Pogo Mine Monitoring Plan

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Pogo Mine Monitoring Plan

This document addresses the requirements of the Sumitomo Metal Mining Pogo LLC Pogo Mine Waste Disposal Permit 0131BA002, the solid waste regulations 18 AAC 60.800 – 860, the Alaska Pollutant Discharge Elimination System (APDES) permit (AK-0054334-1) and addresses the requirements of the Potable Water System Operation Approval for PWSID: 372643 (Pogo Construction Camp) and PWSID 372685 (Pogo Permanent Camp) as well as the State of Alaska Drinking Water Regulations, 18 ACC 80.

The Pogo Mine Monitoring Plan includes the following components:

- Visual monitoring plan, including the Drystack Tailings Facility (DSTF)
- Fluid Management Plan including the Recycle Tailings Pond (RTP);
- Geochemical monitoring plan;
- Surface water monitoring plan;
- Groundwater monitoring plan;
- Effluent monitoring plan;
- Drinking water monitoring plan;
- Appendix A: Rock Segregation Plan;
- Appendix B: Pogo Facilities Map and Monitoring Locations; and
- Appendix C: Inspection Forms.

The geotechnical monitoring plan for the drystack tailings facility is described in the Pogo Mine Drystack Tailings Facility Construction and Maintenance Plan, which is attached to Pogo's **Plan of Operations as Appendix F**.

1.0 PERMIT MANAGEMENT

Implementation of the Waste Management Permit falls under the Environmental Department and the Safety, Health and Environmental (SH&E) Manager who has direct reporting responsibilities to the Pogo General Manager.

Permit compliance and sampling and reporting activities are tracked by the SH&E Manager. All monitoring data are managed using the Environmental Data Management System (EDMS) data management software.

Copies of all inspection and sampling logs are maintained in the Pogo environmental files for at least five years.

2.0 VISUAL MONITORING PLAN

The visual monitoring program includes daily, weekly and annual inspections of the project facilities comprising the waste management system. These facilities are described in the Plan of Operations and shown schematically in plan view on Pogo Facilities Map and Monitoring Locations (**Appendix B**). Copies of the Drystack Weekly Inspection Log and the RTP Dam Inspection Form are shown in **Appendix C**.

2.1 Drystack Tailings Facility (DSTF)

The physical characteristics of the drystack are visually inspected by equipment operators on days when tailings are being placed. As part of their regular daily inspections, operations personnel look for unusual cracks, bulging, and signs of settlement, seepage and erosion on the drystack.

2.2 Incidental, Non-hazardous Waste Disposal within the DSTF

Incidental, non-hazardous, waste is placed within the mineralized rock layer. Incidental waste is encapsulated with drystack tailings in the same manner as mineralized rock. It is placed at least 50 feet from the drystack margins and contained in six foot thick lift of compacted mineralized rock and then covered with at least a two foot thick lift of compacted drystack tailing. Filter cake, from the Water Treatment Plants, is placed on compacted drystack tailing and covered with more compacted drystack tailings. Operations personnel are trained to place and cover inert, incidental waste so as to prevent blowing debris. Records are kept of the volume and description of the incidental non-hazardous waste placed in the DSTF.

2.3 Monitoring Wells

An environmental department individual observes the monitoring wells at least once per week for physical damage and maintains a record of observations.

2.4 Wildlife

Operations personnel monitor wildlife interactions with the surface waste disposal facilities in order to evaluate impacts that operations may have on wildlife. Records of wildlife interactions observed during the visual site inspections are recorded. The drystack operating personnel are trained to record observations of wildlife interaction at the DSTF and the RTP reservoir. Any wildlife mortalities that are observed are

recorded in a log maintained at the project site and the SH&E Manager or designate will contact the Alaska Department of Fish & Game (ADF&G) to report wildlife mortalities.

3.0 FLUID MANAGEMENT PLAN

3.1 Recycle Tailings Pond (RTP) Dam

The Environmental Department conducts a visual inspection of the RTP dam at least once per month and maintains a record of their observations. (See inspection form in **Appendix C**). The visual observations include looking for unusual cracks, bulging, settling, seepage and erosion on the RTP dam. A complete checklist was developed as part of the "RTP Dam Operation and Maintenance Manual".

Once every three years, as required by permit, a formal Periodic Safety Inspection (PSI) is completed by a professional engineer and the results shared with the State Dam Safety official.

3.2 Water Balance Management

Process water is managed by accounting for water discharged into, and withdrawn, from the RTP, as well as RTP water recycled to the mill and water treated and discharged to the Off-River Treatment Works (ORTW).

In periods where precipitation inflows are inadequate, makeup fresh water may be taken from the gravel ponds and pumped into the WTP#2 or the RTP. In the case of an emergency underground (e.g., potential flooding situations), treated water may be pumped to the RTP for storage. Whenever treated water is pumped into the RTP, ADEC will be notified.

Flow meters are associated with water that is pumped. Precipitation is recorded by a rain gauge and monitored daily during summer months. A snow survey is performed annually in the first quarter on the Drystack and RTP watersheds. The V-notch weir located below the Drystack is checked monthly when water is flowing. Flow rate is measured by visual observation at the weir.

A monthly water balance is determined from data provided by the monitoring schedule presented in **Table 3.1**.

Table 3.1: Fluid Management Monitoring Schedule

Fluid Stream	Measurement Type	Units	Frequency
Recycle Tailing Pond	Water Level	gallons	Continuous
Precipitation	Met Stations/ Rain Gauge	inches	Recording/Daily Reading
Snow Survey	Depth and Density	inches	Annual
Seepage Collection Wells	Flow Meter	gallons	Continuous
Gravel Pond Water to RTP	Flow Meter	gallons	Continuous
Fresh Water from Drystack to RTP	Flow through V-Notch Weir	gallons	When water is flowing/Monthly
RTP Water to Mill, Mine or MWTP#2	Flow Meter	gallons	Continuous
Mine Water to Mill or MWTP#2	Flow Meter	gallons	Continuous
Outfall 011 Discharge to ORTW	Flow Meter	gallons	Continuous

Pogo has a number of Permits to Appropriate Water (LAS designations) and Temporary Water Use Authorizations (TWUP designations), granted by ADNR. **Table 3.2** lists permits and associated water sources and water quantity limits. These water sources are monitored and gallons pumped are reported annually to ADNR. **Table 3.3** lists Temporary Water Use Authorizations, associated water sources and water quantity limits.

Table 3.2: Permits to Appropriate Water & Water Quantity Limits

Permit	Location	Measurement Type	Water Quantity Limits		
			Acre-feet per Year	Gallons per Year	Gallons per Minute
LAS 24611	Drinking Water Wells DW02 & DW03	Flow Meter	81.77	26.6 million	NA
LAS 24612	Gravel Pit Pond	Flow Meter	241.95	78.8 Million	NA
LAS 24613	Goodpaster River ORTW Influent	Flow Meter	24195.11	7,879 Million	15,000
LAS 24614	2 wells proposed upstream of ORTW	NA	3226.01	1,051 Million	NA
LAS 24615	4 wells proposed at headwaters of Liese Creek	NA	322.6	105.0 Million	NA
LAS 24616	Surface Water collected in RTP	Flow Meter	387.12	126.1 Million	NA
LAS 24617	Groundwater from Underground Workings	Flow Meter	395.19	128.7 Million	NA
LAS [1]	Seepage Collection Wells	Flow Meter			

[1] May be covered by LAS 24615.

Table 3.3: Temporary Water Use Authorizations (TWUP) & Water Quantity Limits

Permit	Location	Measurement Type	Water Quantity Limits			
			Acre-feet per Year	Gallons per Year	Gallons per Day	Gallons per Minute
TWUP F2006-17 Pogo Mine Access Road	Rosa Creek	Truck tanker loads	24.55	NA	80,000	NA
	Caribou Creek					
	Gilles Creek					
	Shaw Creek					
TWUP F2010-56 Pogo Mine Access Road Mile 0-Mile 28	Gilles Creek	Truck tanker loads	NA	2,400,000	35,000	200
Multi-Year 2010-2014 Hard rock Exploration #9500	15 different water sources approved, only 2 are used concurrently	Truck tanker loads and/or estimation of maximum pumping capacity	NA	NA	40,000 per water source, only 2 sources are used concurrently	NA

4.0 GEOCHEMISTRY

4.1 Drystack

The purpose of the geochemical monitoring program is to track trends in the tailings geochemistry and to compare the geochemical nature of the tailings material to the test work and assumptions used for the drystack design. It is applied to the materials placed on the general placement area.

A sampling schedule for Flotation Tailings, Flotation Interstitial Water and Mineralized Development Rock is shown in **Table 4.1**. Quarterly composites of monthly tailings samples collected from the process plant are submitted for geochemical analysis. Monthly Mineralized Development Rock samples are composited into a quarterly sample for analysis. The solid samples are analyzed for acid-base accounting using procedures generally recommended (Sobek et al, (1978)[1] see **Table 4.2**. The Target Range of greater than 1.4 for the Neutralization Potential/Acid Potential ratio was developed from average flotation tailings test material characteristics shown in Table 8 of the SRK 3 Kinetic Report. The solid samples are also analyzed for 48 element-ICP metals (plus mercury) monitoring parameters for flotation tailings and mineralized development rock placed in the Drystack, see **Table 4.3**. Process water is extracted from the tailings and analyzed for the parameters indicated in **Table 4.4**. A target range was established using actual operating data taking the mean plus or minus two standard deviations to cover the range of measured data. In many cases, the standard deviation is greater than the mean, making the lower range zero.

