CHAPTER 5: IMPACT AVOIDANCE, MINIMIZATION, AND MITIGATION

5.1 INTRODUCTION

This section defines terminology, references applicable guidance, describes the process of identifying mitigation during the NEPA, Section 404, and BLM permitting processes, and identifies measures committed to by Donlin Gold intended to avoid or minimize impacts.

5.1.1 OVERVIEW OF NEPA AND CORPS 404 MITIGATION

NEPA requires federal agencies to consider appropriate mitigation measures to avoid or minimize specific impacts during the NEPA process. Consideration and adoption of mitigation is a continuous process through completion of the EIS and Record of Decision. This includes evaluation of mitigation measures recommended for consideration by EIS team Subject Matter Experts, the lead and cooperating agencies, federally recognized tribal governments, and the public during the NEPA process. The mitigation measures included in this chapter were developed by the EIS Subject Matter Experts, and modified based on agency review comments and the results of discussion during a mitigation measures workshop in the summer of 2015.

Additionally, the Corps Section 10/404 permitting process has very specific requirements for mitigation including a five step process of (1) impact avoidance, (2) minimization, (3) rectifying impacts, (4) reduce and/or (5) resource-specific mitigation measure development and application to compensate for unavoidable impacts under their jurisdiction. Mitigation measures are also developed through other processes such as consultation under Section 106 of the NHPA, permit authorization by other federal and state agencies, and monitoring and adaptive management associated with specific permit requirements. Discussions related to Section 10/404 and Section 106 are commonly not completed at the time of release of the Draft EIS for public review. Mitigation measures related to these discussions will be included as they become available. A general description of the key terms used in this chapter is provided in Table 5.1-1

Table 5.1-1: Common Mitigation Terms

Term Used in This EIS	NEPA Equivalent	Corps 404 Permitting Equivalent	Description
Design Features (or Measures)	Mitigation	Avoidance and Minimization	Design features are impact-reducing actions or designs that Donlin Gold has committed to in their permit applications and supporting documents. These are part of the proposed action. If during the NEPA process the proposed action is required to be changed, some aspects of those required changes may become design features.
Best Management Practices (BMPs) and standard permit requirements	Mitigation	Avoidance and Minimization	These are the predictable requirements that are required in regulation or would be stipulated in project permits. For example, the Construction General Stormwater permit will require a Stormwater Pollution Prevention Plan (SWPPP). These are analyzed as part of the proposed action.
Agency Considered Mitigation	Mitigation	Avoidance and Minimization	Measures agencies consider that would further reduce impacts. These are not considered part of the proposed action.

Table 5.1-1: Common Mitigation Terms

Term Used in This EIS	NEPA Equivalent	Corps 404 Permitting Equivalent	Description
Compensating for Unavoidable Impacts	Mitigation	Compensatory Mitigation	Compensatory mitigation is not required by NEPA but is required for the Corps Section 10/404 process. Compensatory mitigation is required for impacts to waters of the U.S. that cannot be avoided or minimized. [This will be determined by the Corps after the Draft EIS.] The BLM may also require compensatory mitigation under Secretarial Order 3330, FLPMA, and BLM Regional Mitigation Manual MS-1794.
Monitoring and Adaptive Management	Monitoring	Monitoring	Monitoring has been proposed by Donlin Gold, is recommended in this EIS, and may be required by the Record of Decision. It may also be included by stipulation in federal and state permits. Through monitoring, appropriate data are collected to assess predicted project impacts and the effectiveness of mitigation after initial and ongoing implementation. Mitigation that is not proving effective can be adapted.

5.1.2 DEFINITIONS AND PROCESS

Mitigation is considered by the Corps primarily in three ways during the NEPA process: (1) impact avoidance, (2) minimization measures, and (3) resource-specific mitigation measures to compensate for unavoidable impacts. Measures to avoid and/or minimize impacts to resources that are identified in this EIS include:

- Efforts made by Donlin Gold as part of the project design or as standard procedures during construction, operations, and closure,
- BMPs, industry standards, or standard permit requirements, and
- Mitigation measures recommended for consideration by EIS Team Subject Matter Experts, the lead and cooperating agencies, federally recognized tribal governments, and the public during the NEPA process.

After development of the EIS, if the subsequent permitting phase determines that a permit would be issued, additional conditions, stipulations and/or requirements may be added that could act as further mitigation. Monitoring to assess that mitigation measures are achieving the expected results or monitoring for adaptive management shall be used as an assessment tool where applicable. Any such post-EIS requirements are not considered in this EIS.

Avoidance and minimization measures that Donlin Gold has incorporated into the proposed action are identified in this EIS as Design Features. These design features are included in Section 5.2 below. It is beyond the scope of this EIS to list all BMPs, but they would be included as individual permit conditions. Various alternatives to the proposed Donlin Gold Project are discussed in Chapter 2, Alternatives. The Corps will further assess these alternatives (including the Donlin Gold's proposed project) to determine the Least Environmentally Damaging Practicable Alternative (LEDPA). Resource-specific measures being considered by the Corps as conditions of the permit (if issued) include additional measures to further reduce or avoid

impacts (referred to in this EIS as Mitigation Measures) and measures that are intended to offset or compensate for unavoidable adverse impacts (referred to as Compensatory Mitigation). The Corps required compensatory mitigation is only applicable to unavoidable impacts to waters of the U.S. after avoidance and minimization efforts have been made.

The review process for the Department of the Army Permit (Section 10/404) is largely conducted concurrently with the NEPA review process, but not in all instances. In addition, various aspects of the EIS and permit analysis phases are iterative and therefore may repeat analytical steps that result in the further development of mitigation for any or all potential project related effects. The final permit application for the Donlin Gold Project will be provided in an Appendix of the Final EIS. The Corps' determination under the Section 404(b)(1) Guidelines will rely on information presented in the Final EIS. Under the Section 404(b)(1) Guidelines, the Corps has a formal process and requirements that must be met; specifically the inclusion of practicable and appropriate mitigation prior to the determination of which alternative represents the LEDPA. In determining which mitigation measures are practicable and appropriate for inclusion in the Section 404(b)(1) analysis and Record of Decision (ROD), the Corps will incorporate as appropriate, consideration of the potential mitigation measures presented in Table 5.5-1 and additional public and agency comments received during review of the Draft EIS.

The Corps' regulatory authority encompasses waters of the U.S. and aquatic resources and ensures that environmental impacts on aquatic resources from projects are avoided, minimized and mitigated; however, the Corps permit would also include conditions necessary to comply with other federal laws (e.g., ESA, MMPA, and NHPA) and requirements imposed by conditions on state Section 401 water quality certifications.

Following publication of the Final EIS, the Corps will prepare the ROD, which will be the formal Corps decision on whether to issue the requested permit as proposed, a modified permit, or no permit. If the Corps determines it will issue the permit, the ROD will also identify the conditions, including all required mitigation. The ROD will include appropriate Donlin Gold-proposed design features, and any additional mitigation measures considered by the Corps and other agencies with permitting authority, and agreed to by the Corps. The final measures included in the ROD will then be considered part of the project by the Corps during its permitting process.

BLM also has responsibility to identify the conditions including all required mitigation (including compensatory mitigation) for any Mineral Leasing Act right-of-way (ROW) issued pursuant to the Final EIS. BLM takes a regional approach to mitigation and focuses on achieving the highest benefit to help offset the impacts of projects on Federal lands (BLM 2015f). A regional approach to mitigation considers potential impacts across the landscape and focuses on attaining the highest mitigation benefit, regardless of land ownership. BLM has participated in the development of the mitigation measures being considered by the Corps.

5.1.3 NEPA GUIDANCE

NEPA requires federal agencies to describe potential impacts to resources potentially affected by the proposed action and alternatives to the proposed action. Alternatives may be designed to avoid or minimize potential impacts that may be created by the proposed action. Because one of the purposes of NEPA is to promote efforts that will prevent or minimize damage to the environment (42 USC Section 4321), mitigation and monitoring are important tools used to

avoid, minimize, or compensate for potential adverse impacts. Early consideration of measures to avoid and reduce impacts is often integral to project design, and the effort to avoid, reduce, or offset impacts is a key component to the alternative development and decision-making process. Many federal agencies, laws, and regulations have specific guidance regarding required efforts to reduce impacts to resources, and the CEQ requires mitigation to be considered during the NEPA process. According to the CEQ (1981):

> *Mitigation measures discussed in an EIS must cover the range of impacts of the proposal. The measures must include such things as design alternatives that would decrease pollution emissions, construction impacts, esthetic intrusion, as well as relocation assistance, possible land use controls that could be enacted, and other possible efforts. Mitigation measures must be considered even for impacts that by themselves would not be considered "significant." Once the proposal itself is considered as a whole to have significant effects, all of its specific effects on the environment (whether or not "significant") must be considered, and mitigation measures must be developed where it is feasible to do so.*
>
> *All relevant, reasonable mitigation measures that could improve the project are to be identified; even if they are outside the jurisdiction of the lead agency or cooperating agency, and thus would not be committed as part of the RODs of these agencies.*
>
> *However, to ensure that environmental effects of a proposed action are fairly assessed, the probability of mitigation measures being implemented must also be discussed. Thus, the EIS and Record of Decision should indicate the likelihood that such measures will be adopted or enforced by the responsible agencies.*
>
> *Lead agencies "shall include appropriate conditions [including mitigation measures, monitoring, and enforcement programs] in grants, permits, or other approvals" and shall "condition funding of actions on mitigation." Any such measures that are adopted must be explained in the ROD.*

CEQ regulations describe several ways an agency can use mitigation to reduce environmental impacts associated with proposed projects (CEQ 2010). These include:

- Avoiding an impact by not taking a certain action or parts of an action;
- Minimizing an impact by limiting the degree or magnitude of the action and its implementation;
- Rectifying an impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating an impact over time, through preservation and maintenance operations during the life of the action; and
- Compensating for an impact by replacing or providing substitute resources or environments.

