U.S. DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION

FINAL ENVIRONMENTAL ASSESSMENT
and
FINDING OF NO SIGNIFICANT IMPACT

Special Permit Information:

Docket Number:	PHMSA-2016-0149
Requested by:	Donlin Gold Limited Liability Corporation
Date Requested:	November 11, 2016
Original Issuance Date:	June 5, 2018
Effective Dates:	June 5, 2018
Code Section(s):	49 CFR 192.103, 192.105, 192.111, 192.317, and 192.619

I. Background

The National Environmental Policy Act (NEPA), 42 United States Code (USC) §§ 4321 – 4375, Council on Environmental Quality regulations, 40 Code of Federal Regulations (CFR) §§ 1500-1508, and U.S. Department of Transportation (DOT) Order 5610.1C, requires the Pipeline and Hazardous Materials Safety Administration (PHMSA) to analyze a proposed action to determine whether the action will have a significant impact on the human environment. PHMSA analyzes special permit requests for potential risks to public safety and the environment that could result from our decision to grant, grant with additional conditions, or deny the request. As part of this analysis, PHMSA evaluates whether a special permit would impact the likelihood or consequence of a pipeline failure as compared to the operation of the pipeline in full compliance with the Pipeline Safety Regulations. PHMSA developed this assessment to determine what effects, if any, our decision would have on the environment.

Pursuant to 49 U.S.C. § 60118(c) and 49 CFR 190.341, PHMSA may only grant special permit requests that are not inconsistent with pipeline safety. PHMSA will impose conditions in the special permit if we conclude they are necessary for safety, environmental protection, or are otherwise in the public interest. If PHMSA determines that a special permit would be inconsistent with pipeline safety or is not justified, the application will be denied.

The purpose of Enclosure B (draft environmental assessment for the pipeline) is to comply with NEPA for the Donlin Gold Limited Liability Corporation's (Donlin Gold) application for a pipeline special permit. This final environmental assessment (FEA) and finding of no significant impact (FONSI) will accompany the Donlin Gold Project Draft Environmental Impact Statement (DEIS) that is currently prepared by the U.S. Army Corps of Engineers (USACE). This FEA is prepared by PHMSA to assess the pipeline special permit request, in accordance with 49 CFR 190.341, and is intended to specifically analyze any environmental impact associated with the waiver of certain Pipeline Safety Regulations found in 49 CFR Part 192. The special permit for usage of strain-based design (SBD) and Enclosure B (the draft environmental assessment for the pipeline) are included together as an Appendix to the Donlin Gold DEIS currently being prepared by the USACE.

II. Purpose and Need

Donlin Gold proposed the construction of a pipeline to transport natural gas from the Cook Inlet in south-central Alaska to their planned project mine site located approximately 10 miles north of the village of Crooked Creek on the Kuskokwim River in western Alaska. PHMSA regulates pipeline safety by imposing specific regulatory requirements for the design, construction, operation, and maintenance of natural gas pipelines through the regulations in 49 CFR Part 192. PHMSA does not have authority to approve or license pipeline construction or routing; instead, PHMSA enforces compliance with its pipeline safety regulations throughout the various stages of construction and operation of pipeline facilities. Donlin Gold anticipates there will be areas along the planned pipeline route with the potential for frost-unstable soils or ground movement and has requested a special permit from PHMSA to allow SBD for this segment 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 the NEPA in deciding whether to issue a special permit.

This special permit allows Donlin Gold to design and construct the pipeline using SBD. The special permit includes conditions to ensure the pipeline has equal or greater safety than a pipeline constructed in accordance with 49 CFR Part 192.

III. Background and Site Description

Figure 1 (The Donlin Gold Pipeline Route - page 42 of 43) shows the pipeline route from the Cook Inlet to the Donlin Gold project mine site located approximately 10 miles north of the village of Crooked Creek on the Kuskokwim River. The pipeline crosses public lands administered by the State of Alaska and the Bureau of Land Management (BLM) along with private lands, as shown in Figure 1.

The proposed pipeline would span approximately 315 miles (507 kilometers) from the Donlin Gold mine to the west end of the Beluga Gas Field, approximately 30 miles (48 kilometers) northwest of Anchorage, Alaska, at a tie-in located in the Matanuska-Susitna Borough near Beluga, Alaska. The pipeline route begins at the Beluga Natural Gas Pipeline (BPL) (the natural gas source), designated Mile Post (MP) 0[1] within the Susitna Flats State Game Refuge (SFSGR) and follows the Pretty Creek public road easement for most of the pipeline's route though the SFSGR. The gas would receive booster compression supplied by one compressor station located at approximately MP 0.4 near the beginning of the pipeline. No additional compression along the pipeline route would be required. From the SFSGR the route then proceeds north, crossing the Castle Mountain Fault at approximately MP 7, then traversing the east flank of Little Mount Susitna to the Skwentna River (approximately MP 50), and then parallels the Skwentna River westerly to Puntilla Lake (approximately MP 102).

From approximately MP 106 the route trends northwest to a crossing of the Happy River at approximately MP 108.5. From the Happy River crossing, the pipeline route proceeds along a low moraine ridge before turning north into the broad valley of Three Mile Creek. At approximately MP 114.5 the alignment trends westerly as it approaches the unnamed pass in the Alaska Range divide. This pass has an elevation of 3,870 feet (1,179.6 meters). The short steep drainages immediately on each side of the pass are in narrow valleys with talus lobes and stabilized rock glaciers at the base of steep rock slopes. At approximately MP 120.5 the pipeline route enters a typical broad "U shaped" valley characteristic of the glacial valleys in this region. As the pipeline route descends this valley it is

[1] Mile posts (MP) are in miles. From MP 1 to MP 2 is one-mile in length.

typically on the benches or terraces with moderate to little slope that border this unnamed tributary of the Tatina River.

At approximately MP 127.3, the realignment crosses the Tatina River's glacial braided floodplain before it ascends to a broad open pass before descending into the valley of the Jones River at approximately MP 130.5. From approximately MP 130.5 to MP 143 the pipeline route remains in the Jones River Valley and roughly parallels the Jones River. The route crosses the Jones River twice at approximately MP 136.6 and MP 137.6. The pipeline route exits the mountains of the Alaska Range and crosses the Denali Fault at approximately MP 149 heading westerly crossing the South Fork of the Kuskokwim River then trending southwesterly towards Farewell.

The route continues southwest near Farewell (approximately MP 157), paralleling the Alaska Range until crossing the Kuskokwim River (between approximately MP 240 and MP 241). Beyond the Kuskokwim River, the route primarily follows ridgelines for more than 80 miles (129 km) toward the west, to the proposed Donlin Gold mine site, the pipeline terminus, at approximately MP 315, about 10 miles (16 km) north of the village of Crooked Creek.

Except for the first five (5) miles, where the pipeline will parallel an oilfield service road, the route will not intersect or parallel any existing permanent infrastructure. From approximately MP 50 to MP 110, portions of the route will parallel and occasionally intersect with the INHT, which is primarily used for winter recreational activities. Between MP 55 and MP 60, the route will pass through the State of Alaska Shell Hills Subdivision (Subdivision), which consists primarily of five (5) acres of remote recreational parcels, most of which have not been acquired from the State and remain unused.

Pursuant to 49 CFR 192.5, the entire proposed alignment is classified as Class 1, which is defined as a location that has 10 or fewer buildings intended for human occupancy located within 220 yards on either side of any continuous 1-mile length of pipeline. No high consequence areas, as defined under 49 CFR 192.903, have been identified in the planned vicinity of this pipeline.

The permanent width of the main proposed pipeline right-of-way (ROW) would be 50 feet (15.2 meters) through State lands and 51 feet 2 inches (15.6 meters) through Federal lands, as the Federal ROW regulations require a width of 50 feet (15.2 meters) plus the diameter of the pipeline or a total of at least 51 feet 2 inches (15.6 meters). The permanent width or size of the ROW would also be 50 feet (15.2

meters) on all private land through which the proposed pipeline travelled. In addition to the adjoining permanent 50-foot (15.2 meter) ROW, and following the proposed pipeline alignment, an application would be submitted for a nominal 100-foot- (30.5 meter) wide temporary construction ROW area.

The proposed natural gas pipeline corridor crosses four (4) ecoregions. From east to west these areas are the Cook Inlet Basin, the Alaska Range, Tanana-Kuskokwim Lowlands, and Kuskokwim Mountains. East of the Alaska Range, mixed forest is more prevalent with coniferous forests and tundra more common west. Large concentrations of migrating waterfowl and shorebirds occupy the SFSGR. However, the absence of permafrost in that portion of the pipeline would negate the need for SBD or a special permit. A variety of songbirds and raptors inhabit the forested habitats traversed by the pipeline; furbearers include moose, caribou, Dall sheep, and black and brown bears. A detailed description of the pipeline ROW, supporting facilities, and construction methodology and facilities is provided in Chapter 2 of the Donlin Gold DEIS. Baseline environmental conditions and the analysis of environmental effects resulting from construction and operation of a pipeline are addressed by individual resource in Chapter 3 of the Donlin Gold DEIS and in Section V (Environmental Impacts of Selected and Alternatives) of this document.

The pipeline will traverse areas potentially subject to geotechnical hazards (geohazards). Broadly defined, a geohazard is a geological and/or environmental condition with the potential to cause distress or damage to civil works. The particular geohazard of interest for the Donlin Gold pipeline is thaw settlement due to surface disturbance from construction.

