



DONLIN GOLD



ENVIRONMENTAL EVALUATION DOCUMENT

Donlin Gold Project



May 2013

www.DonlinGold.com

ENVIRONMENTAL EVALUATION DOCUMENT

Donlin Gold Project

May 2013



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

Prepared By:
ARCADIS
420 L Street, Suite 100
Anchorage, AK 99501

ACRONYMS AND ABBREVIATIONS	xxi
1.0 INTRODUCTION.....	1-1
1.1 Purpose and Use of the Environmental Evaluation Document	1-1
1.2 EED Format	1-1
1.3 Purpose and Need	1-2
2.0 PROJECT DESCRIPTION.....	2-1
2.1 Overview	2-1
2.2 Donlin Gold Project Components.....	2-1
2.2.1 Mining Methods and Phases	2-1
2.2.2 Mining Facilities	2-2
2.2.3 Milling Facilities and Processes	2-7
2.2.4 Tailings Storage Facility	2-8
2.2.5 Waste Rock Facility	2-9
2.2.6 Overburden Stockpiles	2-10
2.2.7 Infrastructure	2-10
2.3 Safety and Occupational Health	2-33
2.3.1 Communications.....	2-33
2.4 Reclamation and Closure Planning.....	2-37
2.4.1 Tailings Storage Facility	2-38
2.4.2 Waste Rock Facility	2-38
2.4.3 Pit Lake	2-39
2.4.4 Jungjuk Port, Donlin-Jungjuk Road, and Airstrip.....	2-39
3.0 AFFECTED ENVIRONMENT	3-1
3.1 Geology, Geochemistry, and Geotechnical	3-1
3.1.1 Geology	3-1
3.1.2 Geochemistry	3-13
3.1.3 Regolith	3-25
3.1.4 Soils.....	3-27
3.1.5 Geotechnical Considerations	3-37
3.2 Water Resources	3-55
3.2.1 Surface Water Hydrology, Facilities Study Area	3-55
3.2.2 Surface Water Hydrology, Natural Gas Pipeline Routes.....	3-71
3.2.3 Groundwater Hydrology, Facilities Study Area.....	3-92
3.2.4 Groundwater Hydrology, Pipeline Route	3-104
3.2.5 Surface Water Quality, Facilities Study Area	3-104
3.2.6 Surface Water Quality, Pipeline Route.....	3-123
3.2.7 Groundwater Quality, Facilities Study Area.....	3-123
3.2.8 Groundwater Quality, Pipeline Route	3-136
3.2.9 Sediment Quality, Waterway Transportation Corridor, and Crooked Creek	3-136

3.3	Meteorology	3-145
3.3.1	Regional Climate and Atmospheric Conditions	3-147
3.3.2	Meteorology in the Facilities Study Area	3-152
3.3.3	Climate Change.....	3-177
3.4	Air Quality	3-183
3.4.1	Facilities Study Area, Support Facilities, Donlin-Jungjuk Road and Jungjuk Port Site, Waterway Transportation Corridor, and Western Segment of the Pipeline Route.....	3-183
3.4.2	Pipeline Route, Eastern Segment	3-184
3.4.3	Federal Air Shed Designation	3-184
3.4.4	Air Quality Summary	3-184
3.4.5	Mercury in the Air	3-187
3.5	Noise.....	3-191
3.5.1	Facilities Study Area, Support Facilities, Jungjuk Port Site and Donlin-Jungjuk Road Corridor—Ambient Noise	3-192
3.5.2	Pipeline Route	3-192
3.5.3	Waterway Transportation Corridor – Ambient Noise.....	3-193
3.6	Vegetation.....	3-197
3.6.1	Overview of Vegetation in the Facilities Study Area and Associated Road/Port Sites	3-197
3.6.2	Overview of Vegetation along the Pipeline Route	3-198
3.6.3	Vegetation Types	3-201
3.6.4	Distribution of Vegetation Types in the Facilities Study Area and Associated Road/Port Sites.....	3-206
3.6.5	Distribution of Vegetation Types along the Pipeline Route	3-210
3.7	Wetlands.....	3-259
3.7.1	Location and Extent of Wetlands in the Donlin Gold Project Area	3-259
3.7.2	Wetland Types	3-277
3.7.3	Hydrogeomorphic Classification.....	3-284
3.7.4	Wetland Functions.....	3-300
3.8	Aquatic Resources.....	3-305
3.8.1	Facilities Study Area.....	3-305
3.8.2	Pipeline Route.....	3-331
3.8.3	Waterway Transportation and Donlin-Jungjuk Road Corridors	3-345
3.9	Wildlife	3-351
3.9.1	Mammals, Facilities Study Area	3-378
3.9.2	Mammals, Pipeline Route	3-393
3.9.3	Marine Mammals, Waterway Transportation Corridor.....	3-400
3.10	Threatened, Endangered and Special Status Species.....	3-403
3.10.1	Endangered Species.....	3-403
3.10.2	Threatened Species.....	3-403
3.10.3	Candidate Species.....	3-404

3.10.4	Special Status Species	3-407
3.11	Land Use and Transportation	3-413
3.11.1	Land Ownership	3-413
3.11.2	Land Management and Plans	3-414
3.11.3	Existing Land Use	3-425
3.11.4	Transportation, Kuskokwim River Basin	3-426
3.11.5	Transportation, Eastern Segment of the Pipeline Route	3-427
3.12	Kuskokwim River and Other Waterways, Physical Description and Use.....	3-431
3.12.1	Physical Description, Kuskokwim River	3-432
3.12.2	Physical Description, Crooked Creek.....	3-437
3.12.3	River Use, Kuskokwim River and Other Waterways	3-441
3.13	Socioeconomics	3-447
3.13.1	Population	3-447
3.13.2	Subsistence.....	3-451
3.13.3	Income	3-451
3.13.4	Major Economic Sectors	3-459
3.13.5	Commercial Fishing	3-461
3.13.6	Calista Corporation	3-461
3.13.7	Local Governments and Infrastructure.....	3-462
3.13.8	Social Culture.....	3-463
3.14	Community and Human Health	3-467
3.14.1	Environment and Health.....	3-468
3.14.2	Demographic Indicators	3-471
3.14.3	Family Profiles.....	3-475
3.14.4	General Health Status.....	3-476
3.14.5	Behavioral Health.....	3-479
3.14.6	Dental Health	3-479
3.14.7	Mental Distress	3-480
3.14.8	People with Disabilities	3-480
3.14.9	Hospitalizations.....	3-480
3.14.10	Injuries.....	3-481
3.14.11	Preventive Care	3-482
3.14.12	Births	3-483
3.14.13	Deaths.....	3-485
3.14.14	Crime.....	3-487
3.14.15	Housing.....	3-487
3.14.16	Education	3-488
3.15	Subsistence	3-491
3.15.1	Subsistence: Law and Management.....	3-491
3.15.2	Subsistence as a Lifestyle and Value System	3-491

3.15.3	Historical Patterns of Subsistence Resource Use, Middle and Upper Kuskokwim River Region	3-492
3.15.4	Contemporary Subsistence Resource Use Areas and Species, Middle and Upper Kuskokwim River Region	3-492
3.15.5	Food Security in the Kuskokwim River Basin.....	3-517
3.15.6	Current Subsistence-related Issues of Concern, Middle and Upper Kuskokwim Region.....	3-517
3.15.7	Subsistence in the Cook Inlet Drainage	3-519
3.15.8	Contemporary Subsistence Use Areas and Species, Cook Inlet Region.....	3-519
3.15.9	Current Subsistence-related Issues of Concern, Cook Inlet Region.....	3-525
3.16	Cultural Resources	3-527
3.16.1	Project Area Prehistory	3-529
3.16.2	Regional History.....	3-529
3.16.3	Prehistoric and Historic Sites in the Vicinity of the Facilities Study Area, Support Facilities, and Donlin-Jungjuk Road and Port.....	3-529
3.16.4	Prehistoric and Historic Sites along the Proposed Natural Gas Pipeline Corridor	3-531
3.16.5	Paleontological Sites in the Vicinity of the Facilities Study Area, Donlin-Jungjuk Road and Port, and Pipeline Corridor	3-533
3.16.6	Historic Linear Features in the Vicinity of the Facilities Study Area	3-533
3.16.7	Historic Linear Features Along the Proposed Natural Gas Pipeline Corridor	3-533
3.16.8	Traditional Cultural Places	3-534
3.17	Visual Resources.....	3-541
3.17.1	Character of the Landscape.....	3-541
3.17.2	Existing Visual Quality.....	3-542
3.17.3	Potential Viewing Areas/Populations	3-546
3.18	Recreation	3-555
3.18.1	Recreation Areas and Activities	3-555
3.18.2	Economic Potential	3-556
3.18.3	Land Management and Public Access.....	3-557
3.18.4	Sport Fishing.....	3-563
3.18.5	Recreational Hunting.....	3-564
4.0	IMPACTS.....	4-1
4.1	Geology.....	4-1
4.1.1	Potential Impacts in the Facilities Study Area	4-1
4.1.2	Impacts Due to Ground Movement During Pit Development and/or Ongoing Mining Processes	4-1
4.1.3	Potential Geologic Impacts – Pipeline Corridor	4-7
4.2	Water Resources	4-11

