PLAN OF OPERATIONS
Integrated Waste Management

MONITORING PLAN

Donlin Gold Project

December 2016

4720 Business Park Blvd. Suite G-25
Anchorage, Alaska 99503

Prepared By:
SRK Consulting (U.S.), Inc.
4700 Business Park Blvd. Suite E-12
Anchorage, Alaska 99503

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APPENDICES

Appendix A: Quality Assurance Project Plan (QAPP)
Appendix B: Wildlife Mortality Reporting Forms

ACRONYMS

AAC	Alaska Administrative Code
ABA	Acid-Base Accounting
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish & Game
ADNR	Alaska Department of Natural Resources
ANDA	Anaconda Creek (surface water monitoring station)
AP	acid generating potential
APDES	Alaska Pollutant Discharge Elimination System
ARD	acid rock drainage
AS	Alaska Statute
CCBC	Crooked Creek below Crevice Creek (surface water monitoring station)
CCBO	Crooked Creek below Omega Creek (surface water monitoring station)
CCBW	Crooked Creek upgradient of the pit (surface water monitoring station)
CWD	contact water dam
MIW	monitoring/interception well
MW	monitoring well
MWMP	meteoric water mobility procedure
NP_{CO3}	neutralization potential from carbonate material
Plan	Integrated Waste Management Monitoring Plan
PCWTPO	Post Closure Water Treatment Plant Outfall
QAPP	Quality Assurance Project Plan
QAQC	Quality Assurance Quality Control
SRS	seepage recovery system
TSF	tailings storage facility
USF&WS	U.S. Fish & Wildlife Service
WRF	waste rock facility
WTP	water treatment plant

UNITS OF MEASURE

ft	feet/foot
km	kilometer
m	meter
ppm	parts per million

ELEMENTS AND COMPOUNDS

$CaCO_3$	calcium carbonate
NP_{CO3}/AP	ratio of neutralizing potential from carbonate minerals to acid generating potential
WAD	weak acid dissociable

1.0 INTRODUCTION

Donlin Gold LLC[1] (Donlin Gold) is proposing the development of an open pit, hardrock gold mine in southwestern Alaska, about 277 miles (446 km) west of Anchorage, 145 miles (233 km) northeast of Bethel, and approximately 10 miles (16 km) north of the village of Crooked Creek (Figure 1-1). This integrated waste management monitoring plan (Plan) was prepared for the proposed project by Donlin Gold in accordance with state regulations governing the management of solid wastes, and is submitted to the Alaska Department of Environmental Conservation (ADEC) in accordance with Alaska Statute (AS) 46.03.010 et. seq. and Title 18 Alaska Administrative Code (AAC) 60.005 et. seq.

This Plan may be revised periodically (Table 1-1) during operations based on regulatory changes, periodic reviews, facility changes, and review of monitoring results which indicate that further attention is warranted.

Table 1-1: Record of Changes and Amendments

Date	Section (s) Revised or Amended

1.1 Purpose

This Plan presents the elements of Donlin Gold's proposed monitoring and sampling program that was initiated for baseline data collection and that would be refined and continued during the construction, operations, closure, and post-closure phases of the project. The project area is the location of much of the proposed project's infrastructure, including the processing facilities and mining locations. The monitoring and sampling described in this Plan includes only the monitoring activities that will be reported to ADEC as part of the Integrated Waste Management Permit. Monitoring for other resources, such as aquatic resources, dam safety, and permitted air and water discharges are addressed under specific permit requirements and/or other monitoring plans, for example water treatment plant (WTP) discharges authorized under an Alaska Pollutant Discharge Elimination System (APDES) permit. These permit requirements will be addressed by amendments to this Plan or preparation of additional monitoring plans when the specific permit conditions are known.

1.2 Sampling Protocol and Quality Assurance/Quality Control

The list of monitoring parameters, required sample bottles, sampling procedures, and quality assurance/quality control for surface water and groundwater samples are described in the

[1] Donlin Gold LLC is a limited liability company equally owned by Barrick Gold U.S. Inc. and NovaGold Resources Alaska, Inc.

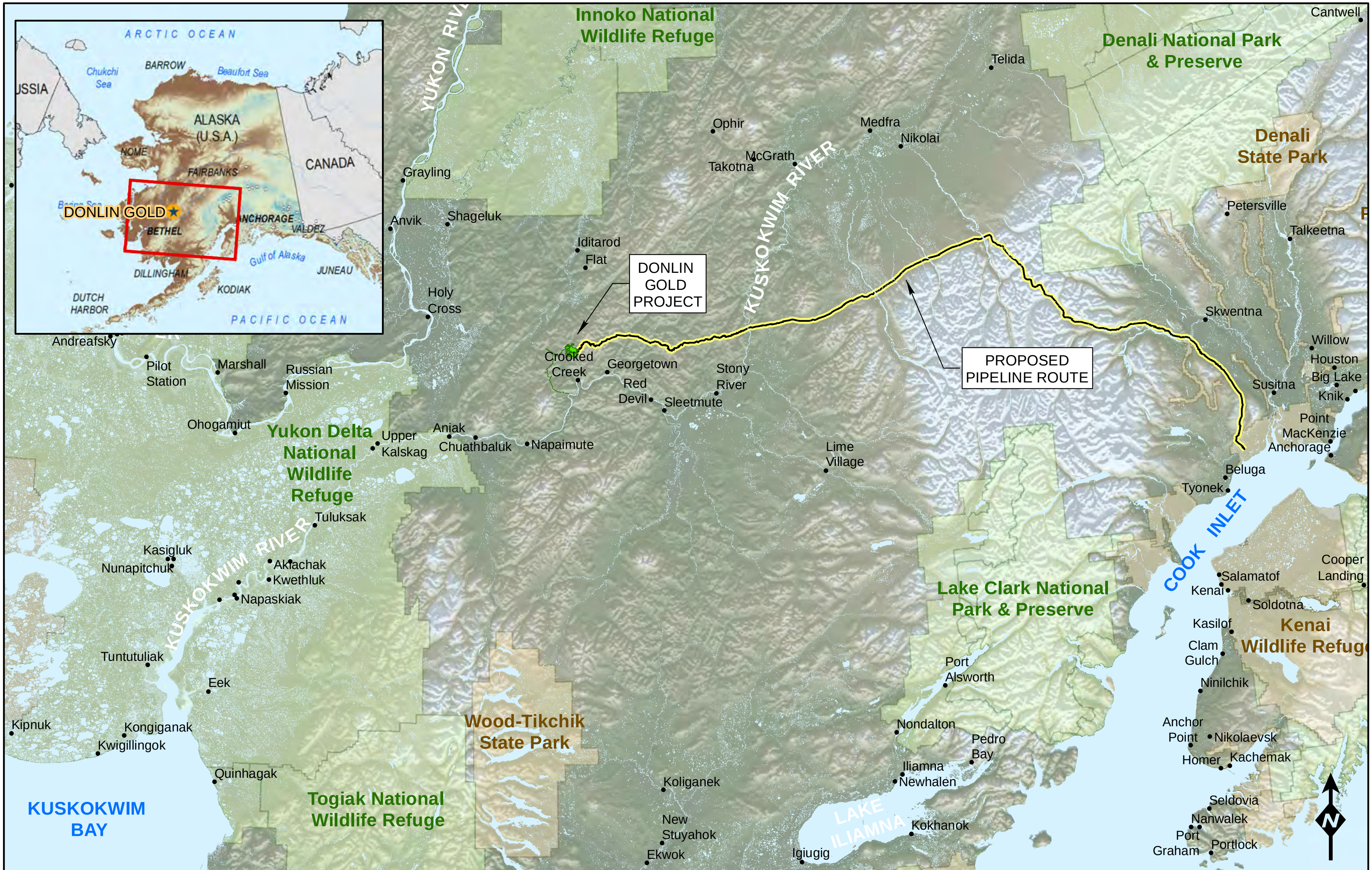
Quality Monitoring and Quality Assurance Program Plan (QAPP) contained in Appendix A. The protocol for analysis of overburden, waste rock, and tailings samples for acid base accounting analysis is also contained in Appendix A.

1.3 Administrative Information

Date:	December 2016
Name of Facility:	Donlin Gold LLC
Type of Facility:	Proposed Gold Mine and Process Plant Operation
Location:	Latitude 62º01'36" North, Longitude 158º13'15" West
Corporate Information:	A Delaware Limited Liability Company jointly held by NovaGold Resources Alaska, Inc. and Barrick Gold U.S. Inc.
Business Name:	Donlin Gold LLC
Address:	4720 Business Park Blvd., Suite G-25
	Anchorage, Alaska 99503
Telephone:	(907) 273-0200
General Manager:	Andrew Cole
Operations Manager:	___________________________________

Designated Contact Person for Regulatory Issues:

Patty McGrath, Environmental Manager
Donlin Gold LLC
4720 Business Park Blvd., Suite G-25
Anchorage, AK 99503
Telephone: (907) 273-0200



• Populated Place

Proposed Natural Gas Pipeline Alignment

Proposed Infrastructure Layout

Federal Administrative Boundaries

State Administrative Boundaries

Seward Meridian, UTM Zone 5, NAD83

SCALE:

0 12.5 25 50 mi

0 20 40 80 km

DONLIN GOLD

PROJECT LOCATION MAP

DONLIN GOLD PROJECT

FIGURE: 1-1

DG: PER540.mxd, 10/05/16, R01

1.4 Project Description

The proposed Donlin Gold project would require approximately three to four years to construct, with the active mine life currently projected to be approximately 27 years. The mine is proposed to be a year-round, conventional “truck and shovel” operation using both bulk and selective mining methods.

The *Project Description, Volume I,* SRK 2016a provides a detailed description of the overall project area and infrastructure necessary to support the development, operation, and closure of the project. The *Tailings Management Plan, Volume IIIA,* SRK 2016f and *Waste Rock Management Plan, Volume IIIB,* SRK 2016c provide detailed information on management of tailings and waste rock.

1.5 Objectives

The objective of compliance monitoring would be to verify the project operates within permit limitations and other permit requirements, thereby minimizing impact to the environment during construction, operations, and post-closure. Compliance monitoring data would also be compared to baseline data which characterized the pre-development surface water and groundwater systems in the project area. This comparison would be used to identify and evaluate the potential changes caused by development and operation of the project.

2.0 COMPLIANCE MONITORING AND SAMPLING – CONSTRUCTION AND OPERATIONS

Monitoring surface water and groundwater resources is an integral part of the environmental protection measures at the proposed project. Pre-mining studies have established baseline conditions against which changes can be compared over time. Figure 2-1 depicts the locations of compliance monitoring and sampling locations for construction activities and Figure 2-2 shows monitoring and sampling locations during operations.

During construction and operations, there is ongoing disturbance of land surface, excavation of borrow material sites, pre-stripping of the mine site, movement of development rock, and placement of waste rock and tailings that could, if not managed properly, affect water quality. Overburden and waste rock will be sampled and analyzed in order to classify and manage this material appropriately. Tailings will be sampled and analyzed to evaluate filtrate and solids characteristic. Tailings solids characterization will include acid rock drainage (ARD) generating potential.

Monitoring and sampling will continue through construction into operations as reagents are introduced into the beneficiation process and more sites become relevant to the overall compliance of the project.

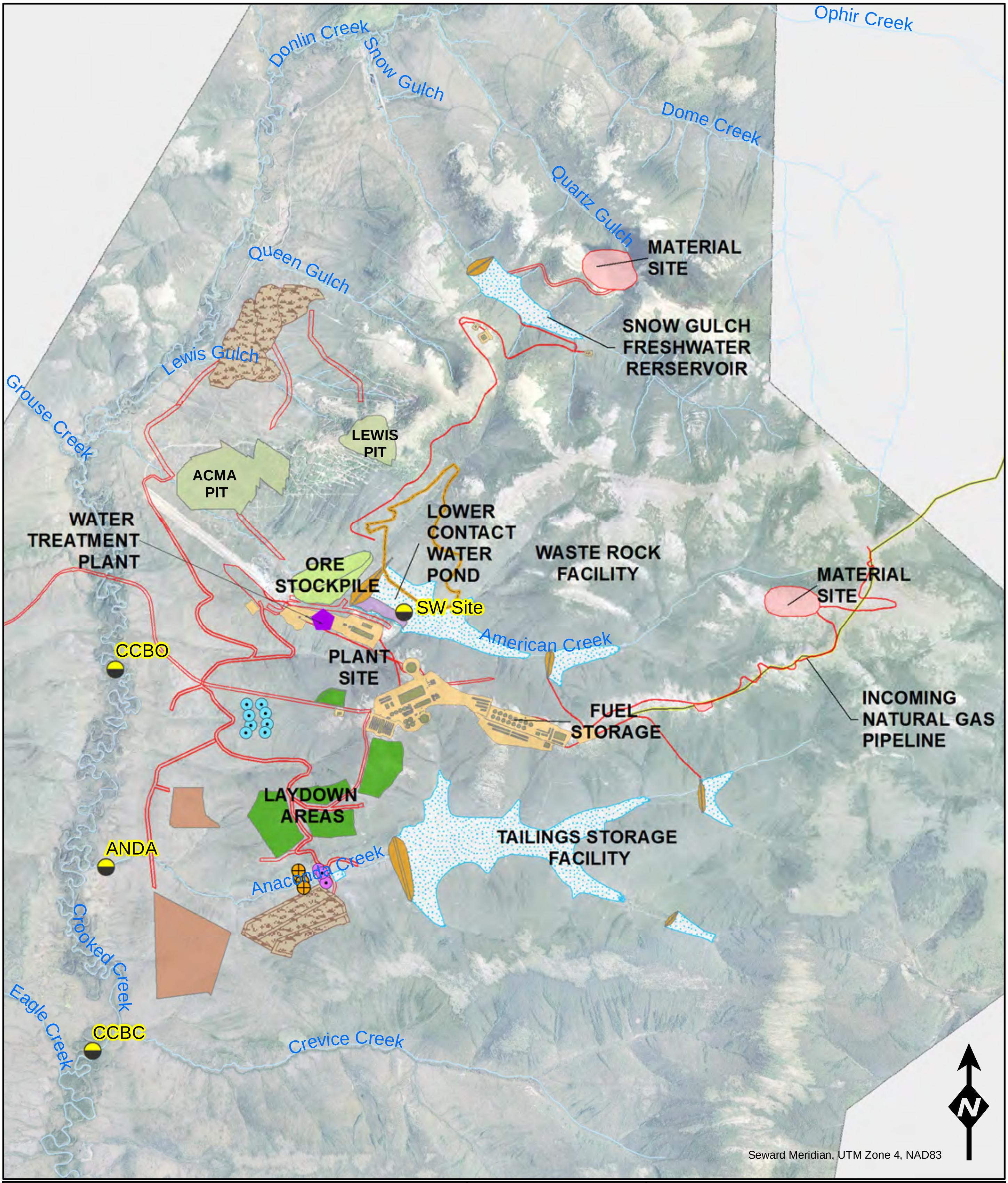
2.1 Solution (Process Water) Monitoring

Solution management at the project encompasses all aspects of water management for the proposed Donlin Gold project. The *Water Resources Management Plan, Volume II,* SRK 2016b provides a description of the solution management of the different water categories during construction, operations, closure, and post-closure. Monitoring requirements are described below.

All process solutions would be controlled under the fluid management system, which consists of the following components:

- Lower and Upper Contact Water Dams (CWDs), containing surface and seepage water from the Waste Rock Facility (WRF), pit dewatering water, surface water from the south overburden stockpile, and pit surface water.
- Process plant, including but not limited to, all tanks, basins, sumps, pumps, and piping necessary to interconnect the components that contain process fluid within this plant.
- Tailings impoundment, tailings discharge lines, and reclaim barge and return lines.

Monitoring requirements for the process fluid management system are shown in Table 2-1.



- Compliance Monitoring Well
- Monitoring/Inception Well
- Surface Water (SW) Site
- Water Supply Well
- Water Treatment Plant

DONLIN GOLD

MONITORING/SAMPLING LOCATIONS CONSTRUCTION

DONLIN GOLD PROJECT

SCALE: 0 0.25 0.5 1 mi; 0 0.4 0.8 1.6 km

FIGURE: 2-1

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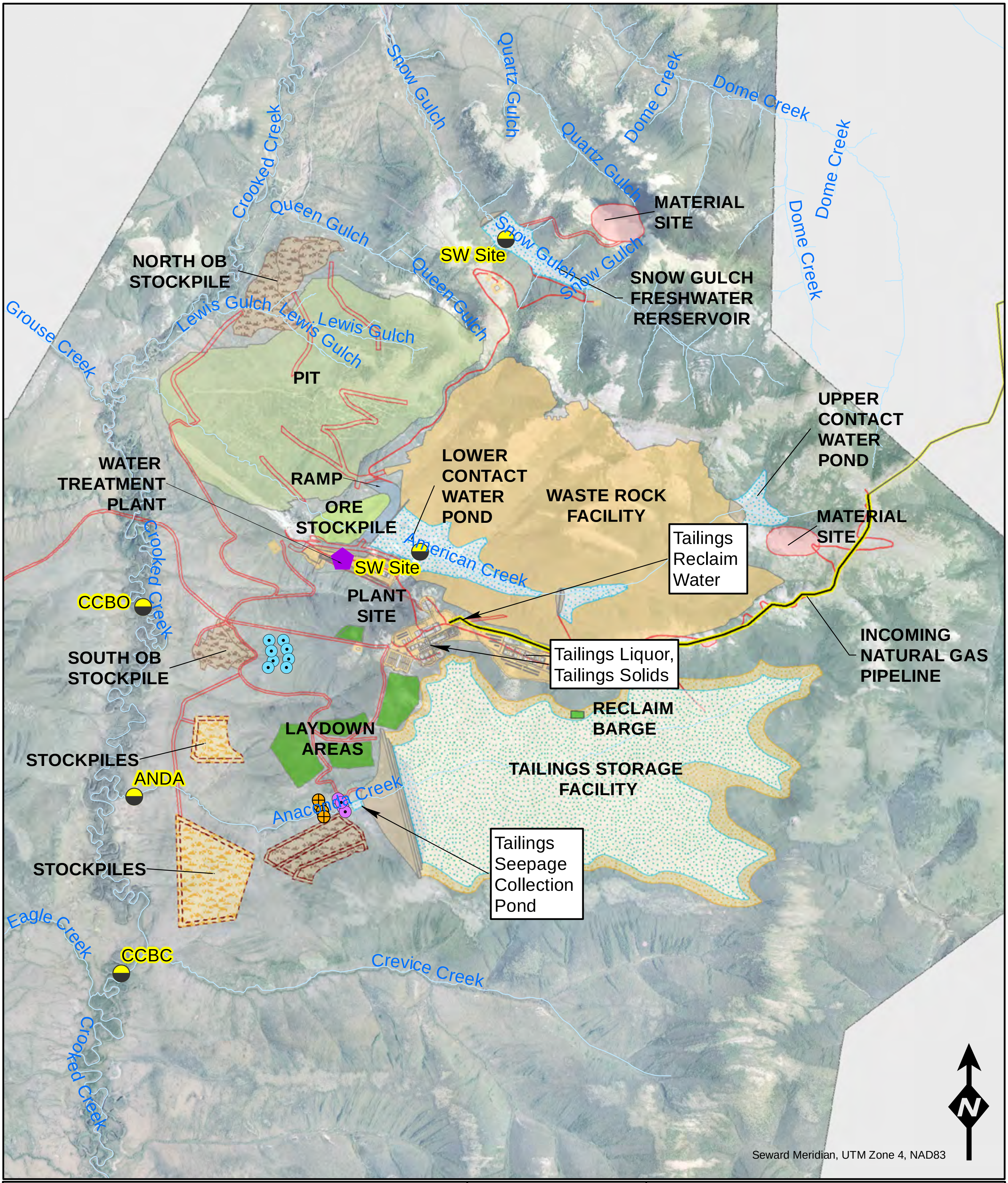

- Compliance Monitoring Well
- Monitoring/Inception Well
- Surface Water (SW) Site
- Water Supply Well
- Water Treatment Plant

DONLIN GOLD

MONITORING/SAMPLING LOCATIONS OPERATIONS

DONLIN GOLD PROJECT

SCALE: 0 0.25 0.5 1 mi / 0 0.4 0.8 1.6 km

FIGURE: **2-2**

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Table 2-1: Process Fluid Management System Monitoring Requirements

Identification	Parameter (Appendix A)	Frequency
Lower CWD	Long List-1*	Quarterly
Tailings at Process Plant (post cyanide detoxification)	pH, Weak Acid Dissociable (WAD) cyanide	2 samples per day
Tailings liquor (filtrate)	Long List-1*	Quarterly
Tailings solids (residue)	Long List-1* Static Acid Based Accounting (ABA) analysis**	Quarterly composite
Tailings reclaim water	Long List-1*	Quarterly

* After two years of monitoring and sampling, the analytical profiles for three of the quarters may be reduced to the following: pH, conductivity, alkalinity (as calcium carbonate [$CaCO_3$]) bicarbonate, and total and WAD cyanide. Any results of analysis from the reduced sample parameters inconsistent with previous water quality analyses would require re-sampling and Long List-1 analysis. Third quarter sample analytical parameters would be Long List-1 or as otherwise specified by the APDES discharge permit. The annual full parameter analysis would provide a database for comparison and enable the water quality trends to be tracked over the life of the operation.
** Material for which static Acid Base Accounting (ABA) analysis results indicate less than 1.4 to 1 ratio of neutralization potential as carbonate to acid generating potential (NP_{CO3}/AP) would require kinetic testing using laboratory humidity cells. A meteoric water mobility procedure (MWMP) extraction (ASTM International 2013) would also be performed on a composite sample of tailings solids collected over the quarter, and would be analyzed for the parameters in Long List-1.

Individual parameters may be reduced after additional sampling. The criteria for reducing parameters would be based on the potential for changes that could result in water quality concerns.

2.2 Surface Water Monitoring/Sampling

Surface water samples include those sources with the potential to be affected by process solution, release of treated water, dewatering activities, or transportation and storage activities. Figure 2-1 shows the locations of upgradient and downgradient surface water monitoring/sampling stations. Table 2-2 lists monitoring locations, parameters, and frequency of monitoring/sampling.

Table 2-2: Surface Water Sampling Locations

Identification	Parameter (Appendix A)	Frequency
American Creek Freshwater Diversion	Long List 1	Quarterly during the first year of operations
Snow Gulch Fresh Water Reservoir	Long List-1	Quarterly*
CCBW	Long List-1	Quarterly*
CCBO	Long List-1	Quarterly*
ANDA	Long List-1	Quarterly*
CCBC	Long List-1	Quarterly*

* Sampling would be attempted seasonally during high- and low-runoff conditions.

2.3 Waste Rock Facility Monitoring

Waste rock management and operational monitoring and sampling of the WRF are described in the *Waste Rock Management Plan, Volume IIIB,* SRK 2016c. Based on monitoring described in the Waste Rock Management Plan, the ratio of neutralizing potential from carbonate minerals to acid generating potential (NP_{CO3}/AP) would be calculated and used to classify waste rock as described in SRK (2016c). Laboratory analyses for total sulfur and NP_{CO3} and ABA calculations would be maintained on site. This geochemical data would be processed on a monthly basis to calculate the average NP_{CO3}/AP for placed waste rock, and to record final destinations.

2.4 Solid Waste Landfill

Inert waste materials generated during construction and operations would be disposed of in solid waste landfill trenches. These inert landfills would be operated as described in the *Integrated Waste Management Plan, Volume III,* SRK 2016d.

Because materials disposed of within the landfill trenches are inert, the potential for leachate is minimal. Furthermore, landfill trenches would be a minimum of 100 ft (30 m) from any surface water body and greater than 200 ft (61 m) from drinking water sources. Surface water runoff would be diverted away or around landfill trenches to minimize infiltration. Additionally, trench bottoms would be located a minimum of 10 ft (3 m) above existing or expected future groundwater table. Consequently, no special groundwater or surface water monitoring is currently planned. Operational visual monitoring and reporting will be done in accordance with requirements of the waste management permit and as described in SRK (2016d).

2.5 Tailings Storage Facility Monitoring

Operational monitoring and reporting for the Tailings Storage Facility (TSF) will be in accordance with the Alaska Department of Natural Resources (ADNR) Dam Safety Operating Permit and as described in the *Tailings Management Plan, Volume IIIA,* SRK 2016f. Environmental monitoring is summarized below.

2.5.1 TSF Water Monitoring

Water monitoring at the TSF is summarized in Table 2-3.

Table 2-3: Tailings Storage Facility Water Monitoring

Identification	Parameter (Appendix A)	Frequency
TSF Starter Dam Pond	Long List-1	Quarterly
Seepage Recovery System (SRS) Collection Pond	Long List-1	Quarterly
TSF monitoring and interceptor wells (MIWs) (MIW-1, MIW-2, MIW-3, MIW-4)	Long List-1	Quarterly
	Static Water Depth	Weekly
	Record instantaneous and totalizer flow for monitoring/interceptor wells (if operation is required)	Weekly
TSF Compliance monitoring wells (MWs) (MW-1, MW-2, MW-3, MW-4)[2]	Long List-1	Quarterly
	Static Water Depth	Weekly

[2] **18 AAC 60.825 Groundwater monitoring systems** (a) Except as provided in 18 AAC 60.820, the owner or operator of a solid waste disposal facility subject to this chapter shall ensure that a groundwater monitoring system is installed with sufficient number of wells, at locations and depths, that yield groundwater samples from the uppermost aquifer that represent the quality of (1) background groundwater that has not been affected by leachate from the facility…

3.0 AVIAN AND TERRESTRIAL WILDLIFE MONITORING

Visual inspection of the tailings impoundment surface would occur during each shift and would focus on the tailings decant pool and unconsolidated tailings depositional areas. Employees would be directed to report to security any unusual circumstances involving wildlife. In addition, all site personnel would have specific responsibility to thoroughly inspect and report any wildlife mortalities or terrestrial animals mired in unconsolidated tailings.

Operational standards require the tailings discharge from the process plant and the resultant reclaim pool to be non-toxic to avian and terrestrial wildlife species. Some natural mortality would occur within the boundaries of the mine site; however, occurrences within specific process component areas, such as the tailings impoundment, would require special collection and sampling.

All wildlife mortalities would be immediately reported to the security officer on duty, and the species and a reclaim water sample would be collected. The reclaim water sample would be collected as close to the site of the carcass as possible. The solution sample would be preserved immediately with sodium hydroxide to attain a pH greater than 10, and submitted to an outside laboratory for WAD cyanide analysis. The collected wildlife species would be immediately preserved by freezing (size dependent) and temporarily stored in a facility under the control of mine security.

Mortalities would be reported to the U.S. Fish & Wildlife Service (USF&WS), the Alaska Department of Fish & Game (ADF&G), and ADEC within 24 hours or during their next scheduled work day. A written follow-up report (Appendix B) would be submitted to USF&WS and ADF&G with the date the mortality was discovered, identification of species, and WAD cyanide level of solution sample. The follow-up report would be submitted within seven days of the initial verbal notification to allow verification of analytical results. A semi-annual summary (Appendix B) would review mortality occurrences during the ice-free period (generally April through September) and during the ice cover (October through March). In the event of wildlife mortality, the semi-annual report would be submitted to the following agencies, as appropriate, within 30 days of the end of the reporting period:

U.S. Fish & Wildlife Service
Ecological Service
101 12th Avenue
Fairbanks, Alaska 99701
Telephone (907) 456-0388

Alaska Department of Environmental Conservation
Northern Regional Office
610 University Avenue
Fairbanks, Alaska 99709
Telephone (907) 451-2101

Alaska Department of Fish & Game
Habitat Division
1300 College Road
Fairbanks, Alaska 99701-1599
Telephone (907) 459-7289

All carcasses would be available for final collection by USF&WS or ADF&G, depending on species (i.e., migratory bird or game species). Laboratory results of analyses for WAD cyanide from solution samples would determine the final disposal procedure for all carcasses collected. WAD cyanide levels greater than 25 ppm would trigger a necropsy to determine cause of death. WAD cyanide levels less than 25 ppm would not require further analysis. Final disposition of carcasses would be determined by the appropriate agency.

Terrestrial animals mired in unconsolidated tailings material would be extracted and moved or herded to a safe area. All attempts to extract mired animals would be based on evaluation as to the health and safety of people and that of the animal.

4.0 COMPLIANCE MONITORING AND SAMPLING – CLOSURE

The *Reclamation and Closure Plan, Volume IV,* SRK 2016e describes reclamation and closure activities for the Project. Table 4-1 provides a summary of anticipated post-closure monitoring. Figure 4-1 shows the monitoring and sampling locations during and after closure.

Table 4-1: Summary of Closure and Post-Closure Monitoring

Monitoring Location	Monitoring Parameters	Frequency	Approximate Duration of Monitoring
Pit Lake	Water level	Annual	Until pit fills to operating level (estimated as 50-55 years after mine closure)
	Water quality by depth (Long List-1)	Every 5 years after closure	Until analyses indicate a stable condition
	Pit water quality of discharge (Long List-1 initially)	Monthly 24-hour composite while WTP is operating or per APDES permit requirements	While WTP is operational, and until analyses indicate a stable condition that meets WQS if WTP operation is discontinued
TSF	Mass stability	Annually for first 5 years and then every 5 years thereafter	Until observations indicate a stable condition
	Pond location and level, Pond surface water quality at spillway (Long List-1)	Quarterly	Until pond surface water consistently meets WQS
	SRS water quality (Long List-1) and flow	Quarterly	Until analyses indicate a stable condition
	MIW and compliance MW water quality (Long List-1) and water level	Quarterly for first 5 years, annually for next 5 years and then every 5 years thereafter	Until analyses indicate a stable condition
WRF	Seepage water quality (Long List-1) and flow	Quarterly	Until analyses indicate a stable condition
	Erosional stability		Until observations indicate a stable condition
Surface Water (CCBC and PCWTPO)	Water quality (Long List-1) and flow	Quarterly	Until flows and water quality are stabilized

Surface water and groundwater monitoring of the TSF, TSF-SRS, Pit Lake, and WRF would continue during closure and post-closure. The monitoring would remain depending on compliance history up to or beyond 30 years until each specific facility has been stabilized, physically and chemically, to the satisfaction of the applicable regulatory agencies.

4.1 Tailings Storage Facility

Several years before the end of operations, tailings deposition would be modified to direct the operating pond toward the southeast corner of the TSF. This would be done in anticipation of final closure of the TSF, when the tailings surface runoff would be directed to the closure spillway into Crevice Creek. At cessation of processing operations, the TSF water would be pumped from a small, lined impoundment located on the southeast corner of the TSF to the pit through a reclaim pipeline. Prior to discharge over the spillway, the pond water will be monitored and be required to meet the applicable water quality criteria. Until that time, pumping of the water to the pit would continue.

The TSF-SRS consisting of the pond and collection/interceptor wells would remain immediately downstream of the closure footprint of the main tailings dam. During operations, water from the SRS would be pumped back to the process plant or WTP. During closure and post-closure periods, the SRS collection pond would be used to monitor water quality in the TSF underdrain. In the event this water does not meet discharge water quality standards, it would be pumped to the pit lake. The SRS collection pond would be decommissioned when it can be demonstrated the water quality of water from the TSF underdrain meets applicable water quality criteria to be discharged into Anaconda Creek. Storm water runoff from the reclaimed downstream face of the dam would flow to the collection pond until water quality standards are met and then the runoff would flow to Anaconda Creek. The *Reclamation and Closure Plan, Volume IV,* SRK 2016e describes in detail the long-term management of the TSF underdrain water.

4.2 Pit Lake

The mined-out open pit would begin to form a pit lake prior to cessation of processing operations and is the central feature of proposed post-closure water management. As the pit fills over approximately 55 years, water level and quality (at different depths) would be monitored, and the pit lake model would be re-calibrated as data become available. Approximately five years before pit water would need to be discharged, a WTP would be built at the site as described in the *Water Resources Management Plan, Volume IIIA,* SRK 2016b. Assessment of the anticipated chemistry of the pit lake water would continue after WTP operation commences. Long-term monitoring of the pit lake water quality and discharge from the WTP would continue.

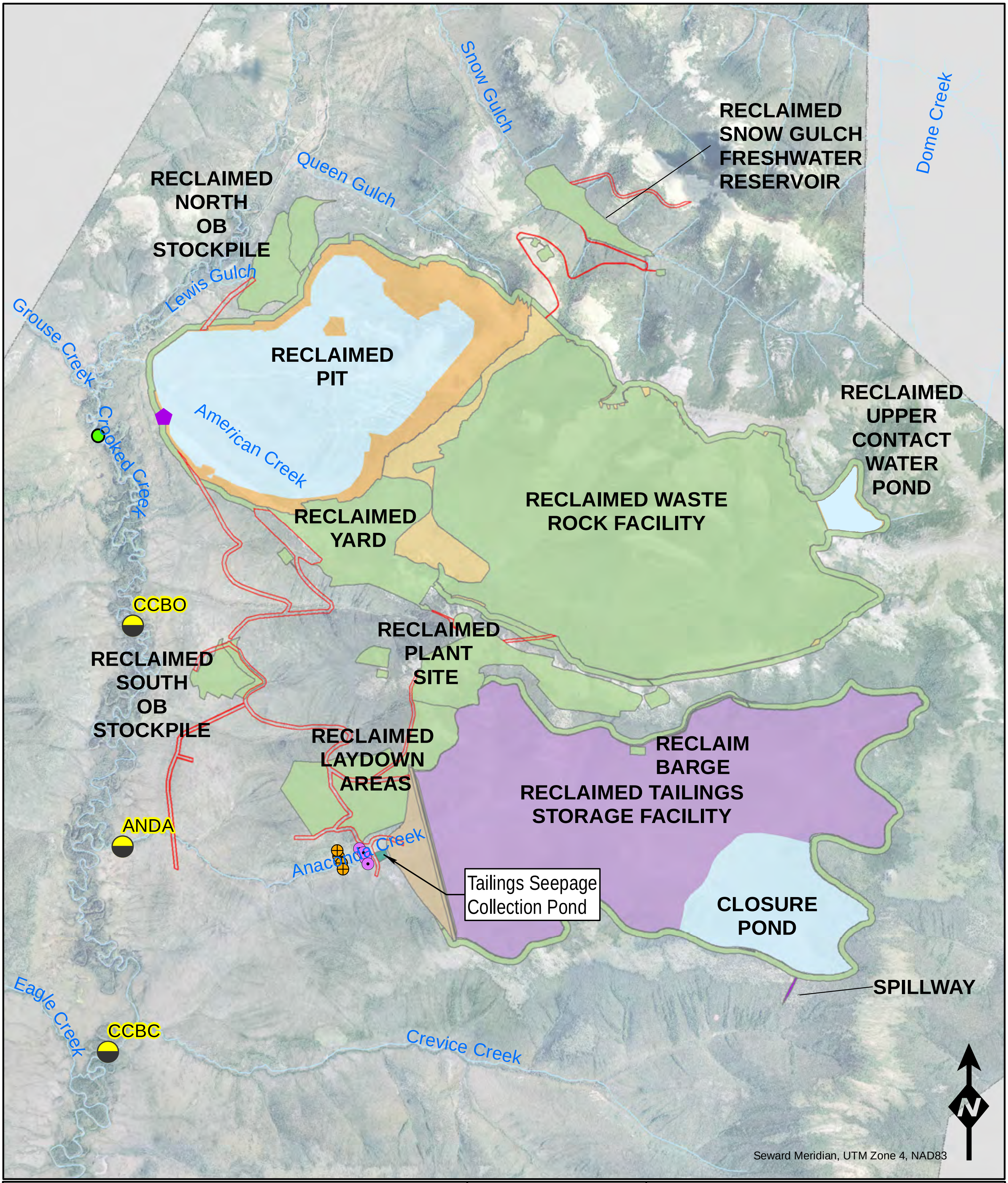
4.3 WRF Stability Monitoring

Post-closure stability monitoring of the WRF would consist of visual inspection including, but not limited to covered areas, areas of potential stormwater concentration, storage facility base areas where seepage would have the highest potential to occur, and stormwater control structures. Inspections would be carried out for a period of not less than five years. The frequency of inspections would be at least once annually in the spring and following storms that equal or exceed the 25-year, 24-hour storm event. The purpose of the inspections would be to observe and document the following:

- physical integrity of the soil cover including areas of erosion, ponding, differential settling, etc.
- extent of vegetation establishment and density

- evidence of any staining, discoloration, streaking or moisture conditions indicating significant geochemical reactivity of disposal facility surfaces
- condition of stormwater control structures
- location and extent of any ponded stormwater.

Conditions that require repair, maintenance, or further evaluation would be documented, with appropriate follow up scheduled for completion. Documentation of inspections, repairs, and evaluations would be submitted to ADEC on an annual basis.



⊕	Compliance Monitoring Well
⊙	Monitoring/Inception Well
●	Post Closure Water Treatment Plant Outfall
⬟	Reclaimed Water Treatment Plant
◒	Surface Water Site

DONLIN GOLD

MONITORING/SAMPLING LOCATIONS CLOSURE AND POST-CLOSURE

DONLIN GOLD PROJECT

SCALE: 0 0.25 0.5 1 mi; 0 0.4 0.8 1.6 km

FIGURE: **4-1**

DG: PER0091.mxd, 06/10/16, R15

5.0 MONITORING RECORDS AND REPORTING

5.1 Documentation of Measurements, Monitoring, and Quality Assurance Program Plan

Sampling and documentation will be conducted in accordance with the Donlin Gold 2016 QAPP (Appendix A), which includes detailed procedures on collecting site measurements and samples, sample handling, data management, and QA/QC.

5.2 Retention of Records

During operation, closure, and reclamation, all records of monitoring activities and results, calibrations, and maintenance records would be retained for a period of at least three years from the date the permit expires and/or as long as necessary to comply with the applicable laws.

5.3 Monitoring Reports and Submission Schedules

Monitoring results would be submitted quarterly to ADEC. Quarterly reports would be submitted on or before the 15th day of the month following the end of the quarter. An annual report through December 31 of each year, including raw data (if required), would be submitted to ADEC on or before January 31. The annual report would be prepared using forms with a database format that is acceptable to ADEC and would address the following:

- the seepage collection system's effectiveness in collecting all process wastewater from the TSF
- an updated annual water balance accounting
- analytical results
- elevated concentrations of metals or reagents in water within the tailings impoundment pond and documentation of any increases that would indicate concentrations that may be toxic to wildlife.

Exceedances of permit conditions would be reported by telephone, fax, or email to ADEC, not later than 5:00 pm of the next regular work day from the time the exceedance has been identified. The report will include the following:

- name, address, and telephone number of the owner or operator
- name, address, and telephone number of the facility
- date, time, and type of incident, condition, or circumstance
- description of any materials released, concentration, and total quantity in gallons or pounds, if applicable
- any human or animal mortality or injury
- an assessment of actual or potential hazard to human health and the environment outside the facility
- if applicable, the estimated quantity of material that would be disposed and the disposal location.

A written summary containing the following would be provided within 10 days of the preliminary report:

- description of the incident and its cause
- periods in which the incident occurred (including exact dates and times)
- whether the cause and its consequences have been corrected, and if not, the anticipated time each is expected to continue
- steps taken or planned to reduce, eliminate, and prevent recurrence of the event.

All available and reasonable actions would be taken, including more frequent and enhanced monitoring, to:

- determine the effect and extent of the incident
- minimize adverse impact to surface water or groundwater arising from the incident
- minimize the effect of each incident on wildlife
- minimize any endangerment of public health and safety.

6.0 REFERENCES

Alaska Department of Transportation and Public Facilities (ADOT&PF). 2011. Alaska Storm Water Pollution Prevention Plan (SWPPP) Guide, Appendix B. Examples of Best Management Practices.

ASTM International. 2013. Method E2242-13, Standard Test Method for Column Percolation Extraction of Mine Rock by the Meteoric Water Mobility Procedure, ASTM International, West Conshohocken, PA.

Donlin Gold LLC. 2016. Quality Assurance Project Plan (QAPP), Donlin Gold Project, August.