Thaw settlement may occur when ground temperatures rise because of disturbance of the surface vegetative mat that causes the ice present in the soil to melt. The melting of previously permanently frozen (permafrost), ice-rich (i.e., contains ice in excess of the volume required to fill the pore space in an unfrozen state) soils results in soil consolidation or settlement, the magnitude of which is dependent on the type of soil. The amount of settlement divided by the initial thickness of the frozen soil layer is denoted as "thaw strain". Differing amounts of settlement along the alignment may cause longitudinal bending of the pipe, resulting in strains in excess of 0.5 percent (%) (the pipe material's yield strength, which is defined at 0.5% strain), and thereby triggering the need to address thaw strain with the use of SBD, heavier walled pipe, or an above-ground pipeline. Soils that are only seasonally frozen (the near-surface soil layers freeze during the winter along the entire pipeline alignment) will not cause displacement of the bottom of the pipe ditch and thus will not affect longitudinal bending of the pipe.

Other geohazards, such as frost heave and fault displacement, are not expected to be of concern due to the planned operating conditions and the design/construction approach. In terms of operating conditions, the pipeline will transport gas at the ambient ground temperature in the permafrost areas and therefore would not generate a permanent frost bulb around the pipe, precluding frost heave. The pipeline will be constructed so that the active fault on the alignment would be crossed via an above-ground mode designed to allow for fault displacement.

Based on soil mapping and geotechnical borings conducted by Donlin Gold the presence of permafrost in significant quantities is limited to the area from MP 100 near Puntilla Lake to MP 215 near (the Tatlawiksuk River crossing). Additionally, isolated pockets of permafrost may occur on other segments of the pipeline. Isolated pockets of permafrost would typically be addressed using alternative engineering and construction techniques (such as horizontal directional drilling, heavier walled pipe, or excavation of frozen material that is below the pipe) in these areas to mitigate the potential for high longitudinal pipe strains due to thaw settlement. These techniques will comply with 49 CFR Part 192.

Donlin Gold has confirmed the presence of discontinuous permafrost between MP 173 to MP 189, MP 192 to MP 196, MP 201 to MP 209.5, and MP 213 to MP 215 could potentially result in thaw settlement causing longitudinal pipe strains in excess of 0.5%. 49 CFR Part 192 requires that "pipe must be designed with sufficient wall thickness, or must be installed with adequate protection, to withstand anticipated external pressures and loads that will be imposed on the pipe after installation."[2] Because buried pipe in permafrost conditions would need to be exceptionally thick-walled to withstand the forces and strains due to thaw settlement, Donlin Gold is proposing to design, install, and operate the pipeline between MP 173 to MP 189, MP 192 to MP 196, MP 201 to MP 209.5, and MP 213 to MP 215 using a SBD approach. The SBD approach would account for these strains from soil consolidation/settlement using alternative strategies, mitigation, and conditions instead of heavy-walled pipe. Regulatory requirements do not presently exist for the use of SBD; however, the SBD special permit includes

[2] Code of Federal Regulations. (2011). *49 CFR Part 192.103 – Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards; Subpart C – Pipe Design; General.* U.S. Government Publishing Office. Retrieved from: https://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol3/pdf/CFR-2011-title49-vol3-part192.pdf.

factors and conditions to ensure the design and safety considerations described under 49 CFR 192.103, 192.105, 192.111, 192.317, and 192.619.

Donlin Gold further recognizes additional areas of permafrost that could potentially result in thaw settlement causing longitudinal pipe strains in excess of 0.5% may be identified at any point between MP 0 and MP 315 as project engineering advances. If such areas are identified and cannot be addressed using the alternative engineering and construction techniques described above then, utilizing the design change process established in Appendix B of the Special Permit, the pipeline will be designed, installed, and operated in these additional areas using an SBD approach. The Donlin Gold DEIS and the environmental analysis presented in Enclosure B therefore address the entire pipeline from MP 0 to MP 315, which is defined as the SBD Segments Permit Area.

IV. Alternatives

An applicant requesting a special permit from PHMSA has the option to build a pipeline that would not be subject to longitudinal bending that could result in longitudinal pipe strains above 0.5% and would not require PHMSA to issue a special permit. This would require the design, construction, and operation of a pipeline that was in full compliance with 49 CFR Part 192. PHMSA's NEPA assessment, therefore, is slightly different from other agencies in that the No-action Alternative is not a No-build Alternative, but instead reflects a pipeline design that would not require the issuance of a special permit. In the case of this document, the applicant is Donlin Gold. The Selected Alternative reflects Donlin Gold's SBD, for which a special permit with conditions would be issued. In the draft environmental assessment, PHMSA referred to a Proposed Action that is called the Selected Alternative in this FEA. The No-action Alternative and the Selected Alternative are described below.

a. **No-Action Alternative**: One or a combination of the following Part 192-compliant techniques would be employed to mitigate the thaw settlement geohazard.

    i. Removal and replacement of thaw-unstable material: This technique, also known as over-excavation, would be employed only in areas with evidence of very high thaw strains in near-surface soils, such as massive ice directly under the ditch. The thaw-unstable soils would be removed and replaced with imported thaw-stable materials. This method would require deeper and wider trenches than would be necessary with an SBD pipeline; it would also require the mining and importation of additional select fill material to backfill the trench below the pipe, as well as disposal of the removed material. This technique is of limited value since the magnitude of settlement required to cause high pipe strains implies a thaw depth in normal soils of more than ten feet below ditch bottom.

ii. Installation of extra heavy-wall pipe (pipe that is approximately 1-inch thick): Heavy-wall pipe allows the pipeline to resist soil movement and conform more gradually to differential displacement of the ditch bottom. This technique could be employed in areas where the lateral extent of the permafrost is limited, the heavy-wall pipe can be demonstrated to withstand strains resulting from permafrost-related geohazards, the depth to thaw-stable soil strata is greater than practical for complete removal and replacement of the overlaying soils, or other areas considered practical.

iii. Above-ground installation: This technique requires installation of support structures known as vertical support members (VSM) to elevate the pipeline a sufficient height above the ground surface to limit thermal interaction between the pipe and the soil. This technique is employed in areas where heavy-wall pipe is not sufficient to reduce the longitudinal bending of the pipe to acceptable levels, the depth to thaw-stable soil strata is greater than practical for complete removal and replacement of the thaw-unstable soils, or in other areas considered practical. Above-ground pipeline installation, as is used in the Trans Alaska Pipeline (TAPS), imposes visual impacts, potential disruption of animal migration/movement, safety/security concerns associated with exposed pipe, and the increased cost of installation due to VSMs.

iv. Trenchless technologies (HDD, horizontal boring, etc.): This technique could be employed in areas where the lateral extent of thaw-unstable soils is limited, the strata thickness is relatively thin and well mapped, and favorable subsurface conditions for drilling make it possible to bore under the problematic soil strata. Although this technique could be used in some site-specific conditions, it is not a practical technique for the entire route due to the expense, duration, and complexity of drilling, as well as the fact that not all ground conditions are amenable to drilling.

For purposes of the impact analysis, it is assumed that substantial segments of the pipeline would be built above ground—as proposed by the No-action Alternative—and that other methods would be implemented as practical/necessary.

b. **Selected Alternative**: The Selected Alternative consists of designing, constructing, operating, and maintaining the pipeline in compliance with the Special Permit Conditions, which will ensure that the pipeline will continue to function effectively and safely even if thaw settlement and longitudinal bending occurred. The SBD Special Permit Conditions will require specific materials, engineering, construction, and operations and maintenance (O&M) procedures for mitigation where thaw settlement and longitudinal bending strains exceed allowed limits (0.5%) in the specified SBD segments.

   i. *Explain what the special permit application asks for:*

   Because PHMSA's current regulations do not address SBD, additional conditions are warranted to address anticipated external loads and/or route hazards that could either cause a pipe to move or to sustain longitudinal loads that require consideration of high strains. Such additional conditions are contemplated under 49 CFR 192.103 and 49 CFR 192.317. Donlin Gold requests that PHMSA issue a Special Permit to incorporate the additional conditions.

   The special permit application covers the use of SBD and assessment to address longitudinal bending of the pipe due to permanent ground deformations. For the Selected Alternative, the predominant geohazard that requires the use of SBD is thaw settlement. Under the Selected Alternative, all pipeline segments identified as requiring SBD will be constructed of 14-inch-diameter American Petroleum Institute (API) 5L Grade X-52 pipe with a minimum wall thickness of 0.406 inches. This is significantly thicker than the minimum wall thickness required for pressure containment (0.276 inches), as calculated using the design formula for steel pipe given in 49 CFR 192.105 for a maximum allowable operating pressure (MAOP) of 1,480 pounds per square inch gauge (psig). For the Selected Alternative, pipe wall thickness would be driven by the thickness required for pressure containment in the aboveground sections and buried sections where all permafrost material is removed from the trench, or by the thickness needed to withstand strains from permafrost-related geohazards in areas where the pipe is buried in permafrost.