4.2.1	Surface Water Hydrology Impacts.....	4-11
4.2.2	Groundwater Hydrology Impacts.....	4-27
4.2.3	Water Quality.....	4-28
4.2.4	Natural Gas Pipeline – Surface Water Hydrology, Groundwater Hydrology, and Water Quality.....	4-38
4.2.5	Donlin-Jungjuk Road and Jungjuk Port – Surface Water Hydrology, Groundwater Hydrology, and Water Quality.....	4-38
4.3	Air Quality	4-41
4.4	Noise.....	4-43
4.4.1	Facilities Study Area-Related Noise Impacts	4-43
4.4.2	Support Facilities-Related Noise Impacts	4-45
4.4.3	Donlin-Jungjuk Road-Related Noise Impacts.....	4-45
4.4.4	Jungjuk Port Site-Related Noise Impacts.....	4-46
4.4.5	Waterway Transportation Corridor-Related Noise Impacts.....	4-46
4.4.6	Proposed Natural Gas Pipeline-Related Noise Impacts.....	4-47
4.5	Vegetation.....	4-49
4.5.1	Facilities Study Area.....	4-50
4.5.2	Support Facilities Area	4-53
4.5.3	Donlin-Jungjuk Road	4-53
4.5.4	Jungjuk Port Site	4-53
4.5.5	Waterway Transportation Corridor	4-54
4.5.6	Natural Gas Pipeline Corridor	4-54
4.6	Wetlands.....	4-69
4.6.1	Wetlands Management	4-69
4.6.2	Mine Site	4-69
4.6.3	Proposed Natural Gas Pipeline Corridor	4-76
4.6.4	Wetlands Impacts Discussion	4-82
4.6.5	Other Potential Wetland Impacts.....	4-84
4.6.6	Impact Mitigation	4-85
4.7	Aquatic Resources.....	4-89
4.7.1	Effects on Aquatic Resources within the Facilities Study Area	4-89
4.7.2	Effects on Aquatic Resources along the Proposed Natural Gas Pipeline Corridor.....	4-112
4.7.3	Effects on Aquatic Resources within the Donlin-Jungjuk Road Corridor.....	4-115
4.7.4	Effects on Aquatic Resources within the Waterway Transportation Corridor	4-118
4.7.5	Effects of Jungjuk Port Construction and Operation on Aquatic Resources within the Waterway Transportation Corridor	4-119
4.8	Wildlife	4-121
4.8.1	Causes of Impacts.....	4-121
4.8.2	Facilities Study Area and Support Facilities-Related Impacts.....	4-123

4.8.3	Donlin-Jungjuk Road-Related Impacts.....	4-126
4.8.4	Waterway Transportation Corridor-Related Impacts.....	4-128
4.8.5	Pipeline Corridor-Related Impacts.....	4-129
4.8.6	Noise Impacts on Wildlife.....	4-130
4.9	Threatened, Endangered, and Sensitive Species.....	4-131
4.9.1	Threatened and Endangered Species Potential Impacts.....	4-131
4.9.2	Special Status and Featured Species Potential Impacts.....	4-132
4.10	Land Use and Transportation.....	4-139
4.10.1	State of Alaska, Kuskokwim Area Plan.....	4-139
4.10.2	State of Alaska, Susitna-Matanuska Area Plan.....	4-142
4.10.3	Federal Land Management Plans.....	4-142
4.10.4	Potential Impacts to Traditional or Historical Land Use.....	4-143
4.10.5	Potential Impacts to Transportation.....	4-147
4.11	Kuskokwim River and Associated Waterways.....	4-149
4.11.1	Erosion.....	4-149
4.11.2	Sedimentation and Turbidity, Construction and Operations Phases.....	4-152
4.11.3	Fuel or Chemical Spills, Construction and Operations Phases.....	4-152
4.12	Socioeconomics.....	4-163
4.12.1	Construction—Employment Impacts.....	4-163
4.12.2	Construction—Indirect Impacts on Jobs, Income, and Business.....	4-164
4.12.3	Operations—Direct Employment Impacts.....	4-164
4.12.4	Operations—Indirect Impacts on Jobs, Income, and Business.....	4-166
4.12.5	Construction and Operations—Potential Social Impacts within the Calista Corporation Region.....	4-169
4.12.6	Construction and Operations—Potential Economic Impacts Outside the Calista Corporation Region.....	4-170
4.13	Community and Public Health.....	4-173
4.13.1	Communicable Disease.....	4-173
4.13.2	Non-Communicable Diseases.....	4-174
4.13.3	Nutrition.....	4-175
4.13.4	Injury.....	4-176
4.13.5	Community Well-Being.....	4-177
4.14	Subsistence.....	4-179
4.14.1	Facilities Study Area and Support Facilities—Impacts during Construction and Operation.....	4-180
4.14.2	Donlin-Jungjuk Road-Related Impacts to Subsistence Resources.....	4-181
4.14.3	Port Facility-Related Impacts to Subsistence Resources.....	4-183
4.14.4	Waterway Transportation Corridor-Related Impacts to Subsistence Resources.....	4-184
4.14.5	Pipeline Corridor-Related Impacts to Subsistence Resources.....	4-187
4.15	Cultural Resources.....	4-193

4.15.1	Facilities Study Area	4-193
4.15.2	Recent Sites.....	4-194
4.15.3	Natural Gas Pipeline Route.....	4-195
4.15.4	Support Facilities.....	4-196
4.15.5	Donlin-Jungjuk Road and Port Site Potential Impacts on Cultural Resources.....	4-196
4.16	Visual Resources.....	4-197
4.16.1	Key Observation Points.....	4-197
4.16.2	Visual Simulations.....	4-198
4.16.3	Visual Contrast Rating	4-198
4.16.4	Summary.....	4-206
4.17	Recreation	4-207
4.17.1	Facilities Study Area/Support Facilities/Donlin-Jungjuk Road—Recreational Impacts During Construction and Operation.....	4-207
4.17.2	Port Facilities—Recreation Impacts during Construction and Operation	4-209
4.17.3	Waterway Transportation Corridor—Recreation Impacts during Construction and Operation	4-210
4.17.4	Natural Gas Pipeline Corridor—Recreation Impacts during Construction	4-210
4.17.5	Natural Gas Pipeline Corridor—Recreation Impacts during Operation	4-212
4.17.6	Post-Closure Impacts to Recreation	4-212
5.0	ALTERNATIVES REVIEWED	5-1
5.1	Introduction	5-1
5.1.1	Development of the Proposed Project through Evaluation of Alternatives.....	5-1
5.2	Power Alternatives.....	5-3
5.2.1	Off-site Electric Generation and Transmission.....	5-3
5.2.2	On-site and Near-site Power Generation	5-5
5.3	Logistics and Supply.....	5-11
5.3.1	Overland Access	5-11
5.3.2	Water Transportation.....	5-14
5.3.3	Air Transportation.....	5-15
5.3.4	Port Sites.....	5-15
5.4	Mining Methods.....	5-23
5.4.1	Loading and Hauling Equipment	5-23
5.4.2	On-Site versus Off-Site Concentrate Processing	5-24
5.4.3	Gold Recovery.....	5-24
5.4.4	Cyanide Alternatives	5-24
5.5	Tailings Management Alternatives.....	5-27
5.5.1	Dry Stack Tailings Disposal.....	5-27
5.5.2	Paste (Thickened) Tailings Disposal	5-27