Additional specific Corps mitigation requirements are found at 33 CFR 325.4 (a):

> *District engineers will add special conditions to Department of the Army permits when such conditions are necessary to satisfy legal requirements or to otherwise satisfy the public interest requirement. Permit conditions will be directly related to the impacts of the proposal, appropriate to the scope and degree of those impacts, and reasonably enforceable.*

Regulatory standards and criteria for the use of compensatory mitigation to offset unavoidable impacts to waters of the United States, including wetlands, authorized under the CWA, were established on April 10, 2008 under 33 CFR Part 332 (Corps) and 40 CFR Part 230 (U.S. Environmental Protection Agency [EPA]).

On January 14, 2011, the CEQ issued a memorandum to federal departments and agencies containing guidance on establishing, implementing, and monitoring mitigation commitments identified and analyzed in Environmental Assessments and EISs, and adopted in the final decision documents. It also clarified the use of mitigated "Findings of No Significant Impact," which is relevant to Environmental Assessments but not EISs. The Donlin Gold EIS complies with federal guidance by considering mitigation during alternative development and by disclosing mitigation as components incorporated into project design, construction, and operations as efforts to avoid and minimize potential impacts.

5.2 DESIGN FEATURES PROPOSED BY DONLIN GOLD

The EIS serves in part to inform the public and review agencies of design features measures, or project elements that are included to reduce or avoid impacts. The Corps views these elements as part of the project, and considers Donlin Gold's proposed design measures as inherent to the Donlin Gold proposed action (Alternative 2) as well as applicable components of the other alternatives' descriptions. These measures become part of the alternative description, and are considered part of the alternative during the NEPA impact analysis and decision-making process.

Donlin Gold's design features were incorporated into Table 5.2-1 below, which presents the Corps' inventory of design measures proposed by Donlin Gold as initial mitigation for potential impacts associated with their proposed project. The table is organized by major project component, with additional columns to refer to subcomponents, as necessary, the project phase, and the resources affected.

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
A1	Pre-construction surveys of vegetation to be disturbed on BLM-managed land would be conducted to determine the presence or absence of any rare and sensitive plant species. If any individuals or populations are found, the appropriate agencies would be consulted to determine potential mitigation such as avoidance or transplant. These mitigation measures could substantially reduce the potential effects on any rare plants.	All	Pre-Construction	Vegetation
A2	Raptor nest surveys would be conducted during the spring prior to start of construction. If occupied nests are found close to areas of proposed activity, the activity would be scheduled to occur outside the nesting season if feasible. If not feasible, the FWS would be consulted to assist in determining measures necessary to avoid impacts to nesting raptors.	All	Pre-Construction	Wildlife
A3	Agreements with Alaska Native land owners create contractual commitments to shareholder hire and revenue flows for Alaska Native shareholders (minority and low income).	All	Pre-Construction	Environmental Justice, Socioeconomics
A4	Where an important cultural resource site was identified near the proposed project upriver port site, a community-based excavation project was undertaken to involve the community in scientific documentation of the site, thereby avoiding loss of context for the cultural resource.	All	Pre-Construction	Cultural Resources
A5	All work would be performed in accordance with relevant permit and lease stipulations and in a manner to prevent infestation of bark beetles or other potential problems consistent with the Donlin Gold Timber Clearing Utilization Plan.	All	Construction/ Operations/ Closure	Vegetation; Land Ownership Management, and Use
A6	Temporary ice roads would be used for pipeline construction to the extent feasible to minimize disturbance to wetlands.	All	Construction/ Operations/ Closure	Vegetation, Wetlands
A7	The project design includes consultation with the public and tourism and recreation businesses to minimize impacts to current uses and operations.	All	Construction/ Operations/ Closure	Recreation, Socioeconomics
A8	Where practicable the project design includes proposed facilities with earth tone colors characteristic of the natural landscapes during the summer months (browns, tans, warm grays, and greens) with matte-finish to minimize visual impacts. The project design includes features to minimize visual impacts to the natural landscape to extent practicable.	All	Construction/ Operations/ Closure	Recreation, Visual Resources

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
A9	Salvaged growth media and topsoil removed during construction would be used for revegetation. Native seed mixes and natural recolonization will be utilized to the extent possible in reclamation activities.	All	Construction/ Operations/ Closure	Vegetation; Land Ownership, Management, and Use; Visual Resources
A10	Where practicable fully shielded light fixtures would be used to reduce potential light attraction to migratory birds.	All	Construction/ Operations	Wildlife
A11	Material sites at the mine site, mine access road, and pipeline would be evaluated prior to use for metals leaching and acid rock drainage (ARD) potential in final design using bulk geochemistry analysis, meteoric water mobility procedure (MWMP), and acid-base accounting (ABA) methods. Alternative sites would be selected if results indicate the potential for impacts to downgradient water resources.	All	Construction/ Operations	Water Quality
A12	Where practicable, construction and maintenance schedules would seek to minimize impacts on subsistence hunting and fishing, with the understanding that some construction activities must also take advantage of seasonal and environmental conditions.	All	Construction/ Operations	Subsistence, Human Health
A13	Donlin Gold would implement a no hunting/fishing policy for employees at work sites to minimize competition from employees for local resources.	All	Construction, Operations	Subsistence, Human Health
A14	The project design includes installation of pipeline components (temporary roads and pipelines) at most water bodies and wetlands primarily in the winter months when frozen ground and snow are present, flows are lowest, and disturbance of the river, stream banks, and local groundwater would be minimized, or by using horizontal directional drilling (HDD) technology to avoid flow impacts at major pipeline river crossings.	All	Construction	Soils, Surface Water Hydrology Ground Water Hydrology, Water Quality, Wetlands
A15	The project design includes the development and implementation of a Construction Communications Plan to inform the public and commercial operators of construction activities.	All	Construction	Noise and Vibration, Recreation, Socioeconomics, Subsistence
A16	The project design includes (when practicable) crossing drainages at right angles to reduce riparian impacts, and use of bridges. The intent of this design feature is primarily to minimize footprint in riparian areas.	All	Construction	Vegetation, Wetlands, Fish and Aquatic Resources

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
A17	The project design includes routing transmission lines in proximity to the road, where possible, to reduce additional vegetation impacts.	All	Construction	Vegetation, Wetlands, Visual Resources
A18	The project design includes assistance to develop project related training programs for local residents to enhance local hire potential during construction and operations phases.	All	Operations	Socioeconomics
A19	Shareholder preference in hiring maximizes economic benefit to local communities (minority and low income); along with enclave work place, this minimizes risk of influx of non-local workers into nearby communities during construction and operations phases.	All	Operations	Socioeconomics, Environmental Justice, Human Health
A20	The project design includes shift work schedules to maximize opportunities for employees to remain active in subsistence harvest efforts during construction and operations phases.	All	Operations	Subsistence, Human Health
A21	Donlin would develop and implement a drug and alcohol abuse prevention program for employees during construction and operations phases.	All	Operations	Human Health, Spill Risk
A22	Donlin would conduct a public outreach program that would include information regarding participation in the “One-Call” program, hazards associated with the unintended release of natural gas, unintended release indicators, and reporting procedures.	All	Operations	Spill Risk, Pipeline Reliability and Safety
A23	Donlin would develop an Operations and Maintenance Plan/Manual; Health, Safety, and Environment Plan (including a Safety Plan/Program), Pipeline Surveillance and Monitoring Plan, and other plans that would outline safety measures that would be implemented during operations.	All	Operations	Human Health, Pipeline Reliability and Safety
A24	Areas of disturbed bedrock and surficial deposits along the ROW, roads, and material sites would be contoured to match existing landforms as feasible, ripped to mitigate compaction effects, covered with growth media as needed and revegetated, and would support the overall drainage of the site, the long-term geotechnical stability, and post-mining land use,	All	Closure	Geology, Soils, Geohazards and Seismic Conditions, Vegetation, Wetlands; Land Ownership, Management, and Use

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
A25	Post-closure sediment controls would include site grading and capping of erodible material, revegetation, and re-routing of surface runoff to reestablish natural conditions.	All	Closure	Surface Water Hydrology, Fish and Aquatic Resources, Vegetation, Subsistence
A26	Where feasible valley bottom and lowland material sites will be reclaimed to create new wetland areas with ponds and emergent vegetation or black spruce wetlands. This should also include restoring vegetation in wetland areas in trenches along the pipeline route to prevent permanent water filled trenches with no vegetative cover as seen at the Beluga to Anchorage Pipeline.	All	Closure	Wetlands, Wildlife
A27	Recyclable materials, including equipment and metals, will be handled in accordance with the Donlin Waste management plan. Materials will be recycled to the extent practicable.	All	Construction/ Operations/ Closure	Lands (ANCSA Corporations)
A28	Monitoring activities would be conducted to include water quality, biological, vegetation, and mass stability.	All	Construction/ Operations/ Closure	Surface Water Hydrology, Water Quality, Mass Stability, Fish and Aquatic Resources, Wetlands, Vegetation
Mine Site				
M1	In final design, site infrastructure, material sites, and roads would avoid ground-disturbing activity in wetland areas whenever practicable. Details would be developed as the mitigation plan is developed and as design and permitting progress. Those details do not exist at the DEIS stage.	General Mine, Roads	Construction/ Operations/ Closure	Vegetation, Wetlands, Wildlife
M2	At the Tailings Storage Facility (TSF) dry beach the project design includes installing silt fences, removing snow from active placement areas only, and using polymer dust suppressant.	TSF	Construction/ Operations	Air Quality, Vegetation, Recreation, Visual Resources, Subsistence, Human Health