Sobek A.A., Schuller W.A., Freeman J.R., and Smith R.M. 1978. Field and Laboratory Methods Applicable to Overburden and Minesoils, USEPA Report No. 600/2-78-054, 203 pp.

SRK Consulting. 2016a. Project Description, Volume I, Donlin Gold Project.

SRK Consulting. 2016b. Water Resources Management Plan, Volume II, Donlin Gold Project.

SRK Consulting. 2016c. Waste Rock Management Plan, Volume IIIB, Donlin Gold Project.

SRK Consulting. 2016d. Integrated Waste Management Plan, Volume III, Donlin Gold Project.

SRK Consulting. 2016e. Reclamation and Closure Plan, Volume IV, Donlin Gold Project.

SRK Consulting. 2016f. Tailings Management Plan, Volume IIIA, Donlin Gold Project.

Appendix A
Quality Assurance Project Plan (QAPP) Water Quality Monitoring, Sampling and Analysis Activities

(This QAPP was prepared for environmental baseline studies and will be updated once permits are issued.)

and
Acid Based Accounting Analysis Protocol

Quality Assurance Project Plan (QAPP)

Water Quality Monitoring, Sampling and Analysis Activities

December 2016

4720 Business Park Blvd. Suite G-25
Anchorage, Alaska 99503

Based on the Generic Tier 2 Quality Assurance Project Plan for Water Quality Monitoring Sampling and Analysis Activities (Revision 2) as directed by the Alaska Department of Environmental Conservation

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ACRONYMS

ADEC	Alaska Department of Environmental Conservation
APDES	Alaska Pollutant Discharge Elimination System
ASTM	ASTM International
DO	dissolved oxygen
DOW	Division of Water
EC	electrical conductivity
EDGE	EQuIS Data Gathering Engine
EDP	electronic data processor
GAI	Golder Associates, Inc.
HDPE	high-density polyethylene
ICPMS	Inductively Coupled Plasma Mass Spectrometry
IDL	instrument detection limit
LOD	limit of detection
MDL	method detection limit
ND	non-detect
NIST	National Institute of Standards Technology
ORP/Eh	oxidation/reduction potential
PPE	personal protective equipment
PQL	practical quantitation limit
QA	quality assurance
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
QC	quality control
RL	reporting limit
RPD	relative percent difference
RSD	relative standard deviation
SOPs	Standard Operating Procedures
SRMs	standard reference materials
TDS	total dissolved solids
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
WQBELs	water quality-based effluent limitations
WQS	water quality standards

UNITS OF MEASURE

±	plus or minus
≤	less than or equal to
≥	greater than or equal to
µmhos/cm	micromhos per centimeter
µS/cm	microsiemens per centimeter
km	kilometers
L	liter
mg/L	milligrams per liter
ml	milliliter
ng/L	nanograms per liter
s.u.	standard units

ELEMENTS AND COMPOUNDS

Ag	silver
Al	aluminum
As	arsenic
Ba	barium
Be	beryllium
Ca	calcium
Cd	cadmium
Cl	chloride
Co	cobalt
CO_3	carbon trioxide
COC	chain of custody
Cr	chromium
Cu	copper
F	fluoride
Fe	iron
H_2SO_4	sulfuric acid
HCl	hydrochloric acid
HCO_3	bicarbonate
Hg	mercury
HNO_3	nitric acid
K	potassium
Li	lithium
Mg	magnesium
Mn	manganese
Mo	molybdenum
Na	sodium
NaOH	sodium hydroxide
Ni	nickel
OH	hydroxide (Alkalinity)
Pb	lead
Sb	antimony
Se	selenium
SO_4	sulfate
Tl	thallium
V	vanadium
Zn	zinc

1.0 PROJECT MANAGEMENT ELEMENTS

1.1 Title and Approvals

Title: Tier 2 Quality Assurance Project Plan (QAPP) for Water Quality Monitoring Sampling and Analysis Activities for the Donlin Gold Project.

Name: Andrew Cole, Project Manager	Phone: 907-273-0200
Donlin Gold LLC	email: acole@donlingold.com
Signature: ________________________________	Date: _______________
Name: , QA, Sampling and Data Manager	Phone:
Donlin Gold LLC	email:
Signature: ________________________________	Date: _______________
Name: , Project Manager	Phone:
ADEC DOW Program	email:
Signature: ________________________________	Date: _______________
Name: , QA Officer	Phone:
ADEC DOW WQSAR Program	email:
Signature: ________________________________	Date: _______________
Name(s): , Field Specialists and Technicians	Phone:
Donlin Gold LLC	email:
Signature(s): ______________________________	Date: _______________

1.2 Distribution List

The quality assurance project plan distribution list is summarized in Table 1.

Table 1: Distribution List

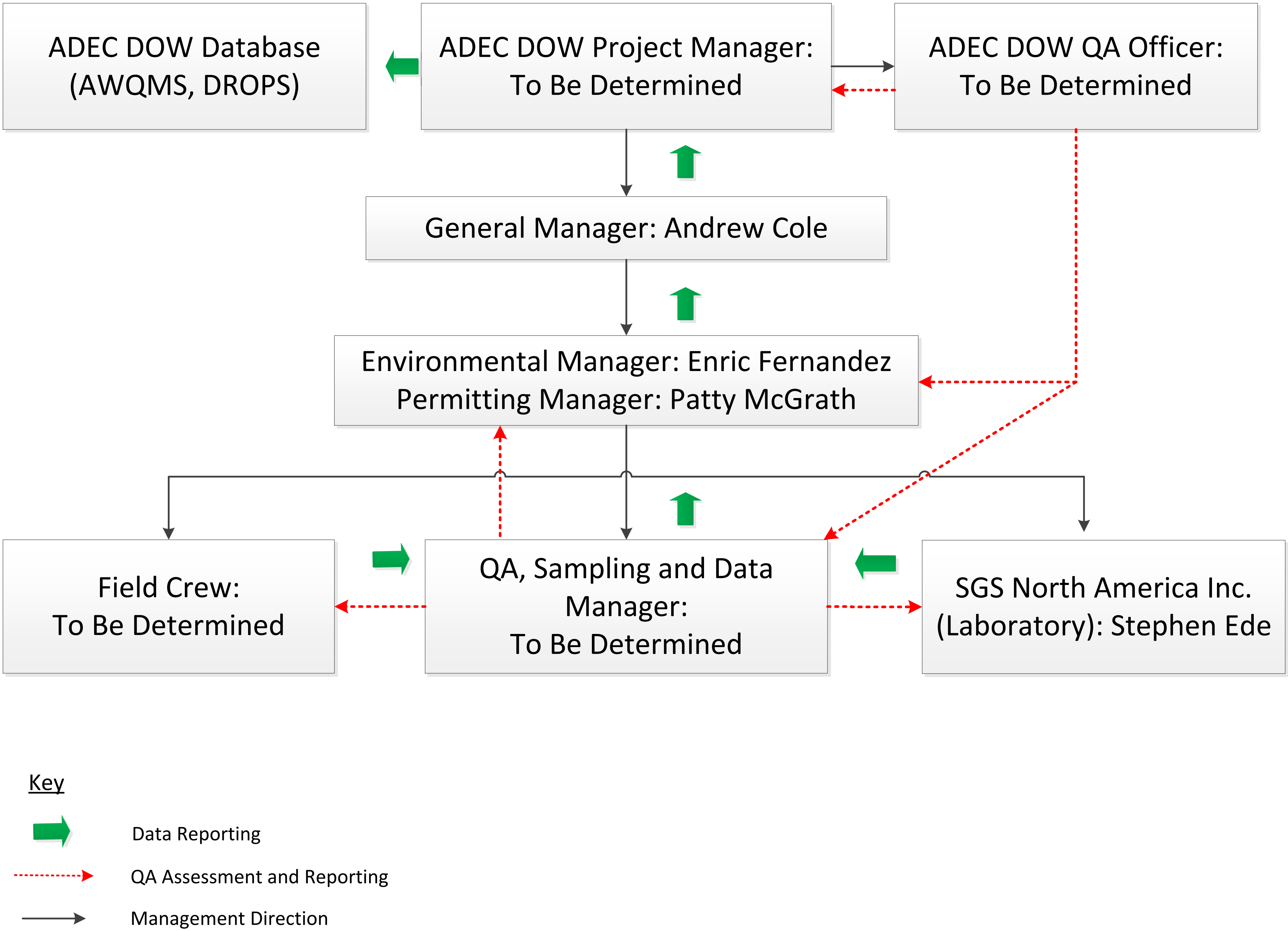
Name	Position	Agency/ Company	Division/ Branch/Section	Contact Information
Andrew Cole	Project Manager	Donlin Gold LLC	N/A	Phone: 907-273-0200 Email: acole@donlingold.com
Enric Fernandez	Environmental Manager	Donlin Gold LLC	N/A	Phone: 907-273-0200 Email: efernandez@DonlinGold.com
Patty McGrath	Permitting Manager	Donlin Gold LLC	N/A	Phone: 907-273-0200 Email: pmcgrath@DonlinGold.com
to be determined	Quality Assurance (QA), Sampling and Data Manager	Donlin Gold LLC	N/A	Phone: 907-273-0200 Email:
Charles Homestead	Lab Manager	SGS North America Inc.	N/A	Phone: 907-562-2343 Email: Charles.Homestead@sgs.com
Mary McDonald	Lab QA Manager	SGS North America Inc.	N/A	Phone:907-562-2343 Email: Mary.McDonald@sgs.com
Stephen Ede	Technical Director	SGS North America Inc.	N/A	Phone:907-562-2343 Email: Stephen.Ede@sgs.com
to be determined	Project Manager	ADEC	Division of Water	Phone: Email:
to be determined	QA Officer	ADEC	Division of Water, Water Quality Standards, Assessment, and Restoration/QA	Phone: Email:

1.3 Project Task/Organization

The project organizational responsibilities are summarized in Table 2, and the water quality sampling program organizational chart for reporting to ADEC when permits are submitted is presented as Figure 1.

Table 2: Project Organizational Responsibilities

Position Title	Agency or Company	Division Branch/Section	Responsibilities
Project Manager	Donlin Gold LLC	N/A	Responsible for overall technical, financial, and contractual management of the project.
Environmental Manager	Donlin Gold LLC	N/A	Responsible for the environmental sector of the project, overseeing technical, financial, and contractual management of the project and subsequent reporting of QA reviewed (validated and verified) data to ADEC.
Permitting Manager	Donlin Gold LLC	N/A	Responsible for the permitting sector of the project, overseeing technical, financial, and contractual management of the permitting program.
QA, Sampling and Data Manager	Donlin Gold LLC	N/A	Responsible QA review to verify all monitoring complies with the QAPP-specified criteria. This is accomplished through routine technical assessments of the sample collection, analysis, and data reporting process. Assessments may include, but are not limited to, onsite field audits, data audits, QA review of blind lab performance evaluation samples, lab audits, etc. These assessments are performed independent of overall project management.
Field Sampling staff	Donlin Gold LLC	N/A	Responsible for the collection, data transcription, and delivery of data to the QA, Sampling and Data Manager.
Laboratory Manager	SGS North America, Inc.	N/A	Responsible for overall review and approval of contracted laboratory analytical work, responding to sample result inquiries, and method specific details. Responsible for quality assurance/quality control (QA/QC) of laboratory analysis as specified in the QAPP and reviews and verifies the validity of sample data results as specified in the QAPP and appropriate U.S. Environmental Protection Agency (EPA)-approved analytical methods.
Laboratory Quality Assurance Manager/Officer	SGS North America, Inc.	N/A	Responsible for QA/QC of water quality laboratory analyses as specified in the QAPP. Along with Laboratory Manager, the Lab QA Officer reviews and verifies the validity of sample data results as specified in the QAPP and appropriate EPA-approved analytical methods.
Project Manager	ADEC	Division of Water	Responsible for overall technical and contractual management of the project. For permit-related monitoring projects, responsible for ensuring permittee complies with permit-required water quality monitoring as specified in the approved QAPP.
Water Quality Assurance Officer	ADEC	Division of Water	Responsible for QA review and approval of plan and oversight of QA activities, ensuring collected data meets project's stated data quality goals.



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1.4 Background and Project Objectives

1.4.1 Introduction

Donlin Gold LLC[1] (Donlin Gold) is proposing the development of an open pit, hardrock gold mine in southwestern Alaska, about 277 miles (446 km) west of Anchorage, 145 miles (233 km) northeast of Bethel, and 10 miles (16 km) north of the village of Crooked Creek, as shown on Figure 2.

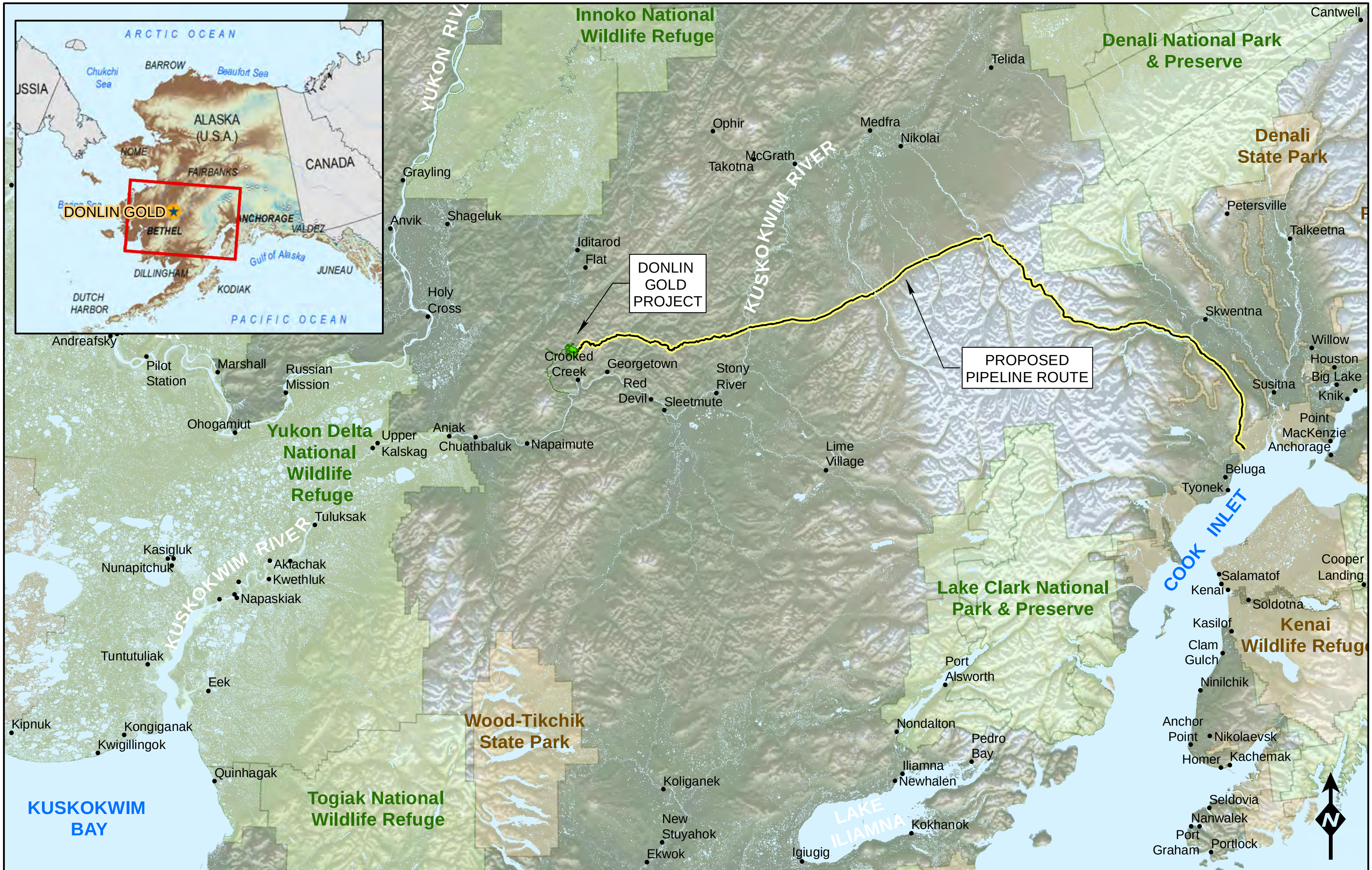
The proposed Donlin Gold project's water quality monitoring program was established with the overall purpose of collecting baseline data of known and sufficient quality to provide defensible documentation of naturally occurring levels and variability of trace elements in surface water and groundwater. The data collected by this program will provide the basis for the evaluation of potential environmental impacts and form the basis for the long-term monitoring necessary to successfully plan and execute final site closure and post-closure monitoring.

1.4.2 Project Background

Surface water collection at the Donlin Gold project area was initiated in 1996. Groundwater monitoring began in 2003. The project site monitoring locations routinely sampled for part or all of the period the site monitoring program was active are shown on Figure 3. The site monitoring locations were designed to characterize conditions in areas of proposed infrastructure and previously disturbed ground, as shown on Figure 4.

Monitoring and annual summary reporting have been typically performed by contractors (1996-1999, 2002-2006) and by Placer Dome, Barrick, or Donlin Creek/Donlin Gold employees (2000, 2007-2015). No monitoring or water quality data collection was performed in 2001. Groundwater and surface water quality monitoring was discontinued at the Donlin project area in December 2013 and June 2015, respectively, as sufficient data existed to characterize current conditions.

[1] Donlin Gold LLC is a limited liability company, jointly owned by Barrick Gold U.S. Inc. and NovaGold Resources Alaska, Inc. on a 50/50 basis.



- Populated Place
- Proposed Natural Gas Pipeline Alignment
- Proposed Infrastructure Layout
- Federal Administrative Boundaries
- State Administrative Boundaries

Seward Meridian, UTM Zone 5, NAD83

SCALE:

0 12.5 25 50 mi

0 20 40 80 km

DONLIN GOLD

PROJECT LOCATION MAP

DONLIN GOLD PROJECT

FIGURE: 2

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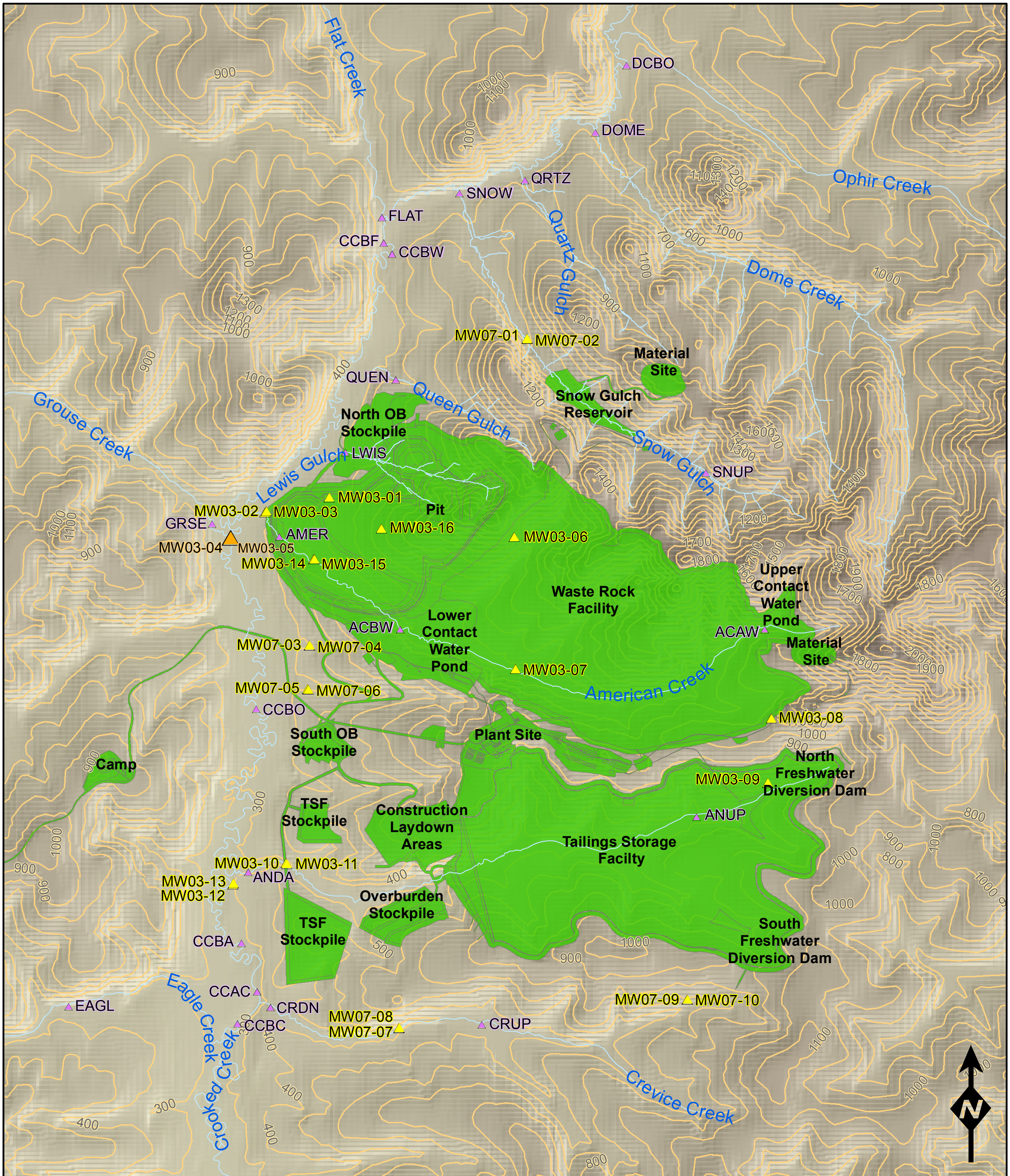


Surface Water Monitoring Station

Monitoring Well

Groundwater Monitoring Site (Decomissioned)

Proposed Infrastructure Layout

Contour (100-ft)

Seward Meridian, UTM Zone 4, NAD83

DONLIN GOLD

PROJECT SITE MONITORING LOCATIONS

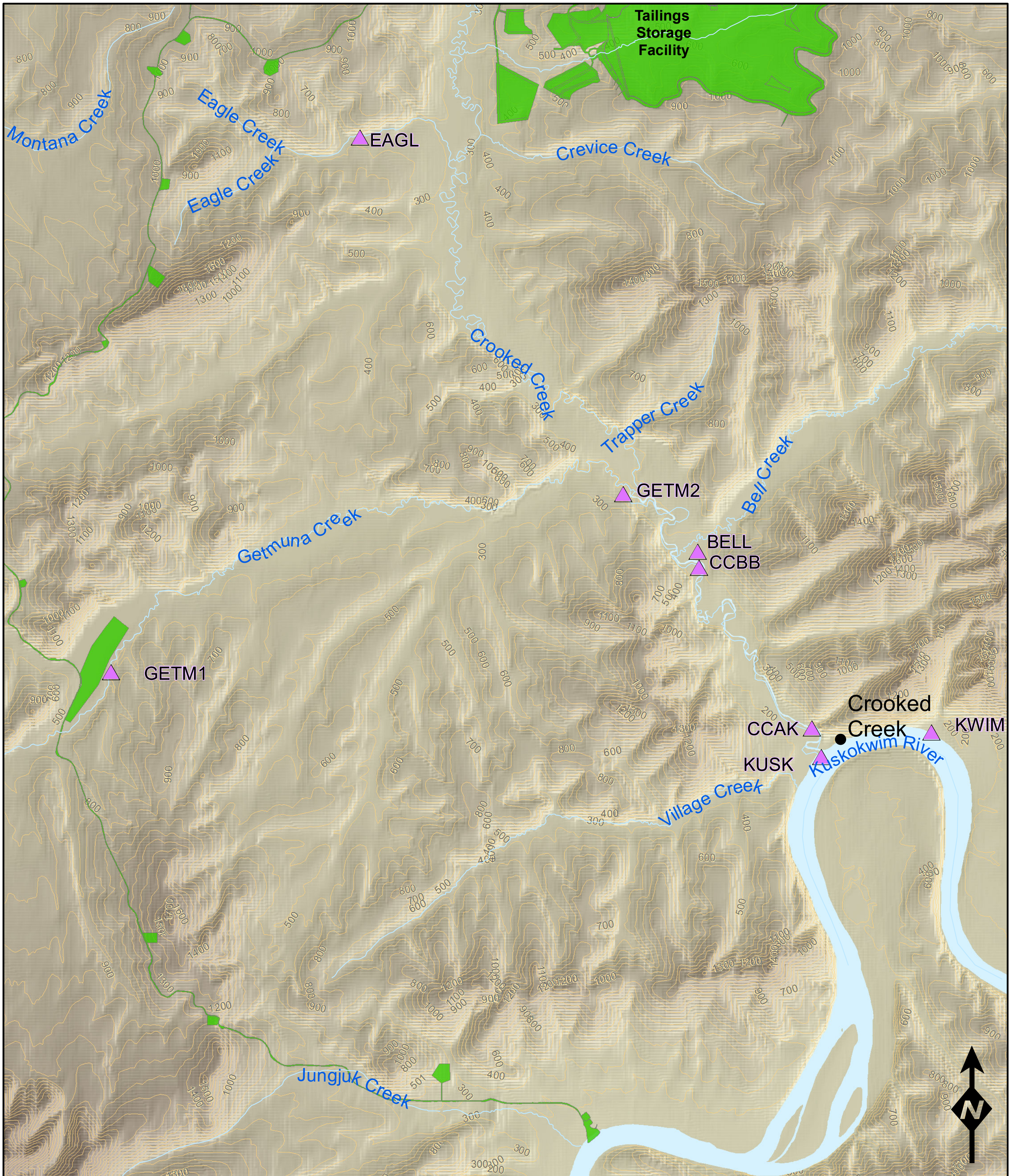
Water Quality QAPP

DONLIN GOLD PROJECT

SCALE: 0 0.25 0.5 1 mi; 0 0.4 0.8 1.6 km

FIGURE: 3

DG: ENV0248.mxd, 08/19/16, R04



Surface Water Monitoring Station

Proposed Infrastructure Layout

Contour (100-ft)

Seward Meridian, UTM Zone 4, NAD83

DONLIN GOLD

PROJECT SITE MONITORING LOCATIONS

Water Quality QAPP

DONLIN GOLD PROJECT

SCALE:

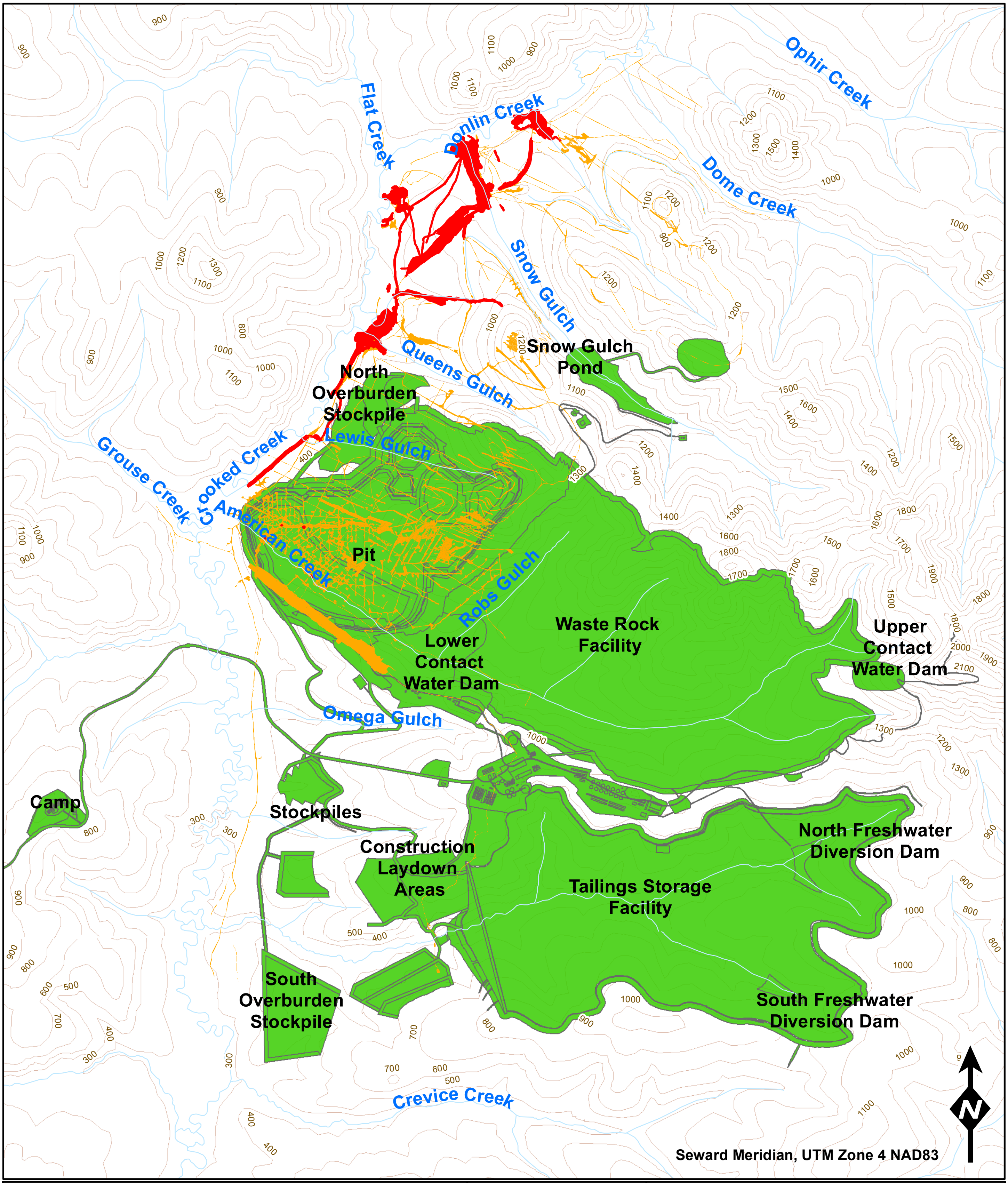
0 0.5 1 2 mi

0 0.75 1.5 3 km

FIGURE:

3b

DG: ENV0289.mxd, 08/19/16, R03



Contours (ft)

Proposed Infrastructure Layout

Previously Disturbed Ground

Roads, Trails, Trenches

Placer Mining Activity

DONLIN GOLD

PROPOSED INFRASTRUCTURE & PREVIOUSLY DISTURBED GROUND

DONLIN GOLD PROJECT

SCALE: 0 0.25 0.5 1 mi / 0 0.4 0.8 1.6 km

FIGURE: 4

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Below is a summary of water quality monitoring performed to date:

- 1996 – CH2M Hill, Inc. (surface water only)
- 1997 – CH2M Hill, Inc. (surface water only)
- 1998 – Agra Earth & Environ. Inc. (surface water only)
- 1999 – AMEC Earth & Environ. Inc. (surface water only)
- 2000 – Placer Dome U.S., Inc. (surface water and groundwater)
- 2001 – no monitoring performed
- 2002 – HMH consulting Ltd/Gates & Co. (surface water only)
- 2002 – Water Management Consultants (groundwater only)
- 2003 – HMH Consulting (surface water only)
- 2004 – HMH Consulting (1^{st} and 2^{nd} quarters, surface water only)
- 2004 – Golder Associates, Inc. (GAI)/Lynx (3^{rd} quarter, surface water only)
- 2004 – Water Management Consultants (1^{st} and 2^{nd} quarters, groundwater only)
- 2004 – Lynx (3^{rd} and 4^{th} quarter, groundwater only)
- 2005 through 3^{rd} quarter 2007 – Lynx (surface and groundwater) for Placer Dome U.S., Inc. (1^{st} quarter 2005) then Barrick Gold of North America (2^{nd} quarter 2005 through 3^{rd} quarter 2007)
- 4^{th} quarter 2007 – Barrick Gold of North America (surface and groundwater)
- 2008 through 2013 – Donlin Creek LLC/Donlin Gold (surface and groundwater)
- 2014 and 2015 through 2^{nd} quarter – Donlin Gold (surface water only).

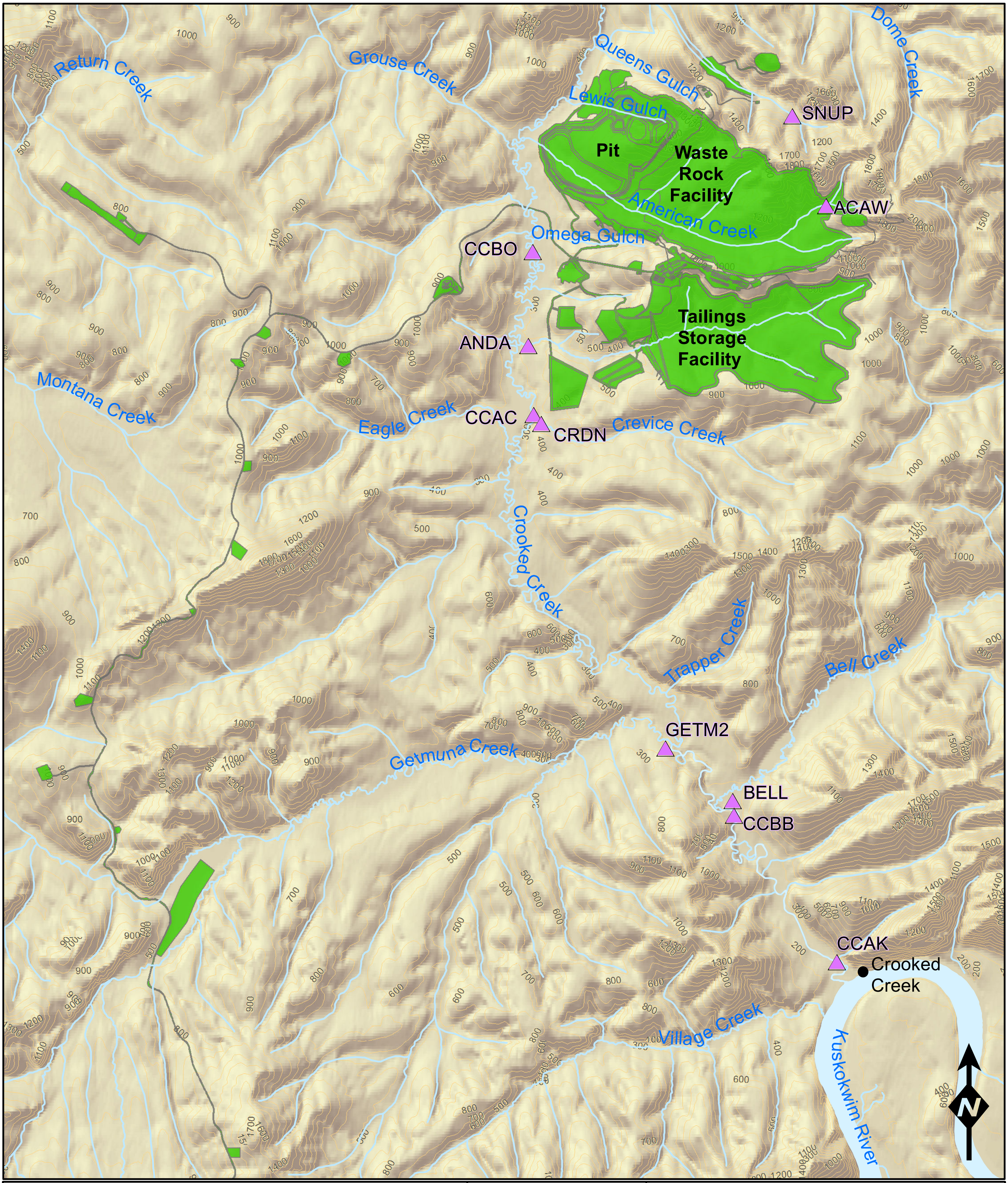
During 2004, GAI compiled, reviewed, and assessed existing water quality electronic data files previously generated for the Donlin Gold project. As part of this task, a single EQWin electronic database file of water quality data (1996–2003, surface water only) was prepared and delivered to Placer Dome (now Barrick). Since 2009, data was migrated to the EQuIS 5 Professional database, developed by EarthSoft Inc., which has streamlined workflow for data field entry, quality assurance (QA) and reporting.

1.4.3 Surface Water Sampling Plan

The surface water sampling plan was first established in 1996. It included 13 water quality monitoring stations that were located throughout the project area, but were concentrated along Crooked Creek (Donlin Creek above the confluence with Flat) and on its tributaries (American, Anaconda, Dome, Flat, Grouse, Quartz, Lewis, Queen, and Snow Creeks) immediately upstream of their confluence with Crooked Creek. These original 13 monitoring stations were located to gather water quality and surface flow data for entire drainage basins.

As the project progressed, understanding of both flow and metals loading from the respective basins increased. In 2005, the sampling plan was redesigned to include the addition of new surface water quality sampling stations and to discontinue monitoring at others. The network was expanded to further define Snow Gulch (upstream), American Creek (mid and upstream) and Upper Anaconda Creek, and to encompass the Crevice Creek drainage (to the south of the proposed facilities).

The revised monitoring site selection is presented below with discussion on the rationale for the changes. The water quality sample stations were determined to be the best sites in terms of both location and access, based on an aerial reconnaissance review, and past experience. The locations of the most recent monitoring stations are presented on Figure 6.



Surface Water Monitoring Station

Proposed Infrastructure Layout

Contours (ft)

Seward Meridian, UTM Zone 4 NAD83

DONLIN GOLD

SURFACE WATER QUALITY MONITORING STATIONS
Water Quality QAPP

DONLIN GOLD PROJECT

SCALE:
0 0.5 1 2 mi
0 0.75 1.5 3 km

FIGURE:
5

DG: ENV0088.mxd, 07/14/16, R08

Surface water quality within the project can be segregated into three basic categories of influence:

- **Category 1:** waters draining undisturbed and non-mineralized areas
- **Category 2:** waters draining area of defined mineralized zone only with no placer mining activities
- **Category 3:** waters draining from areas of both placer mining and the mineralized zone.

The surface water sampling plan is designed to characterize these three area categories, as well as to establish upstream and downstream controls. The surface water hydrologic data collection sites vary from the surface water monitoring stations quality sites, because they are achieving different goals. Additional grab samples and collection of field parameters are collected when practical.

Water quality monitoring stations sites that were not included in the most recent sample program are listed below, along with the rationale for their exclusion. The locations of these stations are shown on Figure 5:

- **ACBW (Category 2):** American Creek site, below proposed waste rock and seepage collection pond facilities, was previously designed as a long-term monitoring station through reclamation and closure. Monitoring was conducted from 1Q2005 to 3Q2012.
- **ANUP (Category 1):** Upper Anaconda Creek site is above any potential influence from proposed diversions or other physical disturbance. Monitoring was conducted from 2Q2005 to 3Q2013.
- **CCBA (Category 3):** Crooked Creek below Anaconda Creek site was replaced by CCAC. The channel and banks are better defined at CCAC and the location will support a cable crossing for use in long-term stream flow monitoring. Monitoring was conducted at this station from 2Q2002 to 3Q2004.
- **CCBC (Category 3):** Crooked Creek below Crevice Creek site is below all proposed facilities and potential impacts at Crevice Creek. Additional lower sites were reinstated to compensate for discontinuing this site. Monitoring was conducted from 3Q2005 to 2Q2013.
- **CCBF (Category 1):** Crooked Creek downstream of Flat Creek site is replaced by Station CCBW which is now being used to characterize this area. Monitoring was conducted from 2Q1996 to 3Q2000.
- **CRUP (Category 1):** Upper Crevice Creek site is above any potential influence from proposed Anaconda facilities. Monitoring was conducted from 3Q2005 to 3Q2012.
- **DOME (Category 1):** Dome Creek site is upstream of all current and proposed activities and provides no critical data for long-term monitoring. Data collection started during 2Q1996 and was discontinued after 3Q2004. This location was added back into the sample program and monitored from 3Q2008 to 3Q2010 in support of proposed exploration activities.
- **EAGL (Category 3):** Data from CCBO will be used to characterize this area. Eagle Creek site was initially established at upper Eagle Creek during 2Q2009 and phased out after 1Q2011.