The use of SBD techniques would supplement the requirements of 49 CFR Part 192, which does not address longitudinal loadings above 0.5% strain, such as those resulting from permanent ground deformations. Since SBD is not covered by any pipeline standards, including 49 CFR Part 192, additional conditions are warranted to address these loadings.

ii. *Cite the regulation(s) for which the special permit is sought, in accordance with 49 CFR 190.341:*

The special permit is sought for 49 CFR § 192.103. Donlin Gold's application for a special permit also addresses the following regulations: 49 CFR 192.105, 192.111, 192.317, and 192.619.

iii. *Explain/summarize how the design/operation/maintenance of the pipeline operating under the special permit would differ from the pipeline operating under the No-action Alternative:*

In addition to applicable requirements under 49 CFR Part 192, a pipeline utilizing SBD would be subject to more rigorous materials testing, construction, and O&M monitoring requirements, as defined in the SBD Special Permit Conditions, specifications, and procedures developed by Donlin Gold. The SBD segments of the Donlin Gold pipeline would be constructed of line pipe that meets the requirements of API 5L Grade X52 PSL 2. During the design phase and with PHMSA's review and response of "no objection," Donlin Gold will develop material specifications, as defined in Appendix A of the special permit. As per the developed material specifications, these material specifications will address the requirements of high-strain behavior and perform material testing, including full-scale testing, to establish tensile and compressive strain capacities for the pipeline material procured. During the construction phase, Donlin Gold will complete comprehensive construction, weld procedure qualifications, non-destructive testing of all welds, and an extensive quality assurance and quality control program for pipe installation, with emphasis on girth welds, 100% nondestructive examination of all girth welds, and records of all field welding. During the operation phase, Donlin Gold will perform comprehensive monitoring to identify potential high-strain conditions and implement appropriate corrective action, as required, thereby ensuring the safe operation of the pipeline. Additional detail on the requirements for design, construction, and operation is provided in the special permit and Section X: Special Permit Conditions of this document.

iv. *The applicant should include the pipeline stationing and MP(s) for the location(s) of the applicable special permit segment(s).*

The SBD segments for the Donlin Gold Pipeline would run from MP 173 to MP 189, MP 192 to MP 196, MP 201 to MP 209.5, and MP 213 to MP 215, as shown in Figure 2 on page 43 of 43. The SBD Segments Permit Area would run from MP 0 to MP 315.

v. *Mitigation Measures*

Additional mitigation measures are addressed in Section X: Special Permit Conditions of this document and the special permit.

V. Environmental Impacts of the Selected Alternative and No-action Alternative

a. *Describe how both small and large pipeline leaks/ruptures could impact safety and human health/the environment.*

i. A small leak from a buried or above-ground pipeline would result in a gradual release of gas, with the total amount of gas released dependent on the time it took for the leak to be detected and fixed. In the case of an above-ground line, gas from a small leak would dissipate directly into the air, whereas for a buried line it would permeate through the backfill material (soil) before dissipating into the air. Small gas pipeline leaks result in some impact on or loss of surrounding vegetation; this browning of vegetation can facilitate the identification of small underground leaks.

ii. A large rupture would result in the rapid release of a large volume of natural gas, creating a trench or crater in the immediate vicinity of the rupture and resulting in significant damage to the pipeline. If an ignition source was present, an intense fire or explosion would result, which could result in death or serious injury to any humans or wildlife in the close vicinity of the pipeline.

iii. For a fire resulting from a large rupture, the extent of a fire would depend on the extent of the combustible materials in the vicinity and local environmental conditions (e.g., rain, snow cover, etc.).

iv. When comparing an above-ground pipe segment to a buried segment, extended segments of above-ground pipeline increase the potential for third-party and other damage to the pipeline (e.g., heavy equipment, bullet strikes, avalanches, etc.). There is a lesser risk from third-party damage to buried pipelines; however, both pipeline types have the potential for fire once a rupture occurs. Potential corrosion and leaks may be easier to locate in above-ground segments and would be quicker and easier to repair without the need for excavation of buried pipe.

b. *Submit an explanation of the <u>delta/difference</u> in safety and possible effects to the environment between the 49 CFR Part 192 baseline and usage of the Special Permit Conditions for SBD mitigation measures.*

i. For purposes of this assessment, Donlin Gold assumes that much of the No-action Alternative would be built using above-ground construction techniques to address concerns related to thaw settlement in areas of permafrost. In some areas where avalanches and other geohazards are present, such as the Three Mile Pass section, a mix of HDD and deep excavation would most likely be utilized. In other areas where geotechnical conditions are suitable, heavier-walled pipe would be utilized. For the Selected Alternative, the SBD segment subject to the Special Permit Conditions will be buried throughout its length, except for the crossings of the Denali and Castle Mountain faults, which would be above ground.

During construction, the installation of the buried pipeline proposed by the Selected Alternative would require earth moving and excavation in addition to the disturbance resulting from the clearance of the ROWs. This would result in a greater disturbance to soils compared to the No-action Alternative, where most the pipeline would be above ground.

The anticipated differences in effects on individual resources between the No-action Alternative and the Selected Alternative are discussed below.

1. Human Health and Safety

As discussed above, above-ground pipeline leaks under the No-action Alternative may be easier to locate and repair. However, Donlin believes that the presence of extensive above-ground pipeline through the permafrost areas proposed by the No-action Alternative could increase the potential for pipeline damage resulting from human or environmental interaction. A buried pipeline along this route is less likely to be damaged by:

- Heavy equipment being transported across the country, especially under winter whiteout conditions;
- Intentional or unintentional bullet strikes, such as those that impacted the Trans-Alaska Pipeline in 2001;[3] or
- Avalanches in the high, narrow valleys of the Alaska Range Crossing.

The pipeline route is extremely remote, with human use consisting primarily of subsistence hunting, recreational hunting, related activities, and use of the INHT. As such, the potential for people to be impacted by a gas release and potential subsequent explosion and fire is low. The above-ground pipeline of the No-action Alternative would present a greater physical threat to the safety or subsistence of other cross-country travelers who could potentially contact the pipeline under low-visibility conditions.

2. Air Quality

There would be no significant difference in emissions between the No-action Alternative and the Selected Alternative. Most heavy equipment required for construction of either would be the same, including equipment such as brushers and bulldozers for the clearing and leveling of the ROW, trucks for transporting pipe, and side booms and welding trucks for pipe placement and welding. Above-ground portions of the No-action

[3] The Alyeska Pipeline Service Company (APSC), State of Alaska Department of Environmental Conservation, State of Alaska Department of Fish and Game, State of Alaska Department of Labor and Workforce Development, State of Alaska Department of Natural Resources, State of Alaska Department of Public Safety, U.S. Environmental Protection Agency, the Joint Pipeline Office, DOT: Office of Pipeline Safety, U.S. Department of the Interior: BLM, and other entities. (February 8, 2002). *Joint After-action Report for the TAPS Bullet Hole Response (October 2001).* Retrieved from: https://dec.alaska.gov/spar/ppr/docs/report/aft_comp.pdf.

Alternative would require additional equipment, such as pile drivers for the installation of pipe supports, while below-ground portions of the No-action Alternative and the Selected Alternative would require additional digging and trenching equipment. O&M activities to maintain the pipeline for the No-action Alternative and the Selected Alternative would require similar equipment and personnel.

3. Aesthetics

The extensive above-ground pipeline described by the No-action Alternative approach would present a substantial visual impact, particularly near the INHT. Trail users would see the pipeline from numerous points along the trail and may, in some cases, need to pass under or over it. Visual effects from the buried special permit line described by the Selected Alternative would be limited to the ROW clearance, which would be less obvious with winter snow cover.

The effects of a small leak are expected to be similar under both pipeline scenarios. However, in the event of a large rupture from an underground pipeline a crater would be created, while the damage caused by a rupture from an above-ground pipeline would be more surficial in nature. In either case, the resulting damage would occur within the ROW footprint.

4. Biological Resources, Including Vegetation, Wetlands, and Wildlife

Chapter 2 of the Donlin Gold DEIS provides a detailed description of proposed pipeline construction methods and Chapter 3 discusses pipeline construction impacts to vegetation, wetlands, aquatic resources, wildlife, and soils, including permafrost. No species listed in the Endangered Species Act are present within the pipeline corridor (see Chapter 3 of the Donlin Gold DEIS).

Compared to the construction of the buried pipeline proposed by the Selected Alternative, construction of extensive above-ground pipeline portions of the No-action Alternative would result in a similar disturbance footprint within the ROW, but would require less excavation and hydrology disturbance.

The buried pipeline proposed by the Selected Alternative would generate more surface disturbance compared to the above-ground pipeline proposed by the No-action Alternative. This is due to the excavation necessary to bury the line and the development of borrow areas—pits where material is excavated for use in the construction of the pipeline—for pipeline bedding. The effects of excavation for pipeline installation and borrow areas would have the greatest effect in wetland areas if drainage and sub-surface flow patterns were not adequately reestablished. These impacts or changes to the wetland areas could affect habitat quality and conditions for wildlife species that depend on the wetlands. However, the relatively narrow width of the ROW, along with revegetation, and efforts to minimize disruption to hydrology are expected to similarly minimize impacts to any wildlife that depends on the wetland/tundra habitat.

Construction of the above-ground portions of the No-action Alternative, including installation of the vertical support members (VSMs), would generally have less of an adverse effect on wetland hydrology than excavation activities associated with buried pipeline segments. Under both scenarios, impacts to wetlands would be lessened using winter construction techniques and route selection that minimized wetland construction requirements. Construction-related wetland impacts are discussed in detail in Chapter 3 of the Donlin Gold DEIS.

Both alternatives would require vegetation clearing, but the trench excavation proposed by the Selected Alternative would likely have a more profound and long-term impact to vegetation, especially due to hydrology disruption.

A small leak on the Selected Alternative's buried pipeline would result in the potential mortality of vegetation in the immediate vicinity of the leak, which would not occur on the No-action Alternative's above-ground pipeline. A similar divergence of impact could occur in wetlands; however, there would be no difference in the pipelines' effect on wildlife species. In the event of a large rupture, the difference of above-ground and buried pipelines' effect on vegetation, wetlands, and wildlife would be small. In the event of a large rupture in a buried segment of pipeline, however, a crater of approximately 0.1 acres could be created within the ROW. The damage caused by a large rupture in an above-ground line would be more surficial. Any crater would be regraded during the repair of the pipeline. The likelihood of a post-rupture fire and explosion would be the same in both cases, with the extent of adverse effects equally dependent on site conditions at the time of the incident.