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
M3	The project design includes developing multiple use facilities – using the same piece of ground for more than one purpose over the life of the mine as well as using existing disturbed areas for temporary construction activities to the maximum extent practicable.	General Mine	Construction/ Operations	Wetlands, Vegetation
M4	Material site selections would take into consideration potential for conversion to wetlands or restoration to higher functioning wetlands.	General Mine	Construction/ Operations	Wetlands, Wildlife, Fish/Aquatic Resources
M5	The shape of the Waste Rock Facility has been designed to conform to the landscape to the extent practicable.	WRF	Construction	Geology
M6	The Tailings Storage Facility and water dams were designed using rockfill, bedrock foundations, multiple filter zones, liners, and downstream construction methods to resist seismic hazards, static stability, and seepage concerns.	TSF	Construction	Soils, Geohazards and Seismic Conditions
M7	Based on the proposed design, the Waste Rock Facility stability meets or exceeds industry design criteria under both static and pseudo-static (earthquake) loading conditions.	WRF	Construction	Soils, Geohazards and Seismic Conditions
M8	The Tailings Storage Facility will include a relatively flexible, textured geomembrane liner (60 mil or 1.5 mm) that is expected to withstand freezing temperatures, sharp rocks, and anticipated settlement scenarios with an appropriate factor of safety and to minimize impacts from porewater seepage on groundwater quality.	TSF	Construction	Soils, Water Quality
M9	The project design includes features to limit permafrost impacts at the mine site such as excavation to bedrock beneath large structures where needed, such as the Tailings Storage Facility abutment and parts of the toe of the Waste Rock Facility.	TSF, WRF	Construction	Soils
M10	The domain- and sector-specific pit wall slope was designed to accommodate varying faults, fractures, and rock quality.	Pit	Construction	Soils, Geohazards and Seismic Conditions

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
M11	Numerous locations and combinations of locations were considered for TSF and WRF layouts during the alternatives development process. These are summarized in Appendix C. The layout of major mine facilities was designed to minimize wetland impacts and limit effects on water quality to the American and Anaconda Creek watersheds. The 404(b)(1) analysis will document the steps taken to minimize wetlands impacts.	General Mine	Construction	Water Quality, Wetlands, Fish and Aquatic Resources, Subsistence
M12	Geosynthetic liner would be used over permafrost in wetland areas to minimize thawing or degradation that could lead to requirements of excessive amounts of fill to avoid shoulder sloughing.	General Mine	Construction	Wetlands
M13	Water management planning at the mine site would assist in controlling the flow of groundwater at the pit and other major facilities (WRF, TSF), as well as controlling the potential effects of groundwater flow on water quality downgradient of the mine. This would be accomplished through design elements such as dewatering wells, collection of groundwater infiltration through and around the TSF at the SRS pond, and lake level maintenance following closure. A variety of groundwater monitoring activities would also be planned.	General Mine	Operations/ Closure	Surface Water Hydrology, Groundwater, Hydrology. Water Quality, Fish and Aquatic Resources, Subsistence
M14	During the operations phase, concurrent reclamation activities (e.g., certain tiers and areas within the Waste Rock Facility) would be conducted immediately after construction and stabilization and whenever practicable in areas no longer required for active mining.	General Mine	Operations/ Closure	Geology, Air Quality, Vegetation, Fish and Aquatic Resources, Visual Resources, Subsistence
M15	The project design at the mine site includes water management strategies that would maintain flow and storage within the design capacity of structures, provide flexibility for extra storage in high precipitation years, and sufficient water supplies for processing in low precipitation years.	General Mine	Operations	Soils, Surface Water Hydrology, Water Quality, Climate Change
M16	The project design includes stream flow monitoring and dam inspections to continually provide data for water management and dam safety purposes.	General Mine	Operations	Soils, Surface Water Hydrology
M17	All mine contact water would be collected and reused or treated and discharged.	General Mine	Construction/ Operations/ Closure	Water Quality

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
M18	The project design includes the use of natural gas to fuel the power plant and the other dual-fuel fired units at the mine site, which would result in lowering Green House Gas (GHG) emissions by 9.6031 MMT during the mine life of 27.5 years compared to diesel fuel.	Processing Plant	Operations	Air Quality, Climate Change
M19	The project design includes use of selective catalytic reduction to minimize oxides of nitrogen emissions at the power plant.	Processing Plant	Operations	Air Quality
M20	The project design includes the use of state-of-the-art mercury abatement systems at the kiln feed and discharge, pressure oxidation vent gas, and electrowinning cell fume hoods and gold refinery area, to comply with maximum achievable control technology regulations.	Processing Plant	Operations	Air Quality
M21	Design for closure would occur even before construction for reclamation and closure planning at the mine site. This incorporates methods for safe and efficient closure of the mine as an integral part of the planned mine design and operations. Implementing design for closure can have the effect of minimizing disturbance and the re-handling of materials.	General Mine	Closure	Geology, Soils, Surface Water Hydrology, Water Quality, Vegetation, Wetlands, Fish and Aquatic Resources, Socio Economics, Subsistence
M22	At the completion of contouring of the WRF and TSF, a layer of unconsolidated material from the North and South overburden stockpiles will be spread over the surface that will be overlain with an additional layer of growth media (topsoil and overburden). This material will be tested to ensure it is non-PAG. The Waste Rock Facility would be designed to maximize concurrent reclamation, minimize the effects of PAG materials, minimize infiltration and erosion, and promote controlled surface runoff and revegetation.	TSF, WRF	Closure	Geology, Surface Water Hydrology, Water Quality Vegetation
M23	With the exception of the first 8 years following closure in the deep bedrock aquifer, dewatering during operations and maintenance of pit lake levels during post-closure would maintain groundwater flow gradients towards the pit, so that impacted mine contact water would not flow away from the mine site	Pit	Closure	Groundwater Hydrology, Water quality
M24	The project design includes maintenance of sufficient freeboard at the mine pit lake in post-closure with several years of lead time to address pumping failures in order to prevent overflow to Crooked Creek.	General Mine	Closure	Soils, Surface Water Hydrology, Water Quality

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
M25	Evaporative sprayers would be employed at the TSF to minimize stored water volume. These could also be directed for use in tailings beach dust control.	TSF	Operations	Surface Water Hydrology, Soils, Air Quality
M26	Design of TSF liner includes allowance of differential settling due to permafrost and season ahead stripping and settlement.	TSF	Operations	Soils
M27	During tailings consolidation in closure, excess porewater would be captured in a capillary rock layer over the TSF, report to the lined pond at the southeast corner of the TSF, and pumped along with runoff water via pipeline to the pit until WQS have been met.	TSF	Closure	Water Quality, Surface Water and Groundwater Hydrology
Transportation Facilities				
T1	Ocean and river fuel barges would be double hulled and have multiple isolated compartments for transporting fuel to reduce the risk of a spill.	Barge	Construction/ Operations	Water Quality, Wildlife, Fish and Aquatic Resources, Subsistence, Spill Risk
T2	Design mine transportation facilities, site access routes, airstrips and other transportation infrastructure along ridge tops whenever possible to minimize wetlands and stream impacts.	General Transportation	Construction/ Operations	Water Quality, Wetlands
T3	The barge operations system was designed to avoid the need for river dredging.	Barge	Construction/ Operations	Surface Water Hydrology, Fish and Aquatic Resources, Subsistence
T4	Specific siting of new airstrips was conducted to minimize the amount of cut and fill required for runway construction.	General Mine	Construction	Geology, Wetlands
T5	The routing of a small segment of the Alternative 4 – Birch Tree Crossing access road within the Yukon Delta National Wildlife Refuge was located on ANCSA Corporation inholdings to avoid impacts to refuge land management.	Road	Construction	Land Ownership, Management, and Use

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
T6	Donlin would implement barge guidelines for operating at certain river flow rates, and conduct ongoing surveys of the Kuskokwim River navigation channel to identify locations that should be avoided to minimize effects on bed scour and the potential for barge groundings. As part of the proposed operation, equipment will be available to free or unload/lighter barges in the event of groundings. The equipment will be available as part of ongoing operations, it will not all be dedicated standby equipment.	Barge	Operations	Surface Water Hydrology, Fish and Aquatic Resources, Socioeconomics, Subsistence, Spill Risk, Climate Change
T7	Using special ISO-approved water tight tank-tainers for the transport of cyanide, equipped with GPS trackers. Design features for cyanide also include cyanide detoxification of the leach tailings and cyanide handling, storage, and transport in compliance with the ICMC.	General Transportation	Operations	Water Quality, Wetlands, Wildlife, Fish and Aquatic Resources, Spill Risk, Human Health
T8	The project design includes special flasks and metric ton containers for mercury transport.	General Transportation	Operations	Water Quality, Wetlands, Wildlife, Fish and Aquatic Resources Spill Risk, Human Health
T9	The project design includes a communication program in communities to keep local communities informed of the schedules and current status of barge traffic as well as minimize displacement of subsistence fishing by barges.	Barge	Operations	Fish and Aquatic Resources, Subsistence, Transportation, Human Health
T10	To reduce impacts on existing river traffic and potential for groundings and accidents, Donlin would establish navigational aids and develop procedures for queuing in narrow channels. Donlin Gold vessels would use state-of-the-art navigation and communication equipment.	Barge	Operations	Fish and Aquatic Resources, Subsistence, Spill Risk, Human Health