- **FLAT (Category 1):** Sufficient data exists to characterize Flat Creek from areas upstream of proposed activities. Monitoring was conducted from 2Q1996 to 3Q2004.
- **GRSE (Category 3):** Sufficient data exists to characterize Grouse Creek from areas upstream of proposed activities. Monitoring was conducted from 2Q1996 to 1Q2009.
- **GETM1 (Category 1):** Getmuna Creek temporary location, downstream of proposed port road and adjacent to proposed material site. One sample was collected during 1Q2012.
- **KWIM (Category 1):** Adequate data exist to characterize the Kuskokwim River water quality at this site (Kuskokwim above Crooked Creek confluence). Discontinued after 3Q2004.
- **KUSK (Category 1):** Adequate data exist to characterize the Kuskokwim River water quality at this site (Kuskokwim below Crooked Creek confluence). Discontinued after 3Q2004.
- **LWIS (Category 3):** Lewis Gulch drains a mineralized area and will be disturbed by proposed operations. Discontinued after 3Q2004.
- **QRTZ (Category 1):** Quartz Creek site is upstream of all proposed activities and provides no critical data for long-term monitoring. Monitoring was resumed in 3Q2008 in support of proposed exploration activities, and discontinued after 3Q2010.
- **QUEN (Category 1):** Queen Gulch is upstream of all activities and provides no critical data for long-term monitoring. Sampling was discontinued after 3Q2004.
- **SNDN (Category 2):** Lower Snow Gulch crosses both the mineralized trend and historic placer mining. This site is above both the mineralization trend and placer mining areas. Discontinued after 3Q2012.

The most recent surface water quality monitoring station network and rationale is presented in Table 3. The water quality monitoring stations were optimized in terms of both location and access based on an aerial reconnaissance review and past experience. The locations of these water quality monitoring stations are presented on Figure 6.

Table 3: Surface Water Monitoring Stations and Site Representativeness

Station Description	Station ID	Rationale and Purpose	Category	Geographic Coordinates (meters) UTM Zone 4 NAD 83	
				Easting	Northing
American Gold above confluence with Crooked Creek	AMER	American Creek below all planned facilities and disturbance and above confluence with Crooked Creek.	2	539333	6878839
American Creek above waste rock	ACAW	American Creek upstream of proposed waste rock placement near proposed upstream diversion of water around all facilities. Also upstream of mineralization in American Creek. Placed to determine quality of diversion water that would be directed to Crooked Creek as non-mine water.	1	545787	6877604
Anaconda Creek above confluence with Crooked Creek	ANDA	Below all proposed facilities at Anaconda Creek and above Crooked Creek.	1	539055	6874441
Snow Gulch Upstream of activity and mineralization trend	SNUP	Snow Gulch crosses both the mineralized trend and historic placer mining. This site is above both the mineralization trend and placer mining.	1	545024	6879725
Snow Gulch above confluence with Crooked Creek	SNOW	Snow Gulch below mineralization and historic placer tails and above confluence with Crooked Creek.	3	541729	6883397
Crooked Creek above Crevice Creek.	CCAC	Below all proposed facilities and potential impacts to Crooked Creek. This site replaces CCBA.	3	538972	6872889
Bell Creek above confluence with Crooked Creek	BELL	Below all proposed facilities and potential impacts to Crooked Creek.	1	543636	6863886
Crooked Creek above confluence with Kuskokwim River	CCAK	Below all proposed facilities and potential impacts to Crooked Creek.	3	546040	6860167
Crooked Creek below Bell Creek	CCBB	Below all proposed facilities and potential impacts to Crooked Creek, below both Bell Creek and Getmuna Creek.	3	543667	6863547
Crooked Gold Below Ophir Creek	CCBO	Downstream of Ophir Creek, which drains from the camp area and airstrip.	3	539021	6876552
Crooked Creek directly below Lyman Wash Plant	CCBW	Crooked Creek below influence of historical placer mining operation.	3	540832	6882598
Lower Crevice Creek above confluence with Crooked Creek	CRDN	Crevice Creek below any potential influence from Anaconda facilities.	1	539215	6872587

Table 3 (Continued): Surface Water Monitoring Stations and Site Representativeness

Station Description	Station ID	Rationale and Purpose	Category	Geographic Coordinates (meters) UTM Zone 4 NAD 83	
				Easting	Northing
Donlin Creek below Ophir Creek	DCBO	Upstream of all proposed activity and above any disturbance from historic placer mining. Project Control..	1	543948	6885105
Getmuna Creek above confluence with Crooked Creek.	GETM2	Getmuna Creek below any potential influence from Port Road and associated materials sites.	1	542076	6865101

1.4.4 Groundwater Sampling Plan

A total of 26 wells have been installed for the groundwater monitoring network (Figure 6). Monitoring well locations were established to characterize the groundwater system both upgradient and downgradient of each major facility. Two of the 26 wells have been decommissioned and plugged (MW03-04 and MW03-05). Table 4 summarizes well location, monitoring target, and current status; the wells are located as shown on Figure 6.

In many of these locations near the lower reaches of a creek where groundwater is likely discharging to the surface water system, two pairs of wells were installed to evaluate vertical gradients. One well was installed to monitor both the shallow groundwater system and the other in the deep groundwater systems, and to evaluate vertical gradients near the lower reaches of the creek where groundwater is likely discharging to the surface water system.

1.4.5 Project Objectives of the QAPP

The purpose of the QAPP is to formalize the procedures and associated quality control for all related activities, including sample collection, sample handling and shipping, contracted laboratory services, review of laboratory results, and data management.

The objectives of the QAPP are to:

- Describe the various components of the water quality monitoring program.
- Provide a foundation and structure to administer water management planning.
- Implement standardized procedures for program components.
- Provide an overview of the overall project goals and the rationale for water quality monitoring locations and frequency.

1.5 Project Description and Schedule

1.5.1 Project Description

Project Description of the Surface Water Monitoring Program

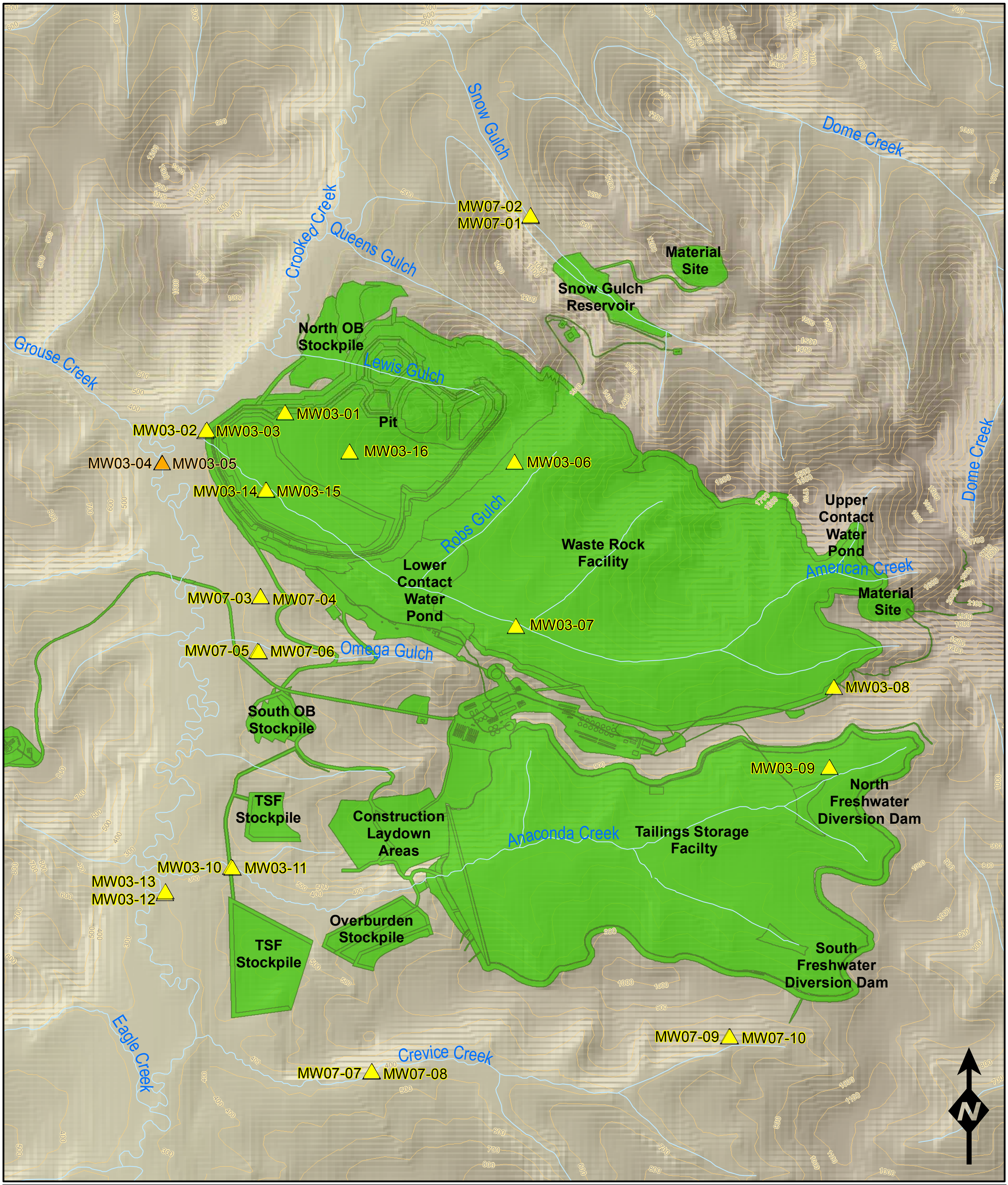
The purpose of the surface water monitoring program is to collect data that establish the baseline conditions of surface water systems in the area potentially affected by development, as depicted in Figure 6. These data may be used during the mine planning and permitting process and for water quality monitoring throughout mine construction, operations, reclamation, closure, and post-closure.

Table 4: Groundwater Monitoring Stations and Site Representativeness

Well ID	Geographic Coordinates (meters) UTM Zone 4 NAD 83		Monitoring Target	Notes
	Easting	Northing		
MW03-01	539999	6879366	Downgradient from mineralized zone	Sampling discontinued after 4Q2013
MW03-02	539144	6879164	Bedrock downgradient from pit / upstream from American Creek	Sampling discontinued after 4Q2013
MW03-03	539163	6879178	Alluvium downgradient from pit / upstream from American Creek	Sampling discontinued after 4Q2012
MW03-04	538680	6878830	Bedrock downgradient from pit / downstream from American Creek	Sampling discontinued after 4Q2013, well decommissioned and plugged with grout in 2014.
MW03-05	538685	6878841	Alluvium downgradient from pit / downstream from American Creek	Sampling discontinued after 4Q2012 well decommissioned and plugged with grout in 2014.
MW03-06	542457	6877089	Shallow groundwater downgradient of waste rock facilities	Not part of program, Completed below permafrost
MW03-07	542470	6877084	Downgradient from the proposed waste rock facilities	Sampling discontinued after 4Q2013
MW03-08	545875	6876430	Upgradient from the proposed waste rock facilities	Sampling discontinued after 4Q2013
MW03-09	545829	6875574	Upgradient from the proposed tailings facility	Sampling discontinued after 4Q2013
MW03-10	539423	6874503	Deep groundwater downgradient from proposed tailings facility	Sampling discontinued after 4Q2013
MW03-11	539433	6874500	Shallow groundwater downgradient from proposed tailings	Well is dry
MW03-12	538714	6874223	Bedrock downgradient from proposed tailings / downstream from Anaconda Creek	Sampling discontinued after 4Q2012
MW03-13	538719	6874245	Alluvium downgradient from proposed tailings / downstream from Anaconda Creek	Sampling discontinued after 4Q2012
MW03-14	539782	6878537	Existing groundwater quality in the mineralized zone	Sampling discontinued after 4Q2013
MW03-15	539797	6878539	Existing shallow groundwater quality in the mineralized zone	Sampling discontinued after 4Q2012
MW03-16	540692	6878952	Groundwater upgradient from the proposed pit	Sampling discontinued after 4Q2013
MW07-01	542627	6881469	Shallow groundwater - Snow Gulch	Sampling discontinued after 4Q2013
MW07-02	542627	6881477	Deep groundwater - Snow Gulch	Sampling discontinued after 4Q2013
MW07-03	539729	6877401	Shallow groundwater - downgradient from mill facility – Omega North	Sampling discontinued after 4Q2012

Table 4 (Continued): Groundwater Monitoring Stations and Site Representativeness

Well ID	Geographic Coordinates (meters) UTM Zone 4 NAD 83		Monitoring Target	Notes
	Easting	Northing		
MW07-04	539734	6877400	Deep groundwater - downgradient from mill facility – Omega North	Sampling discontinued after 4Q2013
MW07-05	539703	6876817	Shallow groundwater - downgradient from mill facility – Omega Gulch	Not sampled quarterly as of December 2012
MW07-06	539714	6876812	Deep groundwater - downgradient from mill facility – Omega Gulch	Sampling discontinued after 4Q2013
MW07-07	540910	6872313	Deep groundwater - downgradient of potential water diversion from Anaconda to Crevice creeks.	Sampling discontinued after 4Q2013
MW07-08	540912	6872313	Shallow groundwater - downgradient of potential water diversion from Anaconda to Crevice creeks.	Ice Cap @ 25 feet (7.62 meters)
MW07-09	544752	6872692	Deep groundwater - upgradient of potential water diversion from Anaconda to Crevice creeks.	Sampling discontinued after 4Q2013
MW07-10	544752	6872692	Shallow groundwater - upgradient of potential water diversion from Anaconda to Crevice creeks.	Sampling discontinued after 4Q2013



Groundwater Monitoring Site (Decomissioned)

Groundwater Monitoring Site (In Place)

Proposed Infrastructure Layout

Contour (100-ft)

Seward Meridian, UTM Zone 4, NAD83

DONLIN GOLD

GROUNDWATER QUALITY MONITORING WELLS

Water Quality QAPP

DONLIN GOLD PROJECT

SCALE:

0 0.25 0.5 1 mi

0 0.375 0.75 1.5 km

FIGURE:

6

DG: ENV0089.mxd, 11/29/16, R09

The primary objectives for the surface water monitoring program are to:

- Continue to monitor the loading from key drainage basins.
- Determine and document the effects of the mineralized zone and historical placer mining activities on the surface water quality in the region.
- Provide data to support water balance modeling.
- Establish long-term monitoring stations for the life of the project mine from exploration through construction, through operations, and, ultimately closure and reclamation.

Project Description of the Groundwater Monitoring Program

The purpose of the groundwater monitoring program is to document the existing baseline, baseline groundwater chemistry, and piezometric surface within the areas where mine development is proposed (Figure 7).

The general objectives of the groundwater monitoring program are to:

- Collect data that can be used to establish the background condition of the bedrock and alluvial groundwater systems in the area. Data will be collected for groundwater quality and groundwater elevations.
- Collect aquifer characteristic data that can be used to aid in facility design and site-wide water management.
- Develop an overall conceptual model of baseline groundwater conditions at the site to support the permitting process.

1.5.2 Project Implementation Schedule

Water quality monitoring, sampling, and analysis activities were initiated in 1995. In December 2013 groundwater quality monitoring at the Donlin project area was discontinued. The wells have been put in caretaker mode and have not been decommissioned. The surface water monitoring program was discontinued after the June 2015 second quarter sampling event. Sufficient surface and groundwater data exist to characterize current conditions for the proposed Donlin Gold project. The surface and groundwater sampling program will resume when required by project advancement.

The historical sampling schedule is described in the project background in Section 1.4.2.

1.6 Data Quality Objectives and Criteria for Measurement Data

1.6.1 Data Quality Objectives

The Donlin Gold project is not currently under a permit by the Alaska Department Environmental Conservation (ADEC); however, a baseline QAPP was developed to provide a basis for baseline data collection. The Laboratory Procedures Program establishes protocols and minimum quality assurance/quality control (QA/QC) requirements for contracted laboratory services to obtain analytical data that meet project requirements. The components described in this section should be reflected in the contractual agreement between Donlin Gold and the analytical testing laboratory providing services to the Donlin Gold project. Requirements and protocols specified in this section are to be reviewed in detail with the testing lab and agreed to in writing.

Known and documented data quality is an essential component of accurate environmental site assessments and effective decision-making associated with any water quality monitoring program. Achieving defined data quality objectives requires clear, concise, and detailed communications with contracted analytical laboratories. The purpose of this section is to establish specific analytical parameter lists for water quality monitoring at the proposed Donlin Gold project site.

The parameter lists include the names, units, basis, analytical method, maximum reporting limit, and the allowable holding time for each parameter (Table 5, Short List-1, and Table 6, Long List-1). The bottle sets required for each analytical list and reporting instructions for the testing labs are provided in Table 7 and Table 8, respectively. The specifications in these tables are used in establishing contractual agreements with contract laboratories prior to the initiation of analytical services. It is recommended that laboratory contract agreements periodically be reviewed and updated as required.

The parameter lists were developed to meet the objectives and strategies of an effective water quality monitoring program for the proposed Donlin Gold project to:

- Define existing water quality (both surface water and groundwater) within the vicinity of the proposed project site location.
- Provide a means for comparing area water quality (past, current, and future) to Alaska regulatory criteria.
- Provide a cost-effective means of assessing various project site features with respect to water quality including past, current, and future influences, as well as long-term and short-term trends.
- Establish an accurate and technically defensible water quality monitoring database to use for a variety of water quality assessments and tasks such as predicting the water quality at various project facilities and developing future water quality-based effluent limitations (WQBELs) associated with the water discharge permitting process defined by the Alaska Pollutant Discharge Elimination System (APDES).

The parameter lists are intended to be working documents. Modifications and revisions to existing lists may be necessary when and if deficiencies are identified or when changes to lab practices or procedures occur. At a minimum, existing lists should be reviewed annually and be revised and updated as needed. Additional parameter lists can be developed and implemented when additional or different water quality data needs are identified.

1.6.2 Measurement Quality Objectives

The relative quality of field measurements, field sampling, and laboratory data can be measured by the precision, accuracy, representativeness, comparability, and completeness of the data. The following sections define these quality parameters, the procedures commonly used for their measurement, and typical parameter acceptance criteria, where applicable.

It should be noted that data quality measurements can originate at many different levels such as in the field versus in the lab (i.e., field duplicate versus lab method duplicate). The point of origin and type of measurement are both important when evaluating data quality measurements.

Typical acceptance criteria are included in Table 8.

Detectability

Detectability is the ability of the method to reliably measure an analyte concentration above background. ADEC Division of Water (DOW) uses two components to define detectability, 1) method detection limit (MDL), and 2) practical quantification limit (PQL) or reporting limit (RL).

- The MDL is the minimum value the instrument can discern above background but without certainty of the accuracy of the measured value. For field measurements, the manufacturer's listed instrument detection limit (IDL) can be used.
- The PQL, or RL, is the minimum value that can be reported with certainty and is usually some multiple of the MDL.

Note: The measurement method of choice should, at a minimum, have a PQL or RL 3 times more sensitive than the respective ADEC water quality standard (WQS) and/or permitted pollutant level (for permitted facilities).

Sample data measured below the MDL is reported as non-detect (ND). An ND value is flagged with a "U" flag, along with a number to indicate the ND value is reported to the limit of detection (LOD), which is generally either 2 or 3.18 times the MDL, depending on analyte and analysis method. Detections as concentrations greater than or equal to (≥) the MDL but less than or equal to (≤) the PQL, or RL, is reported as estimated data, and reported with a "J" flag within all electronic files. Sample data measured above the PQL, or RL, are reported as reliable data per the specific sample analysis unless otherwise qualified by the analytical laboratory.

Table 5: Short List-1, Water Quality Parameters for Analysis of Water Samples

Parameter	Basis	Units	Method[1]	Reporting Limit	Holding Time
GENERAL					
pH	Laboratory	s.u.	SM20 4500-H B	0.01	as soon as possible (ASAP)
Electrical Conductivity	Laboratory	µmhos/cm	SM20 2510B	1	28 days
Total Dissolved Solids (TDS)	Dissolved	mg/L	SM20 2540C	10	7 days
Total Suspended Solids (TSS)	Total Recoverable	mg/L	SM20 2540D	1	7 days
MAJOR CATIONS					
Calcium (Ca)	Dissolved	mg/L	EPA 200.8	0.5	6 months
Magnesium (Mg)					
Sodium (Na)					
Potassium (K)					
MAJOR ANIONS					
Alkalinity, total*	Dissolved	mg/L	SM20 2320B	5	14 days
Bicarbonate *					
Carbonate*					
Hydroxide*					
Sulfate (SO_4)	Dissolved	mg/L	EPA 300.0	1	28 days
Chloride (Cl)				1	
Fluoride (F)				0.1	
METALS					
Aluminum (Al)	Total/Dissolved	mg/L	EPA 200.8	0.02	6 Months
Arsenic (As)				0.005	
Barium (Ba)				0.003	
Cadmium (Cd)				0.0005	
Iron (Fe)				0.04	
Lithium (Li)				0.01	
Manganese (Mn)				0.001	
Nickel (Ni)				0.002	
Zinc (Zn)				0.005	
Mercury (Hg)	Total Recoverable	ng/L	EPA 1631 E	1	90 days
Methyl Mercury	Total Recoverable	ng/L	EPA 1630	0.5	6 Months
CALCULATIONS					
Hardness (as $CaCO_3$)	Dissolved	mg/L	EPA 200.8	2	6 months

* As $CaCO_3$ s.u., Standard Units mg/L, milligrams per liter ng/L, nanograms per liter
µmhos/cm, micromhos per centimeter

Required Sample Preparation Procedures: For total recoverable metals by Inductively Coupled Plasma Mass Spectrometry (ICPMS) 200.8: Digestion – EPA 200.2[2]

Method References:

[1]EPA (200.8): EPA Method 200.8, Trace Elements by ICP-MS, Revision 5.4, 1994

[1]EPA (300.0): EPA Method 300.0, Determination of Inorganic Anions by Ion Chromatography, Revision 2.2, October 1993

[1]EPA (1631 E): EPA Method 1631, Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, Revision E, August 2002

[1]EPA (1630): Method 1630, Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and CVAFS, 2nd revision, January 2001
[1]SM20: Standard Methods for the Examination of Water and Wastes, 20th Edition (1998)
[2]EPA 200.2: Sample Preparation Procedure for Determination of Total Rec. Elements, Rev. 2.8, October 1994

Table 6: Long List-1, Water Quality Field and Lab Parameters for Analysis of Water Samples

Parameter	Basis	Units	Method[1]	Reporting Limit	Holding Time
FIELD PARAMETERS (COLLECTED BY FIELD CREW)					
pH	Field	s.u.	YSI 556 Probe	0.01	ASAP
Electrical Conductivity		µS/cm or µmhos/cm	YSI 556 Probe	1	ASAP
Water Temperature		Degree C	YSI 556 Probe	0.01	ASAP
Air Temperature		Degree C	Digital Thermometer	0.01	ASAP
Oxidation/Reduction Potential		millivolts	YSI 556 Probe	0.1	ASAP
Dissolved Oxygen (DO)		mg/L	YSI 556 Probe	0.01	ASAP
Turbidity (surface water only)		ntu	YSI 556 Probe	0.1	ASAP
GENERAL					
pH	Laboratory	s.u.	SM20 4500-HB	0.01	ASAP
Electrical Conductivity	Laboratory	µmhos/cm	SM20 2510B	1	28 days
Total Dissolved Solids (TDS)	Dissolved	mg/L	SM20 2540C	10	7 days
Total Suspended Solids (TSS)	Total Recoverable	mg/L	SM20 2540D	1	7 days
MAJOR CATIONS					
Calcium (Ca)	Dissolved	mg/L	EPA 200.8	0.5	6 months
Magnesium (Mg)					
Sodium (Na)					
Potassium (K)					
MAJOR ANIONS					
Alkalinity, total*	Dissolved	mg/L	SM20 2320B	5	14 days
Bicarbonate*					
Carbonate*					
Hydroxide*					
Sulfate (SO_4)	Dissolved	mg/L	EPA 300.0	1	28 days
Chloride (Cl)				1	
Fluoride (F)				0.1	
NUTRIENTS					
Nitrate+Nitrite (N)	Total Recoverable	mg/L	SM20 4500NO_3-F	0.1	28 days
Ammonia (as N)		mg/L	SM20 4500NH_3-F	0.1	28 days
CYANIDE					
Cyanide, total	Total	mg/L	SM20 4500CN C,E	0.005	14 days
Cyanide, WAD (weak acid dissociable)	Total Recoverable	mg/L	SM20 4500-CN I	0.005	14 days

Table 6 (continued): Long List-1, Water Quality Field and Lab Parameters for Analysis of Water Samples

Parameter	Basis	Units	Method[1]	Reporting Limit	Holding Time
METALS					
Aluminum (Al)	Total Recoverable/ Dissolved	mg/L	EPA 200.8	0.02	6 months
Antimony (Sb)				0.001	
Arsenic (As)				0.005	
Barium (Ba)				0.003	
Beryllium (Be)				0.0004	
Boron (B)				0.02	
Cadmium (Cd)				0.0005	
Chromium (Cr)				0.001	
Cobalt (Co)				0.004	
Copper (Cu)				0.001	
Iron (Fe)				0.04	
Lead (Pb)				0.0002	
Lithium (Li)				0.01	
Manganese (Mn)				0.001	
Molybdenum (Mo)				0.01	
Nickel (Ni)				0.002	
Selenium (Se)				0.005	
Silver (Ag)				0.001	
Thallium (Tl)				0.001	
Vanadium (V)				0.02	
Zinc (Zn)				0.005	
Mercury (Hg)	Total Recoverable	ng/L	EPA 1631 E	1	90 Days
Methyl Mercury	Total Recoverable	ng/L	EPA 1630	0.5	6 Months
CALCULATIONS					
Hardness (as CaCO3)	Dissolved	mg/L	EPA 200.8	2	6 months

* As $CaCO_3$ s.u., Standard Units mg/L, milligrams per liter ng/L, nanograms per liter
µmhos/cm, micromhos per centimeter µS/cm, microsiemens per centimeter

Required Sample Preparation Procedures: For total recoverable metals by Inductively Coupled Plasma Mass Spectrometry (ICPMS) 200.8: Digestion – EPA 200.2[2]

Method References:

[1]EPA (200.8): EPA Method 200.8, Trace Elements by ICP-MS, Revision 5.4, 1994

[1]EPA (300.0): EPA Method 300.0, Determination of Inorganic Anions by Ion Chromatography, Revision 2.2, October 1993

[1]EPA (1631 E): EPA Method 1631, Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, Revision E, August 2002

[1]EPA (1630): Method 1630:, Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and CVAFS, 2nd revision, January 2001

[1]SM20: Standard Methods for the Examination of Water and Wastes, 20th Edition (1998).

[2]EPA 200.2: Sample Preparation Procedure for Determination of Total Rec. Elements, Rev. 2.8, October 1994

Table 7: Bottle Set List for Short List -1 and Long List-1

List Type	Bottle Count	Parameters	Sample Bottle Specification
Short List-1 (Total of 6 bottles per set)	1	pH, Alkalinity, carbon trioxide (CO_3), bicarbonate (HCO_3), OH, EC, TDS	500 milliliter (ml) high-density polyethylene (HDPE), unpreserved, 0.45 membrane filtered
	1	SO_4, Cl, F	60 ml HDPE, unpreserved, 0.45 membrane filtered
	1	TSS	1 liter (L) HDPE, unpreserved, unfiltered
	1	Ca, Mg, Na, K, dissolved basis (other metals, dissolved basis: only if requested)	250 ml HDPE, nitric acid (HNO_3) preserved, 0.45 membrane filtered
	1	Metals, total basis	250 ml HDPE, HNO_3 preserved, unfiltered
	1	Mercury, total basis – EPA 1631E	500 ml HDPE, hydrochloric acid (HCl) preserved, unfiltered
	1	Methyl Mercury, total basis – EPA 1630 (Brooks Rand Laboratory)	500 ml Teflon (fluropolymer), HCL preserved, unfiltered
Long List-1 (Total of 7 bottles per set)	1	pH, Alkalinity (CO_3, HCO_3, OH), EC, TDS, SO_4, Cl, F	500 ml HDPE, unpreserved, 0.45 membrane filtered
	1	TSS	1 L HDPE, unpreserved, unfiltered
	1	Nitrate/Nitrite-N, Ammonia-N – total basis	250 ml HDPE, sulfuric acid (H_2SO_4) preserved, unfiltered
	1	total cyanide, WAD cyanide – total basis	125 ml HDPE, sodium hydroxide (NaOH) preserved, unfiltered
	1	Ca, Mg, Na, K, (dissolved basis); and dissolved metals	250 ml HDPE, HNO_3 preserved, 0.45 membrane filtered
	1	Metals, total basis	250 ml HDPE, HNO_3 preserved, unfiltered
	1	Mercury, total basis – EPA 1631E	500 ml HDPE, HCl preserved, unfiltered
	1	Methyl Mercury, total basis – EPA 1630 (Brooks Rand Laboratory)	500 ml Teflon (fluropolymer), HCL preserved, unfiltered

Table 8: Measurement Quality Objectives (Method-Specific Minimum QA/QC Acceptance Criteria Requirements)

Parameter	Method[1]	Initial Calibration (Linearity or R^2)	Calibration Verification Standard. (% Recovery)	Laboratory Control Standard (% Recovery)	Matrix Spike (% Recovery)	Method Duplicate (% Recovery)	Method Blank
GENERAL							
pH	EPA 150.1	pH meter per manufacturer	±0.05 pH units	±0.05 pH units	Not applicable	±0.1 pH units	Not applicable
Specific Conductance	SM20 2510B	conductivity meter per manufacturer	90-110	90-110	Not applicable	≤ 20	≤ reporting limit
TDS	SM20 2540C	Not applicable	Not applicable	75-125	Not applicable	≤ 25	≤ reporting limit
TSS	EPA 160.2	Not applicable	Not applicable	75-125	Not applicable	≤ 25	≤ reporting limit
MAJOR ANIONS							
Alkalinity*	SM20 2320B	pH meter per manufacturer	Not applicable	85-115	Not applicable	≤ 20	≤ reporting limit
Chloride	EPA 300.0, rev 2.2	≥ 0.995	90-110	85-115	75-125	≤ 20	≤ reporting limit
Sulfate	EPA 300.0, rev 2.2	≥ 0.995	90-110	85-115	75-125	≤ 20	≤ reporting limit
Fluoride	EPA 300.0, rev 2.2	≥ 0.995	90-110	85-115	75-125	≤ 20	≤ reporting limit
NUTRIENTS							
Ammonia (as N)	SM20 4500NH_3-F	≥ 0.995	90-110	75-125	75-125	≤ 25	≤ reporting limit
Nitrate+Nitrite (as N)	EPA 300.0, rev 2.2	≥ 0.995	90-110	90-110	90-110	≤ 20	≤ reporting limit
CYANIDE							
Cyanide, total	SM20 4500-CN C,E	≥ 0.995	90-110	75-125	75-125	≤ 25	≤ reporting limit
Cyanide, WAD	SM20 4500-CN C,E	≥ 0.995	90-110	75-125	75-125	≤ 25	≤ reporting limit
METALS (TOTAL AND DISSOLVED, INCLUDES MAJOR CATIONS CA, MG, NA, K)							
Metals by ICPMS	EPA 200.8, rev 5.4	Not applicable	85-115	85-115	70-130	≤ 20	≤ reporting limit
Mercury	EPA 1631, rev E	≥ 0.995	77-123	77-123	71-125	≤ 24	≤ reporting limit
Methyl Mercury	EPA 1630	CF ≤ 15%	80-120	67-133	65-135	≤ 35	≤ reporting limit

* Alkalinity to also include Bicarbonate, Carbonate, and Hydroxide (all as CaCO3).

Precision

Precision is a quantitative measure of the agreement among a set of measurements without assumption of knowledge of the true value. Precision is typically assessed through the use of duplicate measurements. For duplicate measurements, analytical precision can be expressed as the relative percent difference (RPD). A quantitative definition of the RPD is included below. A typical acceptance criterion for most laboratory analyses is plus or minus (±) 20% RPD.

If calculated from duplicate measurements:

$$\mathrm{RPD} = \frac{(\mathrm{C1} - \mathrm{C2})\ \mathrm{x}\ 100}{\frac{\mathrm{C1} + \mathrm{C2}}{2}}$$

Where:

RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values.

If calculated from three or more replicates, a relative standard deviation (RSD) is determined, rather than the RPD:

$$\%\mathrm{R}\mathbf{S}\mathrm{D} = (\mathbf{s}/\mathbf{y})\ \mathbf{x\ 100}$$

Where:

%RSD = percent relative standard deviation
s = standard deviation
y = mean of replicate analyses y.

Standard deviation, s, is defined as follows:

$$\mathbf{s} = \sqrt{\sum_{\mathbf{i=1}}^{\mathbf{n}} \frac{(\mathrm{y_i} - \bar{\mathrm{y}})^2}{\mathbf{n-1}}}$$

Where:

s = standard deviation
y_i = measured value of the i^{th} replicate
$\bar{y}$ = mean of replicate measurements y
n = number of replicates.

Accuracy

Accuracy is defined as the closeness of agreement between an observed value and an accepted reference value. Accuracy is typically evaluated for a specific parameter or analyte using a given method through the use of standard reference materials (SRMs) that contain a known value for the parameter or analyte being measured. A matrix spike, an addition of known concentration to a specific matrix, is used to evaluate potential bias for a specific method within a given matrix. Typical acceptance criteria for accuracy for most laboratory analysis are 80-120% recovery.

For situations where an SRM is used:

$$\%\mathbf{R} = 100 \text{ x } \left[\frac{C_m}{C_{srm}}\right]$$

Where:

%R = percent recovery
C_m = measured concentration of SRM
C_{srm} = actual concentration of SRM.

For measurements where matrix spikes are used:

$$\%\mathbf{R} = 100 \text{ x } \left[\frac{S-U}{C_{sa}}\right]$$

Where:

%R = percent recovery
S = measured concentration in spiked aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added.

Representativeness

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the water sampled. Appropriate sampling plan design, sampling techniques, sample handling protocols (storage, preservation, and transportation), and field measurement procedures have been developed to aid in the evaluation of the representativeness of data generated both in the field and the lab. The procedures are included as Appendix A, Field Procedures Program. Required documentation will establish that protocols have been followed to confirm sample identification and integrity.

Comparability

Comparability is the level of confidence with which one data set can be compared to another. Data comparability may be impacted by the degree of consistency of both field and lab methods and procedures used to generate data. Documentation of methods and procedures is also a key factor. Examples of factors that may impact the interpretation of data through comparability include analytical method selection, data reporting criteria, and sample collection and preservation techniques.

Consistency in procedures and methods, in conjunction with adequate documentation, greatly enhance the ability to properly interpret data comparability. Accurate and thorough communication with the contract lab, as well as appropriate data review and corrective action procedures, are key factors in enhancing overall comparability of data. The specific procedures and other requirements described in this document were designed to produce project data with an appropriate level of comparability.

Completeness (Statistical)

Completeness is a measure of the amount of valid data obtained from the measurement system. The completeness goal is 90% for each analytical parameter. Actual completeness can vary with the intrinsic nature of the samples. The completeness of data will be assessed during data review.

Statistical completeness is defined as follows for all measurements:

$$\%\mathbf{C} = 100 \text{ x } \left[\frac{\text{V}}{\text{n}}\right]$$

Where:

%C = percent completeness
V = number of measurements judged valid
n = total number of measurements necessary to achieve a specified statistical level of confidence in decision making.

1.7 Special Training Requirements/Certification

Training at the Donlin Gold project site is accomplished by reviewing the QAPP and previous Donlin Gold procedures manuals, for historical purposes, along with training by experienced and/or senior staff. Additional laboratory sample collection/handling suggestions/directions are relayed by the Technical Director at SGS North America Inc.

Contracted laboratory staff and the Lab Supervisor are responsible for appropriate certification and training within the lab facility. Additional information is found in the SGS North America Inc. Quality Assurance Plan (QAP) included in Appendix C.

Specialized training required for the proposed Donlin Gold project water quality monitoring program is summarized in Table 9.

Table 9: Specialized Training Requirements

Specialized Training	Field Staff	Lab Staff	QA, Sampling and Data Manager	Lab Supervisor
Safety training	X	X	X	X
Water sampling techniques	X		X	
Instrument calibration and QC activities for field measurements	X		X	
Instrument calibration and QC activities for laboratory measurements		X		X
QA principles	X		X	X
QA for water monitoring systems			X	
Chain-of-custody (COC) procedures for samples and data	X	X	X	X
Handling and Shipping of Hazardous Goods	X	X	X	X
Specific EPA-Approved Field Measurement Method Training	X		X	
Specific EPA-Approved Lab Analytical Method Training		X		X
ADEC Microbiological Drinking Water Certification	Certification for microbiological analysis is limited to the individually certified analyst.			
Lab Analytical Methods Training		X		X

2.0 DATA GENERATION AND ACQUISITION

2.1 Sampling Process Design

The sampling process was designed to produce sufficient data of appropriate quality in the Donlin Gold project area for the intended program purpose and objectives. The sampling process design included:

- Defining the roles and responsibilities of persons involved in the sampling program (Section 1.3, Table 2).
- Specifying the required sample analyses and data quality objectives.
- Defining the location, type, and frequency of samples to be collected.
- Adopting appropriate sampling and data management protocols.
- Developing a QA program to verify sampling program requirements were being met.

The roles and responsibilities of persons involved in the sampling program are described in Section 1. The remainder of the sampling program design is described in the following sections.

2.1.1 Surface Water Quality Objectives and Site Representativeness

The purpose of the surface water monitoring program is to collect data that establish the baseline conditions of surface water systems in the area potentially affected by development. These data may be used during the mine planning and permitting process, and for water quality monitoring throughout mine construction, operations, reclamation, closure, and post-closure.

The objectives for the surface water monitoring program are to:

- Continue to monitor the loading from key drainage basins.
- Determine and document the effects of the mineralized zone and historical placer mining activities on the surface water quality in the region.
- Aid in modeling water balance requirements.
- Establish long-term monitoring stations for the life of the mine from construction through operations, and ultimately closure and reclamation.

Table 3 includes a summary of the surface water monitoring stations in the most recent monitoring program, and the rationale and purpose of each station.

2.1.2 Groundwater Quality Objectives and Site Representativeness

The purpose of the groundwater monitoring program is to document the existing groundwater chemistry and piezometric surface within the areas where mine development is proposed.

The objectives of the groundwater monitoring program are to:

- Collect data that can be used to establish the background condition of the bedrock and alluvial groundwater systems in the area. Data will be collected for groundwater quality and groundwater elevations.

- Collect aquifer characteristic data that can be used to aid in facility design and site-wide water management.
- Develop an overall conceptual model of baseline groundwater conditions at the site to support the permitting process.

A summary of the wells in the most recent monitoring program, the target zone for each well, and the number of samples collected through the end of 2011 are included in Table 4. Completion details for the monitoring wells are included in Table 10.

Surface Water vs. Groundwater

Alaska WQS (18 AAC 70) stipulate that "fresh waters" (surface waters) in the state of Alaska are protected for all designated use classifications. These use classifications are as follows:

- water supply – drinking, culinary, and food processing
- water supply – agriculture, including irrigation and stock watering
- water supply – aquaculture
- water supply – industrial
- water recreation – contact recreation
- water recreation – secondary recreation
- growth and propagation of fish, shellfish, other aquatic life, and wildlife.

Although established to protect surface water uses, Alaska WQS also apply to groundwater, and regulations stipulate that groundwater is protected for all use classifications including "aquaculture," to which "aquatic life" criteria apply. Aquatic life criteria are frequently more stringent than drinking, culinary, and food processing water supply standards.

Because Alaska WQS are applicable to surface water and groundwater (except turbidity), a single "full suite" parameter list, Long List-1, described in Section 2.1.3, is used for both surface water and groundwater monitoring.