[1] The Sobek method is the most commonly used Acid Base Accounting method – Sobek A.A.,

Table 4.1: Drystack Sampling Schedule

Sample ID	Sample	Location	Frequency	Sample Type
PC003-solids	Flotation Tailing Solids	Mill Filter Building	Quarterly composite of Monthly samples	Grab
PC003	Flotation Tailing Interstitial Water	Mill Filter Building	Quarterly	Grab
PC002	Development Rock	Drystack, Active Area Mineralized Rock	Quarterly composite of Monthly samples	Grab

Table 4.2: Acid-Base Accounting of Flotation Tailing and Mineralized Development Rock Placed in Drystack

Parameter	Units	Method	Target Range
Paste pH	s.u.	Standard	NA
Inorganic Carbon	%	Sobek	NA
Total Carbon	%	Sobek	NA
Sulfate Sulfur (HCL Leachable)	%	LECO	NA
Sulfide Sulfur (calculated)	%	LECO	NA
Sulfur, Total	%	LECO	NA
Sulfur as Sulfate	%	LECO	NA
Neutralization Potential/Acid Potential	Ratio	Sobek	greater than 1.4
Maximum Potential Acidity	tCaCO3/1Kt	Sobek	NA
Net Neutralization Potential	tCaCO3/1Kt	Sobek	NA

Table 4.3: Flotation Tailing and Mineralized Development Rock Whole Rock Chemistry

Parameters[1]		
Aluminum	Indium	Strontium
Antimony	Lanthanum	Silver
Arsenic	Lead	Sulfur
Barium	Lithium	Tantalum
Beryllium	Magnesium	Tellurium
Bismuth	Manganese	Thallium
Calcium	Mercury	Thorium
Cadmium	Molybdenum	Titanium
Cerium	Niobium	Tin
Cobalt	Nickel	Tungsten
Chromium	Phosphorus	Uranium
Cesium	Potassium	Vanadium
Copper	Rubidium	Yttrium
Iron	Rhenium	Zinc
Gallium	Scandium	Zirconium
Germanium	Selenium	
Hafnium	Sodium	

[1]Arsenic and sulfur are the only metals required by permit to be monitored, the other metals are for informational purposes.

Table 4.4: Flotation Tailing Interstitial Water Chemistry and Operating Target Ranges

Parameter	Units	Method	Original Target[1]	Operating Target Range[2]	Average[2]	Standard Deviation[2]
Total Dissolved Solids	mg/L	EPA 160.1	3,000	1094 to 5040	3588	726
Chloride, total	mg/L	EPA 300.0	34	26 to 230	128	51
Sulfate, total	mg/L	EPA 300.0	2,000	528 to 2740	1634	553
Ammonia as TKN	mg/L	EPA 351.2	17.8	0 to 70.1	33.3	18.4
Nitrate	mg/L	EPA 300.0	4	8 to 236	122	57
Cyanide, WAD	µg/L	SM4500 – CN I	Not Calculated	0 to 29.1	12.3	8.4
Arsenic	µg/L	EPA 200.8	5,100	0 to 2335	569	883
Cadmium	µg/L	EPA 200.8	5	0 to 1.13	0.374	0.378
Chromium	µg/L	EPA 200.8	14	0 to 4.145	0.681	1.732
Copper	µg/L	EPA 200.8	34	0 to 20.97	5.29	7.84
Iron	µg/L	EPA 200.7	29,600	0 to 103.1	35.9	33.6
Lead	µg/L	EPA 200.8	5	0 to 5.972	0.67	2.651
Mercury	µg/L	EPA 1631E	2	0.001 to 0.0014	0.001	0.0002
Manganese	µg/L	EPA 200.8	4,750	0 to 650	226	212
Nickel	µg/L	EPA 200.8	240	0 to 18.2	7.6	5.3
Selenium	µg/L	EPA 200.8	130	0 to 190	60	65
Silver	µg/L	EPA 200.8	2	0 to 0.276	0.08	0.098
Zinc	µg/L	EPA 200.8	700	0 to 48.4	13	17.7

[1]Original Target based on the geochemical characterization of tailings produced as a result of pre-mine metallurgical tests.
[2]Operating Target Range based on mean plus or minus two standard deviations of data from 2006 through June 2010 while operating.

The tailings geochemical results are used to detect trends in tailings composition. Further investigation to determine an appropriate plan of action will be instituted with the appropriate agencies in the event that the interstitial water chemistry exceeds the operating target range for four consecutive quarters.

4.1.1 Development Rock Segregation and Storage

During development and operations, all rock from underground is handled as "mineralized" unless otherwise analyzed and segregated on a round-by-round basis in accordance with the rock segregation procedures identified in **Appendix A**.

Table 4.5 presents development rock segregation parameters for non-mineralized and mineralized development rock.

Table 4.5: Development Rock Segregation Parameters

Parameter	Units	Method	Non-mineralized Action Limit	Mineralized Rock Action Limit
Sulfur	%	XRF Spectrometer	Less than 0.5	Greater than 0.5
Arsenic	mg/kg	XRF Spectrometer	Less than 600	Greater than 600

4.2 Cyanide Detox of Carbon-In-Pulp (CIP) Tailings Prior to Paste Backfill

Prior to disposal as part of the paste backfill tailings, the CIP tailings are subjected to cyanide detoxification using the SO_2/air process or other suitable cyanide detoxification process approved by ADEC. Samples of the CIP tailings interstitial water are taken by mill operators before each paste pour (see **Table 4.7**). At least 90% of the samples shall contain less than ten ppm WAD cyanide and 100% of the samples shall contain less than 20 ppm WAD cyanide, based on analysis by Picric Acid Method of the interstitial water entrained in the CIP tailings prior to placement in the paste backfill (see **Table 4.8**). All CIP tailings are disposed in the underground workings of the mine.

Table 4.7: CIP Tailing Sampling Schedule

Sample ID	Sample	Location	Frequency	Sample Type
PC001	CIP Stock Tank	Mill Complex	Before Every Paste Pour	Grab

Table 4.8: CIP Tailing Analysis Profile

Parameter	Units	Method	Permit Limit	
			90% of samples	100% of samples
Cyanide-WAD	ppm	Picric Acid Method	10	20

5.0 SURFACE WATER MONITORING PLAN

The surface water quality monitoring program is designed to detect potential impacts to the surface water quality in the Goodpaster River. Five stations are used to monitor surface water quality (refer **Figure 1** in **Appendix B** for location map).

Surface water monitoring is being undertaken to fulfill the requirements of the Alaska APDES permit (AK-005334-1) and the ADEC Waste Disposal Permit (0131-BA002).
The APDES permit requires receiving water monitoring:

- To monitor any biological impacts to the Goodpaster River;
- To monitor changes that may occur as a result of activities associated with the discharges from the facility;
- To compare upstream and downstream monitoring results (to show any differences) and to compare monitoring results for each station over time, to show any trends; and
- To assure that state water quality standards are met and to provide information for future permitting actions.

The ADEC Waste Disposal permit requires surface water monitoring:

- For parameters at frequencies and locations, which will ensure that sample results are representative and statistically valid; and
- To detect a violation of a water quality standard.

The objective of the surface water monitoring program is to detect any adverse biological impacts and any exceedance of a water quality standard.

The surface water sampling schedule during active mining operations, Phase II, is shown in **Table 5.1**. Surface water parameters collected are shown in **Table 5.2**.

Whole fish samples of juvenile Chinook salmon are collected annually from the Goodpaster River just before freeze up. A minimum of ten fish are collected upstream from Pogo Mine at site SW01 and ten fish downstream of Pogo Mine at site SW12. Samples are collected to show comparisons in metals accumulation in fish tissue between the upstream and downstream locations. The sampling schedule for fish tissue during active mining operations, Phase II, are shown in **Table 5.1** and fish tissue sampling parameters are located in **Table 5.3**.

Table 5.1: Phase II Active Mining Operations Surface Water Sampling Schedule

Station ID	Sample Location	Sample Frequency	Sample Type
SW01	Above the project site, between Stingray and Otter Creeks	6/year- Late February to mid-March, mid-May, mid-June, early August, late September (including fish tissue samples), December	Grab
SW41	Below the ridge line that divides Liese Creek and Pogo Creek	6/year- Late February to mid-March, mid-May, mid-June, early August, late September, December	Grab
SW42	Near Outfall 002 (Sewage Treatment Plant Discharge)	6/year- Late February to mid-March, mid-May, mid-June, early August, late September, December	Grab
SW15	Below the project site	6/year- Late February to mid-March, mid-May, mid-June, early August, late September, December	Grab
SW12	Furthest downstream sampling point	Annually Late September (including fish tissue samples)	Grab
Dry Stack Toe	Dry Stack Toe	12/year – Monthly when water is present	Grab

Table 5.2: Surface Water Analytical Parameters Profile 13s and Water Quality Standards