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
T11	The project design includes new, dedicated transportation equipment and infrastructure (such as the new port at Angyaruaq (Jungjuk), the mine site airstrip, and the double-hulled barges) that would minimize impacts to existing regional transportation facilities and activities.	General Transportation	Operations	Transportation, Human Health
Pipeline				
P1	Routing decisions were made taking into account baseline archeological studies to avoid identified cultural resource sites and historic properties where practicable.	General Pipeline	Pre-Construction	Cultural Resources
P2	The above-ground fault crossing of the pipeline was designed to resist surface fault rupture hazards, and would be designed to withstand the stress that could occur during a seismic event.	Fault Crossings	Construction/ Operations	Geohazards and Seismic Conditions, Spill Risk, Pipeline Reliability and Safety
P3	The project design includes a natural gas pipeline to decrease amount of barging to transport diesel fuel. The design decision to use a natural gas pipeline instead of barging 110 Mgal of diesel per year was in response to community concern about barge traffic levels.	General Pipeline	Construction/ Operation	Air Quality, Subsistence, Transportation
P4	Burying the pipeline and blending with the natural setting would minimize the potential for pipeline to dominate the landscape and would decrease visual impacts. Revegetation of cleared pipeline right-of-way would begin as soon as construction is complete. Vegetative cover would be maintained during operations to the extent permitted under PHMSA regulations; minimizing visual contrast of right-of-way by blending with existing low vegetation or open areas. While the ROW would be revegetated, PHMSA regulations require brushing of the 50 foot ROW.	ROW	Construction/ Operations	Vegetation, Visual Resources
P5	The project design includes routing decisions to minimize visual impacts to the Iditarod National Historic Trail including co-location of the proposed pipeline with the Iditarod Trail where appropriate to reduce multiple crossings of the Trail by the pipeline and thereby reduce the possibility that the pipeline ROW may become used as a separate trail.	Route	Construction/, Operations	Recreation, Visual Resources, Cultural Resources
P6	Co-location of the proposed pipeline with the Iditarod Trail where appropriate reduces multiple crossings of the Trail by the pipeline and thereby reduces the possibility that the pipeline ROW may become used as a separate trail.	ROW	Construction/ Operations	Recreation, Visual Resources, Cultural Resources

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
P7	Donlin Gold will work with the Iditarod Historic Trail Alliance and other user groups to promote Trail preservation and use. Any actual mitigation measures for impacts to the INHT would be agreed to as a part of the Section 106 compliance process and outlined in a Programmatic Agreement.	General Pipeline	Construction/ Operations	Recreation, Visual Resources, Cultural Resources
P8	Appropriate notices, warning signs, and flagging would be used to promote public safety, but barricades may also be used around dangerous areas such as open trenches during construction.	General Pipeline	Construction	Subsistence Pipeline Reliability and Safety
P9	Approximately 68 percent of the total pipeline length would be constructed during frozen winter conditions to minimize wetland and soil disturbances from support equipment. Areas selected for summer or fall construction would be based on geotechnical, terrain, safety, and continuity considerations.	General Pipeline	Construction	Soils, Wetlands, Fish and Aquatic Resources
P10	Construction would employ design measures to preclude extended soil compaction.	ROW	Construction	Soils, Recreation
P11	A special permit granted by PHMSA would require the use of strain based design in areas where geotechnical hazards may be present to maintain equivalent levels of safety. The strain based design may mandate the use of heavier wall pipe in these areas, rather than just using the wall thickness required for pressure containment, so that equivalent levels of safety are maintained.	General Pipeline	Construction	Geohazards and Seismic Conditions, Spill Risk, Pipeline Reliability and Safety
P12	The project design includes use of BMPs at pipeline stream crossings to minimize alterations of the stream bed and bank erosion. It also includes design of pipeline depth of burial at stream crossings to avoid scour exposure of the pipe.	Stream Crossings	Construction	Surface Water Hydrology, Water Quality, Fish and Aquatic Resources, Pipeline Reliability and Safety
P13	The project design includes routing of the pipeline and siting of the related compressor station along an existing corridor in Susitna Flats State Game Refuge to minimize impacts.	Route	Construction	Wildlife, Fish and Aquatic Resources, Subsistence, Wetlands

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
P14	The project design includes routing of the pipeline to avoid private lands (outside of ANCSA Corporation lands) to the maximum extent possible, i.e., in the vicinity of state disposals of remote parcels near Farewell or Happy Valley.	Route	Construction	Land Ownership Management and Use
P15	Routing of preferred action through Alaska Range north of Dalzell Gorge resulted in decreased overlap and impact to Iditarod National Historic Trail when compared to Dalzell Gorge Alternative 6A	Route	Construction	Land Ownership, Management and Use; Recreation, Cultural Resources
P16	Pipeline construction schedules were adjusted to minimize impacts to peak periods of recreation and tourism activities in the area, e.g., recreation uses of Iditarod National Historic Trail for annual events.	General Pipeline	Construction	Recreation, Cultural Resources
P17	Donlin Gold will coordinate with and help educate people who want to travel in the area during the pipeline construction period through its Public Outreach Plan to either allow controlled access through or within construction zones or provide alternate access.	General Pipeline	Construction	Subsistence, Pipeline Reliability and Safety
P18	The project design includes avoiding areas with tourist-related facilities if reasonably possible. Donlin Gold would engage with lodges and guides in advance of construction to coordinate activities.	General Pipeline	Construction	Recreation, Socioeconomics
P19	The project design includes locked security fencing surrounding aboveground facilities.	Facilities	Operations	Recreation, Pipeline Reliability and Safety
P20	The right-of-way would be reclaimed immediately following construction (in the same or the next season) to minimize erosion effects on exposed bedrock and surficial deposit cuts.	General Pipeline	Closure	Geology, Soils, Surface Water Hydrology, Vegetation
P21	The project design includes in-place abandonment of all subgrade pipeline; eliminating impacts that would occur if pipe were removed.	General Pipeline	Closure	Soils, Vegetation
P22	The pipeline route has been selected, and will continue to be refined in detailed design, to avoid slope stability hazards as much as feasible and practical.	General Pipeline	Construction, Operations	Geohazards, Reliability and Safety

Table 5.2-1: Design Features

I.D.	Design Feature Description	Sub Component	Phase	Resources
P23	Main line valves (block valves) would be placed at intervals of no more than 20 miles along the length of the pipeline.	General Pipeline	Construction, Operations	Pipeline Reliability and Safety

5.3 BEST MANAGEMENT PRACTICES AND PERMIT REQUIREMENTS

Donlin Gold would follow BMPs and industry standards required to comply with regulations and standard permit requirements that are designed to reduce impacts to the environment (SRK 2012a, 2013b). The Corps took these BMPs and permit requirements into consideration when assessing the impacts of the project on the resources as described in Chapter 3, Environmental Analysis.

Relevant permits and regulatory requirements are described in Section 1.10 (Chapter 1, Purpose and Need). Among these are the Clean Water Act (CWA), which in part requires APDES water quality permits for waste water discharges (including stormwater), and the Clean Air Act (CAA), which requires air quality permits and other BMPs (e.g., EPA 2015).

Under the CWA and Oil Pollution Act (OPA) regulations (40 CFR Part 112), the EPA requires facilities that store, use, and manage petroleum products to develop Spill Prevention, Control and Countermeasure (SPCC) Plans and Facility Response Plans (FRP).

Under Sections 165 and 502 of the CAA (42 USC 7401 et seq.), the ADEC is delegated authority to issue air quality permits for facilities operating within state jurisdiction for the Title V operating permit (40 CFR Part 70) and the Prevention of Significant Deterioration (PSD) permit (40 CFR 52.21) to address air pollution emissions. The EPA maintains oversight authority of the State's program.

The project will require ROW authorizations from the BLM and ADNR for the natural gas pipeline. BLM regulations at 43 CFR 2885.11(b) allow the BLM to require that a holder of a ROW grant or temporary use permit furnish a bond, or other security satisfactory to secure all or any of the obligations imposed by the ROW grant and temporary use permits and applicable laws and regulations. The Alaska Department of Natural Resources' (ADNR's) State Pipeline Coordinator's Office (SPCO) issues ROW leases for pipeline transportation systems that are on or cross state lands. Applicants for a ROW lease are required to prepare a plan detailing a comprehensive array of topics including surveillance and monitoring, incident reporting, completion of use, changes in condition, fire prevention and suppression, health and safety, protection of cultural resources, hunting, pollution control, disturbance of natural waters, erosion and sedimentation, excavated material, restoration and revegetation, fish and wildlife protection, use of explosives, contingency plans, corrosion, lighting protection, seismic, fault displacement, soil and ice movement, land and surface disturbance, pipe/soil interaction, and rivers, streams, and floodplains. The SPCO reviews plans in coordination with other state agencies and develops project-specific stipulations that are required as part of the ROW lease. An Oil Discharge Prevention and Contingency Plan (ODPCP), required by the Alaska Department of Environmental Conservation (ADEC) under 18 AAC 75.425, describes the response actions, equipment, procedures, and other required elements necessary to rapidly respond to and manage an oil spill response.

