001B), MW200 (MW-04-213 and MW11-216), and MW12-500, MW12-501, MW12-502 wells. Partial depth-to-water data are provided for some wells, and other cells are left blank, making it unclear if the well was checked for water level.

It is recommended that improvements be made to the water level data recording and how water level and other conditions (e.g., freezing) may be impacting the water collection or water level data. The report narrative for the 2015 annual report for MW11-001A states that the well was not sampled the whole year because no water was present. For MW11-001A in April 2015, the water level was shown to be 40 feet and the water elevation is provided in Appendix G of the annual report. Monitoring well MW11-001A has two rows for the 2015 year in the Appendix G annual report data set—one row for April (described above with no sample collected), and a row for November that states "frozen". This well is sampled quarterly; therefore it would be expected that there would be two additional rows with notation for why samples were not collected (e.g., frozen conditions, dry well).

Quality control sample frequency is described in the QAP in Table 17.3. The Audit Team reviewed the frequency of quality control sample collection and it follows the QAP.

5.3.1.4 WATER BALANCE

Pogo fluid management was evaluated according to the requirements described in Section 1.5.2 and 1.6.2.4 of the WMP, PoO Section 8.0, and the QAP Section 10.0. The Audit Team reviewed the QAP Fluid Management Plan, a Water Balance data sheet provided by Pogo, and annual monitoring reports. The Audit Team also observed the seepage collection station at the RTP, flow meters, the flumes, piezometers, and one of the climate stations.

The flow rate from the DSTF flow-through drain is monitored at Liese Creek Flume #1 upstream of the RTP, and Liese Creek flow downstream of the RTP seepage collection wells is monitored at Liese Creek Flume #2. Pressure transducers are installed during summer season to monitor the water level at these flumes. The RTP Operation and Maintenance Manual states the transducers will record the water level hourly; and according to Pogo staff measurement frequency is set to every six hours. The data are downloaded from the pressure transducer by Environmental Staff “periodically” according to the QAP and “at least monthly” according to the Monitoring Plan. The QAP does not address the protocol for data management from the transducers. It is recommended that the data measurement and recording frequency, as well as data download frequency be edited for consistency between the QAP, Monitoring Plan, and RTP Operation and Maintenance Manual and that the QAP be revised to include pressure transducer data management, or that reference to a separate SOP be included. The QAP (or the SOP) should describe the data collection programing of the data logger; the equipment, frequency, and process for data download, where data will be stored and how they will be managed, how data drift will be reviewed and corrected, and data correction for barometric pressure.

Fluid management appears to be consistent with the Fluid Management Plan, and compliant with the flow monitoring required in the WMP. The Water Balance sheet indicated that there was significant capacity in the RTP and there appeared to be no risk of overtopping.

5.3.1.5 BIOLOGICAL VISUAL SURVEY

Based on Waste Management Permit item 1.6.2.5, Pogo is to conduct a biological visual survey program to monitor wildlife interaction with the surface waste disposal facilities. Pogo visual monitoring methods are described in the Monitoring Plan and the QAP. Personnel currently only record and report fatalities on the waste disposal facilities. The permit does not specify “wildlife interaction” (e.g., fatality on a facility versus sighting on a facility). There are no permit requirements to record the observations or report the data to the ADEC and ADNR.

The QAP states that operations personnel will note “wildlife sightings and any unusual activities or conditions”. In practice, only wildlife fatalities are being tracked at the DSTF and RTP, not sightings. The Monitoring Plan accurately describes that personnel are recording wildlife fatalities that are observed. It is recommended that the QAP be revised to reflect the current practice of recording wildlife fatalities (Section 9.1), and be revised to reflect that the WMP does not require reporting (Section 9.2).

Pogo is complying with the requirement to monitor wildlife interaction. The intent of the WMP monitoring requirement is unclear with use of the term “interaction”. It is recommended that the

intent and the specific permittee obligation be more clearly defined in the revised permit language.

5.3.1.6 CIP PASTE

According to WMP limitations, CIP tailings shall be subject to cyanide detoxification prior to disposal as paste backfill. After cyanide destruction, the CIP tailings are stored in the CIP tank prior to being mixed with cement and used as backfill. Pogo's Mine Monitoring Plan requires grab samples at station PC001 (CIP Stock Tank), which is located directly after the cyanide destruction circuit. Pogo collects samples frequently—one per shift or two per day. Samples are given to the on-site laboratory for WAD cyanide analysis. The WMP requires that samples contain less than 10 mg/L of WAD cyanide as a monthly average and no samples may contain more than 20 mg/L of WAD cyanide. The Audit Team reviewed the sampling process and data with environmental staff, and concluded they are compliant with the WMP limitations and the Monitoring Plan and QAP.

5.3.1.7 ROCK SEGREGATION AND TRACKING

The development rock segregation program is described in the QAP Section 13.0 and the Monitoring Plan Section 4.1.1. The WMP Section 1.2.1 addresses the required development rock segregation based on arsenic and sulfur content to ensure that mineralized development rock is disposed of in a manner that prevents potential environmental impacts.

The Audit Team interviewed the Chief Geologist and assay laboratory manager, toured the on-site assay laboratory, reviewed the lab reporting, and reviewed stockpile signage in the above ground muck bays at the portals. For every advancement at the mine, each different rock material encountered is sampled with heading number and date and sent to the on-site assay laboratory for XRF Spectrometer analysis. Laboratory results are returned within days, with specific, clearly reported values for arsenic and percent sulfur. All laboratory QA/QC is conducted in accordance with the QAP. At the time of the inspection, all surface piles were flagged, whether analysis had come back from the laboratory or was still awaiting results. The final disposition of mineralized development rock on the DSTF was in the center of the DSTF. Non-mineralized development rock was being disposed of around the exterior shell of the DSTF or for use as berms or road maintenance, or for similar use around the mine site. In 2015, 355 rounds blasted (approximately 20 percent) were not sampled due to operational challenges. Any rock that is not analyzed is considered "red" mineralized development rock and were disposed on internally in the DSTF.

The program is conducted in accordance with the sampling, analytical, labeling, and disposal specifications presented in the WMP and QAP.

5.3.2 Closure and Post-Closure Financial Responsibility

5.3.2.1 RECLAMATION AND CLOSURE ACTIVITIES

The Pogo Mine reclamation and closure requirements fall under the jurisdiction of ADNR/ADEC and USACE. The current plan is titled *2012 Pogo Reclamation and Closure Plan* and includes five phases of reclamation (Table 5).

Table 5. Reclamation Phases and Activities

Phase	Description	Activities	Audit Team Observations
I	Reclamation of Construction Disturbance	This phase includes regrading and revegetating areas disturbed during construction and advanced exploration.	1525 Air strip regraded and reclamation of natural areas. All other disturbances moved to Phase II.
II	Reclamation Concurrent with Mining	All of the stockpiled mineralized development rock and a portion of the non-mineralized development rock will be reclaimed during this phase.	Disturbed areas near Mill building and along roads have naturally re-vegetated without direct seeding. The majority of reclamation activities to date at the mine site have been associated with former drill pads and drill access roads. The Audit Team visited reclamation sites associated with former drill pads and access roads. In general, reclamation methods appear to be appropriate for site conditions and erosion and sediment control measures appeared adequate at the observed locations. The Audit Team observed reclamation and re-vegetation in progress and re-vegetation; sediment and erosion control measures appeared to be adequate. The Audit Team also visited vegetation test plots that are summarized in annual monitoring reports. The Upper Exploration Camp has not yet been reclaimed.
III	Final Reclamation & Closure of the Mine Site	This phase will consist of the major closure activities required to decommission the mine and place the site in a stable condition. This will involve removal of all facilities and structures not needed to support future post-closure reclamation activities, placement of a vegetative cover on the DSTF, reclamation of the balance of the non-mineralized development rock stockpiles, sealing the mine portals and vent raises, and reclamation of the airstrip and surrounding area. A temporary closure camp will be set up at the 1525 portal area to support Phase III, IV, and V activities.	

Phase	Description	Activities	Audit Team Observations
IV	Post-Closure Reclamation	This phase will begin when site monitoring indicates that reclamation and revegetation has stabilized the DSTF sufficiently so that major additional earthworks will not be required. At this point, it is anticipated that the vegetative cover on the DSTF will be taking hold, (Phase III). Water quality will be monitored in the surface water and groundwater in Liese Creek downstream of the DSTF to determine whether operation of the RTP and water treatment plant should continue. The RTP and water treatment plant will remain in place during Phase IV to treat the dry-stack runoff and seepage. When agency review of the site information indicates it is appropriate to do so, the RTP water will be treated and discharged, and the RTP will be breached and reclaimed. Sediments within the RTP will be capped in place, in the bottom of RTP reservoir, and protected from erosion. It is anticipated Phase IV will last 10 years.	
V	Post-Closure Monitoring	Phase V will involve post-closure monitoring of groundwater, storm water, and surface water. This is estimated to continue for a 20-year period.	