Surface Water Parameters	Units	Method	Water Quality Standards
Alkalinity, as CaCO3	mg/L	SM 2320B	NA
Alkalinity, Total	mg/L	SM 2320B	NA
Aluminum, Total Recoverable	µg/L	EPA 200.7	87 to 750 if hardness ≥50 mg/L & pH ≥7
Ammonia, as TKN	mg/L	EPA 351.2	pH and temperature dependant
Antimony, Total	µg/L	EPA 200.8	6[1]
Arsenic, Dissolved	µg/L	EPA 200.8	10[1]
Cadmium, Dissolved	µg/L	EPA 200.8	0.094 to 0.64[2]
Calcium, Dissolved	mg/L	EPA 200.7	NA
Chromium, Dissolved	µg/L	EPA 200.8	100[1]
Chlorides	mg/L	EPA 300.0	230[3]
Conductivity, Field	µS/cm	EPA 120.1	NA
Copper, Dissolved	µg/L	EPA 200.8	2.7 to 29[2]
Cyanide, WAD	µg/L	SM 4500-CN I	5.2[4]
Fluoride	mg/L	EPA 300.0	NA
Dissolved Oxygen, Field	mg/L	EPA 360.1	NA
Hardness, as CaCO3	mg/L	SM 2340B	NA
Iron, Total Recoverable	µg/L	EPA 200.7	1000[3]
Lead, Dissolved	µg/L	EPA 200.7	0.54 to 11[2]
Manganese, Total Recoverable	µg/L	EPA 200.8	50[5]
Magnesium, Dissolved	mg/L	EPA 200.7	NA
Mercury, Dissolved	µg/L	EPA 1631E	0.05[5]
Nickel, Dissolved	µg/L	EPA 200.8	16 to 168[2]
Nitrate-Nitrite as Nitrogen	mg/L	SM4500-NO3E	10[1]
pH, Field	s.u.	EPA 150.1	6.5 to 8.5[6]
Potassium, Dissolved	mg/L	EPA 200.7	NA
Selenium, Total Recoverable	µg/L	EPA 200.8	4.6[3]
Silver, Dissolved	µg/L	EPA 200.8	0.30 to 379.30[7]
Sodium, Dissolved	mg/L	EPA 200.7	NA

Surface Water Parameters	Units	Method	Water Quality Standards
Sulfate	mg/L	EPA 300.0	250[6]
Temperature, Field	C	EPA 170.1	NA
Total Dissolved Solids	mg/L	EPA 160.1	500[6]
Total Suspended Solids	mg/L	EPA 160.2	NA
Turbidity	NTU	EPA 180.1	NA
Zinc, Dissolved	µg/L	EPA 200.8	36 to 379[7]

[1] Drinking water primary maximum contaminant levels.
[2] Chronic aquatic life fresh water. These criteria are hardness dependant. The range is shown for hardness of 25 to 400 mg/l $CaCO_3$.
[3] Chronic aquatic life fresh water.
[4] APDES Permit # AK0053341 specifies a site specific ML of 20 µg/L for WAD Cyanide.
[5] Human Health criteria for non-carcinogens.
[6] WQS for fresh water uses.
[7] Acute aquatic life fresh water.

Table 5.3: Fish Tissue Analytical Profile 8 and Action Limits

Fish Tissue Parameters	Units	Methods	Action Limits
Arsenic	mg/kg	EPA 200.8	NA
Antimony	mg/kg	EPA 200.8	NA
Cadmium	mg/kg	EPA 200.8	NA
Copper	mg/kg	EPA 200.8	NA
Lead	mg/kg	EPA 200.8	NA
Nickel	mg/kg	EPA 200.8	NA
Selenium	mg/kg	EPA 7740 or 7741A	NA
Silver	mg/kg	EPA 200.8	NA
Mercury (methyl mercury)	mg/kg	EPA 7741A or 1631	NA

Table 5.4 and **Table 5.5** represent the sampling schedule for Phase III and Phase IV Closure Operations and Phase V Post Closure. Refer to Pogo's Reclamation and Closure Plan for more details about the phases of closure.

Table 5.4: Phase III and IV Closure Operations Surface Water Sampling Schedule

Station ID	Sample Location	Sample Frequency	Sample Type
SW01	Above the project site, between Stingray and Otter Creeks	Monthly for 10 years during closure operations	Grab
SW15	Below the project site	Monthly for 10 years during closure operations	Grab
Dry Stack Toe	Dry Stack Toe	Monthly for 10 years during closure operations	Grab

Table 5.5: Phase V Post Closure Surface Water Sampling Schedule

Station ID	Sample Location	Sample Frequency	Sample Type
SW01	Above the project site, between Stingray and Otter Creeks	Annual sampling on years 1, 2,5,10, 15, 20, and 30	Grab
SW15	Below the project site	Annual sampling on years 1, 2,5,10, 15, 20, and 30.	Grab
Dry Stack Toe	Dry Stack Toe	Annual sampling on years 1, 2,5,10, 15, 20, and 30	Grab

5.1 Storm Water Pollution Prevention Plan and Best Management Practices Plan.

The Pogo Mine Storm Water Pollution Prevention Plan and the Best Management Practices Plan (SWPPP & BMP) sets forth monitoring and inspection guidelines to prevent storm water pollution. It address the requirements of the EPA NPDES Multi-sector General Permits for Storm Water Permit Number AKR05A026. A summary of sampling locations and monitoring requirements are below in **Tables 5.6**.

Table 5.6: Storm Water Sampling Locations

Station ID	Sample Location	Sample Frequency	Sample Type
SW21	Sediment pond, downstream of culvert outlet	Periodic	Grab

Periodic visual exams are performed using the Pogo Mine Storm Water Pollution Prevention Plan Monitoring Report form (**Appendix C**). A summary of visual quality parameters are below in **Tables 5.7**.

Table 5.7: Storm Water Quarterly Visual Quality Sampling

Visual Quality Parameters	
Color	Odor
Clarity	Floating Solids
Settleable Solids	Suspended Solids
Foam	Oil Sheen
Other Obvious Indicators of Storm Water Pollution	Duration of Storm Event
Estimate of Total Gallons of Discharge	Flow Description

Waste Rock and Overburden Piles Discharge Monitoring occurred twice annually in 2009 and 2010. None of the required parameters exceeded the benchmark monitoring limits and therefore Pogo is no longer required to perform twice annual sampling for

Waste Rock and Overburden Piles Discharge Monitoring, and is no longer required to file annual Storm Water Discharge Monitoring Reports.

Storm water quality inspections are required at least monthly from April to October of every year, or between spring break up and winter freeze up. Storm water inspections are also required after every 0.5 rain event. Any deficiencies must be corrected as soon as possible, but not later than 14 days after the inspection. These inspections are performed using the Storm Water Quality Mine Site Inspection Checklist is in **Appendix C**.

An Annual Comprehensive Site Evaluation is required and usually takes place in June. It includes a review of the SWPPP & BMP, a visual inspection of the site (also using Storm Water Quality Mine Site Inspection Checklist in **Appendix C**) and any recommended revisions. The results are summarized into an annual report and filed in the SWPPP & BMP. Corrective action must be made within 14 days, implementation of any SWPPP & BMP changes must occur within 12 weeks of annual inspection.

In conjunction with the Annual Comprehensive Site Evaluation, an Annual Report is also required to be submitted to ADEC. It must be submitted within 45 days after the Annual Comprehensive Site Evaluation, (using the EPA Annual Report Form is in **Appendix C**).

The Pogo Mine Storm Water Pollution Prevention Plan and the Best Management Practices Plan are updated annually or as changes occur. The Best Management Practices Plan (BMP) is reviewed annually by the BMP committee, which also serves as the Storm Water Pollution Prevention Team, and by the Pogo Mine General Manager and the BMP Committee Chairperson. Notice of BMP Certification must be submitted to the Alaska Department of Environmental Conservation as part of the APDES requirements by January 31 of the following year (BMP Committee Annual Review Certification and Signature form, **Appendix C**). **Table 5.8** shows Storm Water Inspections and Reporting Requirements.

Table 5.8: Storm Water Inspections and Reporting Requirements

Inspection/Reporting	Frequency	Deadline
Storm Water Quality Inspections	Monthly, from break up to freeze up, and/or whenever a 0.5 rain event occurs	NA
Annual Comprehensive Site Evaluation	Usually occurs in June	June 31
Annual Report	Occurs in conjunction with Annual Comprehensive Site Evaluation	Due 45 days after Site Evaluation
SWPPP & BMP Review	Updated annually, or as changes occur	NA
BMP Certification	Annually	January 31 of the following year

6.0 GROUNDWATER MONITORING PLAN

During the course of building the Pogo Mine, the natural groundwater flow has reacted to the cone of depression created by the mining operations. Currently, groundwater flows are towards the mine. Approximately ten years after mining operation are completed, and the cone of depression no longer exists, the generally northwest groundwater flow direction will gradually re-establish (Adrian Brown, 2000). Therefore, the groundwater monitoring program is designed to detect potential impacts downstream of the seepage return system and the cone of depression around the mine.

A set of three groundwater monitoring wells are located approximately 450 feet downstream of the RTP dam toe (**Figure 1 Appendix B**). These wells are designed to detect seepage from the RTP and the seepage collection/return system. These wells allow collection of water samples for testing and comparison with baseline conditions.

Groundwater monitoring is being undertaken to address the requirements of the ADEC waste disposal permit (0131BA002). The groundwater monitoring program consists of:

- Water quality detection monitoring at compliance points MW03-500, MW03-501, MW03-502 (refer to **Table 6.3**),
- Water quality trend monitoring at stations MW04-213 and MW11-216, and
- Water elevation trend monitoring at MW11-001A and MW11-001B below the toe of the Drystack and above the RTP.

Table 6.1 represents the sampling schedule for groundwater monitoring during active mining operation phase.