5.5.3	Conventional (Wet) Tailings Disposal	5-28
5.5.4	Tailings Storage Facility Design	5-28
5.5.5	Tailings Storage Facility and Waste Rock Facility Location	5-28
5.6	Facility Layout Alternatives	5-33
5.7	Water Management	5-37
5.7.1	Treatment and Discharge of Contact/Pit Dewatering Well Water and Storage/Use/Re-use of Process Waters	5-37
5.7.2	Storage of All Waters, Including Pit Dewatering Well Water	5-37
5.8	Natural Gas Pipeline Alternatives	5-39
5.8.1	Merrill Pass Routing	5-39
5.8.2	Rainy Pass versus Goodman Pass Routings.....	5-39
5.8.3	Rainy Pass Alignment versus Jones Realignment.....	5-41
5.8.4	Round Mountain Alternative	5-43
5.8.5	Kuskokwim Hills Alternatives.....	5-43
5.9	Closure.....	5-0
5.9.1	Pit Lake Water Management and Backfill	5-0
6.0	OUTREACH AND COMMUNITY COORDINATION.....	6-1
7.0	REFERENCES.....	7-1

Tables

Table 2.2-1	Primary Mining Equipment.....	2-2
Table 2.2-2	Reagents and Chemicals.....	2-8
Table 3.1-1	Geology, Geochemistry, and Geotechnical-related Studies.....	3-2
Table 3.1-2	Donlin Gold Waste Rock Management Categories.....	3-16
Table 3.1-3	Site-specific Calculation of ABA Parameters.....	3-17
Table 3.1-4	Donlin Gold Waste Rock Classification System.....	3-18
Table 3.1-5	Selected MWMP Results for Overburden Samples.....	3-19
Table 3.1-8	Predicted Concentrations in Beach Runoff.....	3-22
Table 3.1-9	Predicted Concentrations in Pore Waters in Buried Tailings.....	3-24
Table 3.1-10	Soils in the Vicinity of the Eastern Segment of the Primary Pipeline Route.....	3-33
Table 3.1-11	Facilities Study Area Peak Ground Acceleration Values.....	3-39
Table 3.1-12	Pipeline Route Peak Ground Acceleration Values.....	3-39
Table 3.1-13	Facilities Study Area Maximum Credible Earthquake Ground Motion Summary.....	3-40
Table 3.1-14	Estimated Earthquake Magnitudes at Western Portions of Denali and Castle Mountain Faults.....	3-41
Table 3.2-1	Water Resources – Related Studies.....	3-55
Table 3.2-2	Crooked Creek Drainages.....	3-56
Table 3.2-3	Stream Gauge Stations.....	3-65
Table 3.2-4	Peak Flow Estimates for American Creek (6.75 mi ²) and Anaconda Creek (7.64 mi ²).....	3-66
Table 3.2-5	Total Annual Precipitation and Maximum Daily Rainfall at the Proposed Donlin Gold Project – Frequency Analysis Results.....	3-66
Table 3.2-6	Snowmelt/Concurrent Rainfall at the Proposed Donlin Gold Project – Frequency Analysis Results.....	3-71
Table 3.2-7	Summary of Climatic Data.....	3-77
Table 3.2-8	Basin and Flow Characteristic at Five Representative USGS Gauged Streams.....	3-80
Table 3.2-9	Average Monthly Discharge (percent of total) at Five Representative USGS Gauged Streams.....	3-81
Table 3.2-10	Summary of Basin Characteristics for the 13 Largest Stream Crossings Along the Pipeline Route.....	3-85
Table 3.2-11	Flood Peak Discharge Estimates for 13 Largest Stream Crossings Along the Pipeline Route.....	3-86
Table 3.2-12	Annual High-flow Duration Estimates for 13 Largest Stream Crossings Along the Pipeline Route.....	3-87
Table 3.2-13	August Low-flow Duration Estimates for 13 Largest Stream Crossings Along the Pipeline Route.....	3-88
Table 3.2-14	Hydrogeologic Data Collected at the Facilities Study Area.....	3-97
Table 3.2-15a	Surface Water Quality Characterization Station Locations, 2003.....	3-111
Table 3.2-15b	Surface Water Quality Characterization Station Locations, 2010.....	3-111
Table 3.2-16	Surface Water Quality Characterization Stations that have been Discontinued.....	3-112
Table 3.2-17	Summary of Water Quality Data from Category 1 Surface Water Monitoring Stations.....	3-115

Table 3.2-18	Summary of Water Quality Data from Category 2 Surface Water Monitoring Stations	3-117
Table 3.2-19	Summary of Water Quality Data from Category 3 Surface Water Monitoring Stations	3-119
Table 3.2-20	Comparison of Donlin Creek Surface Water Quality (2005 to 2010) to Water Quality Criteria.....	3-121
Table 3.2-21	T-Test Results for Surface Water Locations: Category 1 Compared to Category 2.....	3-124
Table 3.2-22	T-Test Results for Surface Water Locations: Category 1 Compared to Category 3.....	3-125
Table 3.2-23	Groundwater Summary for Wells Screened in Alluvium.....	3-131
Table 3.2-24	Groundwater Summary for Wells Screened in Bedrock	3-133
Table 3.2-25	Comparison of Means of Selected Analytes for the Groundwater Alluvium and Bedrock Aquifers	3-135
Table 3.3-1	Baseline Air Quality and Meteorological Data Reports.....	3-146
Table 3.3-2	Air Quality and Meteorological Data Collected	3-147
Table 3.3-3	Regional Average Monthly Precipitation	3-148
Table 3.3-4	Regional Average Monthly Maximum and Minimum Temperatures.....	3-149
Table 3.3-5	Pipeline Route – Average Monthly Precipitation.....	3-150
Table 3.3-6	Pipeline Route – Average Monthly Maximum and Minimum Temperatures.....	3-151
Table 3.3-7	American Ridge Annual Stability Class.....	3-153
Table 3.3-8	American Ridge Annual 33-Foot (10-Meter) Temperatures	3-161
Table 3.3-9	American Ridge Annual 6.6-Foot (2-Meter) Temperatures	3-161
Table 3.3-10	American Ridge Annual Delta Temperatures	3-162
Table 3.3-11	Camp Annual Stability Class.....	3-162
Table 3.3-12	Camp Annual 33-Foot (10-Meter) Temperatures	3-167
Table 3.3-13	Camp Annual 6.6-Foot (2-Meter) Temperatures	3-167
Table 3.3-14	Camp Annual Delta Temperatures	3-168
Table 3.3-15	Hill 1918 Annual Stability Class	3-168
Table 3.3-16	Hill 1918 Annual 33-Foot (10-Meter) Temperatures	3-169
Table 3.3-17	Hill 1918 Annual 6.6-Foot (2-Meter) Temperatures	3-169
Table 3.3-18	Hill 1918 Annual Delta Temperatures.....	3-169
Table 3.3-19	Evaporation Values for Donlin Creek Site Water Balance.....	3-171
Table 3.3-20	Monthly Sublimation at Donlin Creek.....	3-171
Table 3.4-1	Baseline Air Quality Data Reports	3-183
Table 3.4-2	Maximum Allowable Pollutant Increase over Baseline Concentration, Prevention of Significant Deterioration Class II Increments.....	3-184
Table 3.4-3	Background Criteria Pollutant Concentration in Cook Inlet Region, August 1993 to July 1994 ¹	3-185
Table 3.4-4	Criteria Pollutant Data Measured at the Facilities Study Area: October 2006 to June 2009; November 2011; Various Periods	3-186
Table 3.5-1	Baseline Noise Monitoring Report	3-191
Table 3.5-2	Common Noise Sources and Levels.....	3-191
Table 3.5-3	Reference Sound Levels for the Waterway Transportation Corridor.....	3-193