5. Climate Change

There would be limited differences in emissions of greenhouse gases between the No-action Alternative and the Selected Alternative, reflected primarily in diesel emissions during construction. The No-action Alternative and the Selected Alternative would both require equipment that burns fossil fuels for ground clearance, transportation of construction materials and employees, and stringing the pipeline. The buried portions of the No-action Alternative and the Selected Alternative would both require excavation equipment; additionally, the No-action Alternative would necessitate setting thousands of VSMs. When considered on a global scale, the difference between emissions for the alternatives would be minimal. Chapter 4 of the Donlin Gold DEIS discusses the Selected Alternative's greenhouse gas emissions and effect on climate change due to permafrost effects. The No-action Alternative would likely result in a more limited release of greenhouse gases due to the anticipated excavation of permafrost; under both alternatives, however, simply maintaining the ROW could adversely affect permafrost stability.

Permanent melting of permafrost results in the release of methane gas and carbon dioxide. There would be some permanent melting under both options, but greater permanent melting would result from the trench excavation and hydrology disruption under the Selected Alternative, which would cause further loss of insulating vegetation and permanent melting.[4]

6. Cultural Resources

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[4] Leadley, P.W., Li, H., Ostendorf, B., and Reynolds, J.F. (1996). *Road-Related Disturbances in an Arctic Watershed: Analyses of a Spatially Explicit Model of Vegetation and Ecosystem Processes.* In: Reynolds, J.F. and Tenhunen, J.D. (Eds.), *Landscape Function and Disturbance in Arctic Tundra,* Ecological Studies (Analysis and Synthesis) (Vol. 120, pp. 387-415. Springer, Berlin, Heidelberg.

Construction activities have the potential to affect cultural resources, as described in Chapter 3 of the Donlin Gold DEIS, which presents a detailed description of cultural resources and possible impacts associated with pipeline construction. Ground-clearing activities under both the No-action Alternative and the Selected Alternative would be similar; however, the excavation necessary for a buried pipeline would result in a greater potential for adverse effects to buried cultural resources. The USACE is conducting a Section 106 consultation process with stakeholders that will lead to the development of a programmatic agreement to address the management and recovery of known cultural resources, as well as any cultural resources discovered during project implementation. The programmatic agreement would apply to both the No-action Alternative and the Selected Alternative, thereby mitigating their effects on cultural resources. There would be no difference between the two options in the event of either a small or large leak for buried segments; a small gas leak from the above-ground segment of the No-action Alternative would be unlikely to affect cultural resources.

7. Environmental Justice

Since both the No-action Alternative and the Selected Alternative would be sited on the same footprint, there would be no difference in the effects on environmental justice resulting from construction or operation of the pipeline.

8. Geology, Soils, and Mineral Resources

Construction activities have the potential to affect localized areas of soil with minimal effect on regional geology or mineral resources. Construction activities that could contribute to erosion include clearing and grading, excavation trenching, stockpile management, backfilling, and the development of gravel pads. However, most erosion effects are effectively managed through the use of erosion and sediment control measures, including:

- Winter construction in areas with wet and frozen ground conditions;
- Minimizing areas with compacted vegetation;
- Salvaging organic mats used in surface reclamation;

- Settlement basins, silt fences, and other best management practices for storm water control;
- Engineered flow diversions and slope breakers to control water flow on slopes and around water courses; and
- Installing trench breakers to address storm and groundwater flow through the trench backfill or during construction.

Chapter 3 of the DEIS provides a more detailed discussion regarding the impacts of pipeline construction on soils and erosion, as well as the potential mitigation measures necessary to address these impacts. Mitigation measures for erosion and sediment control for both the No-action Alternative and the Selected Alternative would be addressed in detail via the ROW and Section 404 permitting activities.

Because it would result in more physical disturbance to the soil resource, the Selected Alternative would have a greater effect on soils. Mineral resources and geology would be affected in the development of material sites, as discussed in Chapter 3 of the Donlin Gold DEIS, since the need for bedding materials for the buried pipeline would result in a more surface disturbance than would be necessary for an above-ground pipeline.

The effect of the O&M activities that would take place along the pipeline ROW to satisfy 49 CFR Part 192 would be similar for the two alternatives. All O&M excavations would be conducted as authorized under the applicable ROW authorization, which would be issued by the land management agencies responsible for lands along the pipeline route: the BLM and/or the Alaska Department of Natural Resources. All excavations and other applicable activities for both alternatives would be permitted through the appropriate Federal and State agencies.

No differences in effects are expected between the No-action Alternative and the Selected Alternative for a small leak or large rupture, since the differing impacts would have occurred during the construction process and any repairs would be within the pipeline construction footprint.

9. Indian Trust Assets

No Indian trust assets have been identified within the pipeline route.

10. Land Use, Subsistence, and Recreation

Land use, both subsistence activities and recreation, could be altered in the immediate vicinity of construction activities. However, the pipeline's remote location, combined with the relatively small width of the ROW, would generally limit the extent of user displacement to the active construction zones. Construction activities would be timed to avoid potential conflicts of use with the portions of the INHT used during the annual Iditarod sled dog race.

In both options, the route would pass close to—but not overlap—privately held parcels in the Shell Hills Subdivision and the Happy River Remote Recreation Cabin Staking Area. No permafrost has been identified along the alignment in either of these areas; therefore, because below-ground construction would occur in areas free of permafrost in both the Selected Alternative and the No-action Alternative, there would be no difference between the two alternatives. No existing agricultural areas have been identified within the vicinity of the proposed pipeline route.

The construction effects of an above-ground pipeline versus a below-ground pipeline would be minor. After construction of either, the ROW would be graded and revegetated until it reached a stable condition. No long-term linear access along the pipeline alignment is proposed; however, both alternatives are subject to PHMSA regulations that require the pipeline ROW be brushed to prevent the growth of large vegetation over and around the pipeline, thereby maintaining a clearly defined ROW. Chapter 2 of the Donlin Gold DEIS includes a detailed description of the pipeline ROW footprint and post-construction remediation of the ROW. The presence of an above-ground pipeline could create an additional physical barrier in the landscape that would represent an adverse effect for both recreational and subsistence land use activities that would not be present with a buried pipeline. Only a negligible difference in effects on subsistence and recreational use is expected between the No-action Alternative and the Selected Alternative in the event of either a small leak or a large rupture.

Potential effects on recreational, visual, and subsistence uses are examined in detail in Chapter 3 of the Donlin Gold DEIS.

11. Noise

Since much of the equipment used to construct them is the same, noise impacts would be similar for the installation of an above-ground or below-ground pipeline and would generally be limited to the sounds of construction during equipment operations. The impact of construction noise on the public would be of relatively short duration and limited to when people traverse the area, as human use of the location is transient and limited. Wildlife could also be affected by construction-related noise. Noise related to operation of the pipeline itself would primarily result from the occasional maintenance of the ROW and would be limited to the duration of the maintenance. No difference in noise levels is expected between the No-action Alternative and the Selected Alternative and the effect of these levels would be minimal, as ROW maintenance would only occur every few years. A detailed discussion of noise impacts associated with pipeline construction and operation is provided in Chapter 3 of the Donlin Gold DEIS.

12. Water Resources

The trenching required for the buried pipe proposed by the Selected Alternative could result in additional impacts to surface and groundwater if appropriate design and construction techniques are not utilized for both the trenching and backfill of the trench. Appropriate techniques prepared by the USACE would be utilized to prevent the extended flow of groundwater along the trench; such techniques would include the use of trench plugs, as discussed in Chapter 3 of the Donlin Gold DEIS. The placement of adequate backfill and proper reclamation of the ROW would prevent channeling and obstruction of surface water flows. Stabilization techniques—including gravel blankets, riprap, gabions, or geosynthetics—would be used to stabilize the stream banks and channel bed at stream crossings. Most rivers and streams along the pipeline route would be crossed by an open-cut method during winter months, when flows are lowest and disturbance of the channel and stream bank can be minimized. Burial depths for crossings have been based on site-specific calculations to avoid the potential for scour.

The difference between the effects of a small leak in an above-ground pipeline versus a buried pipeline could have on water resources would be minimal, as the gas would pass through any water exposed to a leak underground. A large rupture in an above-ground pipeline would have no effect on water resources except for impacts to the wetland area surrounding the pipeline; however, a large rupture in a buried pipeline could introduce natural gas into surface water or groundwater, although the effect would be both localized and short-lived.

A detailed discussion regarding the management of water during construction and operation of the pipeline, as well as impacts to groundwater and surface water flow and quality resulting from the construction and operation of the pipeline, is presented in Chapter 3 of the Donlin Gold DEIS.

c. *Describe the safety protections provided by the Special Permit Conditions.*

i. What factors were considered to ensure the conditions are adequate to protect against waiving the protections (maximum pipe strength limitations) of the code?

The special permit will require extensive evaluation of the potential for thaw settlement and other geohazards over the full operational life of the pipeline. Once the potential for settlement has been quantified, an appropriate pipe thickness must be selected to withstand the longitudinal strain that may result. Specific test work requirements for the selection and production of the pipe would be established to ensure that the steel is of appropriate quality. Specific training, monitoring, and testing requirements for welding during construction will be established, as well as specific requirements for monitoring through operations to ensure that any longitudinal strains that exceed those contemplated in the design are identified and mitigated in a timely manner. These requirements are discussed in more detail in Section X: Special Permit Conditions.

ii. What are the safety and environmental risks from usage of SBD for which protections are necessary?