5.3.2.2 Financial Responsibility

The Audit Team reviewed the adequacy of Pogo's closure and post-closure financial responsibility. The last ADNR-approved reclamation bond costs estimate was completed in 2012. The Audit Team found that Pogo updated its reclamation bond cost estimate in 2014 by converting the cost to a Standardized Reclamation Cost Estimator (SRCE) model (SRK 2014). This converted estimate was submitted to the ADNR but no additional records were found regarding the agency's review or approval of the SRCE. The Audit Team contacted Stephanie Lovell of ADNR to request clarification on financial responsibility version under the scope of the audit. Ms. Lovell responded via email that

> *"The scope of the audit requests the audit focus on the adequacy of the financial assurance under the current authorizations, which for ADNR Mining is the approved Plan of Operations (F20129500) dated February 7, 2012. This original approval for the current permit cycle has been amended since then. Most of the amendments were considered to be minor changes to the POO and did not necessitate a complete review of the financial assurance, but rather that the costs of the changed aspects be included in the updated cost estimate for the next permit cycle. However, Revision 2 (approved on April 13, 2012) which gave approval for the expansion of the dry stack facility, did require an update of costs. At that time an updated financial assurance was provided (Excel file titled Pogo_Mine_RCE_2012_Cost_Model_Rev_2_Final_20120320"), reviewed and vetted by the agencies (ADNR and ADEC). The financial assurance was increased to $57,104,000, and a new bond was put in place. This is the current amount of the Pogo financial assurance under authorization F20129500 for which to focus on.*
>
> *Pogo took the liberty to bring SRK on board to assist them in converting their cost estimate into the SRCE model. It was understood the intent was to start the conversion early to allow ample time for completion before the current authorization (effective through February 6, 2017) expires. Pogo was interested in receiving feedback from the state on the conversion of the "traditional" cost estimate format into the new SRCE format. ADNR Mining did an informal review of the cost estimate format conversion and found it to be detailed and well done. As the SRCE was not formally submitted to the state agencies for review, ADNR Mining suggests you inquire with your client as to whether they would like you to provide an independent review of the SRCE. If Pogo would like you to do so, ADNR Mining has no objection."*

Proof of Financial Responsibility

According to WMP Section 1.11.1, Pogo is required to provide ADNR with proof of financial responsibility for closure of the facility and post closure monitoring. ADNR accepted Pogo's proof of financial responsibly (bond signed by responsible party and State on July 12, 2012). Table 6 summarizes the current financial assurance.

Table 6. Mining Reclamation Financial Assurance for Pogo Mine (July 12, 2012)

Plan Approval, Permit, ADL, Cert.#	USD Amount	Description
ADL 416809, ADL 417066, ADL 416817	$4,810,000.00	Road and transmission line rights-of-way
Plan of Operations Approval and Amendment (F20129500), Waste Management Permit (2011DB0012), Certificate of Approval to Operate a Dam FY2011-14-AK00304	$52,294,000.00	Pogo Mine Reclamation and Closure Plan, Dam Authorization, and Waste Disposal Permit
Total	$57,104,000.00	

Therefore, the current financial assurance under authorization F20129500 is $57,104,000, which represents calculations made in 2012. The next renewal and update of bond costs will be in early 2017.

2012 Financial Assurance (cost estimating)

The Audit Team reviewed the approved 2012 financial assurance estimates (Pogo Mine RCE 2012 Cost Model Rev 2 Final 20120320.xls file). Overall, the cost estimate approach appears to be complete and consistent with mine activities reviewed during the audit and is consistent with ADNR and ADEC review of the 2012 financial assurance estimates.

While not used as this time for determining costs for reclamation, HDR also reviewed the following documents as part of evaluating reclamation costs relating to current and future mining activities:

- Pogo's SRCE model and report (conducted by SRK, June 2014)
- *Draft Mine Closure and Reclamation Cost Estimation Guidelines* dated December 2013 (ADNR/ADEC, 2013) (not yet approved by agencies)
- *Mine Closure and Reclamation Cost Estimation Guidelines: Indirect Costs Categories (April 2015)* (DOWL, 2015) (not yet approved by agencies)

Pogo has initiated a SRCE model for updating the reclamation and closure costs, which should provide a more detailed analysis and also provides for defensible backup documentation. An area of inconsistency between the 2012 estimates, SRCE, and current Alaska practices relates to indirect costs, which is further discussed below.

ADNR/ADEC define seven indirect cost categories for reclamation and closure:

- Contractor Profit – Calculated as revenue gained from reclamation/closure activities after accounting for contractor expenses, costs, and taxes.
- Contractor Overhead – Contractor overhead refers to all ongoing business expenses not including or related to direct labor, direct materials, or third-party expenses that are billed directly to a project.
- Performance and Payment Bond – Bond to protect owner (in this case the State) from contractor failure to perform contracted scope of work and also to cover payment to subcontractors and others receiving payments from the contractor. State of Alaska

statutes (AS 36.25.010) require both a performance bond and a payment bond for construction of projects administered by the State of Alaska.

- Insurance – liability insurance taken out by the contractor and required by the State.
- Contract Administration – cost incurred by State (and cooperating federal agencies, if applicable) to oversee reclamation and closure activities.
- Engineering Redesign – typically involves the updating of the mine's reclamation and closure plan and PoO. Often done to provide sufficient details to obtain bids from contractors for mine site reclamation and closure. Generally performed by an independent engineer contracted with the State
- Contingency – accounts for unknown or unforeseen costs arising during the reclamation and closure work. The two types of contingency costs are related to the scope of work and contractor bids.

Other indirect costs often reported (may show up in direct costs, or are not accounted for) include:

- Mobilization/demobilization – typically this is included in direct costs (except for the U.S. Forest Service, which includes this as an indirect cost in its guidelines). Pogo's 2012 cost estimate showed mobilization/demobilization as an indirect cost.
- Inflation proofing – the inclusion of additional anticipated project costs due to general economic inflation is often included in the indirect cost category when determining the total estimated reclamation and closure cost. This is more often shown below direct and indirect costs since inflation adjustments should account for both types of costs.

The 2012 Pogo indirect costs calculations were compared to the indirect costs recommended by the ADNR/ADEC draft document, *Draft Mine Closure and Reclamation Cost Estimation Guidelines* (DOWL recommended edits in Appendix A, April 2015) (Table 7). It is recommended that the indirect costs be consistent with Alaska's recommended percentages. Comparison of indirect costs between Pogo's 2012 estimates and the DOWL recommended ranges include:

- Contractor Profit – Pogo's 2012 estimate was at 7.5 percent, which is within the range for ADNR/ADEC draft guidelines.
- Contractor Overhead - Pogo's 2012 estimate used at 7.5 percent, which is within the range for ADNR/ADEC draft guidelines.
- Performance and Payment Bond - Pogo's 2012 estimate was 3.0 percent, which is within the range for ADNR/ADEC draft guidelines.
- Insurance – Pogo's 2012 estimate was the same as ADNR/ADEC draft guidelines.
- Contract Administration – Pogo's 2012 estimate was lower than the ADNR/ADEC draft guidelines (4 percent compared to a range of 5 to 9 percent).
- Engineering Re-design – Pogo's 2012 estimate of 3.0 percent was near the lower end of ADNR/ADEC draft guidelines of 3 to 7 percent.

- Contingency – Pogo's 2012 estimate of 15 percent was within the range of the ADNR/ADEC draft guidelines of 6 to 11 percent (scope).
- Mobilization/demobilization – Pogo included this as an indirect cost, whereas ADNR/ADEC draft guidelines recommend this be included direct costs (see Table 7 for range of values).