Table 6.1: Phase II Active Operations Groundwater Sampling Schedule

Sample Class	Sample Location	Frequency	Sample Type
Monitoring Wells	MW04-213	Semi-Annually	Grab
	MW11-216	Semi-Annually	
	MW03-500	Quarterly	
	MW03-501	Quarterly	
	MW03-502	Quarterly	
	MW11-001A	Quarterly	
	MW11-001B	Quarterly	
Piezometer	LT99-009	Quarterly	Measurement Static Groundwater Level

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The groundwater monitoring programs are designed to detect any potential seepage from the solid waste facilities and monitor trends as the underground workings are developed.

The objectives of the groundwater monitoring program are (1) to detect an exceedance of a water quality standard; for those parameters that have a natural condition exceeding the water quality standards, detect an increase in concentration above the natural condition; and (2) to detect a statistically significant increase above background in water quality.

A list of groundwater parameters sampled is located in **Table 6.2**.

Table 6.2: Groundwater Analytical Parameters Profile 13g and Water Quality Standards

Groundwater Parameters	Units	Method	Water Quality Standards
Alkalinity, as CaCO3	mg/L	SM 2320B	NA
Alkalinity, Total	mg/L	SM 2320B	NA
Ammonia, as TKN	mg/L	EPA 351.2	pH and temperature dependant
Antimony, Dissolved	µg/L	EPA 200.8	6[1]
Arsenic, Dissolved	µg/L	EPA 200.8	6[1]
Cadmium, Dissolved	µg/L	EPA 200.8	0.094 to 0.64[2]
Calcium, Dissolved	mg/L	SM 2340B	NA
Chloride	mg/L	EPA 300.0	230[3]
Chromium, Dissolved	µg/L	EPA 200.8	NA
Conductivity, Field	µS/cm	EPA 120.1	NA
Copper, Dissolved	µg/L	EPA 200.8	2.7 to 29[2]
Cyanide, WAD	µg/L	SM 4500-CN I	5.2
Dissolved Oxygen, Field	mg/L	EPA 360.1	NA
Fluoride	mg/L	EPA 340.2	NA
Hardness, as CaCO3	mg/L	EPA 2340B	NA
Iron, Dissolved	µg/L	SM4500-NO3E	1000[3]
Lead, Dissolved	µg/L	EPA 200.7	0.54 to 11[2]
Magnesium, Dissolved	mg/L	EPA 200.7	NA
Manganese, Dissolved	µg/L	EPA 200.8	50[4]
Mercury, Dissolved	µg/L	EPA 1631	0.77[3]
Nickel, Dissolved	µg/L	EPA 200.8	16 to 168[2]
Nitrate-Nitrite as Nitrogen	mg/L	SM4500-NO3E	10[1]
pH, Field	s.u.	EPA 150.1 (Field)	6.5-8.5[5]
Potassium, Dissolved	mg/L	EPA 200.7	NA
Selenium, Dissolved	µg/L	EPA 200.8	4.6[3]

Groundwater Parameters	Units	Method	Water Quality Standards
Silver, Dissolved	µg/L	EPA 200.8	0.30 to 379.30[6]
Sodium, Dissolved	mg/L	EPA 200.7	NA
Sulfate	mg/L	EPA 300.0	250[6]
Temperature, Field	C	EPA 170.1	NA
Total Dissolved Solids	mg/L	EPA 160.1	500[6]
Zinc, Dissolved	µg/L	EPA 200.8	36 to 379[6]

[1] Drinking water primary maximum contaminant levels.
[2] Chronic aquatic life fresh water. These criteria are hardness dependant. The range is shown for hardness of 25 to 400 mg/l $CaCO_3$.
[3] Chronic aquatic life fresh water.
[4] Human Health criteria for non-carcinogens.
[5] WQS for fresh water uses.
[6] Acute aquatic life fresh water.

Groundwater monitoring wells MW03-500 and MW03-501 and MW03-502 are used to detect any water escaping from the RTP, which is a zero discharge facility. Exceedance of any value in Table 6.3 triggers a corrective action according to section 1.8 of the Pogo Waste Management Permit No. 0131-BA002.

Table 6.3: Upper Tolerance Limit Concentration Triggering Corrective Actions

Parameter	Units	Location		
		MW03-500	MW03-501	MW03-502
Antimony, Dissolved	µg/L	0.36	0.35	0.35
Arsenic, Dissolved	µg/L	47.8	47.6	45.0
Chloride	mg/L	0.79	1.23	1.06
Cyanide, WAD	µg/L	5.2	5.2	5.2
Nitrate as Nitrogen	mg/L	1.28	2.66	2.39
Potassium, Dissolved	mg/L	3.18	3.69	3.27
Selenium, Dissolved	µg/L	1.35	0.99	0.64
Sodium, Dissolved	mg/L	5.41	5.27	3.90

Tables 6.4 and 6.5 present the sampling schedule for groundwater monitoring during Phase III and IV Closure Operations and Phase V Post Closure. Refer to Pogo's Reclamation and Closure Plan for more details about phases of closure.

Table 6.4: Phase III & IV Closure Groundwater Sampling Schedule

Sample Class	Sample Location	Frequency	Sample Type
Monitoring Wells	MW04-213	Semi-Annually for 10 years during closure operations	Grab
	MW11-216		
	MW03-500	Quarterly for 10 years during closure operations	
	MW03-501		
	MW03-502		
	MW11-001A		
	MW11-001B		

Table 6.5: Phase V Post Closure Groundwater Sampling Schedule

Sample Class	Sample Location	Frequency	Sample Type
Monitoring Wells	MW04-213	Sample Year 1, 2, 5, 10, 15, 20, and 30 at Post-Closure years during care and maintenance	Grab
	MW11-216		
	MW03-500		
	MW03-501		
	MW03-502		
	MW11-001A		
	MW11-001B		

7.0 EFFLUENT MONITORING PLAN

Effluent monitoring is required by the APDES permit (AK-005334-1).

The APDES permit requires effluent monitoring:

- To monitor the limits placed on the types and amounts of pollutants that are discharged to ensure protection of water quality and human health.

The objective of the effluent monitoring program is to detect an exceedance of an effluent limitation or an adverse biological impact.

The facility discharges to the Goodpaster River through two outfalls. Outfall 001 is the discharge point for treated mine drainage and excess precipitation. Outfall 002 is the discharge point for treated domestic wastewater. The outfalls and additional monitoring stations are shown on **Figure 1** in **Appendix B** and described below in **Table 7.1**.

Table 7.1: Effluent Monitoring Outfall Locations

Station ID	Location	Purpose
Outfall 001	Mine water effluent stream after the last treatment unit prior to discharge into the receiving waters.	To monitor the effluent quality before discharge into the receiving waters.
Outfall 011	At the Mine Water Treatment Plant (MWTP) near the 1525 Portal.	To monitor the MWTP performance.
NPDES 001B	Influent pond (Pond 1), upstream inlet of the Goodpaster River prior to any mine influence.	To establish the natural condition concurrent with the discharge.
Outfall002	Sewage effluent stream after the last treatment unit prior to discharge into the receiving waters.	To monitor the effluent quality before discharge into the receiving waters.
STP002	Influent to the Sewage Treatment Plant (STP).	To monitor the STP performance.

The effluent monitoring schedules can be found in **Table 7.2**.

Table 7.2: Effluent Monitoring Schedule

Station ID	Frequency	Sample Type
Outfall 001	Weekly, Monthly, and Annual (prior to August 1)	Grab
NPDES 001b	Monthly	Grab
Outfall 011	Weekly & Quarterly	Grab
Outfall 002	Weekly	Grab
STP 002	Quarterly	Grab

Stream Gauging is necessary to determine whether there is sufficient water flowing in the Goodpaster River to allow discharge. If the flow drops below 20 cf/s discharge is not allowed. The USGS maintains a stream flow gauge on the Goodpaster River near the Goodpaster Bridge and the data is made available to Pogo. In the winter when the USGS does not monitor river flow, Pogo does its' own stream gauging to determine river flow as needed.

A list of weekly, monthly and annual parameters sampled at Outfall 001 is included in **Table 7.3, Table 7.4, and Table 7.5**.

Table 7.3: Outfall 001 Weekly Analytical Parameters Profile 10a and Effluent Limits

Effluent Parameters	Units	Methods	APDES Effluent Limit	
			(Daily Maximum)	(Monthly Average)
Cadmium, Total Recoverable	µg/L	EPA 200.8	0.2	0.1
Copper, Total Recoverable	µg/L	EPA 200.8	4.5	2.2
Cyanide, WAD	µg/L	SM 4500-CN I	6.9[1]	4.7[1]
Floating Solids	Presence/Absence	NA	Trace Amounts	Trace Amounts
Hardness, as CaCO3	mg/L	EPA 2340B	NA	NA
Lead, Total Recoverable	µg/L	EPA 200.8	1.3	0.5
Outfall Flow	gpm	Continuous Recording	15,600	NA
pH	s.u.	EPA 150.1	6.5 to 8.5	6.5 to 8.5
Visible Foam	Presence/Absence	NA	Trace Amounts	Trace Amounts

[1]APDES Permit # AK0053341 specifies a site specific ML of 20 ug/L for WAD Cyanide

Table 7.4: Outfall 001 Monthly Analytical Parameters Profile 10b and Effluent Limits

Effluent Parameters	Units	Methods	APDES Effluent Limit	
			(Daily Maximum)	(Monthly Average)
Arsenic, Total Recoverable	µg/L	EPA 200.8	NA	NA
Hardness, as CaCO3	mg/L	EPA 2340B	NA	NA
Manganese, Total Recoverable	µg/L	EPA 200.8	NA	NA
Mercury, Total	µg/L	EPA 1631	0.02	0.01
Sulfates	mg/L	EPA 300.0	NA	NA
Total Dissolved Solids	mg/L	EPA 160.1	NA	NA
Turbidity, effluent	NTU	EPA 180.1	NA	5[1]
Turbidity, natural condition (Station NPDES001B)	NTU	EPA 180.1	NA	NA
Zinc, Total Recoverable	µg/L	EPA 200.8	43.0	16.8

[1] Difference in Turbidity between Outfall 001 and NPDES001B cannot be greater than 5 NTU

Table 7.5: Outfall 001 Annual Whole Effluent Toxicity (WET) Testing and Target Level

Effluent Parameter	Units	Method	APDES Target Level
Whole Effluent Toxicity, chronic	TU_c	EPA/821-R-02-013, October 2002	2

A list of weekly and quarterly parameters sampled at Outfall 011 is included in **Table 7.6, and Table 7.7**.