A partial list of more prominent BMPs and standard permit conditions that would be required for the Donlin Gold Project includes:

- Implementation of Stormwater Pollution Prevention Plans (SWPPPs) and/or Erosion and Sediment Control Plans;
- Development and maintenance of ODPCPs, SPCC Plans, and FRPs;

- Use of BMPs such as watering and use of dust suppressants to control fugitive dust;
- Preparation and implementation of a Stabilization, Rehabilitation, and Reclamation Plan;
- Compliance with ADNR Dam Safety requirements through certificates of approval to construct and operate dams;
- Appropriate bonding / financial assurance required by ADNR;
- Monitoring of water withdrawals to ensure permitted limits are not exceeded;
- Preparation of a Wildlife Avoidance and Human Encounter / Interaction Plan;
- Verification that project vessels are equipped with proper emergency towing equipment in accordance with 18 AAC 75.027(f);
- Development of Blasting Plans;
- Non-native Invasive Species Prevention Plans;
- Compliance with Section 106 Programmatic Agreement and Cultural Resources Management Plan, including adequate survey prior to ground-breaking activities and protocol for inadvertent discovery of cultural resources;
- Verifying pipeline integrity with visual and other non-destructive inspections of welds, hydrostatic testing, use of in-line inspection tools, and aerial inspections; and
- Use of cathodic protection (specific method to be determined in final design) for corrosion protection of the steel pipeline.

5.4 STRAIN-BASED DESIGN SPECIAL PERMIT CONDITIONS

Donlin Gold anticipates there will be areas along the pipeline with potentially frost unstable soils or ground movement, and intends to request a Special Permit from PHMSA to allow Strain-Based Design (SBD) of segments of the pipeline. SBD involves advanced metallurgy and engineering to allow the pipe to deform in the longitudinal direction and better maintain its integrity and safety. PHMSA issues special permits only when consistent with pipeline safety. PHMSA imposes conditions on the grant of special permits to assure safety and environmental protection in accordance with 49 CFR 190.341. PHMSA is required to comply with NEPA in deciding whether to issue the special permit. Appendix E includes draft special permit conditions.

The Special Permit would include conditions to ensure the pipeline has equal or greater safety than a pipeline constructed in accordance with 49 CFR Part 192. Appendix E of this Draft EIS is the Application for this Special Permit and lists those conditions that take into account the material, design, construction, and operations and maintenance (O&M) parameters, which a pipeline operated using SBD must incorporate during its operating life cycle.

5.5 CORPS-CONSIDERED MITIGATION

Mitigation measures listed in this section were developed for consideration by the Corps and cooperating agencies after review of the Preliminary Draft EIS and were the subject of the mitigation workshop in summer 2015. During the NEPA process it is important to note that the

mitigation identified in the EIS may not be required by the Corps and BLM in their RODs. For example, there may be some mitigation identified in the EIS that is not within the federal agencies' authority to require as a stipulation to a permit. The ROD would identify those mitigation measures that the agency has committed itself to adopt and explain why any other practicable mitigation measures have not been adopted.

The Corps is considering measures to further avoid, minimize and mitigate project impacts. These draft measures were developed by the Corps based on analysis of project impacts, input from federal, state and Tribal cooperating agencies (see Table 5.5-1). For unavoidable impacts to aquatic resources, Donlin Gold will propose compensatory mitigation. All compensatory mitigation required by the Corps must be directly related to the impacts of the proposed project, appropriate to the scope and degree of those impacts, and reasonably enforceable.

The additional measures that the Corps is considering to avoid or minimize project impacts to the environment are listed below along with the resources that would be impacted. The Corps will continue to refine required mitigation subsequent to completion of the EIS and issuance of the ROD during the Section 10/404 permit application review process. Additional mitigation identified during that process may include project modifications that are in part considered feasible from a cost and constructability perspective.

Based on recommendations from the mitigation workshop, Table 5.5-1 is organized by six columns: mitigation ID number (which is referenced in resource-specific environmental consequences discussions); mitigation measure description; feasibility/likelihood of effective mitigation; the specific resources affected; permit and agency/authority; and voluntary/or requirement. Two of these columns - feasibility/likelihood of effective mitigation and voluntary/or requirement – are in response to NEPA guidance that balances the need for a thorough look at potential mitigation measures with the emphasis on mitigation measures that can be practicably and legally implemented under agency authority. The information in these columns is an initial assessment that will be modified and/or further detail added based on agency and public review comments. In particular, assessment on whether mitigation measures are voluntary or required will be determined (TBD) based on review comments.