Table 7. Comparison of Indirect Cost Percentages for Reclamation/Closure Costs between 2012 Pogo Mine, ADNR/ADEC Draft Guidelines, and SRCE Model

Cost Categories for Reclamation and Closure	2012 Pogo Mine	2012 ROWs	AK Guidelines 2015 DOWL Draft[1]	SRCE (NV)
	Percent of Direct Costs			
Contractor Overhead and Profit	7.5 (OH) 7.5 (profit)	7.5 (OH) 7.5 (profit)	4 to 8 (OH) 6 to 10 (profit)	10 (profit)
Performance and Payment Bond	3.0	3.0	2.5 to 3.5	3.0
Insurance	1.5	1.5	1.5	1.5
Contract Administration	4.0	4.0	5 to 9	6 to 10
Engineering Re-Design	3.0	4.0	3 to 7	4 to 8
Contingency	15	10	6 to 11 (scope) 4 to 9 (bid)	4 to 10
Inflation Proofing (apply to both direct and indirect costs)	2.06	2.66	An inflation factor based on Anchorage Consumer Price Index average over previous 5 years, and compounded for next 5 years	
Mobilization/Demobilization	5.0	6.5	Part of direct costs	Part of direct costs

[1] Appendix A in *Mine Closure and Reclamation Cost Estimation Guidelines: Indirect Cost Categories,* prepared by DOWL for ADNR and ADEC, April 2015.

The following discussion is based on Pogo's April 2012 reclamation and closure cost estimate and incorporates several of the findings presented by SRK in the document *Basis of the Reclamation Cost Estimate for the Pogo Mine Using the Standardized Reclamation Cost Estimator (SRCE),* June 2014:

- As presented above, Pogo's indirect costs calculations have a couple of inconsistencies with the indirect costs calculations methodology described in the ADNR/ADEC draft 2015 guidelines (DOWL, 2015). The guidelines should be re-visited prior to the 2017 cost updates.
- As reported by SRK in their 2014 report, and verified by the Audit Team, the cost items listed below are accounted for under contractor overhead and contract administration indirect costs, and as well as direct costs in the 2012 estimates (they are double counted):
    - Phase III: Final Reclamation and Closure:
        - Survey field crew including survey field manager, survey crew, and field support vehicle

        - Contract administration and QA/QC costs including resident engineer, engineering technician, laboratory and material testing, and associated field support vehicles
        - Freight costs that were calculated as 12 percent of the total material costs for the Phase III site-wide reclamation
        - Administration costs including office supplies, miscellaneous supplies, and communications
    - Phase IV: Post-Closure Reclamation:
        - Survey field crew including survey field manager, survey crew, and field support vehicle
        - Contract administration and QA/QC costs including resident engineer, engineering technician, laboratory and material testing, and associated field support vehicles
        - Freight costs that were calculated as 12 percent of the total material costs for the Phase IV site-wide reclamation
        - Administration costs including office supplies, miscellaneous supplies, and communications

Additional items that Pogo should address with ADNR/ADEC prior to updating 2017 costs include:

- The 2012 reclamation and closure cost estimates are based on disposal of demolition debris in the DSTF. It should be verified that this is a viable option or if an alternative debris disposal would be more feasible.
- The suitability of using helicopter-seeding for the whole site for re-vegetation should be evaluated and included in the 2017 costs if deemed practical and economical.
- The 2012 Pogo estimate does not include long-term reclamation monitoring, which would likely be required and is typically included in reclamation costs.
- The 2012 estimate assumes that water treatment would continue year-round. There may be limitations in winter for water treatment due to freezing potential. Therefore, it is recommended that the current assumptions in the cost estimate related to water treatment plant seasonal operation be further addressed when the 2017 costs are finalized.

5.4 Millsite Lease

Surface uses of State land are included within the Millsite Lease and are limited to those necessary for the extraction and processing of minerals from the Pogo Mine Project. For the purposes of the Pogo Mine Millsite Lease, uses are limited to those surface uses described in the Plan of Operations and the Reclamation Plan as approved by ADNR or as specifically authorized or required by the Millsite Lease. Public access may be restricted to the Millsite Lease area for safety reasons and to prevent unreasonable interference with millsite operations.

The Millsite area is to be managed in a manner that, to the extent feasible, uses accepted industry practices and mitigates adverse effects of Millsite operations, especially to residents,

recreational users of areas adjacent to the Millsite Area, and disturbance or damage to the environment.

Every fifth year of operation the Millsite Lease requires the Lessee to conduct an environmental audit of the Millsite operations including the mine access systems. The scope of the audit shall at a minimum determine if both the environmental and project management systems of the Lessee are being met and that the systems and controls are functioning as intended.

Based on interview discussions with ADNR, the adjustment for annual rent payments was to occur in 2015. At of the time of the interview, an adjustment to the annual rent payment had not occurred. However, rental payments have been occurring on time. Subsequent to the auditor's interview and based on follow up comments from ADNR, rental payments have since been reviewed. The annual rent payment has been adjusted and back rent from 2015 has been paid.

5.5 Water Use Authorizations

Pogo maintains 15 water use authorizations, including seven Permits to Appropriate Water, four Temporary Water Use Authorizations (TWUA), and four Temporary Water Use Permits (TWUPs) (Table 1). Water use authorizations require reporting monthly pumping volumes on an annual basis. Pogo annual reports include a summary of monthly and annual water usage for water use authorizations. Two of Pogo's TWUPs (F2013-023 and F2013-143) require quarterly reporting, and Pogo only reports water use data in annual reports. However, ADNR notified the Audit Team that they have advised Pogo to only provide water use reports in the Annual Activity Reports, and if Pogo acquires new TWUPs, the written permit reporting requirements will be updated at that time. To date, Pogo has complied with the water use authorizations, including reporting requirements as directed by ADNR.

6.0 Reliability and Integrity of Information Relating to Environmental Reporting and Compliance

Direct field observations and interviews with key mine personnel were completed to determine the reliability of reported information. The reliability and integrity of information for reporting and compliance is reasonable. Pogo has an Environmental Management System Manual that the Audit Team reviewed that includes protocols for reporting, data QA/QC, instrument calibration, and spreadsheets for waste management tracking and monitoring requirements. The staff is well organized, knowledgeable, and well-trained on environmental management for mines. The Senior Environmental Coordinator has regular discussions and planning meetings with the plant and maintenance supervisors. The mine is putting significant effort into ISO 14001:2004 compliance, the standard for best practices in environmental management. The Audit Team observed numerous environmental and safety best management practices throughout the mine tour, from duck ponds under every parked vehicle and spill kits spread throughout the property to erosion and sediment control work at the DSTF diversion ditches. The Audit Team recognized a general knowledge and thoughtfulness for environmental requirements from staff throughout the property at various facilities. The Environmental Team performs new hire environmental training for all personnel, as well as annual training. The Audit Team understands

that this training will be better documented moving forward, tracking personnel in attendance and software-based tracking of personnel attendance at various environmental related trainings.

7.0 Adequacy of State Oversight to Protect State Resources

The Audit Team interviewed various agency representatives, as shown in Table 2 and reviewed inspection reports from ADNR. The reports include two inspections per year for 2010, 2011, 2012, 2013, and one in years 2014 and 2015. The reports summarize their inspection tour and any finding/observations, and provide photographs. The inspections have included staff from ADNR, ADEC, and ADF&G. Inspections included construction activities, the general mine site, and access road. The regulatory agency personnel for this project appear knowledgeable and have ample understanding of mining practices, environmental mitigation measures, and the State regulations.

8.0 Status of 2009 Environmental Audit Findings

The Environmental Audit completed in 2009 provided a number of recommendations related to mine operations, facilities and monitoring activities. Table 8 provides a summary of those recommendations and their current status.

Table 8. Status of 2009 Environmental Audit Recommendations

Summary of 2009 Audit Recommendation	Status
Dry Stack Tailings Facility	
The Operations, Maintenance, and Surveillance should be updated.	The Pogo Plan of Operations was updated in March of 2012 and included an updated DSTF Construction and Maintenance Plan
Recommend the continued placement of compacted non-mineralized development rock for shell development.	Pogo's shell development utilizes compacted non-mineralized development rock and follows the approved design standards
Recommend physical parameter tests such as grain size distribution, Atterberg limits, standard proctor and moisture-retention.	These tests were completed when shells were not rock only, these are not applicable to the shell currently being constructed
The use of 1 foot of compacted dry stack tailings instead of 2 feet over the mineralized development rock will likely not affect water quality after closure has not been verified.	Pogo's DSTF infill follows the approved design standards
Pogo and ANDR should reconcile the difference in the design and operational changes.	The Pogo Plan of Operations was updated in March of 2012 and approved by ANDR on February 7, 2012
QA/QC samples of the DSTF should be collected at the frequency identified in the QAP and should not include the analysis of field blanks. Field duplicates should be included.	DSTF sampling is being performed in compliance with the QAP
Recommend changing the reporting of results to "total inorganic carbon" with units of %C and %CO2. Alternatively, one of the two analyses can be eliminated.	Current lab results provide %Carbon and % Inorganic Carbon, and values vary and do not appear to both represent inorganic carbon
Recycle Tailings Pond	
Repair washout area note along flume spillway.	Completed
Remove HDPE pile that is partially blocking spillway and flume.	Completed
Recommend preforming additional work identified in the 2007 periodic safety inspection including the repair or replacement of the pressure transducer located at the upstream pumps and installation of a fixed gauge to manually monitor water elevation.	Completed
Underground use of signage and picketing needs to be conducted in accordance with the development rock segregation protocol.	The Audit Team did not go underground; however, all above ground rock was labeled in accordance with the protocol.
Overlap between piles of non-mineralized (green) and mineralized (red) development rock should be avoided in surface placement.	Non-mineralized (green) and mineralized (red) development rock are being segregated at the surface. Overlapping was not observed.
Red and green stakes should be used to identify mineralized and non-mineralized rock on the DSTF.	This appears unnecessary as mineralized rock is only placed in the center of the facility, surrounded by tailings. Material is well segregated and labeled prior to final placement on the DSTF.
The reference to lead analysis for the development rock is in error in the QAP and should be correct in future versions.	Appears to have been removed.
XRF and monitoring results for development rock from the DSTF should be compared for quality control by including XRF analysis of the composites of the development rock.	This is not being completed by Pogo. This comparison would provide good information; however is not a permit requirement.