Table 10: Monitoring Well Completion Summary (Metric Units of Measurement)

Well ID	Geographic Coordinates (meters) UTM Zone 4 NAD 83		Surface Casing (meters)	Total Depth (meters)	Top of Screen (meters)	Bottom of Screen (meters)	Top of Sand (meters)	Bottom of Sand (meters)	Casing Diameter (centimeters)	Depth to Water (meters)
	Easting	Northing								
MW03-01	539999	6879366	6.1	22.9	16.4	22.5	14.9	22.9	10.2	9.8
MW03-02	539144	6879164	6.1	24.4	17.8	19.5	16.4	21.3	5.1	1.6
MW03-03	539163	6879178	6.1	6.4	4.9	6.4	3.0	6.4	5.1	2.1
MW03-04	538680	6878830	9.1	27.4	13.6	16.6	12.7	18.1	5.1	2.4
MW03-05	538685	6878841	6.1	11.3	7.9	11.0	6.7	11.3	10.2	2.5
MW03-06	542457	6877089	9.1	24.1	17.7	23.8	19.8	24.1	5.1	1.4
MW03-07	542470	6877084	6.1	6.1	4.3	5.8	3.2	6.1	5.1	1.7
MW03-08	545875	6876430	9.1	27.4	20.4	26.5	18.3	27.4	5.1	20.1
MW03-09	545829	6875574	9.1	19.2	12.5	18.6	11.0	19.2	5.1	8.7
MW03-10	539423	6874503	9.1	27.7	24.1	27.1	22.6	27.7	5.1	4.8
MW03-11	539433	6874500	4.9	9.5	6.4	9.5	5.5	9.5	5.1	9.1
MW03-12	538714	6874223	12.2	48.9	45.9	48.9	44.1	48.9	5.1	4.7
MW03-13	538719	6874245	5.5	11.9	7.9	11.0	6.7	11.6	10.2	4.9
MW03-14	539782	6878537	12.2	182.0	160.1	177.1	160.1	177.1	2.5	0.0
MW03-15	539797	6878539	9.1	24.4	17.7	23.8	16.2	24.4	5.8	1.9
MW03-16	540692	6878952	33.5	186.0	173.8	186.0	173.8	186.0	2.5	45.7
MW07-01	542627	6881469	12.2	25.5	19.3	25.5	18.4	25.5	15.2	18.7
MW07-02	542627	6881477	12.2	47.9	41.7	47.9	40.9	47.9	15.2	4.5
MW07-03	539729	6877401	7.6	17.9	11.7	17.9	11.0	17.9	15.2	5.5
MW07-04	539734	6877400	9.1	48.0	41.7	48.0	39.7	48.0	15.2	5.8
MW07-05	539703	6876817	7.2	23.8	17.6	23.8	16.6	23.8	15.2	2.4
MW07-06	539714	6876812	7.0	47.9	33.7	39.9	32.7	39.9	15.2	3.2
MW07-07	540910	6872313	9.0	45.1	38.6	44.7	37.5	45.1	15.2	2.6
MW07-08	540912	6872313	6.0	18.0	11.6	17.8	10.6	18.0	15.2	Ice plug @ 7.6
MW07-09	544752	6872692	11.7	47.6	41.6	47.6	40.2	47.6	15.2	12.8
MW07-10	544752	6872692	5.9	20.5	14.3	20.4	13.5	20.5	15.2	13.2

2.1.3 Sample Collection Locations, Parameters, and Schedule

Surface water sample station locations are listed on Table 3 and shown on Figure 6. Groundwater monitoring well locations are listed in Table 4 and shown on Figure 7.

Two sample parameter lists have been generated for flexibility. Long List-1 has been used for the baseline water quality monitoring and sampling activities at the Donlin Gold project. Short List-1 has been prepared in anticipation of a reduced data requirement during permitting, but has not been used for baseline water quality characterization. The lists are as follows:

- Short List-1 (Table 5) includes the general chemistry, major cations, major anions, and metals that have been identified as key indicators of water quality. The specific metals were selected based on historical knowledge of existing mineralogy, geochemistry, and previous water quality monitoring performed on and in the vicinity of the project site. This list is optional if, during permitting, a definitive parameters list is required, then fewer analyses may be requested from the laboratory.
- Long List-1 (Table 6) includes all parameters on Short List-1 (Table 5), plus the majority of inorganic parameters for which there are regulatory criteria established under Alaska WQS (18 ACC 70). Parameters not contained on Long List-1, for which regulatory criteria exist, include color, fecal coliform bacteria, oil and grease, petroleum hydrocarbons, radioactivity, settleable solids, temperature, turbidity, asbestos, organic chemicals, disinfection byproducts, chlorine/total residual chlorine, and sulfide.

The sampling frequency for each surface water monitoring station and groundwater monitoring well are listed in Table 11, which depicts frequency for both surface water sites and groundwater locations. Surface water locations marked with a “1” footnote indicate these sites have the potential of no collection during the winter months due to creek bed freezing. Winter months can also delay or eliminate site visits and sample collection due to harsh weather climates and can affect any one of the sites in the baseline list.

Table 11: Sampling Schedule

Location ID	Parameter List	Sample Type	Sample Frequency
SURFACE WATER LOCATIONS			
DCBO	Long List-1	I, G	Quarterly
SNUP[1]	Long List-1	I, G	Quarterly
SNDN	Long List-1	I, G	Quarterly
SNOW	Long List-1	I, G	Quarterly
ACAW[1]	Long List-1	I, G	Quarterly
ACBW	Long List-1	I, G	Quarterly
AMER	Long List-1	I, G	Quarterly
CCBO	Long List-1	I, G	Quarterly
ANUP[1]	Long List-1	I, G	Quarterly
ANDA	Long List-1	I, G	Quarterly
CRUP[1]	Long List-1	I, G	Quarterly
CRDN	Long List-1	I, G	Quarterly
CCAC	Long List-1	I, G	Quarterly
CCBC	Long List-1	I, G	Quarterly
CCBW	Long List-1	I, G	Quarterly
GROUNDWATER LOCATIONS			
MW03-01	Long List-1	I, G	Quarterly
MW03-02	Long List-1	I, G	Quarterly
MW03-03	Long List-1	I, G	Quarterly
MW03-04	Long List-1	I, G	Quarterly
MW03-05	Long List-1	I, G	Quarterly
MW03-06	N/A	N/A	N/A
MW03-07	Long List-1	I, G	Quarterly
MW03-08	Long List-1	I, G	Quarterly
MW03-09	Long List-1	I, G	Quarterly
MW03-10	Long List-1	I, G	Quarterly
MW03-11	N/A	N/A	N/A
MW03-12	Long List-1	I, G	Quarterly
MW03-13	Long List-1	I, G	Quarterly
I = In Situ Measurements G = Grab Sample			

2.1.4 Basis

The basis for sample analysis at the proposed Donlin Gold project are as follows:

- Dissolved – the concentration determined on a sample after filtration through a 0.45 micrometer membrane filter. Filtration is performed in the field, or very soon after sampling, and prior to sample preservation.
- Total – the concentration determined on an unfiltered sample after vigorous digestion, or the sum of the concentrations of both the dissolved and suspended fractions.
- Total Recoverable – the concentration determined on an unfiltered sample after moderately vigorous digestion.

Assessment of water quality compared to regulatory criteria is done using “Total Recoverable” concentrations, as specified in Long List-1 and Short List-1. For all practical purposes, total and total recoverable are identical. The rationale is based on the premise that consumers of drinking water typically do not filter water prior to ingestion, and are therefore exposed to both the dissolved and suspended components. A similar premise applies to aquatic life criteria because aquatic organisms are exposed to both the dissolved and suspended components of the water they inhabit. Analysis requirements for effluent limitation parameters associated with discharge permits issued under the APDES are most frequently required on a “total recoverable” basis.

Laboratory analyses for pH, electrical conductivity, major ion chemistry (calcium, magnesium, sodium, potassium, alkalinity, bicarbonate, carbonate, hydroxide, fluoride, chloride, and sulfate) were previously filtered samples and now filtration has been eliminated so that alkalinity may not be compromised, while total dissolved solids are performed on a “dissolved” basis using filtered samples.

When a comparison of “dissolved” versus “total recoverable” metals is required (as listed in Table 6), this option can be arranged prior to the initiation of sample collection activities by marking bottles that require field filtration. Analysis for dissolved metals requires the collection of one additional sample bottle of filtered water that is also field-preserved with nitric acid. If filtering is required at the lab, the sample cannot be collected with preservative and instead must be collected in a non-preserved bottle.

2.2 Sampling Method Requirements

Producing data of known quality that are considered representative of the sampling environment at an appropriate level of detail can only be achieved by establishing and adhering to a quality-oriented field procedures program. The sampling procedures, described in Section 2.3, provide specific protocols for performing field measurements, sample collection, and handling activities, along with an appropriate level of associated QA/QC.

In general, the field specialists collecting the samples will wear disposable gloves, personal protective equipment (PPE), flotation devices (if needed), and observe precautions (field level risk assessment) before and during the collection of samples. Sampling staff must be aware of the potential chemical, physical, and biological hazards associated with the sampling environment.

2.2.1 Sample Types

In-situ field measurements and a grab sample are collected from each of the active surface water and groundwater monitoring stations. Field measurements are collected and recorded prior to sample collection. Samples collected within the Donlin Gold project for laboratory analyses are characterized as “Grab Samples.” Composite samples are not required to meet Donlin Gold’s baseline water quality monitoring objectives.

Historically and currently, samples have not been described as either composite or grab samples on sampling field documentation. These descriptions are added when entered into electronic records compiled by field personnel and are specified on the chain of custody (COC) prior to sample submission. Samples are assigned appropriate codes “SW-Grab” or “GW-Grab” by the field personnel during data entry and must be transcribed correctly to the COC.

Surface water and groundwater analytical laboratory sample suites are described in Sections 2.1.1 and 2.1.2, respectively. Surface water and groundwater field measurements are described below.

Sampling Equipment

Field instruments used for field measurements require a program of control, calibration, adjustment, and maintenance. Portable water quality instruments in good working order are used for the field measurement of a standard set of field parameters. The field instruments and the parameters measured are summarized in Table 12. The make and model of these instruments may vary over time.

Field crews use field instrumentation maintained at the project site and/or brought in from off site. Field equipment handling, including pumps and other equipment used in sampling, is discussed separately in the surface water and groundwater field procedures described in Section 2.3.1.

2.2.2 Sample Bottle Sets

Bottle sets to allow for analysis of parameters listed in Short List-1 and Long List-1 are provided by SGS North America Inc. and consist of the bottles listed in Table 7. Preservation and holding times are included in Table 7 by individual method and parameter.

Table 12: Field Instruments and Parameters

Equipment	Parameter
Geotech/Keck 100 m Portable Water Level Meter	Water Level (groundwater wells)
Swoffer Metric Model 2100 C-140 Current Velocity Meter	Stream Flow Velocity
YSI 556 Multi-Probe System	pH Water temperature DO Oxidation/reduction potential (ORP/Eh) Conductivity
Hach 2100P Portable Turbidimeter	Turbidity
Digital Thermometer	Air temperature

2.2.3 Sampling Methods

Field Measurements Methods

Surface water and groundwater field measurements are performed as a component of the surface water quality sample collection process. Parameters that are routinely measured in the field immediately prior to sampling include:

- stream flow (as conditions allow, surface water sampling stations only)
- air temperature (surface water sampling stations only)
- water temperature
- pH
- conductivity
- ORP/Eh
- DO
- turbidity

Field measurements made during surface water monitoring are performed in situ whenever possible. In-situ measurements are particularly advantageous for more time-sensitive parameters such as dissolved oxygen (DO) and oxidation/reduction potential (ORP/Eh). Under very cold conditions, it may be necessary to collect a sample in the field and conduct field measurements in the field office. In this case, a sample specifically for field measurements is collected in a clean, unpreserved, sample bottle, and all measurements are performed as soon as possible after sample collection.

Surface Water Sampling Methods

General surface water monitoring tasks are described in this section. Detailed procedures for groundwater monitoring and sampling are described in Section 2.3.

Surface water monitoring begins with an inspection of the designated reach of the stream, followed by collecting qualitative data, quantitative parameters, and sample collection.

The following is a general description of the surface water monitoring process undertaken at each station. All field observations and measurements are recorded on a surface water monitoring field form:

- Observations are made for conditions within the reach of the stream that may impact data collection, such as ice/overflow thickness, weather, and stream flow conditions, and the information is recorded on the sampling sheet.
- If the station is equipped with a staff gage, the water level height is measured and recorded (summer/fall quarters).
- Prior to entering water for stream velocity measurements, field water quality parameters are measured. Water quality measurements are allowed to stabilize prior to being recorded.

- For stream flow velocity, record conditions observed at the site, e.g., if holes were drilled in the ice for general velocity, or if stream velocity is too high for measurements on stream flow sheet (2nd page of Surface Water Monitoring Field Form).
- Collect water quality samples for laboratory analysis.
- Record all pertinent data and information on the Surface Water Monitoring Field Form. Copy and scan the original sheet at the end of each day, and transmit the electronic copy to the QA, Sampling and Data Manager.

Groundwater Sampling Methods

General groundwater monitoring tasks are described in this section. Detailed procedures for groundwater monitoring and sampling are described in Section 2.3.

The groundwater monitoring process begins with an inspection of all monitoring wells to determine which ones will need to be thawed prior to initiating the monitoring tasks. Ideally, this inspection is performed one week prior to the scheduled monitoring event, as it may take 24 hours or more to thaw some wells.

Three monitoring well and sampling pump configurations are in place at the proposed Donlin Gold project site for well purging and water quality sampling: 1) conventional standpipe wells requiring a portable submersible pump, 2) conventional wells with an installed dedicated pump, and 3) wells equipped with dedicated nitrogen-driven displacement pumps manufactured by BarCad© (BarCad pump). The use of bailers for groundwater quality sampling at the Donlin Gold project site is not necessary and will be avoided. Table 10 provides the well construction and completion details for each well. Monitoring procedures vary according to the type of well.

Each groundwater well sampling round includes the following tasks:

- Observe conditions in the vicinity of the well, weather, and any other aspects that may impact water quality.
- Thaw the well using heat trace or other means (if necessary).
- Measure water level in the well.
- Purge the well to collect water quality samples representative of groundwater conditions.
- Measure field parameters during the well purging process to verify the well has been adequately purged. Establish that water quality has stabilized and record data.
- Prior to collection of the water quality sample, perform final measurements of field parameters and record data.
- Collect water quality samples for lab analysis.
- Record all pertinent data and information on the Groundwater Field Form (Appendix B). Copy and scan the original sheet at the end of each day, and transmit the electronic copy to the QA, Sampling and Data Manager.

2.3 Sample Handling and Custody Requirements

2.3.1 Sampling Procedures

The following sampling procedures are used at the Donlin Gold project site.

Surface Water Sampling

- surface water sampling procedure
- field measurement of stream flow
- field measurement of surface water pH, temperature, DO, ORP/EH, and conductivity
- field measurement of turbidity.

Groundwater Sampling

- groundwater sampling procedure
- thawing wells with a submersible heat trace
- water level measurement in a monitoring well
- well purging with submersible pumps
- groundwater field measurements.

General Sampling Procedures

- clean hands/dirty hands procedure
- sample bottle labeling procedure
- cooler shipping procedure
- field instrument handling procedure
- field equipment and instrument decontamination procedure.

These procedures are included in Appendix A.

2.3.2 Chain of Custody

Original COC forms must accompany all samples submitted for laboratory analysis and must be legible (Appendix B). Minimum information requirements on COC forms include the following:

- project name
- name of sampler and/or name of primary contacts
- phone and fax numbers
- reporting and invoicing instructions
- sample point identifications
- date and time collected
- analyses requested

- method of shipment.

Parameter lists, including parameter name, basis, units, and required methodology, reporting limits, and reporting instructions for all requested analyses, are also included with each sample submittal.

Once collected, all samples remain in the custody of the sampler or are secured until the samples are prepared for shipment. The field manager reviews and verifies the completeness of all COC forms before sample shipment. Copies are made of all sample submittal paperwork and mailed under separate cover to the Donlin Gold QA, Sampling and Data Manager.

2.3.3 Shipping Requirements

For the testing laboratory to generate valid test results, the integrity of field samples must be intact upon receipt at the laboratory. Protocols ensuring proper integrity of field samples from the time of collection to the time of receipt at the testing lab include:

- packing samples to prevent breakage or leakage
- immediately cooling and maintaining unpreserved samples at 39°F ± 3.6°F (4°C ± 2°C)
- delivering samples to the lab in a time frame that allows analysis within the parameters' recommended holding times
- confirming the receipt and integrity of field samples with documentation generated by the shipper and the testing lab.

2.4 Analytical Methods and Requirements

Monitoring is conducted in accordance with EPA-approved analytical procedures in compliance with 40 CFR Part 136, "Guidelines Establishing Test Procedures for Analysis of Pollutants", SGS North America Inc.'s standard operating procedures (SOPs) comply with guidelines set by ADEC. The SOPs are reviewed and updated as necessary every 3 years and distributed to ADEC. SGS's SOP and QAP are held electronically on the Donlin Gold network for data review.

The proposed Donlin Gold project's field personnel and QA, Sampling and Data Manager are responsible for verifying all equipment and field sampling bottle sets and associated methods are in compliance with the specifications referenced above. Clear communication with the laboratory on any changes in methods and sample bottle sets will be documented in any future updated QAPPs and the field procedures manual.

2.5 Quality Control Requirements

Quality control activities to verify the defensibility of the data are discussed generally in Section 2.3. This section further details the QA during sample collection. Detailed sample collection procedures for both groundwater and surface water are included in Appendix A and will be followed closely.

2.5.1 Field Generated QA/QC Samples

To monitor the quality of certain field activities, and to aid in evaluating the quality of the analytical data generated from the field and in the lab, field blank, equipment rinse blank, field duplicate, and reference material samples are periodically collected and submitted to the laboratory for analyses, along with other field samples. One set containing one (1) field blank, one (1) equipment rinse blank, and one (1) field duplicate (1 per 10 samples) will be submitted for analyses for each sampling event.

Field blanks are collected by processing deionized water through applicable sample collection equipment and filtration apparatus (if used) and into the appropriate sample bottles. Field duplicate samples are generated by collecting and preparing two complete sets of appropriate sample containers collected at the same time from the same sample station. In addition to a field blank and a field duplicate sample, an equipment rinse blank sample is required if multi-use sampling equipment is used for several sampling stations (e.g., non-dedicated pumps, hoses, re-usable filter vessels, or intermediate sample transfer containers). No equipment rinse blanks are required if all sampling equipment is single-use (disposable) and/or dedicated to a single site. A field-generated SRM sample is prepared and submitted once per year to evaluate lab proficiency for selected parameters.

Unique sample point identifications are assigned by the field manager to the QA/QC samples so their identity as field-generated QA/QC samples is not easily discernible by the analytical testing lab. A field form is completed for each field QA/QC sample, clearly identifying pertinent information about the sample including sample type (i.e., field duplicate, field blank, SRM), sample point (if a field duplicate), preparation technique, and analytes and known concentrations if an SRM (attach certified values and other accompanying information).

The following sections provide additional details regarding field-generated QA/QC samples. Specific procedures for collecting these samples (except field-generated SRM samples) are included in Appendix A.

Field Blank Samples

Field blank samples are required 1 per 10 samples. Two Field blanks are required, at a minimum, for both Donlin Gold groundwater location lists and surface water location lists for all parameters listed in Long List-1. Field blank samples are required every quarterly sampling event.

Field Duplicate Samples

Duplicate samples are required 1 per 10 samples. Two duplicates are required at a minimum for both Donlin Gold groundwater locations and surface water locations for all parameters listed in Long List-1. Duplicate samples are required every quarterly sampling event.

Equipment Rinse Blank Samples

Equipment rinse blank samples are collected to monitor effects of sampling equipment used at multiple monitoring stations and the effectiveness of equipment decontamination procedures. Equipment rinse blank samples are required once per groundwater and surface water event for the Long List-1 parameters.

Field-Generated SRM Samples

At a minimum, a field-generated sample containing known concentrations of all or a selected sub-set of parameters listed on Short List-1 (Table 5) or Long List-1 (Table 6) will be prepared and submitted once per calendar year. The SRM may be prepared by the field manager following the supplier's instructions, or directly by the supplier. Typically, the supplier is responsible for the controlled concentrations of parameters in the list. It is then transferred into an appropriate sample bottle set (supplied by the analytical lab) and included with a standard shipment of field samples to the testing laboratory.

2.5.2 Laboratory Quality Control Measures

Lab-Generated Trip Blank

A trip blank, filled with laboratory reagent water, should travel with all of the samples during shipping, to and from the field, with empty and full sample kits in the cooler. Its purpose is to identify contaminants introduced from the environment during sampling and shipping to the laboratory. If a particular parameter of interest is selected for possible contamination, samples are to be collected for analysis as normal procedure and it is suggested that the trip blank travels with the sample bottles of that particular analysis. For example, methyl mercury is an easily contaminated during sample collection and tracking of contamination should be captured by the trip blank for all methyl mercury samples collected. Because this trip blank can also be contaminated, the trip blank is compared to a laboratory blank (consisting of the same reagent produced by the lab). This lab provided trip blank should be included on the COC, which is filled out by the field team, and marked for the appropriate parameters. An unopened trip blank during sampling and sample handling can be evaluated for discrepancies between total and dissolved metals, as it documents the concentration of metals in the lab water. Separate lab provided trip blanks for methyl mercury and low level mercury samples will have to be ordered separately for each analytical method. If a trip blank is to be used for methyl mercury, the methyl mercury samples must be separated out with the methyl mercury trip blank and packaged in separate coolers.

Lab-Generated Blank Water Analyses

Lab provided blank water, known as lab produced deionized water, is recommended for analysis before each 5 gallon (19 L) batch is provided to Donlin Gold for field QA/QC sample use. Analysis of the provided water should be reported in the relevant data packages.

Known and documented data quality is an essential component of accurate environmental site assessments and effective decision-making associated with any water quality monitoring program. Achieving defined data quality objectives requires clear, concise, and detailed communications with contracted analytical laboratories. Consistency in the use of fundamental laboratory techniques and practices over time is essential for creating a useful, reliable, and technically defensible database of analytical test results. The laboratory QAP and SOPs (Appendix C) establish protocols and minimum QA/QC requirements for their contracted services appropriate to produce analytical data that meet project requirements.

The laboratory's instrumentation and maintenance, calibrations per analytic method, and specific quality control activities, are verified by the laboratory quality assurance manager. Within these measures, the lab is to provide all relevant quality control information in the case narratives of each report, as well as a summary of the data. This allows performance of review and validation of data for the QA, Sampling and Data Manager of these reports.

The parameter lists include the names, units, basis, analytical method, maximum reporting limit, and the allowable holding time for each parameter, as seen in Table 5 (Short List-1) and Table 6 (Long List-1). The specifications in these tables are used in establishing contract agreements with contract laboratories prior to the initiation of analytical services. “Hard copies” of Table 5 and Table 6 should be on file in the Anchorage office with the most recent contract prior to sample submittal for laboratory testing. It is recommended that laboratory contract agreements periodically be reviewed and updated as required. Laboratory minimum requirements are discussed in Section 1.6.

2.6 Instrument Testing, Inspection, Calibration and Maintenance

Before any sampling event at the Donlin Gold project site, all equipment and instruments must be tested through an operational check, inspected for damage and wear, calibrated, and maintained in accordance with manufacturer specifications. Prior to use during sampling, appropriate maintenance must be conducted on field instruments found to have a significant defect or failing to meet acceptable operating specifications during calibration and calibration verification procedures.

Documentation for maintenance of any instrument, typically conducted off site, must be maintained on the Instrumentation Check Out/In List maintained at the Donlin Gold camp, which is used to track any equipment leaving the project site. A blank Instrumentation Check Out/In List is included in Appendix B. The Instrumentation Check Out/In List will be maintained to record a field instrument’s make(s)/model(s), status of parts needed, working status, deficiencies (if any), instrument maintenance records, and any additional pertinent information. Manufacturer’s manuals for the multiprobe meter and turbidity meter are kept with the field sampling equipment.

Typically, and most often, the YSI 556 multiprobe meters are sent off site for calibration, updates and maintenance after each quarterly sampling event. These meters will be tracked at every shipping event.

Field instrument preparation, calibration, and/or operational checks typically are performed at the beginning of each day’s sampling activities. These tasks are performed following instrument manufacturer’s recommended procedures or the procedures contained in this manual. A check of field instrument calibration is conducted initially (before sampling locations), at the completion of the day’s field measurements, and as needed throughout the day (if readings are skewing or otherwise suspected to be off) to establish and document that instruments are operated within specified tolerances.

Documentation of calibration measurements for field instruments will be completed on the Instrument Calibration Form (Appendix B). Standards used for instrument calibration, operational checks, and calibration verification must be in accordance with applicable criteria such as the National Institute of Standards Technology (NIST), ASTM International (ASTM) standards, or other accepted procedures outlined in the instrument manufacturer's specifications. Copies of the instrument calibration form will be readily available at the Donlin Gold project site.

The proposed Donlin Gold project site is subject to varying climatic conditions over the course of a typical calendar year. During the fall, winter, and spring months, air temperatures may be below freezing for extended periods of time. Electrodes used for measuring pH, ORP/Eh, DO, and specific conductance may be ruined or rendered inoperable if allowed to freeze. Procedures must be followed to protect field instrumentation from freezing in the field during water quality monitoring events, as described in Appendix A.

2.6.1 Field Equipment and Instrument Decontamination

All sample collection equipment and field instrumentation that comes into contact with a sample must be decontaminated following sampling. The field equipment and instrument decontamination procedure is included in Appendix A.

2.7 Inspection/Acceptance of supplies and Consumables

Standard solutions and materials used for instrumentation calibration and troubleshooting according to the manufacturer's specifications will be inspected often for expiration dates. If a medium is expired, it will not be used. The Donlin Gold field crew will routinely check the dates of expiration of standards prior to any sampling event.

Detailed instrumentation directions are included in procedures listed in Section 2.3.1. All calibration sessions, completed before and at the end of the day (after a full day of sampling), will be documented. Likewise, equipment and products used during the sampling event(s) will be cleaned often using the methods described in the field equipment and instrument decontamination procedure.

Laboratory calibrations and inspections are explained in each SOP and QAP, and are provided in Appendix C.

2.8 Data Acquisition Requirements (Non-Direct Measurements)

Donlin Gold is currently in the process of only collecting defensible and reliable water quality data for water baseline studies. There currently are no permits that guide this QAPP.

2.9 Data Management

The Donlin Gold project QA, Sampling and Data Manager has overall responsibility for the implementation and execution of the data management program. Program policies and procedures include the following:

- All original field forms and lab reports are organized, compiled, managed, and maintained as discreet records for each calendar year. This is accomplished using binders or other suitable means of organization. One complete set of copies is prepared for archival purposes.
- All original hard copy data review and validation paperwork is added to field form and lab report records for each calendar year.
- A single water quality electronic database file is managed and maintained for the project at the Anchorage, Alaska, Donlin Gold facility.

- All outside requests for water quality data will be administered by the QA, Sampling and Data Manager, using the data reporting features of the EQuIS database management software.

2.9.1 Sampling Documentation

Analytical data may be technically acceptable but not defensible as a result of poor documentation and recordkeeping. Without adequate and accurate records, data that are subpoenaed for litigation purposes may be disqualified, and any decisions based on the data may be dismissed or rendered inaccurate. It is therefore critical that all information related to environmental sampling be accurately and adequately documented to allow reconstruction and verification by a third party at a future time.

All pertinent field measurement and water quality sampling information is recorded on standardized field forms (see Appendix B, Surface Water and Groundwater Monitoring Field Forms) during each day of field activities at each water quality monitoring station. The field manager is responsible for verifying sufficient detail is recorded on the forms. No general rules can specify the extent of information that must be entered on the forms; however, they should contain sufficient information so that all field activities can be reconstructed without relying on the memory of the field personnel. All entries must be made in indelible ink. All corrections will consist of single-line-out deletions that are initialed and dated.

Field Documentation

The sampling team is responsible for field observations, field equipment calibration and maintenance information, field measurements, and sample documentation including monitoring station identification and other pertinent information. Field forms (Appendix B) are to be completed and maintained for each monitoring event.

Proper documentation of sample custody includes keeping records of all materials and procedures involved in sampling. Standardized field forms are used to record field measurement data. All information on the monitoring station and associated water quality samples, including the locations of each monitoring station, are recorded by field personnel. The field manager reviews all data before leaving the monitoring station. Copies of completed field forms and field notebooks (if any) are maintained at the project site office for periodic review and future reference. Original, completed field forms are delivered to Donlin Gold's designated manager of the water quality database for key information data entry.

Corrections to Documentation

All original data are recorded with indelible ink. No accountable documents are destroyed even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on an accountable original document assigned to an individual, that individual must make corrections by drawing a line through the error, initialing and dating the lined-out item, and entering the correct information. The erroneous information is not to be obliterated and must remain legible (single-line strikethrough). Error discovered on documents must be corrected by the individual who made the entry. All such subsequent corrections are initialed and dated.

Field Forms

A standardized field form (Appendix B, Surface Water and Groundwater Field Forms) is to be filled out each time a water quality sample is collected. At a minimum, entries on the field form will include the following:

- proper monitoring station identification (Table 11 for recent active monitoring station identifications)
- date and time of sample collection (Note date and time on form MUST match bottle label)
- weather conditions and temperature at the time the sample was taken
- name(s) of sampler(s)
- sample type
- sampling method, particularly if methods deviate from standardized field procedures
- data generated from all field measurements
- details of actual work effort, particularly any deviations from the field operations plan or SOPs.

Strict custody procedures are maintained for field forms. While used in the field, forms remain with the field personnel at all times. Upon completion of the field effort, the original field forms are transferred to the QA, Sampling and Data Manager. Photocopies of the original forms are used as working documents.

Field Corrective Action

Field monitoring corrective actions are done when field measurement results are not within the acceptable error tolerance range, and may include the following:

- comparison of parameter measurements with readings previously recorded
- comparison of DO readings with the saturation value for water at the temperatures recorded (In the absence of gross pollution, DO in flowing surface water should typically be at or near saturation. DO in groundwater can vary depending on source water conditions but typically is below saturation)
- recalibration of equipment (YSI multi-meter)
- repair or replacement of faulty equipment
- re-sampling when feasible.

The field manager is responsible for implementing appropriate field corrective actions when they are deemed necessary. Field crew members must send electronic copies of the original field forms completed during the day of sample collection, so that field corrective action (if needed) can be applied in a timely manner and before shipping samples off site. All field corrective actions are to be recorded during review of field sheets (Appendix D). Field data are managed as described in Section 2.9.2.

2.9.2 Electronic Data Management

Electronic data for the Donlin Gold project is managed using the EQuIS 5 Professional environmental data management system and associated database. EQuIS is a comprehensive application specifically developed for managing environmental data. The software was designed to meet all requirements for the collection, storage, analysis, and reporting of data. EQuIS and the associated database is the primary resource for the management of all water quality monitoring data generated at the proposed Donlin Gold project.

Some of the specific features and capabilities that EQuIS provides include:

- integration with Microsoft® Excel for all data importing, exporting (reporting), and analysis
- capacity for comparing data to user-defined regulatory criteria and qualifying reported data with user-defined flagging
- flexible reporting features with customized, user-defined report formats that can be modified to meet data end-user needs
- an effective utility for querying databases.

This section is not intended to provide a "how-to" guide on the specific use and maintenance of a database file utilizing EQuIS software. Rather, it is intended to provide a basic description of the EQuIS database file structure developed for the project, and provide an overview of some of the features and capabilities of the EQuIS data management software.

A project-specific EQuIS database file structure was developed for the Donlin Gold project during the second quarter of 2009. This database file structure includes the following components:

- sample stations, both surface water and groundwater
- analytical parameters
- various database code tables of reference values which include parameter class, preparation methods, result codes, result quality, sample class, sample matrix, sampling frequency, sampling method, station type, units, analytical methods, testing laboratories, reporting limits, and water quality standards (inclusive of all applicable Alaska numeric criteria).

Currently, a single EQuIS water quality data base facility (EQuIS_Donlin) is managed and maintained for the project.

Electronic Management of Field Data

Field data are entered into EQuIS using Excel import file templates developed for this purpose. The contents of the Excel files are uploaded to the EQuIS Data Gathering Engine (EDGE), where the field data may be organized prior to being imported into the single EQuIS water quality database. Many of the code features used to associate information with each individual measurement "result" data point are components of the import file structure. These components include information such as database sample number, date and time of collection, all necessary field parameter results, and comments. The Excel import files then generated from EDGE are sent to the QA, Sampling and Data Manager for QC reviews then imported into EQuIS via the Electronic Data Processor (EDP).

Electronic Management of Laboratory Analytical Data

EQuIS makes extensive use of flat file formats, which provides robust delivery of analytical data, lab QC data, and other pertinent information requested by Donlin Gold. As previously mentioned, reference values are standard in EQuIS and have been submitted to the laboratory for their generation of electronic document deliveries. Once the file has been populated with the results and QC information from the lab, the file is uploaded separately into the EDP, an interface in EQuIS, which allows the review and import of analytical results. Any errors, by means of order, size, code type, mapping, and other reference values are automatically highlighted in EDP so that issues can be resolved by the lab before importing. The intent of EDP is to hold laboratories responsible for their sample delivery groups, which include lab sample number, laboratory ID, sampling method, parameter, units, analytical test method, sample preparation method, result, qualifiers, result quality and laboratory quality control results.

2.9.3 Data Storage and Retention

Because the data currently collected is in support of the proposed Donlin Gold project water quality baseline studies, the retention time is indefinite. All original sheets and reports are held within a library on site and placed on the Donlin Gold internal network for archival purposes.

3.0 ASSESSMENTS

Procedures for collecting site data and for executing a comprehensive review and validation process of both field and laboratory data are provided to verify these data meet defined quality requirements.

Each component of the water quality monitoring program has specific QA/QC protocol. Discussion of QA/QC protocols and procedures for each of the following program components are integrated throughout this manual. The following summarizes the program's major components:

- **Field QA/QC** identifies the procedures to be used in the field to verify water samples and field monitoring data are collected according to the requirements of the project. The objective of field QA/QC is to produce data, both field measurements and samples collected for laboratory analyses, which are representative of the environment sampled and that are of known and acceptable quality.
- **Laboratory QA/QC** identifies the minimum acceptable requirements that contract laboratories must observe in order to demonstrate water samples are analyzed according to methodologies acceptable to the EPA, and reported results are of acceptable quality. The objective of the laboratory QA/QC program is to produce data that will meet state and federal analytical requirements, including project permit requirements, and that meet all project objectives for data uses.
- **Data QA/QC** identifies the protocols to be used as part of the data review and validation program to assess if laboratory and field data are of acceptable quality. The objective of the data review and validation program is to demonstrate and document data reported meet project-specified requirements. In the event data fails to meet predetermined acceptance criteria, results are flagged using the following qualifiers:

  J – The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

  J+ – The result is an estimated quantity, but the result may be biased high.

  J- – The result is an estimated quantity, but the result may be biased low.

  B – The sample result (organic parameter) is less than 5-times the associated blank contamination and is considered a high estimated value due to contamination present in an associated blank sample.

  R – The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

Corrective action procedures are provided to identify, investigate, and correct any deficiencies or anomalies.

3.1 Assessment and Response Actions

3.1.1 High Quality End-Use Tier 2 Monitoring Baseline Data

Collection of high-quality baseline monitoring analytical data for the parameters listed in Table 5 and Table 6 is verified by thorough independent validation of the monitoring project preparation activities. Data validation measures include the following:

- Blind sample reviews (standard reference material samples), one per year, for all parameters listed in Table 6 (Table 6 includes all the parameters listed in Table 5)
- Thorough review of all laboratory results including method blank and control sample results in the analytical reports to verify they meeting the measurement quality objectives specified in Table 8
- Sample splits – 5 to 6 sample splits sent per quarter of water quality sampling to another lab (optional)
- QA review of the field measurement data
- A laboratory audit conducted by a third-party consultant.

At this time, the program described in this QAPP is not required by ADEC to satisfy a current permit. Consequently, the "High Quality End-Use Tier 2 Monitoring Baseline Data" generated is not used for compliance monitoring and listing (or delisting) of any impaired waters. After submission of permit applications, this QAPP will be re-evaluated and may be modified to meet any permit requirements.

3.1.2 Lower Quality End-Use Tier 2 Monitoring Data

Donlin Gold is not currently collecting lower quality end-use Tier 2 monitoring data.

3.2 Revisions to QAPP

The QAPP will be reviewed annually by the QA, Sampling and Data Manager. Minor changes to the QAPP are permissible without formal comment, and may include changes to Donlin Gold project staff, the QAPP distribution list, updates to the table contents, and minor editorial changes.

Major changes to the QAPP, though not anticipated until the project is under permit, require approval by the ADEC DOW QA Officer or ADEC Project Manager before implementation. Major changes include lead project staff changes (Project Manager; Environmental Manager; QA, Sampling and Data Manager; and contracted laboratories), critical criteria and method-specific data validation, new monitoring methods, and contents of Table 8, Measurement Quality Objectives.

3.3 QA Reports to Management

The contract laboratory final reports are submitted to the Donlin Gold QA, Sampling, and Data Manager. The QA, Sampling, and Data Manager will review these reports as described in Section 4.2. In addition, an annual data quality assessment is conducted by a contractor, and a report of the findings is submitted to Donlin Gold for review by the Environmental Manager, Environmental Coordinator, and QA, Sampling, and Data Manager.

If significant discrepancies from the requirements of this QAPP are identified from these reviews and assessments, corrective actions to correct the discrepancies will be evaluated and implemented by Donlin Gold.

4.0 DATA VALIDATION AND USABILITY

4.1 Data Review, Verification, and Validation Requirements

Data validation is the process of determining the compliance of analytical data, both field and laboratory data, with established method criteria and project specifications. It is a systematic process consisting of data comparison, screening, checking, auditing, verification, training/certification, and review. The process typically involves the use of method criteria summaries and data review and validation checklists.

It is important that the data reviewers be familiar with the specific methods and QA/QC requirements associated with the Donlin Gold project in order to properly review and validate associated analytical data. Water quality monitoring data are used for establishing baseline conditions, predicting water quality at various project facilities, and developing water quality discharge limitations. For these reasons, and because the data may also be the basis for future closure and reclamation decisions and strategies, it is critical that sample analyses and associated data meet method requirements and project specifications.

4.1.1 Field Data Validation Methods

Field data are first reviewed by field personnel performing the field measurement procedures. As with laboratory data, the field personnel have primary responsibility for the technical quality of field data and for ensuring field methods are properly performed and instrumentation is in good working order.

Surface water and groundwater sample field forms generated by the Donlin Gold field personnel are reviewed and validated by the QA, Sampling and Data Manager using the Field Data Review and Validation Checklist. As with the laboratory data, in the event the field data fail to meet acceptance criteria or are deemed invalid for other reasons, results are flagged with qualifiers (Section 3.0) and corrective action is required. The Corrective Action Form is used and a resolution and corrective action will be clearly defined and implemented. This form, along with a reproducible Field Data Review form and Field Data Review and Validation Checklist are included in Appendix D.

4.1.2 Laboratory Data Validation Methods

Analytical data generated by the laboratory for the Donlin Gold project baseline data are first reviewed by the testing laboratory. The laboratory has primary responsibility for correctly identifying and quantifying analytes of interest, identifying matrix interferences, and for identifying and correcting instrument anomalies when possible. The laboratory is also responsible for the technical quality of the data and for meeting all quality control parameters by correctly following the analytical methods and using instrumentation that is in proper working order for the given method.

Evaluation of total and dissolved metals will involve comparison of results in instances where dissolved is greater than total. Sample results are acceptable if the following criteria are met:

1. Where both results are greater than five times the LOQ, and the RPD between results is less than or equal to 20%.

2. Where the total metals result is less than or equal to 5 times the LOQ, and the absolute value of the difference between the results is less than or equal to the LOQ. If the total metals result is not detected at the LOD, then the value of the LOD will be used for the comparison.
3. Where both total and dissolved results are below the LOQ.