Table 3.6-1	Vegetation Types Located in the Facilities Study Area and Proposed Road/Port Sites	3-208
Table 3.6-2	Facilities Study Area and Proposed Road/Port Sites Vegetation Categories Used for Map Display Purposes	3-209
Table 3.6-3	Vegetation Types Located in the Gas Pipeline Corridor	3-211
Table 3.6-4	Gas Pipeline Vegetation Categories Used for Map Display Purposes	3-213
Table 3.7-1	Donlin Gold Project Area Jurisdictional Classification Definitions	3-260
Table 3.7-2	Wetlands and Waters of the U.S. for the Facilities Study Area and Associated Road/Port Sites	3-261
Table 3.7-3	Wetlands and Waters of the U.S. by Jurisdictional Classification Type for the Facilities Study Area and Associated Road/Port Sites	3-262
Table 3.7-4	Wetlands and Waters of the U.S. for the Gas Pipeline Corridor – Kuskokwim Mountains Section.....	3-263
Table 3.7-5	Wetlands and Waters of the U.S. by Jurisdictional Classification Type for the Gas Pipeline Corridor – Kuskokwim Mountains Section	3-264
Table 3.7-6	Wetlands and Waters of the U.S. for the Gas Pipeline Corridor – Tanana-Kuskokwim Lowlands Section.....	3-264
Table 3.7-7	Wetlands and Waters of the U.S. by Jurisdictional Classification Type for the Gas Pipeline Corridor – Tanana-Kuskokwim Lowlands Section	3-265
Table 3.7-8	Wetlands and Waters of the U.S. for the Gas Pipeline Corridor – Alaska Range Section.....	3-265
Table 3.7-9	Wetlands and Waters of the U.S. by Jurisdictional Classification Type for the Gas Pipeline Corridor – Alaska Range Section.....	3-266
Table 3.7-10	Wetlands and Waters of the U.S. for the Gas Pipeline Corridor – Cook Inlet Basin Section.....	3-266
Table 3.7-11	Wetlands and Waters of the U.S. by Jurisdictional Classification Type for the Gas Pipeline Corridor – Cook Inlet Basin Section	3-267
Table 3.7-12	Wetlands and Waters of the U.S. Extent by River Basin	3-269
Table 3.7-13	Occurrences of Wetland Conditions at Sample Plots by Vegetation Type	3-279
Table 3.7-14	HGM Wetland Types by Basin for the Facilities Study Area and Associated Road/Port Sites	3-289
Table 3.7-15	HGM Wetland Types by Basin for the Pipeline Route	3-291
Table 3.7-16	HGM Wetland Types by Ecoregions for the Donlin Gold Project Area	3-299
Table 3.7-17	Wetland Function by HGM Classification.....	3-301
Table 3.8-1	Aquatic Resources Data Reports.....	3-305
Table 3.8-2	Crooked Creek Watershed Stream Characteristics.....	3-309
Table 3.8-3	Summary of Habitat Type and Attribute Data for Crooked Creek (2009)	3-311
Table 3.8-4	Juvenile Salmon Habitat Suitability for Baseflow Conditions Crooked Creek (2009)	3-312
Table 3.8-5	Fish Species Identified within the Crooked Creek Drainage (2004-2011).....	3-315
Table 3.8-6	Summary of Electrofishing Results within the Crooked Creek Drainage (2004-2011).....	3-317
Table 3.8-7	Averaged Adult Salmon Aerial Counts for the Crooked Creek Drainage (2004-2010).....	3-321

Table 3.8-8	Crooked Creek Weir Salmon Escapement Summary, 2008 to 2011	3-323
Table 3.8-9	Macroinvertebrate Bioassessment Summary Statistics within the Crooked Creek Drainage (2004 to 2011).....	3-327
Table 3.8-10	Average Metal Concentrations in Slimy Sculpin <55mm Long within the Crooked Creek Drainage (2004 to 2011).....	3-329
Table 3.8-11	Stream Characteristics and Water Quality Data by Drainage for the Proposed Donlin Creek Natural Gas Pipeline (2011)	3-337
Table 3.8-12	Summary of Pipeline Route Stream Crossings (2010-2011).....	3-339
Table 3.8-13	Summary of Fish Species Composition per Drainage for the Pipeline Route (2010 to 2011)	3-341
Table 3.8-14	Summary of Fish Species Composition along the Pipeline Route (2010 and 2011).....	3-343
Table 3.8-15	Fish Species Occurring in the Kuskokwim River	3-346
Table 3.9-1a	Baseline Wildlife Studies Conducted in the Facilities Study Area	3-351
Table 3.9-1b	Baseline Wildlife Studies Conducted along the Pipeline Route.....	3-352
Table 3.9-1c	Baseline Wildlife Studies Conducted along the Pipeline Route.....	3-352
Table 3.9-2	Waterfowl and Shorebird Species Observed During Avian and Raptor Surveys in the Facilities Study Area	3-353
Table 3.9-3	Avian Survey Point Counts, Total Number of Identifiable Species, and Total Number of Identifiable Species per Monitoring Area	3-354
Table 3.9-4	Avian Species Observed During All Survey Years, by Common Name, Total Bird Count, and Percent of Total Birds Observed per Species in Descending Order of Total Bird Count.....	3-359
Table 3.9-5	Comparison of Highest Species Richness per Station by Year and Habitat Type in Descending Order.....	3-360
Table 3.9-6	Highest Species Richness, Shannon Diversity, Shannon Evenness and Total Number of Birds per Habitat Type in Descending Order for All Survey Years.....	3-360
Table 3.9-7	Total Number of Birds Observed By Habitat Types for All Survey Years.....	3-360
Table 3.9-8	Raptor Survey results of Occupied and Unoccupied Nests over All Survey Years.....	3-361
Table 3.9-9	Raptor Survey results of Occupied and Unoccupied Nests over All Survey Years in the Greater Raptor Study Area.....	3-361
Table 3.9-10	Raptor Survey results of Occupied and Unoccupied Nests over All Survey Years in Facilities Support Area	3-362
Table 3.9-11	Number and Details of Occupied Great Gray and Great Horned Owl Observations in 2008, 2009, 2010 and 2011 in the Vicinity of the FSA	3-365
Table 3.9-12	Raptor and Owl Species Inhabitation Range and 2010 Observation on the Natural Gas Pipeline	3-366
Table 3.9-13	Nest Counts along Riparian Area	3-367
Table 3.9-14	Waterbird Species Recorded in the Waterway Transportation Corridor	3-375
Table 3.9-15	Total Number of Avian Individuals Recorded in the WTC	3-376
Table 3.9-16	Songbird Species Recorded in the Waterway Transportation Corridor	3-377
Table 3.9-17	Raptor Species Recorded in the Waterway Transportation Corridor	3-377
Table 3.9-18	Baseline Moose and Furbearer Surveys Conducted at the Facilities Study Area	3-378

Table 3.9-19	Donlin Gold Baseline Moose Survey Results, Date, Study Area Square Miles, Total Number of Moose and Average Number of Moose per Square Mile in the Facilities Study Area	3-379
Table 3.9-20	Donlin Gold Furbearer Survey 2011 Species List.....	3-380
Table 3.9-21	Wolf Population Numbers, Based on Alaska Department of Fish and Game Surveys, in Game Management Units Intersecting the Natural Gas Pipeline	3-385
Table 3.9-22	Canidae Species Track Observations across Survey Years	3-385
Table 3.9-23	Weasel Track Observations by Vegetation Community across Survey Years.....	3-386
Table 3.9-24	American Marten Species Track Observation Frequency per Vegetation Community across Survey Years.....	3-387
Table 3.9-25	North American River Otter Track Observations by Habitat Type across Survey Years.....	3-389
Table 3.9-26	Wolverine Track Observations per Vegetation Community across Survey Years.....	3-389
Table 3.9-27	Brown Bear Density per 1,000 km ² and Population Estimates per Game Management Units Intersected by the Proposed Natural Gas Pipeline.....	3-398
Table 3.9-28	Brown Bear Acreage of Supporting Habitat, Density and Population Estimates per Game Management Units Intersected by Proposed Natural Gas Pipeline	3-398
Table 3.9-29	Black Bear Population Acreage of Supporting Habitat and Density Estimates for Game Management Units Intersected by the Proposed Natural Gas Pipeline	3-398
Table 3.10-1	Special Status Bird Species and Observation Numbers in the Donlin Gold Study Area.....	3-408
Table 3.10-2	Summary of Sensitive Bird Species Observed at Five Viewing Stations on the Lower Kuskokwim River in the Water Transportation Corridor	3-409
Table 3.10-3	Special Status Species that may occur along the Pipeline Route	3-410
Table 3.10-4	Occurrences of Special Status Fish Species.....	3-411
Table 3.11-1	Proximity of Pipeline to Iditarod National Historic Trail, Pipeline Route including the Rainy Pass Alignment.....	3-419
Table 3.12-1	Baseline Kuskokwim River and Crooked Creek Studies	3-431
Table 3.12-2	Summary of Boats, Set Nets, Active Fish Camps, and Fish Wheels Observed on the Kuskokwim River from Georgetown to Eek Island During 10 Fishing Activity Surveys Conducted in Summer and Fall 2009	3-442
Table 3.12-3	Counts of Boats and Number of Set Nets on the Lower Kuskokwim River in ADF&G Kuskokwim District Statistical Area 335-12 Summarized by Month from May 20, 2009 through September 29, 2009	3-443
Table 3.12-4	Counts of Boats and Number of Set Nets on the Lower Kuskokwim River between Helmick Point and the Village of Tuntutuliak Summarized by Month from June 3, 2009 through September 24, 2009	3-443
Table 3.13-1	Population in the Calista Corporation Region.....	3-448
Table 3.13-2	Projected Population in the Calista Corporation Region.....	3-448
Table 3.13-3	Workers by Industry in the Calista Corporation Region.....	3-455
Table 3.13-4	Largest Employers in the Calista Corporation Region.....	3-459