The safety and environmental risks associated with the construction of an underground pipeline in permafrost soil could initiate change in wetland conditions and/or melting of the permafrost soils, causing thaw settlement, thereby removing the soil support from under the pipeline and causing a failure of the pipeline, leading to a leak or rupture and the subsequent release of gas and possible explosion or fire. As outlined in the special permit, the use of SBD would ensure that the pipeline is designed, constructed, maintained, and operated in a way that avoids failure due to stronger, more flexible pipe and close monitoring of pipe and soil conditions.

d. *Explain the basis for the particular set of alternative mitigation measures described in the Special Permit Conditions. Explain whether the measures will maintain an equivalent level of safety and environmental protection as compliance with existing regulations.*

The basis for the mitigation measures is the expectation that some segments of the pipeline may experience thaw settlement after construction that would result in unacceptable longitudinal strain on the pipe. To address this expectation, the mitigation measures require the quantification of the maximum amount of thaw settlement possible, selection of a suitable pipe wall thickness, use of steel of an appropriate quality, and ongoing O&M procedures to deal with increases to longitudinal strain on the pipeline. Additional requirements are imposed for inspection of the pipeline welds during construction to ensure weld strength is sufficient to deal with the longitudinal strain. Requirements are established for monitoring during pipeline operation to ensure that the longitudinal strain does not exceed that contemplated in the design, while mitigation requirements are established in case the strain does exceed established parameters.

The compliance with the above measures for the Selected Alternative ensures that no significant environmental impacts would result from the use of SBD for the Donlin Gold pipeline.

e. *Discuss how the special permit would affect the risk or consequences of a pipeline leak, rupture, or failure (positive, negative, or negligible impact). This should include how the special permit's preventative and mitigation measures (conditions) would affect the consequences and socioeconomic impacts of a pipeline leak, rupture, or failure.*

High magnitudes of thaw settlement can lead to increased longitudinal strain and, ultimately, failure of a pipeline if appropriate mitigation is not in place. The special permit will allow for burial of the pipeline in areas that may be susceptible to such thaw settlement. The conditions imposed by the special permit result in a pipeline that is designed, constructed, and operated in such a way that thaw settlement would not lead to pipeline failure. The consequences of a pipeline failure would be similar under either the Selected Alternative or the No-action Alternative.

f. *Discuss any effects on pipeline longevity and reliability (such as lifecycle and periodic maintenance), including integrity management, and any technical innovations.*

Full implementation of the conditions in the special permit will ensure that there are no overall impacts on pipeline longevity or reliability. Implementation of these conditions will impose additional requirements for pipeline integrity management, monitoring, and periodic maintenance.

Requirements for design include:

- The development of an overall SBD plan that addresses all aspects of the pipeline's lifecycle, including design, materials, construction, and O&M;
- Material testing;
- The development and implementation of written material, design, construction, and O&M specifications and procedures; and
- Engineering critical assessments.

Requirements for construction include:

- Expanded welding procedure qualification requirements;
- Expanded testing requirements for welds;
- Use of a high-resolution deformation tool through all SBD segments;
- Expanded grounding and cathodic protection requirements; and
- Development of a ROW monitoring program.

Requirements for O&M include:

- Development of O&M procedures for all operating parameters that affect compliance with the special permit;
- Monitoring and determination of pipeline strain demand;

- Determination of specified timelines for remediation;
- Remedial action for coating disbondment;
- Interference current control;
- Integration and analysis of integrity data; and
- Expanded requirements for reporting and certification, including both technical and management oversight.

g. *Discuss how the special permit would impact human safety.*

The special permit should improve human safety by allowing for the burial of the pipeline in permafrost areas without thaw settlement leading to pipeline failure. Burial of the pipeline would also reduce the potential for pipeline failure resulting from human actions or other natural causes, thereby reducing the overall likelihood of failure and the potential for injury from the resulting release of gas. Additionally, a buried pipeline would not present the physical barrier or hazard to recreational and subsistence users of the area that an above-ground pipeline would create.

h. *Discuss whether the special permit would affect land-use planning.*

By allowing for the burial of the pipeline, the special permit provides for increased flexibility in land-use planning, reduce visual impacts, and mitigate the potential for damage from human actions. Reduction of these potential impacts lessens the need to consider them in evaluating future land use.

i. *Discuss any pipeline facility or public infrastructure safety impacts and/or environmental impacts associated with implementing the special permit. In particular, discuss how any environmentally sensitive areas could be impacted.*

Implementation of the special permit will not affect any pipeline facilities, public infrastructure, or environmentally sensitive areas.

VI. Response to Comments

PHMSA published the special permit request in the Federal Register (82 FR 16273) on April 3, 2017, and the public comment period ended on June 2, 2017. The special permit application from Donlin

Gold, pipeline route maps, public comments, environmental assessment, and Special Permit Conditions are available in Docket No. PHMSA-2016-0149 at: www.regulations.gov. The USACE's DEIS for the Donlin Gold Project can be assessed at: http://www.donlingoldeis.com/.

PHMSA received two comments on the draft environmental assessment. Both comments pertained to the general nature of pipeline safety and the environmental impacts that result from pipeline transportation; neither specifically referenced the use of SBD for the Donlin Gold Pipeline. Therefore, the comments are outside of the scope of the environmental analysis for the consideration of this special permit regarding SBD. Nonetheless, PHMSA thanks the commenters for their participation and views on pipeline safety and environmental protection.

VII. Finding of No Significant Impact (FONSI)

PHMSA has carefully analyzed the public comments on the Federal Register notice for this pipeline, as well as the safety and environmental risks associated with the above alternatives. Based on the above analysis and the additional mandatory safety conditions described in this document and in the Special Permit, PHMSA finds that the issuance of a special permit for the "Selected Alternative" of a below-ground pipeline utilizing SBD technology, in comparison to a pipeline built in full compliance with Part 192, will not result in a significant impact to safety or the human environment.[5]

This special permit will allow the use of SBD in the design, construction, operation, and maintenance of the proposed DGLLC pipeline, but does not affect the decision-making process of the Army Corps of Engineers or any matter relevant to that agency's jurisdiction.

VIII. Consultation and Coordination

a. *Please list the name, title, and company of any person involved in the preparation of this document.*

Preparers:

<u>Donlin Gold</u>

[5] PHMSA's FONSI does not dictate any action for the lead agency (USACE) with respect to the proposed gold mine or the proposed natural gas pipeline. This FONSI and the related special permit do not authorize pipeline construction or any particular pipeline route.

James Fueg, Technical Services Manager

Gene Weglinski, Senior Permitting Coordinator

Michael Baker International

Paul Carson, Chief Engineer for Regulatory Support – Natural Gas Pipelines

Keith Meyer, Deputy Chief Engineer for Regulatory Support – Natural Gas Pipelines

PHMSA

Amelia Samaras, Senior Attorney

Steve Nanney, General Engineer

b. *Please provide names and contact information for any person or entity you know would be impacted by the special permit. PHMSA may perform appropriate public scoping; however, the applicant's assistance in identifying these parties will speed the process considerably.*

Adjacent landowners/land managers who could potentially be impacted:

Cook Inlet Region, Inc.
Jason Brune
Senior Director, Land and Resources
P.O. Box 93330
Anchorage, AK 99509
(907) 263-5104

Bureau of Land Management
Laurie Thorpe
Project Manager
Bureau of Land Management
Anchorage Field Office
4700 BLM Road
Anchorage, AK 99507
(907) 267-1289

Alaska Department of Natural Resources
Jason Walsh
State Pipeline Coordinator
3651 Penland Parkway
Anchorage, AK 99508
(907) 269-6419

c. *If you have engaged in any stakeholder or public communication regarding this request, please include information regarding this contact.*

PHMSA has participated in scoping and public outreach lead by the U.S. Army Corps of Engineers related to the Donlin Gold Project Environmental Impact Statement (EIS). Details of the public outreach, which included both members of tribal entities and the public, are provided in Chapter 1 of the DEIS.

IX. Bibliography

The applicant is to document all information submitted. If a book, website, or other document was used to answer any question, please provide a citation.

X. Special Permit Conditions

a. *If the applicant plans to use SBD, detail the use of SBD and the procedures/conditions to be included in a special permit application. This special permit must address frost heave, thaw settlement, and other geotechnical issues associated with arctic or sub-arctic climates.*

Donlin Gold proposes to use SBD to specifically address thaw settlement and any potential for frost heave, as discussed in Section III: Background and Site Description. Donlin Gold applied to PHMSA for a special permit, as described in Section IV: Alternatives (b)(i). To accommodate Donlin Gold's request, PHMSA identified the series of Special Permit Conditions described below. The full set of conditions for usage of SBD would be issued as part of the special permit, and would include sections for:

- Purpose and Need
- Background and Site Description
- Special Permit: SBD Segments and SBD Segments Permit Area
- Overview: Conditions 1 through 3
- Design and Materials: Conditions 4 through 7
- Construction: Conditions 8 through 14
- Operations and Maintenance (O&M): Conditions 15 through 23
- Reporting and Certification: Conditions 24 through 26
- Nomenclature: Condition 27

- Proprietary Data: Condition 28
- Limitations
- Appendix A: Pipe
- Appendix B: Design Change Process
- Figure 1: The Donlin Gold Pipeline Route
- Figure 2: The Donlin Gold Pipeline—Strain-Based Design Segments

b. The special permit submittal should explain how the applicant would develop and monitor SBD from a quality assurance standpoint, as follows:

i. **Materials:** The special permit should include specifications for steel strength, pipe bevel misalignment, pipe toughness, qualification and manufacturing tests, and steel and pipe mill quality inspections.

1. What regulatory code and industry standards would be used for steel and pipe qualifications?

The Donlin Gold pipeline would be constructed of line pipe that meets the requirements of API 5L, Grade X-52, PSL2, and would comply with the additional design requirements for steel pipe using alternative MAOP, as defined by 49 CFR § 192.112. In addition, Donlin Gold would develop a pipe Material Specifications guideline to ensure consistent material properties are used for material testing, strain-capacity modeling, welding procedures, and strain-demand limits. A Material Specifications guideline for use in SBD segments is contained as Appendix A to the special permit.