For an individual sample where criteria are not met for up to 30% of the parameters, then the associated QC data (including method blanks and field blanks) will be evaluated for bias. If the results for more than 30% of the parameters fail to meet the criteria, then both total and dissolved samples will be reanalyzed. If reanalysis does not eliminate the problem, then results will be qualified by the laboratory. This is only applicable to SGS as other labs do not have this criterion for reporting samples outside of 20% relative percent differences.

4.2 Final Laboratory Data Review and Validation

The final field and laboratory data review and validations are completed by the QA, Sampling and Data Manager assigned to the project. The final review and validation process is documented using standardized data review and validation checklists provided in Appendix D. After completion, checklist forms are filed with the appropriate analytical data package or field form set maintained in the field data or lab data binder, as well as stored on the Donlin Gold network. Any discrepancies, anomalies, or deficiencies found during the review process are discussed with the Donlin Gold QA, Sampling and Data Manager and with the laboratory project manager. A corrective action procedure is initiated to resolve any problems associated with data identified during the review and validation process. Specific details, a record of communications, findings, and actions taken resulting from the corrective action process are documented (hard copy and electronically) and included with the data in the appropriate binder.

Following the receipt of each data package from the analytical laboratory, the QA Sampling and Data Manager reviews and validates the data using the Laboratory Data Review and Validation Checklist (Appendix D). The reviewer completes all pertinent information on the checklist. Specific items on the checklist include a review of the test parameters and methods requested, information associated with reported data, and the sample analysis, with holding times and laboratory QA/QC requirements (Table 8). Also included on this review checklist is a general section where the reviewer is asked to check sample results against historical data for the specific sample point. Any observed inconsistency with trends observed in the Donlin Gold water quality data is noted. Electronic graphs are generated in Excel to plot the most recent data, using two standard deviations. An inconsistent data point may not be a data anomaly, but rather a change in specific water chemistry; however, it is first thoroughly investigated with respect to data quality.

In the event data fails to meet acceptance criteria or is deemed invalid for other reasons, results are flagged using qualifiers defined in Section 3.0. Dissolved samples are flagged as R (unusable) and the total results are not flagged, assuming no other associated QC deficiencies are present. No flag is applied to the total result if the metal was not detected. Corrective action will be taken to identify, investigate, and correct any deficiencies or anomalies. A Corrective Action Form is provided in Appendix D. The deficiency must be clearly identified on this form. All correspondence between the laboratory, field personnel, or both, is documented with a synopsis of the communication, date and time of the communication, and name and position of the individual contacted. Correspondence will include initial contact (deficiency is first discussed with the relevant party), as well as all follow-up communications necessary to clarify and correct the problem. Any corrective action will be clearly discussed, executed and documented to verify the issue is resolved and prevent it from recurring. All resolution actions are clearly outlined and documented to either correct the anomaly or flag the data as deficient and stored with the electronic data in EQuIS 5 Professional. All relevant paperwork generated from the data review and validation process is filed with the data sheets in the appropriate field or laboratory data binder.

Field precision will be evaluated using the criteria presented in Table 13. One set of data are compared to each other for precision: the primary versus duplicate sample sets or primary versus triplicate (QA) sample sets. For results that fall in the Disagreement or Major Disagreement columns, the duplicate or triplicate sample data and the associated laboratory data will be evaluated for any biases that may explain the disagreements. In some cases, associated samples may be qualified as estimates (J) or rejected (R) based on professional judgment.

Table 13: Criteria for Comparing Field QC Data

Matrix	Parameter	Disagreement	Major Disagreement
All	All	> 5x difference when one result is < MDL	> 10x difference when one result is < MDL
All	All	> 3x difference when one result is < MDL	> 5x difference when one result is < MDL
Water	All	> 2x difference	> 3x difference

Field filters are certified by the manufacturer to exhibit non-detectable levels of metals in effluent using inductively-coupled argon-plasma spectrometry, inductively coupled plasma mass spectrometry, or graphite furnace atomic absorption spectrometry instrumentation. The LOD for each metal for the analysis used to analyze the filter effluent by the manufacturer, and the lowest applicable Alaska Water Quality Standard for each metal in the current sampling program, are included in Table D-1 in Appendix D.

4.3 Reconciliation with User Requirements

Data verification methods are reviewed by the QA, Sampling and Data Manager and the Environmental Manager in accordance with baseline water quality data requirements to verify the methods are appropriate to meet the program objectives. Modifications to the monitoring program are reviewed annually, and will be updated as necessary. The current QAPP is designed for to be used to guide collection of baseline data for the Donlin Gold project.

Attachment A
Field Procedures Program

	STANDARD OPERATING PROCEDURE	
DONLIN GOLD	GENERAL ENVIRONMENTAL SAMPLING PROCEDURES	
	EFFECTIVE DATE	DOCUMENT NUMBER
	6/19/2012	ENV-SOP-0036

PURPOSE

To set procedures for general tasks related to environmental sampling as required for surface water, groundwater, and other environmental sampling programs for Donlin Gold employees or contractors in support of environmental studies and monitoring.

SCOPE

This SOP describes procedures for clean hands/dirty hands sampling, sample bottle labeling, sample packaging and shipping, field instrument handling, field equipment decontamination, portable sampling pump decontamination, and Grundfos RediFlo2 pump lubricating fluid replacement.

RESPONSIBILITY

- It is the responsibility of Field Environmental Coordinators to conduct environmental monitoring tasks following accepted procedures.

HEALTH AND SAFETY

Safety of people is the first priority when conducting any task. Personnel must be well-trained (per the procedures below) with standard routines, safety procedures, personal protection equipment, and emergency response actions.

ENVIRONMENTAL

Potential consequences of departing from standard:

- Departure from this Standard could result in injury to people, damage to facilities and/or the Environment resulting in pollution to the land or water, and obtaining erroneous field or laboratory water quality data.

REFERENCES

- Quality Assurance Project Plan for the Donlin Gold Project Water Quality Monitoring, Sampling, and Analysis Activities.
- Field Forms (Water Quality Monitoring, Sampling and Analysis Activities QAPP)

PROCESS

CLEAN HANDS/DIRTY HANDS PROCEDURE

The purpose of the clean hands/dirty hands procedure is to prevent cross-contamination during sampling from container handling. All operations involving contact with the sample bottle and transfer of the sample from the sample collection device to the sample bottle are handled by the individual designated as "clean hands." "Dirty hands" is responsible for preparation of the sampler (except the sample container itself), operation of any machinery, and for all other activities that do not involve direct contact with the sample.

Procedure:

1. Designate one member of the team as “clean hands” and the other as “dirty hands.”
2. “Dirty hands” opens a bag containing non-talc gloves.
3. “Clean hands” removes a pair of clean gloves from “dirty hands”, and puts them on.
   IMPORTANT: “Clean hands” will only be allowed to touch the inner bags and sample bottles from this point on (making sure not to touch anything in the surrounding environment).

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4. "Dirty hands" removes a pair of clean gloves and puts them on (after all equipment is set up, new gloves are needed).
5. "Dirty hands" removes an empty bagged sample bottle set from the container/cooler, closes container/cooler, and opens the bag for "clean hands."
6. "Clean hands" reaches into the bag and removes one bottle.
   IMPORTANT: If this is the Mercury bottle sample: "Clean hands" takes out the inner bag from "dirty hands" who is holding the outer bag of the double bagged mercury bottle. "Dirty hands" prior to this move, has put on new gloves before taking out the bottle.
7. "Dirty hands" seals the bag (or outer bag of the mercury container) and places it back into the cooler.
8. "Clean hands" removes the bottle cap and holds the cap in one hand. With the other hand, "clean hands" fills the sample bottle from the pump tube (groundwater) or by dipping into the flowing water stream, taking precaution to keep their hand downstream of the opening of the bottle (surface water). Fill the bottle until there is a little room for closure, then seal the bottle tightly. Take precautions to not touch the insides of the bottles and their appropriate lids and caps during sampling collection. Note: If dissolved constituents are to be determined, "dirty hands" must perform field-filtration using an appropriate filtration apparatus equipped with 0.45µm membrane filtration media.

There are two alternate methods for steps 1 through 8 accepted for collecting surface water samples that involve "dirty hands" to temporarily be a second set of "clean hands":

Method 1 (open water):

a) "Dirty hands" puts new nitrile gloves on
b) "Dirty hands" collects the sample in a non-preserved, clean or sterile, intermediate container to transfer into the appropriate sample bottle held by "clean hands." The intermediate container is rinsed several times with sample water before the sample is collected.
c) Submerge the intermediate sample container at the sampling point such that the mouth of the container is under the water surface 2 to 3 inches (5-8 cm), if possible.
d) "Dirty hands" fills all bottles held by "clean hands" at that location, careful not to cause splashing while bottles are being filled, as some bottles contain preservative.
e) "Clean hands" seals sample bottle tightly.

Method 2 (during times when sampling from auger holes in ice):

a) "Dirty hands" puts new nitrile gloves on
b) "Dirty hands" prepares the peristaltic pump, places a new and cleaned (Alconox washed and dried) silicon tube in the pump, places one end of the tube into the stream water, and turn pump on.
c) Allow the pump to run for a couple of minutes, with stream water running through the tubing
d) The sample may now be collected directly into the sample bottles from the peristaltic pump at a low flow rate. "Clean hands" holds the water bottle, assuring that the hose does not touch the walls of the bottle and that the flow rate from the pump is low enough to not cause splashing while bottles are being filled, as some bottles contain preservatives.
e) "Clean hands" seals sample bottle tightly.

9. "Dirty hands" retrieves bag from cooler (and/or outer mercury bottle bag) and opens the bag(s).
10. "Clean hands" reaches inside the outer bag, held by "dirty hands," to place the bottle inside.
    For mercury sample only: "clean hands" reaches inside the outer bag for the inner bag and places the bottle inside the inner bag and seals, then places the inner bag in the outer bag.
11. "Dirty hands" seals the outer bag and labels the sample set bag with the site location code and time and places the bagged sample into the cooler.

If two or more bottles are to be filled at the site, "clean hands" must use new nitrile gloves (or other) for each individual bottle, repeating steps 6 through 11.

FILTERING PROCEDURE

When required, filtration is done in the field as soon as possible after sample collection. During very cold conditions it may be necessary to filter samples at the field office. When filtration at the field office is necessary, bulk samples are collected in clean, unpreserved intermediate sample containers such as 1-gallon plastic jugs to provide sufficient water volume to fill all sample bottles in the required sample bottle set.

Samples collected for dissolved analyses will be filtered using the following procedure:

1. Collect sample water into a decontaminated and triple rinsed plastic container (transfer vessel) and filter from the container.
2. Install new tubing in the peristaltic pump and a new 0.45-micron disposable filter on the discharge side of the line.
3. Pump water from the transfer vessel through the filter and into the appropriate bottles as specified in the QAPP. Use clean hands/dirty hands procedure for sample bottle filling and handling.
4. Use a peristaltic pump with clean tubing equipped with a 0.45 micron disposable filter for each sample.
5. Fill filter vessel with sample water and apply vacuum, or turn on pump. Note: If extremely turbid sample water is obtained, it may be necessary to use a pre-filter (usually 3.0 micron) followed by 0.45 micron filtration.
6. Fill sample container with filtered sample and add any appropriate preservative.

SAMPLE BOTTLE LABELING PROCEDURE

Each sample container requires a label large enough to record the information needed to readily identify the sample. The information recorded on each label will include the project name, sample point, date/time collected, filtered or unfiltered, preservation, and sampler's initials. Permanent waterproof ink or permanent marker should be used for all labeling purposes.

Labeling procedure:

1. Carry the cooler containing the bottle sets to a clean location, where cross contamination can be avoided.
2. Put on a pair of clean nitrile gloves (new gloves should be used for each sample set).
3. Pull the sample set out of the cooler, dry it off with a new paper towel for every sample, and set aside on clean paper towels.
4. Record the information from the original field forms onto each label, double checking the date and time, and place them on the correct sample bottles for analysis.
5. Apply clear tape over the bottle label and around the sample bottle to ensure that the information on the bottle label information will not bleed during shipping (samples can "sweat" from condensation) and the label will not detach from the bottle.
6. Place all the collected bottles back into a new bag, clearly labeling the bag with the site location.
7. Discard the nitrile gloves and paper towels used for the set and replace them with new gloves and paper towels before repeating the process with the next sample set.

To maintain consistent record keeping and to aid in maintaining electronic database records, it is important to record the sample station identification on the sample label exactly as it is listed in the Quality Assurance Project Plan.

SAMPLE PACKAGING AND SHIPPING PROCEDURE

Samples are packed and shipped using the following procedure:

1. Remove old shipping labels from the outside of the cooler, verify the inside of the cooler is clean (clean if necessary), then line the cooler with a plastic garbage bag.
2. Check the caps on the sample bottles are secure then place each sample bottle set in a plastic bag, such as a 13 gallon trash bag.
3. Place the sample bottle sets upright in the cooler, leaving room for ice. Surround the samples with sufficient packing material, such as "bubble wrap" to prevent breakage and direct contact from sample to ice pack. Plastic sample containers may be used to separate glass containers from each other.
4. Include the "temperature blank" sample bottle, provided by the lab.
5. Fill the remaining cooler volume with ice packer or ice that has been placed in plastic bags.

6. Check the COC form(s) to ensure that all samples in the cooler have been properly recorded. Sign the COC form(s) to relinquish custody. If more than one cooler comprises the sample submittal, include copies of COC form(s) and all other pertinent paperwork in each cooler. Make electronic copies of all COC forms for record, and forward pertinent information to the QA, Sampling and Data Manager, while also holding a copy of the files on hand.
7. Place the completed COC form(s) and other submittal paperwork in a zipper-locking plastic bag and place it inside the cooler.
8. Seal the cooler using nylon strapping tape or other suitable tape at both ends. It is recommended that at least three wraps of tape around the cooler body be used.
9. Place a signed, dated custody seal across the opening of the cooler and secure with clear tape.
10. Secure the shipping label to the top of the cooler. Place "Keep Cool" and "Do Not Freeze" stickers on prominent locations on the cooler.
11. Transport the cooler to a secure storage area or to the shipping agent.

Hard copy air way bills are not distributed to Donlin Camp and instead issued a waybill number when checked in at the carrier. At this point, it is sufficient that once the cooler(s) have made it to the carrier office and is issued a way bill number, the way bill number must be retrieved by the field technician, and filled out on the copy Chain of Custody. Once filled, the COC must be scanned and emailed to the QA, Sampling and Data Manager, the Lab Project Manager, and Donlin Gold's Shipping and Receiving Clerk. The shipping carrier is not responsible for training on sample Chain of Custody carriers.

For coolers that are carried on as personal luggage by the field crew and not shipped as freight, it is the field crew member's responsibility to notify the QA, Sampling and Data Manager, the Lab Project Manager and the DGLLC's Shipping and Receiving Clerk, that these samples will be "hand carried in" from camp. It is also the field crew member's responsibility to verify that these coolers make it to the Laboratory.

FIELD INSTRUMENT HANDLING PROCEDURE

Prior to beginning field activities:

- Select a cooler/insulating box of adequate size to hold all of the field instruments and associated equipment needed for performing field measurements.
- Equip the inside of a cooler with padding such as "bubble wrap" (sample protection)

When freezing conditions occur, add an adequate heat source to the cooler (heat packs, hand warmers, or other source) to maintain the temperatures inside the cooler above freezing while in the field.

FIELD EQUIPMENT AND INSTRUMENT DECONTAMINATION PROCEDURE

Decontamination procedures differ depending on the instrument or equipment, as described below:

For the water level meter and peristaltic pump, the following procedure should be followed prior to quarterly sampling (not in the field):

1. Rinse in water
2. Wash with Alconox or equivalent anionic detergent
3. Rinse in deionized water
4. Air dry
5. Dispose of Alconox cleaning agent at the proper waste facility.

The purpose of the water and Alconox wash is to remove particulate matter and other potential contaminants. The purpose of the final deionized water rinse is to remove detergent and any residual contaminants.

For the YSI Multi-Probe system, the following procedure should be followed (also refer to the YSI Operations Manual):

1. Thoroughly rinse all probes three times with tap water
2. Place the probe in the storage/transport cup, which should have ¼ inch of tap water or pH 4 buffer (if preferred) before traveling to the new site or for short-term storage

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If continuing to another site for sampling:

3. Rinse the probe with deionized water at the new location to remove residual tap water
4. After the deionized rinse, rinse with the sample water at new location. The probe is now ready for measurements at the new location.
5. After the sample bottles are filled, repeat steps 1 and 2 above.

Tap water is preferred and advised for the rinse solution between site locations, but deionized water may be used as an alternative if tap water is unavailable. It is recommended that pH 4 calibration solution be placed in the probe cap as a buffer solution to keeps the probes primed between sampling locations. *Note: deionized water should never be used in the probe cap for probe storage as it will cause the pH probe to malfunction and require immediate replacement.*

If the YSI multi-purpose probes appear to contain deposits or contaminants that cannot be removed by the rinse steps described above, and a "drift" in parameter readings is observed, the YSI meter should be sent into the nearest vendor for repair, or the simple cleaning methods described below can be done weekly or as needed to remove stubborn deposits:

1. Spray probes with the over-the-counter cleaning agent, "Scrubbing Bubbles," making sure that the lenses are sprayed over well, OR use Alconox solution.
2. Allow bubbles to sit for a couple of minutes.
3. Using the small tube brush included in the maintenance kit; carefully scrub around all the probes to remove debris and build-up.
4. Rinse well with tap water, making sure to remove all the suds.
5. Dispose of any diluted cleaning agents and water at the proper waste facility

PORTABLE SAMPLING PUMP DECONTAMINATION PROCEDURE

Field Rinse Procedure:
This procedure is used between wells during the same quarterly sampling event. See "Camp Procedure" below for procedure for pump decontamination prior to quarterly sampling events. This field rinse procedure is for only for baseline sampling of wells, and not to be used for decontamination after sampling of a well in which there is a history of or indication of contamination.

The following procedure is followed:

1. After sampling at a well is complete, disconnect power and remove dedicated tubing.
2. Drain all well water from the pump and move to the next well.
3. Prior to connecting the tubing and power at the next well, rinse the exterior of pump and wetted portion of the power lead with DI water.
4. Connect tubing and power supply, place pump in well in accordance with sampling procedure.
5. The purge water at the following well is used to rinse the internal portion of the pump prior to a sample being collected.

Camp Procedure:
This procedure is used prior to each quarterly sampling event and is conducted at Donlin Camp. Decontamination between wells during quarterly sampling is done following the "Field Equipment and Instrument Decontamination Procedure"
Decontamination Equipment and Supplies:

- 2-inch (5-cm) diameter PVC well casing, capped on one end, 5 ft (1.5 m) in length
- hand-held sprayer with Alconox solution
- hand-held sprayer with deionized/distilled water
- Minimum of 3 gallons (11L) of deionized water
- paper towels

Decontaminate the pump after each use by performing the following procedure:

1. Decontaminate the exterior of the pump, support cable, and discharge hose:
2. Spray the pump and the hose with Alconox solution.

3. Rinse with deionized/distilled water and dry with paper towels.
4. Decontaminate the interior of the pump and discharge hose:
   - Install the pump into the 2-inch (5-cm) casing and vertically position the assembly.
   - Fill the 2-inch (5-cm) casing with deionized/distilled water.
   - Start the pump and continuously pour deionized/distilled water into the casing until 3 gallons (11 L) have been pumped through the complete assembly.
5. Collect an equipment rinse blank sample, if required (refer to Section 3.6.3).
6. Remove the pump from the 2-inch (5-cm) casing.

GRUNDFOS REDIFLO2 PUMP LUBRICATING FLUID (DEIONIZED WATER) REPLACEMENT PROCEDURE

The Grundfos RediFlo2 pump lubricating fluid, which is deionized water, should be replaced annually using steps 1 through 6 below. The lubricating fluid level should be checked prior to groundwater sampling events each quarter using steps 5 and 6 below to verify the fluid level is full and no air is present

Equipment and Supplies:

- motor filling syringe (Grundfos Part # 3P107)
- flat-bladed screwdriver
- deionized water

Replace the Grundfos RediFlo2 pump lubricating fluid following the procedure described below.

1. Make sure the pump is de-energized by turning the start/stop switch to the STOP position, turn off the generator, and unplug the pump.
2. Turn the pump and motor upside down and remove the screw on the bottom of the pump.
3. Empty the water from the motor and, using the syringe, refill the motor with deionized/distilled water to the bottom edge of the screw hole.
4. Replace the filling screw and turn the pump over several times.
5. Remove the filling screw to let any air trapped inside escape.
6. If necessary, top off again with deionized/distilled water and replace the screw.
   Note: severe motor damage will occur if the motor is operated without lubricating deionized water.

REVISION HISTORY

Revision #	Description of Change	Prepared By	Date
1	Drafted Document	Mike Rieser	3/13/2012
2	Change portable pump field decontamination procedure	Mike Rieser	4/2/2012
3	Add field filtering procedure	Mike Rieser	6/19/2012

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	STANDARD OPERATING PROCEDURE	
DONLIN GOLD	GROUNDWATER MONITORING PROCEDURES	
	EFFECTIVE DATE	DOCUMENT NUMBER
	6/19/2012	ENV-SOP-0037

PURPOSE

To set procedures for groundwater sampling by Donlin Gold employees or contractors in support of environmental studies and monitoring.

SCOPE

- This procedure describes groundwater monitoring and sampling from Donlin Gold monitoring wells and related tasks.

RESPONSIBILITY

- It is the responsibility of Field Environmental Coordinators to conduct environmental monitoring tasks following accepted procedures.

HEALTH AND SAFETY

Safety of people is the first priority when conducting any task. Personnel must be well-trained (per the procedures below) with standard routines, safety procedures, personal protection equipment, and emergency response actions.

ENVIRONMENTAL

Potential consequences of departing from standard:

- Departure from this Standard could result in injury to people, damage to facilities and/or the Environment resulting in pollution to the land or water, and obtaining erroneous field or laboratory water quality data.

REFERENCES

- Quality Assurance Project Plan for the Donlin Gold Project Water Quality Monitoring, Sampling, and Analysis Activities.
- Groundwater Monitoring Field Form, General Environmental Sampling Procedures, Quality Control Sample Collection Procedures

PROCESS

Groundwater Monitoring Procedure

1. Observe conditions in the vicinity of the well, weather, and any other aspects that may impact water quality.
2. Thaw the well using heat trace or other means (if necessary). See **Thawing Wells with a Submersible Heat Trace** procedure below.
3. Measure water level in the well. See **Water Level Measurement** procedure below.
4. Purge the well to insure that the collected water quality sample is representative of groundwater conditions. See **Groundwater Well Purging Procedure** below.
5. Measure field parameters during the well purging process to verify that the well has been adequate purged. Establish that water quality has stabilized. See **Groundwater Field Measurements** procedure below.
6. Prior to collection of the water quality sample, perform final measurements of field parameters including pH, specific conductance, temperature, oxidation/reduction potential, and dissolved oxygen.
7. Collect water quality samples for lab analysis. Record all pertinent data and information on the Groundwater Monitoring Field Form (see Quality Assurance Project Plan), making sure to copy, scan and send the information at the end of the sampling day. See **Groundwater Quality Sample Collection** procedure below.

<u>Thawing Wells with a Submersible Heat Trace Procedure</u>

The following is equipment required for thawing wells using a submersible heat trace:

- portable generators
- fuel for generators
- motor oil for generators
- fuel and oil spill containment pan to place under the portable generator
- oil absorbents
- long extension cords (with LED light connectors if available)
- clean plastic bag or tarp (to place tubing and heat trace on).

It may take more than a day to thaw some wells, depending on the thickness of ice and the borehole diameter. After determining which wells are frozen, and noting how difficult those wells have historically been to thaw, integrate well thawing with other well monitoring tasks to efficiently use time in the field. Some wells will partially refreeze overnight and will need to be re-thawed if not sampled immediately. Record any thawing information that may help with future thawing at each well. Have as many generators as practical running in the same vicinity to complete an area more easily and facilitate overnight refueling. The following are other important procedures to follow:

- Do not pull the heat trace out of the well until the well has thawed sufficiently. If the heat trace is removed too early it may be difficult to re-install.
- After completing water quality sampling tasks, be sure to re-install the heat trace before the well refreezes.
- Use caution around the heat trace plug; do not pull on the plug directly; replace or fix it if needed.

The following describes the procedure used for thawing wells using a submersible heat trace:

1. Inspect the wellhead for damage and/or vandalism, and record observations on the groundwater monitoring field form.
2. Plug the heat trace into the generator.
3. Connect both the deep and shallow well trace at the same time when they are in close proximity.
4. Place the generator in the sled, containment pan, or on spill rags. In addition to protecting the environment from spills it will also help to keep it level as snow melts around the exhaust.
5. Top off the fuel and check the oil.
6. Start the generator.
7. Check the switches and LEDs on the cords to confirm that they are energized.
8. Check the progress of the well thawing periodically by gently tugging the heat trace. However, do not pull the heat trace out of the well if ice is still present.
9. Run the generators overnight if needed. Refuel as needed and check the oil periodically.
10. Verify that the ice is adequately melted before pulling out the heat trace and dedicated tubing. (A small amount of ice may be floating at the surface but should not pose any problems.)
11. Place the tubing/heat trace in a clean plastic bag or clean tarp.
12. Measure and record the water level before installing the sampling pump.
13. After completing the water quality sampling, secure the dedicated tubing to the heat trace and re-install it in the well.

Water Level Measurement Procedure

Water level data are measured in all groundwater monitoring wells during each monitoring event. Water level measurements are performed prior to well purging and water quality sample collection. Results are recorded on the Groundwater Monitoring Field Form (see Quality Assurance Project Plan).

Two separate procedures for performing water level measurements are described below.

#1 – An electronic water level indicator is used to measure depth to water surface in all monitoring wells to the nearest 0.01 ft., or 0.01 m if using a metric meter. Water levels measured in monitoring wells are measured after the well is thawed with heat trace (if frozen) and before any water has been purged in the water quality sample collection process.

#2 – Water levels are measured in monitoring wells equipped with BarCad system pumps (MW03-14, MW03-16) by temporarily removing the valve manifold before using the electronic water level meter. It is not necessary to perform a water level measurement in monitoring well MW03-14 if artesian conditions are present, which has historically been the case.

The equipment and supplies required and instrument preparation procedure for performing water level measurements is as follows:

Equipment and Supplies:

- Geotech/Keck portable electronic water level meter, or equivalent
- Alconox solution
- deionized water
- paper towels.

Instrument preparation procedure:

1. Soak the paper towels with Alconox solution, and wipe down the stainless steel probe and about the first 30 ft (9 m) of the measuring tape.
2. Rinse the wetted parts with deionized water and roll the tape and probe back onto the reel.
3. Discard any Alconox solution used at proper waste water facility (must be carried out of field in a container).

#1 - Water Level Measurement in Wells Not Equipped with BarCad System Pumps

Procedure:

1. Turn the sensitivity knob to the highest setting.
2. Press the battery test button; the buzzer should sound and the red light will come on if the battery is in good condition. If the battery is defective, refer to the equipment operating manual for battery changing procedures.
3. Lower the probe and tape into the well. Stop lowering the probe when the buzzer sounds and the red light comes on.
4. Turn the sensitivity knob to the lowest setting at which the buzzer sounds and the light stays lit.
5. Slowly lift the cable until the light and buzzer go off. Lower the cable to the point where the light and buzzer just come on. It may be necessary to do this several times to find this point accurately.
6. Read the depth to water off the cable at the designated reference point (at the top of the inner PVC casing, north side of the well) to the nearest 0.01 ft. or 0.01 m. Record the following data on the Groundwater Monitoring Field Form (see the Quality Assurance Project Plan): “depth to water,” “total well depth”, and “depth of water column” (note: “depth of water column” = “total well depth” - “depth to water”). If available, also record the reference point elevation, and calculate and record the water level elevation in feet above mean sea level (ft amsl).
7. Reel the probe back up out of the well and turn the sensitivity knob to the off position.

#2 Water Level Measurement in Wells Equipped with BarCad System Pumps

Procedure:

1. Wells equipped with BarCad system pumps will require the use of two crowfoot wrenches to loosen the middle and lower nuts from each other. The middle nut should turn easily by hand once it has been loosened.
2. Lift the "W" manifold (WM) up about 4 inches (10 cm) until the compression union that is connected to the Teflon drop tube has cleared the top of the BarCad riser pipe. (The compression union is located at the bottom of the WM's stainless ¼-inch (0.6-cm) tube.) While taking water levels, leave the center valve in whichever position (open or closed) it was in at the start of this procedure.
3. Stop and hold the WM so that the bottom of the stainless union is resting on the lip of the riser pipe, and secure it in that position. This can be done by either having a second person hold the manifold or by tying it securely to a brace, such as a piece of wood, placed vertically next to the riser pipe. Keep the manifold vertical at all times during this operation. At no time should the Teflon tube be allowed to become kinked or bent over the top of the riser pipe.
4. Lower the water level indicator probe to the surface of the water inside the riser pipe. Note that the water level will drop slightly when the 4 inches (10 cm) of Teflon drop tube are lifted out of the water.
5. Note: water level meters with probes 5/8 inch (1.6-cm) diameter and larger will not fit. If a smaller probe is not available, do not perform the water level measurement.
6. Read the water level depth off the cable at the designated reference point (at the top of the riser pipe on the north side of the well) to the nearest 0.01 ft or 0.01 m. Take several measurements to verify that the water level has reached equilibrium prior to recording the final water level measurement result. Record the following data on the Groundwater Monitoring Field Form (see the Quality Assurance Project Plan): "depth to water," "total well depth" (see Quality Assurance Project Plan), and "depth of water column" (note: "depth of water column" = "total well depth" - "depth to water"). If available, also record the reference point elevation, and calculate and record the water level elevation in feet above mean sea level (ft amsl).
7. Reel the probe back up out of the well and turn the sensitivity knob to the OFF position.
8. Re-attach the WM. The middle and lower nuts should be slightly tightened together with crowfoot wrenches.

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Groundwater Well Purging Procedure

After the water level measurement procedure is completed, purge the monitoring well prior to collecting a water quality sample. The following sections provide detailed procedures for well purging, using three different techniques: a portable pump or a dedicated pump (either an electric or BarCad pump).

Well Purging Procedure Using a Portable Submersible Pump (Grundfos RediFlo2 or equivalent)

1. The minimum volume to be purged is equal to three casing volumes. Determine the minimum volume and record it on the Groundwater Monitoring Field Form (see Quality Assurance Project Plan). For a 4-inch (10-cm) diameter well, this volume is roughly equivalent to 2 gal/ft (25 L/m) of water column. For a 2-inch (5-cm) diameter well, this volume is roughly equivalent to 0.5 gal/ft (6.2 L/m) of water column. For a listing of well casing diameters, see the Quality Assurance Project Plan.
2. Connect the bottom end of the tubing to the pump and carefully lower the pump into the well to the desired depth for purging/sampling. Lower the pump as slowly as possible into the well in order to minimize turbidity. Do not allow the pump to reach the bottom of the well.
3. Connect the power leads of the controller to the Reel EZ assembly. Then plug the controller power cord into to the generator.
4. Fill the generator with unleaded gasoline and check the oil. Add oil if necessary.
5. Set the generator's automatic (eco) throttle control switch to the manual position.
6. Start the generator with the circuit breaker switched off. Allow the generator to warm up until a constant voltage output is obtained.
7. Switch the circuit breaker ON.
8. Check the frequency display on the front of the controller. It should read zero. If it does not, refer to the Troubleshooting section of the manufacturer's manual.
9. If the controller has not been used for more than six months, leave the controller on for at least 15 minutes before proceeding.
10. Start the pump by pressing the Start/Stop switch into the START position.
11. Slowly advance the frequency rate by pressing the "up" arrow on the controller.
12. Adjust the discharge rate of the pump by adjusting the "up" and "down" arrows on the controller. If the pump stops inadvertently during normal operation, do not restart it until all the water in the discharge line has drained back through the pump and into the well.
    Note: DO NOT PUMP TOO FAST! The well purging rate should not be great enough to produce excessive turbulence, typically no greater than 1 gallon/minute (3.8 L/minute).
13. Begin measuring field parameters when 1/2 of the minimum purge volume has been removed from the well (see Groundwater Field Measurements procedure). Record field parameter results and associated well purge volumes at consecutive intervals. The well purging process is deemed complete when a minimum of three casing volumes have been removed and consecutive field measurements are stabilized as described in the Groundwater Field Measurements procedure.
14. For wells that can be pumped dry with the sampling equipment being used, the well should be evacuated to just above the well screen and allowed to recover prior to sample withdrawal. Allow the well to recover to within 85% of the original water level prior to resuming pumping. It is important not to completely dewater the zone being sampled. If the recovery rate is fairly rapid and time allows, evacuation of more than one volume of water is preferred. However, if the minimum volume of water has not been purged after successive periods of recovery, note the collection details on the groundwater monitoring field form and collect the sample.
15. When well purging is complete, record final field measurements.
16. Use the "down" arrow on the controller to reduce the amount of flow from the pump to a suitable flow rate prior to performing the water quality sample collection procedure.
17. After purging and sampling are completed, stop the pump by pressing the start/stop switch into the STOP position.
18. Switch the breaker on the generator to the OFF position and turn the generator off.
19. Disconnect and store all power cables.
20. Reel the pump back out of the well and secure the well cap. Decontaminate the pump as described in the General Environmental Sampling Procedures SOP.
21. Store the pump where it will be protected from freezing temperatures.
    Note: the controller has a limited temperature operating range. The lid of the protective case for the controller

must be left open while the pump is operating to provide cooling. In very cold temperatures, it may be necessary to put heat packs on the converter.

Well Purging Procedure Using a Dedicated Electric Pump

Equipment needed:

- discharge and valve assembly for dedicated pump system
- generator
- extension cord.

Procedure:

1. The minimum volume to be purged is equal to three casing volumes. Determine the minimum volume and record it on the Groundwater Monitoring Field Form (see Appendix C, Form II). For a 4-inch (0.10-cm) diameter well, this volume is equivalent to 2 gal/ft (25 L/m) of water column. For a 2-inch (5-cm) diameter well, this volume is equivalent to 0.5 gal/ft (6.2 L/m) of water column. For a listing of well casing diameters, see the Quality Assurance Project Plan.
2. Attach the PVC discharge and valve assembly to the dedicated pump head.
3. Connect an extension power cord between the dedicated pump electrical plug and the generator.
4. Fill the generator with unleaded gasoline and check the oil. Add oil if necessary.
5. Set the generator automatic (eco) throttle control switch to the manual position.
6. Start the generator with the circuit breaker switched off.
7. Switch the circuit breaker on.
8. Control the discharge rate by adjusting the plastic valve.

Well Purging Procedure Using the BarCad System Pump

These well purging procedures apply to monitoring wells equipped with the BarCad pump system, currently MW03-14 and MW03-16. Additional procedural requirements are provided for MW03-14 only at the end of this section.

Procedure:

1. Attach the gas inline to the valve on the regulator and to the side port on the BarCad WM.
2. Attach the sample return line to the center port on the WM and clip the other end of the line to the top of a five-gallon bucket.
3. Turn the "T" handle on the regulator counter clockwise until it feels loose.
4. Open the valve on the top of the tank. (If leaks are heard coming from the connection between the tank and regulator, turn off the tank and tighten the nut holding the regulator to the tank.)
5. Make sure both valves on the manifold are in a fully open position.
6. Point the black handle of the valve attached to the outlet of the regulator toward the regulator.
7. Turn the "T" handle of the regulator clockwise until the low pressure gauge shows 300 PSI. You should hear gas flowing into the BarCad. Gas should be flowing slowly out of the end of the sample return line as the air in the line is displaced by water rising up the line. (This can be observed by inserting the end of the sample return line into a water bottle).
8. When the end of the sample return line begins to sputter and spray a mix of gas and water, the first purge cycle is complete.
9. The first purge cycle, about 15 gallons (57 L), is stagnant water from the inside of the BarCad riser pipe and should be discarded.
10. Turn the black valve attached to the regulator outlet so that it points away from the regulator and toward the gold-colored muffler.
11. Allow the gas to vent freely until the gas venting from the sample return line slows noticeably. At this point water will begin to enter the bottom of the BarCad riser pipe. The black valve attached to the regulator outlet should be set so that the rate of gas bleed-off slows significantly. This will slow the return of the water into the riser pipe.
    Note: If you wish to use the regulator to cycle the other well during this refill phase, disconnect the gas inline from the BarCad manifold and use the valve on the manifold to regulate the refill.
12. Repeat the initial purge steps for all subsequent purge cycles. After the initial purge, you should begin measuring field parameters in the purge water. Record field parameter results and associated well purge

volumes at intervals as well purging proceeds toward completion. The well purging process is deemed complete when consecutive field measurements for pH, specific conductance, and temperature are stabilize within 10%.

13. If the well dries up prior to removing the minimum purge volume, allow the well to recover to within 85% of the original water level prior to resuming purging. If the minimum volume of water has not been purged after the third period of recovery, proceed to step 14, noting well purging and water quality sample collection details on the groundwater monitoring field form.
14. When the well purging procedure is complete, record final field measurements results and proceed with water quality sample collection procedure.
15. Backflow procedure: After the sample has been collected, allow the system to finish purging. When the spray rate from the sample return line drops off, indicating that water is starting to enter the riser pipe, shut off both valves at the top of the manifold and then turn the valve attached to the regulator outlet so that it points away from the regulator and toward the gold colored muffler to vent off the small volume of pressurized gas trapped between the regulator and the manifold.
16. Attach the gas in-line to the center port (sample return port) and open the valve attached to the regulator and the valve on the manifold's center port. The side port valve should be cracked slightly open. Allow gas to run into the sample return line for 20 or 30 seconds, pushing any water droplets clinging to the inside of the sample return line back down the line and below any potential zones of permafrost.
17. Close the center valve on the manifold, and vent off the remaining pressure in the line from the regulator.
18. Disconnect the gas in-line from the manifold.
19. Slightly open the center valve on the manifold and allow the gas in the sample return line to vent very slowly to the air. (The low flow rate is to prevent water droplets from being lifted back up to levels of possible permafrost.) Allow the gas to continue venting slowly from the side port until system is at equilibrium.
20. Place the protective brass cap loosely over both manifold valve fittings so that the water levels inside the riser pipe may be in equilibrium with the atmosphere.

Modified Procedure for Purging/Sampling Well (MW03-14)

Procedures for purging and sampling well MW03-14 are the same as for the MW03-16, except for the following modifications:

1. MW03-14 is typically the last well to be purged and sampled during groundwater monitoring field activities due to the long thawing period.
2. The heat trace should be energized as quickly as possible at the MW03-14 well after the field crew arrives at the Donlin Gold Project site.
3. At the end of the backflow procedure described in Step 14 above, both manifold valves should be closed. This will allow water to refill into the riser pipe only until the gas pressure in the trapped nitrogen gas pocket reaches equilibrium with the water pressure of the formation. This should occur before the water level reaches the possible permafrost zones.

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Groundwater Field Measurements Procedure

Field measurements are performed as a component of the well purging process and prior to collecting the water quality sampling for analytical laboratory analysis. Parameters that are measured in the field include the following:

- air temperature
- water temperature
- pH
- conductivity
- ORP/Eh
- dissolved oxygen.

All field parameters are measured during the well purging process in order to verify that the well has been adequately purged, and to establish that water quality parameters have stabilized prior to collecting water quality samples. These measurements should be taken and recorded after ½ of the minimum purge volume (or 1½ of well volume) has been removed from the well. Measurements are then recorded at least twice more until the minimum purge volume has been achieved.