Table 7.6: Outfall 011 Weekly Analytical Parameters Profile 11a and Effluent Limits

Effluent Parameters	Units	Method	APDES Effluent Limit	
			(Daily Maximum)	(Monthly Average)
Cyanide, WAD	µg/L	SM 4500-CN I	NA	NA
Hardness, as $CaCO_3$	mg/L	SM 2340B	NA	NA
Iron, Total Recoverable	µg/L	EPA 200.7	1639	817
Outfall Flow	gpm	Continuous Recording	600	NA
pH	s.u.	EPA 150.1	6.0 to 9.0	NA
Total Suspended Solids	mg/L	EPA 160.2	30	20

Table 7.7: Outfall 011 Quarterly Analytical Parameters Profile 11b and Effluent Limits

Effluent Parameters	Units	Method	APDES Effluent Limit	
			(Daily Maximum)	(Monthly Average)
Aluminum, Total Recoverable	µg/L	EPA 200.7	NA	NA
Arsenic, Total Recoverable	µg/L	EPA 200.8	NA	NA
Cadmium, Total Recoverable	µg/L	EPA 200.8	100	50
Chlorides	mg/L	EPA 300.0	NA	NA
Chromium, Total	µg/L	EPA 200.8	NA	NA
Copper, Total Recoverable	µg/L	EPA 200.8	300	150
Lead, Total Recoverable	µg/L	EPA 200.8	600	300
Mercury, Total	µg/L	EPA 1631E	2	1
Nickel, Total Recoverable	µg/L	EPA 200.8	NA	NA
Outfall Flow	gpm	Continuous Recording	600	NA
Selenium, Total Recoverable	µg/L	EPA 200.8	NA	NA
Silver, Total Recoverable	µg/L	EPA 200.8	NA	NA
Sulfates	mg/L	EPA 300.0	NA	NA
Total Dissolved Solids	mg/L	EPA 160.1	NA	NA
Zinc, Total Recoverable	µg/L	EPA 200.8	1500	750

A list of weekly and quarterly parameters sampled at Outfall 0002 is included in **Table 7.8, and Table 7.9**.

Table 7.8: Weekly Effluent Sewage Treatment Plant Outfall 002 Analytical Parameters Profile 12a and Effluent Limits

Effluent Parameters	Units	Methods	APDES Effluent Limit		
			(Daily Maximum)	(Monthly Average)	(Weekly Average)
Biochemical Oxygen Demand (BOD_5)	mg/L	EPA 405.1 or SM 5210B	60	30	45
Dissolved Oxygen	mg/L	EPA 360.1	> 2	NA	NA
Fecal Coliform	#/100 mL	SM 9222D	400	200	NA
Floating Solids	Presence/ Absence	NA	Trace Amounts	NA	NA
Foam	Presence/ Absence	NA	Trace	NA	NA
Nitrate-Nitrite as Nitrogen	mg/L	SM4500-NO3E	160	80	NA
Oily Wastes (Sheen on Receiving Water Surface)	Presence/ Absence	NA	Absent	NA	NA
Outfall Flow	gpd	Daily Recording	72,000	NA	NA
pH	s.u.	EPA 150.1	6.0 to 9.0	NA	NA
Total Suspended Solids	mg/L	EPA 160.2	60	30	45

Table 7.9: Quarterly Influent SewageTreatment Plant (STP002) Analytical Parameters Profile 12b and Effluent Limits

Influent Parameters	Units	Methods	APDES Effluent Limit (% Removal)
Biochemical Oxygen Demand (BOD_5)	mg/L	EPA 405.1 or SM 5210B	85
Total Suspended Solids	mg/L	EPA 160.2	85

8.0 DRINKING WATER MONITORING PLAN

The Drinking Water Monitoring fulfills the requirements of the Potable Water System Operation Approval for PWSID: 372643 (Pogo Construction Camp) and PWSID 372685 (Pogo Permanent Camp) as well as the State of Alaska Drinking Water Regulations, 18ACC80. Both water systems are classified as Type: Non-Transient, Non Community (Class A) Source: GWUDISW (Ground Water Under the Influence of Surface Water).

The drinking water monitoring program consists of:

- Water quality detection monitoring at entry points Potable Water Treatment 1 (PWT1) construction camp and Potable Water Treatment 2 (PWT2) permanent camp, and designated locations throughout the distribution system.

Tables 8.1 and **8.2** represent the sampling schedule for drinking water monitoring during active mining operating and **Table 8.3** shows the drinking water parameters and ADEC maximum contaminant limits.

Table 8.1: Drinking Water Monitoring Schedule for Pogo Construction Camp PWSID: 372643

Drinking Water Parameter	Sample Location	Frequency	Sample Type
Arsenic	Entry Point of Distribution System	Annual	Grab
Asbestos	Distribution System, Waiver granted until 2014	NA	NA
Bromate	Entry Point of Distribution System	Monthly	Grab
Chlorine Residual, End Points	Rotating Throughout the Distribution System associated with Total Coliform Bacteria Sampling	Monthly	Grab
Disinfection Residual (Chlorine) at Entry Point	Entry Point of Distribution System	Daily	Grab
Lead and Copper	Designated Sites Throughout Distribution System	5 samples Annually	Grab
New Inorganics	Entry Point of Distribution System	2011 & 2020	Grab
Nitrate	Entry Point of Distribution System	Annual	Grab
Old Inorganics	Entry Point of Distribution System	2011 & 2020	Grab
Pesticides & Other Organics SOC/OOC	Waiver, renew by 12/31/2012	Waiver renew by 12/31/2015	NA
Total Coliform Bacteria	Rotating Throughout the Distribution System	Monthly	Grab
TTHM & HAA5	End of Distribution System	Annual	Grab
Sanitary Survey	Entire Potable Water System, next survey due in 2012	Every 5 Years	NA
Turbidity	After Filters	Daily	Grab
Volatile Organic Compounds	Entry Point of Distribution System	Annual	Grab

Table 8.2: Drinking Water Monitoring Schedule for Pogo Permanent Camp PWSID: 372685

Drinking Water Parameter	Sample Location	Frequency	Sample Type
Arsenic	Entry Point of Distribution System	Annual	Grab
Asbestos	Distribution System, Waiver granted until 2014	NA	NA
Bromate	Entry Point of Distribution System	Monthly	Grab
Chlorine Residual, End Points	Rotating Throughout the Distribution System associated with Total Coliform Bacteria Sampling	Monthly	Grab
Disinfection Residual (Chlorine) at Entry Point	Entry Point of Distribution System	Daily	Grab
Lead and Copper	Designated Sites Throughout Distribution System	10 samples Semi-Annually	Grab
New Inorganics	Entry Point of Distribution System	2011 & 2020	Grab
Nitrate	Entry Point of Distribution System	Annual	Grab
Old Inorganics	Entry Point of Distribution System	2011 & 2020	Grab
Pesticides & Other Organics SOC/OOC	Waiver, renew by 12/31/2012	Waiver renew by 12/31/2015	NA
Sanitary Survey	Entire Potable Water System, next survey due in 2011	Every 5 Years	NA
Total Coliform Bacteria	Rotating Throughout the Distribution System	Monthly	Grab
TTHM & HAA5	End of Distribution System	Annual	Grab
Turbidity	After Filters	Daily	Grab
Volatile Organic Compounds	Entry Point of Distribution System	Annual	Grab

Table 8.3: Drinking Water Sampling Parameters for: Pogo Construction Camp PWSID: 372643 and Pogo Permanent Camp PWSID: 372685 and Maximum Contaminate Limits

Drinking Water Parameters	Units	Method	ADEC Drinking Water Maximum Contaminate Limit
Arsenic	µg/L	EPA 200.8	10
Bromate	µg/L	EPA 300.1	10
Chlorine Residual, End Points	mg/L	EPA 334.0	At Least Detectable
Disinfection Residual (Chlorine) at Entry Point	mg/L	EPA 334.0	Greater Than 0.2
Copper	µg/L	EPA 200.8	1300
HAA5	µg/L	EPA 552.2	60
Lead	µg/L	EPA 200.8	15
New Inorganics	various	various	various
Nitrate	mg/L	EPA 300.0	10
Old Inorganics	various	various	various
Total Coliform Bacteria	#/100ml	SM 9223B-PA	1
TTHM	µg/L	EPA 524.2	80
Volatile Organic Compounds	µg/L	EPA 524.2	various

Pogo drinking water treatment plants operate in compliance with the Public Water System Final Operation Approval. **Tables 8.4** and **8.5** represent the Operation Approval parameter limits for drinking water monitoring during active mining operating.