Summary of 2009 Audit Recommendation	Status
Laboratories and Sample Analysis Procedures	
The current XRF analysis does not meet the QA/QC requirements as set forth in the QAP. It is recommended that analysis of the standard be continued, while analysis of a duplicate sample should be re-introduced. It is further recommended that duplicate results be evaluated using the RPD approach.	The QA/QC requirements for the XRF are not clearly laid out in the QAP, and this remains a recommendation from this audit.
Surface Water and Effluent Monitoring	
Recommend the development and inclusion of procedures for trend analysis and interpretation in the QAP to evaluate changes in water quality parameters over time. Procedures may include purpose of the statistical analysis, procedures to evaluate the overall pattern of change in a parameter over time, and statistical methods to be used.	This does not appear to be revised within the QAP; however, water quality results are graphed over time and therefore trends can be monitored.
SPCC Plan	
Recommend providing secondary containment for all 55-gallon drums that contain oil or oily water.	No drums were observed outside of containment.
Recommend providing the necessary overfill prevention measures for all double-walled or double-bottom tanks without tertiary containment to comply with EPA Memorandum OSWER 9360.8-38.	The Audit Team did not review the SPCC Plan as part of the scope of work.
Recommend repairing the damaged tertiary containment liner for AST-2 or provide the necessary overfill prevention measures to comply with EPA Memorandum OSWER 9360.8-38	
Recommend monitoring the interstices of double-wall and double-bottom tanks to verify that no water or oil is present, and the primary tanks have not been compromised. This may be done using water-finder or oil-finder paste. Some tanks, such as AST-50, may require installing a plug on the top of the tank to monitor the interstice.	
Recommend implementing specific methods to verify the operation of the liquid level sensing gauges and include this check as part of the periodic inspections.	
Recommend updating the SPCC Plan to include the changes/upgrades noted above as well as all methods for handling and controlling water in open secondary containment that may have oil sheen.	
Groundwater	
A chemist should be consulted to determine what previously collected water quality data were potentially affected by the air-lift purge and sample method and appropriate data qualifier flags added to the database as needed. Alternative purging and sampling methods should be considered to eliminate the air to water contact. Future monitoring reports should include a statistical evaluation for significant water quality parameter changes or trends as discussed in the Surface Water Monitoring Sections of this report.	Water quality results are graphed over time and therefore trends can be monitored. No statistical analysis is currently being completed.
Fluid Management	
Fluid meters should be calibrated on annual basis as specified in the fluid management plan. The factors that contribute to the run-off component used to balance the water budget should be more clearly identified in the monitoring reports, and the magnitude of each should be approximated, if possible, so any error range in the water balance can be estimated.	The runoff component is still estimated and the magnitude of the error range is not clear. The fluid meter calibration schedule is unknown.
Secondary Containment	
It is recommended that engineered secondary containments are constructed and maintained for CIP tailings storage tank and associated pipelines to the paste plant. This may include expansion of the stem-walled concrete for the tank and pipe-in-pipe containment for the pipelines	Completed

9.0 Conclusions

The Audit Team reviewed programs under the POA, WMP, millsite lease, water use authorizations, and ROW authorizations. Pogo is generally in compliance with operations and reporting for all authorizations, with the exception of an outdated QAP, a (potentially) long-term above ground ore stockpile, and other relatively minor observations and recommendations. Recommendations for improved environmental management in each area are bulleted below.

The reliability and integrity of information for reporting and compliance is reasonable. The Pogo staff is knowledgeable and well-trained on environmental management for mines. The Audit Team recognized a general knowledge and thoughtfulness for environmental requirements from staff throughout the property at various facilities.

Dry Stack Tailings Facility

- The Audit Team reviewed annual reports and recommended that Pogo complete cross sections along with their annual DSTF as-built drawings that display annual progress.
- According to WMP monitoring requirements, visual monitoring and documentation of the disposal facilities is required on a weekly basis, and Pogo performs monthly inspections. It is recommended that inspections be performed weekly to comply with the WMP, and that more effort be placed into documentation of the visual inspections, which can only be observed if inspection reports contain notes beyond checking form boxes.
- When the WMP is revised, ADEC may consider editing Section 1.2.1 to reflect the true intent of including weekly disposal rates for floatation tailings and waste rock.
- Pogo annual reports provide the tonnage of floatation tails and mineralized development rock disposed at the DSTF, but do not include the non-mineralized development rock tonnage disposed at the facility. It is unclear how the agency will track total tonnage at the facility without these data, and therefore it is recommended that the non-mineralized development rock tonnage be provided in annual reports. The QAP does not address any quality control or protocol for data management from the pressure transducers used to monitor the DSTF piezometers and flumes. It is recommended that the QAP describe the programing of the data logger, the equipment, frequency and process for data download, where data will be stored and how they will be managed, how data drift will be reviewed and corrected, and data correction for barometric pressure.
- Drystack construction close to downstream face should continue to include 3-foot lift with three passes by a D7 Dozer or equivalent.

RTP

- According to WMP limitations, groundwater in compliance monitoring wells (MW03-500, MW03-501, and MW03-502) must not exceed the upper tolerance limit and exceed WQS. Bedrock monitoring wells MW03-500, MW03-501, and MW03-502 were replaced with alluvial wells MW12-500, MW12-501, and MW12-502 in 2012 after a well collapsed.

The permit reference to the well names needs to be revised when the permit is renewed.Chloride, sodium, and nitrate groundwater concentrations are consistently above the WMP permit trigger limits in each of the wells downgradient of the RTP. There does not appear to be a trend of increasing concentrations. It is recommended that these trigger limit concentrations be evaluated during permit renewal if the observed concentrations are not of concern ADEC.

- It is recommended that the WMP revision consider clarification of WMP Section 1.6.2.1 to more specifically identify which facilities are intended. Section 1.6.2.1 of the WMP uses the term “the facility” (singular), and the term “visual monitoring”, while later, Section 1.6.9.4 uses “inspections” with regard to the RTP. This leads the reader to interpret that the RTP should be monitored on a weekly basis along with other disposal-related facilities; and that Section 1.6.9.4 is pertinent to the PSI *inspections* required in the Dam Permit (not visual monitoring).

Secondary Containment

- The Audit Team recommends that Pogo place roof structures over secondary containment areas to limit precipitation entering secondary containment.
- Where secondary containment impermeable surfaces are HDPE or concrete with gravel over, it is recommended the Pogo remove the gravel from within the containment bottoms (unless the gravel is used to support vehicle traffic).
- If the bottoms are PVC, then they will need to remain covered to protect from UV light.
- The Audit Team’s understands that Pogo has plans to replace the hazardous waste storage area storage area with a new storage area that will be roofed and will have a visible secondary containment system.

  The Audit Team observed an unlined, above ground mineralized rock stockpile located under the Blue Line south of the Mill Bench (graphitic ore). The PoO states an above ground ore stockpile will be temporary and have a high turnover rate to reduce the oxidation potential. Interviews with Pogo personnel indicated that there was no known timeframe for processing this ore or changing the storage location, and that it may be stockpiled in this location indefinitely. Long term storage of ore above ground on an unlined facility carries the potential for leaching acid and metals to groundwater and stormwater, and is out of compliance with the WMP. It is recommended that Pogo relocate this mineralized stockpile to the lined, above ground mineralized pad near the 1525 portal or consider lining the ore pad near the 1690 portal. It is noted that according to ADNR, as of an October 13, 2016 site inspection by ADNR, the ore had been removed from that location.