Table 3.13-5	Real Federal Government Spending in the Calista Corporation Region.....	3-460
Table 3.13-6	Largest Federal Grant Programs in 2009 in the Calista Corporation Region.....	3-460
Table 3.13-7	Characteristics of TKC-Affiliated Communities.....	3-462
Table 3.14-1	Selected Human Health and Social Indicator Data Highlights.....	3-469
Table 3.14-2	Community Populations (2000 and 2010).....	3-472
Table 3.14-3	Age: Percentage of Population (2010).....	3-474
Table 3.14-4	Ethnicity: Percentage of Population (2010).....	3-474
Table 3.14-5	Language Spoken in the Home: Percentage of Population (2010).....	3-475
Table 3.14-6	Geographic Mobility.....	3-475
Table 3.14-7	Household Characteristics: Percentage of Population (2010).....	3-476
Table 3.14-8	Marriage and Divorce Rates: Per 1,000 Population (2008).....	3-476
Table 3.14-9	Nutrition (2005 to 2009).....	3-477
Table 3.14-10	Overweight and Obese Population (2008 to 2010).....	3-477
Table 3.14-11	Exercise – No Leisure Time Physical Activity (2008 to 2010).....	3-477
Table 3.14-12	Annual Infectious Disease Incidences (2009 and 2010).....	3-478
Table 3.14-13	Heavy Drinkers (2008 to 2010).....	3-479
Table 3.14-14	Binge Drinkers (2008 to 2010).....	3-479
Table 3.14-15	Smokers (2008 to 2010).....	3-479
Table 3.14-16	Dental Health: Dental Visit within Last Year (2008).....	3-480
Table 3.14-17	Frequent Mental Distress (2008 to 2010).....	3-480
Table 3.14-18	People with Disabilities—Limitations on Activity due to Physical, Mental, or Emotional Problems (2008 to 2010).....	3-480
Table 3.14-19	Leading Causes for Hospitalizations: Annual Rate per 10,000 Population (2001 to 2005).....	3-481
Table 3.14-20	Hospitalizations Due to Injury: Fatal and Non-Fatal (2000 to 2004).....	3-481
Table 3.14-21	Leading Causes and Numbers of Non-Fatal Injury Requiring Hospitalization (2000-2004).....	3-482
Table 3.14-22	Adults with a Personal Doctor (2008 to 2010).....	3-483
Table 3.14-23	Adults Who Had an Annual Routine Checkup in Last 12 Months (2008 to 2010).....	3-483
Table 3.14-24	Healthcare Coverage (2008 to 2010).....	3-483
Table 3.14-25	Birth Rates: Per 1,000 Population (2009).....	3-484
Table 3.14-26	Methods of Birth: Percentage of Births (2009).....	3-484
Table 3.14-27	Maternal Risk Factors Based on Mother’s Residence: Percentage of Pregnancies (2008).....	3-484
Table 3.14-28	Age-Adjusted Mortality Rates: Per 100,000 People (2007 to 2009).....	3-485
Table 3.14-29	Infant Mortality: Neonatal and Post-neonatal Deaths (2009).....	3-485
Table 3.14-30	Top Five Leading Causes of Death: Rates per 100,000 Population.....	3-486
Table 3.14-31	Number of Reported Crimes (2000).....	3-487
Table 3.14-32	Housing Characteristics.....	3-487
Table 3.14-33	K-12 Public School Enrollment (2005-2006 through 2009-2010 School Years).....	3-488
Table 3.14-34	Public School AYP Status (2009-2010 School Year).....	3-489

Table 3.15-1	Subsistence Resources Pursued by Use Area and Village	3-494
Table 3.15-2	Subsistence Harvests by Village.....	3-495
Table 3.15-3	2004 Kuskokwim River Subsistence Salmon Project: Gear Types	3-498
Table 3.15-4	Salmon Harvests (2000 to 2009)	3-498
Table 3.15-5	Food Security in Middle Kuskokwim Region Villages, Percentage of Population	3-517
Table 3.16-1	Donlin Gold Cultural Resource Surveys	3-528
Table 4.1-1	Waste Rock Classification and Tonnages	4-3
Table 4.1-2	Summary of Minimum Factors of Safety	4-5
Table 4.1-3	Tailings Storage Facility and Freshwater Dam Static Stability Results	4-6
Table 4.1-4	Waste Rock Facility Static Stability Results.....	4-7
Table 4.2-1	Average Streamflow for Disturbed and Undisturbed Conditions	4-25
Table 4.2-2	Water Quality for Wells Completed in the Mineralized Zone ^{1,2}	4-31
Table 4.2-3	Estimated Water Treatment Plant Feed and Effluent Water Quality (mg/L) ¹	4-33
Table 4.2-4	Predicted Pit Lake Surface and Discharge Water Quality (0-33 Feet [0-10 Meters]) Following Filling to Its Operational Level ¹	4-36
Table 4.2-5	Predicted Pit Lake Surface Water Quality (0-33 Feet [0-10 Meters]) at Year 99 ¹	4-37
Table 4.4-1	Major Noise Sources and an Estimate of Individual Sound Levels at 50 Feet (15 Meters).....	4-44
Table 4.5-1	General Vegetation Impact Analysis – Donlin Gold Project Area	4-49
Table 4.5-2	Vegetation Impact Analysis, Facilities Study Area.....	4-51
Table 4.5-3	Vegetation Impact Analysis, Support Facilities.....	4-55
Table 4.5-4	Vegetation Impact Analysis, Donlin-Jungjuk Road	4-56
Table 4.5-5	Vegetation Impact Analysis, Jungjuk Port Site	4-59
Table 4.5-6	Vegetation Impact Analysis, Pipeline Corridor, Kuskokwim Mountains.....	4-63
Table 4.5-7	Vegetation Impact Analysis, Pipeline Corridor, Tanana-Kuskokwim Lowlands	4-64
Table 4.5-8	Vegetation Impact Analysis, Pipeline Corridor, Alaska Range	4-65
Table 4.5-9	Vegetation Impact Analysis, Pipeline Corridor, Cook Inlet Basin	4-67
Table 4.6-1	Potential Wetland Impacts by Classification Unit.....	4-70
Table 4.6-2	Impacts to Wetlands and Other Waters of the U.S. by Wetland Classification Unit and Project Area.....	4-71
Table 4.6-3	Impacts to Wetlands and Other Waters of the U.S. by HGM Type and Project Area ¹	4-73
Table 4.6-4	Summary of Donlin Gold Mine Site Direct Long-term, Short-term, and Permanent Wetland Impacts at End of Mine Life	4-77
Table 4.6-5	Impacts to Wetlands and Other Waters of the U.S. for the Pipeline - by Wetland Classification Unit and Ecoregion.....	4-78
Table 4.6-6	Impacts to Wetlands and Other Waters of the U.S. for the Pipeline- by HGM Type and Ecoregions ¹	4-79
Table 4.6-7	Summary of Donlin Gold Natural Gas Pipeline Direct Long-term and Short-term Wetland Impacts	4-80
Table 4.7-1	Direct Aquatic Habitat Loss and Corresponding Predicted Fish Loss for Streams within the Facilities Study Area.....	4-91