Table 8.4: Drinking Water Operation Approval Limits for Pogo Construction Camp PWSID: 372643

Water Quality Parameter	Units	Limit
Ozone Residual (at outlet of first contactor)	mg/L	≥ 0.3
Water Temperature entering ozone contactor	C	≥ 5
Turbidity (after filtration but before orthophosphate and chlorine addition)	NTU	≤ 1.49[1]
Treatment Plant Flow Rate	gpm	≤ 20[2]
Orthophosphate dose	mg/L	< 15

[1] 95% of monthly reported reading must be less than limit; no spikes greater than 5 NTU.
[2] Record flow rate daily during peak WTP flow and submit with monthly operating report.

Table 8.5: Drinking Water Operation Approval Limits for Pogo Permanent Camp PWSID: 372685

Water Quality Parameter	Units	Limit
Ozone Residual (at outlet of first contactor)	mg/L	≥ 0.3
Water Temperature entering ozone contactor	C	≥ 5
Turbidity (after filtration but before orthophosphate and chlorine addition)	NTU	≤ 1.49[1]
Treatment Plant Flow Rate	gpm	≤ 28[2]
Orthophosphate dose	mg/L	< 15

[1] 95% of monthly reported reading must be less than limit; no spikes greater than 5 NTU.
[2] Record flow rate daily during peak WTP flow and submit with monthly operating report.

9.0 SIGNIFICANT CHANGES TO THE POGO MINE MONITORING PLAN

Table 9.1: Table of Significant Changes

Change #	Change Requested By	Description	Affected Section
1	ADEC	Added requirement for dry stack toe monitoring	Section 5.0 Table 5.1
2	ADEC	Removed requirement to monitor ORTW monitoring wells LL04-031 and LL04-032.	Section 6.0 Tables 6.1, 6.2 & 6.3
3	ADEC	Added requirement for new monitor wells between dry stack and RTP (shallow and deep wells)	Section 6.0 Tables 6.1, 6.2 & 6.3
4	Pogo	Added operating target range and average and standard deviation for operating data (2006-June 2010).	Section 4.0 Table 4.3
5	Pogo	Removed geotechnical monitoring plan	Removed Section 3.0
6	Pogo	Changed the visual monitoring form for RTP Dam	Appendix C
7	Pogo	Input monitoring requirements included in QAPP.	All
8	Pogo	Added Water Use Permit Monitoring	Section 3.2
9	Pogo	Added Storm Water Monitoring	Section 5.1
10	ADEC	Revised as per Agency comments	All

Appendix A

Development Rock Segregation and Tracking Procedures (September 9, 2010)

Pogo Development Rock Segregation and Tracking Procedures September 9, 2010

1.0 Introduction

Development rock are classified as 'mineralized' if it contains >600 ppm arsenic or >0.5% sulfur. Mineralized development rock are segregated for long-term storage because of the potential for generating acid rock drainage (ARD) and/or neutral arsenic leaching as a consequence of weathering.

This section describes the procedures that are utilized to sample, analyze, segregate, and track this development rock during the pre-production and production phases of the mine.

2.0 Development Rock Sampling

A 20 lb sample is collected from the blast hole drill cuttings for each round prior to blasting. The sample is hand collected from the accumulation of drill cuttings at the base of the face by a miner, and is collected so as to provide a representative sample. The miner will then mark the blasted rock with a 1"x36" wood lathe with a unique label indicating the heading from which it came and the shift and date it was shot. A geologist will assign a unique sample number to the sample, and deliver it to the on-site laboratory as soon as practical.

3.0 Development Rock Geochemical Analysis

At the on-site laboratory, the samples are dried at 105 degrees C. Once dry, the sample is passed through the TM crusher to attain a particle size of 85% minus 10 mesh. The sample is then riffled to a mass of 200-300 grams. This amount is then pulverized in an 800 gram barrel for five minutes. The final grind is 90% minus 150 mesh. For samples high in clay, or oxidized or carbonaceous, it may be necessary to add 1.0 ml of methanol to prevent sticking during the pulverizing process. The sample is then rolled on Kraft paper. Two grams of binder and 18 grams of sample are weighed, mixed and compressed at 60,000 psi to form a pellet.

The pellet is analyzed by a wavelength dispersive x-ray fluorescence spectrometer (XRF) to determine the sulfur (S), arsenic (As) and iron (Fe) content. Sensitivities for the XRF are 1 ppm arsenic and 0.01% sulfur. The accuracy of the XRF is maintained

through the use of pure element standards and a library of known standards made previously from Pogo development rock samples. Mineralized development rock thresholds are established at >600 ppm arsenic or >0.5% sulfur.

4.0 Development Rock Segregation

The objective of the segregation plan is to keep individual rounds of development rock separated until they can be classified as 'mineralized' or 'non-mineralized' and ensure that all mineralized development rock is placed in the 1525 mineralized stockpile, underground, or the tailings dry stack. All mineralized development rock that comes to the surface will eventually be placed in the dry stack for permanent storage.

Development rock is moved from the face directly to a temporary storage pad on the surface or, most often, to a remuck bay near the face. In both cases the round (muck pile) are kept separate from other rounds of development rock pending geochemical analysis of the sample for that round. The use of remuck bays shortens mucking time, thus enabling quicker access to the new face for another drill-load-blast cycle.

The mine-crew supervisor will ensure that the scoop or haul truck driver plants the labeled picket into the visible end of the muck pile after it is moved to the surface or a remuck bay. By default, any time a picketed muck pile must be moved to another location, the picket must be moved and re-inserted in the most visible end of the pile at the new location by the miner/operator that moves the pile.

Under no circumstances shall a pile be moved without a picket. If an operator encounters a pile that does not have a picket, the operators shall not move the pile without first contacting the shift supervisor, who shall then contact the geology department. The geology department shall review the tracking information to determine if the pile can be accounted for. If so, the pile shall be re-picketed and handled appropriately. If the pile cannot be accounted for, it shall be picketed as a mineralized pile and handled as mineralized rock.

As soon as practical after the chemical analyses for a round is reported to the geology staff by the on-site laboratory, a geologist will flag the appropriate picket either fluorescent green for a 'non-mineralized' classification or orange for a 'mineralized' classification. Once the muckpile has been classified, the surface shift supervisor may instruct an operator to move the rock to its final destination.

If the development rock is classified 'mineralized', it is hauled to long term storage. If the rock is 'non-mineralized' it may be used on surface for construction.

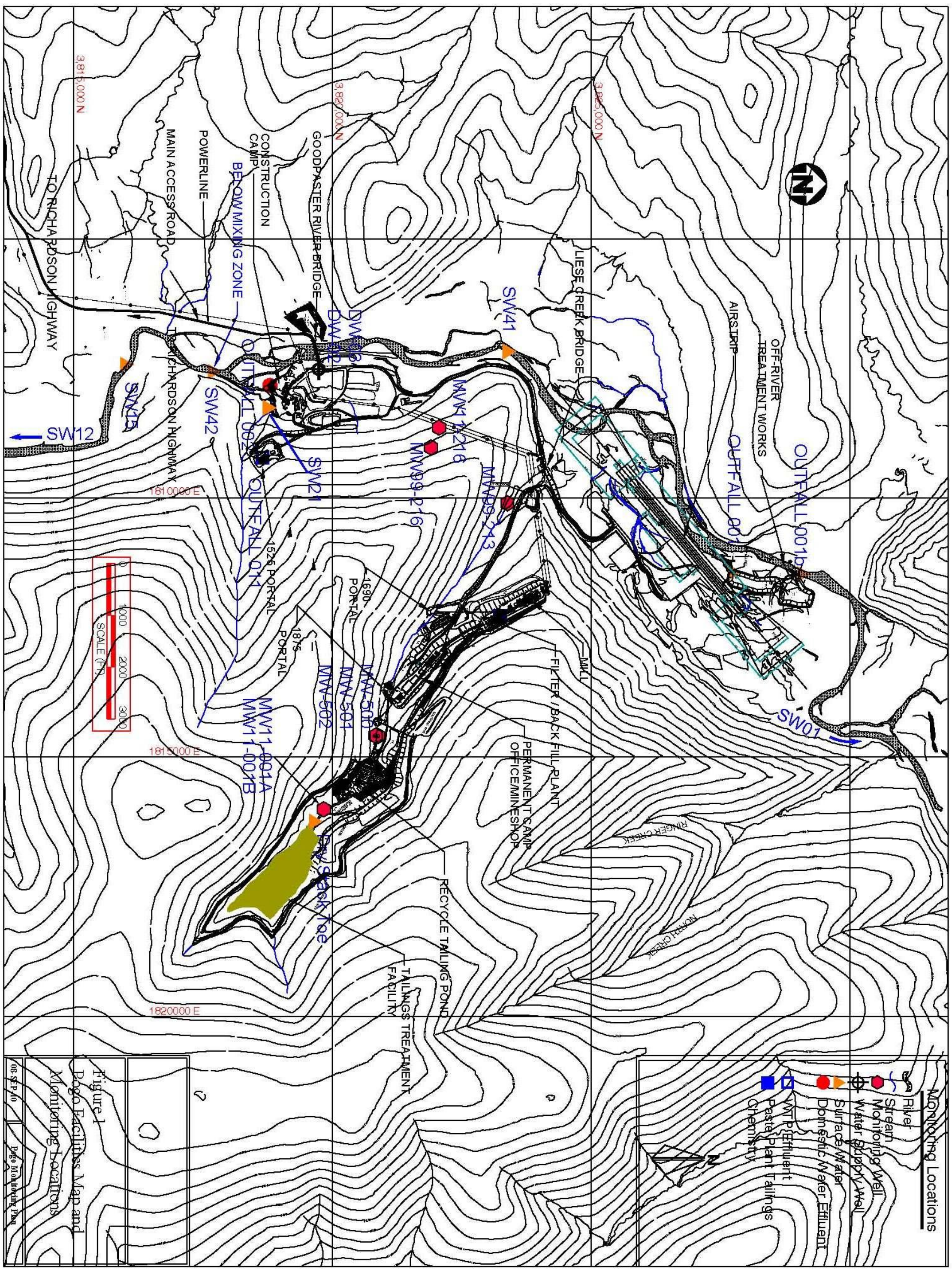
If limited space or other operational limitations preclude the temporary segregation of any individual round, or obtaining a chemical analysis for any round, that round are classified and picketed as 'mineralized' and disposed as if it had been determined to be mineralized on the basis of a chemical analysis.