Laboratory

- The laboratory has implemented QA/QC procedures but documentation is lacking. It is recommended that the laboratory develop a QAP that follows EPA guidance.

- The laboratory uses a colorimetric method with picric acid for the WAD cyanide test method. While the method provides sufficient details for the analysts to run the test, no approved method citation is provided. It is recommended that the method be tied to a reference.
- Because the WAD cyanide analysis is not an EPA, SM, or ASTM method, it is recommended that Pogo periodically (e.g., twice per year) have a subsample analyzed by a contract laboratory that uses a standard method, so that results can be compared to ensure that Pogo's on-site laboratory results are comparable (precision evaluation) to more generally acceptable methods. Furthermore, it is recommended that Pogo consider additional quality control in running its cyanide samples, specifically:
    - Verification of calibration curve by running an independent calibration check with each sample run
    - Periodically run a matrix spike and matric spike blank to check for interferences
    - Run a laboratory control standard (3rd party provided standard sample) to assess method accuracy

The Audit Team inspected Pogo's sample preparation shack and the following recommendations are made:

- Create a master SOP list for environmental sampling and tests.
- Ensure that reagent expiration dates are tracked; do not use past the expiration date.
- A temperature log should be maintained for the refrigerator if it is used for storage of permit compliance samples.
- An update to Pogo's QAP addressing activities associated with the sampling shack including handling of reagents, calibration of meters, and decontamination of field equipment.

Access Road/ROW

- Degraded scour protection at the Shaw Creek Bridge should be evaluated by a Professional Engineer and repaired as soon as practicable. It is noted that according to ADFG Division of Habitat Trip Report from September 20, 2016, the riprap had been repaired under the Shaw Creek Bridge.
- Heavy erosion of the road bank at Gold Hub Creek should be repaired and stabilized as soon as possible.
- A plan should be developed that addresses how localized erosion currently occurring on the side slopes of the access road will be repaired and stabilized.
- A SWPPP should be developed for the access road that identifies erosion and sediment control measures and establishes visual monitoring procedures and frequency of inspection and corrective action. According to Pogo, "windshield surveys" are conducted to identify obvious issues that might need attention.

- If not already occurring, consideration should be given to conducting a condition assessment of all of the bridges on the access road. The Pogo Mine has a planned operational life of 15 years, which will be reached in 2019, and it is possible that the mine could operate beyond 2019. The bridges on the access road were presumably designed to have more than a 15 year design life. However, the access road bridges are none the less of a temporary design, routinely carry heavy commercial loads, and are exposed to extreme environmental conditions. These factors could collectively function to deteriorate structural elements of the bridges.
- Coordination between the PA Signatories and Sumitomo should occur to determine if the PA needs be updated to reflect the current owner of the Mine (Sumitomo) and the current lead federal agency (USACE).
- Coordination should occur between ANDR and Sumitomo to address the private easement agreements associated with the access road.

Monitoring Plan

- It is recommended that data flags be included in reporting and the QAP be revised to reflect that flagged data will not be withheld as invalid.
- The last contract laboratory performance audit was completed in 2012. It is recommended that an audit be completed of the current labs being utilized.
- Table 11.3 in the QAP provides hold times for analyses, and the hold time listed for acid base accounting (ABA) analysis is shown as 28 days. There is typically no holding time for ABA analysis, therefore this should be updated in the QAP.
- In reporting RTP water quality results, no comparison or discussion of a statistical analysis comparing compliance monitoring data against WQS or against background water quality is provided. It is recommended that Pogo initiate inclusion of the background values in the reporting tables and graphs, and where exceedances in the background or WQS are observed for RTP wells, complete statistical analysis to monitor for an SSI. Alternatively, Pogo may revise the QAP to be consistent with the current practice by removing the requirement for the SSI evaluations.
- It is recommended that Pogo initiate inclusion of the background values in the reporting tables and graphs, and where exceedances in the WQS are observed, complete statistical analysis to assess SSI over background per the WMP permit requirement for DSTF and ore zone monitoring wells.
- The groundwater sampling field data sheet provides an erroneous volume constant (1.35) for the 6-inch diameter wells (should be 1.47).
- It is recommended that a percent difference for the field water quality parameter stabilization during purging be defined in the QAP (e.g., stabilized when values between readings differ less than 5 percent).

- It was recommended to Pogo on the site visit that the dissolved oxygen probe may be recording in error and data may potentially need to be flagged if Pogo finds that the probe was inaccurate.
- It is recommended that the recording of water level data be improved to better reflect conditions when water could not be sampled and why.
- It is recommended that the QAP be revised to include pressure transducer data management describing the data collection programing of the data logger, the equipment, frequency and process for data download, where data will be stored and how they will be managed, how data drift will be reviewed and corrected, and data correction for barometric pressure. It is recommended that the data measurement and recording frequency, as well as data download frequency be edited for consistency between the QAP, Monitoring Plan, and RTP Operation and Maintenance Manual.
- It is recommended that the QAP be revised to reflect the current practice of recording only wildlife fatalities for biological visual monitoring and be revised to reflect that the WMP does not require reporting.
- Pogo is complying with the requirement to monitor wildlife interaction. The intent of the WMP monitoring requirement is unclear with use of the term “interaction”. It is recommended that the intent and the specific permittee obligation be more clearly defined in the permit language.

Millsite Lease

- Adjustments to the annual rent payment as described in the Millsite Lease are due in 2020.

Financial Assurance

- It is recommended that the indirect costs of the cost estimate be consistent with Alaska’s recommended indirect cost category percentages. Pogo’s 2012 indirect cost percentage for Contract Administration is lower than the ADNR/ADEC draft guidelines. Additionally, Pogo’s 2012 estimate included mobilization/demobilization as an indirect cost, where guidelines recommend this as a direct cost.
- Some cost items in the 2012 estimates are double counted under contractor overhead and contract administration indirect costs and as well as direct costs.
- The 2012 reclamation and closure cost estimates are based on disposing demolition debris in the DSTF. It should be verified that this is a viable option or if an alternative debris disposal would be more feasible.
- The suitability of using helicopter-seeding for the whole site for re-vegetation should be evaluated.
- The 2012 Pogo estimate does not include long-term reclamation monitoring, which is typically included in reclamation costs.

- Because the water treatment plant may not be able to operate year-round, the seasonal operation assumptions of the water treatment plant should be further negotiated with agencies and described in the text to support 2017 costs.

Water Use Authorizations

- It is recommended that for future water use authorizations, reporting requirements be standardized by specifying the annual report be used by Pogo to provide ADNR with the necessary water use reporting requirements.

10.0 References

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Sumitomo Metal Mining Pogo LLC. 2013. Pogo RTP Operating and Maintenance Plan, October 2013.

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Sumitomo Metal Mining Pogo LLC. 2014. Pogo DSTF Construction and Maintenance Plan, May 2014.

SRK Consulting. 2014. Basis of the Reclamation Cost Estimate for the Pogo Mine Using the Standardized Reclamation Cost Estimator (SRCE), June 2014.

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Appendix A

On-Site Laboratory Audit Checklist

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HDR Pogo Mine Audit
Laboratory
July 16, 2016
Audit by: Michael Murray

Lab Management and Organization		
	Explain lab management and organization? How is this integrated with sampling program? Are current organization charts available and accurate?	John McClain is lab manager, and oversees day to day testing. The lab does assay work, and also test for WAD CN, for plant solutions and for confirming WAD CN detoxification. Also, the lab runs test for sulfur to assess if tailings and waste rock material is sulfide bearing or non-sulfide bearing.
Training		
	Is job-specific training identified and executed (e.g., laboratory analyst's qualification system)?	Yes, staff receive training on testing procedures and training is documented.
	Are training requirements clearly documented in an SOP or similar guidance document (including managers, supervisors, analysts and temporary staff)?	Yes
	Is this training documented and are the documents available for review?	Yes, kept in file.
Laboratory and Sample Collection Chemical Use and Storage and Waste Management		
	Chemical inventory list? MSDS?	Yes
	Are chemicals properly labeled, segregated by hazard classification, & properly stored?	Yes, acid and bases kept separate.
	Are flammable chemicals stored in approved containers, flammable storage cabinets, and/or approved refrigerators?	Yes
	Are gas cylinders properly secured, used, and stored in well-ventilated areas?	Yes
	Are laboratory prepared reagents and solutions properly identified? (e.g., chemical name or symbol, concentration, date of preparation, initials of the analyst who prepared it, and expiration date)?	Dates observed on reagents, did not see analyst initials. Not all reagents have expiration dates.
	Describe lab generated waste, disposal, and documentation	For CN testing, materials placed into 1000 gallon tank (buried tank), and then pumped to CN detoxification facility. It becomes part of that stream. Waste disposal program in