Table 4.7-2a	Estimated Reductions in Aquatic Habitat Surface Area for Summer and Winter Low Flow Conditions during Year 20 of Mine Operations	4-97
Table 4.7.2	Off-channel Habitat Connectivity and Estimated Surface Area for Various Flow Conditions for Mainstream Crooked Creek (2009)	4-99
Table 4.9-1	Bird Observed in the Donlin Gold Study Area on the State of Alaska Wildlife Action Plan and on the Boreal Partners in Flight Priority Species for Conservation List as of 2010	4-135
Table 4.11-1	Wave Energy by Barge Type and Location	4-151
Table 4.11-2	Barge-generated Wave Energy Compared to River Energy	4-151
Table 4.12-1	Proposed Donlin Gold Project: Estimated Mine, Mill, and Support Facilities Operations Staffing	4-165
Table 4.12-2	Potential Direct Impact of Regional Income and Employment	4-166
Table 4.12-3	Potential Total Employment Impacts in the Calista Corporation region (Direct and Indirect Impacts).....	4-167
Table 4.12-4	Potential Total Impact of Regional Income and Employment (Direct and Indirect Impacts).....	4-167
Table 4.12-5	Number of Business Licenses in the Calista Corporation Region Held by Businesses Most Likely to Provide Goods or Services to the Proposed Donlin Gold Project.....	4-168
Table 4.12-6	Percentage of Food and Housing Costs Accounted for by Transportation	4-170
Table 4.12-7	Proposed Donlin Gold Project Total Statewide Employment Impacts (Direct and Indirect Impacts).....	4-171
Table 4.16-1	Degree of Contrast Criteria	4-197
Table 4.16-2	Mount Susitna Visual Contrast Rating	4-203
Table 4.16-3	Rainy Pass Visual Contrast Rating.....	4-203
Table 4.16-4	Dalzell Gorge Visual Contrast Rating	4-204
Table 4.16-5	Farewell Station Airstrip Visual Contrast Rating	4-205
Table 4.16-6	Kuskokwim River Visual Contrast Rating.....	4-205
Table 4.16-7	Jungjuk Port Site Visual Contrast Rating.....	4-206
Table 4.17-1	Potential Recreation Impacts during Pipeline Construction.....	4-211
Table 5.2-1	Off-site Generating Alternatives and Reasons for Elimination	5-4
Table 5.2-2	On-site and Near-Site Generating Alternatives and Reasons for Elimination	5-8
Table 5.3-1	Road Alternatives and Reasons for Elimination	5-14
Table 5.3-2	Downriver Port Sites and Reasons for Elimination	5-19
Table 5.3-3	Upriver Port Location Evaluation Matrix.....	5-22
Table 5.4-1	Mining Method Alternatives and Reasons for Elimination	5-26
Table 5.5-1	Tailings Management Alternatives.....	5-29
Table 5.5-2	Alternative Eliminations.....	5-30
Table 5.8-1	Rainy Pass and Goodman Pass Alternative Attributes.....	5-40
Table 5.8-2	Rainy Pass Alignment and Jones Realignment - Preliminary Comparison of Attributes	5-42
Table 5.9-1	Comparison of Pit Backfill Option and Pit Lake Option.....	5-3
Table 6.0-1	Native and Tribal Organization Meetings.....	6-1
Table 6.0-2a	Community Meetings	6-5
Table 6.0-2b	Project Site Tours and Mine Tours	6-7

Table 6.0-3 Federal and State Agency Consultation6-8
 Table 6.0-4 Non-governmental Organizations6-11

Figures

Figure 2.1-1 Project Location Map2-3
 Figure 2.2-1 General Site Layout2-5
 Figure 2.2-2 Simplified Milling Process Flowsheet.....2-13
 Figure 2.2-3 Tailings Storage Facility Location2-15
 Figure 2.2-4 Waste Rock Facility and Stockpile Locations2-17
 Figure 2.2-5 Preliminary Plant Site Layout.....2-19
 Figure 2.2-6 Mine Facilities Footprint and Location of Off-Site Infrastructure.....2-25
 Figure 2.2-7a Location of Proposed Natural Gas Pipeline Route2-27
 Figure 2.2-7b Location of Proposed Natural Gas Pipeline Route2-29
 Figure 2.2-8 Schematic Water Balance – Operations (Years 2 to 27)2-35
 Figure 3.1-1 Regional Geologic Map.....3-7
 Figure 3.1-2 Depth to Bedrock in American Creek Valley.....3-9
 Figure 3.1-3 Depth to Bedrock in Anaconda Creek Valley.....3-11
 Figure 3.1-4 Permafrost Zones of Alaska.....3-47
 Figure 3.1-5 Permafrost Distribution Map American Creek Area.....3-49
 Figure 3.1-6 Permafrost Distribution Map Anaconda Creek Area.....3-51
 Figure 3.1-7 Permafrost Distribution Map3-53
 Figure 3.2-1 Regional Hydrology.....3-57
 Figure 3.2-2 Typical Watershed Drainage Patterns3-59
 Figure 3.2-3 Crooked Creek Drainages3-61
 Figure 3.2-4 American and Anaconda Creek Hydrographs3-67
 Figure 3.2-5 Donlin and Crooked Creek Hydrographs3-69
 Figure 3.2-6 Map of Proposed Pipeline Corridor, Significant Streams, and Location of
 USGS Stream Gauges.....3-75
 Figure 3.2-7 Map of Proposed Pipeline Corridor and Significant Stream Crossings3-83
 Figure 3.2-8a Current Groundwater Monitoring Sites3-93
 Figure 3.2-8b Potentiometric Surface Groundwater.....3-95
 Figure 3.2-9 Bedrock Hydraulic Conductivity3-101
 Figure 3.2-10 Hydraulic Conductivity by Collar Elevation3-101
 Figure 3.2-11 Hydraulic Conductivity Values from Pumping Tests3-101
 Figure 3.2-12 Bedrock Hydraulic Conductivity for Depths Less than 1,640 Feet
 (500 Meters).....3-101
 Figure 3.2-13a Initial Water Quality Monitoring Locations3-107
 Figure 3.2-13b Surface Water Quality Monitoring Stations.....3-109
 Figure 3.2-14 USGS Water Quality Stations and Proposed Pipeline Location.....3-127
 Figure 3.2-15 Mercury Concentrations (ng/g) in Stream Sediment Samples
 2006, 2007 and 20083-141
 Figure 3.2-16 2006, 2007 and 2008 Mercury Concentrations in Stream
 Sediment Samples.....3-143

Figure 3.3-1	Meteorological Sites.....	3-155
Figure 3.3-2	American Ridge Meteorological Station, Wind Rose.....	3-157
Figure 3.3-3	American Ridge Meteorological, Wind Frequency Distributions, July 2005 – December 2010.....	3-159
Figure 3.3-4	Camp Meteorological Station, Wind Rose.....	3-163
Figure 3.3-5	Camp Meteorological Station, Wind Frequency Distributions, May 2006 – October 2010.....	3-165
Figure 3.3-6	Hill 1918 Meteorological Station, Wind Rose.....	3-173
Figure 3.3-7	Hill 1918 Meteorological Station, Wind Frequency Distributions, April 2007 – December 2010.....	3-175
Figure 3.3-8	Average Monthly Temperature for Crooked Creek, Alaska.....	3-179
Figure 3.3-9	Average Monthly Precipitation for Crooked Creek, Alaska.....	3-181
Figure 3.4-1	Air Quality Control Regions.....	3-189
Figure 3.5-1	Noise Assessment Study Locations.....	3-195
Figure 3.6-1	Alaska Ecoregions Map.....	3-199
Figure 3.6-2	Vegetation Sampling Locations.....	3-215
Figure 3.6-3	Habitat Classification.....	3-217
Figure 3.6-3a	Habitat Classification.....	3-219
Figure 3.6-3b	Habitat Classification.....	3-221
Figure 3.6-3c	Habitat Classification.....	3-223
Figure 3.6-3d	Habitat Classification.....	3-225
Figure 3.6-3e	Habitat Classification.....	3-227
Figure 3.6-3f	Habitat Classification.....	3-229
Figure 3.6-3g	Habitat Classification.....	3-231
Figure 3.6-3h	Habitat Classification.....	3-233
Figure 3.6-3i	Habitat Classification.....	3-235
Figure 3.6-3j	Habitat Classification.....	3-237
Figure 3.6-3k	Habitat Classification.....	3-239
Figure 3.6-3l	Habitat Classification.....	3-241
Figure 3.6-3m	Habitat Classification.....	3-243
Figure 3.6-3n	Habitat Classification.....	3-245
Figure 3.6-3o	Habitat Classification.....	3-247
Figure 3.6-3p	Habitat Classification.....	3-249
Figure 3.6-3q	Habitat Classification.....	3-251
Figure 3.6-3r	Habitat Classification.....	3-253
Figure 3.6-3s	Habitat Classification.....	3-255
Figure 3.6-3t	Habitat Classification.....	3-257
Figure 3.8-1	Resident Species Occurrence and Estimated Adult Salmon Density and Distribution within the Facilities Study Area.....	3-307
Figure 3.8-2	Stream Crossing Aquatic Survey 2010.....	3-335
Figure 3.9-1	2010 Avian Point Count Survey Stations.....	3-355
Figure 3.9-2	Ten Most Common Species Observed Between Survey Years 2007-2010.....	3-357
Figure 3.9-3	2011 Raptor Nest Locations.....	3-363
Figure 3.9-4	2011 Natural Gas Pipeline Raptor Nest Locations.....	3-369