5.0 Development Rock Tracking and Documentation

Each round of development rock is tracked by its unique number from blast to its classification as 'mineralized' or 'non-mineralized'. Documentation of the sampling, analysis, classification, tracking and disposition will include an AutoCAD map accompanied by an Excel spreadsheet that is updated daily to reflect the origin and destination of each round.

Appendix B

Figure 1: Pogo Facilities Map and Monitoring Locations


Monitoring Locations
River
Stream
Monitoring Well
Water Supply Well
Surface Water
Domestic Water Effluent
WTP Effluent
Paste Plant Tailings Chemistry
Figure 1
Pogo Facilities Map and Monitoring Locations
TO RICHARDSON HIGHWAY
RICHARDSON HIGHWAY
MAIN ACCESS ROAD
POWERLINE
CONSTRUCTION CAMP
BELOW MIXING ZONE
GOODPASTER RIVER BRIDGE
LIESE CREEK BRIDGE
AIRSTRIP
OFF-RIVER TREATMENT WORKS
OUTFALL 001b
SW01
SW12
SW41
SW42
SW21
OUTFALL 011
1525 PORTAL
1690 PORTAL
1875 PORTAL
MW-501
MW-502
MW11-001A
MW11-001B
FILTER / BACK FILL PLANT
PERMANENT CAMP OFFICE/MINESHOP
RECYCLE TAILING POND
TAILINGS TREATMENT FACILITY
SCALE (FT)

Appendix C

Inspection Forms

Dry Stack Weekly Inspection Log

Date	Name of Inspector	Observations (Y=observed; N= not observed)					Description of Observation
		Unusual cracks	Bulging	Signs of Settlement	Seepage	Erosion	

Pogo Mine RTP Dam Monthly Inspection Report

Date		Inspector	

Record Readings				
RTP Water Level				ft E.L.
Seepage Collection Rate	#5-#8:	gpm	#9:	gpm
V-notch Weir Reading – Upstream of RTP				inch
V-notch Weir Reading – Downstream of SCW[1]				inch
Elevation of Survey Monument (Center)[2]				ft E.L.
Elevation of Survey Monument (Spillway Side)[2]				ft E.L.

1) V-notch weir at downstream of SCW will be installed in 2011.
2) Survey is conducted in March and September.

Visual Inspection		
Location	Check Point	Results/Action Items
Upstream Dam Face	• Any sign of erosion, collapse, subsidence? • Vegetation cleared?	
Dam Crest	• Any sign of subsidence? • Any damage on facilities?	
Downstream Dam Face	• Any sign of erosion, collapse, subsidence? • Any seepage? • Vegetation cleared?	
Reservoir Walls	• Any sign of erosion, collapse?	
Spillway Inlet (Concrete)	• Check concrete for cracks • Check connection with flume	
Spillway Outfall (Flume)	• Any obstacles in flume? • Any damage? • Any erosion on the ground?	

Comments:

Reviewed by: _____ Date: _____

SWPPP Monitoring Report

Sample Source:	Sample ID#	Date:
Facility Name: Pogo Mine		Monitoring Time:
Mailing Address:		Monitoring Personnel:
Description of Monitoring: Nature of the discharge (circle): Runoff Snowmelt Probable Sources of Any Observed Storm Water Contamination:		Visual Quality of Storm Water Discharge: Color: Odor: Clarity: Floating Solids: Settled Solids: Suspended Solids: Foam: Oil Sheen: Other Obvious Indicators of Storm Water Pollution:
Storm Event Data: Date of Storm: Duration of storm (hrs): Rainfall Measurement or Estimate (inches): Estimate of total volume (gallons) of discharge samples: Time Discharge From Outfall Began: Duration between storm event samples and the end of the previous measurable (greater than 0.1 inch rainfall) storm event:		
Outfall ID#: Outfall SW21		Signature of Sampler:
Diagram of Site:		Comments:
Flow Description:		Ship Via:
"I certify under a penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."		
_____		Date: _____

Storm Water Quality Mine Site Inspection Checklist

Pogo Mine Site

GENERAL INFORMATION POGO MINE SITE		
Inspector's Name		
Inspector's Title		
Signature		
Date of Inspection		
Inspection Type	☐ Prior to forecast rain ☐ 24-hr intervals during extended rain	☐ After a storm event ☐ Other _____
Season (Check Applicable)	☐ Rainy	☐ Non-Rainy
	Storm Start Date & Time:	Duration of Storm (hrs):

Storm Data	Time elapsed since last storm (circle applicable units) Min. Hrs. Days	Rainfall Measurement or Estimate (inches):

Inspection Checklist				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Linear Sediment Barriers				
Are linear sediment barriers properly installed in accordance with the details, functional and maintained?				
Are linear sediment barriers free of accumulated litter?				
Is the built-up sediment less than 1/3 the height of the barrier?				
Are cross barriers installed where necessary and properly spaced?				
Are Brush Barriers installed and maintained on required slopes in accordance with the details, functional and maintained?				
Location:				
Location:				
Location:				
Location:				
Stockpiles				
Are all locations of stockpiles, including soil, in approved areas?				
Are stockpiles protected from run-on, run-off from adjacent areas and from winds?				
Are stockpiles located at least 15 m from concentrated flows, downstream drainage courses and storm drain inlets?				
Area required covers and/or perimeter controls in place?				

Inspection Checklist				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Location:				
Location:				
Location:				
Concentrated Flows				
Are concentrated flow paths free of visible erosion?				
Location:				
Location:				
Location:				
Location:				
Tracking Control				
Are points of ingress/egress to public/private roads inspected, swept, and vacuumed daily?				
Are all paved areas free of visible sediment tracking or other particulate matter?				
Location:				
Location:				
Location:				
Location:				
Wind Erosion Control				
Have dust control measures been implemented?				
Location:				
Location:				
Location:				

Inspection Checklist				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Vehicle & Equipment Fueling, Cleaning and Maintenance				
Are vehicles and equipment fueling, cleaning and maintenance areas reasonably clean and free of spills, leaks or any other deleteriuos material?				
Are vehicle and equipment fueling, cleaning and maintenance activities performed on an impermearble surface in dedicated areas?				
If no, are drip pans used?				
Are dedicated fueling, cleaning and maintenance areas located at least 15 m away from downstream drainage facilities and watercourses, and protected from run-on and run-off?				
Is wash water contained for infiltration/evaporation and disposed of outside the highway right of way?				
Is on-site cleaning limited to washing with water (no soaps, soap substitutes, solvents or steam)?				
On each day of use, are vehicles and equipment inspected for leaks and if necessary, repaired?				
Location:				
Location:				
Location:				
Location:				
Waste Management & Materials Pollution Control				
Are material storage areas and washout areas protected from run-on and run-off, and located at least 15 m from concentrated flows and downstream drainage facilities?				
Are all material handling and storage areas clean; organized; free of spills, leaks or other deleterious material; and stocked with appropriate clean-up supplies?				
Are liquid materials, hazardous materials, and hazardous wastes stored in temporary containment facilities?				
Are bagged and boxed materials stored on pallets?				
Are hazardous materials and wastes stored in appropriate, labeled containers?				

Inspection Checklist				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Are proper storage, clean-up, and spill-reporting procedures for hazardous materials and wastes posted in open, conspicuous and accessible locations adjacent to storage areas?				
Are temporary containment facilities and bagged/boxed materials covered?				
Are spills from mobile equipment fueling and maintenance properly contained and cleaned up?				
Is the site free of litter?				
Are trash receptacles provided in the staging areas, field areas, and at locations where workers congregated for lunch and break periods?				
Is litter from work areas within the mine site area collected and placed in watertight dumpsters?				
Are waste management receptacles free of leaks?				
Are the contents of waste management receptacles properly protected from contact with storm water or from being dislodged by winds?				
Are waste management receptacles filled at or beyond capacity?				
Location:				
Location:				
Location:				
Location:				
Water Body Crossings or Encroachments				
Are water body crossings and encroachments constructed as shown on the plans or as approved by the engineer?				
Does the project conform to the requirements of the 404 permit and/or the 1601 agreement?				
Location:				
Location:				
Location:				
Location:				

Inspection Checklist				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Illicit Connection/Illegal Discharge Detection and Reporting				
Is there any evidence of illicit discharges or illegal dumping on the mine site?				
If yes, has the RP been notified?				
Location:				
Location:				
Location:				
Location:				
Discharge Points				
Are discharge points and discharge flows free from noticeable pollutants?				
Are discharge points free of any significant erosion or sediment transport?				
Location:				
Location:				
Location:				
Location:				
SWPPP Update				
Does the SWPPP adequately reflect the current site conditions and operations?				
Are all BMPs shown on the SWPPP installed in the proper location(s) and according to the details for the Plan?				
Location:				
Location:				
Location:				
Location:				
General				
Are there any other potential water pollution control concerns on the site?				