2. Would the applicant conduct a small-scale and full-scale testing program for steel pipe, girth welds, and anomalies (such as corrosion anomalies) to determine tensile strain capacity or limits?

Donlin Gold would conduct tests and analysis to address the full range of material characteristics, including chemical compositions, microstructures and manufacturing variables, manufacturers, and girth welding procedures. In addition, the tests would address potential girth weld flaws (e.g., type, size, and location) and expected types of anomalies (e.g., corrosion defects, mechanical damage, etc.). The tests and analysis would include, as appropriate, finite element analysis, small-scale testing, medium-scale testing, and full-scale testing. The testing would be conducted on pipe material procured using the Material Specifications guideline found in Appendix A. As required based on the test results, the Material Specifications may be adapted to reflect requirements for change.

3. *What design safety factor would be used for test program results?*

   a. The safety factor for the tensile strain demand limit is 1.667. The tensile strain demand limit is determined by dividing the tensile strain capacity—which is calculated using the procedures, predictive equations, and models outlined in the Special Permit Conditions—by 1.667.

   b. The safety factor for the compressive strain demand limit is defined as follows:

      The compressive strain demand is determined by dividing the compressive strain capacity—which is calculated using the procedures, predictive equations, and models outlined in the Special Permit Conditions—by 1.25 in Class 1, 2, 3, and 4 locations. A factor of 1.11 may be used in lieu of 1.25 in Class 1 locations where the pipeline is not in the ROW for a designated interstate, freeway, expressway, or other principal 4-lane arterial roadway and that, within a potential impact circle, contains fewer than two buildings that have human occupancy of fewer than 50 days in a 12-month period, as defined in § 192.903.

      The test program results would be used to verify the strain capacity values that were calculated by the tensile and compressive predictive equations developed via research and by the analytic reports produced for PHMSA and specified in the Special Permit Conditions.

4. *What would be the test sample size?*

   The test sample sizes for small-, medium-, and full-scale testing are not yet established. The small-scale test matrix was developed to supply all the input aspects required from the tensile and compressive strain capacity predictive models for full-scale prediction, including actual yield, tensile/compressive strengths, and stress-strain curves. Additional small-scale tests, such as fracture toughness, are run to ensure additional minimum requirements for items that are related to overall pipe safety but not directly relevant to the tensile/compressive strain capacity. Medium-scale tests may be performed on short arcs of pipe to simulate the response of an unpressurized pipe to loadings when anomalies are present. Tests of all scale levels are, in a sense, prelude to the full-scale tests. Small- and medium-scale tests help form the testing matrix for the full-scale test program, thereby ensuring that all dangerous aspects of the pipe material, which represent critical items that could be present during operations, are addressed.

5. *What tests would be conducted during manufacturing and construction?*

The tests required during pipe manufacturing are presented in Table A-3 of Appendix A (reproduced below) of the special permit. Tensile tests, hardness tests, and fracture toughness tests would be conducted during weld procedure qualification.

Special Permit Table A-3: Tests and Requirements			
Items		**Frequency** NOTE 3	**Number, Location, and Orientation of the Specimen (see NOTE 4)**
Pipe Body NOTE 1	Chemical composition product analysis	1/heat	1
	Pipe body transverse tensile	1/lot NOTE 2	1
	Pipe body longitudinal tensile (aged)	1/lot	1 (90 degrees, longitudinal)
	Charpy impact – pipe body transverse	1/lot	1 set of 3 specimens
	Drop weight tear test (DWTT)	1/lot	2
Weld	Welded joint tensile	1/lot	1
	Guided root bending	1/lot	1

	Guided face bending	1/lot	1
	Charpy impact – weld	1/lot	1 set of 3 specimens
	Charpy impact – Heat Affected Zone (HAZ)	1/lot	1 set of 3 specimens
	Macro	1/lot	1
	Vickers Hardness	1/lot	Per API 5L
Hydrostatic pressure test		Each pipe	
Visual		Each pipe	
Dimension		Each pipe	
Non-destructive Testing (NDT)		Each pipe	
NOTE 1: For helical seam pipe, the samples must be taken midway between the weld seam. **NOTE 2:** A lot is defined as 100 pipes, or per heat, or as per API 5L, whichever is less. **NOTE 3:** Testing frequency and test type must meet both Table A-3 and API 5L criteria. **NOTE 4:** Location and orientation must comply with API 5L, if not specified otherwise			

6. *How often per heat would tests during manufacturing be conducted?*
    a. Testing frequencies for each test are outlined in Table A-3 of Appendix A of the special permit (see table above).
    b. In addition, production start-up tests would be conducted. One (1) pipe from each heat would be hydrostatically tested, producing a hoop stress of 100% of the Specified Minimum Yield Strength (SMYS). Two pipes per heat would also undergo:
        i. Chemical analysis;
        ii. Longitudinal and hoop tensile tests (full stress-strain curves are also to be provided);
        iii. Charpy impact testing (pipe body transverse, weld, and HAZ) at the specified temperature;
        iv. DWTT at the specified temperature;
        v. Vickers Hardness traverse;

vi. Guided bend testing; and

vii. Metallography of pipe body.

ii. **Material Test Program:** Including girth welds and anomaly effects, what types of small-scale and full-scale testing, material specifications, and design qualifications are needed for the project?

Small-scale testing would consist of longitudinal and hoop tensile tests.

Medium-scale testing would consist of curved wide-plate tests, including a range of high-low misalignment, weld flaws, and other anomalies. A curved wide-plate test consists of removing two sections from a pipe, welding them together (with the final shape resembling a dog bone), and then pulling them until they experience tension failure.

Full-scale tests would consist of pressurized bend tests and include a range of high-low misalignment, weld flaws, and other anomalies.

Project-specific line pipe material and girth weld specifications would be developed and qualified by use of pipe material procured, as per the SBD Material Specifications.

1. *How would the remaining wall strength calculations be validated?*

   O&M procedures for the remaining wall strength calculations would be developed based on the results of the material testing program, finite element analysis of the anomaly, and available PHMSA research on the effects of anomaly wall loss under combined pipeline loadings. If PHMSA research indicates additional tests on the effects of anomalies are required, Donlin Gold would provide the required tests, finite element analysis, and O&M procedures for the 14-inch pipeline special permit segments.

2. *How would steel and girth weld strength variability be accounted for in the design?*

   a. Using the results of the project material testing program, design calculations would be performed for a range of steel and girth weld strengths.

   b. Donlin Gold intends to utilize critical assessment procedures, predictive equations, and models for calculating tensile and compressive strain capacity in the SBD segments during their lifecycle. The critical assessment procedures address materials (pipes and girth welds) that must operate on the upper shelf of the brittle-ductile transition (i.e., that must have ductile behavior). The effects of pipe wall loss or corrosion is currently being addressed by ongoing research sponsored by PHMSA. Donlin Gold would utilize the results of this research as they become available.

iii. **Geotechnical Test Program:** A geotechnical test program was conducted to characterize subsurface route conditions of the proposed pipeline. The results of the program have been used to quantify the magnitude and extent of the thaw settlement geohazard and to estimate the strain demand associated with thaw settlement.

1. *Where and how many geotechnical tests would be conducted?*

   Approximately 2,900 laboratory tests have been conducted in nearly 600 geotechnical investigation locations.

2. *What are the engineering parameters for tests?*

   Unified Soil Classification, moisture content, and thermal state are the main engineering parameters related to the tests.

3. *Provide examples of how the pipe would be designed: above ground, heavier-wall thickness, maximum strain, etc.*

   As described in Section IV: Alternatives, above, the No-action Alternative would mainly be an above-ground pipe, with some sections constructed using either buried heavier-wall-thickness pipe, removal and replacement of thaw-unstable materials, trenchless technologies, or a combination of these methods. The Selected Alternative would be designed using SBD techniques that would allow the pipe to experience strains beyond 0.5%, but with strains limited to specified percentages of the material strain capacity established by material testing. The engineering assessment of the magnitude of pipe displacements due to ditch settlement along the alignment, which is calculated using the soil index values from samples recovered from field geotechnical investigations, is used to determine the target values of the material strain capacities.

iv. **Design and Construction:** Describe the design procedures, specifications, design factors, and inspection procedures—including pipe and weld misalignment—that will be used for this project.

1. *What are the temperature effects on SBD loads and tensile strain capacity?*

   a. The difference between the temperatures of the subsurface pipeline area at construction tie-in versus the operating temperature of the product results in a temperature differential in the pipeline material and causes a mechanical stress (strain) that is routinely accounted for in all pipelines' design calculations. The Donlin Gold pipeline is considered an ambient line; in other words, the operating temperature is at or near the ambient temperature of the surrounding soils. This means that the temperature differential experienced by the line is small and does not have a significant effect on strain demand.

   b. The temperature effect of the climate on the subsurface below the pipe after construction may, due to the change of the surface heat transfer properties, cause subsurface that was previously frozen in place to thaw. Consolidation of the thawed soils may, in turn, cause an overall decrease in soil volume and settlement of the pipe ditch bottom. The magnitude of the thaw depth beneath the pipe, along with the associated settlement of the soil within this thaw depth, depends on the geo-mechanical and geothermal properties of the subsurface; these, in turn, depend on the properties of the subsurface found during the geotechnical field investigations, as discussed in Geotechnical Test Program: Response 3, above. Chapter 3 of the Donlin Gold DEIS discusses thaw settlement and notes that the designs and measures, best management practices, and erosion and sediment control measures are expected to reduce permafrost impacts during construction and operation.

   c. The predictive equations developed for PHMSA and specified in the Special Permit Conditions note that temperature does not affect the tensile strain capacity.