		place, wash water goes to sanitary sewer.
	Any Hazardous Waste? Show labels and documentation	None observed.
	Chemical labels and dating (obsolete chemicals)	Yes, chemicals labeled, did not observe obsolete chemicals, but did not go through each cabnet
Laboratory and Sampling Process Area Egress/Emergency Equipment		
	Have all personnel been instructed as to the location(s) of emergency exits, fire alarm pull stations, fire extinguishers, safety showers, and eyewash stations?	Yes, observed fire extinguishers, eye wash and shower.
	Are all exits, doorways, aisles, and hallways free of impediments or obstructions?	Yes
	Are all fire extinguishers accessible, properly mounted, and fully charged?	Yes, did not check inspection dates.
	Are the safety showers and eyewash stations accessible (not impeded or obstructed)? Are they tested?	Yes
	Does the laboratory have appropriate spill kits and have employees been trained in their use and location?	Yes
Laboratory and Sample Preparation Area Personal Protective Equipment and Safety		
	Is eating, drinking, smoking and storage of such materials prohibited in the laboratory?	Yes
	Are all electrical cords in good condition, free of frayed ends, splices and tears?	Yes
	Is all permanent laboratory equipment plugged directly into an electrical outlet without the use of extension cords?	Yes, but did not observe all equipment
	Proper personal protective equipment is available for employees and visitors and in use/proper sizes	Yes
	Are safety glasses (at a minimum) worn at all times in the laboratory (unless otherwise specified in the CHP)?	Yes
	Are gloves provided to laboratory personnel who handle chemicals and are they selected based on the chemicals used?	Yes
	Is all other required PPE (i.e. goggles, face shield, closed toed shoes) available & used?	Yes
	Are all fume hoods working properly (evidence by checking flow indicating device)?	Yes, but did not test flows
	1st aid kit available and maintained?	yes
	Signs are posted detailing special hazards?	NA
	Emergency phone numbers listed in visible location?	Yes
Laboratory and Monitoring Reference Standards and Solutions		
	Is there a list of standards and resulting solutions used on-site?	NA

	Are all standards labeled with name, source, lot number, and expiration date?	Yes
	Are working or house standards checked against primary standards at appropriate intervals?	No, for CN there was no primary standard to check.
SOPs		
	Is there a list of all approved SOPs?	Yes, for CN, but lacking SOPs for some procedures and laboratory protocols.
	Is there a system for controlling the issuance and revision of all SOPs?	Yes for CN, but not for other lab procedures. .
Samples		
	Is a sample logbook maintained?	No logbook, just paper (single sheets)
	Are samples tracked? Is sample disposition included in tracking?	No
	Are samples labeled appropriately to include: sample description, source, and quantity, date sampled, date sample received for testing?	Yes
Laboratory Test Procedures		
	List of on-site laboratory tests.	No
	Where are test procedures and SOPs kept?	In file and on lab cabinet door next to instrument
	Do the test procedures include sufficient instructions on how to conduct the testing and operate the specific lab instruments?	Yes
Data Management		
	Is data documented in bound prenumbered logbooks, notebooks, or other data storage and acquisition systems?	Sheets, no logbooks
	Are all handwritten documents/data recorded in permanent ink?	Yes
	How is raw data recorded and kept?	Yes
	Are data protected from fire, water, and other environmental hazards?	File cabinet in lab. Could be subject to fire or water.
Laboratory Equipment		
	Master list of laboratory and field sampling equipment?	Yes
	Is there a written qualification, calibration, and preventive maintenance program in place described in an SOP?	Yes
	Is there a master equipment maintenance and calibration schedule?	Yes
	Does each piece of equipment have a logbook or file documenting instrument	No

	maintenance, calibration, and repair histories?	
	Are pH meters standardized and calibrated?	NA
	Are balances calibrated at both upper and lower weighing capability using NIST-traceable standards?	Yes
Laboratory Infrastructure and General Housekeeping		
	Are proper systems in place to minimize cross-contamination during sample preparation and laboratory testing?	Yes
	Are all controlled temperature/humidity storage areas, incubators, etc. monitored to assure that proper conditions are maintained?	NA
	Have purified water systems been validated?	NA
	Is lab water part of the site water monitoring program and is testing frequency established and appropriate?	No, use DI water
	Laboratory Glassware, cleaning methods used?	Yes
	No foods or drinks	None observed
	Overall cleanliness	Good for the test methods being performed.
Methods (Pogo Lab only)		
	SOP method and are staff trained on method?	Yes
	Is there a general SOP for methods validation?	No
	Method validation procedures: accuracy, precision, sensitivity, range?	No

Comments: The laboratory needs to be under a Quality Assurance Project Plan, either incorporate into the Pogo's main QAP for develop separate QAP.

Appendix B

Environmental Shack Audit Checklist

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HDR Pogo Mine Audit
Environmental Sampling Shack
July 16, 2016
Audit by: Michael Murray

Lab Management and Organization		
	Explain lab management and organization? How is this integrated with sampling program? Are current organization charts available and accurate?	The room is used for storage of sample bottles, coolers, and sampling and monitoring equipment. Field chemicals are kept here (e.g., pH solution), and instruments are calibrated here as well. Stacey Staley is in charge of the overall sampling/monitoring program and has responsibility for the sampling shack.
Training		
	Is job-specific training identified and executed (e.g., laboratory analyst's qualification system)?	Field staff receive training on proper use of monitoring and sampling equipment. Somce sampling and equipment maintenance SOPs are in the shack, Audit Team reviewed several SOPs. Listing of all available SOPs was not available at time of audit, thus uncertain of completeness of SOP coverage.
	Are training requirements clearly documented in an SOP or similar guidance document (including managers, supervisors, analysts and temporary staff)?	Yes
	Is this training documented and are the documents available for review?	Yes, kept in file.
Laboratory and Sample Collection Chemical Use and Storage and Waste Management		
	Chemical inventory list? MSDS?	Yes
	Are chemicals properly labeled, segregated by hazard classification, & properly stored?	Yes, acid and bases kept separate.
	Are flammable chemicals stored in approved containers, flammable storage cabinets, and/or approved refrigerators?	Yes (solvent and acid cabinets observed)
	Are gas cylinders properly secured, used, and stored in well-ventilated areas?	N/A
	Are laboratory prepared reagents and solutions properly identified? (e.g., chemical name or symbol, concentration, date of preparation, initials of the analyst who prepared it, and expiration date)?	pH solutions and conductivity solution observed. Both had expiration dates listed on labels. Several pH solutions exceeded expiration date.

	Describe lab generated waste, disposal, and documentation	N/A
	Any Hazardous Waste? Show labels and documentation	No
	Chemical labels and dating (obsolete chemicals)	Yes, chemicals labeled, several pH solutions exceeded expiration dates.
Laboratory and Sampling Process Area Egress/Emergency Equipment		
	Have all personnel been instructed as to the location(s) of emergency exits, fire alarm pull stations, fire extinguishers, safety showers, and eyewash stations?	Yes, observed fire extinguishers. No safey shower or eyewash observed.
	Are all exits, doorways, aisles, and hallways free of impediments or obstructions?	Yes
	Are all fire extinguishers accessible, properly mounted, and fully charged?	Yes, did not check inspection dates.
	Are the safety showers and eyewash stations accessible (not impeded or obstructed)? Are they tested?	Not observed.
	Does the laboratory have appropriate spill kits and have employees been trained in their use and location?	Yes
Laboratory and Sample Preparation Area Personal Protective Equipment and Safety		
	Is eating, drinking, smoking and storage of such materials prohibited in the laboratory?	Yes
	Are all electrical cords in good condition, free of frayed ends, splices and tears?	Yes
	Is all permanent laboratory equipment plugged directly into an electrical outlet without the use of extension cords?	Yes, but did not observe all equipment
	Proper personal protective equipment is available for employees and visitors and in use/proper sizes	Yes
	Are safety glasses (at a minimum) worn at all times in the laboratory (unless otherwise specified in the CHP)?	No, only when acids, bases being used.
	Are gloves provided to laboratory personnel who handle chemicals and are they selected based on the chemicals used?	Yes
	Is all other required PPE (i.e. goggles, face shield, closed toed shoes) available & used?	Yes
	Are all fume hoods working properly (evidence by checking flow indicating device)?	NA
	1st aid kit available and maintained?	yes
	Signs are posted detailing special hazards?	NA
	Emergency phone numbers listed in visible location?	Yes
Laboratory and Monitoring Reference Standards and Solutions		
	Is there a list of standards and resulting solutions used on-site?	No list, pH and conductivity standards stored onsite and use