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 1	Restore flat-to-gently sloping wetlands by removal of fill at project closure where feasible. Removed fill would be moved to approved upland areas. Details would be developed as Donlin Gold's Conceptual Compensatory Mitigation Plan is developed and as design and permitting progress. Those details do not exist at the DEIS stage.	Effective: Yes Feasible/practicable: Yes	Surface Water Hydrology, Water Quality Vegetation, Wetlands	CWA Section 404/Corps	TBD
Mit 2	Train site construction managers to oversee work of specialists in wetland recognition, permit stipulations, and BMPs.	Effective: Yes Feasible/practicable: Yes	Wetlands	CWA Section 404/Corps	TBD
Mit 3	Reduce the risk of electrocution of raptors from above ground power lines by following nationally recognized design guidelines for avian protection. An example of a national recognized guideline is the "Suggested Practices of Avian Protection on Power Lines: The State of the Art in 2006" (APLIC 2012).	Effective: Yes Feasible/practicable: Yes	Wildlife	USFWS	TBD
Mit 4	After mining is completed, Donlin should consider replacing culverts along the mine access road with low water crossings to minimize long-term effects of extreme precipitation events and climate change.	Effective: Yes Feasible/practicable: Yes	Surface Water Hydrology, Climate Change	CWA Section 404/Corps	TBD
Mit 5	Additional investigation should be considered prior to pipeline construction to map the specific location of potential contaminated soils at the Farewell airstrip (all alternatives), North Foreland barge landing (Alternative 3B only), Tyonek-Beluga pipeline trench segment (Alternative 3B only), and Puntilla airstrip (Alternative 3B only) compared to final grading plans, so that disturbance of these soils can be avoided if possible, and the level of effects reduced to low likelihood and intensity.	Effective: Yes Feasible/practicable: Yes	Soils	ADEC	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 6	Seismic stability analyses of the southern pit wall in the post-closure period indicate a low probability of high intensity effects in the event that a larger earthquake occurs than is assumed in the BGC (2014j) analysis. Further analysis using a higher level seismic event, and/or discussion with permitting agencies as to acceptable level of risk for the post-closure pit, should be considered in final design. In addition, experience would be gained during operations as to performance and deformation of the pit walls, and modifying the location of the waste rock backfill accordingly (as a buttressing effect) could increase the post-closure stability of the pit (BGC 2014j).	Effective: Yes Feasible: Yes; may have practicability/cost considerations	Geohazards and Seismic Conditions	ADNR	TBD
Mit 7	Specific plans for borrow site reclamation would be completed in a later phase of the project. In addition to standard BMPs for contouring, drainage, and erosion controls (Section 3.2, Soils), reclamation should consider creating ponds and/or stream connections for fish and wildlife habitat at borrow sites in low lying areas (e.g., at Getmuna Creek) in accordance with ADEC and ADF&G guidance (Shannon & Wilson 2012; McClean 1993).	Effective: Yes Feasible/Practicable: Yes	Geology, Surface Water Hydrology, Water Quality, Vegetation, Wetlands, Wildlife, Fish and Aquatic Resources, Subsistence	BLM, ADNR	TBD
Mit 8	Closure of borrow sites along the mine access road and pipeline, particularly those near communities and major river crossings, would be intended to preclude use of these resources by future users. However, depending on permitter/stakeholder/ landowner interest, consideration should be given to leaving accessible borrow sites open beyond project closure. This may mitigate area wide geologic impacts, through use of existing sites, rather than opening of new sites for borrow materials. A local entity would need to take responsibility for management and ultimate closure of the borrow sites. Per regulation, ADNR may not be able to close use of a borrow site near a community.	Effective: Yes Feasible/practicable: Dependent on local entity management State of Alaska has indicated implementation concerns.	Geology, Socioeconomics, Transportation	BLM, ADNR	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 9	There is a potential for scientifically important pre-Quaternary paleontological resources (dinosaur fossils) to be found during ground disturbing operations. Donlin has submitted an initial draft of a Cultural Resources Management Plan which includes management of cultural and paleontological resources on BLM, State, and private land. The plan would prescribe an effective process for managing potential effects on these resources, and ensure that agreed-upon and approved procedures are established. At a minimum, the plan would include: · Training of workers regarding cultural resource issues and responsibilities; · Measures to avoid or minimize impacts to cultural resources (e.g., flagging, monitoring); · Standard protocols for any known cultural resources that may be exposed during project construction, operations, and reclamation; · Prescribed actions to be taken in the event that unanticipated cultural resources are discovered, or known resources are impacted in an unanticipated manner; and · Protocols for treatment of any discovered human remains. The plan should also include procedures for notification, documentation, sampling, and curation in the event that important fossils are found.	Effective: Yes Feasible/practicable: Yes	Geology, Cultural Resources	BLM, ADNR	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 10	WRF design criteria and plans for excavation at the WRF incorporate assumptions with regard to depth of permafrost. Seismic analysis of the WRF indicates the possibility of instability in the event that liquefiable ice-rich soils are present beneath the WRF deeper than is currently known. If fine-grained and/or ice-rich soil conditions are present deeper than expected, the stability of the soils as they thaw is uncertain and could result in high intensity effects downgradient in the event of WRF deformation or slope failure (Section 3.2.3.2.3, Soils). Further investigation and revised seismic stability analysis of the WRF design criteria and plans for excavation at the WRF toe should be considered to determine if deeper liquefiable materials exist and would require additional excavation during site preparation.	Effective: Yes Feasible/practicable: Yes	Soils, Geohazards and Seismic Conditions; Impact is potential instability of built up area of WRF.	ADNR	TBD
Mit 11	The season of final pipeline termination and reclamation activities is not specified in current pipeline plans (SRK 2013b). To the extent practicable, closure activities should occur during the winter season (similar to construction) to minimize surface disturbances to soil and erosion potential.	Effective: Yes Feasible/practicable: Yes	Soils	BLM, ADNR	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 12	Develop an HDD plan for each HDD river crossing to reduce potential effects from "frac-out," which can occur if drilling fluids are lost into fractures or voids and released into the river above. Plan elements typically include: · Findings of geotechnical investigations, geologic cross-sections, construction drawings, and specifications; · Cross-sections should include vertical and lateral extent of channel migration zone to avoid river scour exposing the pipe during operations and post-closure; · Construction techniques, including information on equipment layout, welding, surveying, grouting, and disposal of spoils and drilling fluids; · Description of the drilling fluid system, identification of points where potential failure would occur (pilot hole, hole reaming, and pullback), and prevention measures; · Mud management plan to track that the amount of drilling mud going into the system is the same as that coming out; · Turbidity monitoring during drilling, both upstream and downstream of the crossing; and · Spill contingency plan for a release underwater or to the ground.	Effective: Yes Feasible/practicable: Yes	Geohazards and Seismic Conditions, Surface Water Hydrology	ADNR, BLM	TBD
Mit 13	House compressors and electric motors in metal-framed and sided buildings with sound insulation designed into the wall thickness, as practicable. If practicable, use specially-quieted equipment such as quieted and enclosed air compressors and properly-working mufflers on engines.	Effective: Yes Feasible/practicable: Yes	Noise and Vibration, Recreation	OSHA	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 14	Erosion Sediment Control measures specified for snow stockpiles along the ROW include water diversion ditches leading to energy dissipators. Additional measures such as settling ponds, silt fences, or sediment barriers should be considered to minimize the amount of sedimentation from snowmelt.	Effective: Yes Feasible/practicable: Yes	Water Quality, Wetlands	ADEC	TBD
Mit 15	The South Overburden Stockpile (SOB) is composed of materials that are potentially metal leaching. The proposed diversion channels and sediment pond may not be adequate to capture groundwater beneath the SOB that could become contaminated from seepage/leachate and flow towards Crooked Creek. One of the following options should be considered for this facility: 1. Hydraulic containment (deep sump as part of sediment pond) and downgradient monitoring wells. The feasibility of digging a deep sump should be evaluated further during design work; 2. Physical containment (liner beneath SOB and sediment pond); or 3. Additional studies during design work (fate and transport groundwater modeling) to demonstrate a lack of substantial groundwater volume that would result in no serious impact on the creek, as a result of natural attenuation of a small temporary slug of contaminated groundwater. In all cases, the sediment pond should be equipped with redundant and freeze-protected pumping systems, and the sediment excavated and properly disposed of at closure.	Effective: Yes Feasible/practicable: Yes	Groundwater Hydrology, Water Quality	ADEC	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 16	Riparian bank vegetation material should be left intact or stored for replacement on the disturbed banks to stabilize and restore the crossing. Monitoring of crossing sites to identify sites that need additional restoration to prevent bank erosion should be implemented after construction. At stream bank crossings, placement of riparian matts or root masses would prevent and facilitate rapid vegetation regrowth to prevent bank erosion.	Effective: Yes Technically Feasible/ Practicable: In limited situations where salvaged material can be stored nearby and reused in a timely way.	Vegetation, Wetlands	ADNR	TBD
Mit 17	Use mats or other appropriate types of ground protection to minimize disturbance to ground vegetative cover during non-winter construction.	Effective: Yes. Less so in rough terrain. Technically Feasible/ Practicable: May be practicability limitations in very remote areas and in rough terrain.	Vegetation, Wetlands	ADNR	R
Mit 18	Salvage and replace the native vegetation mat in wetlands, and/or re-establish wetland vegetation that is typical of the general area, where practicable.	Effective: Yes Technically Feasible/ Practicable: In limited situations where salvaged material can be stored nearby and reused in a timely way.	Vegetation, Wetlands	ADNR	TBD
Mit 19	Reduce construction ROW width to 85 feet where protective mats are required to minimize disturbance to ground vegetative cover, where practicable.	Effective: Yes Technically Feasible/ Practicable: Yes; may be practicability limitations in very remote areas and in rough terrain.	Vegetation, Wetlands	ADNR	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 20	Mark wetland boundaries and vegetation clearing limits with flagging or other markers to prevent crews from damaging more vegetation than needed during construction.	Effective: Yes Technically Feasible/ Practicable: Yes	Vegetation, Wetlands	ADNR	TBD
Mit 21	Use large surface area/low impact tires on or near wetlands to help reduce equipment impacts.	Effective: Yes Technically Feasible/ Practicable: Yes; may be practicability limitations in very remote areas and in rough terrain.	Vegetation, Wetlands	ADNR	TBD
Mit 22	Develop and maintain a native species seed bank for reclamation and restoration practices. Develop and implement test vegetation plots to determine potential revegetation success with native and local plant material and seeds (including lichens and mosses).	Effective: Yes Technically Feasible/ Practicable: Yes to the extent of propagation and test plot success (variable).	Vegetation	ADNR (Plant Materials Center), BLM	TBD
Mit 23	For winter pipeline construction access roads, frost pack muskegs and wetlands (the combination of covering with snow and driving on it causes freezing at depth and provides a slightly elevated running surface) to minimize impacts to vegetative ground cover and wetlands.	Effective: Yes Technically Feasible/ Practicable: Yes; may be practicability limitations depending on winter weather conditions and access.	Vegetation, Wetlands	ADNR	TBD
Mit 24	Where appropriate include mannagrass (*Glyceria striata*) species or other confirmed sensitive and rare plant species identified in the Project Area as part of the seed mix used in the Reclamation Plan to mitigate for loss of habitat.	Effective: Yes Technically Feasible/ Practicable: Yes to the extent of collection and propagation success (variable).	Vegetation	ADNR (Plant Materials Center), BLM	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 25	Where practicable and in compliance with FAA and safety requirements, establish minimum flight altitudes (>1,000 feet is recommended) to minimize impacts to Dall sheep and caribou when these animals are present in the vicinity of the work.	Effective: Yes Technically Feasible/ Practicable: In most conditions.	Wildlife, Subsistence	ADF&G	TBD
Mit 26	Promote salvaging and re-spreading topsoil over the overburden piles and allowing native vegetation and native seed planting vegetation growth to keep topsoil viable until it is needed during final reclamation. In pipeline reclamation practices, segregate windrowed organic soils as cover material (where present). Unless this material comes from the existing topsoil, it should not be used on the top of the trench as subsoil has no viable seed or other organic matter. Good construction practices include taking time to blade the layer of topsoil before trenching the pipeline.	Effective: Yes Technically Feasible/ Practicable: Yes, to the extent space is available for topsoil storage or topsoil is available for reclamation.	Soils, Vegetation	ADNR	TBD
Mit 27	Minimize use of an impact pile driver where practicable in noise and vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver are quieter and cause lower vibration levels where the geological conditions permit their use.	Effective: Yes Technically Feasible/ Practicable: Yes	Noise and Vibration, Recreation	FWS, NMFS	TBD
Mit 28	Install signs that clearly distinguish trails from the pipeline ROW at points where the pipeline crosses trails to guide trail users to stay on the trail and off of the pipeline ROW where the two are not co-located. As practicable, revegetate, or otherwise block access to, a narrow strip of the pipeline ROW where it crosses the trail to help steer and keep trail users on the trail and reduce the visual effect of the pipeline ROW crossing.	Effective: Yes Feasible: Yes Practicable: Yes	Recreation, Visual	ADNR, BLM	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 29	Review the success and practicability of measures that were taken to prevent or minimize adverse effects on visual resources on other linear projects, including the Trans-Alaska Pipeline System (TAPS), the Dalton Highway, the Elliott and Parks Highways, and the Anchorage-to-Fairbanks Intertie, and incorporate successful measures into the design and location of the pipeline where reasonable and appropriate.	Effective: Yes Feasible: Yes Practicable: Possibly	Visual Resources	ADNR, BLM	TBD
Mit 30	When clearing brush and shrubs as required to maintain the operations ROW, introduce variation in the edges of clearing (i.e. avoid extended straight lines) to minimize effects to visual resources, to the extent practicable.	Effective: Yes Feasible: Yes Practicable: Possibly	Visual Resources	ADNR, BLM	TBD
Mit 31	Donlin Gold should use current information and traditional knowledge to identify locations and times when subsistence activities occur, and to the extent practicable, minimize impacts to these activities.	Effective: Yes Feasible: Yes Practicable: Yes	Subsistence	ADNR, EPA, TKC, other ANCSA Village Corporations with river-bank land holdings	TBD
Mit 32	During project construction, operations, and closure, communication between the applicant and subsistence users to ensure dissemination of factual information concerning actual ecological risks and potential exposure of waterfowl to contamination is important to address concerns and perceptions about contamination. This may include monitoring and testing of bird carcasses, if appropriate.	Effective: Yes Feasible: Yes Practicable: Yes	Subsistence, Human Health	ADNR , EPA, TKC, other ANCSA Village Corporations with river-bank land holdings	TBD
Mit 33	Two-way communications strategy should be implemented that keeps local communities informed of the schedules and current status of barge traffic, and keeps Donlin informed of the location and timing of commercial and subsistence fishing activities. Plan of communication needs to include Bethel, as there is a lot of traffic moving through Bethel Port.	Effective: Yes Feasible: Yes Practicable: Yes	Subsistence (fishing), Human Health	ADNR, EPA, TKC, other ANCSA Village Corporations with river-bank land holdings	TBD

Table 5.5-1: Mitigation Measures being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mit 34	To the extent practicable, to mitigate visual impacts to sensitive cultural resources, clear a narrower construction ROW through sensitive areas, use HDD drilling under sensitive features, make a slight realignment of the construction ROW to avoid sensitive areas, and other appropriate measures.	Effective: Yes Feasible: Yes Practicable: Yes	Visual Resources	ADNR, BLM	TBD

Notes:

* In some cases, agency authority may require consultation with the listed entity.
TBD = Whether the measure is required or voluntary would be determined later in the process. At this time, it is not known which mitigation measures will be contained in the ROD or as stipulations in permits.