2. *What is the effect of longitudinal loads on MAOP (72% SMYS) operational hoop pressures? Do strain-based longitudinal loads add to hoop stress; and, if so, how much?*

   The hoop stress evaluated per Barlow's equation, which is the basis of the design formula for pressure containment in 49 CFR 192.105, is unaffected by longitudinal behavior. Barlow's equation is derived from the first principles of equilibrium and does not rely on principles of compatibility for its derivation. A consequence of this derivation is that actions in the longitudinal direction do not affect the hoop stress evaluation of the pipe. Based upon a 14-inch-diameter, 0.276-inch, API 5L Grade X-52 pipeline, the MAOP is 1480 psig.

3. *What is the effect of steel strength, weld property, and wall loss due to corrosion on the strain capacity of pipe under longitudinal and hoop stresses?*

   a. Donlin Gold intends to utilize critical assessment procedures, predictive equations, and models for calculating tensile and compressive strain capacity in the SBD segments during their lifecycle.

   b. Generally, the approach used by Donlin Gold for the evaluation of wall loss due to corrosion is that the effect of longitudinal strain must be technically considered in the presence of metal wall loss or other anomalies. Metal loss must remain below 20% of pipe wall thickness (see Condition 18) and pressure failure ratios must be maintained in accordance with Condition 23 when the longitudinal strain magnitude exceeds 0.5%. Anomalies that encompass greater than 20% wall loss up to 40% wall loss may be allowed in SBD segments with longitudinal strains over 0.5%, but must be evaluated with O&M procedures based upon a destructive test program, finite element analysis, or a combination of the two methods. The effects of pipe wall loss and corrosion are currently being addressed by ongoing research sponsored by PHMSA, the results of which Donlin Gold will utilize as they become available. The results of the PHMSA research could require Donlin Gold to conduct further tests on the effects of pipe wall loss or corrosion on longitudinal strains.

4. *What safety factor would be used for longitudinal stresses? Would these stresses exceed 100% SMYS; and, if so, what safety factor would be used and what strain design factors could be expected?*

   The intent of the SBD approach is to accommodate longitudinal stresses in excess of 100% SMYS. The safety factors to be applied are discussed in Section X: Special Permit Conditions (b)(i)(3), above.

5. *What construction inspection procedures and processes would be put in place to ensure the geotechnical limits for SBD are not exceeded during construction?*

   Construction-related longitudinal stress and strain would be calculated based upon the anticipated pipe ditch installation procedure. As part of the construction quality assurance procedures, Donlin Gold would specify pipe lifting and lowering-in practices, ditch depths, lift heights, the number of lift points, and the spacing between lift points. The intent of the construction specifications is to ensure that the pipe stress during pipeline installation remains below 100% SMYS and adheres to the other requirements in 49 CFR Part 192 and the Special Permit Conditions.

6. *How many and what types of geotechnical tests need to be conducted along the ROW in areas where SBD would be implemented?*

   Geotechnical testing has been conducted throughout the length of the SBD segment. For further information, see Section X: Special Permit Conditions (b)(iii)(1), above.

7. *How would the pipeline be cathodically protected during construction to ensure that anomalies do not jeopardize SBD and integrity management?*

   The special permit does not require that the pipeline be cathodically protected during construction, only that cathodic protection is provided within one year of backfilling. Prior to installation, the pipe would only be subject to atmospheric corrosion mechanisms, which are significantly less pronounced than those experienced in a buried environment. Atmospheric corrosion would be negligible during the time between pipe production and construction due to the application of fusion-bonded epoxy, a high-quality corrosion coating, to the exposed exterior surface. Additionally, a sacrificial anode system would be installed along the entire length of the SBD segments.

8. *How would the pipeline be checked before and/or after construction to ensure low-strength pipe has not been installed?*

   A high-resolution deformation in-line inspection (ILI) tool would be run along the length of the SBD segment by no later than the end of Pipeline Start-Up.

9. *Would all girth welds be non-destructively tested to ensure SBD is applicable? Additionally, would all girth welds be non-destructively tested due to the high pipeline operating pressures?*

   All girth welds along the length of the SBD segment would be non-destructively tested, in accordance with 49 CFR Part 192 and the edition of API Standard 1104 referenced in 49 CFR Part 192: "Welding of Pipelines and Related Facilities."

10. *Due to the high operating pressures, would the pipeline have Charpy impact values that could arrest a running fracture? If not so, how would the pipe toughness be designed to limit this operating failure effect?*

    The pipeline would be constructed of materials operating on the upper shelf of the brittle-ductile transition, as demonstrated by results of Charpy impact tests, with sufficient energy values to self-arrest a running fracture. If a pipe fails due to an anomaly in the pipe wall, the higher Charpy impact values are needed to either arrest the rupture or stop the pipe from rupturing.

11. *What are the minimum pressure test factors that would be used for compressor stations, major river crossings, and Class 1, 2, and 3 locations?*

    All pressure tests would be conducted in accordance with 49 CFR Part 192, Subpart J.

    The proposed pipeline would be characterized as Class 1 for its entire length; as such, the minimum pressure test factor would be 1.25 times the MAOP in all mainline locations. Compressor stations, regulator stations, and meter stations would be pressure tested to 1.5 times the MAOP, in accordance with 49 CFR § 192.505(b).

v. **Operations and Maintenance (O&M):** Outline the proposed monitoring for frost heave, thaw settlement, and other atypical earth movement issues associated with arctic or sub-arctic locations.

1. *Describe the proposed methodology for determining pipeline stress and strain.*

   Donlin Gold would develop and implement a strain demand monitoring system that would focus on the use of an ILI tool to evaluate changes in the curvature of the pipeline. The curvature change, from which pipe strain can be directly calculated, is a direct assessment of the longitudinal bending that a pipe is undergoing due to a change in the pipe ditch profile. By comparing the results from successive ILI tool runs, the strain growth rate could be calculated to calibrate the required frequency of future ILI tool runs. If a pipe segment experienced strains in excess of 0.5%, additional on-location monitoring procedures and methods would be used to verify the reliability and accuracy of the O&M procedures, as well as to provide additional information on strain growth in the time between ILI tool runs. Additional details on the reporting and remediation requirements are specified in Table 2 of Condition 17 of the special permit, reproduced below.

2. *What is the planned timing of inspections and remediation procedures? If not yet developed, when will these procedures be finalized?*

   a. Inspections would be conducted utilizing a geospatial pipeline mapping ILI tool that, per the SBD Conditions, must be run not later than the end of Pipeline Start-Up and once each calendar year thereafter, beginning no later than fifteen (15) months after the first run. Donlin Gold may propose an alternative schedule to PHMSA for review that they may follow if they receive a response of "no objection."

   b. The SBD Conditions require remediation once a strain demand condition of greater than or equal to 75% of the strain demand limit is discovered. This equates to a safety factor of 2.22 (the specified safety factor of 1.667 divided by the 75% limit that requires remediation) for tensile strain capacity and 1.47 (1.10/0.75) to 1.67

(1.25/0.75) for compressive strain capacity. For more information on safety factors, see Section X: Special Permit Conditions (b)(1)(c).

c. Remediation procedures would be developed during the final design phase and before Pipeline Start-up.

Special Permit Table 2: Pipeline Segment Strain Demand Monitoring		
Strain Demand Magnitude that Triggers Action		**Action Required**
Level	***Strain Demand***	
1	Greater than 0.5% longitudinal strain and less than 75% of the strain demand limit	Monitor
2	Equal to or greater than 75% of the strain demand limit but less than 90% of the strain demand limit	Monitor. Develop a site-specific strain growth rate and a corresponding remediation plan to ensure the strain demand limit is not reached during the pipeline's operational life. The remediation plan must be implemented either within one (1) year of the date of discovery or prior to the date when the strain demand limit is expected to be exceeded, whichever is sooner.
3	Equal to or greater than 90% of the strain demand limit	Report this level of strain demand to the PHMSA Regional Director within 5 days of discovery. Develop a remediation plan and submit it to PHMSA within 30 days of discovery. The remediation plan must be implemented within one (1) year of the date of discovery or 90 days prior to the date when the strain demand limit is expected to be exceeded, whichever is sooner.

3. *Has a temperature study been conducted for the maximum operational temperatures and the resultant permafrost effects? If so, please detail the findings of the study, as well as the criteria that would be used to determine whether or for how long it is safe to operate the pipeline if gas chillers are inoperable.*

Donlin Gold is not proposing the use of chillers, as the proposed pipeline would operate at temperatures close to seasonal ambient ground temperatures. The maximum gas pipeline discharge temperatures from the compressor station would be 40 degrees Fahrenheit (°F) in the winter and 100 °F in the summer, as the gas would be processed through an air-cooled heat exchanger (fin-fan). This fin-fan would reduce the gas temperature to within 20 °F of the ambient ground temperature, but never less than 40 °F. The intent of the SBD approach to pipeline design is to account for potential thaw settlement and any frost heave in permafrost areas.

4. *How would maximum compressor station temperatures be maintained to ensure permafrost melt would not affect pipe buoyancy and add additional stresses to the pipe?*

   The intent of the SBD approach to pipeline design is to account for potential thaw settlement and any frost heave in permafrost areas. The Donlin Gold pipeline would operate near seasonal ambient ground temperatures and the single required compressor station would be located a sufficient distance from areas of permafrost as to have no effect on thawing. The gas would be processed through a fin-fan to reduce the gas temperature to within 20 °F of the ambient ground temperature, but never less than 40 °F. The gas temperature is predicted to equilibrate with the ground temperature within the first 50 miles of the pipeline; no permafrost has been identified within this section of the line.

5. *How would the pipeline be chilled between installation and the first transportation of gas to prevent permafrost degradation?*

   The pipeline would not be chilled, as the intent of the SBD approach to pipeline design is to account for potential thaw settlement and any frost heave in permafrost areas.

vi. **Integrity Management:** Describe the assessment timing for baseline assessments and re-assessments, considering the usage of SBD and the MAOP.