Figure 3.9-5	Wildlife Observation Study Stations Along the Kuskokwim River in the Waterway Transportation Corridor.....	3-373
Figure 3.9-6	Aerial Moose Survey Study Area	3-381
Figure 3.9-7	Aerial Furbearer Survey Study Area	3-383
Figure 3.9-8	Project Vicinity Caribou Herd Ranges.....	3-391
Figure 3.9-9	2011 Natural Gas Pipeline Moose Survey Units.....	3-395
Figure 3.10-1	Kuskokwim Shoals, Spectacled and Steller's Eider Critical Habitat and Kittlitz's Murrelet Proposed Habitat.....	3-405
Figure 3.11-1	Kuskokwim Area Plan for State Lands.....	3-415
Figure 3.11-2	Susitna-Matanuska Area Plan	3-421
Figure 3.11-3	ACMP Coastal Districts and Coastal Resource Service Area Boundaries	3-423
Figure 3.11-4	Existing Land Use	3-429
Figure 3.12-1	Kuskokwim River.....	3-433
Figure 3.12-2	Erosion and Deposition in the Lower Kuskokwim River, 1988-2006	3-435
Figure 3.12-3	Erosion and Deposition Upstream of Bethel, 1998-2006.....	3-439
Figure 3.12-4	Fishing Activity on the Kuskokwim River	3-445
Figure 3.13-1	Native Corporation Lands	3-449
Figure 3.13-2	Projected Age Distribution of Population in the Calista Corporation Region.....	3-451
Figure 3.13-3	Composition of Real Personal Income in the Calista Corporation Region, 2009.....	3-452
Figure 3.13-4	Annual Unemployment Rate in Bethel and Wade Hampton Census Areas.....	3-454
Figure 3.13-5	Workers by Industry	3-457
Figure 3.13-6	Real Gross Earnings in Commercial Fishing in the Calista Corporation Region.....	3-461
Figure 3.14-1	Alaska Census Areas.....	3-470
Figure 3.14-2	BRFSS Regions in Alaska	3-471
Figure 3.15-1	Aniak Subsistence.....	3-499
Figure 3.15-2	Chuathbaluk Subsistence	3-501
Figure 3.15-3	Crooked Creek Subsistence	3-503
Figure 3.15-4	Lower Kalskag Subsistence.....	3-505
Figure 3.15-5	Red Devil Subsistence	3-507
Figure 3.15-6	Sleetmute Subsistence	3-509
Figure 3.15-7	Stony River Subsistence	3-511
Figure 3.15-8	Upper Kalskag Subsistence.....	3-513
Figure 3.15-9	Beluga Subsistence	3-521
Figure 3.15-10	Tyonek Subsistence.....	3-523
Figure 3.16-1	Cultural Resource Surveyed Areas.....	3-537
Figure 3.16-2	Surveyed Area – Natural Gas Pipeline Alignment.....	3-539
Figure 3.17-1	Key Observation Point Locations/Viewshed Locations and Figure Index	3-543
Figure 3.17-2	Viewshed Analysis from Surrounding Villages	3-549

Figure 3.17-3	Viewshed Analysis from Rohn, Rainy Pass, and Talachulitna River	3-551
Figure 3.17-4	Viewshed Analysis North Aboveground Segment	3-553
Figure 3.18-1	Federal and State Designated Areas.....	3-559
Figure 3.18-2	Historic Trails in the Vicinity of the Proposed Project	3-561
Figure 3.18-3	Alaska Department of Fish and Game Management Units & Anadromous Streams	3-567
Figure 4.2-1	Water Management Strategy Operations	4-13
Figure 4.2-2a	Water Management Strategy—Closure	4-15
Figure 4.2-2b	Schematic Water Balance—Closure.....	4-17
Figure 4.2-2c	Schematic Water Balance—Closure.....	4-19
Figure 4.2-2d	Schematic Water Balance—Closure.....	4-21
Figure 4.2-2e	Schematic Water Balance—Closure.....	4-23
Figure 4.7-1	Modeled Average Surface Water Temperature for the Pit Lake (Average Flow Year – 50 th percentile)	4-107
Figure 4.7-2	Modeled Average Surface Water Temperature for the Pit Lake (10-Year Low Flow – 10 th percentile)	4-109
Figure 4.9-1	Locations of Critical Habitat	4-133
Figure 4.10-1	“High-value” & “Special-value” Habitat Areas in the Vicinity of the Proposed Project.....	4-145
Figure 4.11-1a	Sensitive Shoreline Habitats	4-155
Figure 4.11-1b	Waterfowl Concentrations and Anadromous Streams.....	4-157
Figure 4.14-1	Aniak and Crooked Creek Subsistence Harvest Areas, 1964-1986, Trapping	4-185
Figure 4.14-2	Seal and Sea Lion Harvest Estimates, Quinhagak, 1998/99.....	4-187
Figure 4.16-2	Mount Susitna Visual Simulation of Proposed Underground Pipeline with Vegetation Clearing Along the Right-of-Way.....	4-201
Figure 4.16-3	Rainy Pass Visual Simulation of Proposed Underground Pipeline with Vegetation Clearing Along the Right-of-Way	4-201
Figure 4.16-4	Dalzell Gorge Visual Simulation of Proposed Underground Pipeline with Vegetation Clearing Along the Right-of-Way.....	4-201
Figure 4.16-5	Farewell Airstrip Visual Simulation of Proposed Underground Pipeline with Vegetation Clearing Along the Right-of-Way.....	4-201
Figure 4.16-6	Kuskokwim River Visual Simulation of Proposed Underground Pipeline with Vegetation Clearing Along the Right-of-Way.....	4-201
Figure 4.16-7	Jungjuk Port Visual Simulation of Proposed Port Site	4-201
Figure 5.3-1	Alternative Road Corridors.....	5-17
Figure 5.6-1	Proposed Plant and Fuel Farm Alternative Locations	5-35
Figure 5.8-1	Goodman Pass Alternative	5-45
Figure 5.8-2	Round Mountain Alternative.....	5-47
Figure 5.8-3	Kuskokwim Hills Alternative	5-49

ACRONYMS AND ABBREVIATIONS

%	percent
°C	degrees Celsius
°C TU	Celsius degree-day temperature units
°F	degrees Fahrenheit
AAAQS	Alaska Ambient Air Quality Standards
ABA	acid-base accounting
ACMP	Alaska Coastal Management Program
ADCCED	Alaska Department of Commerce, Community and Economic Development
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AF-L	Alluvial Forest – Lowland vegetation type
AF-T	Alluvial Forest – Terraces vegetation type
AH	Aquatic Herbaceous vegetation type
AHRS	Alaska Heritage Resource Survey
Al	aluminum
amsl	above mean sea level
ANCSA	Alaska Native Claims Settlement Act
AP	acid potential
APE	Area of Potential Effect
ARD	acid rock drainage
As	arsenic
AKST	Alaska Standard Time
AST	Alpine Shrub Tundra vegetation type
ATV	all-terrain vehicle
AVCP	Association of Village Council Presidents
BACT	Best Available Control Technology
BARE	Bareground, Talus, and Gravel Bars vegetation type
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice
B.P.	before present

BRFSS	Behavioral Risk Factor Surveillance System
BSW	Black Spruce Woodland vegetation type
BTC	Birch Tree Crossing
BTG	Bluejoint Tall Grass vegetation type
CaCO ₃	calcium carbonate
CAS	Closed Alder Shrub vegetation type
CAWS	Closed Alder – Willow Shrub vegetation type
CBSF	Closed Black Spruce Forest vegetation type
CCC	criterion continuous concentration
Cd	cadmium
CDF	Closed Deciduous Forest vegetation type
CFR	Code of Federal Regulations
CIL	carbon-in-leach
CIRI	Cook Inlet Region, Inc.
CLE	contingency level earthquake
cm	centimeter(s)
CMF	Closed Mixed Forest vegetation type
CMP	Comprehensive Management Plan
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
Cr	chromium
CSF	Closed Spruce Forest vegetation type
Cu	copper
CWS	Closed Willow Shrub vegetation type
CWSF	Closed White Spruce Forest vegetation type
dB	decibels
dBA	A-weighted decibel
DBLS	Dwarf Birch Low Shrub vegetation type
DDT	dichlorodiphenyltrichloroethane
DGGS	Division of Geological & Geophysical Surveys
DNL	day-night average sound level
Donlin Gold	Donlin Gold, LLC
DRO	diesel range organics
EA	Emergent Aquatic vegetation type