Procedure:

1. Rinse the YSI 556 multi-meter probe, or equivalent, with tap water.
2. Check the meter using the standard that is nearest to expected field conditions. Recalibrate the probe using appropriate standards if necessary.
3. Initiate the well purging procedure using a dedicated or portable pump, and continue until at least one half of the minimum purge volume has been removed from the well (for wells with BarCad system pumps, complete one full purge cycle before proceeding to step 4).
4. Direct the well purge flow into a clean beaker or other suitable container, allowing the container to fill and overflow. Alternatively, a flow-through cell specifically designed for field measurements can be used.
5. Immerse multi-probe in beaker, or installed in flow-through cell, and turn on meter. Read the temperature, pH, DO, ORP/Eh, and EC and record the results after the readings have stabilized.
6. At appropriate intervals during the well purging process, conduct the field measurements using the YSI meter. Note and record the date/time, purge volume, and associated field measurement results on the Groundwater Monitoring Field Form (see Quality Assurance Project Plan). Continue until well purging process is complete and water quality parameters have stabilized. Water quality parameters are considered stable when three successive readings, collected 3-5 minutes apart, are within:
    - ± 3% for temperature (minimum of ± 0.2° C),
    - ± 0.1 for pH,
    - ± 3% for conductivity,
    - ± 10 mv for redox potential,
    - ± 10% for dissolved oxygen (DO), and
    - ± 10% for turbidity.
7. If applicable, note any problems such as erratic readings. Very cold ambient air conditions may cause freezing of water on the sensors, leading to erratic readings.
8. Decontaminate the multi-probe between wells in accordance with pump as described in the General Environmental Sampling Procedures SOP.

Groundwater Quality Sample Collection Procedure

After well purging and collection of field parameters is complete, collect groundwater samples using the following procedure:

1. Put on a pair of clean gloves—sampling personnel must wear clean, “non-powdered”, polyethylene, PVC, or nitrile gloves
2. Collect samples following clean hands/dirty hands, procedures, as detailed in pump as described in ENV-SOP-0036, General Environmental Sampling Procedures.
3. All unfiltered samples will be collected prior to collecting filtered samples.
4. Field Filtration is performed prior to any sample preservation using the Field Filtering procedure described in ENV-SOP-0036, General Environmental Sampling Procedures. A minimum of 1 L of water will be pumped through the filter prior to sample collection.
5. Carefully note the sample station, sample date/time, and any other pertinent information on the sample bottles.
6. Fill out the Groundwater Monitoring Field Form (see Quality Assurance Project Plan), documenting the sample station, sampling location, date/time of water quality sample collection, site conditions, all field measurement data, and any other pertinent information before leaving the site.

REVISION HISTORY

Revision #	Description of Change	Prepared By	Date
1	Drafted Document	Mike Rieser	3/13/2012
2	Added reference to field filtering procedure	Mike Rieser	6/19/2012

	STANDARD OPERATING PROCEDURE	
DONLIN GOLD	SURFACE WATER MONITORING PROCEDURES	
	EFFECTIVE DATE	DOCUMENT NUMBER
	6/19/2012	ENV-SOP-0038

PURPOSE

To set procedures for groundwater monitoring and sampling by Donlin Gold employees or contractors in support of environmental studies and monitoring.

SCOPE

- This procedure describes groundwater sampling from Donlin Gold monitoring wells and related tasks.

RESPONSIBILITY

- It is the responsibility of Field Environmental Coordinators to conduct environmental monitoring tasks following accepted procedures.

HEALTH AND SAFETY

Safety of people is the first priority when conducting any task. Personnel must be well-trained (per the procedures below) with standard routines, safety procedures, personal protection equipment, and emergency response actions.

ENVIRONMENTAL

Potential consequences of departing from standard:

- Departure from this Standard could result in injury to people, damage to facilities and/or the Environment resulting in pollution to the land or water, and obtaining erroneous field or laboratory water quality data.

REFERENCES

- Quality Assurance Project Plan for the Donlin Gold Project Water Quality Monitoring, Sampling, and Analysis Activities.
- Surface Water Monitoring Field Form, General Environmental Sampling Procedures, Quality Control Sample Collection Procedures

PROCESS

Surface Water Sampling Procedure

In addition to the procedures below, sampling personnel must wear clean, non-powdered, polyethylene, PVC, or nitrile gloves, and must follow the clean hands/dirty hands, filtering, sample bottle labeling, sample packaging and shipping, field instrument handling, and field equipment and instrument decontamination procedures as described in SOP-0036, General Environmental Sampling Procedures.

Procedure:

1. Carry equipment to the sampling location.
2. Set up equipment needed to collect samples.
3. Locate a sampling site at a point in the stream that exhibits the greatest flow and/or highest velocity.
4. Put on a pair of clean gloves—sampling personnel must wear clean, “non-powdered”, polyethylene, PVC, or nitrile gloves
5. Collect samples following “clean hands/dirty hands” procedures, as detailed in the General Environmental Sampling Procedures.
6. Collect Quality Control samples as specified in the Quality Assurance Project Plan, using the methods described in the Quality Control Sample Collection Procedures.

7. Fill out the appropriate field form (see Quality Assurance Project Plan), documenting the sample station, sampling location, date/time of water quality sample collection, site conditions, all field measurement data, and any other pertinent information before leaving the site.

Field Measurement of Stream Flow

Using the Swoffer Current Velocity Meter (Model 2100 C) and Swoffer "Top-Set" Wading Rod (Model 1518), or equivalent:

1. Visually check wading rod and velocity meter for damage. Repair damage to equipment as necessary.
2. Evaluate each reach of stream to determine if the site is suitable, and safe, for an adequate flow measurement. The criteria for determining if the site conditions are ideal for a flow measurement are as follows:
3. The channel is straight within the reach
4. The flow in the reach is confined to a single channel
5. The flow lines of the reach are distributed proportionately across the channel
6. The reach has a uniform slope, and the measurement is done midway between the slope controls
7. There are few, if any, in-stream obstructions within reach to disrupt flow lines, such as fallen logs, boulders, or sand or gravel bars
8. There are no downstream obstructions that may cause backwater at the measurement section, such as beaver dams or road culverts
9. There is good access to the gauging site under all flow conditions, including flooding conditions.
10. Working in pairs, designate one individual to perform the measurements, and one to record data on Surface Water Monitoring Field Form (see Quality Assurance Project Plan).
11. Anchor a surveyor's tape tautly across the stream perpendicular to the direction of stream flow, and attach it on either side of the stream. Provide at least a foot of clearance between the water surface and surveyor's tape.
12. Note the time and gage height, if a staff gage is present, at the beginning of the measurement.
13. Divide the stream width into 10 or more, but no more than 20, equal intervals, or "verticals."
14. Attach the velocity sensor to the wading rod.
15. The person taking measurements in the stream informs the recorder of the location of the first surveyor's tape measuring interval, measuring the total stream depth at that vertical using a wading rod or tape measure. Record total depth measurements to the nearest ⅛ inch (0.3 cm).
    Note: If the stream is frozen, an ice auger will be used to create a series of holes so that measurements can be taken.
16. Velocity measurements will be taken at 60% of the total depth. This is done by measuring the depth on the larger sliding rod (actual depth), then setting the smaller rod (60% depth) to the equivalent number. For example, if the depth is 0.5 meters, slide the probe down until the smaller parallel rod reads 0.5 meters, this will pace the velocity sensor at 60% (0.3 meters) of total depth.
17. The person measuring stream-flow should stand downstream of the surveyor's tape, facing upstream, holding the wading rod vertical in the water column with the velocity sensor facing directly into the current, standing to one side of the sensor to avoid influencing the velocity sensor readings.
18. Repeat the stream velocity measurement procedure at each interval, or "vertical". The data recorder records all measurement data and other appropriate information on the Surface Water Monitoring Field Form (see Quality Assurance Project Plan).

Field Measurement of Surface Water pH, Temperature, Dissolved Oxygen (DO), ORP/Eh, and Conductivity

Using the YSI model 556 multi-meter, or equivalent:

1. Rinse the probe with tap water.
2. Periodically check the meter using the standard that is nearest to expected field conditions. Recalibrate the probe using appropriate standards if necessary (see Quality Assurance Project Plan).
3. Perform measurements in-situ if conditions allow. If a measurement is performed ex-situ, use a clean beaker of sample water.
4. Immerse multi-probe in stream, or beaker, and turn on the meter. For in-situ measurements, the probe should be equipped with a weighted probe-guard to protect the sensors from damage. For ex-situ measurements, swirl the sample in the beaker to provide thorough mixing. Read the temperature, pH, DO, ORP/Eh, and EC, and record the measurements after the readings have stabilized.
5. If applicable, note any problems such as erratic readings. Very cold ambient air conditions may cause freezing of water on the sensors, leading to erratic readings.
6. Rinse the multi-probe with tap water and store it according to the manufacturer's directions, (see Manufacturer's Equipment Manual).

Field Measurement of Turbidity

Using the Hach 2100P turbidimeter, or equivalent:

1. Calibrate the turbidimeter before each sampling event, using pre-manufactured formazin gel calibrating blanks. For reference, refer to the manufacturer Instrument and Procedure Manual.
2. Collect a sample in an appropriate container cell.
3. Wipe the cell with a soft, lint-free cloth to remove water spots and fingerprints.
4. Apply a thin film of silicone oil and wipe with a soft cloth to obtain an even film over the entire surface.
5. Place the instrument on a flat, sturdy surface. Do not hold the instrument while making measurements.
6. Insert the sample cell in the instrument cell compartment so the diamond or orientation mark aligns with the raised orientation mark in front of the cell compartment.
7. Close the lid.
8. Press READ.
9. The display will show "- - - - NTU", then the turbidity in Nepholometric Turbidity Units (NTUs).
10. Record the turbidity after the lamp symbol turns off.
11. Dump the container contents and rinse with deionized water. Before storing, clean the instrument with a clean, dry cloth while avoiding the photocell on the inside of the meter.

REVISION HISTORY

Revision #	Description of Change	Prepared By	Date
1	Drafted Document	Mike Rieser	3/13/2012
2	Added references to applicable General Environmental Sampling Procedures	Mike Rieser	6/19/2012

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DONLIN GOLD	STANDARD OPERATING PROCEDURE	
	QUALITY CONTROL SAMPLE COLLECTION	
	EFFECTIVE DATE	DOCUMENT NUMBER
	6/19/2012	ENV-SOP-0039

PURPOSE

To set procedures for collecting quality control samples as required for surface water and groundwater sampling programs for Donlin Gold employees or contractors in support of environmental studies and monitoring.

SCOPE

- This procedure describes collecting field blank, field duplicate, and equipment rinse blank samples and related tasks.

RESPONSIBILITY

- It is the responsibility of Field Environmental Coordinators to conduct environmental monitoring tasks following accepted procedures.

HEALTH AND SAFETY

Safety of people is the first priority when conducting any task. Personnel must be well-trained (per the procedures below) with standard routines, safety procedures, personal protection equipment, and emergency response actions.

ENVIRONMENTAL

Potential consequences of departing from standard:

- Departure from this Standard could result in injury to people, damage to facilities and/or the Environment resulting in pollution to the land or water, and obtaining erroneous field or laboratory water quality data.

REFERENCES

- Quality Assurance Project Plan for the Donlin Gold Project Water Quality Monitoring, Sampling, and Analysis Activities.
- Surface Water Monitoring Field Form or Groundwater Monitoring Field Form, as applicable

PROCESS

Field Blank Sample Procedure

1. Prepare the field blank at the project site using deionized water and a complete set of sample bottles corresponding to the parameter list for lab analysis.
2. Label the field blank sample bottles with a code that will not alert laboratory personnel that this is a blank sample.
3. Fill the appropriate set of sample containers with deionized water. Use exactly the same procedures as are being used for environmental samples. Use the same preservatives, if any. Perform field filtering for dissolved parameters, if required, using the Field Filtering procedure described in ENV-SOP-0036, General Environmental Sampling Procedures.
4. Measure field parameters in the field blank deionized water using a clean intermediate container, having rinsed the container and instruments beforehand with deionized water.
5. Record all information on a field form, in the same manner as for normal water quality monitoring activities. Indicate this as a field blank sample on the field form, but do not transfer this information to the laboratory.
6. Place the field blank sample bottle set in the same cooler as the normal samples, and deliver all samples to the laboratory in the same manner and at the same time.

Field Duplicate Sample Procedure

1. Take an extra set of sample bottles into the field.
2. Label the field duplicate sample bottles with a code that will not alert laboratory personnel that this is a field duplicate sample.
3. Take the primary sample in the normal manner, after purging the well (if applicable) and measuring field parameters.
4. Collect the field duplicate sample in exactly the same manner as the primary sample.
5. Generate a separate field form for the field duplicate sample and record all information in the same manner as for the primary water quality sample. Indicate this as a field duplicate sample on the field form and to which primary sample the duplicate corresponds, but do not transfer this information to the laboratory.
6. Place the field duplicate sample bottle set in the same cooler as the normal samples, and deliver all the samples to the laboratory in the same manner and at the same time.

Equipment Rinse Blank Sample Procedure

1. Take a large container of deionized water and an extra set of sample bottles into the field.
2. Label the equipment rinse blank sample bottles with a code that will not alert laboratory personnel that this is a rinse blank sample.
3. Collect the equipment rinse blank sample immediately after collecting the normal water quality sample, and after decontaminating the sampling equipment in the normal manner.
4. Details of collecting the equipment rinse blank sample may differ according to the specific sampling equipment being used. The equipment rinse blank sample is intended to represent deionized water that has been processed in the same manner as a water quality sample collected from the field. This may be as simple as placing deionized water in an intermediate sample container and then transferring to the sample bottles; or may involve pumping deionized water through a pump hose. Field parameters are measured using a procedure similar to that used during normal field monitoring activities.
5. Generate a separate field form for the equipment rinse blank sample, and record all information in the same manner as for primary water quality sample. Indicate this as an equipment rinse-blank sample on the field form but do not transfer this information to the laboratory.
6. Place the equipment rinse blank sample bottle set in the same cooler as the normal samples, and deliver all samples to the laboratory in the same manner and at the same time.

REVISION HISTORY

Revision #	Description of Change	Prepared By	Date
1	Drafted Document	Mike Rieser	3/13/2012
2	Revised to reference applicable General Environmental Sampling Procedures	Mike Rieser	6/19/2012

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Attachment B
Field Forms

Donlin Gold LLC - Surface Water Monitoring Field Form (page 1)

1. Station Name and Location: Form must be completed in CAPITAL letters. Once completed this sheet must be scanned, emailed and filed in its correct location.

Station I.D.:	Sample Date/Time:	
Monitoring Performed By (Full Names):		
Site Conditions:	Ice Present? (circle): YES - NO	Ice thickness (if YES):
Stream Flow Conditions (circle): High Flow - Medium Flow - Low Flow - Frozen to stream bed		
UTM Z4 Easting (NAD83):		
UTM Z4 Northing (NAD83):		

2. Water Quality Sample Type

(Check one):

☐	Routine Monitoring	
☐	Field Blank	
☐	Equipment Rinse blank	
☐	Field Duplicate	*DUPLICATE OF:*
☐	Field Generated Reference Material	*Ref. Std I.D.:*

3. Field Parameters:

Air Temperature:		*ºC*
pH:		*pH units*
Conductivity:		*µmhos/cm*
Water Temperature:		*ºC*
Oxidation/Reduction Potential (ORP):		*millivolts (mv)*
Dissolved Oxygen (DO):		*mg/L*
Turbidity:		*ntu*

4. Water Quality Sample Information:

Parameter List Requested (Circle One):	Long List-1 Short List-1 Other:__________
Date and Time Shipped to Lab (must be filled):	

5. Weather and Notes:

Donlin Gold LLC - Surface Water Monitoring Field Form (page 2)

Stream Velocity Measurements (used for determining stream flow)

1. Station Location and Basic Information

Station I.D.:	Date/Time:
Personnel on site (Full Names):	
Measurement site condition (circle): High Flow - Medium Flow - Low Flow - Frozen to stream bed	
Staff Gauge Present? (circle): YES NO	
Staff Gauge Reading (record to nearest 0.01 m):	

2. Velocity Measurement Data

Distance at LEFT bank (m):	Distance at RIGHT bank (m):
Stream Width in meters (left bank – right bank):	
METER CALIBRATION:	

Station (m)	Water Depth	Measurement Depth (6/10 of Water Depth)	Velocity (m/sec)	Notes
	0		0	

3. Additional Notes:

Donlin Gold LLC - Groundwater Monitoring Field Form

General Information

Well ID:	Date/Time on Site:
Monitoring Performed By (Full Names):	
Well Head Condition - Locked?(circle): **yes no** Damaged?(circle): **yes no**	
If damaged, describe:	

Well Thawing (if needed)

Frozen? (circle): **yes no** if so, at what depth?:			
Heat Trace energized	(date/time):	Heat Trace de-energized	(date/time):
Riser thawed successfully (circle): **yes no**			
Notes/comments:			

Water Level Measurement Information

Depth to Water: ____________ feet/meter	Measurement Point::
Total Well Depth: _________feet/meter	Height of Water Column: ________ feet/meter
Elevation of Meas. Pt.: _____________ feet AMSL	Water Level Elevation: _____________ feet AMSL

Well Purging/Field Measurements Information

Minimum Purge Volume*: ________________gals	*0.5 gal/ft of water column for 2" dia. well *2 gal/ft of water column for 4" dia. well			
Field Parameter	First	Second	Third	**Final**
Date/Time:				
Volume Purged (gals):				
Color/Clarity:				
pH (su):				
Conductivity (µmhos/cm):				
Temperature (deg C):				
ORP (mv):				
Dissolved Oxygen (mg/L):				
Date/Time Water Quality Sample Collected:				
Parameter List Requested (Circle):	***Long List-1***	***Short List-1***	***Other***	
Date Shipped to Lab:				

Weather/Notes: ____

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CLIENT: **Donlin Gold LLC**

CONTACT: **Tisha Woolley** PHONE NO: **(907) 569-0342**

PROJECT: **Donlin Creek SW** SITE/PWSID#:

REPORTS TO: **Nick Enos and Tisha Woolley**

Donlin Gold LLC , 4720 Business Park Blvd.Suite G-25, Anchorage, AK 99503

INVOICE TO: **Nick Enos** QUOTE #:

Donlin Gold LLC , same as above P.O. NUMBER:

LONG LIST - 1

Donlin Creek Surface Water (SW)

page ________ of ________

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	PRES USED / SAMPLE TYPE C = COMP G = GRAB	NONE: pH, Cond, TDS, Alk*, Cl, SO4, Fluoride	NONE: TSS	HNO3: Metals, Total	HNO3: Cations (Ca, Mg, Na, K), Dissolved and Dissolved Metals	HCL: Mercury (LL-1631)	H2SO4: Nitrate + Nitrite (as N), Ammonia	NaOH: Cyanide (Tot & WAD)						REMARKS
				SW															
				SW															
				SW															
				SW															
				SW															
				SW															
				SW															
				SW															

Collected/Relinquished By: (1)	Date	Time	Received By:	Shipping Carrier: Shipping Ticket No:	Samples Received Cold? YES NO Temperature °C: _______._______
Relinquished By: (2)	Date	Time	Received By:	Special Deliverable Requirements: KEEP COOL/ DO NOT FREEZE	Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT
Relinquished By: (3)	Date	Time	Received By:	Requested Turnaround Time and Special Instructions: Alk* - Alkalinity, CO3, HO3, OH	
Relinquished By: (4)	Date	Time	Received For Laboratory By:	Metals, Total: Al, Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Li, Pb, Mn, Mo, Ni, Se, Ag, Tl, V, Zn (200.7/200.8)	

- ❑ 200 W. Potter Drive **Anchorage, AK 99518** Tel: (907) 562-2343 Fax: (907) 561-5301
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INVOICE TO: **Nick Enos** QUOTE #:

Donlin Gold LLC , same as above P.O. NUMBER:

LONG LIST - 1

Donlin Creek Ground Water (GW)

page ________ of ________

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	PRES USED / SAMPLE TYPE C = COMP G = GRAB	NONE: pH, Cond, TDS, Alk*, Cl, SO4, Fluoride	NONE: TSS	HNO3: Metals, Total	HNO3: Cations (Ca, Mg, Na, K), Dissolved and Dissolved Metals	HCL: Mercury (LL-1631)	H2SO4: Nitrate + Nitrite (as N), Ammonia	NaOH: Cyanide (Tot & WAD)					REMARKS
				GW														
				GW														
				GW														
				GW														
				GW														
				GW														
				GW														
				GW														

Relinquished	Date	Time	Received
Collected/Relinquished By: (1)	Date	Time	Received By:
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received For Laboratory By:

Shipping Carrier:

Shipping Ticket No:

Samples Received Cold? YES NO

Temperature °C: _______._______

Special Deliverable Requirements:

KEEP COOL / DO NOT FREEZE

Chain of Custody Seal: (Circle)

INTACT BROKEN ABSENT

Requested Turnaround Time and Special Instructions:

Alk* - Alkalinity, CO3, HO3, OH

Metals, Total: Al, Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Li, Pb, Mn, Mo, Ni, Se, Ag, Tl, V, Zn (200.7/200.8)

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CONTACT: **Tisha Woolley**	PHONE NO: **(907) 569-0342**		
PROJECT: **Donlin Creek SW**	SITE/PWSID#:		
REPORTS TO: **Nick Enos and Tisha Woolley** **Donlin Gold LLC , 4720 Business Park Blvd.Suite G-25, Anchorage, AK 99503**			
INVOICE TO: **Nick Enos** **Donlin Gold LLC , same as above**	QUOTE #: P.O. NUMBER:		

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	PRES USED / SAMPLE TYPE C = COMP G = GRAB	NONE: pH, Cond, TDS, Alk*, Cl, SO4, Fluoride	NONE: TSS	HNO3: Metals, Total	HNO3: Cations (Ca, Mg, Na, K), Dissolved and Dissolved Metals	HCL: Mercury (LL-1631)	H2SO4: Nitrate + Nitrite (as N), Ammonia	NaOH: Cyanide (Tot & WAD)					REMARKS
				SW														
				SW														
				SW														
				SW														
				SW														
				SW														
				SW														

Collected/Relinquished By: (1)	Date	Time	Received By:	Shipping Carrier: Shipping Ticket No:	Samples Received Cold? YES NO Temperature °C: _______._______
Relinquished By: (2)	Date	Time	Received By:	Special Deliverable Requirements: KEEP COOL / DO NOT FREEZE	Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT
Relinquished By: (3)	Date	Time	Received By:	Requested Turnaround Time and Special Instructions: Alk* - Alkalinity, CO3, HO3, OH	
Relinquished By: (4)	Date	Time	Received For Laboratory By:	Metals, Total: Al, As, Ba, Cd, Fe, Li, Mn, Ni, Zn (200.7/200.8)	

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CONTACT: **Tisha Woolley**	PHONE NO: **(907) 569-0342**		
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LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	PRES USED / SAMPLE TYPE C = COMP G = GRAB	NONE: pH, Cond, TDS, Alk*, Cl, SO4, Fluoride	NONE: TSS	HNO3: Metals, Total	HNO3: Cations (Ca, Mg, Na, K), Dissolved and Dissolved Metals	HCL: Mercury (LL-1631)	H2SO4: Nitrate + Nitrite (as N), Ammonia	NaOH: Cyanide (Tot & WAD)						REMARKS
				GW															
				GW															
				GW															
				GW															
				GW															
				GW															
				GW															
				GW															

Collected/Relinquished By: (1)	Date	Time	Received By:	Shipping Carrier: Shipping Ticket No:	Samples Received Cold? YES NO Temperature °C: _______._______
Relinquished By: (2)	Date	Time	Received By:	Special Deliverable Requirements: **KEEP COOL / DO NOT FREEZE**	Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT
Relinquished By: (3)	Date	Time	Received By:	Requested Turnaround Time and Special Instructions: **Alk* - Alkalinity, CO3, HO3, OH**	
Relinquished By: (4)	Date	Time	Received For Laboratory By:	**Metals, Total: Al, As, Ba, Cd, Fe, Li, Mn, Ni, Zn (200.7/200.8)**	

DONLIN CREEK YSI METER INSTRUMENT MAINTENANCE LOG	Serial No. of YSI	Date	Time	Issued by:	NOTES/ISSUES

DONLIN CREEK YSI METER CALIBRATION LOG				PH		CONDUCTIVITY		ORP		Calibration by:
DONLIN CREEK A BARRICK/NOVAGOLD COMPANY	**Serial of YSI**	***Date***	***Time***	*Calibration Reading (Circle one)*	*Temp.*	*Calibration Reading*	*Temp.*	*Calibration Reading*	*Temp.*	*Initial for first name, written out last name*
				4.00 7.00 10.0						
Initial calibration (Start, Before Sampling)										
Final calibration (End of Day)										
Initial calibration (Start of Day)										
Final calibration (End of Day)										
Initial calibration (Start of Day)										
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Initial calibration (Start of Day)										
Final calibration (End of Day)										

Attachment C
Contract Laboratory SOPs and QAP

SGS NORTH AMERICA INC. - QUALITY MANUAL

Written in accordance with the requirements of ISO/IEC 17025:2005 – General Requirements For The Competence Of Calibration and Testing Laboratories

REVISION: *8.1*

ISSUED BY:

Heather L. Hall, QA Manager and Client Services/Continuous Improvement Lead

AUTHORIZED BY:

Charles Homestead, General Manager

Stephen Ede, Technical Director

FOR USE AT: *SGS North America Inc. – Alaska Division*
Environmental Services
200 W. Potter Drive
Anchorage, AK 99518

DATE: *20 July 2011*

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1. Introduction

This Quality Manual outlines the Quality System of the Alaska Division of SGS North America Inc. (SGS North America Inc., known as SGS Environmental Services Inc. prior to January 2009, will hereafter be referred to as SGS Alaska or SGS.) As the principal manual in a set of manuals and procedures, it describes the Laboratory's commitment to Quality Management.

This Manual describes the approach of SGS with regard to Quality Management through:

- Continuous upgrading of SGS services;
- Permanent Quality Management to prevent and/or eliminate nonconformities;
- Allocating the necessary resources to maintain and continually improve the organization;
- Conducting reviews of all elements of the system;
- Producing accurate, precise and complete legally defensible data; and
- Communicating to the staff the importance of meeting customer and regulatory requirements.

1.1. Application

- The policies in this Manual apply to all levels of the organization of SGS Alaska at the Anchorage laboratory (200 W. Potter Drive) and the Fairbanks receiving facility (3180 Peger Road).
- Corporate Policies and Procedures related to Human Resources, Finance and Accounting, Management Information Systems and General Administration are covered in separate documents.
- Implementation of the Quality System is achieved by means of this Quality Manual and documented procedures that are developed and followed by SGS Alaska.
- This Manual and supporting procedures are revised as necessary, to meet changing requirements and needs. The QA Office maintains a master file of this manual to insure review on a annual basis. The filing system serves as an accounting of the distribution of the manual. The accounting includes destruction of controlled copies of expired manuals. The QA Office also maintains a historical file of original and electronic versions of this manual; including the current revision and any versions archived within the past 5 years. Any changes to the Manual may be made only by authorization of the QA Office.
- This Manual is readily available to all SGS staff and is available to all SGS clients upon their request.

2. Normative References

2.1. Reference Standards

2.1.1. Quality System

The Quality System of SGS has been designed in accordance with A2LA accreditation for ISO/IEC 17025:2005, the 2003 National Environmental Laboratory Accreditation Conference (NELAC) Chapter 5 standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DOD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (latest version). SGS will follow the established advertising policy to control the use of the A2LA symbol.

Reference:

A2LA Document P101 (www.a2la.org)

SGS SOP 140 (Review of Requests for Quotes, Proposals and Contracts)

2.1.2. Other Standards

In addition, the laboratory's quality system incorporates and adheres to the standards set forth by the NELAC, specifically Chapter 5 (Quality System). A large amount of the analytical work performed by the laboratory is completed to support the regulatory requirements of our clients. This work may be performed to satisfy the provisions in one or more of the following regulatory areas:

- **Clean Water Act (CWA):** Under the CWA, an organization that discharges wastewater into a river system is subject to regulation under the *National Pollution Discharge Elimination System (NPDES)*, as well as the *Alaska Pollution Discharge Elimination System (APDES)*. Various analytical methods are approved or mandated by this act.
- **Resource Conservation and Recovery Act (RCRA):** Under RCRA, any organization that wishes to dispose of solid waste must determine if it is potentially hazardous or exhibits toxic characteristics. Specific methods exist for making such a determination. Also, any organization that is operating a hazardous waste storage facility must have in place a groundwater protection plan. The analyses performed to support this type of plan may use the methods outlined in SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, as published by the Environmental Protection Agency (EPA) of the United States in support of the RCRA program.
- **Safe Drinking Water Act (SDWA):** Under the SDWA, the analysis of drinking water must be analyzed by specific established methodologies. The *Alaska Department of Environmental Conservation Drinking Water (ADEC DW)* programs regulate both Microbiology and Chemistry.
- **Alaska Department of Environmental Conservation Contaminated Sites Program (ADEC CS):** This program mandates the use of specific methods and preservation techniques for contaminated sites and underground storage tanks within Alaska.

- In addition, many projects the laboratory is involved with have oversight by the Air Force Center for Engineering and Environment (AFCEE), Brooks AFB (AFIOH/SCD), the Naval Facilities Engineering Service Command (NFESC), or the US Army Corps of Engineers (USACE). These agencies have jointly developed the Department of Defense (DOD) Quality System Manual (QSM). The DoD QSM is a guidance document which defines specific data quality objectives and other special considerations required in all aspects of data collection. The QSM is built upon ISO 17025 and NELAC standards, with the addition of "Gray Box" clarifications and appendices from the DOD EM/DQ (Environmental Monitoring/Data Quality) Workgroup, composed of members from all DOD branches. Throughout this document and the associated standard operating procedures (SOPs), the term "DOD" will be used generically to refer to AFCEE, Navy and/or Army Corps of Engineers.

Note: It is critical to the success of any project that the laboratory is aware of which regulatory program(s) is(are) involved and if any special considerations have been imposed by either the regulatory agency or client. DOD QSM criteria (using the latest approved version) can be applied in those instances when the laboratory is notified in advance, has the opportunity to review project specific data quality objectives, and had the opportunity to negotiate variance requests (if applicable). Otherwise, all work performed by SGS will be analyzed using the most appropriate methodology (including Standard Methods for the Analysis of Water and Wastewater (SM), EPA, SW846 or methods developed/modified by the laboratory) in accordance with this laboratory QAP. Whenever feasible, SGS will adopt the most recently approved method. Clients should confirm current capabilities with SGS Business Development or their assigned Project Manager.

2.1.3. Other Quality System Manuals

This is the only Quality Manual used by SGS Alaska

3. Terms & Definitions

- "Supplier" and "Vendor" are synonymous and refer to the external source used to acquire purchased products and/or services by the organization.
- Throughout the text of this Quality Manual whenever the term "product" occurs, it can also mean service.
- "Analyst" refers to any member of the staff who prepares or analyzes samples and may refer to any individual who peer reviews data.
- "Customer" can refer to the customer (internal or external), accrediting body, or regulatory authority.
- "General Manager" is used to describe the top level of management at which decisions regarding the lab are made.
- "Quality Assurance (QA) Manager" is used to describe the position at which the overall responsibility for the Quality System occurs.
- "QA/QC Officer" is used to describe staff who assist the QA Manager to implement, maintain and improve the laboratory's quality system.

- "Supervisor" is used to describe the position at which the overall responsibility for approving work schedules, overtime, and allocating labor resources occurs.
- The management team includes the General Manager, Production Manager, Technical Director, QA Manager, Accounting Manager and Client Services/Continuous Improvement Lead.

4. Management Requirements

4.1. Organization

4.1.1. Legal Entity

SGS Alaska is appropriately registered for legal process. All (original) business licenses are held by the SGS legal department.

Reference:

SGS North America Inc. Alaska Business License

4.1.2. Laboratory Responsibility

The mandate of SGS Alaska is to deliver the high quality analysis and reporting of waters (including drinking water, wastewater, surface water, groundwater, etc.), soils and other materials in a timely manner in accordance with the needs of the customer, regulatory authorities and accrediting bodies, including (but not limited to):

- ADEC
- A2LA

The certifications and approvals include on-site evaluations of the laboratory by each agency to ensure that equipment, personnel, and laboratory techniques are in conformance with the EPA and program guidelines. Regulators generally schedule audits at two or three year intervals. More frequent audits may occur when a new method is implemented; a new instrument technology is acquired, as a requirement of a project-specific work plan; or as part of a client's service procurement procedure.

Reference:

ISO/IEC 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories

DoD Quality Systems Manual for Environmental Laboratories, latest version

18 AAC 70 (ADEC Water Quality Standards)

18 AAC 75 (ADEC Oil and other Hazardous Substances)

18 AAC 78 (ADEC Underground Storage Tanks)

18 AAC 80 (ADEC Drinking Water)

4.1.3. Scope of Management System

The laboratory management system covers work carried out at SGS Alaska (the fixed laboratory in Anchorage and the receiving facility in Fairbanks).

4.1.4. Conflict of Interest

SGS Alaska is a member of the SGS group – the world's leading inspection, testing, certification and verification company with more than 64,000 employees in a network of more than 1,250 offices, including over 600 laboratories, around the world.

The core services offered by SGS Global can be divided into these categories:

- **Inspection and Verification Services**. SGS inspects and verifies the quantity, weight and quality of traded goods. Inspection typically takes place at the manufacturer's/supplier's premises or at time of loading or at destination during discharge/off-loading.
- **Testing Services**. SGS tests product quality and performance against various health, safety and regulatory standards. SGS operates state of the art laboratories on or close to customers' premises.
- **Certification Services**. SGS certifies that products, systems or services meet the requirements of standards set by governments, standardization bodies (e.g. ISO 9000) or by SGS customers. SGS also develops and certifies its own standards.

SGS Alaska only offers testing services and is governed by management (as outlined in the organizational chart) which ensures that both real and potential conflicts of interest are prevented. The responsibilities of key personnel (i.e., management and supervisors) are outlined in the job descriptions, which are maintained by senior management.

All SGS employees are expected to avoid any situation where there is or could be a conflict between their own personal interests and the interests of the organization. It is equally important to avoid the appearance of a conflict of interest. These principles are covered in the SGS Code of Integrity and Professional Conduct which is reviewed with all staff upon hire and annually.

Reference:

SGS Organization Charts (Alaska Division and NAM Region)

SGS Code of Integrity and Professional Conduct

SGS North America Employee Handbook

4.1.5. Laboratory Responsibilities

4.1.5.1. Management and Technical Personnel

The goal of SGS Alaska is to provide quality determinations in a timely manner. This can only be realized by fostering excellence in its staff, through training, and provision of a workplace that is safe, adequately sized, results-oriented, and operates with due regard for the quality management system in place.

SGS Alaska has managerial and technical personnel who, irrespective of other duties, have the authority and resources needed to carry out their duties, including the implementation, maintenance, and improvement of the management system, to identify the occurrence of departures from the quality system, and to initiate actions to prevent or minimize such departures.

In order to function smoothly and generate data of the required quality all personnel must:

- Understand SGS' Code of Integrity and Professional Conduct, Quality Policy, and Company Policy on Health, Safety and Environment.
- Understand the necessity for quality control
- Accept their level of responsibility for quality control
- Obtain the skill to perform assigned analyses

Job descriptions for management and technical personnel are maintained by Senior Management and include the above as functions of the respective positions.

Reference:

Sections: 4.10. (Improvement), 4.11. (Corrective Action) and 4.12. (Preventive Action) of this document

4.1.5.2. Undue Pressure

SGS Alaska adheres to the Human Resource Management policies laid down by both SGS and the Government of the United States of America, which helps ensure that management and personnel are free from internal and external commercial, financial and other pressures that might adversely affect the quality of their work. Copies of this documentation are retained in the Human Resources office.

Reference*:*

SGS North America Employee Handbook

4.1.5.3. Customer Confidentiality

SGS is committed to protecting the privacy and information of its customers. A copy of our General Conditions of Services is made available to all customers, and governs their relationship with SGS. All data generated by SGS is to be held in the strictest confidence, and care must be taken to ensure that data is reported and discussed only with the client or an authorized representative. Details of any analysis should never be discussed with anyone outside of the laboratory unless such discussion has been specifically approved by management and/or client.

Reference:

SGS Code of Integrity and Professional Conduct

SGS General Conditions of Service

4.1.5.4. Operational Integrity

Integrity is at the core of the business of the SGS Group, it is the common thread through all activities. A Code of Integrity and Professional Conduct has been established to lay down rules of behavior in all dealings for the SGS Group (including SGS North America Inc. – Alaska Division) and to provide guidance in day-to-day business. In addition, laboratory procedures have been developed to further support the corporate code.

SGS maintains published documents, including the "Code of Integrity and Professional Conduct," which outline the professional demeanor expected from every employee. All employees are required to sign and keep on file these forms, which documents each employee's acceptance and understanding of these requirements. A copy of the signed form is also kept in each employee's personnel file. Initial and annual ethics training is provided by the General Manager. Initial and annual training regarding manual integration is provided for applicable staff; both Analysts and data reviewers.

As outlined in the SGS North America Employee Handbook, disciplinary measures may include a verbal warning, written warning, unpaid suspension, and/or termination; however, there is no guarantee of, or expectation that, progressive disciplinary measures will be followed. Each case is evaluated on its own merits and potential punishment for improper, unethical or illegal actions may not be limited to suspension or termination of employment.

Failure to report suspected improper, unethical or illegal actions is considered a serious offense and may also result in disciplinary action. Prompt reporting of any suspected infractions will not result in disciplinary action. It is SGS' policy, therefore, to require staff to report any matters of concern. Channels for reporting include the direct supervisor, General Manager, Technical Director, QA Manager and the corporate Compliance Officer. All reports must be documented and thoroughly investigated by management.

Reference:

SGS Code of Integrity and Professional Conduct

SGS SOP 144 (Manual Integration)

Gray Box 18: DOD QSM, latest version

EPA Inspector General Letter, September 5, 2001

4.1.5.4.1. Corporate Integrity

All SGS services are to be provided in a professional, independent and impartial manner, honestly and in full compliance with Group approved methods, practices and policies. SGS does not surrender to any pressure from clients in one are of business in order to obtain a favorable treatment in another area.

Reference:

SGS Code of Integrity and Professional Conduct

4.1.5.4.2. Data Integrity

All SGS employees receive data integrity training as part of their initial Orientation & General Training program and annual refresher training is provided. In addition, analysts and reviewers for methods which may involve manual integration are given initial and annual training.

Reference:

SGS Code of Integrity and Professional Conduct

Gray Box 18, DOD QSM, latest version

SGS SOP 144 (Manual Integration)

4.1.5.4.3. Conflict of Interest

A conflict of interest is any situation where the interests of the SGS Group diverge from personal employee interests or from close relatives or persons with whom the employee is in close personal or business contact. The mere appearance of impropriety is to be avoided because it creates the impression of a lack of impartiality.

Employees who find themselves in conflict are obligated to promptly discuss such situations with their Supervisor so that prompt and swift resolution which is amenable to all parties can be achieved. When a conflict of interest does manifest, the Supervisor will promptly resolve the situation in concert with the client so that an informed decision can be made before pursuing a course of action. All approaches to solving conflicts of interest will be transparent to all parties involved. Objectivity will remain at the forefront in all decision processes.

Reference:

SGS Code of Integrity and Professional Conduct

4.1.5.5. Organization Charts

The Organization Chart for SGS Alaska is updated regularly, under the direction of the Human Resources department and is accessible through the SGS intranet (\\usfs700\ank_groupdata\Public\DOCUMENT\RFP). Information on the structure of SGS globally, can be found on the SGS website.

The laboratory organization includes three teams:

- Operations (i.e., analytical, sample receiving/login and sample control staff, who report to the Production Manager)
- Operational Support (i.e., accounting, IT, data services and data management staff, who report to the Accounting Manager)
- Client Services (i.e., project management and business development, who report to the Client Services/Continuous Improvement Lead)

The management team includes the General Manager, Production Manager, Technical Director, QA Manager, Accounting Manager and Client Services/Continuous Improvement Lead.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.6. Responsibility and Authority

SGS Alaska operates under the direction of the General Manager, who is responsible for developing and maintaining the organizational structure, the description of the responsibilities of senior personnel, providing scientific leadership, project planning, equipment maintenance and requisition, laboratory supplies, laboratory production, ensuring overall timely delivery of project results and overall responsibility for the Quality System within the laboratory. The General Manager is responsible for balancing the demands of the internal and external customer groups. Some authority is delegated to appropriate individuals depending upon their specific areas of responsibility and expertise.