1. *How would the engineering evaluations for anomaly assessment be validated and applied during integrity assessments for tensile SBD?*

In order to evaluate anomalies during engineering evaluations, O&M procedures would be developed based on the results of the material testing program and available PHMSA research on the effects of anomaly wall loss under combined pipeline loadings. The procedure, entitled the "O&M Plan," would be supplied to PHMSA for review six months before the start of pipeline operations, as outlined in the SBD special permit.

2. *What design factors would be used for maximum longitudinal strain loads prior to remediation?*

   The SBD Conditions require remediation upon discovery of a strain demand condition of greater than or equal to 75% of the strain demand limit. This equates to a safety factor of 2.22 (the specified safety factor of 1.667 divided by the 75% limit that requires remediation) for tensile strain capacity and 1.47 (1.10/0.75) to 1.67 (1.25/0.75) for compressive strain capacity. For more information on safety factors See Section X: Special Permit Conditions (b)(i)(3), above.

3. *What are the integrity assessment timing intervals for tensile SBD assessments?*

   Integrity assessments associated with SBD would be conducted utilizing a geospatial pipeline mapping ILI tool. In accordance with the SBD Conditions, the tool must be run not later than the end of Pipeline Start-Up and once each calendar year thereafter, beginning no later than fifteen (15) months after the first run. Alternatively, after the first three (3) tool runs the timing of future tool runs may be determined by comparing the rate of increase in site-specific strain demand with the remaining margin between site-specific strain demand and the site-specific strain demand limit.

Completed in Washington, D.C. on: June 5, 2018

Final Document Approved: U.S. Department of Transportation,

Pipeline and Hazardous Materials Safety Administration

Figure 1: The Donlin Gold Pipeline Route

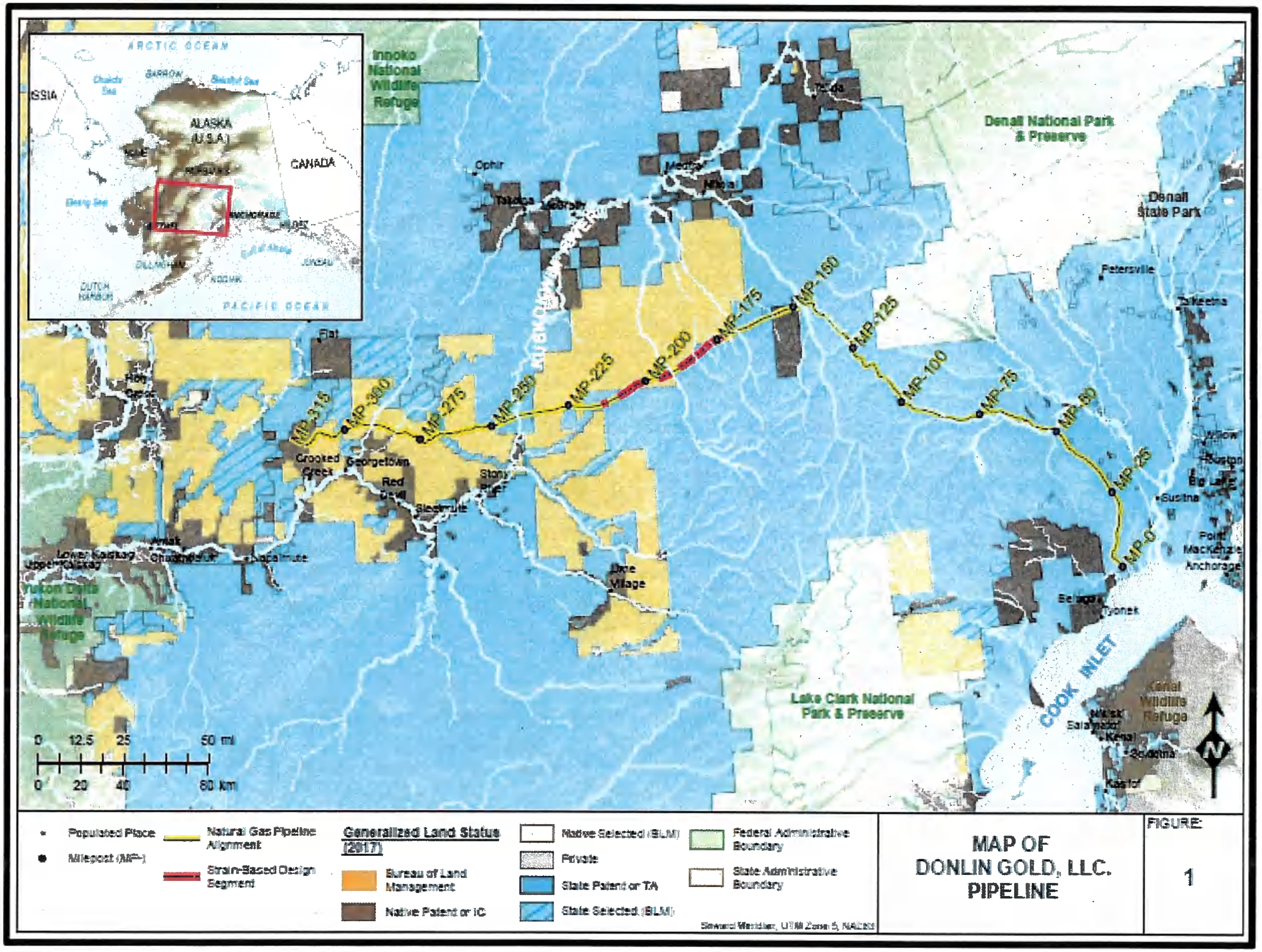
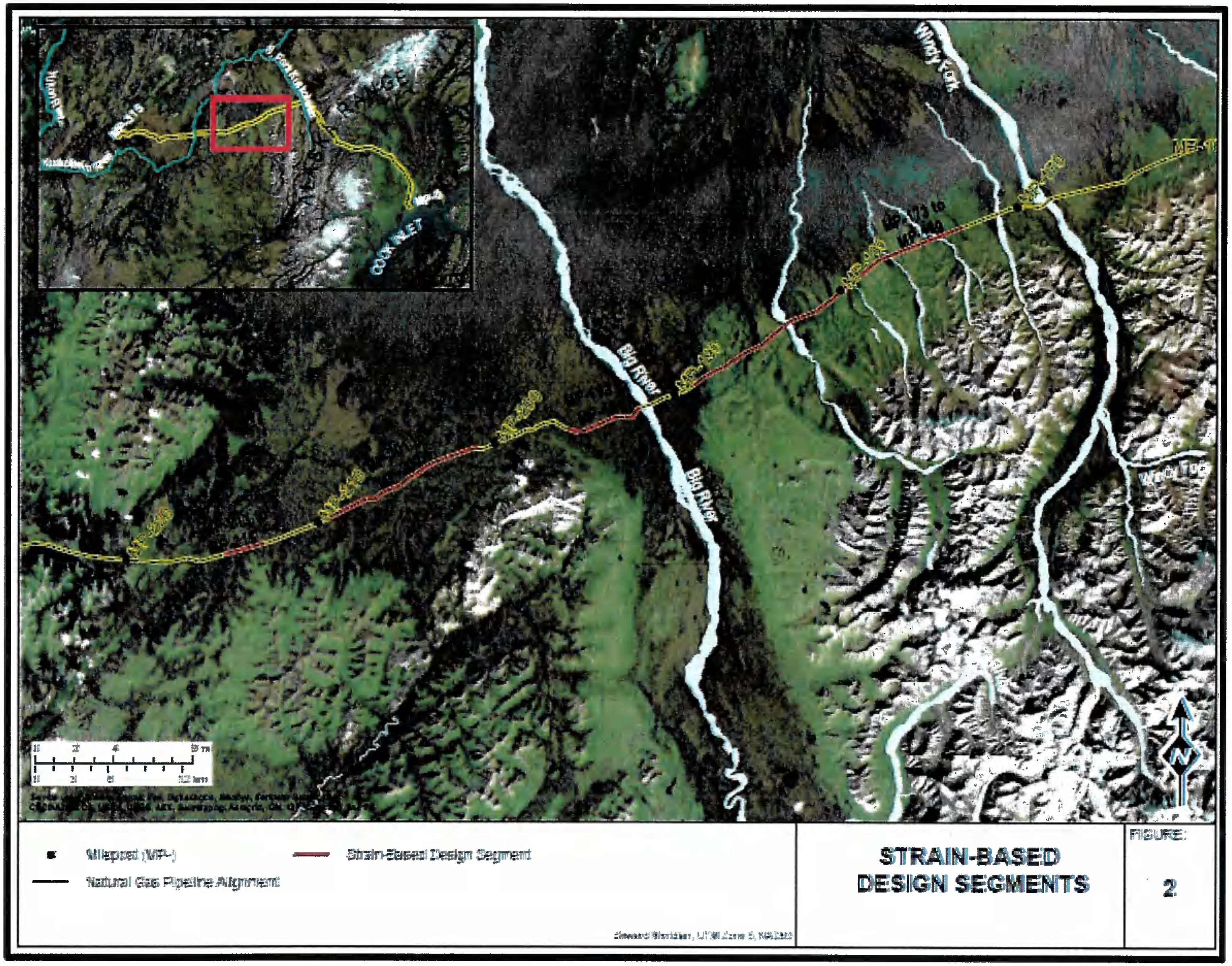


Figure 2: The Donlin Gold Pipeline – Strain-Based Design Segments


Windy Fork
Big River
Big River
COOK INLET
Milepost (MP-)
Natural Gas Pipeline Alignment
Strain-Based Design Segment
STRAIN-BASED
DESIGN SEGMENTS
FIGURE:
2