EED	Environmental Evaluation Document
EFH	essential fish habitat
ESA	Endangered Species Act
ESB-SB	Ericaceous Shrub Bog – String Bog vegetation type
FBI	Federal Bureau of Investigation
Fe	iron
FILL	Fill, Disturbed vegetation type
FSA	Facilities Study Area (mine site)
ft	feet/foot
ft/d	feet per day
ft/sec	feet per second
ft ³ /sec	cubic feet per second
FWD	freshwater dam
FWDD	freshwater diversion dams
GHG	greenhouse gas
GIS	geographic information system
GMU	Game Management Unit
GRO	gasoline range organics
GUA	Guide Use Areas
ha	hectare(s)
HAP	hazardous air pollutant
HCD	Habitat Conservation Division of the National Marine Fisheries Service
HDD	horizontal directional drilling
HDPE	high-density polyethylene
Hg	mercury
HGM	hydrogeomorphic
IHNT	Iditarod Historic National Trail
ISER	Institute for Social and Economic Research
kg	kilogram(s)
km	kilometer(s)
km ²	square kilometer(s)
km/h	kilometer(s) per hour
KOP	key observation point
Ksat	hydraulic conductivity
Ktons	thousand short tons

Ktonnes	thousand tonne
L	liter(s)
lb	pound(s)
LEST	Low Ericaceous Shrub Tundra vegetation type
LLDPE	linear low-density polyethylene
LM	Lichen Mat vegetation type
LNG	liquefied natural gas
LPG	liquid petroleum gas
LSB	Low Shrub Bog vegetation type
m	meter(s)
m/sec	meter(s) per second
m ³	cubic meter(s)
m ³ /h	cubic meter(s) per hour
m ³ /sec	cubic meter(s) per second
MCE	maximum credible earthquake
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
MH	Mesic Herb vegetation type
mi ²	square mile(s)
mine site	portion of the project site that includes all facilities and structures associated with mining and milling (e.g., plant site, dams, ponds, stockpile areas)
MLW	Division of Mining, Land and Water – Alaska Department of Natural Resources
µg/g	microgram(s) per gram
µS/cm	micro Siemens per centimeter
mm	millimeter
mm/yr	millimeters per year
Mn	manganese
MOA	Memorandum of Agreement
mph	mile(s) per hour
MP	milepost
MSHA	Mine Safety and Health Administration
Mst	million short tons
Mt	million tonne(s)
mV	millivolt(s)
MW	megawatt(s)

MWMP	Meteoritic Water Mobility Procedure
NAAQS	National Ambient Air Quality Standards
NAG	non-acid-generating
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
ng/g	nanogram(s) per gram
NLUR	Northern Land Use Research, Inc.
NMFS	National Marine Fisheries Service
NO ₂	nitrogen dioxide
NO _x	nitrogen oxide
NP	neutralization potential
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
NWIS	National Water Information System
O ₃	ozone
OAS	Open Alder Shrub vegetation type
OAWS	Open Alder – Willow Shrub vegetation type
OBSF	Open Black Spruce Forest vegetation type
OBSF-S	Open Black Spruce Forest – Shrub vegetation type
ODF	Open Deciduous Forest vegetation type
OHV	off-highway vehicle
OLE	operational level earthquake
OMF	Open Mixed Forest vegetation type
ORP	oxidation reduction potential
OSF-LM	Open Spruce Forest – Lichen-Moss vegetation type
OSF-ML	Open Spruce Forest – Moss-Lichen vegetation type
OW	Open Water vegetation type
OWS	Open Willow Shrub vegetation type
OWSF	Open White Spruce Forest vegetation type
PAG	potentially acid generating
Pb	lead
PCB	polychlorinated biphenyl
plant site	part of the mine site where ore processing occurs (includes, for example, crusher, concentrator building, grinding area, flotation area, pressure oxidation building, tailings tanks)

PM	particulate matter
POX	pressure oxidation
ppm	parts per million
ppmv	parts per million by volume
project site	includes the mine and plant sites, and also includes the Donlin-Jungjuk Road, natural gas pipeline, permanent accommodations camp, air strip
PSD	Prevention of Significant Deterioration
PTE	potential to emit
PV	Partially Vegetated vegetation type
ROW	right-of-way
RRO	residual range organics
Sb	antimony
SD	standard deviation
Se	selenium
SF-B	Spruce Forest – Burned vegetation type
SHPO	State Historical Preservation Office
SNAP	Scenarios Network for Alaska Planning
SNOW	Snow vegetation type
SO ₂	sulfur dioxide
SOB	south overburden stockpile
SRK	SRK Consulting
st	short ton(s)
st/d	short ton(s) per day
SW-LM	Spruce Woodland – Lichen-Moss vegetation type
SW-ML	Spruce Woodland – Moss-Lichen vegetation type
SW-S	Spruce Woodland – Shrub vegetation type
SWPPP	Storm Water Pollution Prevention Plan
t	tonne(s)
t/d	tonne(s) per day
TCP	traditional cultural property
TDS	total dissolved solids
TKC	The Kuskokwim Corporation
TS	Tussock Sedge vegetation type
TSF	tailings storage facility
TU	degree-day temperature units

USACE	U.S. Army Corps of Engineers
USC	Unified Soil Classification
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish & Wildlife Service
USgal	U.S. gallon
USgpm	U.S. gallons per minute
USGS	U.S. Geological Survey
VOC	volatile organic compound
VRM	Visual Resource Management
VWPs	vibrating wire piezometers
W/m ²	Watts per square meter
WAD	weak-acid dissociable
WDF	Woodland Deciduous Forest vegetation type
WMF	Woodland Mixed Wood Forest vegetation type
WRF	waste rock facility
WRMC	waste rock management category
WSW	White Spruce Woodland vegetation type
WTC	waterway transportation corridor
WTP	water treatment plant
WWF	World Wildlife Fund
yd ³	cubic yard(s)
YKHC	Yukon-Kuskokwim Health Corporation
Zn	zinc

This page intentionally left blank.

1.0 INTRODUCTION

1.1 Purpose and Use of the Environmental Evaluation Document

This Environmental Evaluation Document (EED) describes the proposed project and its environmental measures, and the environmental setting and baseline studies completed in support of environmental permit applications. It also includes a preliminary assessment of potential environmental impacts of the proposed project. In addition, this EED briefly summarizes alternatives to the proposed project that Donlin Gold, LLC (Donlin Gold) evaluated during the project scoping and feasibility study phases. This EED is being provided to regulatory agencies and permitting authorities in support of required federal, state, and local permit applications and the National Environmental Policy Act (NEPA) process. NEPA requires that federal agencies evaluate the environmental impacts of their major decisions prior to issuance of any federal permits. NEPA directs federal agencies to use a systematic and interdisciplinary approach to this impact analysis, and requires that an environmental impact statement is prepared prior to any decision that may significantly impact the human environment. While the lead federal agency will evaluate project applications and supporting information to determine the appropriate level of NEPA review, Donlin Gold assumes that an environmental impact statement will be prepared.

1.2 EED Format

A summary of information provided in subsequent sections of this document is provided here:

- Section 2.0 – Project Description: Describes the components required to mine and mill the identified ore deposits, including environmental measures built into project design.
- Section 3.0 – Description of the Affected Environment: Presents the existing environment and socioeconomic conditions from public and project proponent-generated site-specific studies.
- Section 4.0 – Potential Impacts: Provides information prepared to date regarding the potential impacts of the proposed project to the affected environment.
- Section 5.0 – Alternatives: Provides information about various alternatives to project components that have been considered in developing the proposed project.
- Section 6.0 – Outreach and Community Coordination: Presents community and stakeholder outreach meetings held by the project proponent to date.
- Section 7.0 – References: Provides a list of the references used throughout this document.

1.3 Purpose and Need

The purpose of Donlin Gold's proposed project is to profitably produce gold from ore reserves owned by Calista Corporation, an Alaska Native Claims Settlement Act (ANCSA) corporation, utilizing open-pit mining methods and conventional, proven milling processes suitable for the characteristics of the ore reserves and for application in remote western Alaska.

The need for the proposed project is to enable Calista Corporation and The Kuskokwim Corporation to maximize economic benefits for its Native shareholders, from lands selected under ANCSA for their mineral potential, by producing gold to meet world-wide demand. Gold is an established commodity with international markets.