		for field equipment calibration
	Are all standards labeled with name, source, lot number, and expiration date?	Yes
	Are working or house standards checked against primary standards at appropriate intervals?	NA
SOPs		
	Is there a list of all approved SOPs?	SOPs at the shack but no master list.
	Is there a system for controlling the issuance and revision of all SOPs?	No
Samples		
	Is a sample logbook maintained?	Field sample log
	Are samples tracked? Is sample disposition included in tracking?	Tracked through chain of custody and mine's tracking system.
	Are samples labeled appropriately to include: sample description, source, and quantity, date sampled, date sample received for testing?	Yes, for field samples
Laboratory Test Procedures		
	List of on-site laboratory tests.	NA
	Where are test procedures and SOPs kept?	NA
	Do the test procedures include sufficient instructions on how to conduct the testing and operate the specific lab instruments?	NA
Data Management		
	Is data documented in bound prenumbered logbooks, notebooks, or other data storage and acquisition systems?	Sheets, no logbooks
	Are all handwritten documents/data recorded in permanent ink?	Yes
	How is raw data recorded and kept?	Sheets, kept in filing cabinet
	Are data protected from fire, water, and other environmental hazards?	File cabinet in building, also makes copies of field sheets..
Laboratory Equipment		
	Master list of laboratory and field sampling equipment?	No
	Is there a written qualification, calibration, and preventive maintenance program in place described in an SOP?	No
	Is there a master equipment maintenance and calibration schedule?	No
	Does each piece of equipment have a logbook or file documenting instrument maintenance, calibration, and repair histories?	No
	Are pH meters standardized and calibrated?	Yes

	Are balances calibrated at both upper and lower weighing capability using NIST-traceable standards?	Yes
Laboratory Infrastructure and General Housekeeping		
	Are proper systems in place to minimize cross-contamination during sample preparation and laboratory testing?	Yes
	Are all controlled temperature/humidity storage areas, incubators, etc. monitored to assure that proper conditions are maintained?	Yes, but no log
	Have purified water systems been validated?	Contract laboratory provides DI water.
	Is lab water part of the site water monitoring program and is testing frequency established and appropriate?	NA
	Laboratory Glassware, cleaning methods used?	NA
	No foods or drinks	None observed
	Overall cleanliness	Good for a sampling preparation area.
Methods (Pogo Lab only)		
	SOP method and are staff trained on method?	No
	Is there a general SOP for methods validation?	No
	Method validation procedures: accuracy, precision, sensitivity, range?	No

Appendix C

Site Photographs

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Photo 1. Duck ponds available and positioned beneath every parked vehicle.

Photo 2. Diversion ditches carrying offsite flows around mine facilities, discharging to Liese Creek. Ditches are free from sediment or blockages, and Pogo is addressing erosion of slopes upgradient from the ditches.

Photo 3. DSTF tailings compaction surrounding the mineralized rock disposal in the center of the facility. Non-mineralized rock disposal along margins of the facility.

Photo 4. Monitoring wells were intact and well-labeled, protected with berms, and dedicated pumps installed.

Photo 5. Flumes were intact and maintained free of debris or sediment.

Photo 6. Secondary containment of newly installed paste pipe to 2150 portal.

Photo 7. Fuel secondary containment system with fill material and vegetation.

Photo 8. Former Splice House area where paste spill occurred. Plastic liner is part of new secondary containment system. Pipe coming out of blue tube is the paste line that enters into the 1690 portal.

Photo 9. Best management practice - separation of waste for disposal to on-site incinerator or transported to off-site landfill.

Photo 10. Waste rock outside of portal labeled with the survey lath and waiting for laboratory results for flagging before ultimate disposal.

Photo 11. Non-mineralized rock segregation with flagging outside of portal.

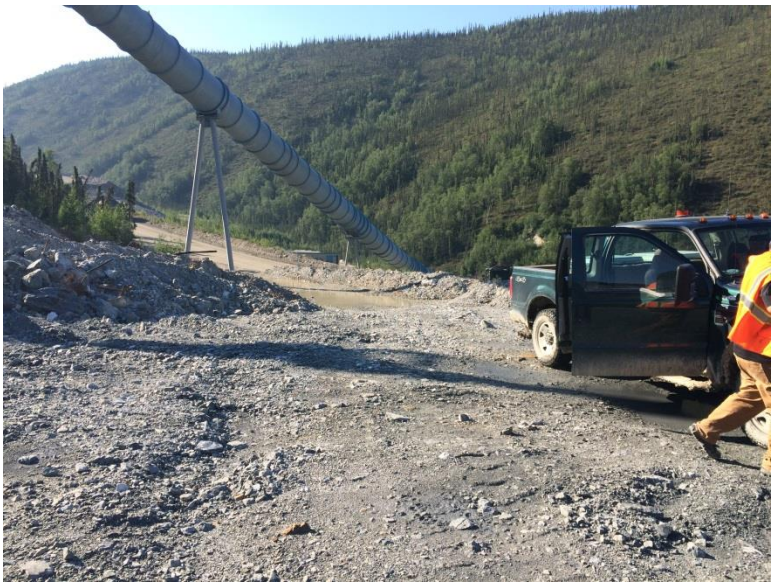

Photo 12. Graphitic ore stockpiled under the blue tube for long-term storage.

Photo 13. Typical Driving Surface on the Shaw Creek Access Road

Photo 14. Goodpaster River Bridge, Bridge Deck

Photo 15. Goodpaster River Bridge Scour Protection, West Bank

Photo 16. Goodpaster River Bridge Scour Protection, East Bank

Photo 17. Shaw Creek Bridge, Bridge Deck and Rails

Photo 18. Shaw Creek Bridge, Degraded Scour Protection

Photo 19. Shaw Creek Bridge, Degraded Scour Protection

Photo 20. Gilles Creek Bridge, Bridge Deck and Rails

Photo 21. Gilles Creek Bridge, Abutment Scour, West Bank

Photo 22. Gilles Creek Bridge, Abutment Scour, East Bank

Photo 23. Caribou Creek Bridge, Bridge Deck and Rails

Photo 24. Caribou Creek Bridge, West Bank Abutment, No Scour Protection

Photo 25. Caribou Creek Bridge, East Bank Abutment Scour Protection

Photo 26. West Keystone Creek Bridge, Bridge Deck and Rails

Photo 27. West Keystone Creek Bridge, West Bank Scour Protection

Photo 28. West Keystone Creek Bridge, East Bank Scour Protection

Photo 29. Typical Drainage Culvert

Photo 30. Three Pipe Gulch

Photo 31. Wolverine Creek Culvert

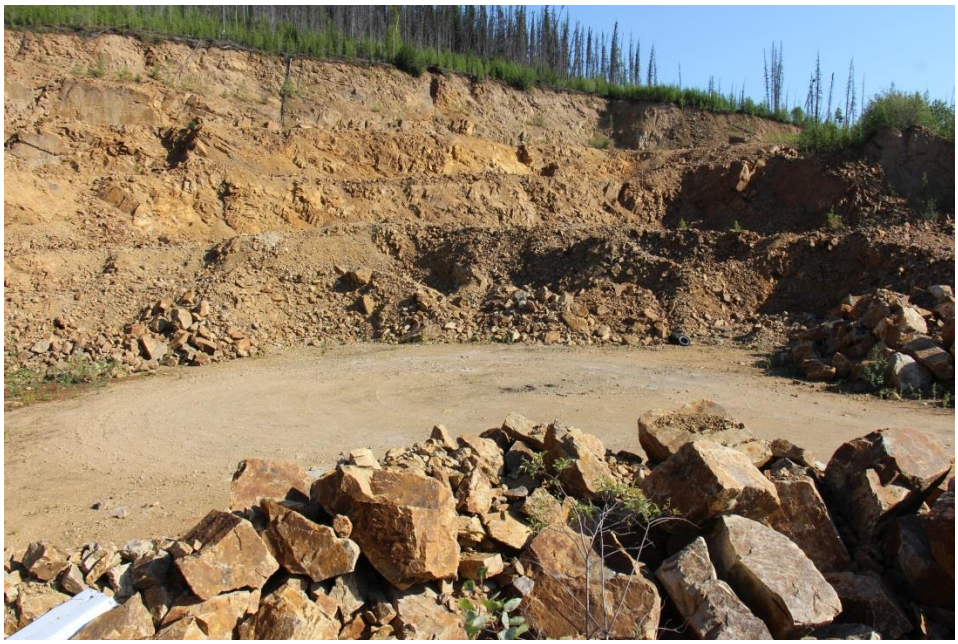

Photo 32. Material Site near the West Bank of the Goodpaster River Bridge

Photo 33. Material Site Located Between Caribou Creek and W. Keystone Creek

Photo 34. Erodible Soil (Sand) on Road Cut

Photo 35. Road Bank Erosion at Gold Creek Gulch

Photo 36. Erosion Caused by Roadside Barriers

Photo 37. Typical Conditions for Transmission Line and Environmentally Sensitive Area Sign Alaska Road and Transmission Line Corridor