Reference:

SGS Organization Chart (Alaska Division)

SGS SOP 126 (Procurement and Receipt of Supplies)

SGS SOP 140 (RFP/Proposal Review)

4.1.5.7. Laboratory Supervision

SGS Alaska provides adequate supervision of all staff as outlined in the SGS Organization Chart.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.8. Technical Management

The Technical Director is ultimately responsible for the technical operation of all departments. The Technical Director reviews all analytical procedures utilized by Analysts and is directly responsible for the accuracy of test results, acquisition of new instruments, method development and modification, laboratory quality control, and is ultimately responsible for the implementation and training of staff in the techniques detailed in Standard Operating Procedures (SOPs) and elements of the laboratory QAP. This position advises clients in proper techniques, methods necessary to properly fulfill the requirements of regulatory agencies, and address routine questions from clients or analytical staff regarding the validity or reliability of specific analytical data.

The Technical Director has a minimum of a Bachelors Degree in Chemistry or other Natural Science discipline and a minimum of 2 years of analytical chemistry laboratory experience.

Note: Per the NELAC 2003 Standard, a Technical Director who is absent for a period of time exceeding 15 consecutive calendar days shall designate another full-time staff member meeting their qualifications to temporarily perform the functions. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.9. Quality Assurance Manager

The Quality Assurance (QA) Manager has the authority and responsibility for ensuring the quality system is implemented and followed at all times, with direct access to the highest level of management at which decisions are made. The QA Manager reports to the General Manager, but works independently and is able to evaluate data objectively, free of managerial influence. A working knowledge of general statistical concepts is required to provide a basis for reviewing data to determine method performance.

The QA Manager is responsible for following:

- Develop and update the overall QA Plan for the laboratory.
- Serve as the focal point for QA/QC and be responsible for the oversight of QC data.
- Aid in the documenting and addressing corrective actions and/or client concerns, as well as to track the long-term effectiveness of corrective actions.
- Oversee proficiency sample testing and evaluation.
- Assist Analysts and administrative staff in preparing and updating SOPs.
- Distribute current SOPs to appropriate personnel via the document control program.
- Issue monthly reports to the corporate Vice President and local Management Team (including the General Manager and Technical Director) outlining QA/QC activities and initiatives.
- Establish effective and efficient internal and external communication channels.
- Maintain current, and explore new, certification or approval programs.
- Facilitate internal and external audit programs, including lab responses and corrective actions.
- Perform periodic review of generated data packages.
- Assist Business Development by reviewing Data Quality Objectives (DQOs) during the quote process and, if applicable, outlining variance requests.

The QA Manager is assisted by the QA/QC Officer(s) and several key staff which comprise the Quality Team. Each person on the Quality Team has oversight responsibility for a specific function of the QA/QC systems (e.g., SOPs, PT samples, DL studies, internal audits, certification/accreditation applications and renewal, corrective actions, training, etc.). Each member of the Quality Team reports to the QA Manager and QA Officer, who oversee progress and deadlines for the QA/QC system. Consequently, where the QA Manager is referenced throughout this document, their designee may carry out the duties under their direct supervision.

Reference:

SGS Organization Chart (Alaska Division)

SGS Monthly QA Reports

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 103 (Internal Blind Program)

SGS SOP 105 (Corrective Actions)

SGS SOP 111 (Document Control)

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

SGS SOP 116 (DL/LOD/LOQ)

SGS SOP 140 (RFP/Proposal Review)

SGS SOP 145 (Control Charts)

4.1.5.10. Managerial Substitution

When the Management staff of the laboratory is away from the laboratory, technical responsibility shifts as per the SGS Alaska Organization Chart.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.11. Place of Staff in Organization Objectives

Laboratory staff are made aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system through regularly scheduled status meetings. Each analytical section has a representative attend status meetings and serve as a liaison for their operational section (e.g., Sample Preparation, Waters, Microbiology, Metals, Fuels, Volatiles and Semivolatiles).

Reference:

SGS Organization Charts (Alaska Division)

SGS SOP 007 (Laboratory Communications)

4.1.6. Responsibility for Communication

Appropriate communication processes have been established and implemented by top management. Regularly scheduled status meetings have been established,

Reference:

SGS SOP 007 (Laboratory Communications)

4.2. Quality System

4.2.1. Policies and Procedures

SGS Alaska Quality Assurance Program is directed by the QA Manager who is responsible for its effectiveness and efficiency. Achievement of these objectives with respect to quality is the responsibility of all personnel. The management system established to implement the Quality Assurance Policy satisfies the requirements of ISO/IEC 17025:2005 (General Requirements for the Competence of Testing and Calibration Laboratories).

Understanding of the management system is demonstrated by all laboratory staff through a quiz, which is based on the principles of the Management System in place. It is taken by all lab staff at the end of their Quality Management System training. When changes are made to the QAP that modify a process, procedure, and/or policy to an extent that the staff would be reasonably expected to be affected by the change, a new quiz will be given to all staff and records of the test maintained. (Note: Where a written quiz is not practical and/or appropriate, an alternate method of verification may be implemented, (e.g. observation and documentation of the successful performance of tasks specific to the quality management system, etc.).

Implementation of the management system is demonstrated through data processing and record keeping.

Reference:

SGS Form FT-017 (QAP Training Quiz)

4.2.2. Quality Manual

The QA Manager is responsible for developing, implementing and updating the Quality Manual (otherwise referred to as the Quality Assurance Plan). The Quality Manual documents top management commitment to the development and implementation of the management system (see section 4.1.2), documents top management's commitment to continually improving its effectiveness (see section 4.15); documents the importance of meeting customer requirements as well as statutory and regulatory requirements (see section 4.1.2); documents a quality policy statement authorized by top management, and supporting quality objectives (see section 4.2.3); includes or makes reference to all procedures within a defined document structure (see section 4.3); defines the roles and responsibilities of technical management and the quality manager (see section 4.1.5.8 and 4.1.5.9); and outlines the structure of documentation used in the management system (see section 4.3).

4.2.2.1. Quality Policy Statement

Sound management practices and commitment to good professional practice and quality of service are important responsibilities in the conduct of our business.

As an employer, SGS Alaska will work to deliver the following:

- High quality analysis of waters, soils and other materials in a timely manner.
- A program of scheduled quality activity that ensures the requirements of the management system are documented and includes the following:
    - Service that is fit-for-purpose, which includes quality and responsiveness.
    - Prevention rather than correction.

- o The use of internationally recognized methods wherever possible.
- o An effective and documented training program.
- o A comprehensive validation program, including accuracy and short & long-term precision; Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantification (LOQ); linearity, and estimation of uncertainty of measurement.
- o Participation in proficiency testing (where available).
- o Competent, trained personnel assigned to carry out duties in a timely manner and in accordance with the mandate of the Management System, while ensuring that the work is done safely and with due regard to the environment.

- Compliance with ISO/IEC 17025:2005 – General requirements for the competence of testing and calibration laboratories and with all applicable legal and regulatory legislation requirements and the NELAC Institute (TNI) standards as defined in applicable accreditation scopes.
- Regular review, audit and internal quality control procedures to continually improve the effectiveness of the management system.
- Communication of the objectives of the management system to ensure understanding by all personnel.

Reference:

SGS Certifications and Accreditations

SGS SOP 007 (Laboratory Communications)

SGS SOP 102 (Training and Certification)

SGS SOP 103 (Internal Blind Program)

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

SGS SOP 116 (DL/LOD/LOQ)

SGS SOP 141 (Uncertainty)

SGS SOP 145 (Control Charts and Control Limits)

4.2.3. Top Management Roles & Responsibilities

Top management is committed to the development and implementation of the management system and to continually improving its effectiveness through the provision of resources to support and develop the system. This includes (but is not limited to) a Management Team which meets regularly to review the lab operations – including the management system – and identify areas of needed improvement.

Reference:

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

4.3. Document Control

4.3.1. Policies and Procedures

SGS Alaska controls all documents that form part of its quality system through defined procedures. Locations are designated for all controlled documents to ensure access by the appropriate people. Both the forms used to gather information and the actual recorded information are controlled with the objective that the personnel developing the method, performing and approving the analysis can be identified if required. All controlled documentation is property of SGS and must be left behind at the termination of employment.

The analytical procedures and associated quality control criteria for the tests performed by SGS are outlined in the laboratory's written SOPs. Additionally, SOPs are prepared for administrative or operational activities that affect data collection activities or sample integrity. Each SOP contains sufficient detail to ensure that specific procedures can be clearly followed and duplicated. The SOPs are issued as controlled documents by the Quality Assurance Office to ensure that only the most recent revisions are in circulation and are distributed to all pertinent staff.

Reference*:*

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.2. Approval and Issue

Analytical SOPs are scheduled for review on an annual basis by the primary user, at which time the SOP may be updated to incorporate the most recent promulgated/approved source method and/or technological advancements. The SOP is generally only updated if scheduled review indicates corrections and additions to the document are necessary; otherwise, the coverpage will be signed to indicate that the document remains current and correct. Minor changes may be made to the document at any time through a controlled "Addendum" with approval of the Technical Director and the Quality Assurance Manager.

Internally generated documents are reviewed by appropriate staff members and, upon approval, are control by the QA Manager and/or Data Services staff. All SOPs, logbooks, and internal forms handled in this manner and electronic, read-only versions are kept on the network.

Reference:

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.3. Master List

A master list of all internal SOPs (current revision and archived SOP numbers) is maintained by the QA Office; a copy of the master list of current SOP revisions is available to all staff on the Network:

\\usfs700\ank_groupdata\Public\DOCUMENT\SOP\~Approved_SOPs~

Note: SGS Alaska does not control all external documents (e.g. regulations). Rather, the lab maintains web links to documents that are made available by the issuing authority and staff access the on-line version/most up-to-date version at all times

Reference:

SGS SOP Training Matrix

4.3.4. Availability

All quality documentation (including instructions, standards, manuals, and reference data) is available where required through the (write-protected) SGS network and in hard copy. All staff have access to the network.

Reference:

SGS Intranet

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.5. Obsolete Documents

It is the responsibility of the QA Office to ensure that all obsolete documentation, (resulting from a document change/update), is removed from the point of use folder and is archived electronically on the SGS network, which is not accessible to anyone outside of the QA Office (or designee).

Electronic documentation that is retained for any reason is marked as archived and/or stored in the appropriate archived documents folder on the SGS Network.

Reference:

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.6. Identification

All quality documentation is identified by a date of issue and/or revision number; page numbering (where appropriate), total number of pages or a mark to signify the end of the document (where appropriate), and the issuing and/or authorizing authority(ies) (where appropriate).

Reference:

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.7. Document Changes

Changes to quality documentation are reviewed and approved by the same function that performed the original review (or designee). Designates have the appropriate access to all pertinent information, as established through the job description.

Reference:

SGS Organization Chart (Alaska Division)

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.8. Altered or New Text

Altered or new text within a SOP is listed under "Summary of Changes from Previous Revision" and the document is assigned a new revision number. All documents are issued beginning with version number 1. Subsequent revisions are in whole number increments (i.e. 1 is modified to 2, etc.) Re-issue of a previously altered document will only contain the revision history of the most recent amendments. (Obsolete copies are stored as per section 4.3.5.)

Reference:

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.9. Hand-written Amendments

The SGS Alaska QA Manager (or designate) is the only person that may authorize hand-written amendments to any controlled document. The amendment shall be made in a permanent form and the change must be signed and dated by the Quality Coordinator (or designate). Hand edits on controlled documents are limited to correcting minor errors and must be extended to all controlled versions of the document (i.e., electronic and hardcopy).

Reference:

SGS SOP 003 (Error Correction Procedures)

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

4.3.10. Computerized Amendments

The QA Manager (or designate) is the only authorized person that may make computerized amendments to any controlled document. The QA Manager (or designate) is the only authorized person with modification rights to all controlled documents issued under the lab accreditation and held on the SGS network. Notification to all affected personnel is made immediately following the change via supervisor and/or e-mail or through the re-issuing of the document.

Reference:

SGS SOP 006 (Preparation and Review of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.4. Review of Requests, Tenders, and Contracts

4.4.1. Policies and Procedures

SGS issues quotations on a regular basis. All laboratory tenders and/or contracts are released in accordance with the requirements of SGS 140. The laboratory (generally done under the direction of the General Manager or designate) verifies that the laboratory has the capability and resources to meet the requirements and to confirm the appropriate method selection.

Reference:

SGS SOP 140 (RFP/Proposal Review)

4.4.2. Records of Review

Records of review (including but not limited to) pertinent discussions with customer; subcontracted work, and significant changes; are retained in the client folder(s), specific to the request, tender or contract.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 140 (RFP/Proposal Review)

4.4.3. Notification of Customer

Records of notification of any deviations from the contract are maintained in the client folder(s), specific to the request, tender, or contact.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 140 (RFP/Proposal Review)

4.4.4. Contract Amendments

Contract amendments are subject to the same policies and procedures, outlined above, and amendments are communicated to all (affected) personnel.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 140 (RFP/Proposal Review)

4.5. Subcontracting of Tests

4.5.1. Competency

SGS Alaska provides an abundant number of tests for clients; however, occasionally it is requested that we perform certain analyses for which we do not have the capabilities. In such cases, as a service to our clients, SGS may arrange for such analyses to be conducted at a subcontract laboratory. SGS does not intentionally solicit work it does not perform, but this service is offered when such a test is relatively small component to the overall scope of a project or at the request of the client. Tests performed at SGS may also be subcontracted to another laboratory during periods of high sample volume or instrument down times, when an alternate instrument or method is either not available or unable to satisfy data quality objectives, in order to meet client needs. SGS will make every effort to obtain prior permission from the client, but may subcontract if it is deemed in the client's best interest when the client cannot be reached.

Selection of a subcontract laboratory is based on the specific project requirements (e.g., ADEC DW, ADEC CS, NELAC, DOD-ELAP, USDA foreign soil importation permit). The subcontract lab must be certified by the appropriate regulatory agency, submit a QAP and be able to provide all data required to satisfy the project data quality objectives. SGS will require subcontracted laboratories to demonstrate that they meet DOD-ELAP requirements where applicable. Records of all subcontract labs used are maintained by Reference Lab Coordinator and are stored on the SGS Network. If an appropriately accredited lab cannot be utilized, it will be the responsibility of the client to make the final determination on which facility to use.

Where a subcontracted lab has been used, a copy of the subcontract lab report will be issued to the client to ensure clarity on which lab performed the work.

Reference:

SGS SOP 132 (Subcontracting Samples to Reference Laboratories)

4.5.2. Customer Notification

The SGS Business Development or Project Manager will advise the client of the need for subcontracting work. This should be done in writing (preferably when the quote is issued) and client approval (in writing) should be secured before the work begins.

The Production Manager will notify the assigned Project Manager in the event that in-house work must be rescheduled for subcontracting in the event of capacity or instrumentation issues. In such an event, the Project Manager will contact the client for approval to subcontract the work. Copies of customer approval and/or notification – written and/or verbal – are kept in the customer file(s).

Reference:

SGS SOP 132 (Subcontracting Samples to Reference Laboratories)

SGS SOP 140 (Review of Requests for Quotes, Proposals and Contracts)

4.5.3. Responsibility

SGS Alaska is responsible for the contracted work, unless the customer or regulatory authority specifies the subcontractor to use. Records of customer or regulatory authority specifications are retained in the customer file(s).

4.5.4. Results

SGS Alaska requires subcontract results to be reported in writing or electronically.

4.6. Purchasing Services and Supplies

4.6.1. Policies and Procedures

Procurement of supplies and services for SGS NAM (including the environmental division) is governed by strict purchasing policies, laid down by the SGS Corporation. All purchases require approval from Management (or designate), to ensure that the supplies or equipment purchased are of adequate quality to sustain confidence in the work. Selection of a supplier is done in accordance with the policies of the SGS Procurement Division. Where possible (or required by the lab) preference is given to suppliers with ISO certification or accreditation and the use of materials that are traceable to international standards. However, the purchasing department may have contracts that were established on an overall service basis, which may or may not include certification or accreditation. Records of suppliers used are maintained by the Purchasing department.

SGS Alaska encourages staff to purchase standards and reagents from vendors with ISO Guide 34 approval.

Reference:

SGS SOP 104 (Equipment Monitoring)

SGS SOP 126 (Procurement, Receiving and Processing Vendor Invoices for Supplies

SGS SOP 127 (Vendor List – Qualification & Maintenance)

4.6.2. Verification

All purchased supplies that affect the quality are utilized only when verified compliant with specifications. Upon receipt of all purchased items for the laboratory, part numbers are checked against the Purchase Order; expiration dates, (if applicable), are verified to ensure a suitable period of usage; all materials that are traceable to a national standard are checked to insure they have a certificate of analysis/production information. In the event that any of the pre-requisites are not supplied, the lab contact notifies the purchasing department and the supplier is contacted for immediate replacement and/or submission of all required documentation.

Where necessary, the following information is retained: date received and/or date opened.

4.6.3. Purchasing Documents

Prior to release, the General Manager (or designate) reviews and approves all purchase orders for technical content.

Reference:

SGS SOP 112 (Standards, Labeling and Traceability)

SGS SOP 126 (Procurement, Receiving and Processing Vendor Invoices for Supplies)

4.6.4. Approved Suppliers

SGS Alaska procures goods and services from reputable organizations with which they have a historical relationship, or which have been investigated and approved for use. Records of approved suppliers are maintained by the Procurement department.

Reference:

SGS SOP 127 (Vendor List – Qualification & Maintenance)

4.7. Service to Customer

4.7.1. Cooperation with Customers

SGS Alaska maintains a customer service department whose sole responsibility is to service the customer. SGS Alaska makes allowances for client access for monitoring of work, while at all times ensuring the confidentiality of other customers. This is achieved through guided tours and on-going communication. Records of client access are recorded in the Visitor's Logbook and/or part of the client file(s), where pertinent communications are maintained. Procedures are in place to ensure that the confidentiality of all customers is protected at all times.

Reference:

SGS Visitor's Logbook

SGS SOP 007 (Laboratory Communications)

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

4.7.2. Feedback

SGS Alaska solicits feedback from customers on a regular basis. Feedback includes (but is not limited to) formal surveys, phone calls, and e-mails. Annually, a formal survey is conducted with results reviewed at the completion of the survey (within 1 month of sending out the survey). All customer feedback requiring follow-up is done as received with a general review of all customer feedback done annually during the Management Review.

Records of customer feedback are maintained by the QA Office.

Reference:

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.8. Complaints

4.8.1. Policies and Procedures

SGS Alaska investigates all complaints made in person, on the telephone, or in writing. The investigation into a concern by a client occurs in a manner similar to Analyst recognition of a nonconformance event. The client is consulted to identify the procedure or data point(s) in question, the reason for the concern, and the expectation for the result or procedure. The documentation and technique of the subject procedure are reviewed to verify that SGS' SOPs were followed and that the SOPs are in line with EPA approved or industry accepted standards. The subject data are reviewed to determine the accuracy of the initial acquisition, calculations, and reporting. This review includes evaluating how the event affected the result(s) (e.g. positive bias).

All client complaints must be reported to management. The Technical Director must be consulted for technical matters outside of the Project Manager's scope of knowledge. Issues relating to data quality and/or method/project compliance must also be directed to the QA Manager. Additionally, the General Manager must be involved in any situations with financial consequences.

The investigation of feedback and any necessary action required is given **top priority** by all concerned. The customer is kept informed of the investigation and is involved in setting time-lines for resolution of problems.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 105 (Corrective Actions)

4.8.2. Records

Documentation of the investigation and findings can occur by one of several means, depending on the nature of the concern. Example forms of documentation are a letter to the client, completion of a Corrective Action Report (CAR), or phone records from telephone/ conference calls. This documentation shall be retained within the client file(s).

4.9. Control of Nonconforming Testing

4.9.1. Policies and Procedures

Where a non-conforming result or action is discovered or suspected internally, the occurrence is reported immediately to the appropriate supervisors and the following remedial actions (where necessary) are taken immediately: confirm finding, stop work or withhold test report if necessary, determine if other areas affected by the nonconformance, and stop work or withhold test reports for any other work affected. Where necessary, customers may be notified and work may be recalled. The Quality Manager or Technical Director may review the circumstances of all non-conforming actions and determine whether corrective action should be taken.

Where the evaluation of the significance indicates that the nonconforming work could recur, or that there is doubt about the compliance of the lab's operations with its own policies and procedures, the corrective action plans given in section 4.11 shall be promptly followed and resumption of work shall occur after authorization given by the authorities responsible.

Reference:

SGS SOP 105 (Corrective Actions)

4.10. Improvement

4.10.1. Policies and Procedures

SGS Alaska has a continual improvement plan in place, within the quality policy, and with quality objectives, with inputs from analysis of data, internal and external audits; corrective and preventive actions, and management reviews.

Reference:

SGS SOP 105 (Corrective Actions)

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.11. Corrective Action

4.11.1. Policies and Procedures

The corrective action process documents an out of control event (OCE) or systematic deficiency that adversely affects data quality objectives or fails to meet method/project requirements. This process further serves to identify the root cause, recommend specific actions to prevent a similar occurrence, and include a follow-up to verify a return to control. The resultant corrective action creates a change in some element in the testing or analytical system to reduce the risk that a quality system failure will recur. This procedure is used as a tool for improving elements of the Quality System and may also involve client participation or notification as necessary.

Corrective action reports (CAR) describe responses to an OCE, including client notification procedures, procedures for repeating or stopping work, and the incorporation of proposed solutions and subsequent verification of its effectiveness. They may be initiated by an Analyst, Project Manager, the Technical Department, or the QA Office. CARs are tracked, investigated and reported by the Corrective Action Committee (CAC). The process generally starts with initial interviews of the person(s) involved, with an emphasis on determining the root cause and opportunities for continuous improvement. Members of the CAC may invite involved staff to the CAC meeting for further discussion and/or initiate training, as warranted.

CARs are not initiated when standard corrective action procedures as outlined in the written SOPs are followed to address isolated OCEs. Documentation for these instances may be found on the QC sample summary reports, case narrative, and/or sample comments for the associated batch. Examples of corrective actions outlined in the analytical SOPs include:

- QC sample or calibration data are outside the acceptance windows.
- Blanks contain contamination above acceptable levels.

Non-conformances that are evidence of systematic error or breakdown in a procedure or for situations that are not typical to day-to-day operations require documentation with a CAR. Examples are:

- Performance Evaluation (PE) sample outliers
- Changes in standard operating procedures due to an external audit
- A problem or non-conformance not under a person’s direct control (e.g. inter-departmental)
- Recurring problems fixable by the employee or failure to follow the approved SOP.
- Undesirable trends in spike recoveries, RPDs, sensitivity capabilities or control charts.
- Customer complaints regarding lab error or deficiency, especially for corrected reports.

The Corrective Action Committee, which includes the Technical Director, reviews all CARs. A summary is provided to the Management Team via the QA monthly report.

Reference:

SGS Analytical SOPs

SGS SOP 105 (Corrective Actions)

4.12. Preventive Action

4.12.1. Action Identification

Needed improvements and potential sources of non-conformances, either technical or concerning the quality system are identified through the internal audit process and/or the corrective action process.

CAR forms are reviewed and evaluated to ensure that there are no repeat occurrences of significant and/or preventable non-conformances. Where a recurrence is noted, additional actions will be taken.

Reference:

SGS SOP 105 (Corrective Actions)

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.12.2. Action Plans

The Corrective Action Committee evaluates the CAR and, where appropriate, assigns action items for implementation. A signed copy of the CAR is maintained on the Network.

The Internal Audit Coordinator verifies that internal audit findings are effectively closed out. An electronic copy of internal audits reports is maintained on the Network; a hard copy is maintained in the QA Office.

Reference:

SGS SOP 105 (Corrective Actions)

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.13. Control of Records

4.13.1. Procedures

SGS Alaska has procedures for identification, collection, indexing, access, filing, storage, maintenance, protection, backup and access of electronic records, and disposal of quality and technical records. Quality records shall include reports from internal audits and management reviews as well as records of corrective and preventive actions.

As technology permits, data may be retained in hardcopy and/or electronic format (e.g., PDF or raw instrument data files). Data pertaining to sample analyses, quality control analyses, instrument or method studies (e.g., DL, IDL, RT windows, IDC) are retained for a minimum of 5 years. As of January 1st 2006 all analytical and calibration batches, final reports and data packages have been scanned, maintained and backed-up on the Network. Quality records not scanned electronically will be retained in hard copy for five years.

In the event that the facility changes ownership or location, or the facility is to be permanently closed, the primary NELAC authority, DOD-ELAP and relevant state certifying bodies will be notified in writing. In the even of closure of the facility, clients will be notified in writing so that records may be transferred according to their instructions. All appropriate regulatory and state legal requirements concerning laboratory records will be followed. The laboratory will be accountable and liable for all analyses before and after a change of ownership.

SGS is committed to providing customers with service excellence, which includes a strong emphasis and respect for customers' right to privacy. All personal information is collected only for the purpose of performing the requested service or of adding the customer name and contact information to our database or mailing list, so that we can provide them with information, or respond to a request they have made. By requesting services from SGS, customers consent to the collection and use of this information in accordance with the SGS Privacy Statement. SGS does not disclose any personal information to third parties, except as required by law or upon the customer's request. Specifically, confidentiality is maintained through Employee Agreements, and Human Resources specific policies for electronic storage and transmission of results.

Reference:

SGS SOP 008 (PDF Reporting and Archiving)

SGS SOP 125 (SOP for Storing Raw Data and Work Order Files)

SGS SOP 142 (IT Backup Procedures)

4.13.2. Record Integrity

All records shall be legible and shall be stored and retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss. Retention times of records shall be maintained.

Reference:

SGS SOP 142 (Electronic Data Storage)

4.13.3. Technical Records

SGS Alaska maintains technical records of:

- All original observations;
- Derived data;
- Sufficient information to establish an audit trail;
- Calibration records;
- Copies of each test report;
- Personnel responsible for the test;

- Personnel responsible for checking results;

Reference:

SGS SOP 003 (Documentation and Error Correction)

SGS SOP 111 (Document Control)

SGS SOP 112 (Standards, Labeling and Traceability)

4.13.4. Record Information

The records retained identify factors affecting uncertainty and contain sufficient information such that the method could be repeated under the original conditions.

Reference:

SGS SOP 003 (Documentation and Error Correction)

SGS SOP 111 (Document Control)

SGS SOP 141 (Uncertainty)

4.13.5. Recording

Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task; all runs will be documented.

Reference:

SGS SOP 003 (Documentation and Error Correction)

SGS SOP 111 (Document Control)

4.13.6. Corrections to Records

Where it is necessary to make a correction to a record, it shall be done in such a way to ensure the following:

- Original record is not obscured;
- Correct values are entered alongside;
- Alterations authorized by initial (or suitable electronic tracking system);

Reference:

SGS SOP 003 (Documentation and Error Correction)*)*

4.13.7. Corrections to Electronic Records

SGS Alaska utilizes a Laboratory Information Management System (LIMS), Horizon, which is accessed through unique user login and password. In addition, where modifications to an electronic record are made through the data management system, it is retained in the system. Where applicable, instrument software maintains an audit trail of any deletions or manual integrations. All other quality records are retained on the write-protected folder of the SGS network, with only the QA Office having modification rights.

4.14. Internal Audits

4.14.1. Requirements

Audit reports are provided to the Production Manager, Technical Director, and General Manager by the QA Manager, who serves as the audit facilitator. Changes in laboratory standard operating procedures as a result of an audit are communicated to the appropriate staff and implementation of changes is ensured via follow-up by the QA Manager, Technical Director and/or Production Manager.

In addition to external audits conducted by certifying agencies or clients, SGS conducts the following internal audits.

- Internal Audits are conducted by the QA Manager (or designee) in each area of the lab to assess method and program analytical areas are identified annually for the internal audit schedule. Audit reports are issued with corrective action plans (if necessary) and follow-up audits are performed as needed.
- Blind samples are introduced into the analysis stream to evaluate personnel and methods on an ongoing basis.
- Blind samples are also introduced on an as-needed basis when concerns arise about a particular analysis, the method, the instrument, or the Analyst via quick response testing services offered by ISO 17025 accredited vendors of PE or PT sample materials. This often includes blank samples to test for false positive results.

Reference:

SGS SOP 113 (Audits, Assessments and managerial Review Program)

4.15. Management Review

4.15.1. Objectives

SGS Alaska senior management reviews the quality system annually, in accordance with a predetermined procedure to ensure the continuing suitability and effectiveness, and to introduce changes or improvements.

The internal audit process, the corrective action system, the training program, issuance of the monthly QA reports and regular management meetings are all central elements of managerial review.

On an annual basis, the management team will review the previous year and develop action plans for the coming year. Their findings will be recorded in the Annual management Review (AMR) Report which is distributed to the corporate Vice President and local Management Team. Action items resulting from the AMR are monitored during Management Meetings held throughout the year to ensure progress and closure.

The laboratory's Management Team meets regularly in round-table discussions to review concerns regarding lab operations and to consider ideas for improvements.

The laboratory's General Manager and Production Manager track key performance indicators (KPIs) and changes in the volume and type of work. Lab resources, capacity and the ability to satisfy project turn-around-times are also reviewed during frequent status meetings involving the General Manager, Project Managers (PMs), Technical Director, QA Manager, Business Development, Production Manager and representatives from each analytical section.

Client feedback, in the form of Data Quality Reviews, inquiries, and/or complaints, is in most cases initially provided to the Project Manager. It is the PM's responsibility to notify management of any concerns and facilitate a prompt resolution.

Quality Assurance Reports to management are intended to keep management abreast of QA/QC activities and developments. Monthly reports, which are distributed to the corporate Vice President and local Management Team, will generally include:

- SOP review status
- Status of DL studies and review of control charts
- Performance test study status and scores.
- Status of various certification programs
- Results of external and internal audits
- CARs
- Summary of training records
- Comments and recommendations regarding other concerns affecting the quality of the data generated within the laboratory.

Originals are signed, dated and maintained on file in the QA Office, along with a record of their distribution.

Reference:

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

4.15.2. Contents

The AMR takes account of:

- suitability of policies and procedures
- reports from managerial and supervisory personnel
- outcome of recent internal audits
- corrective and preventive actions
- assessments by external bodies
- results of interlaboratory comparisons or proficiency tests
- changes in the volume and type of work

- customer feedback
- complaints
- recommendations for improvement
- other relevant factors such as quality control activities, resources and staff training

All findings and necessary actions that arise from reviews are recorded and maintained.

4.15.3. Actions Taken

All actions identified are carried out within an appropriate and agreed time scale.

4.15.4. Records

Records of the management review and actions taken shall be signed by the General Manager and QA Manager.

5. Technical Requirements

5.1. General

SGS Alaska makes every attempt to ensure that the many factors affecting the correctness and reliability of the tests performed by the lab are controlled. Control is achieved through Analyst training and proficiency, appropriate environmental conditions and a rigorous and on-going validation program.

5.2. Personnel

5.2.1. Qualifications

The objective of SGS Alaska is to provide quality analytical determinations in a timely manner. This can only be realized by fostering excellence in its staff, through training, and provision of a workplace that is safe, adequately sized, and results-oriented.

It is the responsibility of the Technical Director, to ensure that staff has the necessary qualifications and experience to produce quality analytical data and to provide appropriate training as required to achieve this.

Reference*:*

SGS Organization Chart (Alaska Division)

5.2.2. Trainees & Training

New hires are matched to an experienced mentor to facilitate onboarding. In addition to norms and expectations outlined in the Welcome Packet, new hires are guided through the Orientation & General Training program. The goal of this program is to provide a common basis of knowledge for all staff and each module is facilitated by an experienced staff member. Topics include (for example): Training Manuals & the training program, Quality System Orientation, Introduction to the Ethics Program, Laboratory Communication, Introduction to LIMS, etc. For laboratory staff, modules also include (for example): General Chemistry, Use & Calibration of Balances, Use & Calibration of Pipettors, Foreign Soils, Waste Disposal, Peer Review Reports, etc.

Analysts are trained by an experienced Analyst on an individual basis using the procedures outlined in the SGS Training and Certification SOP. All documentation is filled in the individual's training record, maintained by each Analyst, and with the Technical Director. A Demonstration of Capability Record is completed annually for each method an Analyst is performing. Only Analysts who have completed training may run analyses independently. Analysts in training work directly with a trained Analyst.

The Technical Director, QA Manager, Safety Officer or their designee will coordinate the training and documentation thereof. Intra-laboratory training programs and on-the-job training include:

- Study of Standard Operating Procedures and references, including MSDS forms, reference methods, initial and ongoing training for safety precautions, etc.
- Observing experienced Analyst
- Performing the procedure under direct supervision of experienced personnel
- Analyzing blind QC samples prepared by the experienced trainer
- Completing Initial Demonstration of Capability (IDC), DL and PE studies (as applicable)

Each new hire is escorted through the laboratory by the Safety Officer for training in the location and use of the lab's safety equipment. Follow-up laboratory safety walk-through tours are also performed annually. Additional safety training is provided on an ongoing basis as coordinated by the Safety Officer. The Safety Officer maintains records of attendance.

Additional training from outside short courses or seminars (i.e. the SGS Sexual Harassment Policy, SGS Ethics Training, Manual Integration Policies and Practices, etc.) is also documented in the training record.

The laboratory maintains a comprehensive Training Program, managed by the Client Services/Continuous Improvement Lead. The QA Manager and Technical Director review documentation in support of an Analyst's certification to perform a particular test method. The qualification records are maintained on the network in the Central Data Storage (CDS) directory or with the CS/CI Lead (as appropriate).

Reference:

SGS SOP 102 (Training and Certification)

5.2.3. Employees

The Company seeks to provide employees with meaningful and challenging work, as well as with development opportunities to prepare for new responsibilities. Supervisors provide feedback and review employee development plans annually through the SGS Employee Review. Employees are expected to take primary responsibility for their own careers, showing initiative, taking job training when necessary, and working with supervisors to achieve Company objectives while moving toward their own career goals. SGS Alaska encourages employees to continue to develop their skills through work experience, education and cross-training.

All training is documented and employees must provide a copy of any post-secondary, training/course/seminar certificate received for inclusion in their personnel file.

SGS Alaska only uses personnel who are permanent staff, contract staff, students or are from temporary agencies.

Reference*:*

SGS SOP 102 (Training and Certification)

5.2.4. Job Descriptions

The laboratory shall use personnel who are qualified on the basis of appropriate education, training, experience and/pr demonstrated skills, as required. The Senior Management maintains job descriptions for all staff.

Accounting Manager: The Accounting Manager serves as the local Human Resources representative, Office Manager and Business Development support. This position oversees Data Management, Data Services, IT and Accounting staff responsible for invoicing, mailing, data deliverables, accounts payable and accounts receivable.

Client Services/Continuous Improvement Lead: Project Managers are coordinated by an experienced member of the Management Team who develops and oversees client services efforts throughout the laboratory. This individual also oversees training for all staff, to include initial and ongoing training (e.g., onboarding, orientation & general training, content areas and strategic cross training), and staff development. In coordination with the managerial team, this individual also identifies areas of the laboratory which need improvement, facilitates Lean events involving cross-functional teams, and follows up to ensure changes are effectively implemented.

Project Manager: The PM serves as the liaison between the laboratory and its clientele. The PM is responsible for understanding the needs of the client and communicating this information to the operational staff. He or she handles all daily client interactions regarding project specifications and also tracks the status of all project analyses during testing and review processes.

Sample Control Staff: The sample receiving process is viewed as one of the most critical elements of the legal defensibility of the analytical process. It is essential that the client documents complete and accurate information on the chain of custody (COC) and sample bottles. Sample Control staff is responsible for the following tasks:

- Provide clients with proper sample containers and preservatives.
- Receive samples from clients; inspect them for proper preservation/volume and not irregularities.

- Receive and review the COC record for collection dates and sample identifications.
- Assign unique sample IDs for each container and complete sample receiving records.
- Maintain the storage and handling of samples to ensure easy retrieval and compliance with storage requirements for the requested test methods.
- Track and perform sample disposal.
- The Fairbanks Manager will be responsible for forwarding samples to the Anchorage facility expeditiously, ensuring valid COC.

Production Manager: Directly responsible for the supervision of the operations and sample control staff, including oversight responsibility of daily activities to ensure the generation of timely data that meets industry accepted practices and project-specific requirements. Oversees documentation practices supporting the tests performed, instrument maintenance, and decision making processes affecting the data.

Organic Chemist: Performs gas chromatographic analysis of volatile and/or semivolatile organic contaminants, fuels, pesticides, and polychlorinated biphenyls in water, soil, wipe, and oil samples.

Cold Vapor/AA/ICP-MS Chemist: Performs chemical analysis for metals in drinking water, wastewater, oil, and soil by cold vapor, AA and ICP-MS technology.

Inorganic Chemist: Performs analysis of water and wastewater for minerals, nutrients, solids, etc., by specific reference methods.

Organic Extraction and Metals Digestion Specialist: Performs extractions for analysis by the Organic Chemist and metals digestions for analysis by the Metals Chemist.

Microbiology Analyst: Performs microbiological analysis of drinking water and wastewater.

Hazardous Materials Specialist: Directs the technical operation of the proper disposal of laboratory generated hazardous waste.

5.2.5. Authorized Personnel

SGS Alaska operates under the direction of the General Manager, who is responsible for developing and maintaining the proper organizational structure to include authorized personnel for specific testing, issuing test reports, giving opinions and interpretations, and the operation of certain equipment types. In addition, the General Manager, is responsible for the description of the responsibilities of senior personnel, providing scientific leadership, project planning, ensuring overall timely delivery of project results and overall responsibility for the quality system within their departments.

5.2.6. Records

The Technical Director and Client Services/Continuous Improvement Lead maintain technical records of training; the QA Manager (or designee) maintains documents specific to the Quality Management System; and the Human Resources department maintains academic and professional training records for all personnel (including contract staff). The records retained include training, skills and experience, educational and professional qualifications, proficiency records, authorizations, letters of commendation, and significant scientific reports.

All personnel files maintained by the Human Resource department are treated as confidential in so far as the individual (under the Freedom of Information Act) can access the contents.

Reference*:*

SGS Organization Chart (Alaska Division)

5.3. Accommodation and Environmental Conditions

5.3.1. Technical Requirements

SGS Alaska is a facility offering analytical functions. This requires a highly technical building with many specialized functions. Where necessary, the environmental conditions of the lab that can affect results are monitored and documented by the department personnel to ensure the integrity of the test work is not adversely affected.

5.3.2. Facility

The SGS Alaska Anchorage office is currently utilizing two buildings for its operation. The combined size of these buildings totals approximately 22,000 square feet. Building One houses most of the administrative offices which include: reception area, accounting, computer information systems management, purchasing office, data entry, quality control, and all of the analytical facilities excluding volatile and semi-volatile gas chromatography. Building Two houses the gas chromatography departments, microbiology, walk-in sample storage, and the warehouse.

Sample Storage: SGS Alaska has a walk-in refrigerator (>1000 ft^3) and two reach-in refrigerators (each 48 ft^3) to segregate samples for volatile analyses. There are two point-of-use refrigerators located in GC prep and the waters department (each 32 ft^3). In addition, there are four reach-in refrigerators (>100 ft^3) in sample receiving area to maintain controlled temperatures during temporary sample storage.

Sample Preparation Areas: The organics preparation area is supplied with a separate air handler to supply adequate ventilation. The metals preparation area has been upgraded to include a semi-clean room for low level metals analysis. A separate clean room is maintained for low level mercury analysis.

Volatiles Analysis: Instrumentation for GC/MS volatiles analysis is located in an isolated room to control potential laboratory contamination of samples.

The SGS Alaska Fairbanks receiving office consists of two rented rooms that total 976 square feet and includes: reception area, sample kit preparation area and storage. There are two refrigerators (each >20 ft^3) available for overnight sample storage.

5.3.3. Monitoring

Laboratory rooms containing fume hoods have air exhausted through fume hoods as well as through a general exhaust system to maintain minimum airflow requirements. Rooms not containing fume hoods are exhausted through the general exhaust system.