5.6 COMPENSATORY MITIGATION

Compensatory mitigation is a critical tool to help the federal government meet the longstanding national goal of "no net loss" of wetland acreage, function, and value. For projects authorized under Section 404, compensatory mitigation is not considered until all appropriate and practicable steps have been taken to first avoid and then minimize adverse impacts to the aquatic ecosystem pursuant to 40 CFR Part 230 (i.e., the CWA Section 404(b)(1) Guidelines) Regulatory standards and criteria for the use of compensatory mitigation to offset unavoidable impacts to waters of the U.S., including wetlands, authorized under the CWA, were established on April 10, 2008 under 33 CFR Part 332 (Corps) and 40 CFR Part 230 (U.S. Environmental Protection Agency [EPA]). Compensatory mitigation is used for permanent and temporal resource losses that are specifically identifiable, reasonably likely to occur, and of importance to the human or aquatic environment. Compensatory mitigation may include: 1) restoration of previously existing wetlands or waters, 2) enhancing or improving functions of existing wetlands or waters, 3) creation of new wetlands or waters, or 4) preservation of existing wetlands or waters. Compensatory mitigation may be provided through permittee-responsible mitigation activities, or as payment for preserving existing wetlands through mitigation banks or in-lieu fees. As discussed in Section 3.11.1 Wetlands, and Appendix M, Donlin Gold has developed a conceptual Compensatory Mitigation Plan in coordination with federal, state, and local governments and landowners. Specific compensatory mitigation for the proposed Donlin Gold Project would be determined by the Corps during its review of the Section 10/404 permit applications and included in the ROD and approved permit.

The BLM may also require compensatory mitigation for impacts that cannot be avoided or minimized. BLM's authority to require compensatory mitigation is derived from:

> Secretarial Order 3330, *Improving Mitigation Policies and Practices of the Department of the Interior* (DOI 2013). The Secretarial Order states that, "for impacts that cannot be avoided or effectively minimized, the Department should seek ways to offset or compensate for those impacts to ensure the continued resilience and viability of our natural resources over time."
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> *Federal Land Policy and Management Act (FLPMA)* (1976). Under FLPMA, the BLM has the responsibility to manage the public lands for multiple use and sustained yield. FLPMA requires that "Use of the public lands….minimize adverse impacts on the natural, environmental scientific, cultural, and other resources and values….of the public lands involved." 43 U.S.C. § 1732(d)(2)(a).
>
> *BLM Regional Mitigation Manual MS-1794.* Agency policy allows the BLM to condition land use authorization on the successful performance of compensatory mitigation either on- or off-site from the impacts (BLM 2015f).

5.7 MITIGATION MONITORING AND ADAPTIVE MANAGEMENT

Monitoring is an important part of mitigation strategy so the effectiveness of mitigation efforts can be assessed. A monitoring program should clearly describe monitoring objectives, performance standards, monitoring methods, a schedule, and reporting. If performance standards are not being met, mitigation can be adjusted as appropriate. Draft measures for monitoring and adaptive management are included as Table 5.7-1. This table is organized in a

fashion similar to Table 5.5-1, based on recommendations from the mitigation workshop, and has similar guidance on its current content.

The Corps will require that Donlin Gold prepare a mitigation monitoring and adaptive management plan to monitor success of mitigation efforts that includes a process for making changes to or adding mitigation as needed. This plan would be submitted to the Corps and cooperating agencies for review and approval in draft form prior to publishing the Final EIS. The plan should clearly identify, at a minimum:

- Performance standards;
- Where and when monitoring will take place;
- Monitoring goals and objectives;
- Who will be responsible for monitoring;
- How the information will be evaluated;
- What actions (contingencies, adaptive management, corrections to future actions) will be taken based on the results of monitoring; and
- How the public can get information on mitigation effectiveness and monitoring results.