Photo 38. GVEA Pogo Tap Substation

Appendix D

Quality Assurance Plan Review

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QAP Section Number	Observation
1	Update the Plan of Operations version/date.
Page xi	Update all individuals who are to receive a copy of the QA Project Plan and identify their organization
Table 2.1	Update the contract labs performing various analytical for the site, the permit reference numbers do not appear to be correct in all instances. Update to include on-site laboratory.
Table 2.2	Update names fulfilling various roles.
2.5.1	Update the anticipated frequency of laboratory audits by the QAO.
2.5.1	Update to reflect ongoing data validation approach to samples that do not meet holding time. These samples are currently not being considered invalid samples if holding times are not met.
2.6	Include additional information about training – how the training will be provided, where it is documented.
2.6	If SOPs are not going to be developed for various sampling tasks the sentence regarding SOP availability for training purposes should be removed.
Table 4.1	Update to include all sampling SOPs.
4.7.2	Update to include how deficiencies should be resolved.
Sections 4.0 and 5.0	Update to include activities associated with the sampling shack including handling of reagents, calibration of meters, and decontamination of field equipment.
Section 5.0	The laboratory has implemented QA/QC procedures but documentation is lacking. It is recommended that the laboratory develop a QAP that follows EPA guidance.
Section 5.0	The laboratory uses a colorimetric method with picric acid for the WAD cyanide test method. While the method provides sufficient details for the analysts to run the test, no approved method citation is provided. It is recommended that the method be tied to a reference.
Section 5.0	Because the WAD cyanide analysis is not an EPA, SM, or ASTM method, it is recommended that Pogo periodically (e.g., twice per year) have a subsample analyzed by a contract laboratory that uses a standard method, so that results can be compared to ensure that Pogo's on-site laboratory results are comparable (precision evaluation) to more generally acceptable methods. Furthermore, it is recommended that Pogo consider additional quality control in running its cyanide samples.
6.1.1 and 6.1.2	States that all original data records will be kept on site for 5 years. It is not clear if there are five year worth of hard copy field data forms, after data is entered into the EDMS system it is not clear if the sheets are saved.
7.7	The QAP does not address the use of pressure transducers and data loggers for the measurement and recordation of water levels in piezometers or water level at flumes. It is recommended that, at a minimum, the frequency of data download from the data loggers and reference to a separate SOP to included. The QAP or the SOP should describe the data collection programing of the data logger, the equipment, frequency and process for data download, where data will be stored and how it will be managed, how data drift will be reviewed and corrected, how data will be corrected for barometric pressure, etc.
Sections 9.0-20.0	Add information regarding contingencies during sampling. What to do if sampling sites are inaccessible, how to document frozen conditions on field data sheets and in the database, how to document dry conditions in the database, etc.
9.1	States that "Operations personnel note wildlife sightings and any unusual activities or conditions (sickness, mortality etc.) surrounding the interactions." Only wildlife fatalities are being tracked at these facilities, not sightings.
9.2	States that any unusual wildlife interactions, such as mortalities or hazing events, which occur at the DSTF or the RTP Reservoir, are reported in the quarterly and annual water quality monitoring reports as required by the Waste Management Permit. This reporting is being conducted; however, this is not a requirement of the permit.

Table 11.3	Lists the hold time for ABA analysis of rock as 28 days. There is typically no holding time for ABA analysis.
17.1.1	States: “Pogo imports electronic data from the contract laboratories directly into EDMS as discussed in Section 8. The data is compared to the mean of the background data and any significant statistical variation (Outlier above 0.1% Significance, and Outlier Above 5% Significance) is noted and qualified within the EDMS database. Monitoring results are reported in the quarterly and annual reports.” No monitoring data comparison against background is provided in the reporting.
Table 17.2	Pogo does not appear to be consistently recording water elevations for the MW11 and MW200 wells because it is not a permit requirement. Or this may be a data recording issue. There are a couple dates (not predominance) where water quality data is available and water level data was not and vice versa. The QAP Table 17.2 states that they will monitor for water level.
17.1	"If well is frozen, record depth to frozen surface and thaw well by plugging heat trace into generator." In November 2015 a well was not sampled because it was frozen. If a well is known to freeze in the winter (MW11-001A) then for 4th Q sampling should probably be attempted in October, and in 1st Q attempted in March.
Pogo Mine Sampling Field Data Sheet	The volume constant value for the well bore volume calculations is incorrect for 6-inch wells. The value on the field data sheet is 1.35; but the value should be 1.469 for 6" wells (which is pi*r^2*7.48).
17.1	It is recommended text be added to clarify the target stabilization expected, such as "Stabilization is achieved after three successive readings are within ± 0.1 for pH, ± 10 mV for ORP, ± 5% for specific conductance, ± 10% for DO, and <10 NTU for turbidity. Sampling may begin once the well has stabilized (and the well is purged three bore volumes?)." In addition - the DO values for the sampling of groundwater are pretty high. If the meter was recently calibrated and passed for DO, then the well likely needed to purge for additional time.
Section 17.0	Table 17.3 in the QAP and Table 6.3 in the Monitoring Plan are the only mention of piezometers LT99-009 and MW99-216. It is recommended that the text address these wells, what purpose they serve, and what any change in trends may mean if observed.
Section 17.0	It is recommended that Pogo update QAP to provide direction for reporting the background values in the reporting tables and graphs, and where exceedances in the WQS are observed, complete statistical analysis to assess SSI over background per the WMP permit requirement for RTP, DSTF and ore zone monitoring wells.

Attachment 1

Groundwater Sampling Form

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APR 2 7 ENT'D

Pogo Mine Sampling Field Data Sheet

EDMS Site Number	MW12-001A
EDMS Site Identifier	MW12-001A
Date	4/26/2016
Time	1540
Profile	13g (Groundwater)
Duplicate Sample Indentifier	
Blank Sample Identifier	
LL HG Method Blank Sample Indentifier	MW12-001A_MB

Time:
Time:

DRY

Field Conditions

Temperature
Skies
Wind

Field Equipment

YSI
Gloves
Bottles
Cooler
Dipstick
DI Water
PPE

Field Preserved	Yes
Field Filtered	
Parmeters Measured at Lab	
Parameters Measured in the Field	

Volume Purged (gals)	Temperature (°C)	pH (pH units)	Specific Conductance (mS)	D.O. (mg/L)	Appearance
1300 5	5.92	7.11	144	9.45	Yellow
1330 75	5.07	6.88	142	8.94	Clear
150	~~5.05~~	~~7.54~~	143	9.65	Clear
1430 225 @Sample	5.37	7.29	147	12.10	Clear

Dedicated Pump
Portable Pump
Hand Bailer

Well	example	MW12-500	MW12-501	MW12-502	MW12-001A	MW12-001B	MW99-216
Depth to Bottom	50	36.45'	27.5'	17.8'	67.0'	160.0'	500.0'
Depth to Water	- 25	-	-	-	- 11.80 56	-	-
Water Height	= 25	=	=	=	=	=	=
Volume Constant	x 0.653	x 1.35	x 1.35	x 1.35	x 1.35	x 1.35	x 0.041
	75 125_ 150__				75		
One Well Volume	= 16.325	=	=	=	=	=	=
	x 3	x 3	x 3	x 3	x 3	x 3	x 3
Total Purge	48.975				225		

Well	LL04-031	LL04-032	MW04-213	MW11-216	MW11-001A	MW11-001B	LT99-009
Depth to Botom	63.0'	58.9'	152.6'	234.0'	38.85'	74.9'	
Depth to Water	-	-	-	-	-	-	-
Water Height	=	=	=	=	=	=	=
Volume Constant	x 0.163	x 0.163	x 0.163	x 0.653	x 0.653	x 0.653	x 0.163
One Well Volume	=	=	=	=	=	=	=
	x 3	x 3	x 3	x 3	x 3	x 3	x 3
Total Purge							

Field Team Members