The Sample Control staff monitors fume hood velocities on a weekly basis. They determine a pass or fail if the fume hood based on the standard 100 fpm velocity for our fume hoods. All fume hoods are on a preventive maintenance schedule to ensure efficient operating parameters are maintained.

The laboratory monitors the DI water systems to ensure that the DI water is free from reagents or contaminants that would otherwise interfere with testing.

All laboratory areas are supplied with proper and adequate lighting. The water and power supply is gauged to the demands of the equipment and instrumentation in each laboratory area.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.3.4. Incompatible Activities

There is effective separation between incompatible activities in the SGS Alaska laboratory. This is accomplished through the use of space to physically separate specific areas.

5.3.5. Access

Access to the facilities is constricted at all times. All visitors are required to sign in at the front counter and are escorted by laboratory personnel while in the building.

5.3.6. Housekeeping

SGS Alaska maintains contract personnel to ensure good housekeeping in the lab. All staff are responsible for the housekeeping in their respective lab workspaces, using cleaning products that are compatible with the work done in the lab.

5.4. Test Methods and Method Validation

5.4.1. Methods and Procedures

SGS Alaska uses appropriate methods and procedures for testing (which include as necessary) estimation of uncertainty and statistical techniques for the analysis of data.

Reference:

SGS SOP 141 (Uncertainty)

SGS SOP 145 (Control Charts & Control Limits)

5.4.2. Equipment Instructions

All supporting documents for method performance, including Standard Operating Procedures for equipment, are in place and are available electronically on the SGS network. Where appropriate, they are either included or referenced in the test methods or supporting operating procedures. Alternatively, equipment operating instructions are located in the manufacture's guide, located in the laboratory.

Reference:

SGS SOP 006 (Preparation of SOPs)

5.4.3. Method Deviations

Where deviation from a test method is required, the deviation is documented, technically justified, authorized by Technical Director, and accepted by the customer prior to implementation. Records of method deviations are retained in the customer file(s).

5.4.4. Method Selection

SGS Alaska performs its testing operations according to the most current, up-to-date-methods and procedures (where appropriate), which meet the needs of the customer and are appropriate for the test. Deviations, if any, from the reference method and regulatory guidance will be documented in the method SOP.

Where applicable (e.g., if in-house control limits do not meet DOD QSM, sample mass varies from reference method, etc.), deviations to the DOD QSM will be submitted in the DOD QSM Variance Request template and provided to clients requesting proposals for DOD projects.

5.4.5. Non-Customer Specified Method Selection

Where methods are not specified, methods are selected from those published by international or national bodies, reputable technical organizations or in scientific texts or journals and that have been validated, or that have been developed and validated in-house. Method selection is based upon the media of the sample (e.g. solid vs. liquid), the amount available, and the concentration range expected for the contaminant being tested.

5.4.6. Inappropriate Methods

If laboratory staff feels that the customer has specified an inappropriate method, this fact is documented, the customer is notified, and a valid method is selected from those published by international or national bodies, reputable organizations or in scientific texts or journals. Records of notification to customer are retained in the customer file(s).

5.4.7. Published Reference Methods

Where SGS Alaska performs testing operations based on published standard methods, the performance characteristics of the standard method are verified and recorded (with the method). The verification of validation is repeated if the standard method changes.

5.4.8. Laboratory Developed Methods

Where it is necessary to employ performance based methods that have not been established as standard, SGS Alaska will endeavor to ensure that these methods are precise and accurate. The methods are assigned to qualified personnel, fully documented and validated if possible and fit-for-purpose through customer consultation.

Where it is necessary to modify or establish a lab developed method, this will be, with the Technical Director's approval, listed as a deviation in the applicable SOP.

5.4.9. Non-Standard Methods

Where it is necessary to employ methods that have not been established as standard, SGS Alaska endeavors to ensure that these methods are precise and accurate. Prior to use of a non-standard method, SGS Alaska will get customer approval (recorded in the customer file(s)). Non-standard methods are fully documented and validated if possible and deemed fit-for-purpose prior to use in the lab.

5.4.10. Method Validation

Method validation is the process of establishing performance characteristics and the fitness for the intended use of a method. SGS Alaska will retain documents relating to method development.

Reference:

SGS SOP 111 (Document Control)

5.4.11. Range and Accuracy

The range and accuracy (the closeness of the assessment between the result of a measurement and a true value of the measurement) of a method employed by the laboratory must be relevant to the customer's needs. Range and accuracy of all methods is established prior to use in the lab.

5.4.12. Measurement Uncertainty

Measurement Uncertainty is an estimate, attached to a test result, which characterizes the range of values within which the true value is asserted to lie. Potential sources of uncertainty include all parameters associated with sample preparation, sample analysis and computational effects. SGS Alaska has an uncertainty of measurement policy, which is applied to all analytical methods.

Reference:

SGS SOP 141 (Uncertainty)

SGS SOP 145 (Control Charts & Control Limits)

5.4.13. Reasonable Estimates

Where test methods do not allow for a statistical estimation of measurement uncertainty, SGS Alaska will make a reasonable estimation and reports this estimate in a way that does not give a wrong impression of the uncertainty.

5.4.14. Calibrations

SGS Alaska performs in-house calibrations for thermometers, mechanical pipettors and balances. Calibrations of reference thermometers and weights are contracted out to ISO 17025 accredited calibration laboratories.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.4.15. Calculations and Data Transfers

Calculations and data transfers are checked by laboratory staff authorized to preview and release of the final report. This is performed before the final report is generated and sent to the customer.

Reference:

SGS SOP 101 (Peer Review)

SGS SOP 122 (Login and Package Review)

5.4.16. Computers or Automated Equipment

Where computers or automated equipment are used:

- that have lab developed software and/or calculations, these are verified and records of verification maintained by the QA Office.
- these are maintained to ensure proper functioning through routine maintenance as required/planned
- appropriate environmental and operating conditions are provided.

5.4.17. Protection of Data

SGS Alaska has procedures in place for the protection of data and includes the following:

- Integrity and confidentiality of data entry or collection - Data integrity and confidentiality are maintained through proper training of employees and the use of security protocols. Two levels of password authentication are used to control user activity with customer data. To gain access to the network, each PC must be logged in using a valid Windows domain account. Access to various areas of the network, as well as the LIMS database, is restricted based on the account used. The second security level controls access into the LIMS, a specific LIMS logon ID and password combination is required and access levels are restricted based on this logon ID. Every user of the LIMS must log in using their own logon ID and password combination to gain access to the LIMS. Access to the LIMS system is fully audited and can be traced back to individual users. All user classes in LIMS have defined idle time allowances, after which the system will terminate the session.
- Storage - All critical data are stored on either the LIMS server, which holds the LIMS database as well as the worksheet files, or on the main file server. These servers are maintained in a secure climate controlled room. Each server uses a RAID 5-drive configuration and has a redundant power supply for fault tolerance, as well as UPS battery backup. The LIMS database is backed up nightly to tape. Transaction logs are copied onto multiple locations on the server and are archived to tape weekly. File and database servers have a nightly incremental back up to tape, full backup to tape is performed weekly. The backup tape sets

are taken from the primary location to a secure secondary location the next day for further recoverability in the event of a major catastrophe.

- Transmission - Electronic data transmissions are routinely sent out in PDF format to reduce the possibility of tampering with the data. Data authenticity and integrity can also be maintained and enforced using digital signatures and encryption of emails and attachments when required. *Note: all email transmissions are screened for viruses at the server level, as well as at the desktop level. This helps reduce the risk of infection resulting in data loss, as well as the sending out of infected emails to our customers.

Reference:

SGS SOP 142 (IT Backup Procedures)

SGS SOP 008 (PDF Reporting and Archiving)

5.5. Equipment

5.5.1. Operation

SGS Alaska ensures that all of the equipment required for performing all test work is maintained in good working order, is compliant with specifications, is checked and calibrated before use (where appropriate), is operated by authorized personnel, is operated using available current instructions on use and maintenance, and is uniquely identified. It also meets the accuracy necessary for performing the test work and is checked on a regular basis to ensure compliance with the specifications. All available equipment is checked (and calibrated if necessary) before use to ensure proper functioning and is capable of achieving accuracy required for the test method.

Standard operating procedures, together with the manufacturer's instructions are in place to ensure proper use and maintenance of the equipment.

The SGS Alaska Production Manager assigns a unique identification number to all pieces of equipment.

5.5.2. Records

It is the responsibility of the Production Manager to ensure that a maintenance log is kept for each piece for major analytical equipment. At a minimum, these logs must document the following.

- Each entry is dated and initialed by the person making the entry.
- Each time the instrument is taken out of service and the type of repair made.
- Each time the instrument is moved to a new location
- Any non-compliant behavior in the instrument that required the maintenance/repair (i.e. a cause and corrective action format)
- Each time the instrument receives routine maintenance from either SGS staff or instrument company representatives.
- Each time an instrument is returned to service.

Additionally, it is the responsibility of the analytical staff and Production Manager to implement preventative maintenance on the analytical equipment as necessary, to avoid instrument failures which could impact data quality.

SGS Alaska maintains records of equipment, which include the following information:

- Date purchased or put into service;
- Identity of the equipment and its software;
- Manufacturer's name, model, and serial number or other unique identification;
- Checks that the equipment complies with the lab requirements and standard specifications;
- Current location, where appropriate;
- The manufacturer's instructions, if available, or reference to their location;
- Calibration history and due date of next calibration;
- The maintenance plan, where appropriate, and maintenance carried out to date;
- Any damage, malfunction, modification or repair to the equipment;

Reference*:*

SGS Statement of Qualifications - Equipment List

5.5.3. Procedures

Analytical instruments and equipment require routine and non-routine maintenance. The instrumentation employed in sample analysis is maintained by the primary Analyst to ensure that the data generated is of the utmost quality. The Production Manager is responsible for ensuring that preventative maintenance is performed. Records of preventative maintenance are part of the permanent record for each instrument. Analysts are responsible for monitoring an inventory of spare parts for each instrument. Spare parts are defined as: *Expendable parts as well as those parts subject to wear and/or breakage.* A sufficient inventory will be kept on hand to reduce down-time.

Routine maintenance is performed by the instrument operator as described in the preventive maintenance procedures of the operator's manual or instrument SOP. Typically, the following preventative maintenance activities will be performed:

1. Check instrument sensitivity and response daily or prior to each use as described in the operator's manual, SOP, or analytical method. This may include:
    - Tuning and Daily Calibration
    - Gas Flow Measurements/Leak Checks
    - Proper Energy Levels
    - Zeroing and Full Scale Operation

2. Incubators, refrigerators and freezers are checked daily for proper temperature. Thermometers are calibrated annually (or quarterly for digital thermometers).
3. Balances are checked daily for proper calibration. All readings are entered into a logbook.
4. Exhaust hoods are checked weekly to verify that they are functioning properly and flow rates are recorded in a logbook.
5. The waste storage area is also inspected weekly for safety.
6. Storage blanks, for volatile organic contaminants, (water and/or soil depending on matrix of samples stored in the refrigerator) are rotated and analyzed biweekly to monitor for laboratory contamination.
7. Annual DI Water Suitability Test is performed to verify suitability for microbiology testing along with monthly checks.

Non-routine maintenance may be performed by vendor service technicians, Analysts, or the Technical Department. All non-routine maintenance must be recorded in the instrument maintenance logs with sufficient detail, noting the problem, corrective action, and the date on which the instrument returned to operational service.

Reference*:*

SGS Analytical SOPs

SGS SOP 104 (Laboratory Equipment Monitoring)

5.5.4. Out-of-Service

Out of service equipment is isolated (if appropriate) clearly labeled as "Out-of-Service" or "Not-in-Service" or "Do-Not-Use", examined for the effects of the problem and addressed appropriately.

Reference*:*

SGS SOP 104 (Laboratory Equipment Monitoring)

5.5.5. Calibration Status

For equipment not calibrated on an as-used basis, the calibration status of equipment is identified, including (where practicable) date when last calibrated and expiry date or recalibration date. NELAP/DOD-ELAP require that a calibration be preformed annually at a minimum.

5.5.6. Return to Service

If equipment goes outside the direct control of the lab, it is checked and validated before being returned to service. Records of return to service are maintained in the equipment files.

5.5.7. Adjustments

Access to the lab is controlled, preventing unauthorized access by anyone into the lab area. The main doors to the facility are locked at all times (excluding the front door and GC prep doors during business hours) and visitors or non-SGS personnel are escorted while in the lab to further ensure no unauthorized adjustments are made to any equipment.

Internally, all equipment that could be affected by adjustments is monitored daily to ensure conformance to specifications. Records of monitoring (e.g. balance checks, incubators, etc.) are maintained.

5.6. Measurement Traceability

5.6.1. Calibration Program

Balances calibrations are checked at the start of the day and more frequently if necessary. The readings for each balance are entered into the equipment monitoring log as per the Equipment Monitoring SOP. Class S weights (calibrated and certified by a third party at least once every 5 years) are used in the calibration of the balances. The balances are calibrated monthly by SGS Staff; the balances are serviced annually.

Non-digital thermometers are calibrated annually using an NIST Certified reference thermometer. Sample receiving and other digital thermometers are calibrated quarterly. The temperature for each thermostatically controlled device is maintained and recorded daily (twice a day for Microbiology). Corrective actions for temperatures that are out of control are addressed according to the Equipment Monitoring SOP. The NIST-traceable reference thermometer is sent out for calibration from an independent source at least once every 5 years.

In accordance with many of the regulatory protocols for analytical procedures, the temperatures of ovens, incubators, refrigerators, and freezers must be checked to ensure control. The verification data is recorded in logbook and reviewed for exceedance which may affect date quality by QA or designated staff. Sample refrigerators and freezers are monitored 7 days a week. Microbiology equipment is monitored twice daily; once a day on weekends and holidays.

Mechanical Eppendorf (or equivalent) pipettors are all calibrated quarterly and verified monthly. The mechanical devices are tagged with the Analyst's initials and the date of the quarterly calibration. Disposable volumetric pipettors are verified on a per lot basis. All calibration checks are recorded in the pipette logs.

All other Environmental Services equipment requiring calibration has a calibration procedure in place, which is referenced in the method.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.6.2. Traceability to International System of Units

Balances are calibrated monthly by SGS staff using reference weights that are calibrated by an external calibration laboratory that is accredited to ISO/IEC 17025. Thermometers are calibrated by SGS staff using a reference thermometer that is calibrated by an external calibration laboratory accredited to ISO/IEC 17025. External calibration services have a demonstrated competence, measurement capability and traceability with certificates that contain the measurement results and measurement uncertainty and/or compliance statement.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

SGS SOP 112 (Standards Labeling and Traceability)

5.6.3. Traceability

Where traceability cannot be strictly made to International System (SI) units, traceability is established through the use of certified reference materials, agreed methods (validated with interlaboratory comparisons where appropriate), and consensus standards (validated with interlaboratory comparisons where appropriate).

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

SGS SOP 112 (Standards Labeling and Traceability)

5.6.4. Reference Standards

SGS Alaska has procedures in place for handling reference standards. A set of reference standards (i.e. a weight set and a thermometer) are stored the QA Office (or other designated area) and are reserved for verification purposes only.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.6.5. Reference Materials

Reference Materials used in the laboratory are traceable to SI units where possible, or to certified reference materials. Internal reference materials are checked as far as is technically and economically practicable. Intermediate checks are carried out to maintain confidence in the calibration status of reference materials according to defined procedures and schedules. Procedures for the transport and storage of reference materials are in place.

Solvents (e.g., methylene chloride) are analyzed for purity by subjecting a solvent blank to the analytical method corresponding to its intended use. The solvent's purity is then monitored periodically through the analysis of method blanks. Any reagent will be discarded at the first sign of decomposition or contamination. The Analyst is responsible for checking expiration dates and discarding expired reagents/standards.

Water is considered to be laboratory grade (equivalent to EPA Type II) when it has been passed through a charcoal filter to remove organic constituents and then through a deionizing column. Deionizing cartridges are changed when conductivity exceeds 2 µmhos/cm. The quality of the water is routinely monitored against established acceptance criteria for each analysis. Monitoring for use by the Microbiology Section consists of periodic measurements of the conductivity, pH, residual chlorine, HPC, and an annual water suitability test. To further ensure the quality of water, method blanks are performed with each analysis.

Standard solutions are generally purchased. If prepared by Analysts for in-house use, they are recorded in a logbook along with supplier identity, lot number, grade, concentration, method of preparation, Analyst name, the date of preparation, and the expiration date. Standard solutions are then validated prior to use. Standard solutions are monitored for deterioration and discarded if such signs as color changes, precipitation, or concentration changes are detected. Solutions known to be light sensitive are stored in amber glass bottles.

SGS has procedures in place to ensure traceability of the purchase, receipt, and use of consumable materials used for the technical operation of the laboratory. These procedures consist of:

- Maintaining the vendor’s certificate of analysis or purity, if available.
- Labeling the original container with a unique identifier, date received, and expiration date.
- Documenting the receipt and preparation indicating traceability to purchased stock or neat compounds by lot number or other unique identifier, method or preparation, dates, preparer’s initials, expiration dates.
- Standards and solvents used in an analysis are recorded in the preparation and/or run logs to ensure traceability.

Stock standards traceable to NIST standards are purchased from approved vendors. Staff are encouraged to purchase from ISO Guide 34 vendors whenever available.

The quality of data generated in an analytical laboratory is directly related to the quality and purity of the reagents/solvents used in preparing samples and calibrating instruments. These reagents/solvents fall into four categories:

- Solvents used in sample extraction
- Reagents used in sample digestion
- Internal spike/surrogate compounds
- Instrument tuning/calibration reagents

Unyielding efforts are made to acquire, maintain and verify reagents of the highest quality. In order to ensure the highest quality and purity, all chemicals and reagents acquired by SGS are of an appropriate grade, purchased through reliable commercial sources. If it is necessary for a particular method or procedure, “Ultrex” or spectrochemical grade reagents are purchased. Lower grade reagents may be acceptable for some procedures. The method objectives and availability determine the grade. When a particular method requires reagents, it is the responsibility of the Analyst to order the proper grade through the purchasing agent.

All chemicals are inspected, initialed, and dated at the time of arrival. These are four areas of storage:

- Those items currently in use for analytical needs are stored in the lab area.

- Flammables, solvents, and liquid hazardous materials are stored in a regulated room meeting code requirements (i.e. explosion proof lighting, ventilation, spill kit, etc.)
- Reagents chemicals in powder form are stored in a separate room in storage cabinets marked with the appropriate safety information, hazard classification, and identification.
- Temperature sensitive reagents and standards are stored in a refrigerator or freezer.

The purchasing agent is responsible for the transfer of all MSDS forms (Material Safety Data Sheet) to the laboratory Safety Officer to be added to the employee MSDS library.

Reference:

A2LA Document P102 (www.a2la.org)

SGS SOP 112 (Standards Labeling and Traceability)

SGS SOP 126 (Procurement and Receipt of Supplies)

SGS SOP 500 (Analytical Chemistry Quality)

5.7. Sampling

5.7.1. Procedures and Plan

There is a sampling procedure in place for taking sub-samples for analysis, which includes a sampling plan (based on appropriate statistical methods, wherever reasonable) and includes factors to be controlled to verify the validity of the results, the selection of samples, and the withdrawal and preparation of samples.

The responsibility for collecting and transporting samples to SGS resides with the client. In cases where SGS personnel perform the sampling, a sampling plan is first reviewed and approved by the client. Data quality is directly related to proper sampling procedures. SGS will provide consultation and assistance in designing sampling protocols to see that field procedures assure the following;

- Samples contain no foreign material and accurately represent the site where samples are collected.
- Samples are:
  - of adequate size
  - collected in containers of appropriate type and quality for the matrix and analysis requested
  - properly preserved in terms of pH and temperature during transport
- Airborne or sample cross-contamination does not occur during transport.
- Accurate records are generated and kept regarding on-site conditions, such as maps of sampling sites, labeling of samples and weather conditions.

- Field monitoring instruments are working properly.
- Samples arrive at SGS in a timely manner.
- If site-specific quality control (QC) sample analyses are required, sufficient sample bottles will be provided with instructions regarding sample volume requirements in order to achieve the QC objectives for the site.

SGS will supply containers that are properly cleaned, labeled, and preserved for sample collection. Extra bottles are provided upon client request or for projects of sufficient sample size for the collection of extra volume to fulfill method and/or site requirements for laboratory quality control sample analyses. The client will complete the label with information that matches the information on the Chain-of-Custody record. Sample holding times begin at the time of sample collection and determinations of the time held is based on the time of the test method by the bench chemist. For composite samples, the holding time assessment begins with the end date and time of the composite period. For trip blanks, the collection date and time assigned by the client should coincide with the collection of the first sample in the set.

In the event that SGS collects samples, the following will apply: samples should provide a fair representation of the media being sampled; the sampling supervisor/project manager should try to determine the quantity and type of samples and the sample location prior to actual field work. As few people as possible should handle samples to minimize potential variables. The field sampler will be solely responsible for the care and custody of all samples collection until the time of transfer to the laboratory via commercial courier or hand delivery.

A written record will be kept of sampling activities in a bound book. In addition to a log of all samples collected and all field instruments readings, information on items such as weather conditions, sampling techniques, and on-site conditions at the site of sampling will be recorded. Changes in the visual appearance of samples, odors, notable characteristics of the materials being samples, and other observations made during sampling will be recorded. Sample labels will be completed for each sample container with waterproof ink.

Reference:

SGS SOP 106 (Sample Receiving)

SGS SOP 107 (Sample Custody)

SGS SOP 118 (Sample Kit Preparation)

5.7.2. Deviations

All customer-requested deviations are noted in the client file and are communicated to the lab personnel.

5.7.3. Records

The Chain of Custody form used by SGS Alaska, allows for a record of the following, where supplied by the customer:

- Sampling procedure;

- Sampler identification;
- Environmental conditions (if relevant);
- Sampling location;
- Basis for sampling procedure statistics (if appropriate);

The sub-sampling procedure used in-house is maintained on the network and is the procedure followed by all staff. Where deviations from this method occur, they will be noted in LIMS via sample comments.

Reference:

SGS SOP 143 (The Weighing of Soils and Solids for Metals (including Mercury), Semivolatile and Volatile Analyses)

5.8. Handling of Test Items

5.8.1. Procedures

Sample custody begins at the time of collection and concludes with disposal or complete consumption of the raw sample, extracts and/or digestates during laboratory processes. Legal custody records should provide a continuous record of possession or storage of samples in the field and the laboratory. Commercial shipping couriers are not required to sign the custody records; however, documentation must be made that identifies the courier and the airbill number or copy of the bill of lading.

The original Chain-of-Custody Record will identify the transported contents and will accompany the shipment. The field services supervisor will retain a copy of the COC. Samples shall be properly packaged for shipment and dispatched to the laboratory. Packages sent via US Postal Service. Shipment via other commercial couriers must be accompanied by a bill of lading or airbill. All postal receipts, bills of lading or airbills must be retained as part of the permanent project file record. A sample is considered to be in the possession of a person if:

- It is in that person's physical possession.
- It is in view of that person after that person has accepted receipt of it and has physical possession of it.
- That person has placed it in a secure area.
- The three previous items are all qualifiers until that person has relinquished it to someone else who fulfills any of the above requirements.
    - The Sample Control personnel will accept custody of the shipped samples and will verify that the information on the sample bottle labels and COC agree. Discrepancies are noted on the Sample Receipt form. COC forms must accompany all samples. No more than one project may be recorded per COC.

The internal COC begins at the time of receipt and is completed upon sample disposal. Sample Receiving staff log each work order into a logbook. The Sample

Custodian will distribute samples to the appropriate storage locations. Laboratory personnel will be responsible for the care and custody of samples while in their possession. When sample analysis and necessary quality assurance checks have been completed in the laboratory, the unused portion of the sample will be retained for 14 days after release of the final report or data deliverables (whichever is later) unless prior arrangements are made. Other arrangements can be made if necessary. For samples transferred from the Fairbanks facility, condition upon receipt in Anchorage will be documented on an additional form.

Reference:

SGS SOP 106 (Sample Receiving)

SGS SOP 107 (Sample Custody)

5.8.2. Identification

All samples submitted to SGS Alaska are assigned a unique identification through the LIMS system.

5.8.3. Deficiencies

All abnormalities and deficiencies identified upon receipt of the test items are recorded and if necessary, the customer is notified. Records are maintained in the customer file(s).

Any changes to the COC submitted (e.g., changes to sample ID and/or collection information, addition/deletion of rush requests) must be documented. The Change Order Form should be initiated by the PM and completed by the client. Alternatively, e-mail or fax directives from the client may be used. Any change order received must be scanned with the COC and sample receipt forms as part of the official work request and the laboratory must be notified of the changes.

5.8.4. Facilities

All exterior doors (excluding the front entrance) are locked, preventing the unauthorized entry of an individual into the laboratory. Entry is gained by use of a master key and a pass code, which is issued to each employee. Specific areas within the lab where there is controlled access have their own keys.

5.8.5. Environmental Conditions

Records of the environmental conditions are monitored and recorded, (as appropriate). Records of non-compliance with required conditions are communicated to the customer and maintained in the customer file.

5.8.6. Handling Instructions

Where handling instructions are provided by the customer, these instructions are recorded in the LIMS, and records of instructions are maintained in the customer file(s).

5.9. Assuring the Quality of Test Results

5.9.1. Quality Control

SGS Alaska has a method validation program to establish the performance characteristics of a method to demonstrate "fitness for use". The performance characteristics are established over the short term and long term; all data generated by the lab is evaluated against the performance characteristics to determine if the results are acceptable (or fit-for-use).

SGS Alaska has quality control procedures for monitoring data validity, which may include but not limited to: use of reference materials (certified wherever possible); participation in interlaboratory comparison or proficiency testing programs; replicates; re-testing of retained items; correlation of results for different characteristics of an item.

Reference*:*

SGS SOP 145 (Control Charts and Control Limits)

5.9.2. Quality Control Data

All quality controls in place in the laboratory are recorded using the on-line LIMS system and reviewed to detect trends, and, where practicable, statistical techniques are applied. Acceptance criteria is based on validation, reference methods, or control charting, or as determined by the technical manager.

Where applicable, QA will engage in routine electronic review of electronic data via the MintMiner software program.

Reference:

SGS SOP 101 (Peer Review)

SGS SOP 145 (Control Charts and Control Limits)

5.9.3. Quality Control Data Analyzed

Monitoring of quality control data is done by all groups through the data approval process, by use of the quality control program and by comparison of the result to established performance characteristics. Where practicable, data may be charted.

Where results do not fall within the specified tolerances, action is taken to correct the deficiency. Detailed steps on actions to be taken if results are unacceptable can be found in the Corrective Action Table of analytical SOPs. Any corrective actions needed to address QC outlier or other technical challenges that are not listed in the SOP require the prior approval of the QA Office or Technical Department. In the event that data quality is impacted, the Project Manager will be notified and a corrective action will be initiated as specified in the Corrective Action SOP.

In order to maintain quality control on an ongoing basis, laboratory control samples (LCSs) prepared from NIST-traceable sources are analyzed with each batch. Full compound list spikes are performed for all DOD projects. Data must fall within specified control limits in order for sample analyses to proceed.

Reference:

SGS SOP 101 (Peer Review)

SGS SOP 145 (Control Charts and Control Limits)

5.10. Reporting the Results

5.10.1. Test Reports

Hold times are monitored to the hour for analyses with hold times greater than 72 hours. Analyses with short hold times (i.e., less than or equal to 72 hours) are monitored to the minute.

It is the responsibility of each Analyst to assure that adequate written records are kept of each analysis performed.

SGS Alaska provides test reports that contain, (where appropriate), the following information:

- Work Order number
- Name and address of laboratory;
- Location where test carried out (if different);
- Unique identification of the report on each page, and a clear identification of the end of the report;
- Name and address of customer;
- Unique item identification;
- Date and time of item receipt;
- Date and time test performed;
- Sampling plan and procedure used (where relevant);
- Test result with units;
- Name(s), function(s) and signature(s) or equivalent identification of person(s) authorizing the report;
- Statement to the effect that the results relate only to the items tested, where relevant;
- Subcontracted results clearly identified;

The QA Manager and Technical Department regularly review data packages (including at least 10% of all DOD packages) and calibration activities to ensure their adherence to SGS QA/QC standards.

5.10.2. Test Result Interpretation

Upon request SGS Alaska will provide all information necessary for the interpretation of test results that include the following:

- Variances from test methods;
- Information on specific test conditions;

- Statement of compliance;
- Statement on the estimated uncertainty when it is relevant to the validity or application of the result, a customer requires it, or when the uncertainty affects compliance to a specification limit;
- Opinions and interpretations, which are clearly marked;
- Additional requested information;
- Date of sampling, where available;
- Identification of the substance, material, or product sample;
- Sampling location, (where available);
- Environmental conditions during sampling (where available);
- Sampling method or procedure used and deviations, (where available);

SGS offers four levels of data packages in Portable Document Format (PDF) files. PDF reports, with authenticated electronic signatures, are considered official reports and intended to be used in their entirety. SGS provided all reports and deliverables online. This secure web portal, Lab View, can be accessed at http://labview.sgs.com.

After peer review of all analyses is complete, LIMS will generate a final report. (A partial or preliminary report may be issued at the discretion of the Project Manager.) The PM will review the report for consistency and specific project and/or client requirements. With the completion of this final review stage, the report is issued to the client.

If a data package is required, following the release of the analytical report to the client, Data Services will receive the request. Level 3 and level 4 packages are prepared using forms generated from LIMS and, as applicable, raw data. If required, electronic deliverables are also produced.

Reference:

SGS Statement of Qualifications – Data Deliverables

SGS SOP 008 (PDF Reporting and Archiving)

SGS SOP 122 (Login and Package Review)

5.10.3. Opinions and Interpretations

Where SGS Alaska provides opinions and interpretations, the lab shall document in the customer file, the basis upon which these have been made.

5.10.4. Amendments

All amendments made to test reports are identified by a change in revision number in the report and contains all information as required by section 5.10.1. Records of amendment are maintained in the customer file(s) and tracked through the LabView. The customer is notified prior to the re-issue of any amended document.

5.10.5. Simplified Reporting

Where results are reported to the customer in a simplified way, all information normally reported is retained.

6. HISTORY OF REVISIONS

Effective 7/18/11:

- Minor spelling and formatting edits have been made.
- The coverpage was updated to reflect the current QA Manager.
- Section 1 was updated to specify the Alaska division of SGS.
- Section 2.1.2 was revised to correctly identify AFCEE.
- Section 3 was revised to describe QA/QC Officer and Analyst.
- Section 4.1.2 was revised to delete the Oregon ELAP.
- Section 4.1.4 was updated for SGS staff and locations.
- Sections 4.1.5.4.1 through 4.1.5.4.3 were added.
- Section 4.1.5.5 was revised to update the team descriptions.
- Section 4.2.2 was revised to indicate that this Quality Assurance Plan is the referenced Quality Manual.
- Sections 4.4.1 through 4.4.4 were revised to delete reference to SOP 131.
- Section 4.11 references were revised to include Analytical SOPs.
- Section 5.2.2 was revised to add PE studies (as applicable).
- Section 5.2.2 was updated to revise the storage of training records.
- Section 5.2.4 was revised to update Accounting Manager responsibilities.
- Section 5.3.2 was revised to update the number and capacity of sample receiving refrigerators.
- Section 5.4.7 was revised to delete “Standard Methods” (to avoid confusion with the Standard Methods for the Examination of Water and Wastewater).
- Section 5.5.2 references were revised to include the Statement of Qualifications.
- Section 5.6.5 was modified to indicate monitoring “for use by Microbiology.”

7. REFERENCES

International Standard ANSI/ISO/IEC 17025, Second Edition 2005-05-15, General Requirements for the Competence of Testing and Calibration Laboratories.

Attachment D
Laboratory Data Validation Forms and Information

Corrective Action Form – Donlin Gold Project

Sample I.D.(s)______________________________ **Date Sampled** __________________

Laboratory Job Number(s)___________________ **Date Analyzed** __________________

Reviewed By___________________________________

Describe the deficiency:

Document all correspondence involved:
Include date and time of the communication(s), as well as the name and position of all individuals contacted. Also include a synopsis of each communication, attach extra pages as necessary.

Define a corrective action:

Explain the resolution:

LABORATORY DATA REVIEW AND VALIDATION CHECKLIST – DONLIN GOLD PROJECT

Sample Point(s):		Laboratory #(s):			
Parameter list requested:		Date Samples Collected:			
		Date Samples Received by Lab:			
Category		**Yes**	**No**	**N/A**	**Comments**
Reported Data					
1. COC & other field documents included?					
2. All reporting requirements satisfied? (Section 4.4, items 1, 3, and 4)					
3. Parameters reported match parameters requested?					
4. Methods reported match methods requested?					
5. Reporting limits and units as requested?					
6. Electronic file matches hard copy?					
Sample Analysis					
1. Analysis holding times met?					
Laboratory QA/QC Requirements					
1. Blanks	proper frequency?				
	acceptance criteria met?				
2. LCSs	proper frequency?				
	acceptance criteria met?				
3. Spikes	proper frequency?				
	acceptance criteria met?				
4. Duplicates	proper frequency?				
	acceptance criteria met?				
General: *Note any additional comments/observations on back of sheet.*					
1. Are sample results consistent with historical data for specific sample point(s)?					

Reviewed by: **Date:**

FIELD DATA REVIEW AND VALIDATION CHECKLIST – DONLIN GOLD PROJECT

<table>
<tr><td rowspan="3">Sample Point(s):</td><td colspan="4">Date Collected:</td></tr>
<tr><td colspan="4">Date Shipped to Lab:</td></tr>
<tr><td colspan="4">Collected By:</td></tr>
<tr><th>Category</th><th>Yes</th><th>No</th><th>N/A</th><th>Comments</th></tr>
<tr><td>Reported Data</td><td></td><td></td><td></td><td></td></tr>
<tr><td>1. Are all appropriate data fields filled out?</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Are water level data measurements calculated and recorded correctly?</td><td></td><td></td><td></td><td></td></tr>
<tr><td>3. Are flow measurements calculated and recorded correctly?</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">General</td></tr>
<tr><td>1. Are sample results for field measurements consistent with historical data for specific sample point(s)?</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">2. Note additional comments/observations (use back of sheet if necessary):</td></tr>
<tr><td colspan="2">Reviewed by:</td><td colspan="3">Date:</td></tr>
</table>

Table D–1: Limits of Detection of Analysis of Water for Metals Leaching from Geotech dispose-a-filter[1] Filter Media (mg/L) and Most Stringent Alaska Standards

Parameter	Limit of Detection (mg/L)	Most Stringent AK Standard and Basis[2], (mg/L) (total/total recoverable)
Aluminum[2]	0.0008	0.75 AQ[3]
Antimony	0.00002	0.006 HH[4]
Arsenic	0.0002	0.010 HH[4]
Barium	0.00001	2 HH[4]
Boron	0.002	0.75 Irrig[5]
Cadmium	**0.0005**	0.00025 AQ[3,6]
Chromium (total)	0.00003	0.1 HH[4] (III, 0.079 AQ[3,6]; VI, 0.011 AQ[3,6])
Copper	0.0005	0.008 AQ[3,6]
Iron	0.001	1.0 AQ[3]
Lead	0.00005	0.002 AQ[3,6]
Manganese	0.0005	0.050 HH[4]
Mercury	**0.00005**	0.00005 HH[4]
Nickel	0.0005	0.047 AQ[3,6]
Selenium	**0.007**	0.005 AQ[3]
Zinc	0.001	0.1 AQ[3,6]

Notes: 1: Information for the Limit of Detection for Geotech Environmental Equipment, Inc. dispose-a-filter filter capsules was downloaded from http://www.geotechenv.com/disposable_filter_capsules.html on June 18, 2012.

2: The most stringent State of Alaska water quality standards as applied to Crooked Creek were derived from two sources:

18 AAC 70, Alaska Water Quality Standards (Amended as of April 8, 2012)

Alaska Water Quality Criteria Manual for Toxics (December 12, 2008)

Hardness-based standards for metals were derived using a hardness of 90 ml/L (average of surface water stations at the site) as CaCO3.

3: AQ: Aquatic life water quality standard for chronic conditions

4: HH: Human health water quality standard.

5: Irrig: Irrigation water quality standard.

6: Based on a hardness of 90 ml/L (average of surface water stations at the site) as CaCO3.

bold: Limit of Detection value is equal to or greater than most stringent water quality standard.

Acid Based Accounting Analysis Protocol

The ratio of neutralization potential from carbonate materials (NP_{CO3}) to acid generating potential (AP) is determined as follows (SRK 2011):

Total sulfur content of the material will be measured in the onsite laboratory using a LECO® analyzer. AP is then calculated from the total sulfur concentration where:

$$AP = 31.25 \times \text{total sulfur (weight percent)}$$

NP would be measured in the onsite laboratory using the Sobek method (Sobek et al., 1978). The rock is digested with boiling hydrochloric acid, and then the base equivalent amount of acid consumed is determined by titrating the acid solution to a pH of 7 and converting the measured quantities to NP expressed as kilograms (kg) calcium carbonate per tonne ($CaCO_3$/t). Once NP is calculated, a correction factor is applied to account for the presence of carbonates that do not contribute to the actual neutralizing potential of the material. NP_{CO3} would be estimated from the following equations:

$$NP_{CO3} = NP \text{ (for } NP \leq 22.7 \text{ kg } CaCO_3/t)$$

$$NP_{CO3} = 0.85 \cdot NP + 3.4 \text{ (for } NP > 22.7 \text{ kg } CaCO_3/t)$$

Variables that were incorporated in the block model to aid with the geochemical classification of waste rock at the proposed Donlin Gold project include NP from carbonate minerals (NP_{CO_3}), and AP.

NP from carbonate minerals (NP_{CO3}) was estimated from:

$$NP_{CO_3} = 0.76 \cdot NP + 4.8$$

To avoid a bias at low NP values, the calculated NP_{CO3} should not exceed analytical NP when NP is below 50 lb. (22.7 kg) $CaCO_3$/t. Therefore, the following rules are applied to the calculation of NP:

If $NP \leq 22.7$ kg $CaCO_3$/t: $NP_{CO3} = NP$

If $NP > 22.7$ kg $CaCO_3$/t: $NP_{CO3} = 0.85 \cdot NP + 3.4$

Appendix B
Wildlife Mortality Reporting Forms

MINE SITE WILDLIFE MORTALITY REPORT FORM

DONLIN GOLD PROJECT

DATE: ________________________

WAD CYANIDE - RESULT OF ANALYSIS: ________________________

Number and Species Identification

RAPTORS________________________

SONGBIRD________________________

UPLAND GAME________________________

WATERFOWL________________________

SHOREBIRD________________________

MAMMAL________________________

OTHER________________________

Reporter: ________________________

Title:________________________ Phone:________________________

MAIL TO:

US Fish & Wildlife Service
Ecological Service
101-12th Avenue
Fairbanks, Alaska 99701

Alaska Department of Fish & Game
Habitat Division
1300 College Road
Fairbanks, Alaska 99701-1599

Observer Comments (Include maps showing location of find, date, and other information):

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SEMI-ANNUAL MINE SITE MORTALITY REPORT

DONLIN GOLD PROJECT

REPORTING PERIOD:______________________________

YEAR: _________________________

MORTALITIES

Number and Species Identification

	CYANIDE	NON-CYANIDE
RAPTORS	______________	______________
SONGBIRD	______________	______________
UPLAND GAME	______________	______________
WATERFOWL	______________	______________
SHOREBIRD	______________	______________
MAMMAL	______________	______________
OTHER	______________	______________

Reporter: ____

Title:______________________________ Phone:____________________

MAIL TO:

US Fish & Wildlife Service
Ecological Service
101-12th Avenue
Fairbanks, Alaska 99701

Alaska Department of Fish & Game
Habitat Division
1300 College Road
Fairbanks, Alaska 99701-1599

Observer Comments (Include maps showing location of find, date, and other information):

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