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 1	In order to reduce the potential for a breach to occur at the narrow geomorphic barrier between the Crooked Creek floodplain and the northwest pit crest, BGC (2014j) suggests several possible options. These could be considered during detailed design, and reassessed during operations and closure preparation as part of an adaptive management strategy, based on actual slope performance and geometry and future climate conditions: The cut slope angle in overburden at the top of the crest could be reduced by flattening and armoring with coarse rock fill to increase the stability of the slope and reduce the likelihood of erosion at flood stage. A berm or diversion dike could be placed at the crest of the pit to limit the likelihood of Crooked Creek reaching the pit crest at flood stage. A retaining wall could be constructed on the first bedrock bench below the crest to improve stability of the soil excavation at the crest.	Effective: Yes Feasible: Yes; may have practicability/cost considerations	Geohazards and Seismic Conditions, Water Quality	ADNR	TBD
Mon 2	Monitor the American Creek Landslide during construction of the Lower CWD for indications of downslope movement and the need for additional mitigation measures beyond the planned stabilization berm. If warranted, adaptive management measures could include lowering of the water table through pumping wells, temporary buttressing of the slope, additional excavation of overburden, or layback of the slope crest to a stable configuration (BGC 2011c).	Effective: Yes Feasible/practicable: Yes	Geohazards and Seismic Conditions	ADNR	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 3	To minimize the effects of climate change, reexamine the continuing applicability of key portions of the water balance model on approximate 10-year intervals as determined by the data collected and operational or closure conditions and experiences. For example, current mine plans for the pit lake during closure indicate that the water level would be monitored and pit lake model recalibrated as data become available. It is recommended that climate change precipitation predictions also be reevaluated periodically in post-closure, and incorporated into water balance and groundwater model updates, in order to adequately anticipate climate change effects on pit filling and other project structures such as reclaim components.	Effective: Yes Feasible/practicable: Yes	Surface Water Hydrology, Groundwater Hydrology	ADNR	TBD
Mon 4	Include monitoring and inspection of stream banks on Crooked Creek and tributaries where water will be discharged, and response with appropriate streambank protection, in order to ensure erosion of stream banks does not occur.	Effective: Yes Feasible/practicable: Yes	Surface Water Hydrology	ADNR	TBD
Mon 5	To characterize winter low flow conditions during construction, operations, and closure, expand current surface water monitoring program to include quarterly monitoring, evenly spaced and including winter monitoring.	Effective: Yes Feasible/practicable: Yes	Surface Water Hydrology	ADNR	TBD
Mon 6	Recommend adding the upstream monitoring site DCBO as control point for monitoring water quality and discharge.	Effective: Yes Feasible/practicable: Yes	Surface Water Hydrology	ADNR	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 7	The groundwater flow model should be reexamined 3 years after the commencement of pit dewatering to minimize uncertainty about the effects of the dewatering activity, with a 5-year review frequency thereafter, or when noteworthy unexpected conditions are encountered. Unexpected conditions should be used to revise projections and adjust management plans as needed. As required by permit conditions, relevant groundwater data (such as production rates and water table levels) should be collected as mining progresses to facilitate model revisions.	Effective: Yes Feasible/practicable: Yes (could be part of adaptive management program)	Surface Water Hydrology, Groundwater Hydrology	ADNR	TBD
Mon 8	The monitoring plan and data evaluation details should be elaborated upon to describe the proposed approach to statistical comparisons with baseline data, and how it will be determined that water quality standards have been met and management activities can change. For example, the closure and removal of the SRS under Alternative 2 should include details such as the timeframes for data collection, numbers and sources of samples, and statistical evaluation of the data compared to WQS and baseline. Groundwater monitoring should occur at locations downstream of mine facilities in both alluvial and deeper bedrock aquifers.	Effective: Yes Feasible/practicable: Yes	Groundwater Hydrology, Water Quality	ADEC	TBD
Mon 9	The potential exists for arsenic and/or other metals leaching and ARD formation from overburden taken from the pit and TSF areas and stored in stockpiles near Crooked Creek. Water quality monitoring should be conducted during operations in the sedimentation ponds downgradient of the North and South overburden stockpiles, as well as in Lewis Gulch for the North overburden pile. Monitoring results would form the basis for additional adaptive management measures (such as increased pumping or pond size) to reduce potential water quality effects.	Effective: Yes Feasible/practicable: Yes	Water Quality, Fish and Aquatic Resources	ADNR/ADEC	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 10	Additional alluvial and/or bedrock groundwater monitoring wells should be considered at locations downgradient of mine facilities not already covered by the existing monitoring network (e.g., overburden stockpiles), where sufficient alluvial aquifer material is present that could represent a pathway to Crooked Creek, and bedrock groundwater is not captured by the pit cone of depression.	Effective: Yes Feasible/practicable: Yes	Water Quality	ADNR/ADEC	TBD
Mon 11	The pond collecting the flow from the drain layer of the TSF cover is planned to be monitored quarterly during Years 6 through 10 post-closure. It is recommended that drainages from the non-acid generating (NAG) WRF and the isolated PAG cells also be monitored on a quarterly basis to allow evaluation of seasonal variability and the effects that variability may have on the pit lake stratification when these waters are pumped to the deep layers of the pit lake.	Effective: Yes Feasible/practicable: Yes	Water Quality	ADNR/ADEC	TBD
Mon 12	According to the Water Resources Management Plan (SRK 2012b), surface and groundwater monitoring systems in closure would remain in place "up to and possibly beyond 30 years, depending on compliance history" until each facility has stabilized, physically and chemically, to the satisfaction of regulatory agencies. The PAG 5 rock in the WRF is not predicted to produce ARD for several decades (SRK 2007). Therefore, ARD may not develop in the NAG portion of the WRF until after the 30 years of suggested monitoring. Accordingly, it is recommended that long-term, semi-annual (after spring melt and in late summer) monitoring and sampling of the NAG WRF seepage continue long-term.	Effective: Yes Feasible: Yes; may have practicability/cost considerations	Water Quality	ADNR/ADEC	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 13	Beginning at closure, semi-annual pit lake monitoring (after spring melt and in late summer) is recommended for collection of in-situ temperature and total dissolved solids (TDS) (or the related measurement of specific conductance) at 20-foot depth intervals from the surface through the pycnocline, and then every 100 feet to the bottom, noting the depth of the discharge end of the pipe from the TSF and WRF. The goal would be to evaluate whether the pit lake is stratified, whether the water being delivered at depth is aiding or detracting from the optimal pit lake stratification, and whether the pumped water from the TSF, WRF, or other source would improve stratification if pumped to an alternate depth. In addition, Pitmod, or an equivalent pit lake model using the latest groundwater modeling results, should be re-run 3 years after the cessation of groundwater dewatering of the pit and every 5 years thereafter, to predict the estimated duration of the pycnocline and evaluate whether groundwater and reclaimed WRF runoff and seepage water delivered below the pycnocline would tend to shorten its lifespan. Based on the modeling results, piped water from the reclaimed WRF and any other controlled water inputs to the lake should be delivered to the pit lake at such a depth so as to maximize the lifespan of the pycnocline while minimizing adverse impacts to surface water quality at the surface of the lake.	Effective: Yes Feasible/practicable: Yes	Water Quality	ADNR/ADEC	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 14	The formation and long-term stratification of pit lakes are complex phenomena. Scientific knowledge is incomplete and the modeling of pit lakes is as yet an inexact science. As such, order-of-magnitude or more uncertainties exist in the predicted concentrations of constituents of interest in the post-closure pit lake surface water. Thus, it is possible that the currently envisioned post-closure WTP may not be adequate to treat pit lake water. Accordingly, it is recommended that the adequacy of proposed post-closure WTP technology be reevaluated as pit lake water monitoring is conducted; that the reevaluation be added to the reclamation plan and financial assurance requirements; and that treatment technologies be adjusted as necessary as a result of this evaluation.	Effective: Yes Feasible: Yes; may have practicability/cost considerations	Water Quality, Climate Change	ADNR/ADEC	TBD
Mon 15	The Stabilization, Rehabilitation and Reclamation (SRR) Plan would cover pipeline termination activities (SRK 2013a), but not necessarily post-closure monitoring by Donlin Gold, which may be required to mitigate long-term effects from climate change such as thaw settlement on the ROW or scour effects in drainages if the abandoned pipeline is uncovered. The need for monitoring and rehabilitation in post-closure should be addressed in the revised SRR Plan prior to closure, and additional financial assurance considered to cover these activities.	Effective: Yes Feasible: Yes; may have practicability/cost considerations	Soils, Climate Change	ADNR, BLM	TBD
Mon 16	Monitoring of bank erosion upstream and downstream of Jungjuk port and consideration of streambank protection as part of adaptive management plan if warranted. This may include installation of geotextile matting, riprap armoring or methods from ADF&G's Streambank Revegetation and Protection Manual (Walter et al. 2005) to reduce the effects of eddy formation, scour, and bank erosion during flood events (BGC 2014e).	Effective: Yes Feasible/practicable: Yes	Soils, Surface Water Hydrology, Wetlands	Corps	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 17	Collection of additional groundwater quality data in Anaconda valley upgradient of the TSF should be considered prior to construction in order to establish site-specific background conditions that are pertinent to future monitoring and decommissioning of the SRS. This might involve installation of 1 to 2 additional monitoring wells east and southeast of the TSF.	Effective: Yes Feasible/practicable: Yes	Groundwater Hydrology, Water Quality	ADEC	TBD
Mon 18	Based on performance of the Seepage Recovery System in operations, consider an additional well field and/or pond that acts as a secondary containment system to the SRS downgradient of the SRS. This measure should be considered to minimize the likelihood of an extended pumping failure in Alternatives 2 and 5A.	Effective: Yes Feasible/practicable: Yes	Groundwater Hydrology	ADNR/ADEC	TBD
Mon 19 Adaptive Management	Monitor Donlin tug-barge passages during the first years of construction to assess potential effects of barge traffic on riverbed scour, bank erosion, and nearshore velocities at variable depths and channel configurations, as well as fish habitat and fish passage. If needed, effects analysis of barge passage impacts would provide a basis for potential adaptive management.	Effective: Yes. Feasible / practicable: Yes.	Fish and Aquatic Resources	ADFG, EPA, TKC, other ANCSA Village Corporations with river-bank land holdings	TBD
Mon 20 Monitoring	Monitoring to evaluate the relationship between vessel speeds and wave heights of representative barge tows in potential hotspot areas during the first years of construction would help determine what barge operational measures are needed (if any) to minimize or avoid risks relative to the displacement and/or stranding of small outmigrant salmon and other young-of-year fishes, as well as commercial and subsistence fishing.	Effective: Possibly. Feasible / practicable: Possibly.	Fish and Aquatic Resources, Socioeconomics, Subsistence, Human Health	ADFG, EPA, TKC, other ANCSA Village Corporations with river-bank land holdings	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 21 Adaptive Management	Monitor potential effects of barge traffic and natural environmental parameters on rainbow smelt spawning areas. Should potential impacts of barge traffic be documented, consider adaptive management measures to minimize impacts on rainbow smelt such as directing barge traffic to deeper portions of the river channel while traveling in the vicinity of previously identified rainbow smelt spawning grounds between mid-May and late June depending on the annual timing of peak spawning activity. Monitoring of both physical environment impacts (e.g., water parameters) and biological impacts (fish spawning locations, etc.) associated with the range of potential barge impacts would allow clearer answers to adaptive management questions. Based on monitoring results, consider mitigation measures such as reduced barge speed during critical fish spawning and larval migration periods, to minimize prop scour impacts.	Effective: Possibly. Feasible / practicable: Yes, as an adaptive management measure based on monitoring.	Fish and Aquatic Resources	ADFG, EPA, TKC, other ANCSA Village Corporations with river-bank land holdings	TBD
Mon 22 Monitoring	Coordinate construction and operations phase fish population and water quality monitoring with agencies or working groups (such as the Kuskokwim River Salmon Management Working Group). Continue baseline project fish and water quality studies to help track possible incremental impacts for development of adaptive management strategies as necessary if impacts occur beyond what are expected.	Effective: Yes Feasible / practicable: Yes	Fish and Aquatic Resources, Water Quality	EPA, ADFG, TKC	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 23 Monitoring	As a condition of permitting, additional pre-construction baseline analysis of fish and aquatic resource habitat along the barge transport route should be conducted. Predicting the level of potential effects on fish and aquatic resources requires additional analyses based on the type of tug and barge combinations proposed for the project in order to assess the locations, magnitude, character, and extent of vessel-generated turbidities. Monitor fish and aquatic habitat along the barge route upstream of Bethel during the barging season to assess potential changes in habitat. If warranted, specific adaptive management measures to reduce adverse impacts would be considered.	Effective: Possibly Feasible / practicable: Possibly not.	Fish and Aquatic Resources	EPA, FWS	TBD
Mon 24 Monitoring	Fish tissue monitoring should include development of site-specific bioaccumulation factors for methylmercury evaluation. Contingency measures (adaptive management) should be developed and defined if impacts occur beyond what are expected.	Effective: Yes. Feasible / practicable: Yes.	Fish and Aquatic Resources, Water Quality, Human Health	ADEC, ADFG, EPA	TBD
Mon 25	Monitor reclaimed construction areas and other previously disturbed sites for revegetation to meet visual resource objectives. Take remedial action where expected revegetation success is not achieved.	Effective: Yes Feasible: Yes Practicable: Yes	Visual Resources	ADNR, BLM	TBD
Mon 26	Socioeconomic monitoring: Monitor socioeconomic conditions (population, demographics, employment, income, education, and health indicators) in Y-K villages using existing/annually updated state and federal statistics.	Effective: Yes Feasible: Yes Practicable: Yes	Socioeconomics, Human Health	ADHSS	TBD

Table 5.7-1: Monitoring and Adaptive Management being Considered by the Corps

I.D.	Mitigation Measure Description	Feasibility/ Likelihood of Effective Implementation	Specific Resource Affected	Permit & Agency/Authority*	Voluntary (V) or Requirement (R)
Mon 27	Conduct pre-construction surveys at stream crossings along the mine access road of suitable detail to be able to monitor erosion and deposition after culvert placement.	Effective: Yes Feasible: Yes Practicable: Yes	Surface Water Hydrology, Aquatic Resources	ADNR, Corps	TBD

Notes:

* In some cases, agency authority may require consultation with the listed entity.

TBD = Whether the measure is required or voluntary would be determined later in the process. At this time, it is not known which mitigation measures will be contained in the ROD or as stipulations in permits.