Inspection Checklist				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Location:				
Location:				
Location:				
Storm Water Monitoring				
Were there any BMPs not properly implemented, or breaches, malfunctions, leakages or spills observed, which could result in the discharge of pollutants to surface waters that would not be visially detectable in storm water?				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan during rain events?				
Did storm water contact stored materials or waste and result in a discharge from the mine site? (Materials not in watertight containers, etc.)				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan during rain events?				

NPDES Permit Tracking No.:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

Annual Reporting Form

A. GENERAL INFORMATION

1. Facility Name:

2. NPDES Permit Tracking No.:

3. Facility Physical Address:

a. Street:

b. City: c. State: d. Zip Code: -

4. Lead Inspectors Name: Title:

Additional Inspectors Name(s):

5. Contact Person: Title:

Phone: - - Ext. E-mail:

6. Inspection Date: / /

B. GENERAL INSPECTION FINDINGS

1. As part of this comprehensive site inspection, did you inspect all potential pollutant sources, including areas where industrial activity may be exposed to stormwater?
☐ YES ☐ NO

If NO, describe why not:

NOTE: *Complete Section C of this form for each industrial activity area inspected and included in your SWPPP or as newly identified in B.2 or B.3 below where pollutants may be exposed to stormwater.*

2. Did this inspection identify any stormwater or non-stormwater outfalls not previously identified in your SWPPP? ☐ YES ☐ NO

If YES, for each location, describe the sources of those stormwater and non-stormwater discharges and any associated control measures in place:

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3. Did this inspection identify any sources of stormwater or non-stormwater discharges not previously identified in your SWPPP? ☐ YES ☐ NO

If YES, describe these sources of stormwater or non-stormwater pollutants expected to be present in these discharges, and any control measures in place:

4. Did you review stormwater monitoring data as part of this inspection to identify potential pollutant hot spots? ☐ YES ☐ NO ☐ NA, no monitoring performed

If YES, summarize the findings of that review and describe any additional inspection activities resulting from this review:

5. Describe any evidence of pollutants entering the drainage system or discharging to surface waters, and the condition of and around outfalls, including flow dissipation measures to prevent scouring:

6. Have you taken or do you plan to take any corrective actions, as specified in Part 3 of the permit, since your last annual report submission (or since you received authorization to discharge under this permit if this is your first annual report), including any corrective actions identified as a result of this annual comprehensive site inspection?

☐ YES ☐ NO

If YES, how many conditions requiring review for correction action as specified in Parts 3.1 and 3.2 were addressed by these corrective actions? ☐☐

NOTE: *Complete the attached Corrective Action Form (Section D) for each condition identified, including any conditions identified as a result of this comprehensive stormwater inspection.*

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C. INDUSTRIAL ACTIVITY AREA SPECIFIC FINDINGS

Complete one block for each industrial activity area where pollutants may be exposed to stormwater. Copy this page for additional industrial activity areas.

In reviewing each area, you should consider:

- Industrial materials, residue, or trash that may have or could come into contact with stormwater;
- Leaks or spills from industrial equipment, drums, tanks, and other containers;
- Offsite tracking of industrial or waste materials from areas of no exposure to exposed areas; and
- Tracking or blowing of raw, final, or waste materials from areas of no exposure to exposed areas.

INDUSTRIAL ACTIVITY AREA _____:

1. Brief Description:

2. Are any control measures in need of maintenance or repair? ☐ YES ☐ NO

3. Have any control measures failed and require replacement? ☐ YES ☐ NO

4. Are any additional/revised control measures necessary in this area? ☐ YES ☐ NO

If YES to any of these three questions, provide a description of the problem: (Any necessary corrective actions should be described on the attached Corrective Action Form)

INDUSTRIAL ACTIVITY AREA _____:

1. Brief Description:

2. Are any control measures in need of maintenance or repair? ☐ YES ☐ NO

3. Have any control measures failed and require replacement? ☐ YES ☐ NO

4. Are any additional/revised c necessary in this area? ☐ YES ☐ NO

If YES to any of these three questions, provide a description of the problem: (Any necessary corrective actions should be described on the attached Corrective Action Form)

INDUSTRIAL ACTIVITY AREA _____:

Brief Description:

2. Are any control measures in need of maintenance or repair? ☐ YES ☐ NO

3. Have any control measures failed and require replacement? ☐ YES ☐ NO

4. Are any additional/revised BMPs necessary in this area? ☐ YES ☐ NO

If YES to any of these three questions, provide a description of the problem: (Any necessary corrective actions should be described on the attached Corrective Action Form)

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NOTE: *Copy this page and attach additional pages as necessary*

INDUSTRIAL ACTIVITY AREA ______:

1. Brief Description:

2. Are any control measures in need of maintenance or repair? ☐ YES ☐ NO

3. Have any control measures failed and require replacement? ☐ YES ☐ NO

4. Are any additional/revised BMPs necessary in this area? ☐ YES ☐ NO

If YES to any of these three questions, provide a description of the problem: (Any necessary corrective actions should be described on the attached Corrective Action Form)

INDUSTRIAL ACTIVITY AREA ______:

1. Brief Description:

2. Are any control measures in need of maintenance or repair? ☐ YES ☐ NO

3. Have any control measures failed and require replacement? ☐ YES ☐ NO

4. Are any additional/revised BMPs necessary in this area? ☐ YES ☐ NO

If YES to any of these three questions, provide a description of the problem: (Any necessary corrective actions should be described on the attached Corrective Action Form)

INDUSTRIAL ACTIVITY AREA ______:

1. Brief Description:

2. Are any control measures in need of maintenance or repair? ☐ YES ☐ NO

3. Have any control measures failed and require replacement? ☐ YES ☐ NO

4. Are any additional/revised BMPs necessary in this area? ☐ YES ☐ NO

If YES to any of these three questions, provide a description of the problem: (Any necessary corrective actions should be described on the attached Corrective Action Form)

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D. CORRECTIVE ACTIONS

Complete this page for each specific condition requiring a corrective action or a review determining that no corrective action is needed. Copy this page for additional corrective actions or reviews.

Include both corrective actions that have been initiated or completed since the last annual report, and future corrective actions needed to address problems identified in this comprehensive stormwater inspection. Include an update on any outstanding corrective actions that had not been completed at the time of your previous annual report.

1. Corrective Action # ☐☐ of ☐☐ for this reporting period.

2. Is this corrective action:

- ☐ An update on a corrective action from a previous annual report; or
- ☐ A new corrective action?

3. Identify the condition(s) triggering the need for this review:

- ☐ Unauthorized release or discharge
- ☐ Numeric effluent limitation exceedance
- ☐ Control measures inadequate to meet applicable water quality standards
- ☐ Control measures inadequate to meet non-numeric effluent limitations
- ☐ Control measures not properly operated or maintained
- ☐ Change in facility operations necessitated change in control measures
- ☐ Average benchmark value exceedance
- ☐ Other (describe): _____

4. Briefly describe the nature of the problem identified:

5. Date problem identified: ☐☐/☐☐/☐☐☐☐

6. How problem was identified:

- ☐ Comprehensive site inspection
- ☐ Quarterly visual assessment
- ☐ Routine facility inspection
- ☐ Benchmark monitoring
- ☐ Notification by EPA or State or local authorities
- ☐ Other (describe): _____

7. Description of corrective action(s) taken or to be taken to eliminate or further investigate the problem (e.g., describe modifications or repairs to control measures, analyses to be conducted, etc.) or if no modifications are needed, basis for that determination:

8. Did/will this corrective action require modification of your SWPPP? ☐ YES ☐ NO

9. Date corrective action initiated: ☐☐/☐☐/☐☐☐☐

10. Date correction action completed: ☐☐/☐☐/☐☐☐☐ or expected to be completed: ☐☐/☐☐/☐☐☐☐

11. If corrective action not yet completed, provide the status of corrective action at the time of the comprehensive site inspection and describe any remaining steps (including timeframes associated with each step) necessary to complete corrective action:

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E. ANNUAL REPORT CERTIFICATION

1. Compliance Certification

Do you certify that your annual inspection has met the requirements of Part 4.2 of the permit, and that, based upon the results of this inspection, to the best of your knowledge, you are in compliance with the permit? ☐ YES ☐ NO

If NO, summarize why you are not in compliance with the permit:

2. Annual Report Certification

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

Authorized Representative Printed Name: Title:

Signature: Date Signed:

BMP Committee Annual Review Certification and Signature

I certify that I have reviewed the Pogo Mine Site BMP Plan and that the BMP Plan fulfills the requirements set forth in APDES Permit No. AK-0055334-1.

Signature :	Date:
Name (printed) :	Title:
Signature :	Date:
Name (printed) :	Title:
Signature :	Date:
Name (printed) :	Title:
Signature :	Date:
Name (printed) :	Title:
Signature :	Date:
Name (printed) :	Title:
Signature :	Date:
Name (printed) :	Title: