

APPENDIX T

Roads Crossed by the Mainline Pipeline

APPENDIX T: ROADS CROSSED BY THE MAINLINE PIPELINE

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Roads Crossed by the Mainline Pipeline				
Milepost	Name of Road Crossed	Road Type	Right-of-Way Width Crossed (feet)	Crossing Type
0.3	Pipe access road	Private road	60	Open cut
2.6	Drillsite 15 Road	Private road	60	Open cut
4.5	Pipe access road	Private road	60	Open cut
4.6	Spine Road	Private road	60	Open cut
4.8	Unnamed road	Private road	60	Open cut
63.3	Dalton Highway	Highway	200	Conventional horizontal bore
68.1	Dalton Highway	Highway	200	Conventional horizontal bore
115.3	Dalton Highway	Highway	200	Conventional horizontal bore
119.3	TAPS access road	Private road	60	Open cut
122.9	Dalton Highway	Highway	200	Conventional horizontal bore
123.0	Unnamed road	Private road	60	Open cut
129.6	Unnamed road	Private road	60	Open cut
136.5	Dalton Highway	Highway	60	Conventional horizontal bore
141.2	Campground access	Local road	60	Open cut
144.1	Dalton Highway	Highway	200	Conventional horizontal bore
145.0	TAPS access road	Private road	60	Open cut
148.2	Dalton Highway	Highway	200	Conventional horizontal bore
148.7	Unnamed road	Private road	60	Open cut
149.0	Unnamed road	Private road	60	Open cut
149.3	Dalton Highway	Highway	200	Conventional horizontal bore
152.9	TAPS access road	Private road	60	Open cut
155.4	Unnamed road	Private road	60	Open cut
156.2	Unnamed road	Private road	60	Open cut
168.7	Dalton Highway	Highway	200	Conventional horizontal bore
169.0	Dalton Highway	Highway	200	Conventional horizontal bore
171.8	Dalton Highway	Highway	200	Conventional horizontal bore
173.9	Unnamed road	Private road	60	Open cut
175.3	Unnamed road	Private road	60	Open cut
182.0	Dalton Highway	Highway	200	Conventional horizontal bore
187.6	Atigun River access	Local road	60	Open cut
191.0	Unnamed road	Private road	60	Open cut
193.3	Dalton Highway	Highway	200	Conventional horizontal bore
195.2	Unnamed road	Private road	60	Open cut
196.5	Dalton Highway	Highway	200	Conventional horizontal bore
206.6	Dalton Highway	Highway	200	Conventional horizontal bore
208.6	TAPS access	Private road	60	Open cut
209.2	TAPS access	Private road	60	Open cut
210.6	Dalton Highway	Highway	200	Conventional horizontal bore

TABLE T-1 (cont'd)				
Roads Crossed by the Mainline Pipeline				
Milepost	Name of Road Crossed	Road Type	Right-of-Way Width Crossed (feet)	Crossing Type
210.6	Dalton Highway	Highway	200	Conventional horizontal bore
218.8	Winter Trail	Private road	60	Open cut
219.2	Unnamed road	Local road	60	Open cut
228.1	Dalton Highway	Highway	200	Conventional horizontal bore
228.9	TAPS access	Private road	60	Open cut
229.5	TAPS access	Private road	60	Open cut
231.0	Dalton Highway	Highway	200	Conventional horizontal bore
236.1	Unnamed road	Private road	60	Open cut
236.7	Campground access	Private road	60	Open cut
241.2	Unnamed road	Local road	60	Open cut
243.9	Unnamed road	Private road	60	Open cut
251.2	Unnamed road	Private road	60	Open cut
252.3	Dalton Highway	Highway	200	Conventional horizontal bore
255.4	Unnamed road	Private road	60	Open cut
257.4	Unnamed road	Private road	60	Open cut
257.8	TAPS access	Private road	60	Open cut
259.8	Dalton Highway	Highway	200	Conventional horizontal bore
283.7	Unnamed road	Private road	60	Open cut
289.8	TAPS access	Private road	60	Open cut
306.9	Airport Road	Private road	60	Open cut
310.7	Dalton Highway	Highway	200	Conventional horizontal bore
319.1	Unnamed road	Private road	60	Open cut
326.7	Unnamed road	Private road	60	Open cut
341.6	Dalton Highway	Highway	200	Conventional horizontal bore
347.8	Dalton Highway	Highway	200	Conventional horizontal bore
348.5	TAPS access	Private road	60	Open cut
351.0	TAPS access	Private road	60	Open cut
358.3	Pump Station access	Private road	60	Open cut
358.9	TAPS access	Private road	60	Open cut
363.5	TAPS access	Private road	60	Open cut
368.2	TAPS access	Private road	60	Open cut
370.2	Dalton Highway	Highway	200	Conventional horizontal bore
371.9	TAPS access	Private road	60	Open cut
373.7	TAPS access	Private road	60	Open cut
376.5	TAPS access	Private road	60	Open cut
377.8	TAPS access	Private road	60	Open cut
379.5	TAPS access	Private road	60	Open cut
380.5	TAPS access	Private road	60	Open cut

TABLE T-1 (cont'd)				
Roads Crossed by the Mainline Pipeline				
Milepost	Name of Road Crossed	Road Type	Right-of-Way Width Crossed (feet)	Crossing Type
382.3	TAPS access	Private road	60	Open cut
394.0	Material site road	Local road	60	Open cut
395.3	TAPS access	Private road	60	Open cut
398.2	Dalton Highway	Highway	200	Conventional horizontal bore
400.7	Elliott Highway	Local road	200	Conventional horizontal bore
469.2	Unnamed road	Local road	60	Open cut
470.7	Parks Highway	Highway	200	Conventional horizontal bore
471.7	Railroad access	Private road	60	Open cut
472.3	FAA Hill Road	Local road	60	Open cut
472.7	Parks Highway	Highway	200	Conventional horizontal bore
473.8	Unnamed road	Local road	60	Open cut
498.7	Parks Highway	Highway	200	Conventional horizontal bore
504.8	Unnamed road	Private road		Open cut
513.0	Rock Creek Road	Local road	60	Open cut
514.7	Ferry Road	Local road	60	Open cut
521.8	Parks Highway	Highway	200	Conventional horizontal bore
523.2	Stampede Road	Local road	60	Open cut
526.7	B Street	Local road	60	Open cut
527.0	Otto Lake Road	Local road	60	Open cut
532.3	Parks Highway	Highway	200	Conventional horizontal bore
553.1	Unnamed road	Private road	60	Open cut
559.8	Unnamed road	Local road	60	Open cut
566.4	Denali Highway	Highway	200	Open cut
566.8	Old Anchorage-Fairbanks Highway	Local road	200	Open cut
567.3	Old Parks Highway	Local road	60	Open cut
572.6	Parks Highway	Highway	200	Conventional horizontal bore
588.2	Parks Highway	Highway	200	Conventional horizontal bore
607.1	Unnamed road	Local road	60	Open cut
612.6	Parks Highway	Highway	200	Conventional horizontal bore
625.1	Parks Highway	Highway	200	Conventional horizontal bore
630.2	Parks Highway	Highway	200	Conventional horizontal bore
631.6	Parks Highway	Highway	200	Conventional horizontal bore
640.5	Parks Highway	Highway	200	Conventional horizontal bore
648.5	Parks Highway	Highway	200	Conventional horizontal bore
657.6	Parks Highway	Highway	200	Conventional horizontal bore
664.7	Petersville Road	Local road	60	Open cut
749.2	Unnamed road	Local road	60	Open cut
758.7	Unnamed road	Local road	60	Open cut

TABLE T-1 (cont'd)				
Roads Crossed by the Mainline Pipeline				
Milepost	Name of Road Crossed	Road Type	Right-of-Way Width Crossed (feet)	Crossing Type
760.3	Unnamed road	Local road	60	Open cut
764.7	Dead Moose Drive	Local road	60	Open cut
765.0	Beluga Highway	Highway	60	Open cut
765.9	Grant Street	Local road	60	Open cut
796.7	Charlie's Way	Local road	60	Open cut
797.3	Sylvan Way	Local road	60	Open cut
798.6	Nikishka Beach Road	Local road	60	Open cut
799.9	Wik Road	Local road	60	Open cut
800.3	Wik Road	Local road	60	Open cut
803.5	Hedberg Drive	Local road	60	Open cut
804.3	Chevron Road	Private road	60	Open cut
804.5	S-490 Kenai Spur Highway	Highway	60	Open cut
805.5	Tesoro Road	Local road	60	Open cut
806.5	Miller Loop Road	Local road	60	Open cut
FAA = Federal Aviation Administration; TAPS = Trans Alaska Pipeline System				

APPENDIX U

**Bureau of Land Management
Alaska National Interest Lands Conservation Act
Section 810 Preliminary Evaluation**

APPENDIX U: ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT SECTION 810 PRELIMINARY EVALUATION

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Appendix U: ANILCA Section 810 Preliminary Evaluation

U.1 SUBSISTENCE EVALUATION FACTORS

Section 810(a) of the Alaska National Interest Lands Conservation Act (ANILCA), 16 United States Code 3120(a), requires that an evaluation of subsistence uses and needs be completed for any federal determination to “withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands.” As such, an evaluation of potential impacts on subsistence under ANILCA Section 810(a) must be completed for the Alaska Liquefied Natural Gas (Alaska LNG) Pipeline Environmental Impact Statement (EIS). ANILCA requires that this evaluation include findings on three specific issues, as follows:

- The effect of use, occupancy, or disposition of public lands on subsistence uses and needs
- The availability of other lands for the purposes sought to be achieved
- Other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes

Per Bureau of Land Management Instruction Memorandum No. AK-2011-008 (BLM 2011), three factors are considered when determining if a significant restriction of subsistence uses and needs may result from the proposed action, no action, or in the cumulative case, as follows:

- Reduction in the abundance of harvestable resources used for subsistence purposes
- Reduction in the availability of resources used for subsistence caused by alteration of their distribution, migration patterns, or location
- Legal or physical limitations on access of subsistence users to harvestable resources

Each alternative must be analyzed according to these criteria. BLM policy also requires that cumulative impacts be analyzed (BLM 2011). This approach helps the reader separate subsistence restrictions that could be caused by the proposed action from those that could be caused by past, present, and reasonably foreseeable activities in or near the Project area.

An alternative would be considered to significantly restrict subsistence uses if, after consideration of protective mitigation measures, it can be expected to substantially reduce the opportunity to use subsistence resources (BLM 2011). Substantial reductions are generally caused by large reductions in resource abundance, a major redistribution of resources, extensive interference with access, or major increases in the use of those resources by non-subsistence users.

If the analysis determines that the proposed action, alternatives, or the cumulative case may significantly restrict subsistence uses, the BLM is required to notify the State of Alaska and appropriate regional and local subsistence committees. BLM also must conduct ANILCA Section 810 hearings in the vicinity of potentially affected communities.

It is possible that the finding may be revised to “will not significantly restrict subsistence uses” based on changes to alternatives, new information, or new mitigation measures resulting from the hearings. If the significant restriction remains, the BLM may prohibit the action or finalize the evaluation by making the following determinations as required by ANILCA Section 810(a)(3):

- A significant restriction of subsistence uses would be necessary, consistent with sound management principles for the use of public lands

- The proposed activity would involve the minimal amount of public land necessary to accomplish the purpose of the use, occupancy, or other disposition
- Reasonable steps would be taken to minimize adverse effects on subsistence uses and resources resulting from such actions

The head of the appropriate Federal agency may then authorize use of the public lands.

In addition to ANILCA, Environmental Justice, as defined in Executive Order 12898, also calls for an analysis of the effects of federal actions on minority populations with regard to subsistence. Specifically, Environmental Justice is:

The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies (EPA, 2016.)

Section 4-4 of the Executive Order on Environmental Justice, regarding the Subsistence Consumption of Fish and Wildlife, requires federal agencies to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence, and to communicate to the public any risks associated with those consumption patterns.

Additional guidance is found in the CEQ document, Environmental Justice – Guidance under the National Environmental Policy Act, December, 1997.

U.2 ANILCA SECTION 810(A) EVALUATIONS AND FINDINGS

This ANILCA Section 810 Preliminary Evaluation is based on the information contained in the Alaska LNG Project draft EIS. Chapter 4, Environmental Analysis, describes areas and resources important for subsistence, and specific communities' degree of dependence on various fish and wildlife resources.

The description of subsistence harvest patterns focuses on community profiles from five regions as presented in section 4.14, Subsistence, of the draft EIS. These five regions (North Slope, Yukon River, Tanana River, South Central, and Kenai Peninsula) were delineated based on shared common language and common harvest patterns. Any community within 30 miles of the Project and any community more than 30 miles from the Project area but with a subsistence use area within 30 miles of the Project area was identified as a subsistence community for this analysis. The regions and corresponding communities are presented in table 1.

Region	Community
North Slope	Utqiagvik (Barrow), Nuiqsut, Kaktovik, Anaktuvuk Pass
Yukon River	Evansville, Alatna, Allakaket, Stevens Village, Rampart, Wiseman, Coldfoot, Bettles
Tanana River	Tanana, Manley Hot Springs, Minto, Nenana, Four Mile Road CDP, Anderson, Ferry, Healy, Denali Park CDP
South-Central	Cantwell, Chase, Talkeetna, Trapper Creek, Skwentna, Alexander Creek/Susitna, Beluga, Tyonek
Kenai Peninsula	Nikiski, Seldovia, Port Graham, Nanwalek

Table 1. Subsistence regions and study communities.

U.2.1 Evaluation and Finding for the No Action Alternative

The Project would not be completed under the no action alternative. Current management actions and resource trends would continue in the vicinity of the proposed project area.

U.2.1.1 Evaluation of the effect of use, occupancy, or disposition on subsistence uses and needs

Existing impacts on subsistence would continue, and would not significantly reduce or limit the abundance, availability, or access to subsistence resources for communities within the North Slope, Yukon River, Tanana River, South-Central, or Kenai Peninsula regions.

U.2.1.2 Evaluation of the availability of other lands for the purpose sought to be achieved

The no action alternative does not propose the disposition or use of public lands needed for subsistence purposes; therefore, evaluating the availability of other lands is not applicable.

U.2.1.3 Evaluation of other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence

The no action alternative would eliminate the use and occupancy of public lands needed for subsistence purposes. The proposed action alternative would not reduce or eliminate the use of public lands needed for subsistence when compared to the no action alternative. Additional alternatives were reviewed in Chapter 3 of the draft EIS, but none were identified that could provide a significant environmental advantage over the Project.

U.2.1.4 Findings

The no action alternative will not result in a significant restriction in subsistence uses. A positive determination pursuant to ANILCA Section 810 is not required.

U.2.2 Evaluation and Finding for the Proposed Action

The Alaska LNG Project (Project) would involve the construction and operation of gas treatment, mainline (pipeline), and liquefaction facilities. The Alaska Gasline Development Corporation (AGDC) proposes to construct and commission the Project in two phases over about 8 years. Phase 1 would be completed over about 6 years and include construction related to the Liquefaction and Mainline Facilities. The second phase would install the remaining Project components needed for full production.

The 806.6 mile pipeline route would start at the gas treatment plant (GTP) and generally follow the existing Trans Alaska Pipeline System (TAPS) crude oil pipeline and adjacent highways south to Livengood, Alaska. From Livengood, the route would generally head south-southwest to Trapper Creek following the Parks and Beluga Highways, and then turns south-southeast around Viapan Lake. It would then cross the Cook Inlet near Shorty Creek to Boulder Point on the Kenai Peninsula. The permanent Mainline Facilities include eight compressor stations, one heater station, mainline valves (MLVs), and permanent access roads.

Constructing the Project would require the use of about 35,405 acres of land. Following construction, AGDC would maintain about 8,586 acres for Project operation.

U.2.2.1 Evaluation of the effect of use, occupancy, or disposition on subsistence uses and needs

The preliminary evaluation summarizes potential impacts on subsistence resources (wildlife, fish and benthic invertebrates, and other resources) for communities within the North Slope, Yukon River, Tanana River, South-Central, and Kenai Peninsula regions as well as impacts on resource access.

North Slope

The North Slope communities analyzed in the draft EIS section 4.14, Subsistence, include Utqiagvik, Nuiqsut, Kaktovik, and Anaktuvuk Pass (figure 4.14.3-1). Section 4.14 describes potential impacts to subsistence that could occur during construction, operations, or both phases of the project. These impacts include:

- Displacement of resources due to disturbance and/or habitat loss,
 - Changes in migratory behavior and/or local movements of marine mammals due to noise and/or vessel traffic,
 - Changes in migratory behavior and/or local movements of caribou due to construction activities and the maintained right-of-way,
- Impacts to access to traditional subsistence use areas due to construction-related activities and vessel traffic, and
- Increased competition with non-local hunters due to unauthorized use of access roads.

These potential impacts to wildlife, fish, other resources, and potential impacts to subsistence user access, are discussed below.

Wildlife

Displacement of wildlife resource due to disturbance and/or habitat loss could affect the availability and abundance of wildlife resources for Utqiagvik, Nuiqsut, and Anaktuvuk Pass. These resources include marine mammals (bowhead whale, ringed and bearded seals, and Pacific walrus), caribou, and upland birds.

Impacts to the availability of marine mammals could be moderate to major but would be effectively mitigated. Marine mammals could be displaced from traditional use areas and travel routes due to noise and shipping traffic. Displacement of marine mammals would be mitigated and minimized during critical time periods by coordinating with local communities and whaling associations to identify areas within which construction activities should be avoided (see AKLNG draft EIS section 4.14.2.6, General Impact Assessment, page 4.18). As a result, impacts to the availability of marine mammals for subsistence use are expected to be minor and temporary.

Impacts to the availability of caribou could be moderate but would be effectively mitigated. Caribou movements could be locally disrupted due to the construction and presence of the right-of-way. Current best management practices for development on the North Slope include construction methods that allow for the safe, unimpeded passage of caribou and other large mammals across linear infrastructure. Therefore, while caribou movements could be locally impacted, these impacts are expected to be minor

and temporary, and will not prevent caribou from accessing critical habitat or areas within which they are traditionally hunted.

Impacts to the availability of upland birds are expected to be minor. While local displacement may occur, residents of Utqiagvik, Nuiqsut, and Anaktuvuk Pass harvest these resources in a much broader area beyond that within and adjacent to the pipeline right-of-way and will not be adversely impacted.

Impacts to the abundance and availability of terrestrial wildlife species due to increased competition with non-local hunters could be moderate for residents of Anaktuvuk Pass. Proposed mitigation measures and best management practices such as prohibiting employees from engaging in hunting and fishing and blocking right-of-way access points will deter the majority of hunters. Residual impacts would be minor, and would be sufficiently addressed by adapting State and Federal hunting regulations to changing hunting pressure and population dynamics.

Fish

Utqiagvik non-salmon fish use areas are crossed by the Project and could be temporarily affected by the modifications at West Dock, including changes to a fish passage area. Construction of the pipeline, PTTL (Point Thomson Transmission Line), and GTP would occur over winter seasons and would therefore have limited impacts on resource availability of non-salmon fish for Nuiqsut harvesters. Kaktovik and Anaktuvuk Pass subsistence use areas are predominantly located on the periphery of the project area.

Construction and operation are anticipated to have a limited and short term effect on resource availability, and cost and effort to harvest fish resources for these users. Neither abundance nor availability of fish and benthic invertebrates in the North Slope region are likely to be reduced or limited to the extent that subsistence uses would be significantly impaired.

Other Resources

Other resources such as wood, water, or berries would not be affected by the proposed action.

Access

Impacts on the ability of subsistence users to access traditional subsistence use areas could be moderate, but would be effectively mitigated. The mitigation measures proposed as part of this project would require that local residents be consulted prior to and during construction so that access to important subsistence use areas would not be blocked or prohibited. Therefore, impacts to access would be negligible to minor.

Yukon River

The Yukon River communities analyzed in the draft EIS section 4.14, Subsistence, include Evansville, Alatna, Allakaket, Stevens Village, Rampart, Wiseman, Coldfoot, and Bettles. Section 4.14 describes potential impacts to subsistence that could occur during construction, operations, or both phases of the project. These impacts include:

- Displacement of resources due to disturbance and/or habitat loss,

- Permanent habitat conversion in berry harvesting areas,
- Impacts to access to traditional subsistence use areas due to construction-related activities, and
- Increased competition with non-local hunters due to unauthorized use of access roads.

These potential impacts to wildlife, fish, other resources, and potential impacts to subsistence user access, are discussed below.

Wildlife

Displacement of wildlife resource due to disturbance and/or habitat loss could affect the availability and abundance of wildlife resources for residents of Evansville, Alatna, Allakaket, Stevens Village, Rampart, Wiseman, Coldfoot, and Bettles. These resources include large mammals (moose, caribou, Dall sheep, and bear), furbearers, small game (Snowshoe hare, grouse, and ptarmigan), and waterfowl.

Impacts to the availability of large mammals could be moderate but would be effectively mitigated. Caribou movements could be locally disrupted due to the construction and presence of the right-of-way. Current best management practices for development include construction methods that allow for the safe, unimpeded passage of large mammals across linear infrastructure. Therefore, while movements could be locally impacted, these impacts are expected to be minor and temporary, and will not prevent caribou and other large mammals from accessing critical habitat or areas within which they are traditionally hunted.

Impacts to the availability of other wildlife, including furbearers, small game and waterfowl are expected to be minor. While local displacement may occur, residents of the Yukon River region harvest these resources in a much broader area and will not be adversely impacted.

Impacts to the abundance and availability of terrestrial wildlife species due to increased competition with non-local hunters could be moderate for residents of Stevens Village and Wiseman. Proposed mitigation measures and best management practices such as prohibiting employees from engaging in hunting and fishing and blocking right-of-way access points will deter the majority of hunters.

Fish

Summer is an important time for harvesting fish for residents of the Yukon River region. Harvesting salmon in the Yukon and Koyukuk River watersheds and non-salmon species in rivers and lakes is important in Allakaket, Alatna, Rampart, Stevens Village, Bettles, and Evansville. Wiseman harvest from local waterbodies is composed primarily of non-salmon fish.

Construction activities along the pipeline would overlap with non-salmon fish at stream crossings. As discussed in section 4.14, Subsistence, construction could have a short term impact on fish distribution and habitat and affect access to resources along the Dalton Highway.

Construction activities could also cause downstream effects on fish and their habitat. However, impacts to subsistence use and harvest during construction and operation would be minimal for downstream communities due to the distance of the use areas from the Project. Construction impacts to fish resources, habitat, and users of the Yukon River would be minimized due to the crossing of the Yukon River accomplished through use of the buried trenchless construction method.

Construction and operation are anticipated to have a limited and short term effect on resource availability, and cost and effort to harvest fish resources for these users. Neither abundance nor availability of fish and benthic invertebrates in the Yukon River region are likely to be reduced or limited to the extent that subsistence uses would be significantly impaired.

Other Resources

Impacts to the abundance of berries would be negligible to minor. Vegetation, including blueberry, cloudberry, and other species traditionally collected during the late summer and early fall would be impacted within the right-of-way footprint. Traditional berry collecting areas for Stevens Village and Rampart overlap with the right-of-way and could be impacted. Collection of these resources occur within a large area, and areas closer to these communities are likely the most important and would not be affected.

Access

Impacts on the ability of subsistence users to access traditional subsistence use areas could be moderate, but would be effectively mitigated. The mitigation measures proposed as part of this project would require that local residents be consulted prior to and during construction so that access to important subsistence use areas would not be blocked or prohibited. Therefore, impacts to access would be negligible to minor.

Tanana River

The Tanana River communities analyzed in the draft EIS section 4.14, Subsistence, include Tanana, Manley Hot Springs, Minto, Nenana, Four Mile Road, Anderson, Ferry, Healy, and Denali Park CDP. Section 4.14 describes potential impacts to subsistence that could occur during construction, operations, or both phases of the project. These impacts include:

- Displacement of resources due to disturbance and/or habitat loss,
- Permanent habitat conversion in berry harvesting areas,
- Impacts to access to traditional subsistence use areas due to construction-related activities, and
- Increased competition with non-local hunters due to unauthorized use of access roads.

For the Tanana River region, these potential impacts to wildlife, fish, other resources, as well as potential impacts to subsistence user access are discussed below.

Wildlife

Impacts to wildlife resource abundance and availability due to displacement of resources, vegetation disturbance, and increased competition with non-local hunters would be similar to those described under the North Slope and Yukon River sections. Impacts would be minor in intensity and duration. These minor impacts are not anticipated to significantly limit or reduce wildlife availability or abundance for subsistence use.

Fish

Summer is a key time for harvesting fish in the Tanana River region. Fishing begins in June and continues through the fall as salmon migrate through the region's watersheds. Non-salmon freshwater fish species harvested during the summer include Arctic grayling, whitefish, sheefish, trout, char, and burbot.

Construction could have a short term impact on access to, and availability of, resources as a result of habitat loss, increased competition from non-local harvesters, increased traffic, blocked harvester access to subsistence use areas, and additional cost and effort to harvest these resources. Competition for resources may continue during Project operation in portions of the region.

Construction activities could also cause downstream effects on fish and their habitat. However, impacts to subsistence use and harvest during construction and operation would be minimal for the downstream communities of Tanana and Manley Hot Springs due to the distance of the use areas from the Project. Downstream effects can also be mitigated at some locations through the timing of construction.

Construction and operation are anticipated to have a limited and short term effect on resource availability, and cost and effort to harvest fish resources for these users. Neither abundance nor availability of fish and benthic invertebrates in the Tanana River region are likely to be reduced or limited to the extent that subsistence uses would be significantly impaired.

Other Resources

Impacts to the abundance of berries would be negligible to minor based on magnitude and duration. Vegetation, including blueberry, cloudberry, and other species traditionally collected during the late summer and early fall would be impacted within the right-of-way footprint. Traditional berry collecting areas for Nenana, Ferry, Healy, and Denali Park CDP overlap with the right-of-way and could be impacted. Collection of these resources occur within a large area, and areas closer to these communities are likely the most important. The identified negligible to minor impacts are not anticipated to significantly reduce or limit the availability or abundance of other resources.

Access

Impacts on the ability of subsistence users to access traditional subsistence use areas could be moderate, but would be effectively mitigated. The mitigation measures proposed as part of this project would require that local residents be consulted prior to and during construction so that access to important subsistence use areas would not be blocked or prohibited. Therefore, impacts to access would be negligible to minor.

South-Central

The Yukon River communities analyzed in the draft EIS section 4.14, Subsistence, include Cantwell, Chase, Talkeetna, Trapper Creek, Skwentna, Alexander Creek and Susitna, Beluga, and Tyonek. Section 4.14 describes potential impacts to subsistence that could occur during construction, operations, or both phases of the project. These impacts include:

- Displacement of resources due to disturbance and/or habitat loss,
- Permanent habitat conversion in berry harvesting areas,

- Impacts to access to traditional subsistence use areas due to construction-related activities, and
- Increased competition with non-local hunters due to unauthorized use of access roads.

For the South-Central region, these potential impacts to wildlife, fish and benthic invertebrates, other resources, as well as potential impacts to subsistence user access are discussed below.

Wildlife

Impacts to wildlife resource abundance and availability due to displacement of resources, vegetation disturbance, and increased competition with non-local hunters would be similar to those described previously. Impacts would be minor.

Fish

At a regional level, salmon was identified as the third most important resource. Communities harvest salmon from a number of the rivers crossed by the Project. Use areas for some communities are concentrated along the existing highway corridor while some residents may also use coastal areas to harvest marine invertebrates.

Construction could have a short term impact on access to, and availability of, resources as a result of habitat loss, increased competition from non-local harvesters, increased traffic, blocked harvester access to subsistence use areas, and additional cost and effort to harvest these resources. Competition for resources may continue during Project operation in portions of the region.

Construction and operation are anticipated to have a limited and short term effect on resource availability, and cost and effort to harvest fish resources for these users. Neither abundance nor availability of fish and benthic invertebrates in the South Central region are likely to be reduced or limited to the extent that subsistence uses would be significantly impaired.

Other Resources

Impacts to the abundance of berries would be negligible to minor based on the extent of the impact within subsistence berry picking areas. Vegetation, including blueberry, cloudberry, and other species traditionally collected during the late summer and early fall would be impacted within the right-of-way footprint. Traditional berry collecting areas for Cantwell, Chase, Beluga, and Tyonek overlap with the right-of-way and could be impacted. Collection of these resources occur within a large area, and areas closer to these communities are likely the most important. The identified negligible to minor impacts are not anticipated to significantly reduce or limit the availability or abundance of other resources.

Access

Impacts on the ability of subsistence users to access traditional subsistence use areas could be moderate, but would be effectively mitigated. The mitigation measures proposed as part of this project would require that local residents be consulted prior to and during construction so that access to important subsistence use areas would not be blocked or prohibited. Therefore, impacts to access would be negligible to minor.

Kenai Peninsula

The Kenai Peninsula communities analyzed in the draft EIS section 4.14, Subsistence, include Nikiski, Seldovia, Port Graham, and Nanwalek. Several Kenai Peninsula region study communities (including Nikiski) are federally designated as non-rural communities and are located within a state non-subsistence area. As a result, Nikiski is not included in this analysis.

Section 4.14 describes potential impacts to subsistence that could occur during construction, operations, or both phases of the project. These impacts include:

- Displacement of resources due to disturbance and/or habitat loss,
- Impacts to access to traditional subsistence use areas due to construction-related activities, and
- Increased competition with non-local hunters due to unauthorized use of access roads.

Wildlife

Impacts to wildlife resource abundance and availability due to displacement of resources and increased competition with non-local hunters would be similar to those described previously. Impacts would be minor.

Fish

Data from communities in this region indicate that salmon and non-salmon fish are the most important resource categories as measured as a proportion of the total harvest. Subsistence users harvest all five species of Pacific salmon. Harvest occurs in marine and freshwaters. A variety of marine and freshwater non-salmon fish and marine invertebrates are also harvested.

Project construction activity and operation of the pipeline and Liquefaction Facility could impact subsistence users by reducing resource availability and access while increasing harvest cost and effort and potential resource competition. Construction would also require additional shipments during the summer shipping season. The additional traffic would occur in an already established shipping lane. The Project shipping route in Cook Inlet would directly overlap Nanwalek subsistence use areas for non-salmon fish.

Construction and operation are anticipated to have a limited and/or short term effect on resource availability, and cost and effort to harvest fish resources for these users. Neither abundance nor availability of fish and benthic invertebrates in the Kenai Peninsula region are likely to be reduced or limited to the extent that subsistence uses would be significantly impaired.

Other Resources

Impacts to the abundance of berries would be negligible to minor based on the extent of the impact within subsistence berry picking areas. Vegetation, including blueberry, cloudberry, and other species traditionally collected during the late summer and early fall would be impacted within the right-of-way footprint. Collection of these resources occur within a large area, and areas closer to these communities are likely the most important. The identified negligible to minor impacts are not anticipated to significantly reduce or limit the availability or abundance of other resources.

Access

Impacts on the ability of subsistence users to access traditional subsistence use areas could be moderate, but would be effectively mitigated. The mitigation measures proposed as part of this project would require that local residents be consulted prior to and during construction so that access to important subsistence use areas would not be blocked or prohibited. Therefore, impacts to access would be negligible to minor.

U.2.2.2 Evaluation of the availability of other lands for the purpose sought to be achieved

Other lands are available for pipeline construction. Relatively minor variations in the route and the location of processing facilities would be feasible. However, the proposed pipeline route would minimize total pipeline length, reduce the amount of challenging terrain, avoid and/or minimize impacts to existing right-of-ways (and maximize co-location of right-of-ways where desirable), and avoid parks, preserves, refuges, and wilderness areas.

U.2.2.3 Evaluation of other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence

The no action alternative would eliminate the use and occupancy of public lands needed for subsistence purposes. The proposed action alternative would not reduce or eliminate the use of public lands needed for subsistence when compared to the no action alternative. Additional alternatives were reviewed in Chapter 3 of the draft EIS, but none were identified that could provide a significant environmental advantage over the Project.

U.2.2.4 Findings

This evaluation concludes that the proposed action will not result in a significant restriction in subsistence uses for the communities listed in table 1. A positive determination pursuant to ANILCA Section 810 is not required.

U.2.3 Evaluation and Finding for the Cumulative Case

Cumulative impacts to subsistence are described in the draft EIS section 4.19.4.14. The goal of the cumulative case analysis presented in Chapter 4 is to evaluate the incremental impact of the actions considered in the draft EIS in conjunction with all past, present, and reasonably foreseeable future activities in or near the Project area. The geographic area within which cumulative effects were considered includes habitat and the migratory range for subsistence resources such as caribou, salmon and non-salmon fish, migratory birds, and the traditional subsistence use areas for communities affected by the Project. Past, present, and reasonably foreseeable future actions that could cumulatively affect resources within these geographic areas are listed in appendix X-1.

*U.2.3.1 Evaluation of the effect of use, occupancy, or disposition on subsistence uses and needs**Wildlife*

Oil and gas activities on state and federal lands near the Project have deterred subsistence hunters from using traditional caribou hunting areas (BLM 2013, North Slope Borough 2014, and National Research Council 2003). The projects listed in appendix X-1 that are between the Colville and Canning Rivers

could increase the amount of activity within the Central Arctic Herd caribou range, and could expose a large number of the Teshekpuk Caribou Herd and Western Arctic Herd caribou to development in their summer and winter grounds and during migration. Continued expansion of industrial activity could displace caribou from their normal migratory routes, increase the area considered to be undesirable by subsistence users, and require subsistence users to travel further to harvest subsistence foods at a greater cost in terms of time, fuel, wear and tear on equipment, and harvester's lost wages and increased safety risks.

While direct habitat loss from cumulative oil and gas development near the Project would affect only a small proportion of the total area used by caribou, functional habitat loss could result from long-term displacement of caribou from the vicinity of the applicable projects listed in appendix X-1 and could encompass a much larger area resulting in reduced availability of caribou. AGDC would implement mitigation measures, including consultation with the potentially affected subsistence communities, to prevent conflicts with subsistence hunting. Nonetheless, the cumulative effects of the proposed action in combination with other past, present, and reasonably foreseeable activities on the North Slope may result in a significant restriction of subsistence use for the communities of Nuiqsut, Kaktovik, Utqiagvik, and Anaktuvuk Pass due to a potential decrease in the availability of caribou.

Cumulative effects on marine mammals such as bowhead whales could result from offshore activities on the North Slope. If activities associated with the proposed action occur concurrently and within proximity to other applicable projects listed in appendix X-1, impacts on marine mammals would likely be exacerbated and could result in changes in movement and migratory patterns, shifts in foraging behavior, or reduction in access to productive forage areas. These behavioral changes would likely require subsistence users in Nuiqsut, Kaktovik, and Utqiagvik to travel further to harvest bowhead whales at a greater cost in terms of time, fuel, and wear and tear on equipment. AGDC would coordinate with the AEWC (Alaska Eskimo Whaling Commission) to work under a Conflict Avoidance Agreement to decrease impacts on bowheads and subsistence hunters. This measure would sufficiently minimize cumulative impacts on bowhead whales because communication under this agreement would enable AGDC to plan offshore activities and transportation schedules so that they do not conflict with major migration times or subsistence hunting. These agreements have generally been successful. Residual impacts would still exist, but would be minor based on magnitude and extent.

Section 4.19.4.14 of the draft EIS cites increased traffic along the Dalton and Parks highways and increased competition for wildlife resources as additional sources of potential cumulative impacts to subsistence. Current best management practices on the North Slope include policies that prevent employees and personnel from hunting or fishing while stationed at camps or other work facilities. This practice would continue under the proposed action. Therefore, wildlife resource abundance will not be significantly reduced or limited under the cumulative case.

Fish

Cumulative impacts on fisheries and benthic invertebrate resources are described in the Aquatics section (section 4.19.4.7) of the draft EIS. Potential impacts include degradation of habitat and direct mortality and alteration of population abundance through disruption of habitat, decreased health, and indirect mortality resulting from changes to water and sediment quality. The magnitude of cumulative impacts on fisheries and benthic invertebrate resources were characterized as less than significant.

With regards to subsistence use of fish and benthic invertebrates, development activities and their subsequent impacts could result in temporary disruptions within subsistence use areas, and cause short term decreases in aquatic subsistence resource availability, harvest rates, and user access. Effort required to participate in subsistence activities could increase during the development phase of the Project and other applicable actions listed in appendix X-1. Past, present, and reasonably foreseeable actions will not significantly reduce abundance or limit the availability of aquatic subsistence resources or the continued ability of subsistence users to access resources.

Other Resources

Other resources such as wood, water, or berries would be locally affected by the proposed action and other projects described in appendix X-1. However, collection of these resources occurs across a wide area. The abundance of these other resources would not be significantly reduced or limited under the cumulative case.

Access

Impacts on the ability of subsistence users to access traditional subsistence use areas could be moderate, but would be effectively mitigated. The mitigation measures would require that local residents be consulted prior to and during construction so that access to important subsistence use areas would not be blocked or prohibited. Therefore, impacts to access would be negligible to minor.

U.2.3.2 Evaluation of the availability of other lands for the purpose sought to be achieved

Evaluation of the availability of other lands is identical to that described under the proposed action.

U.2.3.3 Evaluation of other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence

Evaluation of other alternatives is identical to that described under the proposed action.

U.2.3.4 Findings

This evaluation concludes that the cumulative case, when taken in conjunction with the proposed action, may result in a significant restriction to subsistence uses for the communities of Nuiqsut, Kaktovik, Utqiagvik, and Anaktuvuk Pass due to potential decline in the availability of caribou for subsistence use. A positive determination pursuant to ANILCA Section 810 is required.

U.3 NOTICE AND HEARINGS

ANILCA Section 810(a) provides that there shall be no “withdrawal, reservation, lease, permit, or other use, occupancy, or disposition of the public lands which would significantly restrict subsistence uses,” until the federal agency gives the required notice and holds a hearing in accordance with ANILCA Section 810(a)(1) and (2). The BLM will provide notice in the *Federal Register* that it made positive findings pursuant to ANILCA Section 810 that the cumulative case presented in the draft EIS met the “may significantly restrict” threshold. As a result, public hearings will be held in the potentially affected communities of Nuiqsut, Kaktovik, Utqiagvik, and Anaktuvuk Pass. The hearings in Nuiqsut and Utqiagvik will be held in conjunction with public comment meetings for the draft EIS. Notice of all

hearings will be provided in the *Federal Register* and in local media, including the *Arctic Sounder* and KBRW, the Utquigvik radio station with coverage to all villages on the North Slope.

U.4 SUBSISTENCE DETERMINATIONS UNDER THE ANILCA SECTION 810(A)(3)(A), (B), AND (C)

ANILCA Section 810(a) provides that there would be no “withdrawal, reservation, lease, permit, or other use, occupancy or disposition of the public lands which would significantly restrict subsistence uses,” until the federal agency gives the required notice and holds a hearing, in accordance with ANILCA Section 810(a)(1) and (2), and makes the following three determinations required by ANILCA Section 810(a)(3)(A), (B), and (C): 1) that such a significant restriction of subsistence use is necessary, consistent with sound management principles for the use of the public lands; 2) that the proposed activity would involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other such disposition; and 3) that reasonable steps would be taken to minimize adverse impacts on subsistence uses and resources resulting from such actions (16 USC 3120(a)(3)(A), (B), and (C)).

The BLM has found in this preliminary evaluation that the cumulative case may significantly restrict subsistence uses. This is in agreement with the findings presented in the draft EIS cumulative impacts analysis, which conclude that the cumulative effects of the Alaska LNG Project in combination with other projects on the North Slope could disrupt the distribution of caribou on the North Slope and could negatively affect subsistence harvests of caribou by Nuiqsut, Kaktovik, Utqiagvik, and Anaktuvuk Pass. The BLM will undertake the notice and hearing procedures required by ANILCA Section 810 (a)(1) and (2), in conjunction with the release of the draft EIS in order to solicit public comment from these potentially affected communities.

The determination that the requirements of the ANILCA Section 810(a)(3)(A), (B), and (C) have been met will be analyzed in the Final ANILCA Section 810 Evaluation. The Final Evaluation will integrate input voiced during the hearings by the residents of potentially affected communities.

U.5 REFERENCES

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APPENDIX V
Health Impact Assessment

PUBLIC

ALASKA LNG

Health Impact Assessment

November 1, 2018

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Alaska LNG


3201 C Street, Suite 200
Anchorage, Alaska 99503
T: 907-330-6300
www.alaska-lng.com

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ACRONYMS AND ABBREVIATIONS

ABHP	Alaska Bureau of Highway Patrol
ABVS	Alaska Bureau of Vital Statistics
ACS	U.S. Census, American Community Survey
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADHSS	Alaska Department of Health and Social Services
ADM	average daily membership
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AGDC	Alaska Gasline Development Corporation
AIDS	acquired immune deficiency syndrome
AK-IBIS	Alaska Indicator-Based Information System
ANTHC	Alaska Native Tribal Health Consortium
ANVSA	Alaska Native Village Statistical Area
AOI	area of interest
APNCU	Adequate Prenatal Care Utilization Index
ASAP	Alaska Stand Alone Pipeline
AST	Alaska State Troopers
ATR	Alaska Trauma Registry
ATSDR	Agency for Toxic Substances and Disease Registry
BACT	best available control technology
BMI	body mass index
BMP	best management practices
BLM	Bureau of Land Management
BRFSS	Behavioral Risk Factor Surveillance System
CDC	U.S. Centers for Disease Control and Prevention
CDP	census designated place
CHD	coronary heart disease
CLRD	chronic lower respiratory disease
CO	carbon monoxide
COPD	chronic obstructive pulmonary disease
CS	congenital syphilis
CT	chlamydia trachomatis
DB	Denali Borough
DPH	Section of Chronic Disease Prevention and Health Promotion
DRIT	direct rapid immunohistochemical test
EPA	Environmental Protection Agency
FAS	Fetal Alcohol Syndrome
FASD	Fetal Alcohol Spectrum Disorders

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FERC	U.S. Department of Energy, Federal Energy Regulatory Commission
FNSB	Fairbanks North Star Borough
GC.....	gonococcal infection
GTP	Gas Treatment Plant
HA2020.....	Healthy Alaskans 2020
HCV.....	hepatitis C virus
HEC.....	Health Effects Categories
HIA.....	health impact assessment
Hib	Haemophilus influenzae type b
HIV.....	human immunodeficiency virus
ICD.....	International Classification of Diseases
IFC	International Finance Corporation
IPIECA.....	International Petroleum Industry Environmental and Conservation Association
KPB	Kenai Peninsula Borough
Mainline	an approximately 800-mile-long, large-diameter gas pipeline
Mat-Su.....	Matanuska-Susitna
MSB	Matanuska-Susitna Borough
MSM.....	men who have sex with men
NEPA.....	National Environmental Policy Act of 1969, as Amended
NGL.....	natural gas liquid
NIH	National Institute of Health
NOx	nitrogen oxides
NSB.....	North Slope Borough
OCS.....	Office of Children’s Services
OPR.....	opioid pain reliever
PAC.....	potentially affected communities
PBTL.....	Prudhoe Bay Transmission Line
PID.....	pelvic inflammatory disease
ppm	parts per million
Project.....	Alaska LNG Project
PSP	paralytic shellfish poisoning
PTTL.....	Point Thomson Transmission Line
ROW	right-of-way
SEIS.....	supplemental environmental impact statement
SDH.....	social determinants of health
SO ₂	sulfur dioxide
SOE	Section of Epidemiology
SPCS.....	State Pipeline Coordinator’s Section
SSA	socioeconomic study area
STI.....	sexually transmitted infections
TB	tuberculosis

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U.S. United States
 USACE..... U.S. Army Corps of Engineers
 USDA U.S. Department of Agriculture
 USDHHS..... U.S. Department of Health and Human Services
 VOC volatile organic compound
 VPSO..... Village Public Safety Officers
 WHO..... World Health Organization
 YRBS Alaska Youth Risk Behavior Survey

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1. INTRODUCTION

This Health Impact Assessment (HIA) was prepared by the Alaska Gasline Development Corporation (AGDC) for the Alaska LNG Project (Project) and is intended as supplemental information to Section 5.4.2.10, Environmental Justice and Public Health, of Resource Report No. 5 (Socioeconomics) in the Environmental Report of the Federal Energy Regulatory Commission (FERC) Application. The HIA was requested by FERC in response to their February 15, 2018 Environmental Data Request No. 287. The HIA includes baseline health data provided by the Alaska Department of Health and Social Services (ADHSS) and its contractor NewFields, LLC, as well as an assessment completed by AGDC and follows the 2015 Technical Guidance for HIA in Alaska (ADHSS, 2015a). AGDC updated the baseline health data as possible using sources from ADHSS, the Center for Disease Control and Prevention (CDC), the Alaska Native Epidemiology Center, and others.

1.1. HIA Overview

In summary, the HIA provides information to decision-makers about potential positive and negative human health impacts related to the proposed Project. The HIA relies on a number of inputs (interdependencies) from other Project studies. These interdependencies, along with key performance indicators relied upon, are outlined in the following subsections. The HIA has been prepared utilizing existing baseline health data as well as available information within the Project Resource Reports and from comments and issues raised during meetings with the federal, state, and local government, the public during scoping meetings, and other stakeholders.

1.2. HIA Framework and Methodology

1.2.1. HIA Definition

The HIA is a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.

1.2.2. HIA Methods

As presented in the 2015 Alaska Technical Guidance for HIA in Alaska, the HIA methods include:

- Engaging relevant stakeholders;
- Reviewing Project specifics;
- Reviewing physical and general environmental setting of the Project;
- Identifying Potentially Affected Community (PACs);
- Analyzing of sufficiency of baseline health information;
- Selecting key health impacts using both a set of defined health effects categories (HECs) and input from stakeholder meetings;

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- Conducting a qualitative impact rating and ranking analysis, consistent with standard National Environmental Policy Act (NEPA) approaches/methodologies; and
- Proposing a series of mitigation recommendations for potential impacts.

1.2.3. HIA Screening

The screening phase of the HIA determined that a comprehensive HIA was appropriate for the Alaska LNG Project. The hallmark of a comprehensive HIA is the collection of data to address gaps identified. This analysis included a review of the Project plan for factors that are known to influence human health. Project characteristics that indicated an in-depth comprehensive analysis was necessary include:

- Prominent new linear features, including transport features;
- Large footprint facilities (such as the Liquefaction Facility);
- Large project in rural settings;
- Construction related influx;
- Environmental concerns:
 - Potential for hazardous materials exposure;
 - Air quality; and
 - Water resources (quality, quantity, access);
- Subsistence resources, harvest and practices;
- Social issues, such as:
 - Worker influx and
 - Resettlement/relocation;
- Economic concerns; and
- Equity concerns.

Screening decisions are based on the best available knowledge about the Project and the best available information on human health in the potentially affected areas.

1.2.4. HIA Scope

An HIA to support a NEPA evaluation is not mandatory in Alaska; however, the 2015 Technical Guidance for HIA in Alaska was used as a primary resource for the public health evaluation of the Project required under NEPA. The 2015 Technical Guidance for HIA in Alaska methodology provides a comprehensive overview of health categories that are generally applicable to the evaluation of impacts related to the proposed Project.

This report does not address classic occupational health concerns (e.g., physical hazards or environmental hazards encountered while working), which are referred to as “inside the fence.” Those concerns are

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addressed by federal and Alaska health and safety legal requirements. However, “cross-over” issues (e.g., health issues that arise as workers interact with local communities) are analyzed within this HIA.

This HIA reviews the proposed Project based on the following information:

- Existing most recent baseline health data for Alaska (2017);
- Project Resource Reports;
- Comments and issues raised during public consultations meetings, affected community meetings, and external stakeholder groups and held by the Project; and
- General parameters developed by the 2015 Alaska Technical Guidance for HIA in Alaska.

1.2.5. Health Effects Categories

The HECs, shown in Table 1, were developed by ADHSS to identify the full spectrum of possible health impacts related to various projects. The HECs were developed as a basis for systematic evaluation of the potential for project-related impacts (i.e., positive, negative, or neutral).

Table 1. Health Effects Categories

Health Effects Category	Pathway Description
Social Determinants of Health (SDH)	<ul style="list-style-type: none"> • The SDH are the conditions in which people are born, grow, live, work, and age. These circumstances are shaped by the distribution of money, power, access, and resources at global, national, state, regional, and local levels. The SDH are mostly responsible for health inequities—the unfair and avoidable differences in health status seen within the State. • This category reviews outcomes and determinants related to mental health, maternal and child health, substance use, social exclusion, psychosocial distress, historical trauma, family dynamics, economic status, educational status, social support systems, and employment status.
Accidents and Injuries	<ul style="list-style-type: none"> • This category contains health outcomes and determinants related to accidents and injuries. • The key outcomes considered are increases and decreases in intentional and unintentional injuries with fatal and nonfatal results. The key determinants in this category include items such as the presence of law enforcement, traffic patterns, alcohol involvement, distance, and access to emergency services, and the presence of prevention programs.
Exposure to Potentially Hazardous Materials	<ul style="list-style-type: none"> • This category contains health outcomes and determinants that may arise from exposure to hazardous materials. • The key health outcomes considered are increases and decreases in documented illnesses or exacerbation of illnesses commonly associated with pollutants of potential concern. These may be mediated through inhalation, ingestion, or physical contact.
Food, Nutrition, and Subsistence Activity	<ul style="list-style-type: none"> • This category includes health outcomes and determinants related to food security, dietary choices, and the consumption of subsistence foods. • The key health outcomes considered are nutrient levels, malnutrition or improvements in nutrient intake, and the subsequent increases or decreases in

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Health Effects Category	Pathway Description
	related diseases. The key determinants include diet composition, food security, and the consumption of subsistence foods.
Infectious Disease	<ul style="list-style-type: none"> • This category includes health outcomes and determinants that result from infectious diseases. • The key health outcomes include rates of increase or decrease for a range of infectious diseases, such as sexually transmitted infections (STI), respiratory illness, or skin infections. Important health determinants may include immunization rates, and the presence of infectious disease prevention efforts.
Water and Sanitation	<ul style="list-style-type: none"> • This category includes changes to access, quantity, and quality of water supplies. • Key determinants reviewed may include distance to clean water, water fluoridation, indoor plumbing, water treatment facilities, adequate volume of water resources, and the existence of community facilities, such as self-service laundry or community shower facilities, etc.
Non-communicable and Chronic Diseases	<ul style="list-style-type: none"> • This category includes health outcomes and determinants related to chronic disease. • Important outcomes include increases or decreases in mortality and morbidity rates of cancer, cardiovascular and cerebrovascular diseases, diabetes, respiratory diseases, and mental health disorders. Key determinants for chronic diseases may include smoking rates, rates of alcohol and drug abuse, physical activity levels, presence of recreation centers, as well as cancer screening rates.
Health Services Infrastructure and Capacity	<ul style="list-style-type: none"> • This category considers health outcomes and determinants related to health care access and health care infrastructure. • Important outcomes include the increase or decrease in the number of medical evacuations, clinics or hospital visit trends, health expenditures, and medication usage. Health determinants may include distance to health facilities, medevac facilities/aircraft, the presence of community health staff, and the frequency of physician visits to the area.

Source: ADHSS, 2015a

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2. POTENTIALLY AFFECTED COMMUNITIES

2.1. Introduction and Background

The Project background and description is provided in Resource Report No. 5, Section 5.1. The socioeconomic study area (SSA) including the area of interest (AOI) and the State of Alaska as a whole are provided in Section 5.2 of Resource Report No. 5. Resource Report No. 1 provides more detailed information regarding Project location, access, and construction schedule.

The Project AOI for the purposes of the HIA analysis is described in Section 5.2.2 of Resource Report No. 5 and includes boroughs and census areas in which Project facilities and major Project transportation routes are located. As shown in Figure 1.1-1 of Resource Report No. 1, the Liquefaction Facility would be located in the Kenai Peninsula Borough (KPB); the Mainline would traverse the KPB, Matanuska-Susitna Borough (MSB), Denali Borough, Fairbanks North Star Borough (FNSB), Yukon-Koyukuk Census Area, and North Slope Borough (NSB); and the Gas Treatment Plant (GTP), Prudhoe Bay Transmission Line (PBTL), and Point Thomsen Transmission Line (PTTL) would be located in the NSB.

A potentially affected community (PAC) is defined as an area, community, or village where Project-related health impacts may reasonably be expected to occur. While the HIA recognizes the social, economic, and cultural importance of all communities in the Project Area, experience with HIA consistently demonstrates that the health-specific PAC footprint does not necessarily match the environmental, economic, and social PAC footprints. There are subtle but critical disciplinary differences that produce variations in the delineation of the PACs. Relevant Resource Reports were reviewed, and communities were analyzed using elements of the HECs and include:

- Anticipated employment;
- Proximity to Project facilities and/or effects;
- Subsistence impacts;
- Exposure to outside workforce;
- Proximity to worker housing;
- Transportation corridors; and
- Port facilities.

The Project AOI was used as a basis for the health-related PAC analysis and other communities were identified as health PACs after evaluation of relevant Resource Reports. These communities are listed in Table 2. The AOI, together with the State of Alaska as a whole, constitute the SSA, as well as the health study area.

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Table 2. Alaska Boroughs, Census Areas, Cities, Census Designated Places, and Alaska Native Village Statistical Areas in the Area of Interest (AOI)

Census Area	Project Facility in the Area	Transportation Corridor	Logistical and Supply Center	Growth-Related Effects	Subsistence & TLK Study Area
North Slope Borough	Mainline/GTP/PTTL/PBTL			X	
Prudhoe Bay/Deadhorse	Mainline/GTP/PTTL/PBTL	Dalton Hwy/primary port/airport	X		X
Barrow					X
Nuiqsut					X
Kaktovik					X
Anaktuvuk Pass					X
Yukon-Koyukuk Census Area	Mainline				
Bettles		Dalton Hwy			X
Coldfoot		Dalton Hwy/airport			X
Evansville/Evansville ANVSA		Dalton Hwy			X
Livengood		Dalton Hwy/airport			X
Manley Hot Springs		Dalton Hwy			X
Minto		Dalton Hwy			X
Nenana	Mainline	Parks Hwy/airport			X
Wiseman	Mainline	Dalton Hwy			X
Alatna					X
Allakaket					X
Stevens Village					X
Beaver					X
Rampart					X
Tanana					X
Four Mile Road					X
Fairbanks North Star Borough	Mainline			X	
Fairbanks		Richardson Hwy/Parks Hwy/Steese Hwy/airport/railway	X		
Denali Borough	Mainline				
Anderson		Parks Hwy			X
Cantwell		Parks Hwy/airport			X

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Census Area	Project Facility in the Area	Transportation Corridor	Logistical and Supply Center	Growth-Related Effects	Subsistence & TLK Study Area
Healy	Mainline	Parks Hwy/airport			X
McKinley Park	Mainline	Parks Hwy			X
Ferry					X
Matanuska-Susitna Borough	Mainline			X	
Big Lake	Mainline	Parks Hwy			
Houston	Mainline	Parks Hwy			X
Knik-Fairview		Knik-Goose Bay Rd			X
Palmer		Parks Hwy			
Point MacKenzie	Mainline	Knik-Goose Bay Road/secondary port/railway			
Skwentna	Mainline				
Talkeetna	Mainline	Parks Hwy/airport			X
Trapper Creek	Mainline	Parks Hwy			X
Wasilla	Mainline	Parks Hwy			X
Willow	Mainline	Parks Hwy/airport			X
Chase					X
Petersville					X
Susitna North					X
Lakes					X
Meadow Lakes					X
Point MacKenzie					X
Tanaina					X
Wasilla					X
Buffalo Soapstone					X
Butte					X
Farm Loop					X
Knik River					X
Lazy Mountain					X
Palmer					X
Sutton Alpine					X
Chickaloon					X
Glacier View					X

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Census Area	Project Facility in the Area	Transportation Corridor	Logistical and Supply Center	Growth-Related Effects	Subsistence & TLK Study Area
Skwentna					X
Alexander Creek					X
Kenai Peninsula Borough	Mainline			X	
Anchor Point		Sterling Hwy			X
Beluga		Road to Tyonek/airport/ primary barge landing			X
Clam Gulch		Sterling Hwy			
Cohoe	Liquefaction Facility	Sterling Hwy			
Cooper Landing		Sterling Hwy			X
Happy Valley		Sterling Hwy			
Homer		Sterling Hwy/secondary port			X
Kalifornsky	Liquefaction Facility	Sterling Hwy			
Kasilof	Liquefaction Facility	Sterling Hwy			
Kenai	Liquefaction Facility	Airport			X
Moose Pass		Seward Hwy			
Nikiski	Liquefaction Facility	Primary port	X		X
Ninilchik/Ninilchik ANVSA		Sterling Hwy			X
Salamatof	Liquefaction Facility				X
Seward		Seward Hwy/ primary port/railway/airport			
Soldotna	Liquefaction Facility	Sterling Hwy			X
Sterling	Liquefaction Facility	Sterling Hwy			
Tyonek	Mainline				X
Hope					X
Sunrise					X
Nikolaevsk					X
Fritz Creek					X
Seldovia					X
Port Graham					X
Nanwalek					
Municipality of Anchorage				X	

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Census Area	Project Facility in the Area	Transportation Corridor	Logistical and Supply Center	Growth-Related Effects	Subsistence & TLK Study Area
Anchorage		Glenn Hwy/Seward Hwy/primary port/airport/railway	X		X
Eklutna ANVSA		Glenn Hwy			
Southeast Fairbanks Census Area					
Big Delta		Richardson Hwy			
Delta Junction		Richardson Hwy			
Dot Lake/Dot Lake ANVSA		Alaska Hwy			
Dry Creek		Alaska Hwy			
Tanacross		Alaska Hwy			
Tok		Alaska Hwy			
Tetlin		Alaska Hwy			
Northway Junction		Alaska Hwy			
Northway		Alaska Hwy			
Alcan Border		Alaska Hwy			
Municipality of Skagway Borough		Klondike Hwy/Alaska Hwy/secondary port			
Valdez-Cordova Census Area					
Chistochina		Tok Cutoff			
Copper Center/Copper Center ANVSA		Richardson Hwy			
Gakona		Richardson Hwy			
Gakona ANVSA		Richardson Hwy			
Glennallen		Richardson Hwy			X
Gulkana		Richardson Hwy			
Gulkana ANVSA		Richardson Hwy			
Mentasta Lake/Mentasta Lake ANVSA		Tok Cutoff			
Paxson		Richardson Hwy			
Slana		Tok Cutoff			
Tazlina/Tazlina ANVSA		Richardson Hwy			
Tonsina		Richardson Hwy			
Valdez		Richardson Hwy/secondary port/airport			X
Whittier		Primary port/railway			X

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Census Area	Project Facility in the Area	Transportation Corridor	Logistical and Supply Center	Growth-Related Effects	Subsistence & TLK Study Area
Copper Center					X
Kenny Lake					X
Other					
Adak		Secondary port			
Nome/Nome ANVSA		Secondary port			
Unalaska		Primary port/airport			
<p>Notes:</p> <p>A city/CDP and the corresponding ANVSA are listed separately only if the populations of the two geographical units differ.</p>					

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3. BASELINE HEALTH CONDITIONS

Baseline health conditions form a fundamental context for the overall HIA process. The baseline health summary creates a point of reference for the health status of a community prior to development of a proposed project and also describes an overall health profile for an area. The health profile can inform decision-makers about health vulnerabilities in a region as well as positive health traits present in a population. Decision-makers can use their knowledge about the features of a project and the health profile of a region to better consider health in their deliberations.

For Alaska, baseline health information resides in public health surveillance systems maintained by the CDC, the State of Alaska, the Alaska Native Tribal Health Consortium (ANTHC), and occasionally local borough and tribal entities.

Alaska public health agencies routinely report public health surveillance data at the statewide or regional level. These agencies do not report village or community-level data to avoid privacy violations (e.g., stigmatization) and problems with statistical analysis when case numbers are small. In general, the State of Alaska does not release disaggregated results for small numbers (e.g., <6). As a result, the information in the baseline summary, when developed for a number of parameters, represents entire boroughs and will not report community level data.

The seven Public Health Regions represent an internal reporting standard for the Alaska Division of Public Health. Alaska Public Health Regions are based broadly upon the Alaska Department of Labor and Workforce Development's six Economic Regions (Anchorage and Matanuska-Susitna [Mat-Su], Gulf Coast, Interior, Northern, Southeast, and Southwest), with the exception of MSB, which is reported separately from the Municipality of Anchorage (Behavioral Risk Factor Surveillance System [BRFSS], 2016).

The Alaska Native Epidemiology Center within the ANTHC have 12 tribal health regions. The boundaries of the tribal health regions do not always follow those of boroughs and census areas.

AGDC completed a review of the available relevant baseline health data and prepared and updated the information provided by ADHSS in cases where the data was available. Sources of baseline data included the following:

- Alaska Native Regional Health Status (ANTHC)
- National Patient Information Reporting System
- 2000 and 2010 United States (U.S.) Census
- 2016 5-year estimates from the American Community Survey of the U.S. Census Borough
- Alaska Bureau of Vital Statistics (ABVS)
- Alaska Department of Epidemiology
- Government Performance and Results Act
- Alaska Trauma Registry

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- ANTHC Immunization Registry
- Alaska Area Diabetes Program
- ANTHC Department of Environmental Health and Engineering
- Alaska Native Tumor Registry
- County Health Rankings (University of Wisconsin)
- Alaska Division of Community and Regional Affairs: Alaska Community Database
- Alaska Department of Labor and Workforce Development
- Behavioral Risk Factor Surveillance System (BRFSS)
- Youth Behavioral Risk Factor Surveillance System
- Alaska Indicator-Based Information System (AK-IBIS)

The HIA team has also reviewed subject matter reports as well as findings from the scientific literature, nutritional surveys and field sampling data. The most recent Alaska Department of Fish and Game (ADF&G) survey results have been reviewed; ADF&G surveys included interviews with residents of the AOI, regarding their subsistence activity.

Of note, public health was addressed in the public and stakeholder meetings held during the subsistence and traditional knowledge study, Project open houses, state and local government meetings, and the FERC public scoping meetings held in 2015. Comments that were captured and health impacts discussed are provided in Resource Report No. 1, Appendix D.

Another key resource for the development of the HIA was the Healthy Alaskans 2020 report. This statewide report was developed by a coalition of public health groups led by the ADHSS and the ANTHC who are collaborating to improve health and reduce health disparities among Alaskans.

3.1. Health Effect Category 1: Social Determinants of Health

The World Health Organization (WHO) and the CDC define the social determinants of health as, “the circumstances in which people are born, grow up, live, work, and age, and the systems put in place to deal with illness” and asserts that “the social determinants of health are mostly responsible for health inequities—the unfair and avoidable differences in health status seen within and between countries” (WHO, 2008).

Both health outcomes data and health determinant data are used to establish baseline health status for the Social Determinants of Health HEC. An outcome is a health event that has actually occurred, while a determinant is a “setting” or context that strongly influences health status.

Of note, social determinants of health are real and important; however, it is extremely difficult to establish direct causality between a change in a social determinant and a particular health outcome. The language used to communicate impacts related to social determinants should reflect that SDH influence health in complex ways.

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For outcomes (or endpoints), the HIA reports life expectancy, maternal and child health, suicide rates, and substance abuse rates as general indicators of physical and social well-being. For health determinants general demographics, family structure, economic status, and educational attainment are included. Regional parameters are compared to all Alaska Natives, all Alaskans and occasionally to the U.S. population, where possible. See Section 5.3.1 of Resource Report No. 5 for demographics including population size and density, projections, age characteristics, and race and ethnicity of the PACs and Statewide.

3.1.1. Social Determinants of Health and Psychosocial Issues

SDH and psychosocial issues are very important in Alaska, particularly for small, remote villages. HIA seeks to disentangle the determinants of health and identify the individual, social, environmental, and institutional factors that produce direct, indirect, or cumulative health impacts. This exercise is complex because many individual and institutional factors interact with each other.

- Individual factors include genetic, biological, lifestyle or behaviors, and specific circumstances. Examples of individual determinants include gender, age, dietary intake, exercise, alcohol and tobacco use, educational attainment, and employment.
- Institutional factors include the capacity, capability, and coverage of public sector services, such as health, schools, transportation, and communications.

The HIA considers psychosocial issues. Subsistence-based rural populations can suffer significant anxiety/stress associated with perceived changes in their autonomy, traditional lifestyle, and cultural stability. This reaction, however, is not necessarily uniform across the community, as there may be a generational split. Even though the generational divide may be unrelated to the Project, it may be accentuated by the Project. Important health outcomes including drug/alcohol usage, teen/unwed pregnancy, gender violence suicides, and depression are considered within this HEC.

3.1.1.1. Demographics

See Section 5.3.1 of Resource Report No. 5 for demographics including population size and density, projections, age characteristics, and race and ethnicity of the PACs and statewide.

3.1.1.2. Economic Indicators

See Section 5.3.2 of Resource Report No. 5 for economic data including employment, income, and labor force characteristics of the PACs.

3.1.1.3. Life Expectancy

Life expectancy can give some general information about expected well-being for infants. Life expectancy is the number of years that infants born in a specific year can expect to live if they experience the same age-specific death rates for all persons who died during their birth year. In 2009, the average life expectancy for all Alaskan infants was 77.1 years compared to all U.S. infants at 78.1 years; data are not publicly available at the borough level (CDC, 2011).

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3.1.1.4. Maternal and Child Health

Maternal and child health outcomes (e.g., low birth-weight) can profoundly influence youth and adult health status and can suggest current or future challenges (or improvements) to human health. The HIA will report components of maternal and child health including initiation of prenatal care, teen-birth rates, low-birth weight, substance abuse during pregnancy, infant mortality child-abuse, and domestic violence.

The ADHSS completed the Alaska Vital Statistics 2015 Annual Report that summarizes data on births and deaths. The purpose of this report is to provide basic reference material and indicators for health and vital events in Alaska. The data is available at www.dhss.alaska.gov and the information summarized here is used to assess baseline conditions for public health in the State of Alaska (ADHSS, 2015b).

3.1.1.4.1. Mother Medical Services Utilization

In 2015, the overall level of mothers receiving first trimester care increased from 74.7 to 76.8 percent (%). Asian/Pacific Islander mothers remain the least likely to initiate prenatal care during the first trimester of pregnancy.

The adequacy of prenatal care utilization index compares the number of prenatal visits with the expected number of visits for the period when care began and with the delivery date (see Appendix C). Since 2006, this index in Alaska has increased 1.4%. Since 2006, the percentage of births by Cesarean section has dropped slightly by 0.9%. African American mothers were most likely to have a Cesarean section birth, while American Indian/Alaska Native mothers were least likely (ADHSS, 2015b).

3.1.1.4.2. Adequacy of Prenatal Care

Initiation of prenatal care during the first trimester is an important marker, as adequate prenatal care has been shown to increase the likelihood of a healthy pregnancy and reduce the likelihood of adverse birth outcomes (Krueger and Scholl, 2000) (Table 3). Prenatal care not only identifies women at risk for complications during delivery, but also enables screening and treatment of medical conditions that may arise during pregnancy. Some conditions, such as preeclampsia, hemorrhage, and intra-partum infection, may be life threatening to both the mother and developing fetus. Prenatal appointments further allow for interventions involving behavioral risk factors associated with poor birth outcomes, such as smoking (WHO, 2005; CDC, 2010).

The Adequate Prenatal Care Utilization Index (APNCU) is a measure that combines the initiation of prenatal care and the number of prenatal visits. A ratio of actual to recommended visits is calculated; if the ratio is 110% or greater, care is considered “adequate plus” prenatal care. If the ratio is greater than 80% but less than 110%, care is considered “adequate”. A ratio between 50 and 79% is considered “intermediate” and a ratio of less than 50% is considered “inadequate” (ADHSS, 2014). The categories of “adequate” and “adequate plus” were combined to create the category “adequate or better”.

In 2012, only approximately 40% of all pregnant women in the NSB Census Area and the Yukon-Koyukuk Census Area were documented on the birth certificate as having received adequate or better prenatal care (ABVS, 2014). This is considerably less than in the State of Alaska, where around 60% of all pregnant women reported experiencing adequate or better prenatal care. Of pregnant Alaska Native women, only

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25% in Skagway-Hoonah-Angoon Census Area had received adequate or better prenatal care, compared to 52% of all Alaska Natives in 2012. In the NSB Census Area and Yukon-Koyukuk Census Area, 43.6% and 39.8% of pregnant Alaska Native women had received adequate or better prenatal care. These discrepancies indicate that fewer Alaska Native women within these regions were receiving proper prenatal care.

In 2013, just over half (54.5%) of mothers of Alaska Native infants had documented adequate prenatal care (AN EpiCenter, 2016). During 1991-2013, the proportion of mothers receiving documented adequate prenatal care among mothers of Alaska Native infants decreased to a low of 43.0% in 2008, but has been increasing since 2008 (Figure 1). During 2009-2013, the proportion of mothers receiving documented adequate prenatal care varied significantly by tribal health region, ranging from 30.7% to 80.5% (AN EpiCenter, 2016) (Figure 2). The Arctic North Slope had the lowest level of adequacy of prenatal care among the tribal health regions that may be potentially impacted by the project (e.g., containing PACs).

Table 3. Adequacy of Prenatal Care for Females by Potentially Affected Census Area, Alaska 2012

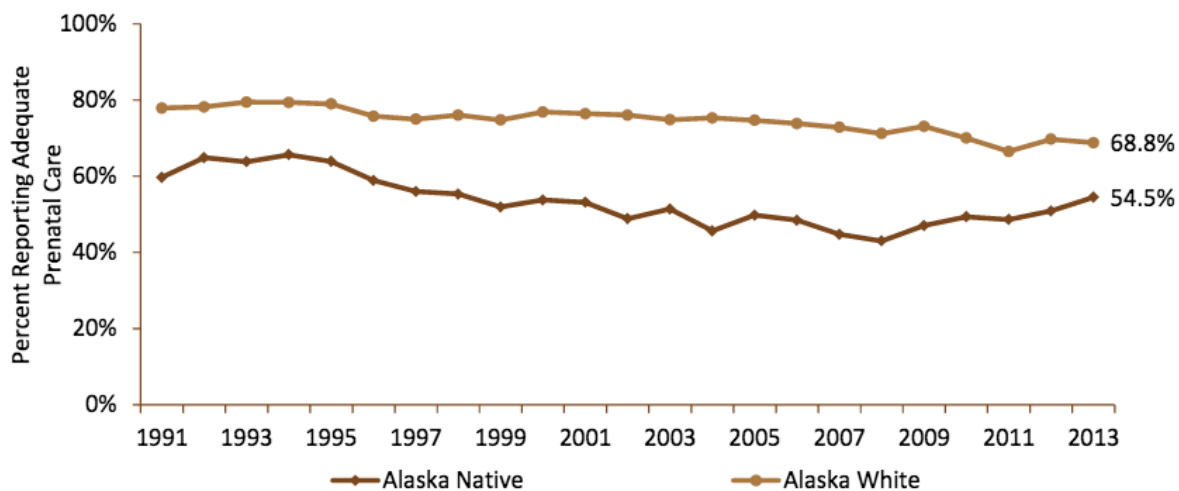
Adequacy of Prenatal Care (APNCU Index)	All Races		White		Alaska Native	
	Births (No.)	Percent (%)	Births (No.)	Percent (%)	Births (No.)	Percent (%)
North Slope Borough						
Adequate plus	43	21.5	1	10.0	42	22.2
Adequate	49	24.5	2	20.0	46	24.3
Intermediate	63	31.5	3	30.0	60	31.7
Inadequate	45	22.5	4	40.0	41	21.7
Yukon-Koyukuk Census Area						
Adequate plus	7	9.0	0	0.0	7	10.3
Adequate	24	30.8	3	33.3	21	30.9
Intermediate	24	30.8	3	33.3	21	30.9
Inadequate	23	29.5	3	33.3	19	27.9
Fairbanks North Star Borough						
Adequate plus	296	21.5	235	23.2	25	13.0
Adequate	677	49.1	513	50.5	84	43.8
Intermediate	186	13.5	133	13.1	33	17.2
Inadequate	220	16.0	134	13.2	50	26.0
Denali Borough						
Adequate plus	1	5.6	**	**	**	**
Adequate	8	44.4	**	**	**	**
Intermediate	2	11.1	**	**	**	**
Inadequate	7	38.9	**	**	**	**
Matanuska-Susitna Borough						
Adequate plus	371	29.5	311	29.7	40	29.6
Adequate	534	42.4	447	42.7	52	38.5
Intermediate	184	14.6	153	14.6	20	14.8
Inadequate	170	13.5	137	13.1	23	17.0
Kenai Peninsula Borough						

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Adequacy of Prenatal Care (APNCU Index)	All Races		White		Alaska Native	
	Births (No.)	Percent (%)	Births (No.)	Percent (%)	Births (No.)	Percent (%)
Adequate plus	116	15.9	91	14.7	21	23.9
Adequate	299	41.0	256	41.4	31	35.2
Intermediate	208	28.5	179	28.9	23	26.1
Inadequate	107	14.7	93	15.0	13	14.8
Municipality of Anchorage						
Adequate plus	1,008	24.5	585	23.3	208	34.8
Adequate	1,655	40.2	1,111	44.2	193	32.3
Intermediate	802	19.5	520	20.7	82	13.7
Inadequate	655	15.9	299	11.9	114	19.1
Southeast Fairbanks Census Area						
Adequate plus	9	9.4	8	9.8	1	12.5
Adequate	30	31.3	27	32.9	1	12.5
Intermediate	24	25.0	19	23.2	2	25.0
Inadequate	33	34.4	28	34.1	4	50.0
Valdez-Cordova Census Area						
Adequate plus	14	12.0	8	9.3	5	20.8
Adequate	42	35.9	29	33.7	12	50.0
Intermediate	33	28.2	26	30.2	4	16.7
Inadequate	28	23.9	23	26.7	3	12.5
Skagway-Hoonah-Angoon Census Area						
Adequate plus	6	23.1	5	38.5	1	8.3
Adequate	8	30.8	5	38.5	2	16.7
Intermediate	5	19.2	1	7.7	4	33.3
Inadequate	7	26.9	2	15.4	5	41.7
State of Alaska						
Adequate plus	2,360	23.1	1,423	23.3	619	23.4
Adequate	3,967	38.8	2,674	43.7	756	28.6
Intermediate	2,134	20.9	1,217	19.9	630	23.8
Inadequate	1,755	17.2	802	13.1	640	24.2
Source: ABVS, 2016						
** Data suppressed for confidentiality concerns if total births, by race, is less than five.						

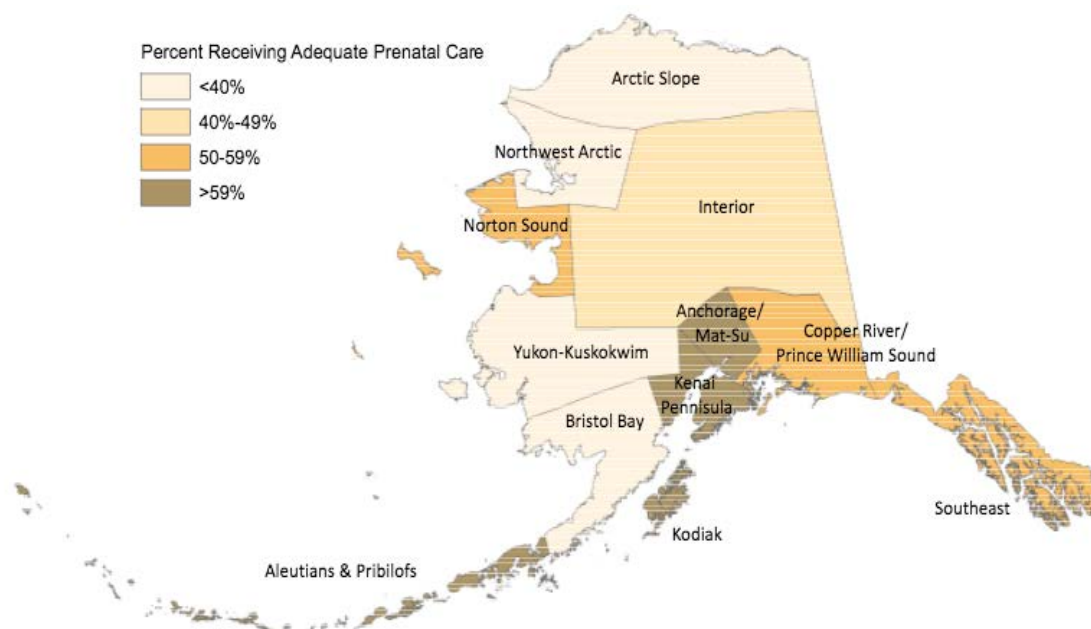
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Figure 1. Adequate Prenatal Care by Alaska Native Status, 1991 – 2013



Source: AN EpiCenter, 2016

Figure 2. Adequate Prenatal Care by Tribal Health Region, 2009-2013



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Teen birth rates, defined as live births per 1,000 females ages 15–19 years, exert important influences on childhood development and female health. The children of teenage mothers are more likely to have lower school achievement and to drop out of high school, have more health problems, be incarcerated at some time during adolescence, give birth as a teenager (Venture et al., 2011). Teenage mothers are less likely to receive a high school diploma, which may negatively impact their future health (CDC, 2010). Teen birth rates by the potentially affected area is provided in Table 4, below.

Table 4. Teen Birth Rates by Potentially Affected Area, Alaska 2012

Census Area	Percent of Total Births (%) to Alaska Native Mothers < 20 Years	Percent of Total Births (%) to All Mothers <20 Years
North Slope Borough Census Area	10.1	9.3
Yukon-Koyukuk Census Area	8.7	7.5
Fairbanks North Star Borough	10.3	6.1
Denali Borough	**	5.3
Matanuska-Susitna Borough	16.2	7.9
Kenai Peninsula Borough	10.0	6.0
Municipality of Anchorage	10.3	6.5
Southeast Fairbanks Census Area	25.0	8.1
Skagway-Hoonah-Angoon Census Area	23.1	11.1
Valdez-Cordova Census Area	0.0	3.2
State of Alaska	12.6	7.5
Source: ABVS, 2016		
** Data suppressed for confidentiality concerns if total births, by race, is less than five.		

3.1.1.4.3. Birth Summary

The number of live births to Alaska residents has declined slightly over the previous year, decreasing 0.9%. However, the overall number of births has still risen 2.7% since 2006. Births to American Indian/Alaska Native mothers and white mothers continue to comprise the majority of Alaska's births.

Crude birth rates, which measure how many births occur per 1,000 population, have returned to a 10-year low of about 15 births per 1,000 population, the same rate as 2012. Fertility rates measures how many births occur per 1,000 female population between the ages 15 and 44. As this measure only takes into account the portion of the population that typically bears children, fertility rates are a more meaningful measure of birth patterns. The overall fertility rate of Alaska mothers has increased 0.1% since 2006 (ADHSS, 2015b).

3.1.1.4.4. Births by Age Group

Fertility rates by age group, or age-specific fertility rates, vary substantially. Alaska mothers between the ages of 20 and 29 continue to have the highest fertility rates by age group. Since 2006, the overall teen mother (15–19) birth rate has declined 28.8%, with the black teen mother birth rate seeing the largest decrease.

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As the two predominant races in Alaska, births to American Indian/Alaska Native and white teen mothers comprised the majority of teenaged births. American Indian/Alaska Native teen mother birth rates remain approximately three times higher than white teen mother birth rates. In 2015, the teen birth rate for American Indian/Alaska Native teens was 55 per 1,000 population, compared to 29 per 1,000 for white teens (ADHSS, 2015b).

3.1.1.4.5. Preterm Birth

A preterm birth is one in which the delivery occurs before 37 weeks of gestation. Since 2006, this percentage has decreased 8%. White mothers continue to have the lowest overall preterm birth rate, while Asian/Pacific Islander mothers and American Indian/Alaska Native mothers have the highest (ADHSS, 2015b).

Low birth weight is considered an infant that weighs less than 2,500 grams (approximately 5.5 pounds). Since 2006, the overall percentage of low birth weight births has remained within a narrow range. In 2015, black mothers had the highest percentage of low weight births, at 8%. It is widely suspected that low birth weight infants (<5.5 pounds) experience a greater number of adverse health outcomes during development and adulthood. Combined with other parameters, birth weights can also help approximate baseline health conditions for a region. Typically, low birth weight is a result of poor delivery of nutrients and oxygen to the fetus, which, in turn, is directly related to the health of the mother. Low birth weight is associated with an increased risk of lifelong disability and a 20-fold increased risk of death (ABVS, 2016). **Error! Bookmark not defined.** Therefore, low birth weight is both an indicator of the health of the maternal population and a determinant of the health of the infant. Low birth weights by PACs is provided in Table 5, below.

Table 5. Low Birth Weight Births by Potentially Affected Communities, Alaska 2012

Census Area	Percent of Total Low Birth Weight Births (%) to Alaska Native Mothers <20 Years	Percent of Total Low Birth Weight Births (%) to All Mothers <20 Years
North Slope Borough	7.4	7.0
Yukon-Koyukuk Census Area	4.3	5.0
Fairbanks North Star Borough	6.9	5.2
Denali Borough	10.5	**
Matanuska-Susitna Borough	6.5	10.1
Kenai Peninsula Borough	4.7	8.8
Municipality of Anchorage	7.4	5.9
Southeast Fairbanks Census Area	0.0	0.0
Skagway-Hoonah-Angoon Census Area	0.0	0.0
Valdez-Cordova Census Area	8.3	7.3
State of Alaska	6.8	5.6
Source: ABVS, 2016		
** Data suppressed for confidentiality concerns if total births, by race, is less than five.		

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Substance use during pregnancy adversely affects birth outcomes and future health for individuals. Substance use during pregnancy refers to the consumption of alcohol, tobacco, and/or drugs during the partum period. Substance use is dangerous for both the mother and the fetus and can lead to premature detachment of the placenta, Sudden Infant Death Syndrome (SIDS), and developmental problems in childhood. Excessive alcohol use during pregnancy puts infants at risk for Fetal Alcohol Syndrome (FAS), the leading preventable cause of birth defects and mental retardation. Fetal Alcohol Spectrum Disorders (FASD) describe with a group of physical, mental, behavioral, or learning disabilities associated with maternal alcohol use during pregnancy. Approximately 1 in 10 infants diagnosed with FASD meet the case definition for the most severe form of the disorder, FAS, which produces typical facial features as well as growth and neurodevelopmental deficits from prenatal alcohol exposure (Community Anti-Drug Coalition of American, 2010).

Smoking during pregnancy is the single most significant contributor to low birth weight (CDC, 2004; Brook, 1989; Kramer, 1987). The NSB had the highest percent of mothers reporting smoking during pregnancy among all residents (48.0%) and Alaska Natives (55.0%) (ABVS, 2016) (Table 6). The Skagway-Hoonah-Angoon Census Area had the lowest percentage of Native Alaska women (15.4%) reporting smoking during pregnancy but the lowest reported rate occurred among all mothers residing in Southeast Fairbanks Census Area (7.1%). The percentage of women reporting drinking during pregnancy was much lower than reported rates of smoking statewide and across all regions. The highest reported levels of drinking during pregnancy occurred among Native Alaska woman living in the Municipality of Anchorage, whereas the highest percentage of all women reporting drinking during pregnancy resided in the Yukon-Koyukuk Census Area.

Table 6. Infants Born to Mothers Reporting Substance Use during Pregnancy by Potentially Affected Communities Area, Alaska, 2012

Census Area	Percent of Alaska Native Mothers Reporting Smoking (%) during Pregnancy	Percent of all Mothers Reporting Smoking (%) during Pregnancy	Percent of Alaska Native Mothers Reporting Drinking (%) during Pregnancy	Percent of all Mothers Reporting Drinking (%) during Pregnancy
North Slope Borough	55.0	48.0	0.7	0.6
Yukon-Koyukuk Census Area	29.0	25.0	5.9	5.1
Fairbanks North Star Borough	32.5	11.8	3.4	1.2
Denali Borough	**	10.5	**	0.0
Matanuska-Susitna Borough	27.7	13.9	4.1	2.6
Kenai Peninsula Borough	30.8	13.9	4.4	3.2
Municipality of Anchorage	31.1	9.3	6.2	3.1
Southeast Fairbanks Census Area	37.5	7.1	0.0	0.0
Skagway-Hoonah-Angoon Census Area	15.4	11.1	0.0	0.0

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Census Area	Percent of Alaska Native Mothers Reporting Smoking (%) during Pregnancy	Percent of all Mothers Reporting Smoking (%) during Pregnancy	Percent of Alaska Native Mothers Reporting Drinking (%) during Pregnancy	Percent of all Mothers Reporting Drinking (%) during Pregnancy
Valdez-Cordova Census Area	20.8	11.3	0.0	2.5
State of Alaska	32.0	13.8	3.7	2.6
Source: ABVS, 2016				
**Data suppressed for confidentiality concerns if total births, by race, is less than five.				

3.1.1.4.6. Fetal and Infant Mortality

Fetal and infant mortality is another health outcome that can be used to approximate baseline health conditions in a region. A fetal death is defined as death before the complete expulsion or extraction from its mother, irrespective of the duration of the pregnancy. The number of fetal deaths between 2013 and 2015 decreased to 184, down from 194 between 2012 and 2014. The fetal mortality rate is the number of fetal deaths, per 1,000 live births and fetal deaths. From 2013 to 2015, the fetal mortality rate averaged 5.4 deaths per 1,000 live births and fetal deaths.

Infant mortality is an important indicator for population health and is influenced by living conditions, food security, domestic conflict, socioeconomic wellbeing, and access to health services. This rate is often used as an indicator to measure the health and well-being of a nation, because factors affecting the health of entire populations can also impact the mortality rate of infants (CDC, 2014). Infant mortality can be separated into neonatal deaths, which occur during the first 28 days of life, and post-neonatal deaths, which occur from the 28th day to 1 year of life. Whereas neonatal deaths are associated with the quality of prenatal and perinatal health care, post-neonatal deaths are more closely associated with socioeconomic conditions (CDC, 2010).

During 1981 to 2013, infant mortality declined among Alaska Native, Alaska White and U.S. White population (Figure 3) (AN EpiCenter, 2016). During this time period, the Alaska Native infant mortality rate declined 49.4%, a significant decrease ($p < 0.001$). During 2009 to 2013, rates of infant mortality varied by tribal health region, ranging from 2.6 to 10.9 per 1,000 live births (Figure 4) (AN EpiCenter, 2016).

The number of infant deaths between 2013 and 2015 increased to 219, up from 201 between 2012 and 2014. The infant mortality rate is the number of infant deaths per 1,000 live births for a given calendar year. From 2013 to 2015, the infant mortality rate averaged 6.4 deaths per 1,000 live births (ADHSS, 2015b).

3.1.1.4.7. Neonatal Infant Deaths

Neonatal deaths are deaths of infants under 28 days of age. These deaths are frequently associated with circumstances related to pregnancy and delivery. The number of neonatal infant deaths increased from 34 in 2014, to 44 in 2015.

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The neonatal infant mortality rate is the number of neonatal infant deaths, per 1,000 live births for a given calendar year. From 2013 to 2015, the neonatal infant mortality rate averaged 3.2 deaths per 1,000 live births. During this period, American Indian/Alaska Native infants were more than twice as likely to die during the neonatal period than white infants.

In 2015, congenital malformations, deformations, and chromosomal abnormalities were the leading causes of neonatal death (ADHSS, 2015b).

3.1.1.4.8. Postneonatal Infant Deaths

Postneonatal deaths are deaths of infants between 28 and 364 days of age. These deaths are frequently associated with living conditions. The number of postneonatal deaths decreased from 41 in 2014, to 35 in 2015.

The postneonatal infant mortality rate is the number of postneonatal infant deaths, per 1,000 live births for a given calendar year. From 2013 to 2015, the postneonatal infant mortality rate averaged 3.3 deaths per 1,000 live births. During this period, American Indian/Alaska Native infants were more than three times as likely to die during the postneonatal period than white infants.

In 2015, SIDS and unintentional injuries were the leading causes of postneonatal death (ADHSS, 2015b).

Infant deaths and mortality rates by PAC for Alaska and the U.S. are provided in Table 7.

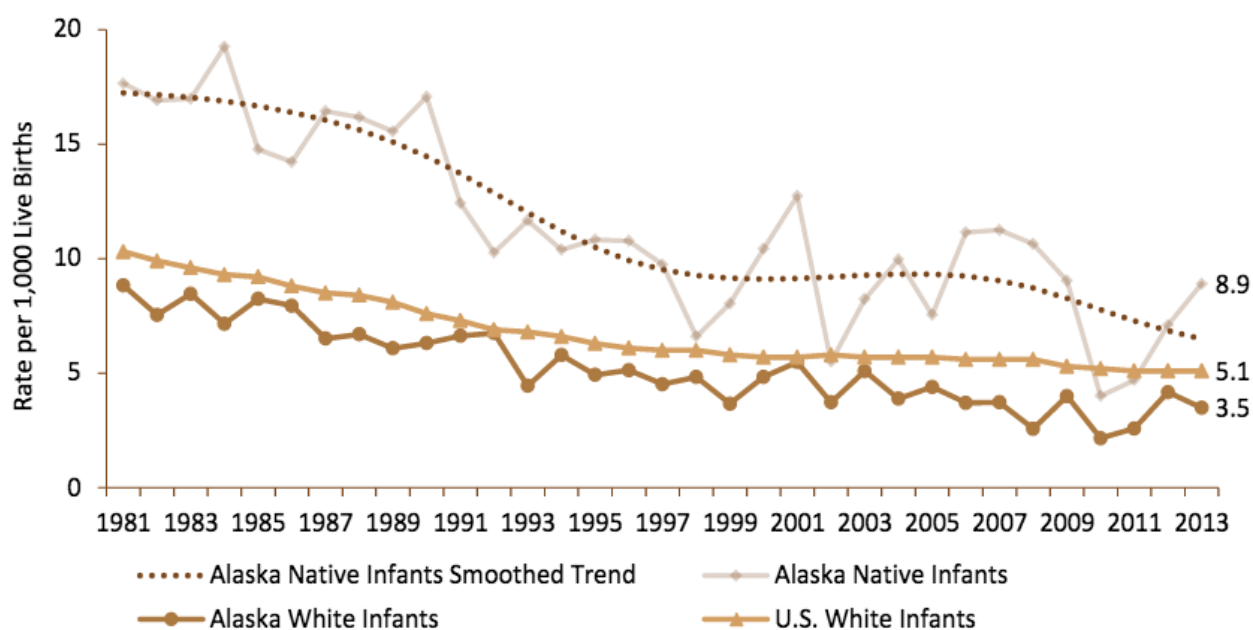
Table 7. Infant Deaths and Infant Mortality Rates by Potentially Affected Area, Alaska, and the U.S.

Census Area	Neonatal (Infants less than 28 Days of Age)		Postneonatal (Infants 28 Days to 1 Year of Age)		Infant Mortality Rate
	Number of Deaths	Rate per 1,000 Live Births	Number of Deaths	Rate per 1,000 Live Births	Rate per 1,000 Live Births
North Slope Borough (2008-2012)	3	**	3	**	6.8*
Yukon-Koyukuk Census Area (2008-2012)	0	0.0	4	**	**
Fairbanks North Star Borough (2010-2012)	14	2.8*	5	**	3.8*
Denali Borough (2008-2012)	1	**	0	0.0	**
Matanuska-Susitna Borough (2010-2012)	9	2.2*	7	1.7*	4.0*
Kenai Peninsula Borough (2010-2012)	4	**	3	**	3.2*
Municipality of Anchorage (2012)	11	2.4*	12	2.6*	5.0
Southeast Fairbanks Census Area (2008-2012)	2	**	0	0.0	**
Skagway-Hoonah-Angoon Census Area (2008-2012)	0	0.0	0	0.0	0.0
Valdez-Cordova Census Area (2008-2012)	1	**	1	**	**

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Census Area	Neonatal (Infants less than 28 Days of Age)		Postneonatal (Infants 28 Days to 1 Year of Age)		Infant Mortality Rate
	Number of Deaths	Rate per 1,000 Live Births	Number of Deaths	Rate per 1,000 Live Births	Rate per 1,000 Live Births
State of Alaska (2012)	36	3.2	25	2.2	5.5
U.S. (2013)	15,867	4.04	7,573	1.93	5.96
Source: ABVS, 2016; CDC, 2016 *Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution. ** Data suppressed for confidentiality concerns if total births, by race, is less than five.					

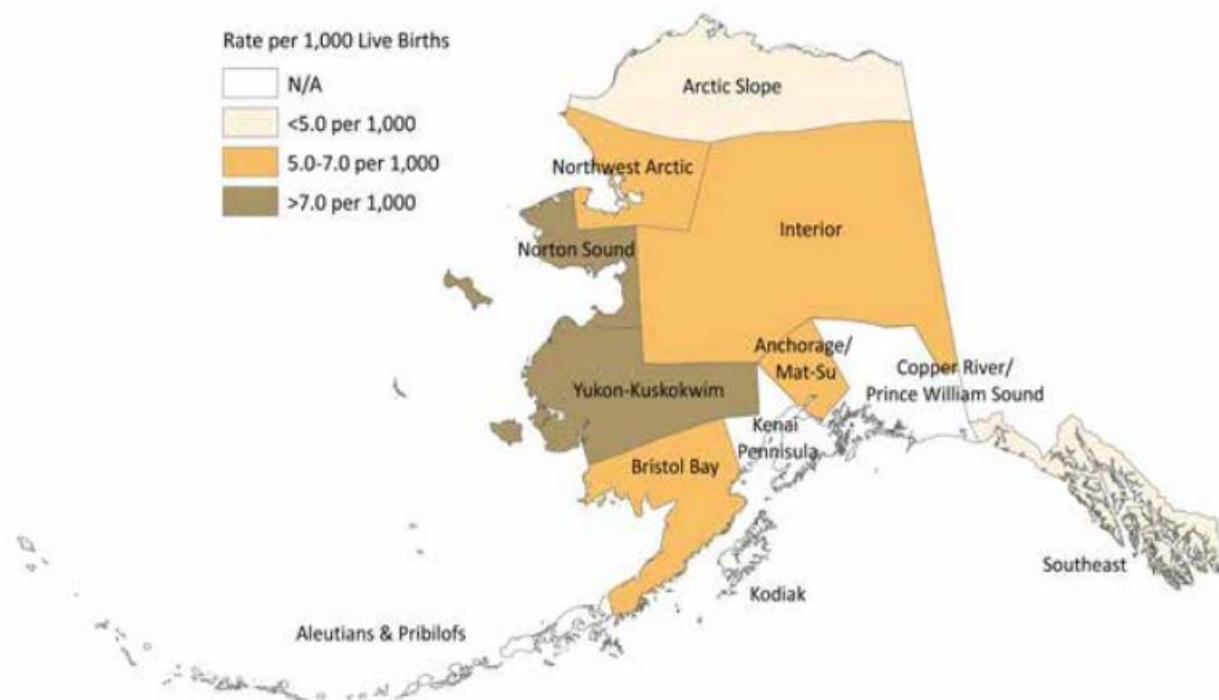
Figure 3. Infant Mortality Rate, 1981-2013



Source: AN EpiCenter, 2016

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Figure 4. Alaska Native Infant Mortality Rates by Tribal Health Region, 2009-2013



Source: AN EpiCenter, 2016

3.1.1.4.9. Child Mortality Summary

The under 5 mortality rate is the number of deaths that occur before age 5 (age 0–4), per 1,000 live births for a given calendar year. From 2013 to 2015, the under 5 mortality rate averaged 8.1 deaths per 1,000 live births. American Indian/Alaska Native children are nearly three times as likely to die before their fifth birthday than white children.

Mortality rates for children and teenagers age 5 to 19 are calculated on an age-specific basis. On average, from 2013 to 2015, approximately 17 Alaska children (age 5–14), and 71 teenagers (age 15–19) died per 100,000 population. American Indian/Native Alaska children (age 5–14) are three times as likely to die than white children, while American Indian/Native teenagers (age 15–19) are more than two and one-half times as likely to die than white teenagers (ADHSS, 2015b).

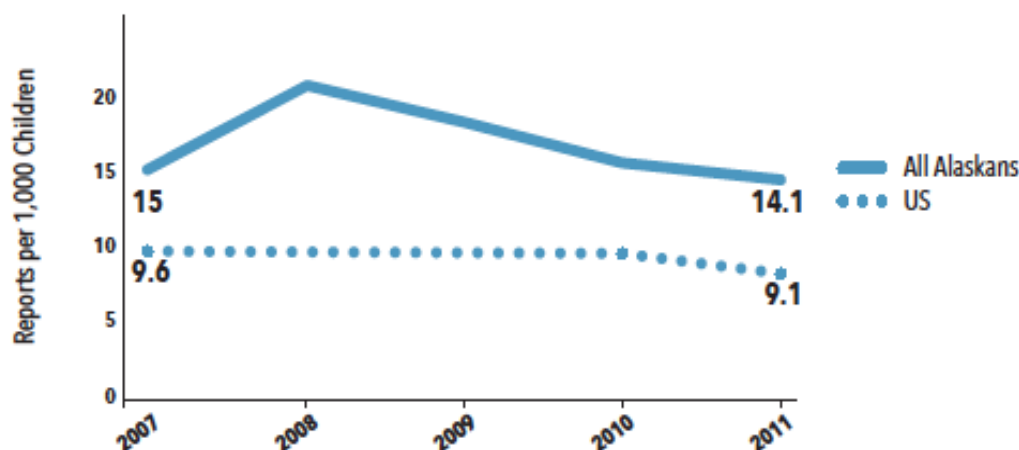
Child abuse is a major contributor to childhood morbidity and mortality. In addition to its direct impact on health, child abuse has been linked to long-term effects on cognitive development and on physical and mental health. Childhood physical abuse predicts a graded increase in depression, anxiety, and severe ill health, as well as multiple medical diagnoses and physical symptoms (Kramer, 1987; Chartier et al., 2007; Springer et al., 2007; U.S. Department of Health and Human Services [USDHHS], 2016). Child abuse and neglect are long-standing issues in Alaska, with rates historically significantly higher than in the U.S.

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overall. A database maintained by ADHSS, Office of Children’s Services (OCS) is used to monitor reports of child maltreatment.

Figure 5 demonstrates improvement in both the Alaska and U.S. rates (per 1,000 children) of substantiated child maltreatment between 2007 and 2011; however, the Alaska rate remained more than 50% higher than the U.S. rate (Healthy Alaskans 2020 [HA2020], 2014). OCS also provides services to families whose children have been determined to be unsafe or at high risk of maltreatment by their parent or caregiver.

Figure 5. Child Maltreatment, All Alaskans and the U.S. (2007-2011)



Source: HA2020, 2014

Child maltreatment data are not specifically aggregated by community or borough, instead, the Alaska OCS publishes statistics for each of five regions. OCS provides services to families whose children have been determined to be unsafe or at high risk of maltreatment by their parent or caregiver. Decisions regarding needed interventions with families are based on thorough information collection that guides the initial and ongoing assessment of safety and risk. OCS has experienced an increase in the number of children in care. Table 8 shows OCS’ statistics on children in out-of-home care for one or more days during the calendar year.

Table 8. Number of Children in Out-of-Home Care (Calendar Year)

Region	Reporting Period				
	2013	2014	2015	2016	2017
Anchorage	1,175	1,317	1,579	1,719	1,723
Northern Region	506	568	665	759	831
Southcentral Region	721	831	926	1,108	1,083
Western Region	235	273	280	285	299
Southeastern Region	249	256	266	267	273
Alaska Statewide (Total)	2,886	3,245	3,716	4,138	4,209
Source: ADHSS, OCS, 2018					

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3.1.1.4.10. Intimate Partner Violence

Intimate partner violence and sexual violence cause an array of direct physical and psychological injuries to victims. In one study, abuse was linked to numerous adverse medical effects including arthritis, chronic neck or back pain, migraine, STIs including human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS), chronic pelvic pain, peptic ulcers, irritable bowel syndrome, and frequent indigestion, diarrhea, or constipation (Coker et al., 2000). Abuse of pregnant women can cause pregnancy complications, such as low weight gain, anemia, infection, and first and second trimester bleeding, as well as elevated rates of depression, suicide attempts, and substance abuse among mothers (The Family Violence Prevention Fund, 2004). Exposure to high levels of intimate partner violence has also been shown to have an association with IQ suppression in young children (Koenen et al., 2003).

The Alaska Victimization Survey is modeled after the National Intimate Partner and Sexual Violence Surveillance System. Statewide surveys were conducted in 2010 and 2015. Regional surveys were administered between 2011 and 2014 within Anchorage, Bristol Bay, Fairbanks, Juneau, Ketchikan, Kodiak, Matsu, Nome, Sitka, Yukon-Kuskokwim, North Slope, and Aleutians. The survey excluded non-English speaking women, women without phone access, and women not living in a residence. It is important to note, therefore, that estimates may be higher among women excluded from the survey. In addition, estimates may also be conservative due to the stigma of reporting victimization. Because these limitations may vary across regions, the validity of regional comparisons remains should be interpreted with caution. Table 9 illustrates past year and lifetime estimates of each form of intimate partner violence measured among women residing in those project regions included in the survey. Among project regions, FNSB had the lowest rates of physical violence and threats; rates were similar among other projects regions. Prevalence of sexual violence was similar among all regions and slightly below that of the state overall.

The most recent Alaska Victimization Survey (2015) conducted by the University of Alaska Anchorage Justice Center for the Council on Domestic Violence and Sexual Assault found that 21,401 adult women in Alaska experienced intimate partner violence, sexual violence, or both in the past year. Half of adult women in Alaska (more than 130,000) have experienced violence in their lifetime. There was, however, a decline in intimate partner and sexual violence in Alaska since 2010. In 2010, 12 in 100 women had experienced intimate partner violence, sexual violence, or both in Alaska during the previous year. By 2015, that number had dropped to 8 in 100. Overall, intimate partner violence decreased by 32% and sexual violence decreased by 33%. In 2015, 6,556 fewer women experienced intimate partner violence than in 2010. In 2015, 3,072 fewer women experienced sexual violence than in 2010.

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Table 9. Lifetime Estimates of Intimate Partner Violence and Sexual Violence among English-Speaking Adult Women by Region and Statewide (2010-2015)

Census Area	Lifetime		Past Year	
	Percentage (%)	Number	Percentage (%)	Number
Fairbanks North Star Borough (2011)				
Intimate Partner Violence ^a	36.4%	11,749	4.8%	1,630
Threats	21.8%	7,403	3.5%	1,188
Physical Violence	34.3%	11,647	4.6%	1,562
Sexual Violence ^b	31.6%	10,730	1.3%	441
Alcohol or Drug Involved Sexual Assault	21.1%	7,165	1.2%	407
Forcible Sexual Assault	23.6%	8,014	0.4%	136
Matanuska-Susitna Borough (2013)				
Intimate Partner Violence ^a	45.5%	13,895	7.6%	2,321
Threats	27.9%	8,520	3.7%	1,130
Physical Violence	44.9%	13,712	7.2%	2,199
Sexual Violence ^b	33.7%	10,292	3.0%	916
Alcohol or Drug Involved Sexual Assault	22.3%	6,810	1.5%	458
Forcible Sexual Assault	26.1%	7,971	2.2%	672
Municipality of Anchorage (2011)				
Intimate Partner Violence ^a	42.2% 45,030 8.2% 8,750 45,030 8.2% 8,750	45,030	8.2%	8,750
Threats	22.8%	24,329	3.6%	3,841
Physical Violence	41.6%	44,390	8.1%	8,643
Sexual Violence ^b	29.6%	31,585	1.4%	1,494
Alcohol or Drug Involved Sexual Assault	18.0%	19,207	1.2%	1,280
Forcible Sexual Assault	22.8%	24,329	0.4%	427
Kenai Peninsula Borough (2013)				
Intimate Partner Violence ^a	43.0%	8,561	4%	796
Threats	26.3%	5,236	1.5%	299
Physical Violence	41.6%	8,283	3.5%	697
Sexual Violence ^b	30.1%	5,993	2.2%	438
Alcohol or Drug Involved Sexual Assault	18.8%	3,743	1.4%	279
Forcible Sexual Assault	22.8%	4,539	1.4%	279
Alaska Statewide (2013)				
	Lifetime		Past Year	
	2010	2015	2010	2015
Intimate Partner Violence ^a	47.6%	40.4%	9.4%	6.4%
Threats	31.0%	25.6%	5.8%	3.0%

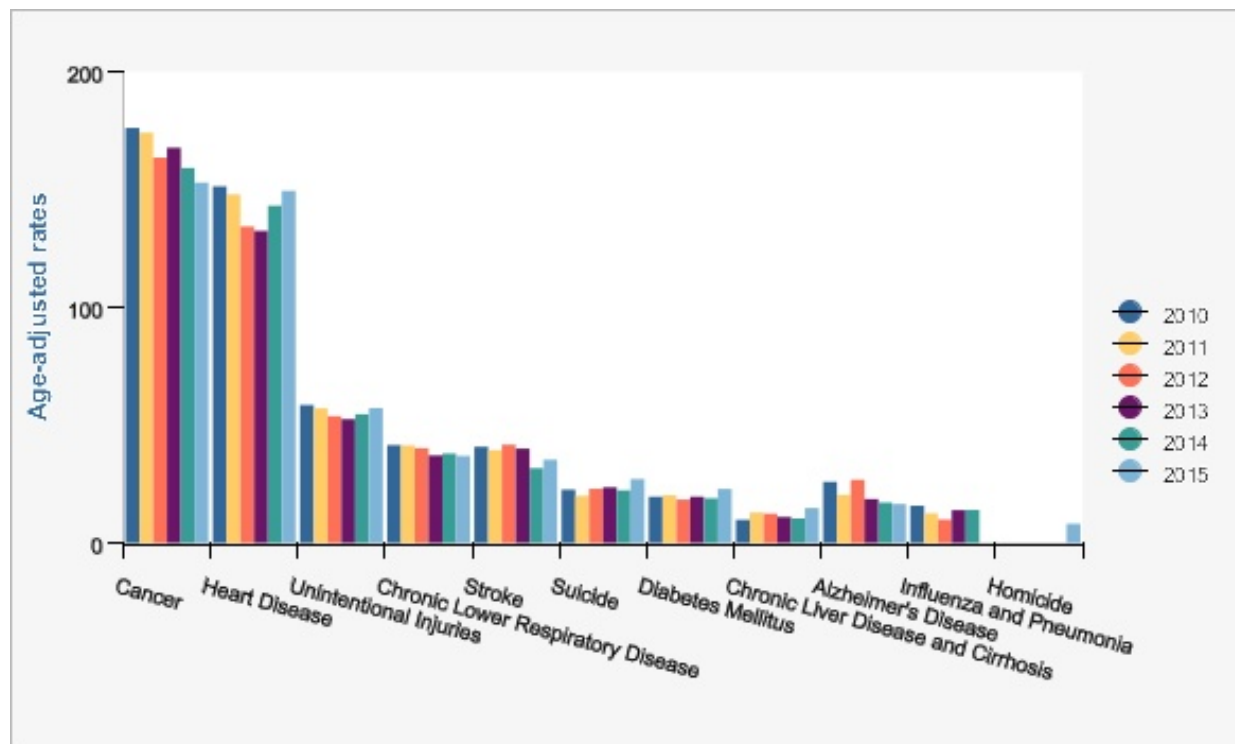
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Census Area	Lifetime		Past Year	
	Percentage (%)	Number	Percentage (%)	Number
Physical Violence	44.8%	39.6%	8.6%	5.9%
Sexual Violence ^b	37.1%	33.1%	4.3%	2.9%
Alcohol or Drug Involved Sexual Assault	26.8%	22.6%	3.6%	2.0%
Forcible Sexual Assault	25.6%	23.5%	2.5%	1.6%
Source: Alaska Victimization Survey, 2010-2015				
^a Includes both threats of physical violence and physical violence by intimate partners.				
^b Includes both alcohol or drug involved sexual assault and forcible sexual assault.				
Note: This survey measured the number of victims, not the number of victimizations. In addition, not all forms of intimate partner violence or sexual violence were measured.				

3.1.1.5. Leading and Select Causes of Death Summary

In 2015, the top 10 leading causes of death claimed the lives of 3,146 Alaskans, comprising 72.8% of all deaths. The top leading causes of death are shown in Figure 6, below. Cancer continues to be the number one leading cause of death in Alaska.

Figure 6. Leading Causes of Death in for All Alaskans 2010–2015



Source: Alaska Vital Statistics 2015 Annual Report (ADHSS, 2015b)

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In 2015, assault (homicide) replaced influenza and pneumonia as the tenth leading cause of death. Years of potential life lost is defined as the difference between the assumed life span of a “typical” person, and the actual age of death. Assuming that a typical person’s lifespan is 75 years, the top ten leading causes of death were responsible for a total 43,792 years of potential life lost in 2015.

In addition to the top ten leading causes of death, data on three select causes of death are also presented. Select causes are composite categories of special interest. Because these categories can contain deaths that may fall into more than one leading cause, they are not ranked (ADHSS, 2015b).

3.1.1.5.1. Death Summary

In 2015, 4,324 Alaskans died. As the two most predominant races in Alaska, American Indian/Alaska Native and white Alaskans comprise the majority of deaths.

Crude death rates measure how many Alaskans died per 100,000 population. Since 2006, Alaska’s crude death rates have increased 17.9%. Crude death rates for American Indian/Alaska Native people were 44.2% higher than for white people.

When comparing death rates between different populations, age-adjusted death rates should be used. This is because populations with a higher proportion of older people will tend to have higher crude death rates. In 2015, Alaska’s age-adjusted death rate was 736 deaths per 100,000 U.S. year 2000 standard population. Age-adjusted rates for American Indian/Alaska Native people are about 79.6% higher than for white people (ADHSS, 2015b).

3.1.1.5.2. Suicide

Suicide is an important health outcome that can function as one indicator for mental health wellness in a population. Mental illness and other life stressors are highly associated with suicide. The economic and human cost of suicidal behavior to individuals, families, communities, and society makes suicide a serious public health problem (HA2020, 2014). Timely access to mental health and substance use disorder treatment services are essential to preventing suicide. Many conditions and stressors may be related to suicide, including:

- Previous suicide attempt(s);
- History of depression or other mental illness;
- Alcohol or drug abuse;
- Family history of suicide or violence;
- Physical illness; and
- Local epidemics of suicide.

Alaska had the second highest age-adjusted suicide rate in the nation in 2013 at 23.1 per 100,000 population, the most recent year for which national data are currently available (AK-IBIS, 2016). During the 2005-2009 period, suicide was the leading cause of death among Alaskans aged 15-44 years and the sixth leading cause of death overall in Alaska (ABVS, 2016). Alaska's suicide rates are highest among males,

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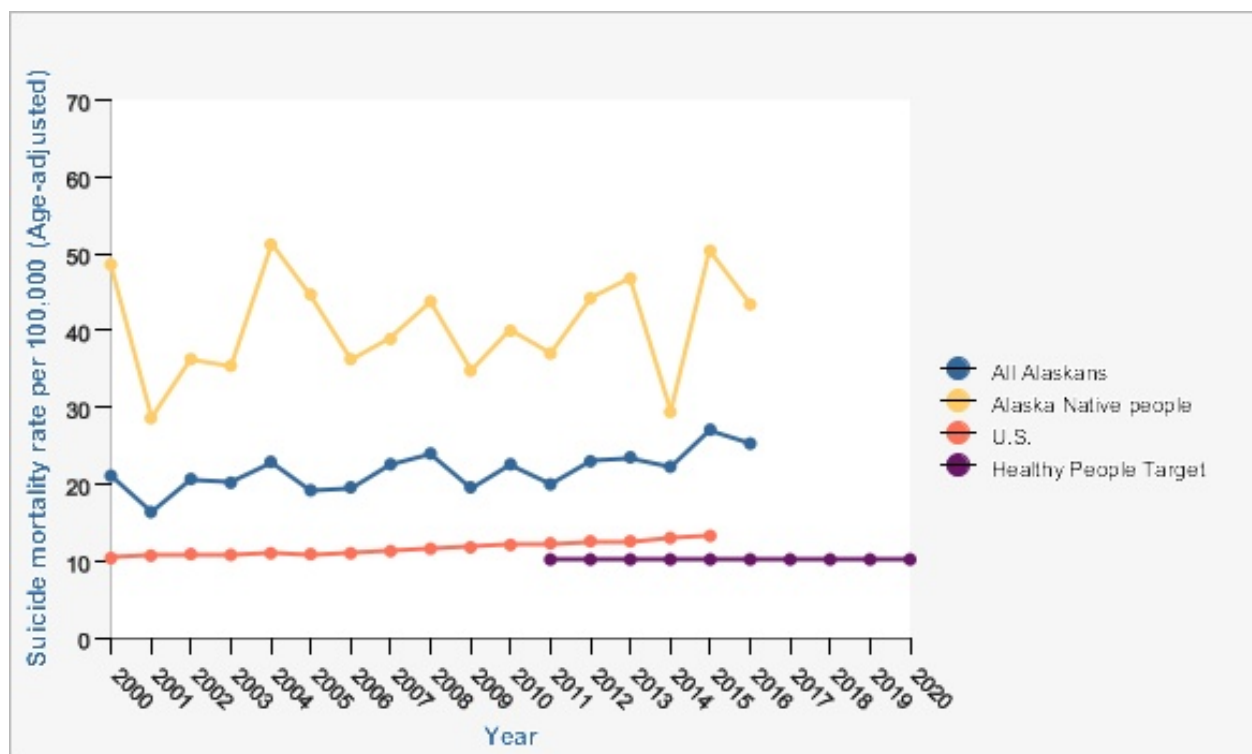
young adults, American Indian/Alaska Native people, and persons living the rural regions of the state (Figures 7 and 8). Between 2000 and 2014, males had a higher suicide rate in every age group (Figure 8).

Intentional self-harm, or suicide, is the fifth leading cause of death in Alaska. In 2015, suicide claimed the lives of 200 Alaskans. Firearms were the leading mechanism of death by suicide, making up 61% of all suicide deaths (98 males and 24 females).

Among the leading causes of death in Alaska, suicide ranked third in total years of potential life lost with 7,510 years lost. On average 37.5 years of life were lost prematurely for each suicide death.

Since 2006, the crude death rate for suicides has increased 38.3%. During this same time period, the age-adjusted rate has increased 38.3% (ADHSS, 2015b).

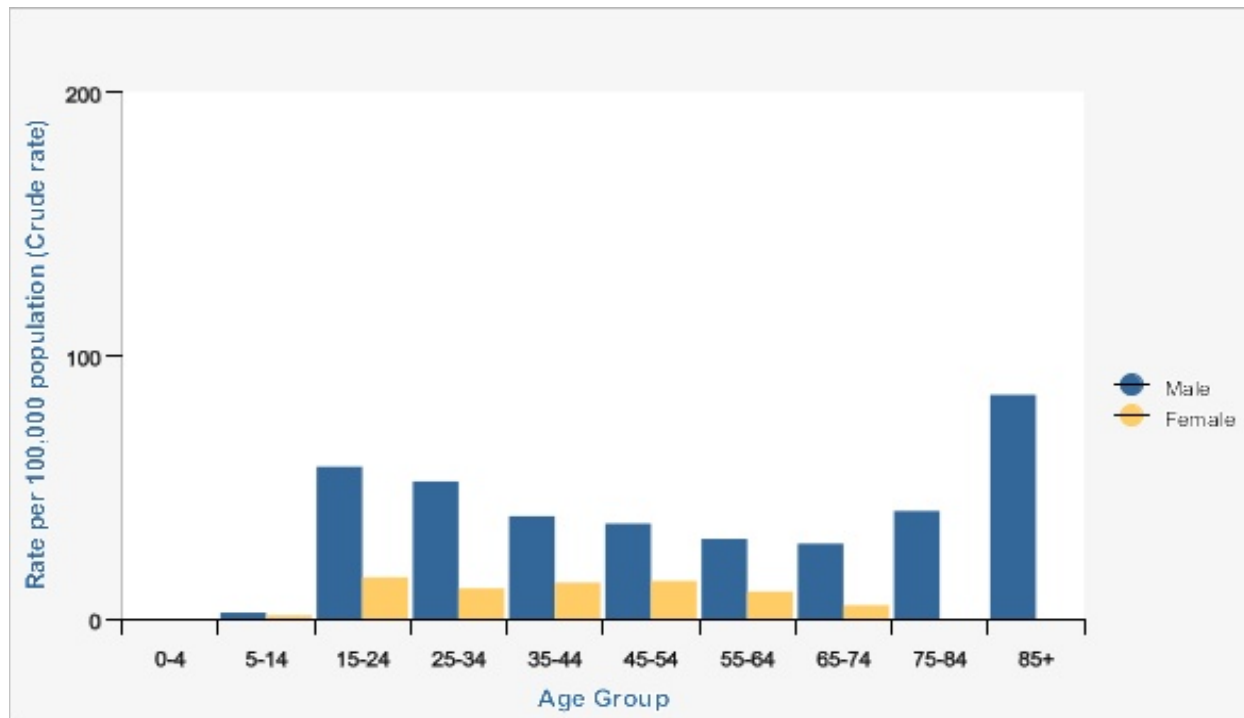
Figure 7. Suicide Mortality Rate per 100,000 Population, All Ages, All Alaskans, Alaska Natives, and U.S. (2000-2016)



Source: AK-IBIS, 2016

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Figure 8. Suicide Mortality Rate per 100,000 Population, by Age Group and Sex, All Alaskans, (2002-2016 [15-Year Average])



Source: AK-IBIS, 2016

Table 10 provides the 5-year (2012-2016) average suicide mortality rate per 100,000 population for all ages classified by Alaska Economic Region.

Table 10. Suicide Mortality Rate per 100,000 Population, All Ages, by Alaska Economic Region, 2012-2016 (5-Year Average)

Economic Region	Suicide Mortality Rate per 100,000 (Age-adjusted)	Lower Limit	Upper Limit	Numerator	Denominator
Anchorage	21.3	20.4	22.1	327	1,497,336
Gulf Coast	27.1	25.2	28.9	108	404,103
Interior	20.8	19.4	22.2	119	565,714
Northern	19.2	17.7	20.6	91	490,241
Mat-Su	45.2	41.0	49.4	64	138,014
Southeast	16.6	15.0	18.1	61	371,027
Southwest	49.9	46.3	53.5	109	211,294
Statewide	24.2	23.6	24.8	891	3,680,926

Source: AK-IBIS, 2016

Among potentially affected areas (Table 11), Yukon-Koyukuk had the highest age-adjusted suicide rate at 72.3 per 100,000 population; however, this figure was derived from a sample size less than 20 and is,

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therefore, not statistically robust (Table 11). KPB has the highest statistically reliable suicide rate at 27.3 per 100,000 population.

Table 11. Suicide Rates by Potentially Affected Area and Alaska Statewide (2011-2013)

Borough/Census Area	Number of Deaths	Age-adjusted Rate per 100,000 Population ^a
North Slope Borough Census Area	6	21.1*
Yukon-Koyukuk Census Area	12	72.3*
Fairbanks North Star Borough	57	19.2
Denali Borough	0	0.0
Matanuska-Susitna Borough	48	17.4
Kenai Peninsula Borough	47	27.3
Municipality of Anchorage	163	17.9
Southeast Fairbanks Census Area	3	**
Skagway-Hoonah-Angoon Census Area	1	**
Valdez-Cordova Census Area	7	27.9*
State of Alaska	481	22.2
Source: ABVS, 2016		
^a Age-adjusted rates are per 100,000 U.S. year 2000 standard population.		
*Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.		
**Rates based on fewer than 6 occurrences are not reported.		

3.1.1.5.3. Substance Abuse

The term "Substance Abuse" refers to the overindulgence in or dependence on an addictive substance, especially alcohol or drugs. In 2013, the American Psychiatric Association updated the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), replacing the categories of substance abuse and substance dependence with a single category: substance use disorder. The symptoms associated with a substance use disorder fall into four major groupings: impaired control, social impairment, risk use, and pharmacological criteria (i.e., tolerance and withdrawal) (National Institute of Health [NIH], 2014).

Substance abuse can cause health problems and strongly influences many related health outcomes, such as accidents and injuries. Substance abuse includes illegal drugs (e.g., heroin, cocaine) alcohol addiction, and binge drinking.

According to the Alaska State Troopers 2015 Annual Drug Report:

The greatest contributing factor to violent crimes—including domestic violence and sexual assault—is drug and alcohol abuse. Property crimes, such as burglary and theft, often have a drug and alcohol abuse nexus. It is also widely recognized that many of the accidental deaths that occur in Alaska are related to alcohol use. This is especially true in the western regions of the state and is evident in the statistics entered into the Alaska State Trooper case management systems. Drugs and alcohol continue to be a factor in intimate partner violence and sexual assault in Alaska. According to the 2015 Alaska Victimization Survey conducted by the University of Alaska-Anchorage (UAA), for every 100 adult women in Alaska, an estimated 40 have experienced intimate partner violence,

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33 have experience sexual violence, and 50 have experienced intimate partner violence, sexual violence, or both. The survey revealed 22.6% experienced at least one alcohol or drug involved sexual assault in their lifetime. 2.0% experienced at least one alcohol or drug involved sexual assault in the past year.

Additionally, according the UAA Justice Center’s “Descriptive Analysis of Domestic Violence and Sexual Assault Incidents Closed by the Alaska State Troopers: 2008–2011” alcohol use by domestic violence suspects or victims was documented in 67.78% of domestic violence cases reported to the Alaska State Troopers from 2008 through 2011. Alcohol use by sexual assault suspects or victims was documented in 39.3% of sexual assault incidents reported to the Troopers during the same timeframe.

According to a July 2015 bulletin released by the Division of Public Health, State of Alaska Epidemiology, the rate of inpatient hospital discharges coded for heroin poisoning nearly doubled from 2.4 per 10,000 in 2008 to 4.7 per 10,000 population in 2012. Heroin-related inpatient and outpatient hospital costs exceeded \$2 million. Heroin-associated deaths more than tripled from 2008 to 2013. During that timeframe, 72 people died with heroin use as the primary or a contributing cause of death. The number of Medicaid health care services payment requests for heroin poisoning increased almost ten-fold from 2004 to 2013. During the years 2009–2013, heroin-related admissions to publicly- funded substance use treatment centers nearly doubled, and the majority of patients admitted for heroin use treatment were aged 21–29 years. The number of treatment admissions for all patients reporting heroin as their primary substance of choice increased by 58% and the number of treatment admissions for patients aged 21–29 reporting heroin as their primary substance of choice increased by 74% (AST 2015).

Substance abuse for adolescents is defined as having used alcohol, marijuana, or cocaine in the past 30 days. The Alaska Youth Risk Behavior Survey (YRBS) is part of an epidemiological surveillance system established by the CDC in 1990 to monitor the prevalence of health-risk behaviors among youth. The YRBS is a biennial, anonymous, and voluntary survey of students in grades 9–12 in public traditional high schools (excluding boarding, correspondence, home study, alternative, and correctional schools). The purpose of the YRBS is to help monitor the prevalence of behaviors that put Alaskan youth at risk for the most significant health and social problems that can occur during adolescence and adulthood. This anonymous survey examines a minimum of six categories of adolescent behavior:

1. Behaviors that result in unintentional and intentional injuries;
2. Tobacco use;
3. Alcohol and other drug use;
4. Sexual behaviors that can result in HIV infection, other STIs and unintended pregnancies;
5. Dietary behaviors; and
6. Physical activity.

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Surveys have also been aggregated into six public health regions; however; because this collection of surveys is not conducted with the same scientific rigor as those producing the statewide estimates, the resulting rates are considered indicators of the existence of specific behaviors but not necessarily the precise prevalence estimates, limiting the utility of comparisons (Youth Behavioral Risk Factor Surveillance System, 2015). Consequently, results of these surveys will be discussed at the state level.

Alaska's pattern of substance use disorder generally follows national trends, with the following exceptions (Substance Abuse and Mental Health Services, 2015):

- Approximately 4 in 10 (42.4%) adolescents (aged 12-17) in Alaska in 2013-2014 perceived no great risk from smoking one or more packs of cigarettes a day, exceeding the national percentage (34.7%).
- Approximately 8 in 10 (82.9%) adolescents (aged 12-17) in Alaska in 2013-2014 perceived no great risk from smoking marijuana once a month, exceeding the national percentage (76.5%).

3.1.1.5.4. Drug-Induced Deaths

Drug-induced mortality is a composite that includes deaths due to dependent and non-dependent use of drugs (legal and illegal use), and due to poisoning from medically prescribed, or other drugs. It excludes injury, homicides, other causes indirectly related to drug use, and newborn deaths due to the mother's drug use.

In 2015, drug-induced deaths claimed the lives of 126 Alaskans. Since 2006, the crude death rate for drug-induced deaths has increased 39%. During this same time period, the age-adjusted rate has increased 36.6%.

There were 4,301 years of potential life lost due to drug-induced deaths, with 34.1 years lost prematurely for each death, on average (ADHSS, 2015b).

3.1.1.5.5. Alcohol-Induced Deaths

Alcohol-induced mortality is a composite that includes deaths due to alcohol psychoses, alcohol dependence syndrome, non-dependent abuse of alcohol, alcohol-induced chronic liver disease and cirrhosis, and alcohol poisoning. It does not include deaths due to traumatic injury such as motor vehicle accidents.

In 2015, alcohol-induced deaths claimed the lives of 160 Alaskans. Since 2006, the crude death rate for alcohol-induced deaths has increased 3.8%. During this same time period, the age-adjusted rate has decreased by 3.3%.

There were 3,740 years of potential life lost due to alcohol-induced deaths, with 23.4 years lost prematurely for each death, on average (ADHSS, 2015b).

The number of alcohol-related fatal crashes in 2016 increased by 4% from 2015 (Alaska Department of Transportation and Public Facilities [ADOT&PF], 2017), (see Section 5.1.3.4, Traffic Accidents and Injuries, or Resource Report No. 5).

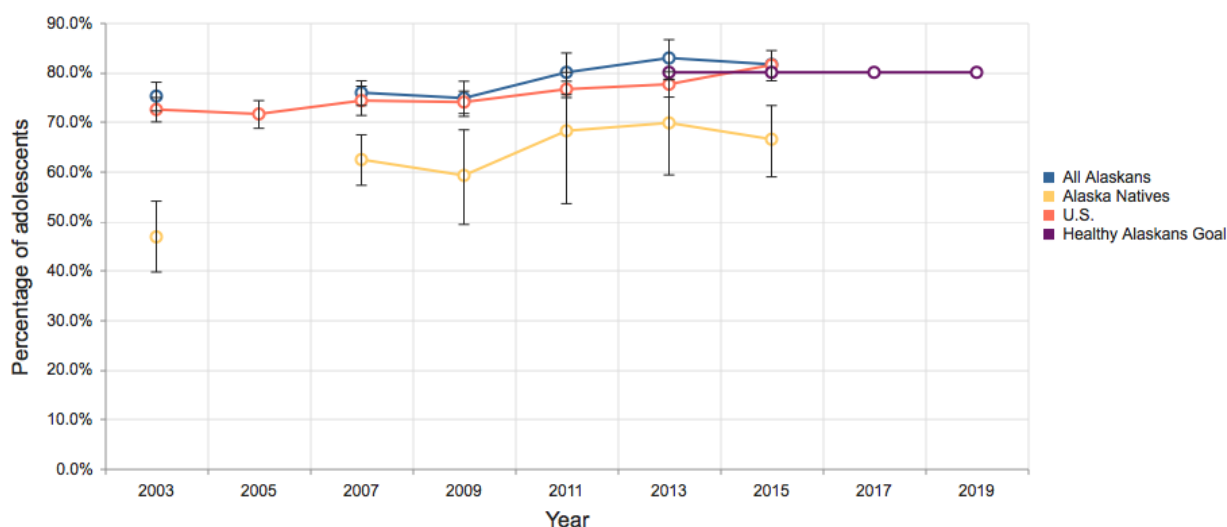
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3.1.1.5.6. Tobacco Use

Tobacco use is the leading cause of preventable disease and death in the U.S. (CDC, 2007). According to the Office of the Surgeon General, there is no safe level of exposure to tobacco smoke. Smoking has been directly linked to one-third of all cancer deaths each year and is the cause of 85% of all lung cancers in the U.S. In addition, smoking increases the risk of adverse pregnancy outcomes, such as miscarriage and low birth weight, and can lead to DNA damage in sperm that might reduce fertility (USDHHS, 2010). Furthermore, there is no risk-free level of exposure to secondhand smoke; even brief exposure can be damaging to health.

In 2015, the percentage of adolescents who reported not smoking or using tobacco products within the past 30 days was lower among adolescent Alaska Natives in grades 9-12 (66.5%) as compared to all Alaskan adolescents statewide (81.6%) and adolescents nationally (81.5%) (Figure 9).

Figure 9. Percent of Adolescents (grades 9-12) Who Have Not Smoked Cigarettes, Cigars, or Used, Chewing Tobacco, Snuff, or Dip on One or More of the Past 30 Days, All Alaskans, Alaska Natives, and U.S. (2003-2019)



Source: AK-IBIS, 2016

The Alaska BRFSS program collects data regarding use of tobacco products and environmental exposure to tobacco smoke among Alaska adults. Table 12 shows the age-adjusted prevalence of residents who reported to be current smokers or users of smokeless tobacco products, and the age-adjusted prevalence of residents who had said that they themselves or someone else had, smoked inside of the home within the past 30 days. The NSB had both the highest prevalence of smoking and use of smokeless tobacco products and smoking inside of the home, among all Alaskans residing in potentially affected regions (48.3% and 19.3%, respectively). The NSB also had the highest rates among Alaska Native residents; however, the prevalence of smoking in the home was slightly higher among Alaska Native residents living in the MSB (23.4% as compared to 24.2%). The Municipality of Anchorage had the lowest prevalence of smokers and users of smokeless tobacco products, while the Yukon-Koyukuk Census Area had the lowest prevalence of people reporting exposure to tobacco smoke within the home within the past 30 days.

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Table 12. Tobacco Use and Environmental Exposure to Tobacco Smoke, Potentially Affected Area, all Alaskans and Alaska Natives (2011-2013)

Census Area	Percentage of Residents who are Current Smokers or Smokeless Tobacco Users		Percentage of Residents Reporting Exposure to Smoking Inside the Home-Past 30 days	
	Age-adjusted Prevalence / All Alaskans	Age-adjusted Prevalence / Alaska Natives	Age-adjusted Prevalence / All Alaskans	Age-adjusted Prevalence / Alaska Natives
North Slope Borough	48.3%	56.6%	19.3%	23.4%
Yukon-Koyukuk Census Area	46.4%	54.1%	6.5%	5.2%
Fairbanks North Star Borough	24.4%	38.0%	10.8%	13.2%
Denali Borough	33.8%	**	16.0%	**
Matanuska-Susitna Borough	26.0%	42.9%	12.1%	24.2%
Kenai Peninsula Borough	25.8%	53.7%	11.7%	19.9%
Municipality of Anchorage	21.5%	33.4%	8.6%	12.6%
Southeast Fairbanks Census Area	24.0%	**	12.6%	**
Hoonah-Angoon Census Area	32.1%	**	7.5%	**
Valdez-Cordova Census Area	24.4%	31.1%	14.6%	**
Source: BRFSS, 2016				

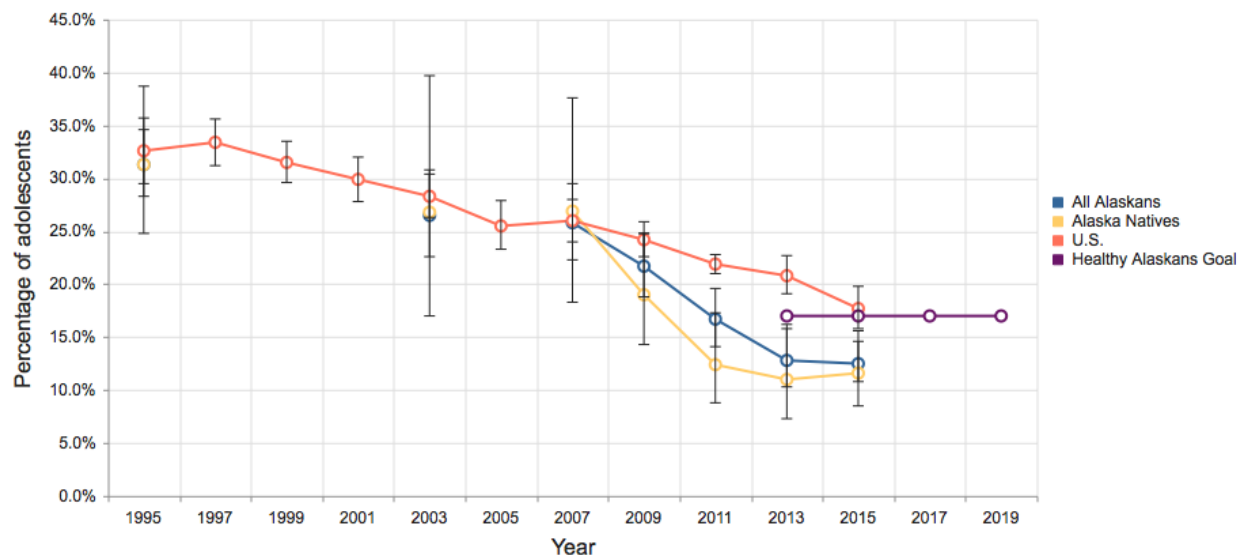
3.1.1.5.7. Alcohol Use

Alaska experiences a disparately high rate of alcohol-induced mortality compared to the U.S. Alcohol and other drug use is common among adolescents and is a strong predictor of dependence in later life. In 2013, the rate of alcohol induced mortality among all Alaskans statewide was 16.4 per 100,000 population as compared to 52.8 per 100,000 populations among Alaska Natives statewide and 8.2 per 100,000 population, nationally (AK-IBIS, 2016).

Binge drinking is defined as having five or more drinks on one or more occasion in the past 30 days for men, and more than four drinks for women. Figure 10 shows a decrease in the rate of binge drinking among adolescents since 1995. In 2015, the rate of binge drinking among all Alaskans (12.5%) was higher than that among Alaska Natives statewide (11.6%).

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Figure 10. Percentage of Adolescents (Students in Grades 9-12) Who Reported Binge Drinking in the Past 30 Days, all Alaskans, Alaska Natives, and the U.S. (1995-2019)



Source: AK-IBIS, 2016

The BRFSS is a source for estimating binge-drinking prevalence for Alaskan adults. The BRFSS is a telephone survey of adults ages 18 and older. Information on background and methodology of the BRFSS managed by the CDC can be found at: <http://www.cdc.gov/brfss/>. The website for the Alaska BRFSS is: <http://dhss.alaska.gov/dph/Chronic/Pages/brfss/default.aspx>.

Adult Native Hawaiian/Other Pacific Islanders had the highest rate of self-reported binge drinking within the past 30 days between 2012 and 2014 (Table 13), while Asians reported the lowest percentage of binge drinking, at less than half of most other races. Among potentially affected boroughs/census areas, adult residents of the NSB reported the lowest level of binge drinking within the past 30 days among both all residents and among Alaska Natives. The FNSB had the second lowest reported percentage, also among all residents as well as Alaska Natives. The highest percentage of adults that self-reported binge drinking within the past 30 days were Alaska Native adults residing in the Southeast Fairbanks Census Area at 50.5%. This percentage represents more than twice that reported by adults living in other potentially affected boroughs/census areas (Table 14).

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Table 13. Percentage of Adults Who Reported Binge Drinking in the Past 30 Days by Race/Ethnicity, All Alaskans, 2014-2016 (3-Year Average)

Race/Ethnicity	Percentage of Adults	Lower Limit	Upper Limit	Numerator	Denominator
Alaska Native (any mention)	11.40%	6.80%	18.30%	25	191
Asian (non-Hispanic)	18.50%	11.00%	29.40%	18	149
Black (non-Hispanic)	17.20%	7.80%	33.70%	9	51
Native Hawaiian/Other Pacific Islander (non-Hispanic)	19.10%	17.70%	20.50%	1,246	8,270
White (non-Hispanic)	26.60%	13.60%	45.50%	14	89
Multiracial/Other (non-Hisp.)	22.20%	16.00%	29.90%	57	287
Hispanic (alone or multi)	21.90%	16.90%	27.90%	85	400
Healthy Alaskans Goal	20.00%				

Source: AKIBIS

Table 14. Percentage of Adults (18+) Who Reported Binge Drinking in the Past 30 days, Potentially Affected Area, All Alaskans and Alaska Natives, 2014-2016 (3-Year Average)

Race/Ethnicity	Borough/Census Area	Percentage of Adults	Lower Limit	Upper Limit	Numerator	Denominator
All Alaskans	Anchorage Municipality	19.00%	16.80%	21.50%	347	2,269
All Alaskans	Fairbanks North Star Borough	17.70%	15.20%	20.50%	273	1,811
All Alaskans	Kenai Peninsula Borough	21.60%	18.30%	25.40%	192	1,213
All Alaskans	Matanuska-Susitna Borough	16.60%	14.30%	19.20%	255	1,808
All Alaskans	North Slope Borough	15.50%	8.30%	27.00%	14	107
All Alaskans	Skagway Municipality	**				22
All Alaskans	Southeast Fairbanks	16.20%	9.40%	26.40%	25	250
All Alaskans	Valdez-Cordova	20.80%	14.00%	29.90%	42	247
All Alaskans	Yukon-Koyukuk	30.60%	19.10%	45.10%	40	185
Alaska Native people	Anchorage Municipality	21.10%	15.00%	28.90%	38	213
Alaska Native people	Fairbanks North Star Borough	17.00%	10.80%	25.70%	30	168
Alaska Native people	Kenai Peninsula Borough	20.60%	12.70%	31.60%	17	109
Alaska Native people	Matanuska-Susitna Borough	20.40%	13.70%	29.40%	30	172
Alaska Native people	North Slope Borough	17.30%	8.10%	33.30%	9	61
Alaska Native people	Skagway Municipality	**				1
Alaska Native people	Southeast Fairbanks	**				28
Alaska Native people	Valdez-Cordova	**				31
Alaska Native people	Yukon-Koyukuk	37.60%	22.20%	56.00%	30	104

Source: AK-IBIS, 2018
 ** Data statistically unreliable

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3.1.1.5.8. Other Drug Use

Drug-induced deaths include all deaths for which drugs are the underlying cause, including those attributable to acute poisoning by drugs (drug overdoses) and deaths from medical conditions resulting from chronic drug use (e.g., drug-induced Cushing's syndrome). A drug includes illicit or street drugs (e.g., heroin and cocaine), as well as legal prescription and over-the-counter drugs; alcohol is not included (CDC, 2005). In 2013, the drug-induced mortality rate among Alaskans statewide was 14.2 per 100,000 population, lower than the national rate of 16.4 per 100,000 population (AK-IBIS, 2016).

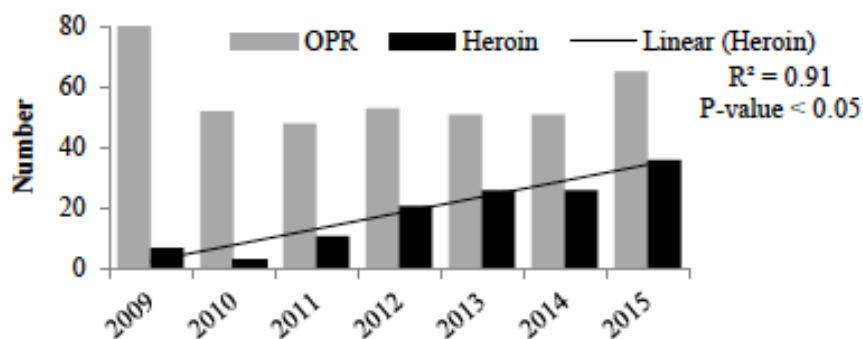
Marijuana is the most commonly used illicit drug in the U.S. (NIH, 2016). Marijuana use alters perceptions and mood, disrupts learning and memory, and causes thinking and problem-solving difficulties. In 2015, 19.0% of all Alaskan in grades 9-12 had reported using marijuana within the past 30 days, as compared to 26.1% of Alaska Natives statewide and 21.7% of all adolescents in grades 9-12 nationally (AK-IBIS, 2016). In Alaska, marijuana was the primary drug of abuse among about one-third of adolescents (ages 12-17) entering treatment in 2013 and 2014 (AK-IBIS, 2016).

Prescription drugs are the third most commonly abused category of drugs, behind alcohol and marijuana. Some prescription drugs can become addictive, especially when used in a manner inconsistent with their labeling by someone other than the patient for whom they were prescribed, or when taken in a manner or dosage other than prescribed (National Council on Alcoholism and Drug Dependence, 2015). In 2015, 6.4% of all Alaskan adolescents in grades 9-12 reported taking a prescription drug without a prescription in the past 30 days (AK-IBIS, 2016). This was a higher percentage than the percentage of Alaska Native adolescents statewide (4.1%).

3.1.1.5.8.1. Heroin and Opioid Pain Reliever Use

In 2012, Alaska's prescription opioid pain reliever (OPR) overdose rate was more than twice the U.S. rate (10.5 versus 5.1 per 100,000 population, respectively). Alaska's heroin-associated overdose death rate exceeded that of the U.S. by more than 50% (3.0 versus 1.9 per 100,000 population, respectively). Between 2009 and 2015, there were 774 drug overdose deaths reported in the Alaska mortality database (ADHSS, 2016). Prescription drugs were noted as a primary or contributing cause in 66% of these deaths. While the rate of OPR-associated deaths have remained relatively stable since 2010, the number of heroin-associated overdose deaths increased more than 10-fold from <5 deaths in 2010 to 34 deaths in 2015 (Figure 11).

Figure 11. Overdose Deaths Associated with OPR or Heroin - Alaska, 2009–2015



Source: ADHSS, Section of Epidemiology (SOE), 2016

According to studies conducted by the ADHSS, there were a total of 51 hospital admissions and 201 outpatient evaluations linked to heroin poisoning between 2008 and 2012 (ADHSS SOE, 2015). The rate of inpatient hospital discharges coded for heroin poisoning nearly doubled from 2.4 per 10,000 population in 2008 to 4.7 per 10,000 population in 2012. Between 2008 and 2013, the number of heroin-associated deaths more than tripled; 72 persons died with heroin use as the primary or contributing cause of death. Between 2009 and 2013, heroin-related admissions to publicly-funded substance use treatment centers nearly doubled, and the majority of patients admitted for heroin use treatment were aged 21–29 years. The number of treatment admissions for all patients reporting heroin as their primary substance of choice increased by 58%; and the number of treatment admissions for patients aged 21–29 reporting heroin as their primary substance of choice increased by 74% (ADHSS SOE, 2015).

3.1.1.6. Economic Indicators

Economic status creates a powerful context for human health and improved income is generally thought to be associated with improved community health. While there are many indicators used to assess economic status, the HIA reports median household income, employment, and the percentage of households living below poverty levels. Indicators that are important in the HIA evaluation are described below. See Section 5.3.2 of Resource Report No. 5 for economic data including employment and income, and labor force characteristics of the PACs.

3.1.1.6.1. Median Household Income

Median household income is one important measure of economic well-being and a key determinant of human health. Median means that half of the households have higher income and half of the households have lower income. In Alaska, income includes all monetary sources of income including wages, the Permanent Fund Dividend, Corporation Dividends, and Public Assistance. Income does not include subsistence resources.

Section 5.1.3.2.3, Income and Unemployment Rate, of Resource Report No. 5, describes income and unemployment in detail. As shown in Table 5.3.2-4 (Income and Labor Force Characteristics in the Socioeconomic Study Area, per capita income was highest in NSB at \$46,457 and lowest in the Yukon-

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Koyukuk Census Area between 2009 and 2013. Rural communities often lack significant job opportunities and endure a high cost of living, while more populous and urbanized areas tend to offer more job opportunities and higher wages. The high per capita income in the NSB is influenced by the high paying jobs in the oil and gas industry.

The per capita income in KPB was \$31, 625 between 2009 and 2013, slightly below the statewide per capita income of \$32,651. Of Kenai communities, Moose Pass had the highest per capita income at \$36,927. The per capita income in Nikiski was \$32,337 with an unemployment rate of 6.0%, similar to the statewide unemployment rate (6.5%). Dot Lake ANVSA had the highest unemployment rate of 57%.

3.1.1.6.2. Employment

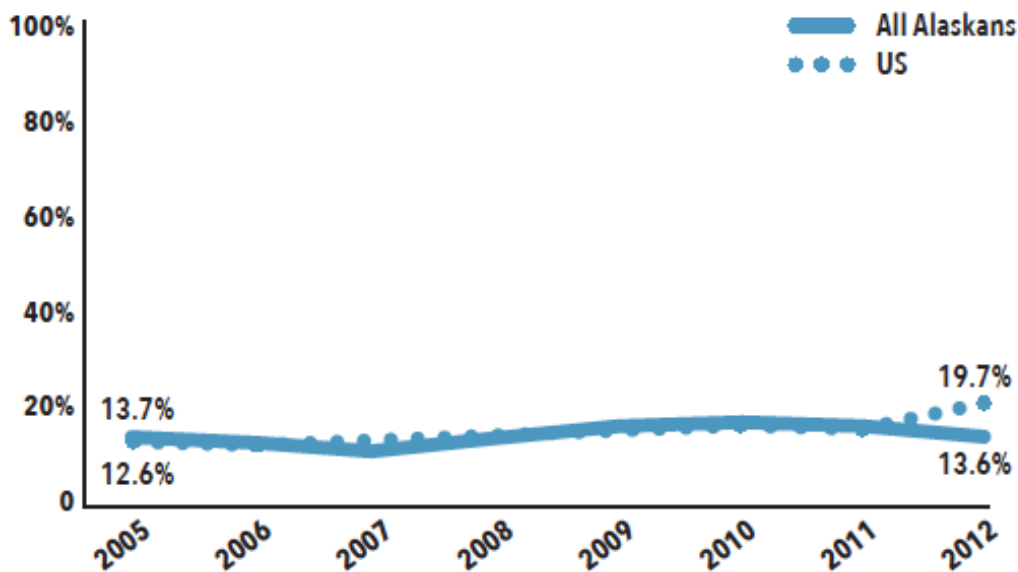
Employment is another key demographic factor that influences health. According to U.S. Department of Labor, unemployment includes anyone who has made an active attempt to find work in the 4-week period up to and including the week that includes the 12th of the referenced month. Due to the scarcity of employment opportunities in rural Alaska, many individuals do not meet the official definition of unemployed because they are not conducting active job searches.

3.1.1.6.3. Percentage of Households Living Below Poverty Line

Poverty, which takes into account household income level as well as household size is a powerful determinant of human health. The U.S. Census Bureau defines poverty in a complex way that does not take into account the higher cost of living in Alaska. The ADHSS adjusts poverty guidelines for entitlement programs, such as women, infants and children, and temporary assistance for needy families for local factors. Due to the higher cost of living in Alaska compared to the U.S. overall, poverty status for Alaska is defined as 125% of the federal poverty threshold. The Alaska rate shows more variability than the U.S. rate over the past 8 years; however, in 2012, the percentages of Alaskans and U.S. residents who met this definition of being in poverty were similar (Figure 12).

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Figure 12. Percentage of Persons Living Below the Federal Poverty Level, All Alaskans and the U.S. (2005-2012)



Source: HA2020, 2014

Table 5.3.2-16 (Average Poverty Rate in the Socioeconomic Study Area) of Resource Report No. 5, shows the poverty rate in the PACs and the state as a whole according to data from the U.S. Census Bureau. In general, the poverty rate is higher in Alaska's rural areas than in urbanized areas. Among the PACs, the poverty rates for the Yukon-Koyukuk Census Area, NSB, and Southeast Fairbanks Census Area in 2013 were higher than that of the state as a whole. The state's most populous areas, including the Municipality of Anchorage, FNSB, MSB, and KPB, tend to have less poverty (Shanks, 2012). In general, boroughs and census areas with high unemployment rates and/or with larger Alaska Native populations have high poverty rates.

3.1.1.6.4. Educational Attainment

Table 5.3.4-1 (Characteristics of School Districts in the Area of Interest, FY2015) of Resource Report No. 5, identifies the number of schools in communities within the PACs, as well as the grade levels and student enrollment at those schools in terms of average daily membership (ADM). ADM is the average number of students enrolled to attend a specific school district on any given school day. As noted in Resource Report No. 5, the aggregate school facility capacity was not exceeded in any school district; however, enrollment may be above capacity at some schools within a district.

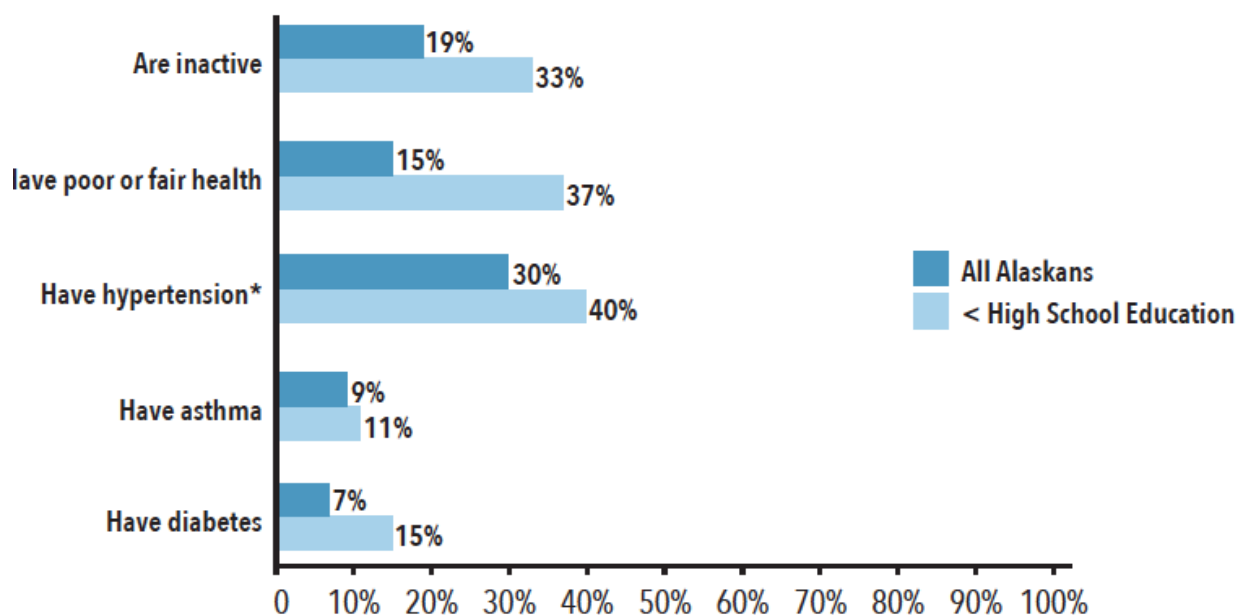
The level of educational attainment in a household can influence health. Internationally, the highest level of household educational attainment positively correlates with improved overall family health status. In addition, household head educational attainment levels also predict challenges or opportunities that will occur in regards to local hiring programs. Selected risk factor prevalence is higher for people with less than a high school education compared to the total Alaska population (HA2020, 2014). Alaskans who have

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not completed high school report higher rates of inactivity, poor or fair self-rated health status, and have higher prevalence of hypertension, asthma, and diabetes (Figure 13).

The percentage of residents over the age of 25 who have achieved high school graduation or higher and received a bachelor's degree or higher are presented in Table 15, in addition to high school dropout rates for potentially affected school districts for the 2016-2017 calendar school year. Skagway Municipality had the highest percentage of residents with a high school diploma or higher and a bachelor's degree or higher and Skagway district had the lowest high school dropout rate at 0.00%. Among census areas and boroughs, FNSB had the highest level of educational attainment for both indicators. Nenana City had the highest high school dropout rate at 24.93% and the lowest percent of residents with a high school education or higher and the lowest percentage of residents who had obtained a bachelor's degree or higher (Table 15).

Figure 13. Prevalence of Selected Risk Factors, by Education Level (2012)*



*Except 2011, where noted

Source: HA2020, 2014

Table 15. Education Indicators among Potentially Affected Communities (2012-2016)

Borough/School District	Educational Attainment of Population 25 Years and Over		
	High School Graduate or Higher (%)	Bachelor's Degree or Higher (%)	High School Drop-out Rate 2016-2017 (%)
North Slope Borough	37.8%	9.7%	-
North Slope Borough School District	-	-	9.55%
Yukon-Koyukuk Census Area	39.9%	7.7%	-
Yukon-Koyukuk School District	-	-	6.01%
Fairbanks North Star Borough	22.2%	20.7%	-

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Borough/School District	Educational Attainment of Population 25 Years and Over		
	High School Graduate or Higher (%)	Bachelor's Degree or Higher (%)	High School Drop-out Rate 2016-2017 (%)
Fairbanks North Star Borough School District	-	-	3.66%
Denali Borough	23.4%	29.9%	-
Denali Borough School District	-	-	2.06%
Nenana City School District	-	-	20.73%
Matanuska-Susitna Borough	31.8%	13.7%	-
Matanuska-Susitna Borough School District	-	-	1.91%
Kenai Peninsula Borough	32.2%	14.7%	-
Kenai Peninsula Borough School District	-	-	1.69%
Municipality of Anchorage	24.0%	21.7%	-
Anchorage School District	-	-	3.31%
Southeast Fairbanks Census Area	33.4%	11.1%	-
Alaska Gateway School District	-	-	5.06%
Delta-Greely School District	-	-	1.42%
Skagway Municipality	24.9%	26.9%	-
Skagway School District	-	-	2.44%
Valdez-Cordova Census Area	27.3%	21.6%	-
Chugach School District	-	-	4.37%
Copper River School District	-	-	3.47%
Cordova City School District	-	-	2.04%
Valdez City School District	-	-	1.09%
Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates, State of Alaska Report Card, 2016-2017 School Year			

3.1.1.6.5. Family Structure

Family stability is generally considered to exist in families whose parents are healthy and earning incomes; whose members experience housing changes only infrequently; and whose family members stay together with infrequent divorce and remarriage, or few separations due to immigration and job-seeking reasons. The benefits of family stability on children are numerous. Family stability results in more effective child supervision and parental monitoring; less family conflict, and more family cohesion. Good parental monitoring, in particular, results in better child physical and mental health (Proescholdbell, 2010).

The ABVS maintains a database on divorce for the state, boroughs, and census areas. The FNSB had the highest divorce rate among both males and females, followed by the Municipality of Anchorage and MSB (Table 16). These rates were higher than the divorce rate for Alaska statewide. Yukon-Koyukuk Census Area had the lowest rate for both genders, followed by the NSB. In general, the more rural areas appear to have lower rates of divorce, as compared to urban areas.

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Table 16. Divorce Rate by Potentially Affected Communities (2013)

Census Area	Female Rate per 1,000 Population	Male Rate per 1,000 Population
North Slope Borough	2.4	1.5
Yukon-Koyukuk Census Area	1.5	1.6
Fairbanks North Star Borough	9.4	8.7
Denali Borough	6.2	4.1
Matanuska-Susitna Borough	8.8	8.1
Kenai Peninsula Borough	7.9	7.6
Municipality of Anchorage	8.8	8.3
Southeast Fairbanks Census Area	4.1	3.6
Skagway-Hoonah-Angoon Census Area	4.0	3.6
Valdez-Cordova Census Area	4.7	5.8
Alaska Statewide	7.9	7.3

Source: ABVS, 2016

Table 17. Household Characteristics by Potentially Affected Community and Statewide, 2016 ACS

Location	Number of Households	Average Household Size	Percent of Family Households	Female Headed Households (Percent of Family Households)	Married-Couple Family Household with own Children Present <18
North Slope Borough	2,018	3.25	75.1%	29.6%	31.3%
Prudhoe Bay	0	0.00	-	-	-
Yukon-Koyukuk Census Area	1,981	2.75	64.0%	26.8%	21.1%
Bettles	5	1.6	20.0%	0.0%	0.0%
Coldfoot	0	0	-	-	-
Evansville	8	1.38	25%	0.0%	0%
Livengood	0	0	-	-	-
Manley Hot Springs	38	2.16	71.0	0.00%	0.0%
Minto	69	3.09	59.4%	31.7%	29.3%
Nenana	144	2.59	61.8%	20.2%	9.0%
Wiseman	4	3.0	100%	0%	100%
Fairbanks North Star Borough	35,303	2.72	63.1%	12.9%	35.6%
Fairbanks City	10,965	2.75	62%	20%	35.4%
Denali Borough	707	2.29	55.2%	7.4%	39.7%
Anderson	64	2.05	69%	2%	25.0%
Cantwell	95	2.15	53%	12%	28.0%
Healy	428	2.61	64%	8%	47.4%
Denali Park	105	1.4	17%	0%	0.0%
Matanuska-Susitna Borough	30,839	3.14	71.0%	11.5%	36.0%
Big Lake	1,252	2.84	69%	14%	26.0%
Houston	690	2.93	66%	12%	30.9%
Knik-Fairview	5,051	3.37	73%	11%	37.4%
Palmer	2,063	3.01	63.8%	22.3%	36.9%

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Location	Number of Households	Average Household Size	Percent of Family Households	Female Headed Households (Percent of Family Households)	Married-Couple Family Household with own Children Present <18
Point MacKenzie	94	1.99	45.7%	0.0%	23.3%
Skwentna	25	2.04	68.0%	0.0%	29.4%
Talkeetna	344	2.42	52.3%	5.0%	29.4%
Trapper Creek	180	1.94	42.8%	24.7%	13.0%
Wasilla	2,970	2.99	65.5%	22.1%	31.8%
Willow	715	2.9	64.1%	5.2%	26.9%
Kenai Peninsula Borough	21,481	2.6	63.8%	12.6%	29.1%
Anchor Point	821	2.46	58%	6%	27.7%
Beluga	5	-	0%	-	-
Clam Gulch	89	2.22	48%	0%	34.9%
Cohoe	568	2.3	63%	13%	21.5%
Cooper Landing	182	2.68	83%	3%	37.1%
Happy Valley	269	2.36	65%	16%	24.7%
Homer	2,149	2.46	61%	17%	26.4%
Kalifornsky	2,895	2.75	71%	7%	37.1%
Kasilof	133	3.06	63%	6%	27.4%
Kenai	3,085	2.43	56%	20%	29.8%
Moose Pass	138	2.57	89.1%	27.6%	10.6%
Nikiski	1,770	2.83	63.6%	6.7%	32.4%
Ninilchik	359	2.13	55.2%	11.6%	13.1%
Salamatof	241	2.73	69.7%	14.9%	19.0%
Seward	838	2.49	55.8%	15.6%	27.8%
Soldotna	1,696	2.59	64.4%	26.3%	23.7%
Sterling	2,051	2.75	69.2%	6.8%	28.3%
Tyonek	79	3.71	72.2%	49.1%	12.3%
Municipality of Anchorage	104,969	2.77	66.6%	18.2%	32.9%
Southeast Fairbanks Census Area	2,085	3.15	68.7%	12.8%	32.2%
Big Delta	176	3.28	66%	0%	35.0%
Delta Junction	290	3.62	67%	8%	48.2%
Dot Lake Village	0	-	-	-	-
Dry Creek	33	2.76	45%	0%	33.3%
Tanacross	57	2.88	38.6%	18.2%	13.6%
Tok	482	2.56	69.9%	20.8%	23.7%
Tetlin	29	4	48.3%	21.4%	7.1%
Northway Junction	18	3.11	61.1%	18.2%	18.2%
Northway Village	28	3.5	53.6%	20.0%	6.7%
Alcan Border	7	5	100%	0%	100.0%
Municipality of Skagway Borough	428	2.07	46.3%	12.1%	24.7%
Valdez-Cordova Census Area	2,937	3.14	67.2%	12.6%	26.2%
Chistochina	16	4.31	69%	64%	0.0%

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Location	Number of Households	Average Household Size	Percent of Family Households	Female Headed Households (Percent of Family Households)	Married-Couple Family Household with own Children Present <18
Copper Center	91	3.54	49%	29%	35.6%
Gakona	45	3.69	78%	26%	25.7%
Glennallen	77	2.27	83%	0%	18.8%
Gulkana	25	2.96	64%	38%	31.3%
Mentasta Lake	45	4.02	66.7%	46.7%	16.7%
Paxson	9	-	0.0%	-	-
Slana	0	-	-	-	-
Tazlina	93	3.46	66.7%	37.1%	8.1%
Tonsina	14	-	0.0%	-	-
Valdez	1,154	3.24	64.4%	17.8%	23.8%
Whittier	119	2.67	42.9%	2.0%	33.3%
Other					
Adak	36	3.39	58%	33%	9.5%
Nome Census Area	2,879	3.3	76.0%	26.1%	29.5%
Unalaska	938	3.59	58.5%	10.7%	45.0%
Alaska Statewide	250,235	2.86	65.9%	18.5%	29.7%
Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates					

3.1.1.6.6. Dependency Factors

Dependency ratio, a measure of the portion of a population that is composed of dependents (people who are too young or too old to work and need support or care) to those of working, age is a measure of the need for social services. This ratio, in part, determines the amount of services needed in a community and the economic workforce available to fund them. It is also a factor in economic growth and stability. The dependency ratio is equal to the number of individuals aged below 15 or above 64 divided by the number of individuals aged 15 to 64, expressed as a percentage. An increase in this ratio can indicate an increased burden on the productive part of the population in terms of maintaining the upbringing and pensions of the economically dependent proportion of the population.

Population age structure is discussed in detail in Resource Report No. 5, Section 5.3.1.2. Both the KPB and Yukon-Koyukuk Census Area have larger proportions of people aged 65 or older compared to the state as a whole (Table 18). The KPB maintains a high retiree population (Shanks and Rasmussen 2010), while the out-migration of working-age adults likely accounts for the high percentage of seniors in the Yukon-Koyukuk Census Area (Shanks, 2013).

Denali Park, Point MacKenzie, Chistochina, and Bettles had the lowest dependency ratio (excluding Prudhoe/Deadhorse) at 9.1%, while the highest occurred in Manley Hot Springs (121.6%), Alcan Border (125.0%), and Beluga (150.0%); these are more than twice, and in the case of Beluga, more than three times, the statewide dependency ratio of 45.1%.

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Table 18. Age Characteristics of Potentially Affected Communities and Alaska Statewide (2012-2016)

Location	Median Age	Percent Ages 15-64	Percent Under 16 and Over 65	Dependency Ratio
Alaska	33.6	69.3	30.7	53.5
North Slope Borough	33.8	73.7	26.3	43.4
Prudhoe Bay/Deadhorse	49	95.9	4.1	4.2
Yukon-Koyukuk Census Area	35.2	63.3	36.7	70.6
Bettles	37.9	86.2	13.8	16.1
Coldfoot	35.5	100	0	-
Evansville	58.3	54.6	45.4	83.3
Evansville ANVSA	51.4	78.7	21.3	27.0
Livengood	-	-	-	-
Manley Hot Springs	57.5	45.1	54.9	121.6
Minto	27.2	65.3	34.7	63.8
Nenana	48.3	64.6	35.4	73.5
Wiseman	41.3	58.3	41.7	71.4
Fairbanks North Star Borough	30.7	71.2	28.8	47.8
Fairbanks	27.7	70.1	29.9	47.1
Denali Borough	37.3	77.6	22.4	33.7
Anderson	44.7	72	28	38.8
Cantwell	45.8	64.9	35.1	56.9
Healy	40.4	71.9	28.1	49.5
Denali Park	31.6	93.9	6.1	6.5
Matanuska-Susitna Borough	34.8	67.7	32.3	58.7
Big Lake	39.6	64.8	35.2	66.2
Houston	36.7	65.9	34.1	60.4
Knik-Fairview	33.5	68.1	31.9	56.1
Palmer	30.4	67.4	32.6	59.3
Point MacKenzie	41.8	92.7	7.3	11.5
Skwentna	54.6	48.9	51.1	104
Talkeetna	38.3	71.8	28.2	56.3
Trapper Creek	49.6	62.8	37.2	62.3
Wasilla	33.9	65	35	64.3
Willow	41.6	70.3	29.7	53.1
Kenai Peninsula Borough	40.5	66.9	33.1	59.0
Anchor Point	47.5	63.8	36.2	65.7
Beluga	68.2	40	60	150.0
Clam Gulch	50.9	59.1	40.9	94.1
Cohoe	49.9	69.8	30.2	50.1
Cooper Landing	37.2	53.7	46.3	93.3
Happy Valley	46.5	65.3	34.7	65.2
Homer	40.4	65.5	34.5	63.6
Kalifornsky	32.8	65.5	34.5	64.1

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Location	Median Age	Percent Ages 15-64	Percent Under 16 and Over 65	Dependency Ratio
Kasilof	44.1	62	38	79.3
Kenai	37	66	34	61.4
Moose Pass	46.1	65.8	34.2	51.9
Nikiski	44.2	68.3	31.7	60.3
Ninilchik	57.7	60.8	39.2	70.2
Ninilchik ANVSA	43.7	66.2	33.8	60.8
Salamatof	40.7	79.1	20.9	31.1
Seward	38.7	75.9	24.1	36.2
Soldotna	36.4	67.4	32.6	55.6
Sterling	47	65.1	34.9	67.8
Tyonek	31.3	73.3	26.7	48.7
Municipality of Anchorage	32.8	70	30	51.4
Eklutna ANVSA	52.8	66.8	33.2	60.0
Southeast Fairbanks Census Area	36.4	65.9	34.1	62.1
Big Delta	28.7	66.7	33.3	57.2
Delta Junction	31.3	65.6	34.4	60.3
Dot Lake	-	-	-	-
Dot Lake ANVSA	43.3	81.5	18.5	44.4
Dry Creek	53.3	66	34	51.7
Tanacross	41.5	65.8	34.2	56.2
Tok	41.2	64.7	35.3	69.0
Tetlin	29.2	67.2	32.8	50.6
Tetlin ANVSA	29.2	67.2	32.8	50.6
Northway Junction	30.4	67.9	32.1	75
Northway	27.4	67.8	32.2	50.5
Northway ANVSA	29.3	63.3	36.7	64.7
Alcan Border	16.6	58.3	41.7	125
Municipality of Skagway Borough	44.1	79.5	20.5	29.5
Valdez-Cordova Census Area	37.6	68.9	31.1	52.2
Chistochina	46.6	86.8	13.2	15.0
Copper Center	33.9	73.3	26.7	42.6
Copper Center ANVSA	32.3	66.5	33.5	56.0
Gakona	23.7	51	49	102.4
Gakona ANVSA	25.1	58.2	41.8	80.0
Glennallen	24.5	72.4	27.6	41.2
Gulkana	36.5	59.5	40.5	68.2
Gulkana ANVSA	30.5	49.6	50.4	101.6
Mentasta Lake	32.5	66.8	33.2	49.6
Mentasta Lake ANVSA	32.5	66.8	33.2	49.6
Paxson	-	0	100	-
Slana	-	-	-	-

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Location	Median Age	Percent Ages 15-64	Percent Under 16 and Over 65	Dependency Ratio
Tazlina	31.8	77.7	22.3	30.9
Tazlina ANVSA	30.5	76	24	35.2
Tonsina	-	0	100	-
Valdez	34.2	71.6	28.4	47.4
Whittier	40.5	63.6	36.4	70.1
Adak	29.9	59.8	40.2	71.8
Nome	30.8	68.1	31.9	61.0
Nome ANVSA	31.1	66.6	33.4	61.3
Unalaska	37.5	81.7	18.3	26.2

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

An '-' entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.

3.1.1.6.7. Cultural Indicators

Cultural factors are also important determinants of health in that people who are involved with their communities and culture tend to be healthier than people who are not. Cultural continuity has been linked to numerous health outcomes including reduced rates of suicide (Chandler, 1998; Chandler, 2004). Speaking a native language and participating in subsistence activities have been highlighted by circumpolar Natives as important signifiers of community health and cultural continuity (Stevenson, 2009). In addition, in Alaska, cultural identification is closely related to the use of subsistence foods, which are not only eaten for nutrition value but for cultural practices. The Alaska Federation of Natives describes subsistence as “the hunting, fishing, and gathering activities which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today...Subsistence, being integral to our worldview and among the strongest remaining ties to our ancient cultures, is as much spiritual and cultural, as it is physical” (U.S. Department of the Interior, 2005).

Subsistence uses are central to the customs and traditions of many cultural groups in Alaska. These customs and traditions encompass sharing and distribution networks, cooperative hunting, fishing, and ceremonial activities. Participation in subsistence activities promotes transmission of traditional knowledge from generation to generation and serves to maintain people's connection to the physical and biological environment.

Table 19 displays the primary Alaska Native cultural groups present in each borough/census area. The predominant group in the NSB is Inupiat and in the Yukon-Koyukuk and Southeast Fairbanks Census Areas, Athabascan. In general, the more populous regions comprise a greater diversity of Alaska Native cultural groups. As noted in Resource Report No. 5 Socioeconomics, larger populations tend to correspond with lower proportions of Alaska Native residents. Table 5.1.3-17 of Resource Report No. 5 presents a detailed breakdown of race and ethnicity.

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Table 19 also shows the percentage of households where a language other than English was spoken at home. It should be noted that this percentage is inclusive of all languages spoken and does not reflect only Alaska Native languages spoken at home.

Table 19. Cultural Indicators by Potentially Affected Area and Statewide (2012-2016)

Location	Primary Alaska Native Cultural Group(s)	Percent Speaking a Language Other Than English at Home (2012 to 2016) (%) ^a
North Slope Borough Census Area	Inupiat	31.9
Yukon-Koyukuk Census Area	Athabaskan	15.1
Fairbanks North Star Borough	Athabaskan, Inupiat, Yup'ik, Tlingit-Haida	10.5
Denali Borough	Athabaskan	11.3
Matanuska-Susitna Borough	Athabaskan, Inupiat, Yup'ik, Tlingit-Haida, Aleut	7.1
Kenai Peninsula Borough	Athabaskan, Inupiat, Yup'ik, Tlingit-Haida, Aleut	7.6
Municipality of Anchorage	Athabaskan, Inupiat, Yup'ik, Tlingit-Haida, Aleut	17.5
Southeast Fairbanks Census Area	Athabaskan	26.0
Skagway Municipality	Tlingit-Haida	11.7
Valdez-Cordova Census Area	Athabaskan, Aleut	7.9
Alaska Statewide		16.2

^aU.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

3.2. Health Effect Category 2: Accidents and Injuries

Accidents and Injuries are an important cause of mortality and morbidity in Alaska. The term unintentional injury refers to causes of injury or death other than suicide and homicide. Fatal injury information is drawn from death certificates and the Alaska Violent Death Reporting System while non-fatal injuries are typically obtained from the Alaska Trauma Registry. Alcohol use is a powerful risk factor for accidents and injuries and so alcohol related injury events are reported. The presence of law enforcement or Village Public Safety Officers (VPSOs) also influences safety in rural communities.

3.2.1. Fatal Accidents and Injuries

3.2.1.1. Unintentional Injury and Poisoning Deaths

Unintentional injuries (including unintentional poisonings) are the third leading cause of death in Alaska. In 2015, unintentional injuries claimed the lives of 385 Alaskans. More Alaskans died due to unintentional poisoning than any other type of unintentional injury; 85 males and 49 females.

Among the leading causes of death in Alaska, unintentional injuries ranked first in total years of potential life lost with 11,151 years lost. On average, 29 years of life were lost prematurely for each unintentional injury death.

Since 2006, the crude rate for unintentional injuries has increased 12.5%. During this same time period, the age-adjusted rate has increased 9.6% (ADHSS, 2015b).

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3.2.1.2. Firearm-Related Deaths

Firearm-related mortality is a composite that includes deaths due to unintentional discharge of a firearm, and deaths due to intentional discharge (suicide or homicide.)

In 2015, firearm-related deaths claimed the lives of 176 Alaskans. Since 2006, the crude death rate for firearm-induced deaths has increased 47.5%. During this same time period, the age-adjusted rate has increased 39.6%.

There were 6,798 years of potential life lost due to firearm-related deaths, with 38.6 years lost prematurely for each death, on average (ADHSS, 2015b).

3.2.1.3. Assault (Homicide) Deaths

Assault (homicide) is the 10th leading cause of death in Alaska. In 2015, assault (homicide) claimed the lives of 62 Alaskans.

Among the leading causes of death in Alaska, assault (homicide) ranked fifth in years of potential life lost with 2,589 years lost. On average, 41.8 years of life were lost prematurely for each assault (homicide) death.

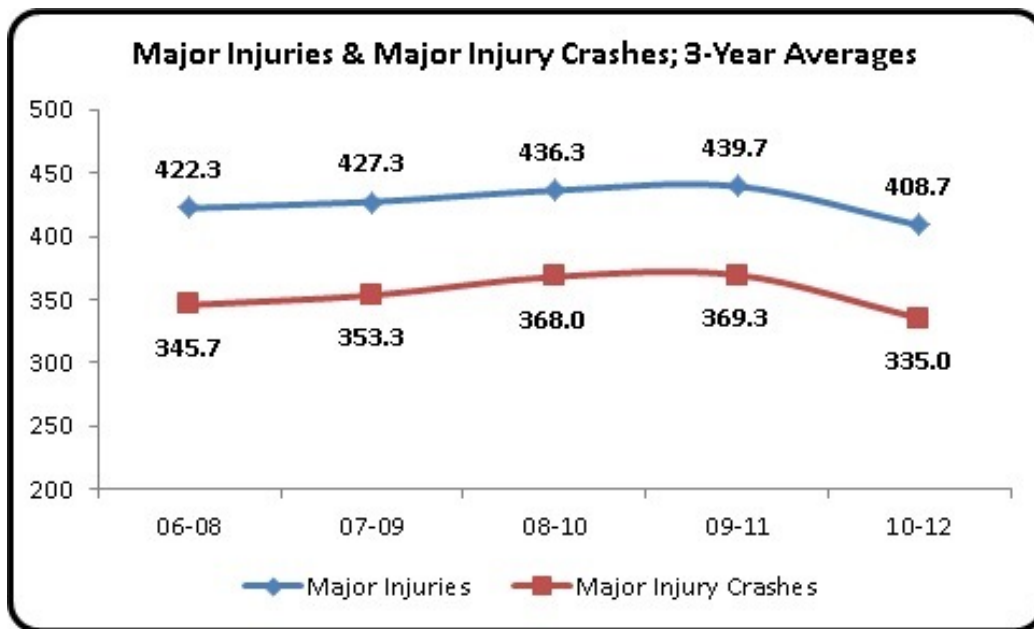
Since 2006, the overall crude death rate for assault (homicide) has increased 31.3%. During this same time period, the age-adjusted rate has increased 30.6% (ADHSS, 2015b).

3.2.1.4. Traffic Accident Fatalities

In 2016, Alaska experienced 84 fatalities in 78 crashes. These figures show a 31% increase in fatalities and a 30% increase in fatal crashes from 2015 (ADOT&PF 2017). Figures 14 and 15 shows 3-year averages of major/minor injuries and major/minor injury crashes. Figure 16 shows fatalities and fatal crashes, averaged over 3 years, between 2009 and 2015 in Alaska.

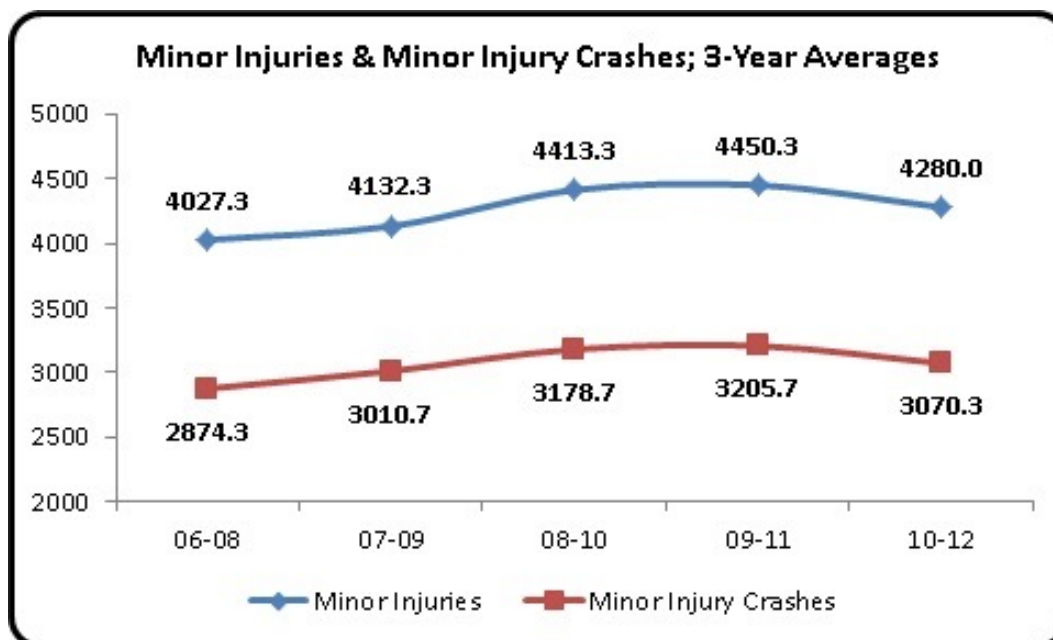
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Figure 14. Major Injuries and Major Injury Crashes; 3-Year Averages 2006 - 2012



Source: Alaska Highway Safety Office, Transportation & Public Facilities

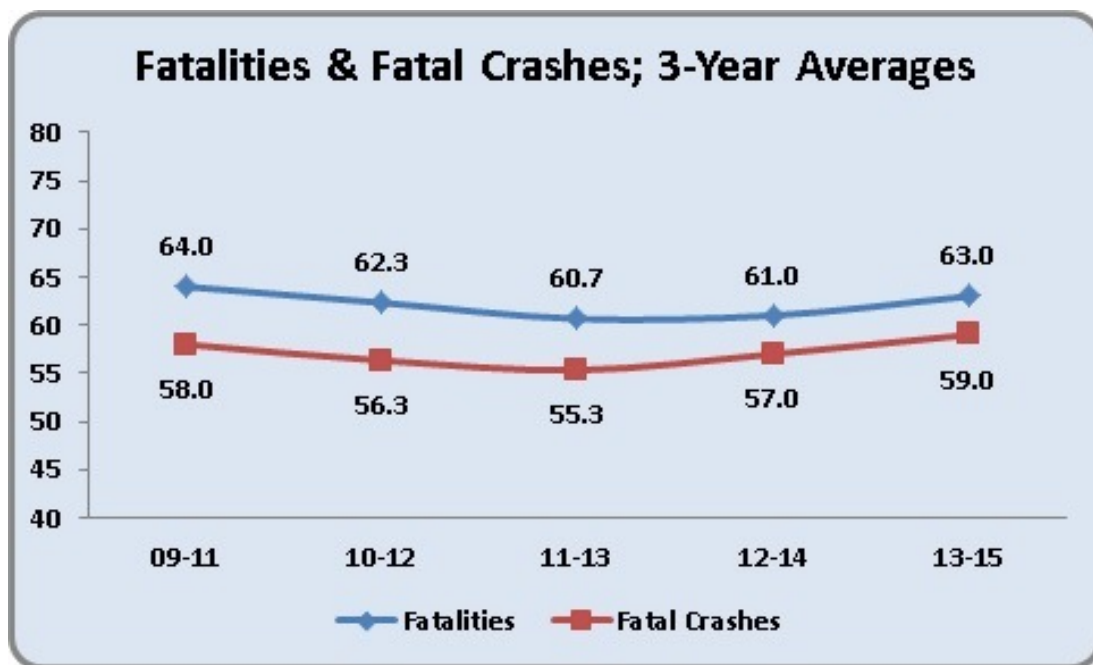
Figure 15. Minor Injuries and Minor Injury Crashes; 3-Year Averages 2006 - 2012



Source: Alaska Highway Safety Office, Transportation & Public Facilities

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Figure 16. Fatalities and Fatal Crashes; 3-Year Averages 2009 - 2015



Source: Alaska Highway Safety Office, Transportation & Public Facilities

3.2.1.5. Unintentional Injury Deaths among Alaska Natives

From 2008 to 2011, unintentional injury was the third leading cause of death among Alaska Native people, with a mortality rate of 106.9 per 100,000, and the leading cause of death people aged 25–44 years (AN EpiCenter, 2014). Despite improvements in rates over the past 30 years, Alaska Native people had an unintentional injury mortality rate 2.2 times that of Alaska non-Natives and 2.6 times that of U.S. whites from 2008 to 2011 ($p < 0.01$). Unintentional mortality rates varied widely by tribal health region, ranging from 64.2 to 153.6 deaths per 100,000 during this time period. Among the potentially affected Tribal Health Regions, the Interior had the highest unintentional injury death rate at 131.1 per 100,000 population, while the rate in the KPB was less than half of this value, at 65.0 per 100,000 (Table 20). Only Anchorage-Mat-Su had an unintentional injury death rate among Alaska Natives similar to that of the state overall. Between 2002 and 2011, poisoning was the leading cause of unintentional injury death among Alaska Natives, comprising 26.6% (Figure 17). Drowning was the second leading cause, followed by motor vehicle accidents.

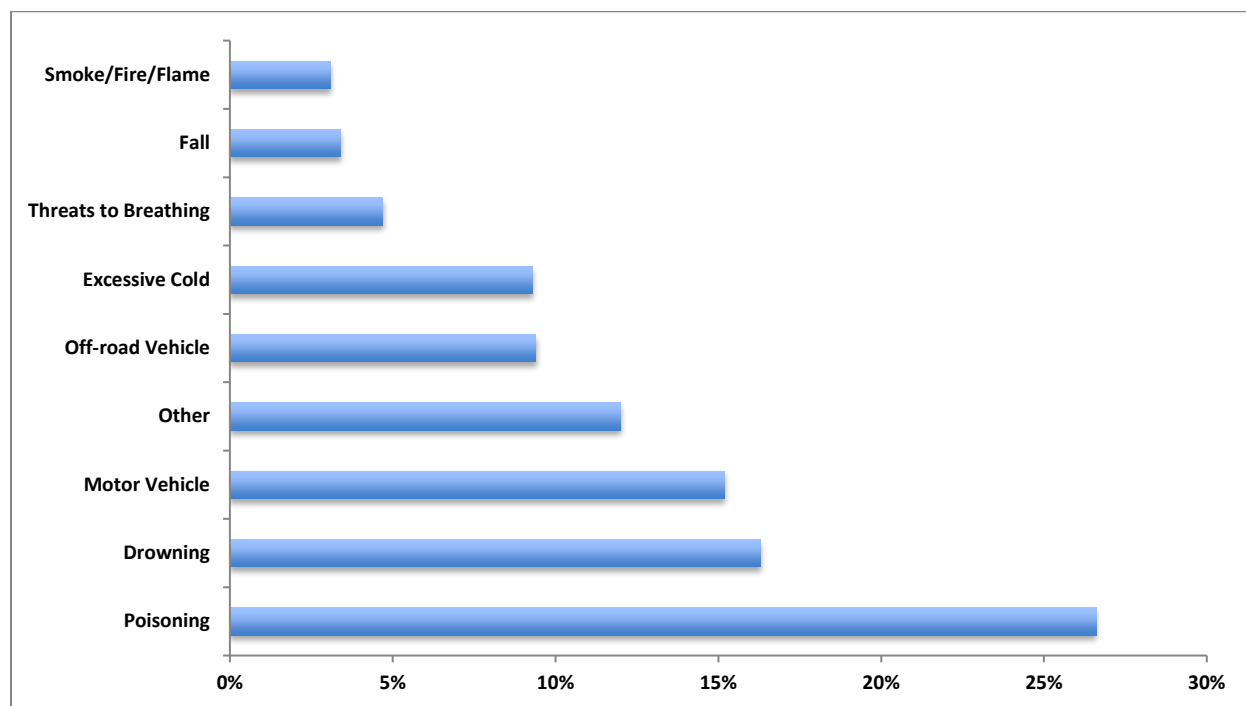
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Table 20. Average Annual Age-adjusted Unintentional Injury Death Rates per 100,000 by Potentially Affected Tribal Health Region, Alaska Natives, 2012 to 2015

Tribal Health Region	Number	Rate
Arctic Slope	14	96.4
Interior	58	131.1
Anchorage/Mat-Su	118	101.7
Copper River/Prince William Sound	6	106.1
Kenai Peninsula	10	65.0
Statewide	401	99.4

Source: AN Epicenter, 2017
Note: Rates based on fewer than 20 cases are not statistically reliable and should be used with caution. Number and rate not reported for less than five cases

Figure 17. Unintentional Injury Death by Type, Alaska Native People, All Ages (2002-2011)



Source: AN EpiCenter, 2014

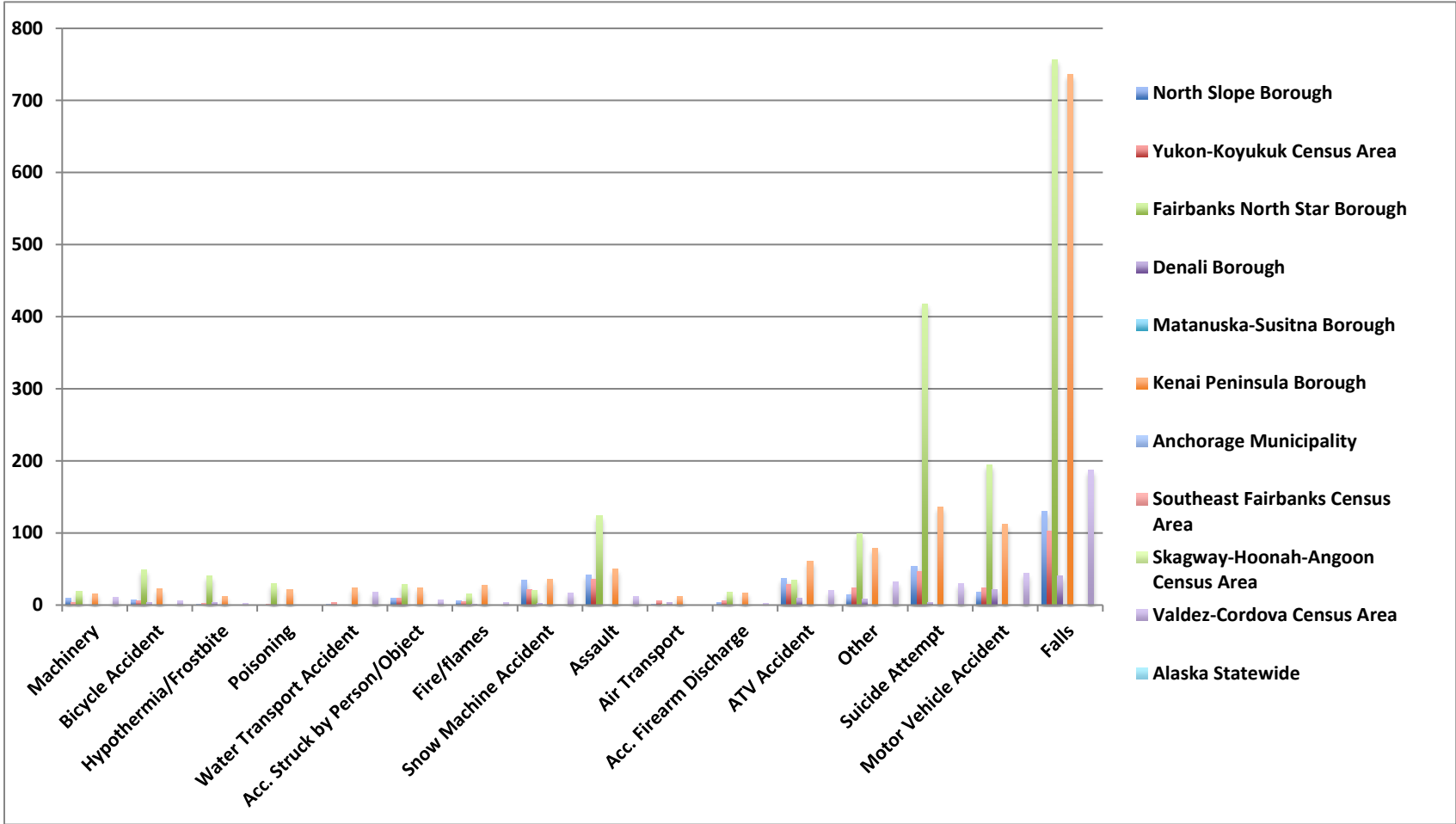
3.2.1.6. Non-fatal Injuries

Injury hospitalizations are collected in the Alaska Trauma Registry (ATR). The cases reported in the ATR include patients with injuries admitted to an Alaska hospital, held for observation, transferred to another acute care hospital, or declared dead in the emergency department. Between 2007 and 2011, falls were the leading cause of non-fatal injury among all potentially affected boroughs/census areas.

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Figure 18. Leading Causes of Non-fatal Injury by Potentially Affected Area and Alaska Statewide (2007-2011)



Source: Alaska Trauma Registry, 2015

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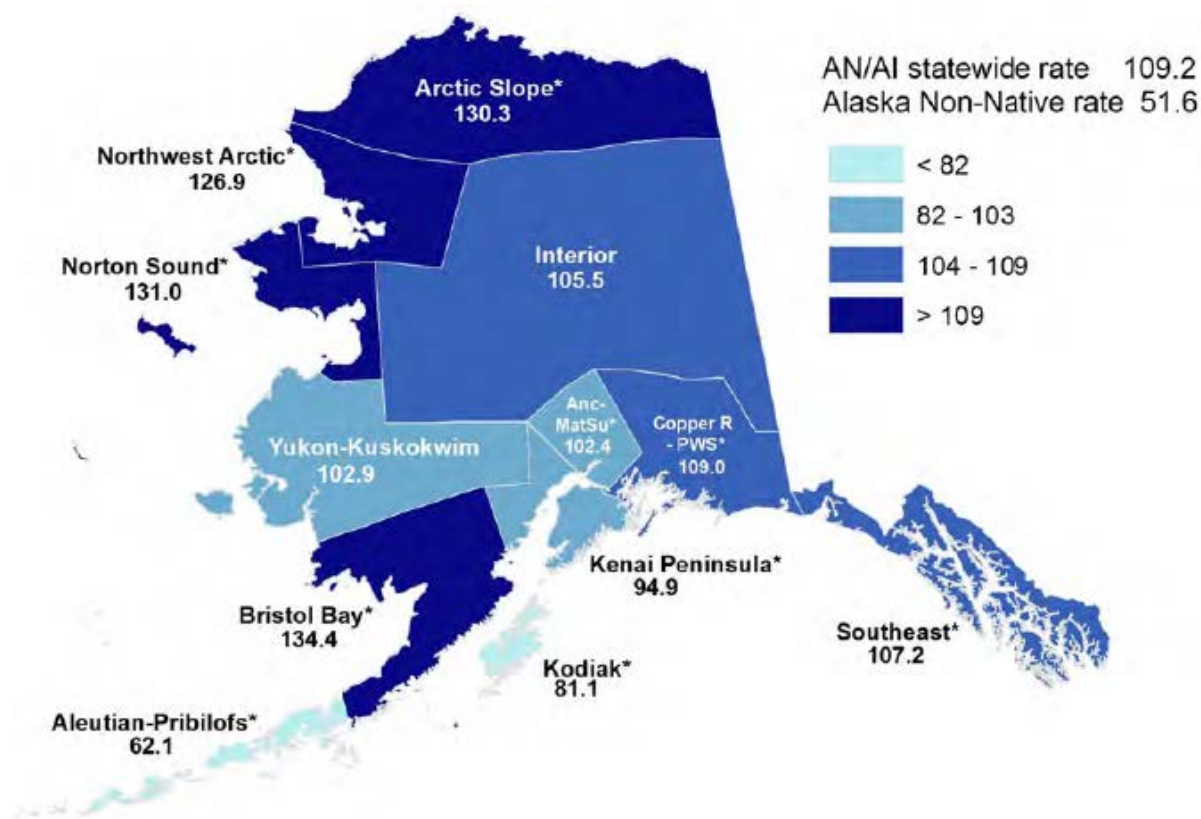
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3.2.1.7. Non-fatal Unintentional Injuries among Alaska Natives

Between 2002 and 2011, there were 10,955 hospitalizations for unintentional injuries among Alaska Native people, representing 67.9% of all injury hospitalizations (16,141). Alaska Native people were 2.1 times more likely to be hospitalized for an unintentional injury than non-Natives statewide (2002-2011, 109.2 and 51.6 per 10,000, respectively, $p < 0.05$) (Figure 19). Among potentially affected regions, Alaska Natives living in the Arctic Slope had the highest rate of non-fatal unintentional injury. Rates among the Interior, Kenai Peninsula, and Anchorage-Mat-Su were similar to the state rate of non-fatal unintentional injury hospitalization.

Similar to all races combined, falls were the leading cause non-fatal unintentional injury hospitalizations among all Alaska Natives statewide (43.9% of 10,955) (Figure 20). Between 2002 and 2011, there were 4,089 hospitalizations for fall injuries among Alaska Native people.

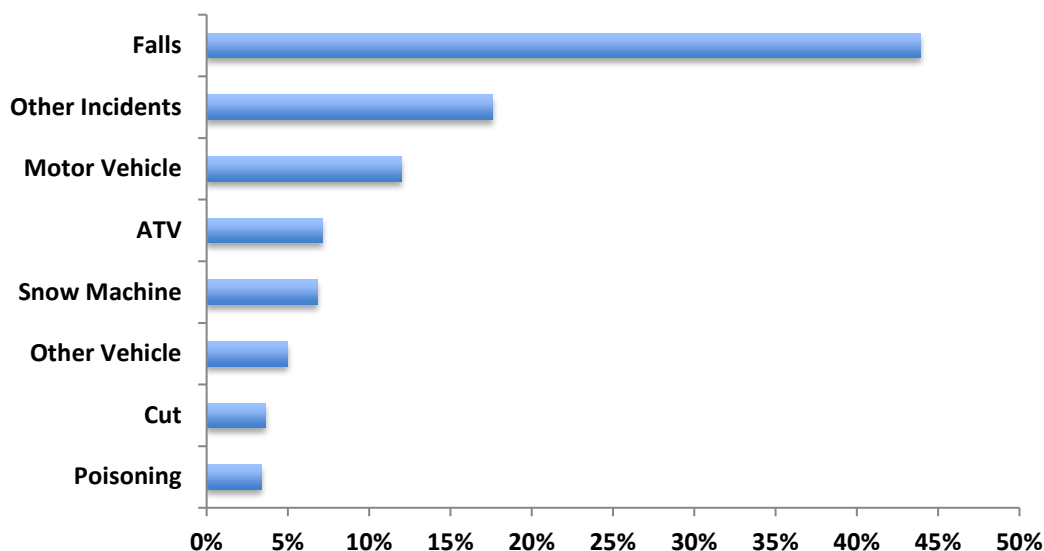
Figure 19. Unintentional Hospitalization Rates by Region, Alaska Native People, 2002-2011



Source: AN EpiCenter, 2014

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Figure 20. Unintentional Injury Hospitalization by Type, Alaska Native People, All Ages, 2002-2011



Source: AN EpiCenter, 2014

3.2.1.8. Law Enforcement

The Alaska State Troopers (AST) is a division of the Alaska Department of Public Safety with posts throughout the state. Because Alaska does not have counties, and therefore, lacks county police or sheriffs, the troopers also handle civil papers and mental health custody orders and serve as police throughout most of rural Alaska. Some cities do have local police departments; however, their staffs, with the exception of Fairbanks and Anchorage, are fairly limited.

The AST, Alaska Bureau of Highway Patrol (ABHP) has an emphasis on impaired driving enforcement and is responsible for coordinating and/or conducting traffic law enforcement on a statewide basis. The ABHP is also responsible for investigating fatal and major incapacitating injury collisions statewide and for responding to enforcement and investigative requests by other agencies. Most team members are AST. Some of the team members are officers with local police departments as well as personnel from the DOT Commercial Vehicles Enforcement section. ABHP traffic teams deploy from Fairbanks, Mat-Su West, Soldotna, and Girdwood (AST, 2016).

Table 21 provides the location of AST detachments, headquarters, and posts. Posts along the Project transportation corridor include: Fairbanks, Cantwell, Healy, Glennallen, Palmer, Mat-Su West, Wasilla, Nenana, Northway, Tok, Anchorage, Girdwood, Cooper Landing, Soldotna, Ninilchik, and Seward. A post in Talkeetna was slated to close in 2015, leaving the posts in Willow and Cantwell as the closest to the community (Hollander, 2015).

Law enforcement in most rural areas is the primary responsibility of the AST; however, local law enforcement response in Alaska Native villages is often undertaken by a VPSO. The VPSO Program was designed to train and employ individuals residing in the village as first responders to public safety

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emergencies such as search and rescue, fire protection, emergency medical assistance, crime prevention, and basic law enforcement. The VPSO position is overseen by the AST and funded by Alaska Native Corporations. The AST D Detachment serves as the primary or secondary source of law enforcement for more than 30 villages located in Interior Alaska. The Fairbanks-based Rural Service Unit supports the VPSOs in the region and responds to calls for police services and search and rescue support in Interior Alaska.

Table 21. Alaska State Troopers Detachments, Headquarters, and Posts

Detachment	Headquarters	Posts
A	Ketchikan	Haines, Juneau, Klawock, Ketchikan, Petersburg
B	Palmer	Glennallen, Palmer, Mat-Su West
C	Anchorage	Anchorage, Aniak, Bethel, Dillingham, Emmonak, Iliamna, King Salmon, Kodiak, Kotzebue, McGrath, Nome, Saint Mary's, Selawik, Unalakleet
D	Fairbanks	Barrow, Cantwell, Delta Junction, Fairbanks, Galena, Healy, Nenana, Northway, Tok
E	Soldotna	Anchor Point, Cooper Landing, Girdwood, Ninilchik, Seward, Soldotna
ABI	Anchorage	Anchorage, Bethel, Dillingham, Fairbanks, Juneau, Ketchikan, Kotzebue, Nome, Palmer, Soldotna, Wasilla

Source: Alaska Department of Public Safety, 2016

3.2.1.9. Dry/Damp/Wet Community

Alaska Native village policies have been enacted that designate a community as dry (i.e., alcohol sale and consumption prohibited), damp (i.e., sale of alcohol illegal, but possession allowed), and wet (i.e., sale and possession allowed). Approximately 11% of the total Alaska population and 52% of the Native population live in places that restrict the availability of alcohol (Figure 21). Of the PACs, Minto and Tetlin have a ban on the sale and importation of alcohol, and Tanacross and Gulkana have a ban on the sale, importation as well as possession of alcohol (Berman and Hull, 1997).

Figure 21. Alcohol Control Status by Population



Source: Berman and Hull, 1997

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3.3. Health Effect Category 3: Exposure to Potentially Hazardous Materials

When gathering data on exposure to potentially hazardous materials, the HIA team reports on outcomes, such as the prevalence of illnesses, which result from exposures to hazardous materials including asthma/COPD, cancer, thyroid disorder, developmental delays and birth defects. For health determinants, the HIA relies on information, where available, regarding soil, water and air to understand the types and quantities of contamination present. Physical and material hazards include illnesses related to radiation, noise, vibration, light, or wildlife interactions as well as pollutants.

ADHSS monitors two pollutants: methyl mercury (through hair samples of pregnant women) and lead exposures. There are currently no statewide monitoring programs for other criteria air pollutants, such as ozone, nitrous oxide (NO_x), carbon monoxide (CO), sulfur dioxide (SO₂), and particulate matter (PM).

3.3.1. ADHSS Mercury Monitoring Program

People are most commonly exposed to mercury through consumption of fish and marine mammals. In July 2002, the Alaska Section of Epidemiology began the Statewide Maternal Hair Mercury Bio-monitoring Program, offering free and confidential hair mercury testing to all pregnant women and all women of childbearing age (i.e., women aged 15 to 45 years) in Alaska. This program focuses on women of childbearing age because the growing fetus is particularly vulnerable to the neurotoxic effects of mercury.

Through 2012, the Alaska State Public Health Laboratory analyzed hair samples from 312 pregnant women and 685 non-pregnant women of childbearing age from 127 communities throughout Alaska.

3.3.2. Pre-existing Environmental Hazardous Materials

Alaskans in rural communities have several possible contamination exposure sources, including industrial fuel and biomass combustion, pollution transported through the air, water or locally bio-accumulated from global sources, local waste processes, and abandoned contaminated sites.

Inhalation is one method of exposure to released contaminants. Pollutants can also dissolve in water sources or deposit on terrestrial surfaces. From their presence in any of these mediums, they can be ingested through drinking or ingesting contaminants directly or through their bio-accumulation in subsistence flora or fauna. Contaminant bio-accumulation in subsistence animals is a pathway of particular concern for Alaskans.

3.3.2.1. Contamination in Nikiski

Nikiski is an industrial area where there may be higher risk for pre-existing environmental hazards. For example, the 10-acre Arness Septage disposal site property was used from the late 1970s to the mid-1980s to process waste, including septage (i.e., the partially treated waste from septic tanks), oily waste water and bilge waste water. Some clean-up and monitoring has occurred at the site. A 135-foot groundwater monitoring well was installed in 1988 and sampled four times between 1988 and 2004. In each sample, the 1,1,1-trichloroethane or TCA level was between 0.006 parts per million (ppm) (or milligrams per liter) and 0.019 ppm – concentrations that are well below the Alaska Department of Environmental Conservation's (ADEC) groundwater cleanup level of 0.2 ppm (ADEC, 2014). In 2012, an

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oilfield service company, AIMM Technologies Inc., applied for a permit from ADEC's Solid Waste Program to dispose of oilfield wastes in a proposed monofill on a 10-acre parcel adjoining and southwest of the Arness Septage site property. The company installed six groundwater monitoring wells as per requirements of the Solid Waste Program's permit application. Samples from four wells initially installed showed no detection of chlorinated solvents or hydrocarbons. The other two wells were drilled later and had not yet been sampled at the time. The primary health concern is potential exposure to chlorinated solvents and hydrocarbons that may occur if drinking water wells in the area draw contaminated groundwater.

In 2012, ADEC sampled eight drinking water wells belonging to eight small businesses within a half-mile of the Arness Septage disposal site. Two wells tested positive for two chlorinated contaminants; all but one sample was well below the ADEC groundwater clean-up level. One sample tested above the ADEC regulatory level for trichloroethylene or TCE of 0.005 ppm at 0.00558 ppm; however, the ADEC considers that this contamination resulted from the Arness site (ADEC, 2014). As a result of the public concerns associated with the Arness property and AIMM's proposed monofill, the KPB applied for and received a \$150,000 legislative appropriation to investigate groundwater conditions in the Nikiski area; this study is ongoing (ADEC, 2014).

3.3.3. Natural Environmental Patterns (Weather/Climate Change)

Some hazardous exposures may emerge from natural environmental patterns, such as flooding, wind and weather patterns, that create air quality problems (i.e., inversions or high PM content), or secondary effects from climate change.

3.3.4. Air Quality

Air pollution has been shown to increase the risk of or exacerbate a number of respiratory and cardiac conditions. The elderly, children, and those with underlying health problems are particularly vulnerable to the effects of air pollution. Information on air quality in the AOI has been provided in Resource Report No. 9.

According to U.S. Environmental Protection Agency (EPA), tribes in Alaska face unique challenges to protecting air quality and reducing health risks in their communities, including the following:

- Most tribes do not have a reservation or defined lands where they can assert jurisdiction to address air quality issues.
- Frozen ground prevents burying waste in landfills, and many communities resort to burning trash that creates air pollution.
- Electricity primarily comes from diesel generators that produce particulate and other air pollutants.
- The cold climate means people spend significant time indoors in homes and buildings where indoor air pollution can accumulate.
- Many homes have older wood stoves that can be inefficient and create air pollution.

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- Dust from unpaved roads may contain pollutants that can be inhaled or deposited on subsistence food sources (Ware et al., 2013).

Ware et al. conducted surveys focused on understanding the demographics, home heating practices, indoor activities, community/outdoor activities, and air quality perceptions in rural Alaska communities over a 2-year period. Results from these surveys showed that there is an elevated potential for PM₁₀/PM_{2.5} exposures in rural Alaska. Significant indoor air quality concerns included mold, lack of ventilation or fresh air, and dust. Important outdoor air pollution concerns identified were open burning/smoke, road dust, and vehicle exhaust (e.g., snow machines, ATVs, etc.) (Ware et al., 2013).

3.3.5. Water Quality

See Resource Report No. 2, Sections 2.2 and 2.3 for water resources baseline conditions.

The Safe Drinking Water Information System contains information about public water systems and violations of EPA's drinking water regulations, as reported to EPA by the states. These regulations establish maximum contaminant levels, treatment techniques, and monitoring and reporting requirements to ensure that water systems provide safe water to their customers. Drinking water violations is an indicator of the presence or absence of health-based drinking water violations in counties served by community water systems. Health-based violations include Maximum Contaminant Level, Maximum Residual Disinfectant Level, and Treatment Technique violations (County Health Rankings 2016b). A "Yes" indicates that at least one community water system in the county received a violation during the specified time frame, while a "No" indicates that there were no health-based drinking water violations in any community water system in the county. During fiscal year 2013, the only potentially affected area that did not have at least one violation was the NSB. There was no data for Denali Borough.

3.4. Health Effect Category 4: Food, Nutrition, and Subsistence Activity

See Resource Report No. 5, Appendix D, as well as ADF&G baseline subsistence data provided as an attachment and filed in response to FERC on submitted on December 1, 2017 (see Accession No. 20171201-5211), for subsistence and food security baseline conditions in the PACs.

The Alaska Natives Commission describes subsistence as “the hunting, fishing, and gathering activities which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today” (U.S. Department of the Interior, 2005).

Subsistence is part of a rural economic system, called a “mixed, subsistence-market” economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods. Fishing and hunting for subsistence resources provide a reliable economic base for many rural regions. Subsistence is focused toward meeting the self-limiting needs of families and small communities (Wolfe and Walker, 1987). Participants in this mixed economy in rural Alaska augment their subsistence production by cash employment. Cash (from commercial fishing, trapping, and/or wages from public sector employment, construction, firefighting, oil and gas industry, or other services) provide the means to purchase the equipment, supplies, and gas used in subsistence activities. The combination of subsistence and

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commercial-wage activities provides the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker, 1987).

The State of Alaska confirms that subsistence fishing and hunting are important sources of employment and nutrition in almost all rural communities (Alaska Department of Fish and Game, undated). Subsistence is a source of nutrition for residents in an area of Alaska where food prices are high. While some people earn income from employment, these and other residents rely on subsistence to supplement their diets throughout the year. Furthermore, subsistence activities support a healthy diet and contribute to residents' overall wellbeing.

3.4.1. Contribution of Subsistence Activities

Johnson et al. (2009) note that Alaska Native foods are especially nutritious as they are dense in protein, iron, vitamin B12, polyunsaturated fats, monounsaturated fats and omega-3 fatty acids. Fish and seafood especially contributed to energy, protein, mono and polyunsaturated fatty acids, selenium, magnesium and vitamins D and E. In addition, they are low in saturated fat, added sugar, and salt. Native meats, such as moose and caribou, are generally lean. Berries and greens are high in water content and micronutrients and low in empty calories. In addition, hunting, gathering, harvesting and preserving Native foods are energy intensive, providing physical activity.

Johnson et al. (2009) report the findings of this research as:

- Daily seal oil and salmon consumption were associated with lower prevalence of glucose intolerance compared with individuals reporting less than-daily consumption.
- Higher intakes of the omega-3 fatty acids may afford some degree of protection against coronary heart disease.
- Lower rates of atherosclerotic lesions among Alaska Natives on autopsy compared with non-Native people was attributed to high intake of omega-3 fatty acids.
- Greater amounts of alpha-tocopherol and fresh bird intake were associated with higher HDL/LDL-cholesterol ratios.
- Elevated intakes of simple sugars, which might be contributing to an excess intake of energy that leads to a rise in obesity and diabetes.
- Low intake of calcium, dietary fiber, fruits and vegetables could be contributing to an increased incidence of cancers of the digestive system.

3.4.2. Food Security

Food security means having enough food to fully meet basic needs at all times. Food Insecurity is the percentage of the population who did not have access to a reliable source of food during the past year (Gundersen et al., 2015). Lacking constant access to food is related to negative health outcomes such as weight-gain and premature mortality (Brownson et al., 2006; Adams et al., 2003). The Core Food Insecurity Model was developed by the U.S. Department of Agriculture (USDA) to measure the ability of the

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population to access food. In addition to asking about having a constant food supply in the past year, the module also addresses the ability of individuals and families to provide balanced meals further addressing barriers to healthy eating. This measure was modeled using data collected from the Community Population Survey, Bureau of Labor Statistics, and American Community Survey. In 2013, 14% of Alaskans statewide were determined as food insecure. The highest percentage of food insecure persons were residents of the Yukon-Koyukuk Census Area (Table 22), while the lowest were residents of the Municipality of Anchorage and MSB. This trend is most likely a result of the fact that there are a larger percentage of rural communities in the Yukon-Koyukuk Census Area.

“Limited access to healthy foods” is defined as the percentage of the population who are low income and do not live close to a grocery store. Grocery store proximity is defined differently for rural versus nonrural areas. For rural areas, it means living less than 10 miles from a grocery store and in nonrural areas, less than 1 mile (County Health Rankings, 2016a). Low income is defined as having an annual family income of less than or equal to 200% of the federal poverty threshold for the family size.

There is strong evidence that residing in a geographic area where affordable and nutritious food is difficult to obtain, is correlated with a high prevalence of overweight, obesity, and premature death (Ahern et al., 2011; Taggert, 2005; Schafft, 2009). Supermarkets generally provide healthier options than convenience stores or smaller grocery stores (Wrigley et al., 2002). In addition, lack of access to fresh fruits and vegetables is a significant barrier to consumption and is related to premature mortality (Brownson et al., 2006).

In 2010 (the most currently available data) indicated that Yukon-Koyukuk Census Area had the highest percentage of residents with limited access to healthy foods at 50%, more than 5 times the percentage of all Alaskans statewide (see Table 22). The second highest percentage of person with limited access to healthy foods resided in Denali Borough.

“Food environment” is a composite of the percentage of food insecure persons and percentage of persons with limited access to healthy foods (County Health Rankings, 2016a). The “food environment index” ranges from 0 (worst) to 10 (best) and equally weights two indicators of the food environment. The Yukon-Koyukuk Census Area scored lowest on the food environment index (1.4), more than 5 times lower than the overall value for the state as a whole (see Table 22). The Anchorage Municipality scored the highest at 7.9.

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Table 22. Percentage of the Population Who Lack Adequate Access to Food by Potentially Affected Area and Alaska Statewide (2010 and 2013)

Census Area	No. of Persons Food Insecure (2013)	Percent of Persons Food Insecure (2013)	No. Persons with Limited Access to Healthy Foods (2010)	Percentage of Persons with Limited Access to Healthy Foods (2010)	Food Environment Index
North Slope Borough Census Area	1,330	14%	360	4%	7.7
Yukon-Koyukuk Census Area	1,180	21%	2,799	50%	1.4
Fairbanks North Star Borough	13,050	13%	9,737	10%	7.2
Denali Borough	290	14%	338	19%	6.1
Matanuska-Susitna Borough	11,370	12%	5,138	6%	7.8
Kenai Peninsula Borough	7,310	13%	3,273	6%	7.7
Municipality of Anchorage	36,350	12%	13,342	5%	7.9
Southeast Fairbanks Census Area	1,160	16%	644	9%	6.6
Skagway-Hoonah-Angoon Census Area	570	18%	360	4%	4.9
Valdez-Cordova Census Area	1,250	13%	1,047	11%	7.2
Alaska Statewide	ND	14%	ND	8%	7.3
Source: Gunderson et al., 2015 ND: Not determined					

3.4.3. Food Costs

Overall, the cost of living in Rural Alaska is 8% higher than the average cost of living in the U.S. (Economic Policy Institute, 2016). Of the four locations included in the Economic Policy Institute's dataset for Alaska, Rural Alaska is the fourth most expensive. In general, groceries are more expensive in rural Alaska due to the costs of shipping to remote locations and because there is typically no competition among vendors (i.e., often only one grocery or convenience store present per community).

3.4.4. Nutrition

Measuring the consumption of fruits and vegetables is a means of assessing adult diet. The data show the percentage of adults who report having eaten at least two servings of fruits and at least three servings of vegetables per day during the past month (AN EpiCenter, 2014). Fruits include 100% fruit juice and fruit. Vegetables include green salad, potatoes (excluding French fries, fried potatoes, or potato chips), carrots, or other vegetables. The amount of fruits and vegetables recommended daily varies according to age, sex, and level of physical activity. One of the key recommendations from the Dietary Guidelines for Americans is to increase fruit and vegetable intake. Eating more fruits and vegetables adds nutrients to diets, reduces

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the risk for heart disease, stroke, and some cancers, and helps manage body weight when consumed in place of more energy-dense food (USDA, 2015). In 2013, the age-adjusted prevalence of Alaskans meeting the recommended standard of consuming at least 2 cups of fruit and 3 cups of vegetable per day was low at 13.1% and 8.9%, respectively (Moore and Thompson, 2015). The highest percentage of all Alaskans living in Matanuska-Susitna reported consuming the standard of fruits and vegetables (15.3%) and Alaska Native residents of FNSB (Table 23). The lowest percentage of all Alaskans and Alaska Natives who reported meeting the standard of fruits and vegetables were residents of Yukon-Koyukuk Census Area.

Table 23. Fruit and Vegetable Consumption (2+ Fruits and 3+ Vegetables per Day) by Potentially Affected Area

Borough/Census Area	Age-adjusted Prevalence/All Alaskans	Age-adjusted Prevalence/Alaska Natives
North Slope Borough Census Area	7.9%	**
Yukon-Koyukuk Census Area	4.0%	4.5%
Fairbanks North Star Borough	12.8%	16.1%
Denali Borough	5.9%	**
Matanuska-Susitna Borough	15.3%	13.8%
Kenai Peninsula Borough	12.5%	11.4%
Municipality of Anchorage	11.9%	8.8%
Southeast Fairbanks Census Area	7.3%	**
Hoonah-Angoon Census Area	**	**
Valdez-Cordova Census Area	8.6%	**
State of Alaska		
Source: BRFSS, 2016		
**Data statistically unreliable		

Micronutrients are nutrients required by humans and other organisms throughout life in small quantities to orchestrate a range of physiological functions. Vitamin D deficiency is a common problem for children and adults in Alaska and can lead to bone diseases such as rickets. A review of rickets and vitamin D deficiency cases among Alaska Native children aged <10 years for the period 2001 to 2010 was performed by ADHSS SOE (2014). Results of the study indicated rickets was more common in Alaska Native children than in other U.S. children, and the incidence of rickets increased with increasing geographic latitude within Alaska. Pediatric risk factors for rickets in Alaska include general malnutrition, darker pigmentation, living at higher latitude, and lack of vitamin supplementation in breastfed and formula fed infants (ADHSS, 2014).

There were no reported deaths by malnutrition among the PACs or by nutritional disorders such as scurvy, marasmus, vitamin B12, or other deficiencies. Information on clinical visits for deficiencies other than vitamin D is not available at this time, but incidence is generally low and not likely related to involuntary nutritional limitations.

3.5. Health Effect Category 5: Infectious Diseases

Reportable communicable diseases include infectious and parasitic diseases, such as tuberculosis (TB), septicemia, viral hepatitis, HIV, and STIs as well as influenza and pneumonia. Reportable infectious diseases are tracked by local, state, and federal governments utilizing a cooperative relationship with

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clinicians and laboratories. When an individual is identified with an infectious disease clinicians and laboratories report to their local or state health department. All disease specific information is collected regarding the infectious disease event and is then reported to the CDC.

Communicable diseases disproportionally affect poor populations and are exacerbated by unsanitary conditions, unsafe water, and inadequate personal hygiene. Children and adults without proper immunization are at higher risk of contracting infections and left untreated, chronic infections can lead to cancers, such as cervical (caused by HPV) and liver cancer (Hepatitis B and C) (WHO, 1999).

From 2011 to 2015, 36 cases of foodborne botulism were reported in the State; one case of infant botulism was reported in 2015. Seven cases of foodborne botulism, representing four outbreaks, were reported in 2015. The age range of patients with foodborne botulism in 2015 was 23–77 years (median age: 48 years); five (71%) were female (ADHSS, 2016).

Alaska averaged 103 cases of Campylobacter infection each year from 2011 to 2015. New for 2015, the case definition for campylobacteriosis included cases with positive results on culture independent diagnostic tests. Reported cases of campylobacteriosis have shown an increase during the summer months. There were five Campylobacter outbreaks in 2013, and the largest of these infected 31 people and was associated with raw milk consumption. Another Campylobacter outbreak linked to raw milk occurred in 2011, infecting 18 individuals (ADHSS, 2016).

In 2015, 5,653 cases of chlamydial infection (CT) were reported in the State; Alaska's CT incidence rate was 766 cases per 100,000 persons. This represents a 1.5% rate decrease compared to 2014 data (788 cases/100,000 persons). Alaska ranked first for national CT rates from 2010–2014 (ADHSS, 2016).

Alaska averaged 93 cases of giardiasis from 2011 to 2015. Giardia is a well-known inhabitant of Alaska's surface waters. Cases of Giardia have shown an increase during the summer months and the fall hunting season. However, cases are also transmitted from person-to-person and thus can occur year-round. Often cases occur sporadically with no source identified. During the summer of 2012, one major outbreak of giardiasis was identified and investigated. Reports were received for 21 ill patients, and the source was determined to be contaminated spring water. There was one giardia outbreak investigated in 2014, involving five individuals (ADHSS, 2016).

In 2015, 1,115 cases of gonococcal infection (GC) were reported to the State; Alaska's GC incidence rate was 151 cases per 100,000 persons. This represents a 16% decrease compared to 2014 data (ADHSS, 2016).

The State of Alaska received 107 reports of invasive Haemophilus influenzae cases from 2011 to 2015. In 2015, 22 cases of H. influenzae were reported. Of these 22 cases, six (27%) were type a, one (5%) was type b, one (5%) was type e, 13 (59%) were nontypeable, and one (5%) was not tested. The six cases of H. influenzae type a came from the Yukon-Kuskokwim Delta, the region that has seen the most H. influenzae from 2002 to 2013. The patient with H. influenzae type b (Hib) was aged less than 6 years. Six total cases of Hib were reported between 2011–2015; five cases of Hib were reported in children aged less than 10 years from Southwestern Alaska in 2009 (ADHSS, 2016).

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From 2011 to 2015, the State of Alaska received an average of 1,189 reports annually of hepatitis C virus (HCV) infection, with 1,542 new reports of HCV infection in 2015. These data represent newly reported cases of either acute or chronic infections. Rates of HCV reports were highest in the Anchorage/Mat-Su, Gulf Coast, and Southeast regions (ADHSS, 2016).

From January 1, 1982, through December 31, 2015, 1,680 cases of HIV infection were reported to the state, including cases with an initial diagnosis in Alaska and those previously diagnosed out-of-state who are living in Alaska. Of the 1,680 cases, 586 (35%) were in persons who are known to have subsequently died. Of the 1,094 HIV-infected persons who are not known to have died, 671 (61%) are currently living in Alaska. During 2015, 64 cases of HIV infection were reported to SOE; 22 (34%) of which were initially diagnosed in Alaska, yielding a 2015 statewide incidence rate of 3 cases per 100,000 persons. Of the 22 newly diagnosed persons, 17 (77%) were male, 15 (68%) were non-whites, and 10 (45%) were men who have sex with men (MSM). Of the MSM who agreed to be interviewed, the most commonly reported venues to meet sexual partners were online and through mobile applications. Other reported risk factors for newly diagnosed persons include drug and alcohol abuse (57%), history of incarceration (38%), coinfection with a bacterial STI (29%), and homelessness (19%). The number of new HIV infections reported to SOE varies from year to year, as Alaska is a low incidence jurisdiction. The most common risk factor is MSM, which represents approximately half of new infections each year (ADHSS, 2016).

From 2011 to 2015, 42 cases of paralytic shellfish poisoning (PSP) were reported. During this time, the age range of patients with PSP was 13–72 years (median age: 51 years); 30 (72%) were male. All ill persons consumed self-harvested shellfish from the Gulf Coast or Southeast regions of Alaska, except one probable case from the Northern region in 2014. Confirmed or probable cases have been reported in every month, with the spring and summer months being most common. During 2011, a large outbreak accounting for 21 of the 26 cases from 2011 was identified in Metlakatla and Ketchikan that resulted in four hospitalizations. PSP cases from 1993–2014 were summarized in a 2015 bulletin. The State of Alaska does not monitor or certify any beaches for toxins associated with PSP for the purposes of recreationally harvested shellfish; however, commercially harvested shellfish are routinely tested by the ADEC prior to sale (ADHSS, 2016).

During 2015, 106 cases of pertussis were reported, yielding an incidence rate of 14 cases per 100,000 persons; nearly half of the cases were reported as part of an outbreak in the Interior. A breakdown of pertussis cases reported to SOE by age group for 2011–2015 is displayed. An outbreak of pertussis that began in 2012 accounted for significant increases in cases reported in 2012 and 2013.² Data from 2012 and 2013 were also summarized in a report that estimated epidemic conditions are reached after monthly cases counts exceed 30.

There were eight cases of animal rabies confirmed at the Alaska State Virology Lab (ASVL) in 2015. The priorities for testing at ASVL have been animals for which there may be public health actions associated, such as to determine whether an exposed human would need administration of rabies post-exposure prophylaxis, or appropriate follow-up for another animal exposed to the suspected rabid one. In March 2011, the CDC trained staff from ADF&G, the University of Alaska Fairbanks, and the USDA Wildlife Services in field screening direct rapid immunohistochemical test (DRIT) methods. All animals tested

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positive by DRIT must be confirmed by DFA (direct fluorescent antibody) at CDC. On average, annually DRIT is used to evaluate 10 times more animals than are tested at ASVL. Two of the five bats that have ever tested positive for rabies in Alaska initially tested positive by DRIT and were subsequently confirmed to have rabies by CDC. An Epidemiology Bulletin released in 2016 summarized updates to what is known about rabies in Alaska bats (ADHSS, 2016).

From 2011 to 2015, the State of Alaska received an average of 69 reports annually of salmonellosis. Many cases reported were sporadic with no confirmed source. During 2015, there were 21 laboratory-confirmed cases associated with the multistate outbreak of *S. Poona* linked to the consumption of cucumbers. There were 13 outbreaks detected during 2013-2014; 64 of the 83 cases reported in 2013 were linked to seven outbreaks. Eleven of 59 cases in 2012 were part of an *S. Heidelberg* outbreak linked to poultry from a single producer that sickened more than 120 people in 13 states (ADHSS, 2016).

In 2015, 20 cases of early (primary, secondary, and early latent) syphilis were reported, which represents a 50% decrease from 2014 data. The incidence rate fell from 5.4 cases per 100,000 persons in 2014 to 2.7 cases per 100,000 in 2015. This outbreak resulted in two congenital syphilis (CS) cases, one in 2012 and one in 2013. The 2013 CS case resulted in stillbirth. Common risk factors include MSM, and persons engaging in anonymous sex, often with multiple partners found through the internet and phone apps (ADHSS, 2016).

In 2015, 68 cases of TB were reported to the Alaska Tuberculosis Control Program, for a rate of 9.2 cases per 100,000. This was the highest rate in the U.S. in 2015, well above the nationwide rate of 3.0 cases per 100,000. The Southwest and Northern regions of Alaska traditionally have the highest rates of TB, and Alaska Natives and Asians/Pacific Islanders bear a disproportionate burden of TB in Alaska. In 2013, one village-based outbreak from the Southwest Region accounted for 17 cases of TB with a corresponding incidence rate of ~2,000/100,000 (ADHSS, 2016).

Alaska averaged 55 cases of varicella annually from 2011 to 2015. A spike in varicella cases occurred in the fall of 2012 in Kenai Peninsula communities with low vaccination rates. A Public Health Advisory was published and an investigation completed. Twelve cases were confirmed among school age children attending four schools in Homer. The majority of cases reported to the State of Alaska are only clinically diagnosed without laboratory confirmation; health care providers are encouraged to test to more accurately describe varicella epidemiology and ensure that appropriate disease control measures are implemented (ADHSS, 2016).

During 2011-2013, reportable communicable disease was not among the leading causes of death for any Potentially Affected Areas. Of infectious and parasitic diseases, septicemia, followed by viral hepatitis was the most common causes of death due to infectious and parasitic disease in all areas (Table 24). For most areas, the mortality rate due to influenza and pneumonia was higher than the rate for infectious and parasitic diseases, with pneumonia being the most common cause of death.

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Table 24. Deaths due to Reportable Communicable Diseases, by Potentially Affected Area and Alaska Statewide (2011-2013)

Cause of Death	Deaths	Age Adjusted Rate
North Slope Borough		
Infectious and Parasitic Disease	1	**
Tuberculosis	0	0.0
Septicemia	1	**
Viral Hepatitis	0	0.0
HIV Disease	0	0.0
All Other Infectious Disease	0	0.0
Influenza and Pneumonia	0	0.0
Influenza	0	0.0
Pneumonia	0	0.0
Yukon-Koyukuk Census Area		
Infectious and Parasitic Disease	5	**
Tuberculosis	0	0.0
Septicemia	5	**
Viral Hepatitis	0	0.0
HIV Disease	0	0.0
All Other Infectious Disease	0	0.0
Influenza and Pneumonia	6	46.4*
Influenza	0	0.0
Pneumonia	6	46.4*
Denali Borough		
Infectious and Parasitic Disease	2	**
Tuberculosis	0	0.0
Septicemia	1	**
Viral Hepatitis	1	**
HIV Disease	0	0.0
All Other Infectious Disease	0	0.0
Influenza and Pneumonia	1	**
Influenza	0	0.0
Pneumonia	1	**
Fairbanks North Star Borough		
Infectious and Parasitic Disease	23	9.8
Tuberculosis	0	0.0
Septicemia	12	5.3*
Viral Hepatitis	6	1.8*
HIV Disease	1	**
All Other Infectious Disease	1	**
Influenza and Pneumonia	21	12.1
Influenza	3	**
Pneumonia	18	11.1*
Matanuska-Susitna Borough		
Infectious and Parasitic Disease	28	9.9
Tuberculosis	0	0.0
Septicemia	9	3.2*
Viral Hepatitis	9	3.2*

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Cause of Death	Deaths	Age Adjusted Rate
HIV Disease	1	**
All Other Infectious Disease	9	3.2*
Influenza and Pneumonia	18	9.6*
Influenza	0	0.0
Pneumonia	18	9.6*
Kenai Peninsula Borough		
Infectious and Parasitic Disease	23	12.0
Tuberculosis	1	**
Septicemia	9	5.3*
Viral Hepatitis	8	4.7*
HIV Disease	1	**
All Other Infectious Disease	4	**
Influenza and Pneumonia	17	11.8*
Influenza	1	**
Pneumonia	16	9.4*
Municipality of Anchorage		
Infectious and Parasitic Disease	128	17.6
Tuberculosis	2	**
Septicemia	55	8.7
Viral Hepatitis	33	3.2*
HIV Disease	15	1.7*
All Other Infectious Disease	23	3.7
Influenza and Pneumonia	64	10.9
Influenza	4	**
Pneumonia	60	10.3
Southeast Fairbanks Census Area		
Infectious and Parasitic Disease	4	**
Tuberculosis	0	0.0
Septicemia	1	**
Viral Hepatitis	2	**
HIV Disease	0	0.0
All Other Infectious Disease	1	**
Influenza and Pneumonia	1	**
Influenza	0	0.0
Pneumonia	1	**
Skagway-Hoonah-Angoon Census Area		
Infectious and Parasitic Disease	2	**
Tuberculosis	0	0.0
Septicemia	0	0.0
Viral Hepatitis	1	**
HIV Disease	0	0.0
All Other Infectious Disease	1	**
Influenza and Pneumonia	1	**
Influenza	0	0.0
Pneumonia	1	**
Valdez-Cordova Census Area		
Infectious and Parasitic Disease	4	**

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Cause of Death	Deaths	Age Adjusted Rate
Tuberculosis	0	0.0
Septicemia	1	**
Viral Hepatitis	1	**
HIV Disease	0	0.0
All Other Infectious Disease	2	**
Influenza and Pneumonia	3	**
Influenza	0	0.0
Pneumonia	3	**
Alaska Statewide		
Infectious and Parasitic Disease	268	14.8
Tuberculosis	8	4*
Septicemia	115	7.2
Viral Hepatitis	68	2.5
HIV Disease	19	8*
All Other Infectious Disease	58	3.7
Influenza and Pneumonia	176	12.1
Influenza	11	5*
Pneumonia	165	7.5
Source: ABVS, 2016		
^a Age-adjusted rates are per 100,000 U.S. year 2000 standard population		
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.		
**Rates based on fewer than 6 occurrences are not reported.		

3.5.1. Chlamydia

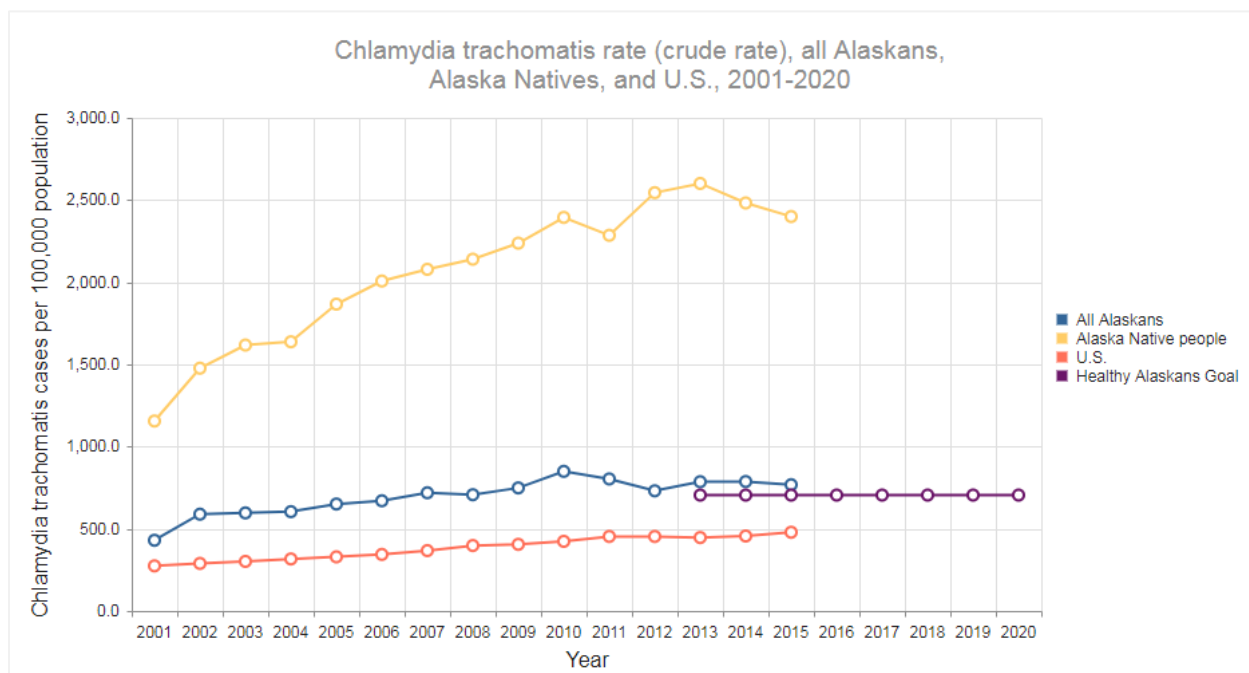
Chlamydia trachomatis (CT or chlamydia) infection is the most commonly reported bacterial sexually transmitted disease in the U.S. and in Alaska. Chlamydia is known as a 'silent' infection because most infected people have no symptoms. Untreated CT infection can cause pre-term labor, pelvic inflammatory disease (PID), ectopic pregnancy, and infertility in women; epididymitis and Reiter's syndrome in men; and eye infection and pneumonia in newborns. Alaska has consistently had the first or second highest (CT) infection rate in the nation since 2000 (Figure 22) (ADHSS, 2011a). In 2015, there were a total of 5,653 cases statewide at an incidence rate of 766 per 100,000 population, representing a 1.5% decrease in incidence from 2014 (ADHSS, 2016). Among PACs, the Anchorage-Mat-Su region had the highest number of cases (2,890). Statewide, 67% of cases were among females, and 81% were in persons aged ≤29 years. The highest rate occurred among 20–24 year old age group.

Alaskan women, adolescents and young adults, and Alaska Natives are disproportionally impacted by chlamydia. There is a significant disparity in chlamydia rates between both the Alaska Native and non-Native populations as compared to the U.S. White population (AK-IBIS, 2016). In 2012, the highest number of new CT infections were seen among the 15-24 and 25-34 age groups, and approximately three of four infections reported were in among females. Chlamydia rates vary widely by tribal health region, from a low of 344.2 per 100,000 (Kodiak Area) to a high of 2,375.9 per 100,000 (Norton Sound; AN EpiCenter, 2014). Among potentially affected tribal health regions, Anchorage-Mat-Su had the highest incidence rate at 2,603.2 per 100,000 population (Table 25). The remaining regions had rates below that of the state overall.

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To address the elevated rates of chlamydia in Alaska, several partners in state have sponsored expedited partner therapy as a means to promote safe sexual behavior (ADHSS SOE Bulletin Volume 14, 2011). The SOE regularly warns health care providers to be alert for risks and symptoms of STIs and to provide testing and prompt reporting of any outbreaks.

Figure 22. Chlamydia Trachomatis Crude Rate, All Alaskans, Alaska Natives, and U.S. (2001-2020)



Source: AK-IBIS, 2018

Table 25. Age-Adjusted Alaska Native Chlamydia Incidence Rates by Region per 100,000 by Potentially Affected Native Health Corporation Region, Alaska Natives, 2016

Tribal Health Region	Age Adjusted Rate per 100,000
Arctic Slope	1,541.3
Interior	2,025.3
Anchorage/Mat-Su	2,519.1
Copper River/Prince William Sound	902.1
Kenai Peninsula	908.6
Alaska Statewide	7,444.9
Source: AN EpiCenter, 2018	

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3.5.2. Gonorrhea

Gonorrhea is an STI caused by the bacterium *Neisseria gonorrhoeae*. In 2014, Alaska had the third highest gonococcal infection (GC) rate in the nation (ADHSS, 2014; CDC, 2010). Untreated GC can result in PID, pre-term labor, ectopic pregnancy, and infertility in women; epididymitis and infertility in men; and conjunctivitis in neonates. GC can also facilitate the transmission of HIV (ADHSS, 2016). In 2015, there were 1,115 GC cases statewide at an incidence rate of 151 cases per 100,000 persons, representing a 16% decrease from 2014. The majority of cases occurred among persons aged ≤29 years (61%) and just over half were females (51%). The highest GC rate occurred among non-Hispanic American Indian/Alaska Native persons (AI/AN), Blacks, and Native Hawaiian/Pacific Islanders (NH/PI). Between 2014 and 2015, there was a 40% rate increase among NH/PI persons. While the demographic and geographic distribution of GC has remained relatively consistent over recent years, the observed rate increase among NH/PI persons was considered notable by the ADHSS Section of Epidemiology (ADHSS, 2016). In 2014, the Anchorage-Mat-Su Native Health Corporation Region had the highest incidence rate of gonorrhea among Alaska Natives residing in the PACs (Table 26).

Table 26. Age-Adjusted Alaska Native Gonorrhea Incidence Rates by Region per 100,000 by Potentially Affected Native Health Corporation Region, Alaska Natives, 2016

Tribal Health Region	Age Adjusted Rate per 100,000
Arctic Slope	1,541.3
Interior	2,025.3
Anchorage/Mat-Su	2,519.1
Copper River/Prince William Sound	902.1
Kenai Peninsula	908.6
Alaska Statewide	7,444.9
Source: AN EpiCenter 2018	

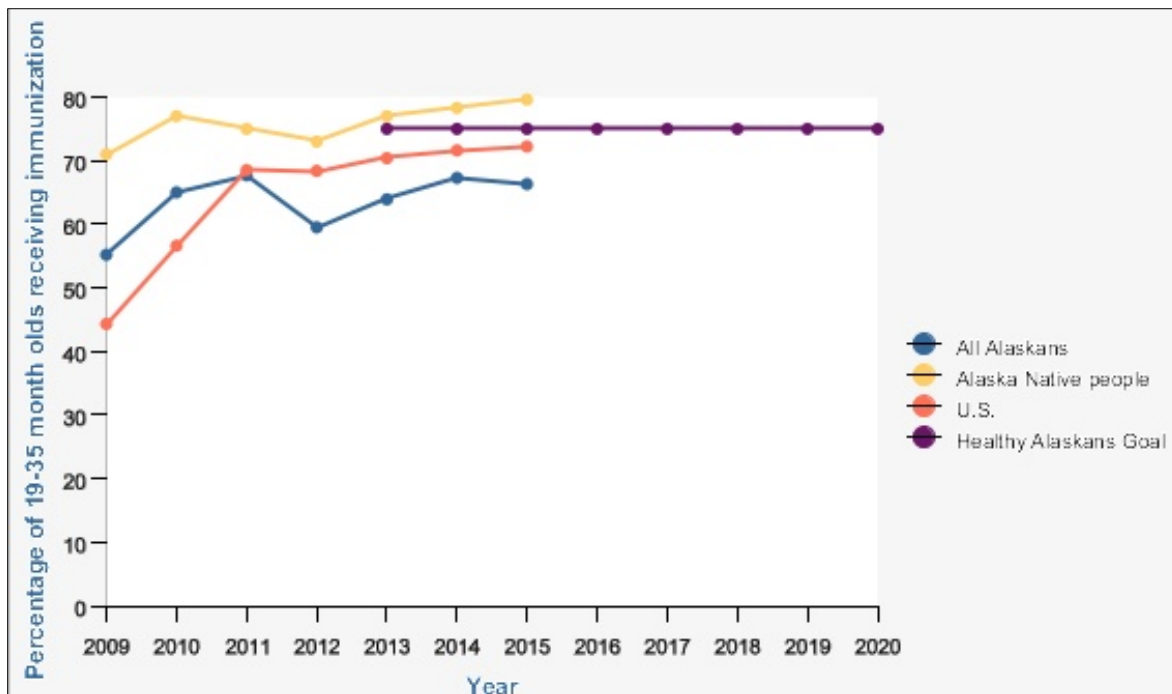
3.5.3. Immunizations

Immunization rates (greater than 80% coverage) for both children and adults are a critical community health population level performance indicator. By 2 years of age, it is recommended that all children should have received four doses of diphtheria-tetanus-pertussis, three doses of polio, one dose of measles-mumps-rubella, three doses of Hepatitis B, and three doses of Hemophilis Influenza, type B vaccines. This recommendation is referred to in shorthand as "4:3:1:3:3." For adults aged 65 years and older, respiratory diseases are an extremely important source of observed mortality and morbidity that can be reduced through proper immunization, along with behavior changes.

In 2013, 67% of all 19- to 35-month-old children statewide had received the recommended vaccination series, falling short of the Healthy Alaskans 2020 goal of 75% (Figure 23). The rate among Alaska Natives, however, exceeded both the national rate and the Healthy Alaskans 2020 goal in 2013 at 78%.

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Figure 23. Percentage of Children Aged 19-35 Months Who Received the 4:3:1:3:3 Vaccination Series, All Alaskans, and the U.S. (2009-2020)



Source: AK-IBIS, 2018

Pneumonia, a respiratory disease, most often causes illness in children under 5 years and older adults (>65 years). Also at higher risk are those with other medical conditions, such as chronic liver, heart or lung disease (NIAID, 2011). In 2013, pneumonia was the most common cause of death due to a reportable infectious disease in: Yukon-Koyukuk Census Area, FNSB, KPB, and statewide. Between 2005 and 2013, 65.1% of Alaskans over 65 years of age statewide had received the pneumococcal vaccine. The highest vaccine coverage occurred in Yukon-Koyukuk Census Area (72.6%) and the lowest, in Valdez-Cordova Census Area (57.5%). From 2011 to 2013, 33.1% of Alaskans statewide had received the influenza vaccine. The highest coverage occurred among Alaska Natives living in Yukon-Koyukuk Census Area (42.1%) and the lowest percentage of influenza vaccination occurred for all Alaskans living in Southeast Fairbanks Census Area.

3.6. Health Effect Category 6: Non-communicable Diseases

Non-communicable diseases include:

- Cardiovascular;
- Cerebrovascular;
- High blood pressure;
- Chronic lower respiratory diseases;

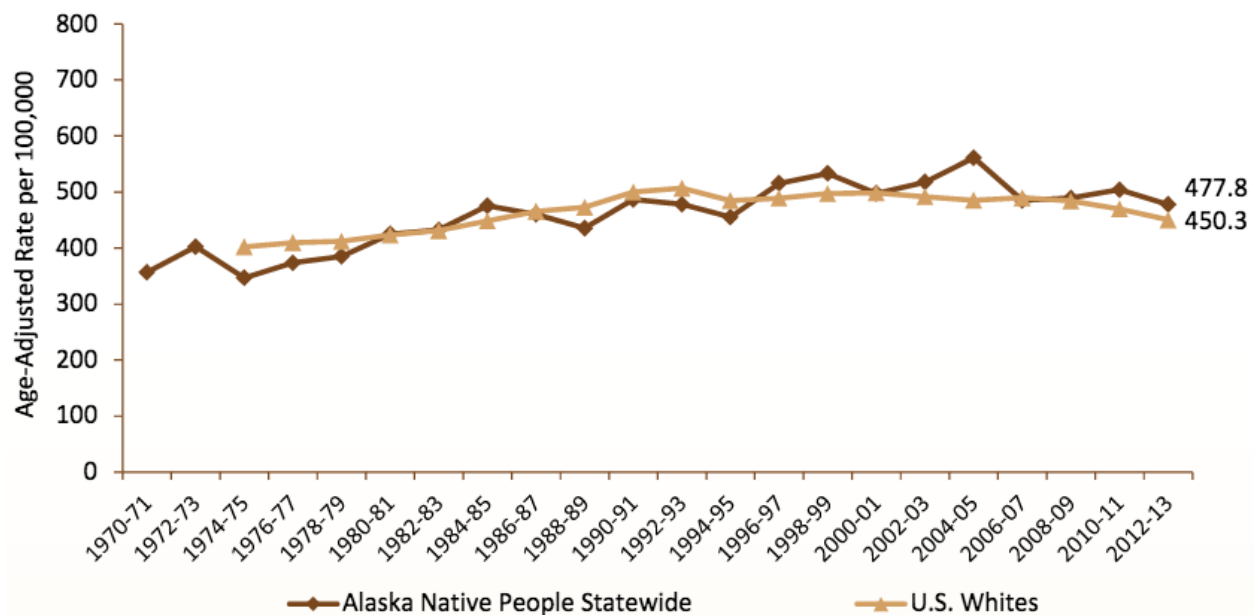
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- Chronic obstructive pulmonary diseases;
- Mental health disorders;
- Physical activity/dietary diseases;
- Diabetes; and
- Cancer.

3.6.1. Cancer

Cancer incidence is defined as the number of new cancers diagnosed in a specified population during specified time period. Cancers incidence rates for a specific type of cancer are based on the primary site reported or on the site of origin. Alaska Native cancer incidence was similar to that of US Whites nationally during 2012-2013 (Figure 24). The number of deaths due to cancer defined as International Classification of Diseases (ICD)-9 codes 140-208 and ICD-10 codes C00-C97 as the underlying cause of death among residents during a calendar year. Despite the decline in the cancer death rate over the past decade, cancer remains the leading cause of mortality among all Alaskans and among Alaska Natives. In 2013, the cancer mortality rate among all Alaskans was 167.9, while for Alaska Natives the rate was 272.5 per 100,000 population (AK-IBIS, 2016).

Figure 24. Trends in Cancer Incidence Rates per 100,000 Population (1970-1971 to 2012-2013)



Source: AN EpiCenter, 2015

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3.6.1.1. Malignant Neoplasm (Cancer) Deaths

Malignant neoplasms, or cancer, is the number one leading cause of death in Alaska. In 2015, cancer claimed the lives of 962 Alaskans. More Alaskans died from cancer of the trachea, bronchus, and lung than any other type of cancer; 145 males and 112 females.

Among the leading causes of death in Alaska, cancer ranked second in total years of potential life lost with 9,214 years lost. On average, 9.6 years of life were lost prematurely for each cancer death.

Since 2006, the crude death rate for cancer has increased 12.6%. During this same time period, the age-adjusted death rate for cancer has decreased 14.4% (ADHSS, 2015b).

3.6.1.2. Lung Cancer

Lung cancer is the second most common cancer in men (after prostate cancer) and in women (after breast cancer) in the U.S. (AK-IBIS, 2016). Approximately two-thirds of people diagnosed with lung cancer are 65 or older; the average age at diagnosis is 70. The risk of men developing lung cancer is about 1 in 13; for women the risk is about 1 in 16. Typically, symptoms do not develop until the disease reaches an advanced stage, limiting early detection, thus lung cancer survival rates are relatively low (American Cancer Society, 2016).

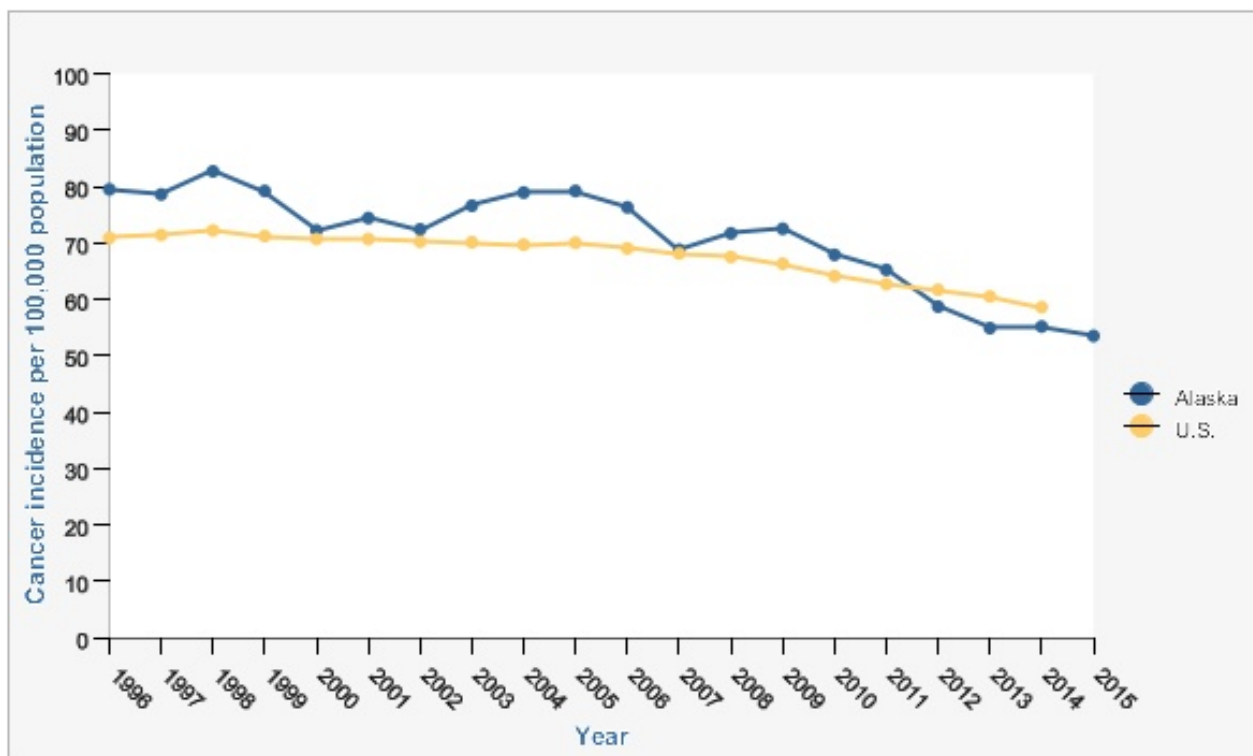
Cigarette smoking is the largest risk factor for lung cancer, followed by cigar and pipe smoking and accounts for approximately 80% of lung cancer deaths. Chronic exposure to secondhand smoke will increase a non-smoker's chance of developing lung cancer by 20-30%. Other risk factors for lung cancer include: long-term exposure to radon, workplace exposure to asbestos fibers, exposure to diesel exhaust or outdoor air pollution, radiation therapy to the chest for a previous cancer, high levels of arsenic in drinking water, and a family history of lung cancer (American Cancer Society, 2016).

Between 2011 and 2013, the NSB (238.7 per 100,000 population) and Yukon-Koyukuk Census Area (229.4 per 100,000 population) had the highest rate of deaths due to malignant neoplasms exceeding the Alaska Statewide rate by more than 25% (168.1 per 100,000). Denali had the lowest number of deaths due to cancer (N=5). Among all regions, the highest death rate due to a specific cancer type was lung cancer.

Alaska has had consistently higher incidence rates of lung cancer than the U.S. overall. In 2011, Alaska's lung cancer incidence rate was 64.3 per 100,000 population compared with the national rate of 61.1 (Figure 25). Lung cancer is ranked second for the number of cancer incident cases in Alaska between 2008 and 2012. Lung cancer incidence rates have declined over the decade in both Alaska and the U.S. In Alaska, lung cancer incidence rates among men are consistently higher than among women, and men are on average about 1.4 times more likely to develop the disease (AK-IBIS, 2016). In 2012, the lung cancer incidence rate for men was 60.8 per 100,000 males, compared to 54.6 per 100,000 females. Between 1996 and 2012, the incidence of lung cancer ranged from a high of 120.3 per 100,000 population in NSB to a low of 34.9 per 100,000 population in Skagway-Hoonah-Angoon Census Area, compared to the statewide rate of 72.4. During this time period, Alaska Natives had a much higher incidence rate of lung cancer than any other race at 94.5 per 100,000 population, compared to 70.1 for Whites, 65.3 for Blacks, and 47.6 for Asians/Pacific Islanders.

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Figure 25. Lung Cancer Incidence Rate (Age-Adjusted), Alaska and US (1996-2015)



Source: AK-IBIS, 2016

3.6.1.3. Breast Cancer

Excluding basal and squamous cell skin cancers, breast cancer is the most common cancer among U.S. women (AK-IBIS, 2016). Risk factors associated with breast cancer, include: excessive alcohol consumption, being overweight or obese after menopause, physical inactivity, previous exposure of the chest area to ionizing radiation for treatment of a different cancer at a young age, long-term use of hormone replacement therapy after menopause (especially estrogen plus progesterone), use of oral contraceptives, never having children or having a first child after age 30, having more menstrual cycles over a lifetime due to early start (before age 12) and/or late age of menopause, and a family history of breast cancer (American Cancer Society, 2014). Alaska has consistently had higher rates of breast cancer than the U.S. In 2011, Alaska's breast cancer rate was 128.4 per 100,000 females compared with the U.S. rate of 121.9.

Female breast cancer ranked first for the number of cancer incidence cases in Alaska between 2008 and 2012. Similar to the U.S. overall, breast cancer incidence in Alaska has remained relatively stable over the past decade. Among potentially affected regions, the lowest incidence of breast cancer occurred in Denali Borough (61.2 per females) and Yukon-Koyukuk Census Area (69.8 per females) between 1996 and 2012. During this time period, the highest incidence occurred among female residents of Matanuska Susitna Borough (135.4 per females). The statewide incidence was 131.9. Asians/Pacific Islanders had a lower incidence rate of breast cancer than any other race at 83.0 per 100,000 females, compared to 137.1 for

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Alaska Natives, 134.8 for Whites, and 128.2 for Blacks. During 2011 to 2013, the breast cancer mortality rate was 18.6 per 100,000 women in Alaska. Among potentially affected regions, the KPB had the highest breast cancer mortality rate at 21.3 per 100,000 women, while Skagway-Hoonah-Angoon Census Area has the lowest breast cancer mortality rate with zero deaths.

3.6.1.4. Prostate Cancer

Prostate cancer is the most common cancer among men (excluding basal and squamous cell skin cancers) in the U.S. Approximately 1 in 7 men (14%) will develop prostate cancer during their lifetime. Risk factors for developing prostate cancer include older age, Black race, a family history of prostate cancer, and a diet high in red meats, high-fat dairy products, or calcium (AK-IBIS, 2016). Prostate cancer ranked third among incident cancers among men between 2008 and 2012, statewide.

Among Potentially Affected regions, Southeast Fairbanks Census Area had the lowest incidence of prostate cancer with zero cases, while Hoonah-Angoon had the highest at 182.8 cases per 100,000 males (AK-IBIS, 2016). The statewide rate was 142.9 per 100,000 males. Prostate cancer incidence is strongly correlated with race. Between 1996 and 2012, Blacks had a much higher rate than any other race in Alaska at 249.4 per 100,000 males, compared to 151.7 for Whites, 106.3 for Asian/Pacific Islanders, and Alaska Natives had the lowest rate at 74.1 per 100,000 males. Despite the high incidence, most men who are diagnosed from cancer do not die as a result of the disease. The Alaska Statewide prostate cancer mortality rate was 18.2 per 100,000 males during 2011-2013, Rates among Potentially Affected Areas were similar to the statewide rate with the exception of Valdez-Cordova Census Area, which had a rate of 114.4. It should be noted, however, that this rate was based on fewer than 8 occurrences and is therefore statistically unreliable.

3.6.1.5. Colorectal Cancer

Colorectal cancer is the third most common cancer found in men (after prostate and lung) and in women (after breast and lung) in the country. The risk of developing colorectal cancer is about 1 in 20 (5%) and is slightly higher for men as compared to women (AK-IBIS, 2016). Important risk factors for colorectal cancer include old age (approximately 90% of people with colorectal cancer are over age 50), diets high in red and processed meats, physical inactivity, obesity, smoking, and heavy alcohol use. Other risk factors include type 2 diabetes, inflammatory bowel disease, colorectal polyps, or previous colorectal cancer, as well as a family history of colorectal cancer (American Cancer Society, 2015).

Colorectal cancer ranked fourth in Alaska for the number of cancer incident cases during 2008-2012. Rates of colorectal cancer in Alaska and the U.S have declined over the past decade.

In 2011, the incidence of colorectal cancer was similar for all Alaskans (40.7 per 100,000 population) and the U.S. (40.0 per 100,000 population; AK-IBIS, 2016). Colorectal cancer incidence rates for men are consistently higher than for women, and men are 1.3 times more likely to develop the disease, on average in Alaska. In 2012, the colorectal cancer incidence rate for men was 41.7 per 100,000 males, as compared to 37.6 per 100,000 females.

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Between 1996 and 2012, the NSB had the highest incidence rate for colorectal cancer (108.9 per 100,000 population), while Skagway-Hoonah-Angoon Census Area had the lowest (35.8 per population; AK-IBIS, 2016). During this same time period, Alaska Natives had a much higher incidence rate of colorectal cancer than any other race at 97.4 per 100,000 population, compared to 52.9 for Blacks, 44.6 for Whites, and 33.1 for Asians/Pacific Islanders (AK-IBIS, 2016). Between 2011 and 2013, colorectal cancer mortality rates were among the highest for all areas and in many cases, were the second leading rate of cancer death after lung cancer (Table 27).

The colorectal mortality rate cancer increases with age; median age at death is 74 years. Mortality from colorectal cancer is higher among men and in Black and American Indian/Alaska Native individuals of both sexes. Between 2007 and 2011, the highest rate of death from colorectal cancer was among Black men (National Cancer Institute, 2016).

Table 27. Cancer Deaths by Type and Potentially Affected Area (2011-2013)

Cause of Death	Deaths	Age Adjusted Rate
North Slope Borough		
Malignant Neoplasms	36	238.7
Colon, rectum and anus	7	38.2
Liver and intrahepatic bile ducts	0	0.0
Lung	15	140.0*
Breast ^b	2	**
Prostate ^b	0	0.0
Lymphoid & hematopoietic	2	**
Non-hodgkin's lymphoma	0	0.0
Leukemia	2	**
All other lymphoid & hematopoietic	0	0.0
All other malignant neoplasms	0	0.0
Yukon-Koyukuk Census Area		
Malignant Neoplasms	37	229.4
Colon, rectum and anus	4	**
Liver and intrahepatic bile ducts	0	0.0
Lung	8	52.2*
Breast ^b	2	**
Prostate ^b	1	**
Lymphoid & hematopoietic	4	**
Non-hodgkin's lymphoma	3	**
Leukemia	1	**
All other lymphoid & hematopoietic	0	0.0
All other malignant neoplasms	18	107.6*
Denali Borough		
Malignant Neoplasms	5	**
Colon, rectum and anus	1	**
Liver and intrahepatic bile ducts	0	0.0
Lung	2	**
Breast ^b	1	**

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Cause of Death	Deaths	Age Adjusted Rate
Prostate ^b	0	0.0
Lymphoid & hematopoietic	0	0.0
Non-hodgkin's lymphoma	0	0.0
Leukemia	0	0.0
All other lymphoid & hematopoietic	0	0.0
All other malignant neoplasms	1	**
Fairbanks North Star Borough		
Malignant Neoplasms	322	169.1
Colon, rectum and anus	26	12.6
Liver and intrahepatic bile ducts	11	5.6*
Lung	94	51.2
Breast ^b	16	15.3*
Prostate ^b	8	13.9*
Lymphoid & hematopoietic	34	20.6
Non-hodgkin's lymphoma	13	7.9*
Leukemia	12	6.7*
All other lymphoid & hematopoietic	9	6.0*
All other malignant neoplasms	133	65.4
Matanuska-Susitna Borough		
Malignant Neoplasms	400	176.9
Colon, rectum and anus	29	14.2
Liver and intrahepatic bile ducts	14	4.6*
Lung	116	51.7
Breast ^b	23	16.1
Prostate ^b	13	18.3*
Lymphoid & hematopoietic	29	14.4
Non-hodgkin's lymphoma	9	4.3*
Leukemia	16	8.1*
All other lymphoid & hematopoietic	4	**
All other malignant neoplasms	176	76.2
Kenai Peninsula Borough		
Malignant Neoplasms	266	141.7
Colon, rectum and anus	25	13.4
Liver and intrahepatic bile ducts	10	3.7*
Lung	77	39.8
Breast ^b	21	21.3
Prostate ^b	15	23.5*
Lymphoid & hematopoietic	19	10.4*
Non-hodgkin's lymphoma	10	5.4*
Leukemia	6	4.0*
All other lymphoid & hematopoietic	3	**
All other malignant neoplasms	99	53.8
Municipality of Anchorage		
Malignant Neoplasms	1082	158.3
Colon, rectum and anus	83	11.7
Liver and intrahepatic bile ducts	63	8.0

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Cause of Death	Deaths	Age Adjusted Rate
Lung	296	44.9
Breast ^b	79	20.8
Prostate ^b	39	14.2
Lymphoid & hematopoietic	236	15.3
Leukemia	90	5.9
All other lymphoid & hematopoietic	61	3.8
All other malignant neoplasms	1160	66.3

Source: ABVS, 2016

^a Age-adjusted rates are per 100,000 U.S. year 2000 standard population

* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.

**Rates based on fewer than 6 occurrences are not reported.

3.6.2. Cardiovascular Disease

Heart disease is not a single disease, but rather multiple diseases with different causes, risks, and potential interventions. Heart diseases include coronary heart disease, rheumatic heart disease, ischemic heart disease, hypertension, pulmonary heart diseases, heart failure, heart valve disease, cardiomyopathy, and other heart conditions. The most common form of heart disease is coronary heart disease (CHD), also known as coronary artery disease. CHD is the largest contributor to death from heart disease.

Modifiable risk factors for CHD include behaviors (e.g., tobacco use, physical inactivity, and improper nutrition), health status (e.g., hypertension, hyperlipidemia, overweight, or diabetes), and policies (e.g., smoking policies in restaurants and worksites; Fryar and Chen, 2012). Substantial differences in CHD death rates and preventive measures exist by race, age, sex, place of residence, and other demographic factors (Mozaffarian, 2015).

Heart disease is the second leading cause of death in Alaska. In 2015, heart disease claimed the lives of 835 Alaskans.

Among the leading causes of death in Alaska, heart disease ranked fourth in total years of potential life lost with 7,383 years lost. On average, 8.8 years of life were lost prematurely for each heart disease death.

Heart disease in Alaska declined between 2000 (213.1 deaths per 100,000 people) and 2013 (132.2 deaths per 100,000; AK-IBIS, 2016). In 2013, national rates of heart disease mortality were higher in males (206.5 per 100,000) than females (180.6 per 100,000). There is a growing disparity in heart disease mortality rates between Alaska Native and non-Native people. Alaska Native people had significantly higher rates of heart disease mortality (214.2 per 100,000) than white individuals (122.7) in Alaska in 2013 (AK-IBIS, 2016). Between 2008 and 2011, Alaska Native residents of the Interior had the highest heart disease mortality rate, exceeding the statewide rate (201.5 per 100,000 population) for all Alaska Natives by close to 40% (see Table 28). The Copper River/Prince William Sound Region had the lowest heart disease mortality rate at 104.5 per 100,000 population.

Since 2006, the crude death rate for heart disease has increased 21.1%. During this same time period the age-adjusted death rate has decreased 11.6% (ADHSS, 2015b).

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Among the potentially affected boroughs and census areas, Valdez Cordova Census Area had the highest rate of major cardiovascular disease death at 233.8 per 100,000 population (see Table 29). Between 2011 and 2013, the lowest rate occurred among residents of the Municipality of Anchorage (119.1 per 100,000 population), which was lower than the statewide rate of 189.9 deaths per 100,000 population. Heart disease was the leading cause of major cause cardiovascular disease death in all regions, with ischemic heart disease as the most common type.

Table 28. Age-Adjusted Alaska Native Heart Disease Death Rates by Potentially Affected Tribal Health Region per 100,000 by Potentially Affected Native Health Corporation Region, Alaska Natives (2012-2015)

Tribal Health Region	Number of Deaths	Age Adjusted Rate per 100,000
Arctic Slope	18	166.7
Interior	69	166.0
Anchorage/Mat-Su	178	226.1
Copper River/Prince William Sound	11	264.4
Kenai Peninsula	29	264.3
Alaska Statewide	618	208.2

Source: AN EpiCenter, 2018

Table 29. Major Cardiovascular Disease Deaths by Potentially Affected Area (2011-2013)

Cause of Death	Deaths	Age Adjusted Rate
North Slope Borough		
Major Cardiovascular Diseases	20	165.8
Heart Disease	14	84.7*
Ischemic heart disease	7	24.8*
Acute myocardial infarction	0	
Atherosclerotic cardiovascular disease	5	**
All other ischemic heart disease	2	
All other heart disease	7	60.0*
Cerebrovascular disease	5	**
All other cardiovascular diseases	1	**
Yukon-Koyukuk Census Area		
Major Cardiovascular Diseases	41	261.9
Heart Disease	35	220.2
Ischemic heart disease	23	126.0
Acute myocardial infarction	4	**
Atherosclerotic cardiovascular disease	11	52.8*
All other ischemic heart disease	8	50.4*
All other heart disease	12	94.2*
Cerebrovascular disease	6	41.7*
All other cardiovascular diseases	0	0.0
Denali Borough		
Major Cardiovascular Diseases	5	**
Heart Disease	4	**
Ischemic heart disease	4	**

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Cause of Death	Deaths	Age Adjusted Rate
Acute myocardial infarction	0	0.0
Atherosclerotic cardiovascular disease	3	**
All other ischemic heart disease	1	**
All other heart disease	0	0.0
Cerebrovascular disease	1	**
All other cardiovascular diseases	0	0.0
Fairbanks North Star Borough		
Major Cardiovascular Diseases	338	191.5
Heart Disease	242	130.1
Ischemic heart disease	139	68.0
Acute myocardial infarction	27	14.1
Atherosclerotic cardiovascular disease	55	20.5
All other ischemic heart disease	57	33.5
All other heart disease	103	62.1
Cerebrovascular disease	74	48.9
All other cardiovascular diseases	22	12.5
Matanuska-Susitna Borough		
Major Cardiovascular Diseases	355	182.2
Heart Disease	263	131.2
Ischemic heart disease	149	66.6
Acute myocardial infarction	33	14.6
Atherosclerotic cardiovascular disease	48	17.9
All other ischemic heart disease	68	34.1
All other heart disease	114	64.7
Cerebrovascular disease	68	39.6
All other cardiovascular diseases	24	11.3
Kenai Peninsula Borough		
Major Cardiovascular Diseases	296	183.7
Heart Disease	232	142.6
Ischemic heart disease	145	84.4
Acute myocardial infarction	25	14.7
Atherosclerotic cardiovascular disease	65	36.0
All other ischemic heart disease	55	33.7
All other heart disease	87	58.2
Cerebrovascular disease	45	30.6
All other cardiovascular diseases	19	10.5*
Municipality of Anchorage		
Major Cardiovascular Diseases	1067	119.1
Heart Disease	792	127.5
Ischemic heart disease	450	70.9
Acute myocardial infarction	76	13.4
Atherosclerotic cardiovascular disease	161	19.7
All other ischemic heart disease	213	37.8
All other heart disease	342	56.6
Cerebrovascular disease	208	36.9
All other cardiovascular diseases	67	11.0

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Cause of Death	Deaths	Age Adjusted Rate
Southeast Fairbanks Census Area		
Major Cardiovascular Diseases	34	206.0
Heart Disease	28	168.5
Ischemic heart disease	22	121.4
Acute myocardial infarction	0	0.0
Atherosclerotic cardiovascular disease	13	67.3*
All other ischemic heart disease	9	54.1*
All other heart disease	6	47.0*
Cerebrovascular disease	3	**
All other cardiovascular diseases	3	**
Skagway-Hoonah-Angoon Census Area		
Major Cardiovascular Diseases	15	208.0*
Heart Disease	11	160.0*
Ischemic heart disease	6	87.0*
Acute myocardial infarction	1	**
Atherosclerotic cardiovascular disease	2	**
All other ischemic heart disease	3	**
All other heart disease	5	**
Cerebrovascular disease	4	**
All other cardiovascular diseases	0	0.0
Valdez-Cordova Census Area		
Major Cardiovascular Diseases	43	233.8
Heart Disease	34	183.6
Ischemic heart disease	23	115.8
Acute myocardial infarction	5	**
Atherosclerotic cardiovascular disease	12	68.7*
All other ischemic heart disease	6	30.9*
All other heart disease	11	37.1*
Cerebrovascular disease	9	50.1*
All other cardiovascular diseases	0	0.0
Alaska Statewide		
Major Cardiovascular Diseases	2866	189.9
Heart Disease	2146	137.7
Ischemic heart disease	1225	74.3
Acute myocardial infarction	246	15.7
Atherosclerotic cardiovascular disease	450	22.6
All other ischemic heart disease	529	24.1
All other heart disease	921	63.4
Cerebrovascular disease	544	40.4
All other cardiovascular diseases	176	11.8
Source: ABVS, 2016		
^a Age-adjusted rates are per 100,000 U.S. year 2000 standard population.		
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.		
**Rates based on fewer than six occurrences are not reported.		

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3.6.3. Chronic Lower Respiratory Disease (Chronic Obstructive Pulmonary Disease)

Chronic lower respiratory disease (CLRD), or chronic obstructive pulmonary disease (COPD), is the fourth leading cause of death in Alaska. In 2015, CLRD claimed the lives of 204 Alaskans.

Among the leading causes of death in Alaska, CLRD ranked tenth in total years of potential life lost with 1,263 years lost. On average, 6.2 years of life were lost prematurely for each CLRD death.

Since 2006, the overall crude death rate for CLRD has increased 34.5%. During this same time period, the age-adjusted rate has decreased 3.1% (ADHSS, 2015b).

3.6.4. Cerebrovascular Disease (Stroke)

Cerebrovascular disease, or stroke, is the sixth leading cause of death in Alaska. In 2015, stroke claimed the lives of 178 Alaskans.

Among the leading causes of death in Alaska, cerebrovascular disease ranked ninth in years of potential life lost with 1,307 years lost. On average, 7.3 years of life were lost prematurely for each stroke death.

Since 2006, the overall crude death rate for stroke has decreased 6.6%. During this same time period, the age-adjusted rate has decreased 26.2% (ADHSS, 2015b).

3.6.5. Chronic Liver Disease & Cirrhosis

Chronic liver disease and cirrhosis is the eighth leading cause of death in Alaska. In 2015, chronic liver disease and cirrhosis claimed the lives of 113 Alaskans; 57 males and 56 females.

Among the leading causes of death in Alaska, chronic liver disease and cirrhosis ranked sixth in years of potential life lost with 2,112 years lost. On average, 18.7 years of life were lost prematurely for each chronic liver disease and cirrhosis death.

Since 2006, the overall crude death rate for chronic liver disease and cirrhosis has increased 135.4%. During this same time period, the age adjusted rate has increased 117.6%.

This is the single largest crude or age-adjusted rate increase of any leading cause of death in Alaska (ADHSS, 2015b).

3.6.6. Alzheimer's Disease

Alzheimer's disease is the ninth leading cause of death in Alaska. In 2015, Alzheimer's claimed the lives of 67 Alaskans; 18 males and 49 females.

Among the leading causes of death in Alaska, Alzheimer's disease ranked 31st in terms of potential life lost with 27 years lost. On average, 0.4 years of life were lost prematurely for each Alzheimer's disease death.

Since 2006, the crude death rate for Alzheimer's disease has decreased 15.7%. During this same time period, the age-adjusted rate has decreased 37.5% (ADHSS, 2015b).

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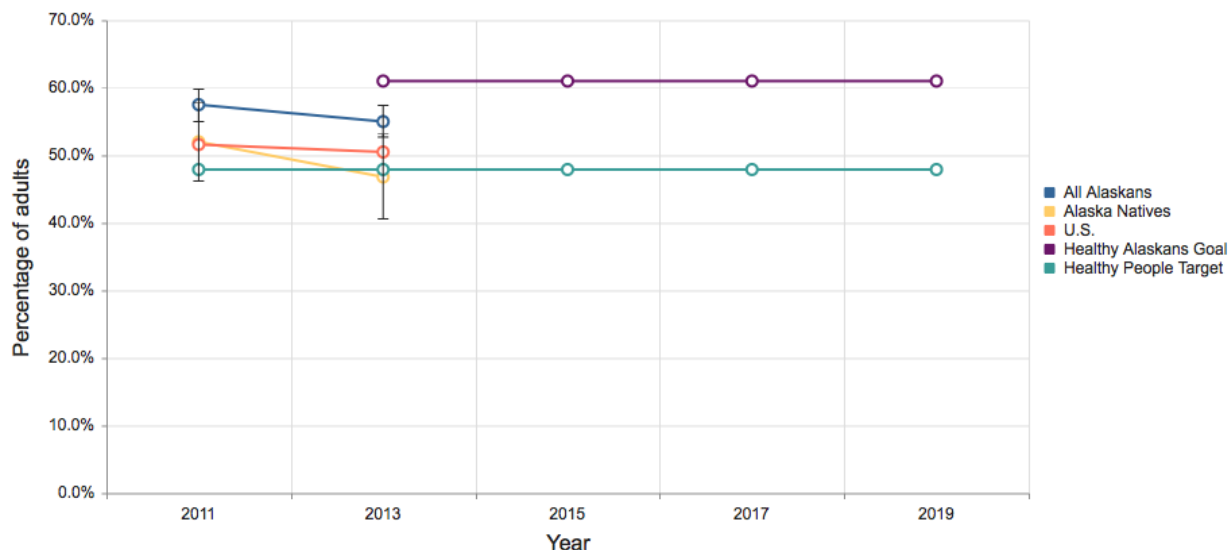
3.6.7. Physical Activity Levels

Consistent physical activity is an important indicator of future non-communicable diseases risk, particularly cardiovascular disease risk. Moderate physical activity is defined as some activity that causes an increase in breathing or heart rate (30 or more minutes a day, 5 or more days per week). Vigorous physical activity is defined as some activity that causes a large increase in breathing or heart rate (20 or more minutes a day, 3 times or more a week).

The HA2020 goal for physical activity is to increase the percentage of adults (age 18 years and older) who meet the 2008 U.S. Department of Health and Human Services Physical Activity Guidelines (150 minutes or more total minutes per week of moderate or vigorous exercise) to 61% by 2020. Figure 26 shows the percentage of adults getting the recommended amount of aerobic physical activity. In 2013, 55.0% of all Alaskans reported getting the recommended amount of physical activity, while 46.8% of Native Alaskans reported the same. The percentage of all adults nationally who reported getting the recommended amount of physical activity in 2013 was 50.5%.

Table 30 provides the percentage of people who had reported participating in any physical activities or exercises, such as running, calisthenics, golf, gardening, or walking for exercise, other than for their job for each potentially affected region. The highest percentage of people residing in Hoonah-Angoon Census Area answered yes to this question (92.7%), followed by the Municipality of Anchorage (80.9%). The lowest percent of people living in the NSB reported leisure time physical activity.

Figure 26. Percent of Adults (18+) Who Report Getting the Recommended Amount of Aerobic Physical Activity, all Alaskans, Alaska Natives, and the U.S. (2011-2019)



Source: ADHSS, Section of Chronic Disease Prevention and Health Promotion (DPH), 2018; National Center for Chronic Disease Prevention and Health Promotion, 2018

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Table 30. Leisure Time Physical Activity Rates by Potentially Affected Region (2011-2013)

Census Area	Number	Age-Adjusted Prevalence
North Slope Borough	265	66.0%
Yukon-Koyukuk Census Area	460	74.2%
Fairbanks North Star Borough	2,816	79.1%
Denali Borough	155	77.4%
Matanuska-Susitna Borough	2,366	76.9%
Kenai Peninsula Borough	1,986	75.1%
Municipality of Anchorage	3,474	80.9%
Southeast Fairbanks Census Area	431	76.8%
Hoonah-Angoon Census Area	93	92.7%
Valdez-Cordova Census Area	411	76.6%
Alaska Statewide		
Source: BRFSS, 2016		

3.6.8. Obesity and Overweight

Obesity and overweight are terms that define an accumulation of fat that is greater than what is considered healthy. Being overweight or obese increases the risk of diabetes, diseases of the heart (mainly stroke and heart disease), cancer, and even death (WHO, 2014).

The prevalence of obesity and overweight in the U.S. is significantly higher today as compared to previous decades, in all age groups. One of the largest changes has been an increase in the number of Americans in the obese category. In the 1970s, the prevalence of obesity was 5% for children between the ages of 2 and 5 years, 4% for children ages 6 to 11 years, 6% for adolescents ages 12 to 19 years, and 15% for adults. By 2008, the prevalence of obesity had reached 10% for children 2 to 5 years, 20% for children 6 to 11 years, 18% for adolescents 12 to 19 years, and 34% for adults. In the early 1990s, no state had an adult obesity prevalence rate of more than 25%. Since 2008, 32 states have an adult obesity rate more than 25% (USDHHS, 2015). Obesity increases the risk of Type 2 diabetes, heart disease, high blood pressure, stroke gallbladder disease, osteoarthritis, sleep apnea, respiratory problems, and some types of cancer. It also adversely effects physical performance, life expectancy, and quality of life. The current generation of children is predicted to have a shorter lifespan than their parents due to obesity (Olshansky et al., 2005).

Body mass index (BMI) is a commonly used indicator of obesity and overweight status. Current BMI assessment requires that height and weight be collected within the last 5 years or if over age 50, within the last 2 years. Children must have been assessed within the last year. These terms are defined as:

- Overweight (adults 19 – 74 years): Persons who have a current BMI assessment with a BMI of 25 to 29.9.
- Obese (adults 19 – 74 years): Persons who have a current BMI assessment with a BMI of 30 or greater.
- Overweight (children 18 and younger): Persons who have a current BMI assessment with a BMI greater than or equal to the 85th percentile using age-specific growth charts are considered ‘at risk of overweight’.

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- **Obese (children 18 years and younger):** Persons who have a current BMI assessment with a BMI greater than or equal to the 95th percentile using age-specific growth charts are considered obese.

In 2014, the prevalence of obesity and overweight among all Alaskan adults (ages 18 and over) was 29.7% and 36.5%, similar to the national prevalence, 29.6% and 35.4%, respectively (AK-IBIS, 2016). Obesity and overweight prevalence among Alaskans adolescents (students in grades 9-12 in traditional schools) was 14.0% and 16.7% and among children (grades K-8), 17.3% and 16.7%, respectively. Between 2011 and 2013, the NSB had the highest prevalence of obesity at 39.9%, while Denali Borough had the lowest at 19.9% (see Table 31). Hoonah-Angoon Census Area had the highest percentage of overweight adults at 49.5%. The percentage of overweight adults was similar across other potentially affected regions.

Table 31. Age-adjusted Prevalence of Obesity and Overweight Residents by Age Group and Potentially Affected Area, (2011-2013)

Census Area	Obesity	Overweight
	Age-adjusted Prevalence/ All Alaskan Adults	Age-adjusted Prevalence/ All Alaskan Adults
North Slope Borough	39.9%	37.9%
Yukon-Koyukuk Census Area	27.5%	38.2%
Fairbanks North Star Borough	26.9%	36.0%
Denali Borough	19.9%	41.8%
Matanuska-Susitna Borough	28.3%	38.4%
Kenai Peninsula Borough	28.0%	39.6%
Municipality of Anchorage	29.0%	36.8%
Southeast Fairbanks Census Area	27.7%	39.0%
Hoonah-Angoon Census Area	28.9%	49.5%
Valdez-Cordova Census Area	27.6%	39.2%
Alaska Statewide		
Source: BRFSS, 2016		

3.6.9. Cerebrovascular Disease (Stroke) Deaths

Cerebrovascular disease, or stroke, is the sixth leading cause of death in Alaska. In 2015, stroke claimed the lives of 178 Alaskans.

Among the leading causes of death in Alaska, cerebrovascular disease ranked ninth in years of potential life lost with 1,307 years lost. On average, 7.3 years of life were lost prematurely for each stroke death.

Since 2006, the overall crude death rate for stroke has decreased 6.6%. During this same time period, the age-adjusted rate has decreased 26.2% (ADHSS, 2015b).

3.6.10. Diabetes Mellitus Deaths

Diabetes mellitus is a metabolic disease characterized by high blood sugar levels, which result from defects in insulin secretion, insulin resistance, or both. Diabetes occurs when sugars stays in the bloodstream rather than going into the muscle and fat cells. There are two types of diabetes: Type 1 and Type 2. Type

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2 is the most common type of diabetes and is considered a preventable illness. Uncontrolled diabetes can have serious medical consequences including eye disease, dysfunction of circulation and sensation in the hands and feet, cardiovascular diseases, and ultimately, death. As both a risk factor for many diseases and a serious medical condition needing treatment itself, diabetes is an extremely serious public health challenge with tremendous population health impacts.

Diabetes has reached epidemic proportions in the U.S. According to the CDC, the number of Americans diagnosed with diabetes has more than tripled, from 5.6 million in 1980 to 20.9 million in 2011 (Seaquist, 2012). Currently, the CDC estimates that one in three persons will develop diabetes during their lifetime (CDC, 2015).

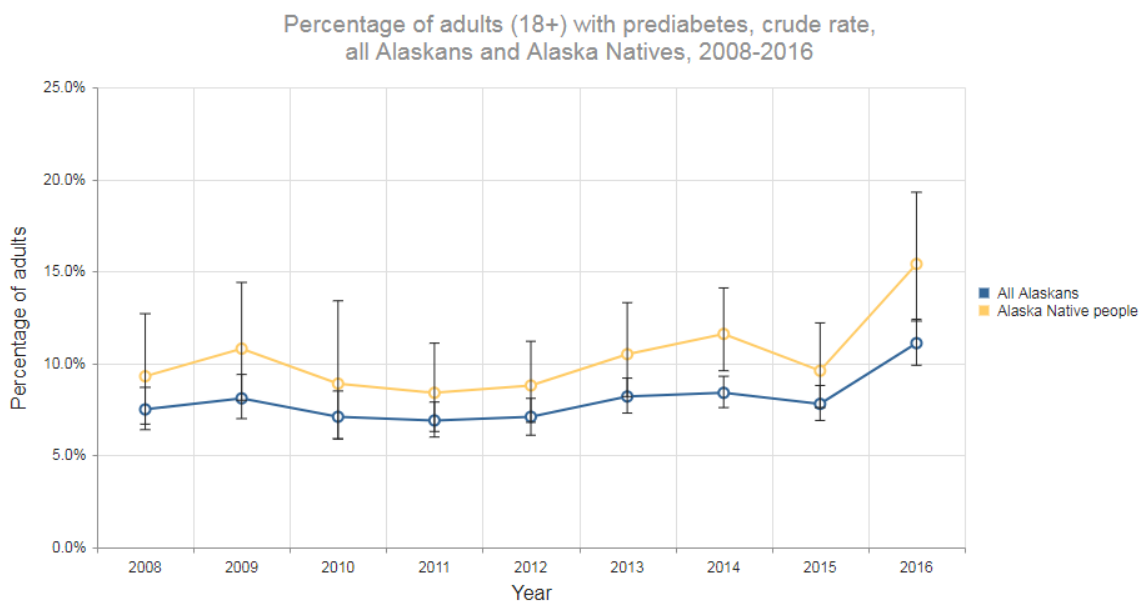
The prevalence of diabetes has steadily increased, both nationally and in Alaska due to: increasing rates of obesity and sedentary lifestyles; as well as while improvements in medical care, which has extended the lifetime of people living with diabetes. The percentage of adults with diabetes in Alaska is lower than that for the U.S. (Figure 27). As of 2012, only 39.2% of individuals with a diagnosis of diabetes in Alaska saw a health care professional for their diabetes (AK-IBIS, 2016).

Diabetes is the seventh leading cause of death in Alaska. In 2015, diabetes claimed the lives of 140 Alaskans: 91 males and 49 females.

Among the leading causes of death in Alaska, diabetes ranked 11th in terms of potential life lost with 1,236 years lost. On average, 8.8 years of life were lost prematurely for each diabetes death.

Since 2006, the crude rate of deaths due to Diabetes Mellitus has increased 17.3%. During this same time period, the age-adjusted rate has decreased 12.9% (ADHSS, 2015b).

Figure 27. Percentage of Adults (18+) with Diabetes, Crude Rate, all Alaskans, Alaska Natives, and U.S. (1991-2014)



Source: AK-IBIS, 2016

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Table 32 shows the prevalence and death rate due to diabetes among potentially affected regions. Skagway Municipality had the highest prevalence of diabetes (9.7%), while Valdez-Cordova Census Area had the lowest (5.6%). Southeast Fairbanks Census Area (33.2 per 100,000 population) had the highest rate of diabetes death, exceeding the statewide rate of 19.4 per 100,000 population; however, this rate was based on fewer than 20 occurrences and is, therefore, not statistically reliable. The Municipality of Anchorage (22.2%) had the highest diabetes death rate, which was based on more than 20 occurrences, slightly above the statewide rate. FNSB had the lowest rate of death due to diabetes at 13.0 per 100,000 population.

Table 32. Age-adjusted Diabetes Prevalence and Deaths due to Diabetes by Potentially Affected Area, (2011-2013)

Census Area	Age-adjusted Diabetes Prevalence/All Alaskan Adults	Number of Diabetes Deaths	Age-adjusted Diabetes Death Rate/All Alaskans
North Slope Borough	7.5%	2	**
Yukon-Koyukuk Census Area	6.7%	4	**
Fairbanks North Star Borough	6.6%	26	13.0
Denali Borough	7.3%	1	**
Matanuska-Susitna Borough	7.8%	43	18.5
Kenai Peninsula Borough	6.9%	33	17.8
Municipality of Anchorage	8.2%	140	22.2
Southeast Fairbanks Census Area	7.3%	7	33.2*
Skagway Municipality	9.7%	ND	ND
Skagway-Hoonah-Angoon	ND	3	**
Valdez-Cordova Census Area	5.6%	6	24.6*
Alaska Statewide	ND	324	19.4
Source: BRFSS, 2016; ABVS, 2016			
^a Age-adjusted rates are per 100,000 U.S. year 2000 standard population.			
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.			
**Rates based on fewer than 6 occurrences are not reported.			
ND: Not determined			

3.6.11. Chronic Lower Respiratory Diseases

CLRD includes asthma, COPD, bronchitis, and emphysema. In 2014, this suite of diseases was the fourth leading cause of death in Alaska and in the U.S. Between 2011 and 2013, the highest rate (statistically reliable) of death due to chronic respiratory disease occurred among MSB residents (50.0 per 100,000 population). The lowest rate occurred in Denali Borough where there were no deaths related to CLRD. Rates across other potentially affected regions were relatively similar to the statewide rate of 39.4 per 100,000 population (see Table 33).

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Table 33. Age-adjusted Chronic Lower Respiratory Disease Death Rate by Potentially Affected Area and Statewide (2011-2013)

Borough/Census Area	Number of Deaths	Age-adjusted Rate
North Slope Borough	10	117.3*
Yukon-Koyukuk Census Area	5	**
Fairbanks North Star Borough	66	40.0
Denali Borough	0	0.0
Matanuska-Susitna Borough	87	50.0
Kenai Peninsula Borough	67	37.7
Municipality of Anchorage	215	35.0
Southeast Fairbanks Census Area	7	39.5*
Skagway-Hoonah-Angoon Census Area	2	**
Valdez-Cordova Census Area	6	27.0*
Alaska Statewide	579	39.4
Source: ABVS, 2016		

3.6.12. Chronic Obstructive Pulmonary Disease

COPD refers to a group of lung diseases that block airflow and make breathing difficult. Risk factors include tobacco smoking, underlying asthma plus smoking, age, genetics and chronic exposure to chemical fumes, vapors, and dusts (Mayo Clinic, 2014). COPD mortality includes deaths from bronchitis, emphysema, and other CLRDs excluding asthma.

There is significant disparity in rates of COPD mortality between Alaska Natives and Non-Natives. During 2008-2011, Alaska Native people experienced a COPD mortality rate 1.9 times higher than non-Natives and 1.6 times higher than U.S. Whites ($p < 0.01$; see Figure 28). The highest (statistically reliable) COPD mortality rate occurred in the Interior Tribal Health Region at 137.9 per 100,000 population, while the lowest occurred in Anchorage/Mat-Su (62.7 per 100,000 population; see Table 34). The statewide COPD mortality rate among Alaska Natives for this time period was 73.5 per 100,000 population.

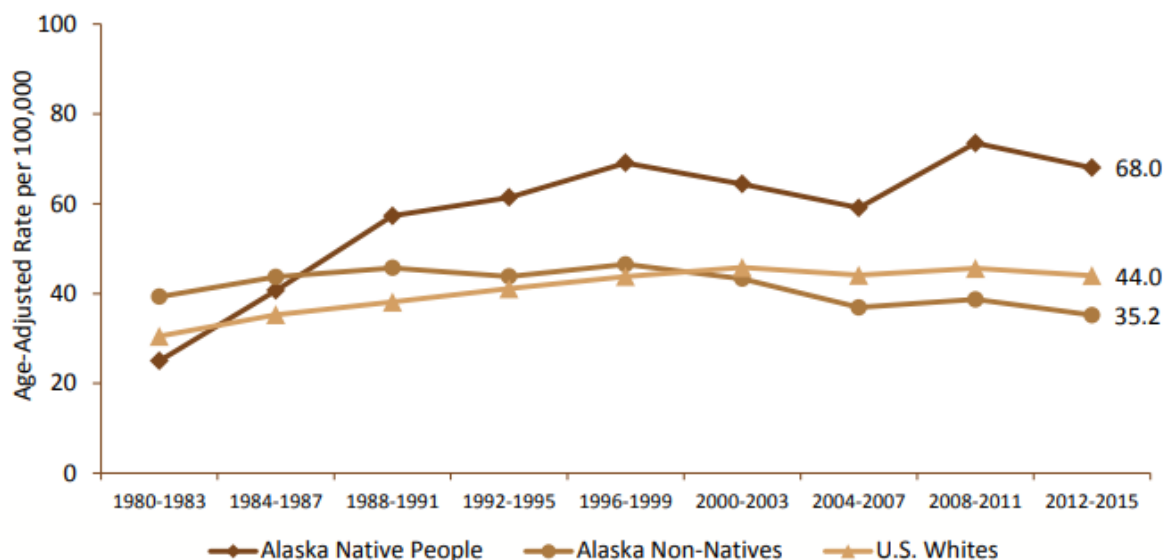
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Figure 28. Average Annual Age-Adjusted COPD Mortality Rates per 100,000 Population (1980-2015)

Age-Adjusted COPD Mortality Rate per 100,000 Population, 1980-2015

Data Source: Alaska Health Analytics and Vital Records Section; Centers for Disease Control and Prevention, National Center for Health Statistics.

Note: U.S. Whites data are for 2012-2014.



Source: AN EpiCenter, 2018

Table 34. Average Annual Age-Adjusted COPD Mortality Rates per 100,000 Population by Tribal Health Region, Alaska Native People (2008-2011)

Tribal Health Region	Number of Deaths	Rate
Arctic Slope	10	113.9
Interior	27	74.9
Kenai Peninsula	8	56.3
Anchorage/Mat-Su	45	61.2
Statewide	183	68.0

Source: AN EpiCenter, 2017

Note: Rates based on fewer than 20 cases are not statistically reliable and should be used with caution. Number and rate not reported for less than five cases.

3.6.13. Mental Health

Mental health, or behavioral health, is increasingly considered a critical component of overall health and is linked to physical health and well-being for people at all ages. Mental health was recognized in the U.S. Surgeon General's 1999 report as being fundamental to overall health (U.S. Office of the Surgeon General, 1990). Evidence has shown that mental disorders are strongly related to the occurrence, successful treatment, and course of many chronic diseases including diabetes, cancer, cardiovascular disease, asthma, and obesity, as well as many risk behaviors for chronic disease, including physical inactivity, smoking, excessive drinking, and insufficient sleep (AK-IBIS, 2016). In teens, depression can lead to poor grades at school, alcohol or drug use, and unsafe sex. Research has demonstrated that mental health issues have been the most commonly identified precipitating circumstance in suicides.

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The HA2020 goal for mental health is reduce the mean number of days in the past 30 days that adults (age 18 and older) report being mentally unhealthy to 2.9 days by 2020. In 2014, the mean number of mentally unhealthy days was 3.1 for all Alaskans and 3.0 for Alaska Native people (AK-IBIS, 2016). Females reported a higher number of mentally unhealthy days (3.6) as compared to males (2.6) in 2014. Overall, people over the age of 65 reported fewer mentally unhealthy days than most younger age groups. Alaska Native people reported significantly more mentally unhealthy days during the past 30 days (3.7) than White individuals (3.0; AK-IBIS).

Results from the 2015 YRBS found both short-term and longer-term trends show an increase in the percentage of students feeling sad or hopeless (33.6% in 2015). There has also been an increase in the percentage of students who say they feel alone (24.8% in 2015; YRBS, 2016). Between 2013 and 2015, there was also an increase in the percentage of students who had seriously considered suicide (20.1% in 2015). There were no significant long-term or recent changes in the percentages of students planning (16.7% in 2015) or making a suicide attempt (10.7% in 2015) (YRBS, 2016).

3.7. Health Effect Category 7: Water and Sanitation

The lack of clean running water and proper sewage disposal is a leading cause of preventable disease in rural Alaska villages. Respiratory, gastrointestinal, and skin diseases are common in areas without safe water supplies. Many Alaska villages continue to lack adequate sources of water that are safe to drink and facilities that can safely dispose of their wastewater. Hennessy et al. (2008) found that regions with a lower proportion of home water service had significantly higher hospitalization rates for pneumonia and influenza (rate ratio [RR] = 2.5), skin or soft tissue infection (RR = 1.9), and respiratory syncytial virus (RR = 3.4 among those younger than 5 years) than did higher-service regions. Within one region, infants from villages with less than 10% of homes served had higher hospitalization rates for pneumonia (RR = 1.3) and respiratory syncytial virus (RR = 1.2) than did infants from villages with more than 80% served. Outpatient *Staphylococcus aureus* infections (RR = 5.1, all ages) and skin infection hospitalizations (RR = 2.7, all ages) were higher in low-service than in high-service villages.

A “served” community is one in which more than 55% of homes are served by a piped, septic tank and well, or covered haul system. An “unserved” community is one in which 55% or less of homes are served by a piped, septic and well, or covered haul system (ADEC, 2016). The number of occupied houses in the “unserved” communities ranges from 12 to 193 with an average of four people per household. There are currently more than 3,300 year-round occupied rural Alaska homes that lack running water and flushing toilets (2,300 homes in 47 “unserved” communities and 1,000 homes in served communities).

Water in sewer systems in rural Alaska primarily consist of the following:

- **Public laundry facilities and central watering points** – Treated drinking water is delivered to a single service connection and people must use their own containers to collect drinking water. These systems do not provide drinking water to homes or wastewater removal from homes.
- **Individual wells and septic systems** – Due to soil conditions (e.g. permafrost), these systems are not feasible in many parts of the State. Where they are used drinking water wells and septic

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systems often do not meet the minimum separation distances for safety. Wells can become contaminated with inadequately treated sewage.

- **Water and sewer truck or trailer haul systems** – Because this type of service is costly, homeowners will often self-limit water use, and therefore, do not realize many of the health benefits associated with household running water and sanitary sewage removal.
- **Piped water and sewer systems** – This type of service provides centralized treatment, storage and piped distribution directly to homes (ADEC, 2016).

More than 700 homes are served by operation-intensive haul systems. There are approximately 4,500 rural homes connected to community-wide piped systems that have surpassed or are nearing the end of their design life. The ADEC, Division of Water recognizes that conventional, community-wide piped systems and truck haul systems are increasingly expensive to construct, maintain, and replace (ADEC, 2016). An increasing number of communities cannot afford the high operation and maintenance costs associated with piped or haul systems. The monthly user cost for operating these systems often exceeds 5% of total monthly household income in many villages (as compared to 1 – 2% of monthly household income in most urban areas). In response to this public health challenge, the ADEC, in partnership with a multi-agency steering committee (consisting of experts in various fields related to water and wastewater), is developing a decentralized approach to provide small scale treatment at each home, avoiding the need to pipe water from a central source to multiple homes and collect sewer from homes and pipe to a disposal site (ADEC, 2016).

Proper disposal of solid waste is also important to human and animal health. Improper dumping and poorly designed landfills can contaminate water supplies, attract wildlife foraging, create unpleasant odors, and allow litter to be blown over surrounding land. ADEC regulates and permits landfills in rural and urban areas.

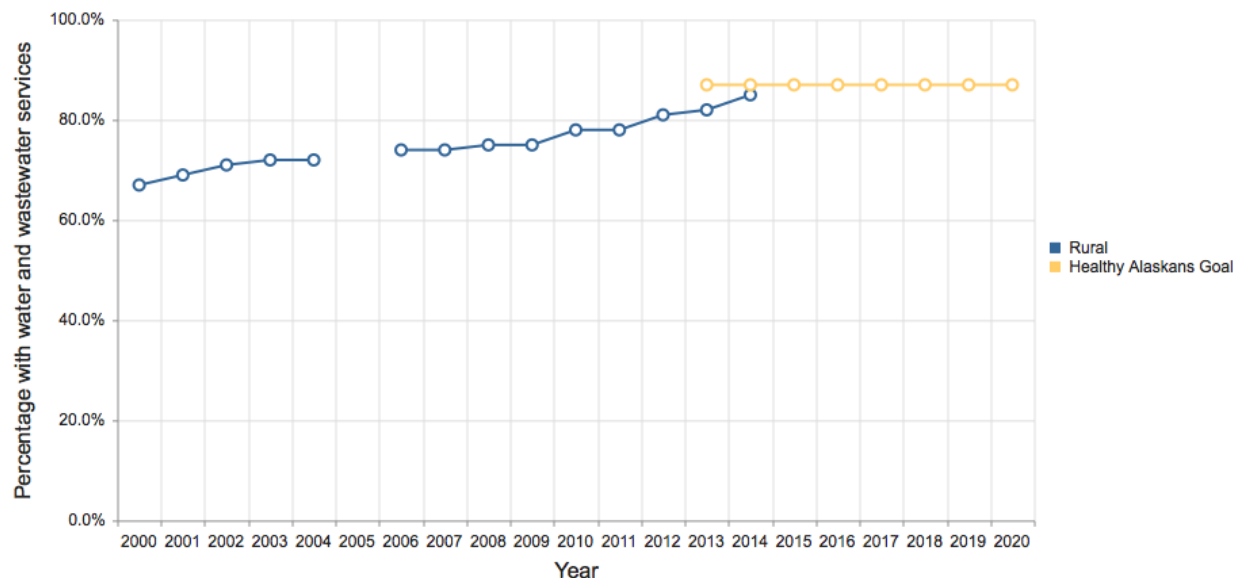
3.7.1. Water and Sanitation Facilities and Services within Potentially Affected Communities

See Resource Report No. 2, Sections 2.2 and 2.3, for water resources baseline conditions.

Despite major improvements in recent decades, Alaska still lags behind other states in having basic sanitation services. Table 35 provides the water and sanitation services available in the PACs. In 2014, 85.0% of rural community housing units statewide had water and sewer services, falling short of the HA2020 goal of 87.0% (Figure 29).

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Figure 29. Percentage of Rural Community Housing Units with Water and Sewer Services, Rural Alaska (2000-2020)



Source: AK-IBIS, 2016

Table 35. Water and Sanitation Services, Potentially Affected Communities

Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
North Slope Borough				
Prudhoe Bay	NSB operates a Class I ADEC permitted landfill located northwest of Deadhorse on Oxbow Road	Three wastewater collection and treatment systems serving a total of approximately 2,000 people. Two are owned and operated by BP Exploration (Alaska) Inc., one by NSB	In November 2015, NSB opened a new processing facility off the Sag River Road in Prudhoe Bay for water, wastewater, and sewage	NA
Yukon-Koyukuk Census Area				
Bettles	Use landfill in Evansville	ND	ND	NA
Coldfoot	Use Fairbanks North Star Borough South Cushman Landfill	ND	ND	NA
Evansville	ADEC Class III permitted landfill located in Evansville Village operated by the Village	ND	ND	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Livengood	Use Fairbanks North Star Borough South Cushman Landfill	ND	ND	ND
Manley Hot Springs	ADEC Class I permitted landfill operated by the Manley Hot Springs Community Association	ND	ND	ND
Minto	ADEC Class III permitted landfill operated by the Native Village of Minto	ND	ND	ND
Nenana	Refuse is collected by a private firm and hauled to the new Denali Borough regional landfill, located south of Anderson	A piped gravity system collects sewage, which is treated at a secondary treatment plant	Close to 100% of residents have treated, fluoridated water piped to their homes There are 226 connections serving 432 people	ND
Wiseman	Use Fairbanks North Star Borough South Cushman Landfill			ND
Fairbanks North Star Borough				
Fairbanks City	Fairbanks North Star Borough South Cushman Landfill is an ADEC Class I permitted landfill serving number of communities in the region	2 wastewater collection and treatment systems (CUC and GHU) operated by Golden Heart Utilities serving a total of 41,182 people with 8,431 connections	The GHU water treatment and distribution system serves 77,535 people with 6,415 connections	NA
Denali Borough				
Anderson	Use Denali Borough Denali Borough operates an ADEC Class III permitted landfill located on the Parks Highway outside of Anderson serving a number of communities in the area	ND	ND	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Cantwell	Use Denali Borough landfill	ND	ND	ND
Healy	Use Denali Borough landfill	ND	ND	ND
McKinley Park	Use Denali Borough landfill	ND	ND	ND
Matanuska-Susitna Borough				
Big Lake	Use Palmer Matanuska-Susitna Borough landfill	ND	ND	ND
Houston	Use Palmer Matanuska-Susitna Borough landfill	ND	ND	ND
Knik-Fairview	Use Palmer Matanuska-Susitna Borough	ND	ND	ND
Palmer	ADEC permitted landfill is operated by Matanuska-Susitna Borough	ND	ND	ND
Point MacKenzie	Use Palmer Matanuska-Susitna Borough landfill	ND	ND	ND
Skwentna	Matanuska-Susitna Borough operates an ADEC permitted Class III landfill	ND	ND	ND
Talkeetna	Use Palmer Matanuska-Susitna Borough landfill	Mat-Su Borough operates a wastewater collection and treatment system serving 450 residents with 215 connections	Mat-Su Borough operates a water treatment and distribution system serving 1,100 people	NA
Trapper Creek	Use Palmer Matanuska-Susitna Borough landfill	ND	ND	ND
Wasilla	Use Palmer Matanuska-Susitna Borough landfill	City of Wasilla operates a wastewater collection and treatment system serving 2,685 people with 895 connections	City of Wasilla operates a water treatment and distribution system with 848 connections, serving 18,222 people regionally	
Willow	Use Palmer Matanuska-Susitna Borough landfill	ND	ND	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Kenai Peninsula Borough	Soldotna Kenai Peninsula Borough Central Landfill (operated by the borough) is located three miles south of the Kenai River bridge in Soldotna. Landfill accepts waste from all communities on Kenai Peninsula except Seldovia, Nanwalek, and Port Graham, which each have their own landfills	ND	ND	ND
Anchor Point	Anchor Point Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	ND	Anchor Point Water Treatment System serves 348 people	ND
Beluga	The Kenai Peninsula Borough operates a landfill in Beluga	ND	Water is supplied by three deep wells and is piped to 75% of households	ND
Clam Gulch	Use Soldotna Kenai Peninsula Borough Central Landfill	ND	ND	ND
Cohoe	Use Soldotna Kenai Peninsula Borough Central Landfill	ND	ND	ND
Cooper Landing	Locally use Cooper Landing Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	ND		NA

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Happy Valley	Use Soldotna Kenai Peninsula Borough Central Landfill or Anchor Point Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	ND	ND	ND
Homer	Locally use Homer Baling/Landfill Facility or McNeil Canyon Transfer Site	ND	ND	ND
Soldotna Kenai Peninsula Borough Central Landfill.	City of Homer operates a wastewater treatment and collection system serving 5,400 people with 1,500 connections	City of Homer operates a water treatment and distribution system serving 6,008 people	NA	ND
Kalifornsky	Use Soldotna Kenai Peninsula Borough Central Landfill	ND	ND	ND
Kasilof	Locally use Kasilof Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	ND	ND	NA
Kenai	Locally use Kenai Transfer Facility	City of Kenai operates a wastewater collection and treatment system serving 5,380 people with 1,793 connections	City of Kenai operates a water distribution system serving 5,375 people	ND
Moose Pass	Locally use Crown Point Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	Individual septic	Private wells	NA

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Nikiski	Locally use Nikiski Transfer Facility; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	Individual septic	Private wells	NA
Ninilchik	Locally use Ninilchik Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	Individual septic	Private wells	NA
Salamatof	Use Soldotna Kenai Peninsula Borough Central Landfill or Kenai Transfer Site	Individual septic	Private wells	
Seward	Locally use Seward Transfer Facility; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	City of Seward operates a wastewater collection and treatment system serving 2,830 with 750 connections	City of Seward operates a water distribution system serving 4,000 people	NA
Soldotna	Use Soldotna Kenai Peninsula Borough Central Landfill	City of Soldotna operates a wastewater treatment and collection system serving 3,800 people with 1,300 connections	City of Soldotna water serves distribution system 4,307 people	NA
Sterling	Locally use Sterling Transfer Facility; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill	Individual septic	Private wells	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Tyonek	Kenai Peninsula Borough operates a landfill 2 miles northwest of the Village	A piped water and sewer system serves the entire community of approximately 50 homes (many used seasonally) and community facilities. Water is derived from Second Lake and is treated and stored in a 175,000-gallon tank. Back-up water supplies are available from a lake near the airport. All occupied homes are fully plumbed. A small coin-operated self-laundry service with one washer and dryer is available	ND	ND
Municipality of Anchorage	Anchorage Municipality operates a Class I ADEC permitted landfill located south of Eagle River, on West Hiland Road off the Glenn Highway	Anchorage Municipality operates 2 wastewater collection systems and 1 and wastewater treatment facility serving a total of 23,186 people	Anchorage Municipality operates a water distribution system with 85,146 service connections	NA
Southeast Fairbanks Census Area				
Big Delta	Use Delta Junction landfill	ND	ND	ND
Delta Junction	ADEC permitted Class II landfill located at Milepost 257.2 Richardson Highway, 7 miles south of Delta Junction	ND	ND	ND
Dot Lake Village	Village operates a Class III ADEC permitted landfill	ND	ND	ND
Dry Creek	Village operates a Class III ADEC permitted landfill 1 miles south from Alaska Hwy	ND	ND	ND
Tanacross	Village operates a Class III ADEC permitted landfill	ND	ND	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Tok	JD Refuse Services operates a Class III ADEC located at mile 120.5 Glenn Highway	ND	ND	ND
Tetlin	Village operates a Class III ADEC permitted landfill	ND	ND	ND
Northway Junction	Uses Northway Village landfill located 2 miles southeast of the community	ND	ND	ND
Northway Village	Village operates a Class III ADEC permitted landfill	ND	ND	ND
Alcan Border	Uses Tok landfill	ND	ND	ND
Municipality of Skagway Borough	Municipality operates an incineration plant and Class III ADEC permitted landfill located over 4 miles north of town on the Klondike Hwy	ND	ND	ND
Valdez-Cordova Census Area				
Chistochina	The local landfill is closed pending clean-up and relocation to a new site. Use landfill in Glennallen	Some residents use individual septic tanks, however, the majority have outhouses or pit privies. Approximately 40% of homes are completely plumbed	Nearly half of residences have individual wells; the remainder haul treated water from the community center	ND
Copper Center	Refuse collection services are available from Copper Basin Sanitation, which hauls waste to the Glennallen landfill	The majority of homes use individual water wells and septic tanks. Others haul treated well water from a site operated by Copper Center Safe Water. A private Glennallen firm delivers water to home storage tanks for a fee. The school operates its own well-water system. 75% of homes are fully plumbed	ND	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unservd Rural Community
Gakona	Refuse collection services are available from Copper Basin Sanitation, which hauls waste to the Glennallen landfill	All residences have individual wells and septic systems and complete plumbing. The school uses its own well-water system	ND	ND
Glennallen	Copper Basin Sanitation Company operates a Class II ADEC permitted landfill located at Milepost 122.5 of the Richardson Highway. Accepts waste from Slana, Chitina, Copper Center, Paxson, Melchina, Mendeltna, Tolsina, Gulkana, Gakona, and Tazlina	All year-round homes are fully plumbed. The majority of downtown is connected to a piped sewage system operated by The Glennallen Improvement Corporation. The sewage system serves 52 homes and businesses. Most residences have individual septic tank systems, but permafrost and high water tables cause drainage failures	Although most residents have private wells in the Glennallen area, the water is often of very poor quality. Glennallen Heights utilizes two wells to serve a piped system, and a local private business delivers water by truck to fill home water tanks	ND
Gulkana	Refuse collection services are available from Copper Basin Sanitation, which hauls waste to the Glennallen landfill.	Village operates a Class II water treatment facility serving 83 people via haul system. Water is currently derived from a well, treated, and stored in a 100,000-gallon tank. A piped water and sewer system serves most homes. A community septic tank treats wastewater. Individual septic tanks are also used by a few residences. Permafrost and high water tables are problematic in this region.	ND	ND
Mentasta Lake	Use Tok landfill	Nearly half of homes have individual wells and septic tanks and are fully plumbed. Privies are used by most residents.	Mentasa Washeteria/14 plex water system serves untreated water to approximately 90 people via haul system (Washeteria)	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Paxson	Garbage collection is provided monthly by Copper Basin Sanitation, and then hauled to the Glennallen landfill	Individual wells and septic tanks are used by residents. Public water sources are available for hauling. More than half of all homes are completely plumbed.	ND	ND
Slana	Use landfill in Glennallen	Outhouses, honeybuckets, and septic systems are used for sewage disposal. Approximately one-third of the homes have complete plumbing.	Individual wells are the primary source of water in Slana; others draw water from Rufus Creek. The schools operate individual wells.	ND
Tazlina	Copper River Native Association (CRNA) members haul trash to local dumps in the Village and the Council pays for the sanitation company to pick it up.	Copper River Sanitation located in Tazlina, provides septic services/collection and household and business garbage collection services for the whole region. Individual village councils cover the cost of these services for their members. Occupied houses are fully plumbed.	The new CRNA Robert Marshall Bldg. has a water treatment plant and there is a program, which provides elderly and single mother beneficiaries with free drinking water delivery. Others purchase drinking water from local meter cheaply. Well water is largely undrinkable due to the geology.	ND
Tonsina	Use landfill in Glennallen	ND	ND	ND
Valdez	City of Valdez operates a Class II ADEC permitted landfill located at mile 0.6 on the Valdez Glacier Road that utilizes a balefill system.	City of Valdez operates a waste water collection	ND	ND

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Capable of processing 1.25 million gallons a day, which serves 3,800 people with 1,103 connections. Sewage is deposited in a secondary treatment lagoon. Over 95% of homes are fully plumbed.	City of Valdez operates 3 water treatment and distribution systems with a total of 1,346 service connections.	ND	ND	ND
Water is derived from four primary wells and is stored in five 750,000-gallon reservoirs prior to piped distribution throughout Valdez (City). Water storage capacity is 2.24 million gallons.	NA	ND	ND	ND
Whittier	Use Anchorage Municipality landfill.	The City of Whittier operates a small, untreated water distribution system serving 650 people.	ND	NA
Adak	City of Adak operates a Class III ADEC permitted landfill.	The City of Adak operates a small, untreated water system serving 220 people.	ND	ND
Nome Census Area	City of Nome operates a Class II ADEC permitted landfill.	City of Nome operates a wastewater collection and treatment system serving 3,400 with 1,250 connections.	City of Nome operates a Class I water treatment and distribution system serving 3,930.	ND
Unalaska	City of Unalaska operates a Class I ADEC permitted landfill.	City of Unalaska operates a wastewater collection and treatment system serving 4,300 people with 526 connections.	City of Unalaska operates a water treatment and distribution system serving 9,200 people with 553 connections.	NA

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Location	Solid Waste	Sewer	Water Treatment and Distribution	Unserved Rural Community
Source: Alaska Department of Commerce, 2016 ADHSS, YEAR 2015b??? Copper River Knowledge System, 2016 Notes: "Untreated" designation means that no treatment chemicals are added to the water. Passive forms of treatment may be used to treat water at a small treated system. Examples of passive treatment include the use of cartridge filters, UV disinfection, or water softeners. Membrane filtration is not considered passive treated. Small systems treating with membrane filtration, chemically aided filtration, or multiple chemicals are classified as water treatment systems. NA: Not applicable ND: Data not available				

3.7.2. Community Water Fluoridation

Community water fluoridation is the controlled adjustment of fluoride in a public water supply to optimal concentration prevent dental caries among members of the community. Fluoride impedes demineralization enhances remineralization of dental enamel, both of which prevent dental caries. While fluoride occurs naturally in water across the U.S., it is usually lower than the optimal concentration needed to prevent dental caries. The optimal concentration of fluoride in drinking water is the concentration that provides the best balance of protection from dental caries while limiting the risk of dental fluorosis (Truman et al., 2002). The USDHHS recommends an optimal water fluoridation concentration of water fluoridation concentration of 0.7 milligrams per liter (CDC, 2015).

The CDC recognizes community water fluoridation as one of ten significant public health achievements of the 20th Century. Water fluoridation is considered a safe, effective, and inexpensive means to deliver the benefits of fluoride to all residents of a community, regardless of age, educational attainment, or income level (AK-IBIS, 2016). Research suggests that water fluoridation reduces tooth decay by approximately 25% over a person's lifetime (Newbrun, 1989; Brunelle and Carlos, 1990). Untreated dental caries can lead to incapacitating pain, tooth extraction, and loss of dental function, and may progress to an acute systemic infection.

In 2013, 45.7% of all Alaskans were served by community water systems with optimally fluoridated water, falling short of the HA2020 goal of 58.0% (AK-IBIS, 2016). In 2012, 74.6% of the U.S. population was served by community water systems with optimally fluoridated water.

3.8. Health Effect Category 8: Health Services Infrastructure and Capacity

See Section 5.3.4.2 of Resource Report No. 5 for health services infrastructure and capacity baseline conditions.

3.8.1. Healthcare Delivery Organizational Structure

Alaska is made up of dozens of tribal health care organizations, which operate the area health care facilities. The Indian Health Service maintains a complete list of all the organizations and links to their respective websites: <https://www.ihs.gov/alaska/tribalhealthorganizations/>.

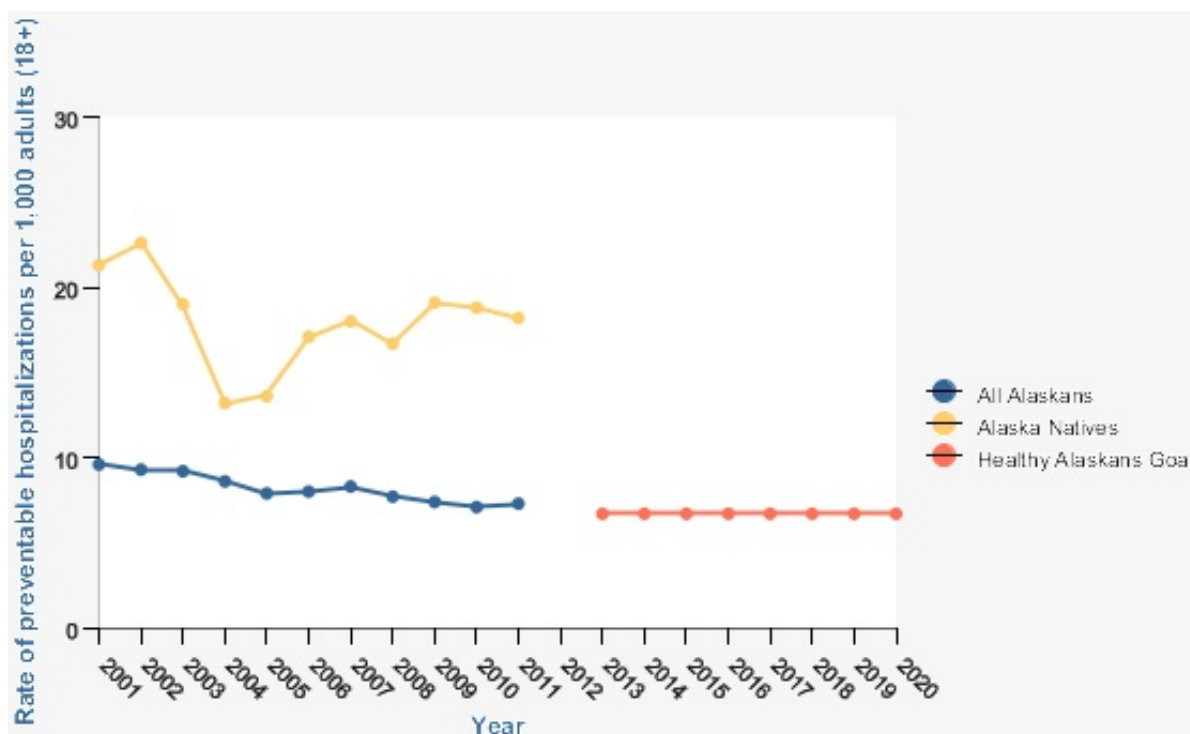
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3.8.2. Access to Healthcare

Access to quality healthcare is influenced by a number of factors, including: having a usual source of care, having health insurance, and capacity to afford care (AK-IBIS, 2016). “Preventable hospitalizations” are defined as hospitalizations, which could be avoided if patients had early access to good quality outpatient healthcare. This measure can be used to assess the effectiveness and accessibility of primary health care.

Figure 30 shows the disparity between the rates of preventable hospitalizations among all adult Alaskans as compared to Alaska Native adults between 2001 and 2011. In 2012, the rate among Alaska Natives (18.2 per 1,000 adults) was more than twice that of all Alaskans (7.3 per 1,000 adults) statewide.

Figure 30. Rate of Preventable Hospitalizations per 1,000 adults (18+), all Alaskans and Alaska Natives (2001-2020)



Source: AK-IBIS

Health insurance plans provide partial or complete payment of specified health care costs for enrollee(s), with varied levels of coverage among individual plans. Some plans are provided by employers, some by government programs,

such as Medicare, and others are purchased directly by individuals from insurance companies. People without health insurance are more likely to lack a usual source of medical care, such as a primary care provider. They more often skip routine and preventive medical care thus increasing their risk for developing serious and disabling health conditions that cost more to treat (AK-IBIS, 2016).

In 2014, 13.6% of all Alaskans statewide reported cost as a barrier to accessing healthcare within the past year, 11.8% of all Alaska Natives reported cost as a barrier to care (AK-IBIS, 2016).

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Examining insurance rates among nonelderly adults, or those ages 18-64, is a commonly used indicator because Medicare covers the preponderance of adults age 65 and older in this country.

Health services are provided by a variety of organizations in Alaska, some designed for all people and others that focus on the health needs of Alaska Natives. The Baseline Summary will include an analysis of health services and capacity of areas potentially impacted. Community online database, community KIIs.

Prudhoe Bay is classified as an isolated town/Sub-Regional Center. It is found in EMS Region 6A in the North Slope Region. Emergency Services have limited highway, coastal, and airport access. Emergency service is provided by a paid Emergency Medical Services unit and Fairweather Deadhorse Medical Clinic (open daily and on call 24 hours a day [907-685-1800] for emergencies and urgent care). Auxiliary health care is provided by oil company medical staff and the Greater Prudhoe Bay Fire Dept. Individuals requiring hospital care are usually transported to the nearest hospital/medical center, Samuel Simmonds Memorial Hospital, in Barrow, Alaska. Because no roads connect Prudhoe Bay to Barrow, individuals are transported by helicopter or air ambulance (an approximately 45-minute flight).

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4. POTENTIAL HEALTH IMPACTS

The overall goal of an HIA is to identify potential health impacts and communicate these impacts to decision-makers during the planning and permitting process. A health impact is a positive or negative change in a specific health outcome or health determinant. Health impacts are:

- Changes in health outcomes or determinants, not general changes in environmental conditions;
- Specific health outcomes or determinants, not general statements about health status; and
- Quantifiable, whenever possible.

Each HEC contains potential health impacts that fit the criteria above. Detailed analyses of potential impacts are described utilizing standard NEPA methodologies, i.e., context and intensity.

The level of the human health impacts from the proposed Project were determined and ranked based on the impact assessment criteria for human health presented in Table 1. This table is derived from the Impact Assessment methodology described in the Alaska HIA Toolkit. The scoring system includes consequences (i.e., health effect, duration, magnitude, and geographic extent), which collectively determine the severity rating. Together the severity rating and the estimated likelihood determine the impact rating. Potential public health impacts from the proposed Project were ranked and rated by using the following four-step semi-quantitative risk assessment procedure:

- Step 1. Score the level of each consequence (health effect, duration, magnitude, and geographic extent,) on a four-point scale: low (0), medium (1), high (2), and very high (3), as described in Table 36.
- Step 2. Rate the severity of the health impact (low, medium, high, or very high) based on the sum of the scores of the consequences.
- Step 3. Rate the potential (or likelihood) of the impact to occur based on professional judgment on the percent probability of the impact occurring.
- Step 4. Rate the identified health impacts (low, medium, high, or very high) based on the intersection of the level of severity and potential (or likelihood) as shown in Table 37. Health issues anticipated to have negligible or zero impacts were identified as having no impacts.

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Table 36. Step Risk Assessment Matrix (Step 1 of 4)

Step Risk Assessment Matrix (Step 1 of 4)				
Step 1: Consequences				
Impact Level (Score)	A – Health Effect	B – Duration*	C – Magnitude	D – Extent**
Low (0)	Effect is not perceptible	Less than 1 month	Minor	Individual cases
Medium (1)	(+/-) minor benefits or risks to injury or illness patterns (no intervention needed)	Short-term: 1 - 12 months	Those impacted will: 1) Be able to adapt to the impact with ease and maintain preimpact level of health, 2) See noticeable but limited and localized improvements to health conditions	Local; small limited impact to households
High (2)	(+/-) moderate benefits or risks to illness or injury patterns (intervention needed, if negative)	Medium-term: 1 to 6 years	Those impacted will: 1) Be able to adapt to the health impact with some difficulty and will maintain preimpact level of health with support, or 2) Experience beneficial impacts to health for specific population some maintenance may still be required	Entire PACs; village level
Very High (3)	(+/-) severe benefits or risks: marked change in mortality and morbidity patterns (intervention needed, if negative)	Long-term: more than 6 years/life of project and beyond	Those impacted will: 1) Not be able to adapt to the health impact or to maintain pre-impact level of health 2) See noticeable major improvements in health and overall quality of life	Extends beyond PACs; regional and state-wide levels
Source: ADHSS, 2015a * Duration refers to the duration of the potential impact or risk of impacts, not necessarily the duration of the Project. ** Extent does not necessarily refer to project-wide impacts at the local and PAC level (e.g., impact level score may be high even for potential impacts to a few PACs, not all PACs, if the impact would affect an entire PAC).				

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Table 37. Step Risk Assessment Matrix (Steps 2, 3, and 4 of 4)

Step Risk Assessment Matrix (Steps 2, 3, and 4 of 4)								
Step 2: Severity Rating (Magnitude + Duration + Geographic Extent + Health Effect)	Step 3: Likelihood Rating							
	Extremely Unlikely < 1%	Very Unlikely 1–10%	Unlikely 10–33%	About as Likely as Not 33–66%	Likely 66–90%	Very Likely 90–99%	Virtually Certain > 99%	
	Low (1–3)	◆	◆	◆	◆	◆◆	◆◆	◆◆
	Medium (4–6)	◆	◆	◆	◆◆	◆◆	◆◆	◆◆◆
	High (7–9)	◆◆	◆◆	◆◆	◆◆◆	◆◆◆	◆◆◆	◆◆◆◆
	Very high (10–12)	◆◆◆	◆◆◆	◆◆◆	◆◆◆◆	◆◆◆◆	◆◆◆◆	◆◆◆◆
	Step 4: Impact Rating	Key: Low = ◆ Medium = ◆◆ High = ◆◆◆ Very High = ◆◆◆◆						
Sources: ADHSS, 2015a								

Potential health impacts related to large projects, such as the Alaska LNG Project, are described in the next sections. The U.S. Army Corps of Engineers (USACE) Supplemental Environmental Impact Statement (SEIS) prepared for the Alaska Stand Alone Pipeline (ASAP) Project contains a summary of impacts for a similar project and is referenced here. Of note, the risk assessment completed for the Alaska LNG Project has been prepared independently of the ASAP SEIS; however, the impacts are very similar for each HEC. Potential impacts are summarized in Table 38.

Table 38. Types of Effects and Impacts on Public Health

Type of Effect	Proposed Action Causing Potential Impact	
	Construction	Operations
Social Determinants of Health (SDH) Positive or negative change in: <ul style="list-style-type: none"> • Maternal Health Status • Depression/anxiety prevalence • Substance abuse rate • Suicide rate • Teen pregnancy rates • Domestic violence and family stress • Economy and employment 	<ul style="list-style-type: none"> • Worker camps, increase rail and truck traffic—presence of outside workers and traffic could exacerbate social problems or stress and impact mental health for residents of PACs • Employment opportunities could alleviate family stress by improving family income, and the local economy 	<ul style="list-style-type: none"> • Presence of gas in the pipeline—residents of PACs could experience fear of catastrophic incident linked to the proposed Project and/or perceptions that the proposed Project threatens a way of life • Employment opportunities could alleviate family stress by providing jobs and family income, improving the local economy and reducing unemployment

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Type of Effect	Proposed Action Causing Potential Impact	
	Construction	Operations
Accidents and Injuries <ul style="list-style-type: none"> • Increase in unintentional injury (e.g., drowning, falls, snow machine, ATB injury) rates • Increase in roadway incidents and injuries • Decrease in safety during subsistence activities • Increase (positive effect) of behavior-based and other safety culture programs implemented in the project 	Fatal and nonfatal injuries due to: <ul style="list-style-type: none"> • General construction activities • Increased rail transport (e.g., rail-auto collisions, trespassing, train accidents and highway-rail crossing accidents) • Increased trucking- injuries to truck drivers, other motorists and pedestrians from trucks hauling pipes; transportation of materials; bussing construction workers to camps; and additional truck deliveries and pickups linked to construction • Seaborne transit-related injuries • Increase in truck and rail traffic in PACs along the rail line and highways • Increased trucking- injuries to truck drivers, other motorists and pedestrians from trucks hauling pipes; transportation materials; bussing construction workers to camps; and additional truck deliveries and pickups linked to construction 	<ul style="list-style-type: none"> • Fatal and nonfatal injuries due to leaks, fires, or explosions
Exposure to Hazardous Materials <ul style="list-style-type: none"> • Increase in physiologic contaminant levels such as fugitive dust, criteria pollutants, persistent organic pollutants, and VOCs 	Human exposure linked to air emissions (fugitive dust, criteria pollutants, VOCs): <ul style="list-style-type: none"> • Diesel-powered mobile equipment • Increase in truck and rail traffic in PACs along the rail line and highways • Fugitive dust due to vehicle traffic on unpaved roads and general construction activities (especially during summer) 	<ul style="list-style-type: none"> • Potential fugitive emissions from pipeline connections • Operations of GTP would emit combustion related pollutants, such as NO_x, CO, PM, VOCs and SO₂ • Potential for other toxic / hazardous substances – components of natural gas and natural gas liquids (NGLs) (e.g., isobutene, pentanes, hexanes, hydrogen sulfide, butane, and ethane) as well as paints, solvents, petroleum products and fertilizers • Operation would result in various emissions when the natural gas is consumed in Fairbanks, Anchorage and other cities

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Type of Effect	Proposed Action Causing Potential Impact	
	Construction	Operations
Food, Nutrition, and Subsistence Activity <ul style="list-style-type: none"> Decrease in amount of dietary consumption of subsistence resources Change (positive or negative) in composition of diet Change (positive or negative) in food security 	<p>Construction activities (e.g., construction noise, traffic, human presence, barging, water use requirements) causing:</p> <ul style="list-style-type: none"> Removal or disruption of subsistence use areas Temporary decrease in resource availability Temporary reduction in harvester access to the proposed Project Area Contamination (real or perceived) <p>Positive impacts could include:</p> <ul style="list-style-type: none"> Increased food security related to increased in employment and income 	<p>Operations could lead to a decrease in dietary consumption of subsistence resources, resulting in a change in diet composition and a decrease in food security due to:</p> <ul style="list-style-type: none"> Cleared ROW and construction of new access roads attracting new harvesters New access roads, and increased traffic and noise from aerial and ground-based pipeline inspections, which could displace or reduce availability of terrestrial wildlife for subsistence uses Resource availability could be reduced in the unlikely event that a leak in the pipeline led to a forest fire <p>Positive impacts could include:</p> <ul style="list-style-type: none"> Increased food security related to increased employment and income
Infectious Disease Positive or negative change in: <ul style="list-style-type: none"> Transmission of pediatric or adult respiratory disease rates STD rates, gastro intestinal outbreaks, and antibiotic-resistant staph skin infections 	Transmission of disease by infected resident or nonresident construction workers (often coming from out of state) stationed at worker camps or in PACs	Transmission of disease by infected resident or nonresident operations and maintenance workers stationed at worker camps or in PACs

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Type of Effect	Proposed Action Causing Potential Impact	
	Construction	Operations
Water and Sanitation <ul style="list-style-type: none"> Change in potable water access Positive or negative change in water quantity or quality Change in demand on water and sanitation infrastructure due to the influx of non-resident workers 	<p>Change in water quality due to:</p> <ul style="list-style-type: none"> Solid waste generated due to construction activities Domestic waste water produced from worker camps Hazardous materials from construction activities <p>Change in potable water access due to use of surface water for construction activities as well as for hydro-testing and horizontal directional drilling</p> <p>Change in demand on water and sanitation infrastructure due to demand on existing services while construction work camps are being utilized</p>	<p>Potential effects to water quality from spills</p>
Non-Communicable and Chronic Disease <p>Positive or negative change in:</p> <ul style="list-style-type: none"> Cardiovascular disease rates Type 2 Diabetes rates Chronic lower respiratory disease rates Cancer rates 	<p>Asthma, Chronic Obstructive, Pulmonary, Cardiovascular Disease:</p> <ul style="list-style-type: none"> Project emissions of criteria pollutants, particularly PM_{2.5} <p>Diabetes:</p> <ul style="list-style-type: none"> Change in diet if there was loss of subsistence resources 	<p>Positive changes in air quality in Fairbanks and potential reduction of the rate of exceedances of the National Ambient Air Quality Standard (NAAQS)</p> <p>This change depends on expansion of the gas distribution network in Fairbanks (discussed in cumulative impacts for Air Quality)</p>
Health Services Infrastructure and Capacity <p>Increase in:</p> <ul style="list-style-type: none"> Number or quality of clinics and staff Accessibility of health care Utilization/clinic burden from non-resident influx 	<p>Potential increased use of health infrastructure resources / clinic burden due to resident or worker injuries or illness during construction</p>	<p>Impacts only to the degree that operations could result in increased injuries from pipeline accidents or increased need for medical services</p>
Source: USACE, 2018		

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4.1. HEC 1: Social Determinants of Health (SDH)

See Sections 5.4.2 and 5.4.3 of Resource Report No. 5 for details of the socioeconomic impacts. As described in Section 5.4.1.1.1 of Resource Report No. 5, local spending has a stimulus effect on the state's economy, thereby increasing the number of jobs and amount of labor income.

4.1.1. Potential Construction Impacts

The employment opportunities generated by the building of the Project facilities may constitute an economic net benefit to Alaska residents if the new jobs are taken by current residents who were previously unemployed or under-employed and/or if the new jobs result in an increase in wage rates within industrial sectors affected by the Project (USACE, 2012). It is possible there would be an increase in median household income in the PACs (see Section 5.4.1.1.1 of Resource Report No. 5).

Potential impacts on subsistence and subsistence lifestyle arising in selected PACs, including Minto, Nenana, Four Mile Road, Alexander Creek, Tyonek, and Beluga, are of concern (see Section 4.4, HEC 4: Food, Nutrition, and Subsistence Activity), although extensive conditions are being put in place consistent with regulatory and permitting requirements to minimize those impacts. Subsistence is important in several contexts including health and sociocultural impacts.

Project construction and work camps could potentially exacerbate existing problems that impact SDHs within individual households, for the duration of construction. The presence of outside workers could exacerbate social problems or stress and impact mental health for PACs, particularly in smaller communities. Households impacted would be expected to adapt with some difficulty but could maintain pre-impact level of health with support from community, regionally-based, and existing federal support of native health, public health programs. PACs located within the rail belt and on a highway, would be expected to be impacted by the increase in traffic during construction, which could cause mental stress and anxiety regarding the real or perceived issues of safety and environmental health associated with the increased rail and truck traffic. This impact would be mitigated by implementing traffic control plans and by keeping communities aware of the Project schedule.

Employment opportunities could alleviate family stress by improving family income, and the local economy during construction (Table 38).

Overall, potential adverse impacts to the SDHs would be medium during construction, with individual impact criteria ratings as follows:

- Health Effect: Medium (1), minor risks.
- Duration: High (2), medium-term, 2-4 years, 6-8 years, for the duration of construction in the region of a PAC.
- Magnitude: High (2) moderate risk, individuals, and households would be expected to adapt to with some difficulty, but could maintain pre-impact level of health with support.
- Extent: Medium (1), potential impact to individual households.
- Likelihood: Likely that construction would impact the SDHs within a given PAC.

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- Potential positive impacts to SDHs would be high during construction from the potential change in employment and median household income for individuals and households involved with Project construction.

4.1.2. Potential Operations Impacts

Potential health impacts to each of the individual sub-categories of SDH during operations are presented in Section 5.4 of Resource Report No. 5, including impacts to demographics and economic indicators (employment, wages, etc.). Primary adverse impact to SDHs during proposed Project operations could result from the possible fear and anxiety within PACs over the real or perceived potential for increased gas leaks, fires, and explosions from the introduction of a new Project and associated facilities, although the areas impacted by the Project generally already have similar facilities (e.g., North Slope, Nikiski) and a major pipeline. A limited number of workers would be required during the 30-year operations and maintenance period, thus the potential adverse effects on SDHs would be negligible during this period.

The potential impact of the operations of the proposed Project on SDH is estimated to be medium with individual impact criteria ratings as follows:

- Health Effect: Medium (1), minor risks to SDH, such as anxiety from the presence of the Mainline and other gas facilities and the possibility of gas leaks, fires, or explosions. There are also localized improvements including employment and income.
- Duration: Very High (3), long-term, 30 years.
- Magnitude: Low (0), minor adverse impacts to SDH and localized improvements.
- Extent: Medium (1), local, limited to individuals or households located near the Project.
- Likelihood: About as likely as not.
- Potential positive impacts to SDH would be high during operations from changes in employment and median household income for individuals and households involved with Project operations and maintenance.

4.2. HEC 2: Accidents and Injuries

The accidents and injuries health effect category describes changes to fatal and non-fatal injury statistics that can be either intentional (suicide, homicide, assault, self-harm) or unintentional (motor vehicle crashes, falls).

This category includes impacts related to both fatal and non-fatal injury patterns for individuals and communities. Changed patterns of accidents and injuries may arise due to:

- Influx of non-resident personnel (increased traffic on roadways, rivers, air corridors).
- Distance of travel required for successful subsistence.
- Project-related income and revenue used for improved infrastructure (e.g., roadways) and improved subsistence equipment/technology.

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4.2.1. Potential Construction Impacts

Construction of the proposed Project and associated infrastructure would result in the possibility of accidents and injuries. Accidents/injuries could occur in two primary populations: those who construct (and later operate) the proposed Project (occupational injuries) and the general population (non-occupational injuries). It is conventional practice to address only non-occupational health effects. However, occupational injuries (fatal and nonfatal) are considered here because these could place demands on existing health care facilities (see section on health infrastructure and capacity) and, moreover, some data (such as for highway fatalities) do not distinguish between those occupationally injured and others.

Occupational injuries include those for proposed Project construction workers and those for workers that support the construction activity, such as those that could occur to employees of the Alaska Railroad or trucking companies, who transport pipe sections to storage locations, etc.

The potential impact of the construction of the proposed Project on Accidents and Injuries is estimated to be medium with individual impact criteria ratings as follows:

- Health Effect: Medium (1), although the effect may be serious to those affected, the expected number of fatal and nonfatal injuries is very low (and might be zero).
- Duration: High (2), medium-term, 2-4 years, 6-8 years, for the duration of construction in the region of a PAC.
- Magnitude: Medium (1), although those impacted will not be able to adapt, there is a moderate risk to the overall accident and injury rate. Safety in the workplace and the introduction of a safety culture beyond the workplace will offset the risks of accidents and injuries of individuals and households.
- Extent: Low (0), limited to individual cases.
- Likelihood: Extremely unlikely

4.2.2. Potential Operations Impacts

The potential impact of the operations phase of the proposed Project on Accidents and Injuries is estimated to be medium with individual impact criteria ratings per Tables 36 and 37, as follows:

- Health Effect: Medium (1), although the effect would be serious to those affected, the expected number of fatal and nonfatal injuries is very low.
- Duration: Very high (3), the potential for risk is long-term, 30 years.
- Magnitude: Medium (1), the expected number of fatal and nonfatal injuries is very low (or close to zero). Those impacted will not be able to adapt; however, there may be limited and localized improvement to safety from the introduction of a safety culture beyond the workplace that will offset the risks of accidents and injuries of individuals and households.
- Extent: Low (0), limited to individual cases.

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- Likelihood: Extremely unlikely

4.3. HEC 3: Exposure to Potentially Hazardous Materials

This category includes Project emissions and discharges that lead to potential exposure. Exposure pathways include:

- Food - quality changes in subsistence foods (risk based on analysis of foods or modeled environmental concentrations);
- Drinking water;
- Air - respiratory exposures to fugitive dusts, criteria pollutants, VOCs, mercury, and other substances;
- Work - secondary occupational exposure such as a family member's exposure to lead on a worker's clothing; and,
- Indirect pathways, such as changing heating fuels/energy production fuels in communities

4.3.1. Potential Construction Impacts

Resource Report No. 9 describes the fugitive dust, criteria pollutants, and VOCs that would be generated by the proposed Project. As described therein, emissions from construction equipment combustion, fugitive dust, and open burning would be controlled to the extent required by the ADEC. As a result, AGDC would comply with applicable regulations, and the emissions from proposed Project construction-related activities would not significantly affect local or regional air quality. Therefore, construction of the proposed Project should not significantly increase exposure of the PACs to these substances.

Fugitive dust, for example, is one of the materials that would be generated as part of construction activities. Fugitive dust results from vehicle traffic on unpaved roads and construction activities. People most at risk from breathing particulate pollution are children, the elderly, and people with respiratory or heart disease proximate to the construction work areas. Healthy people can be affected as well, especially outdoor exercisers (USACE, 2012).

Other toxic and hazardous substances that could be used during construction of the proposed Project include some pesticides, paints, solvents, petroleum products, and fertilizers. The proposed Project would be subject to extensive state and federal regulations regarding the use of toxic and hazardous materials, including, but not limited to:

- Pipeline Safety Regulations (49 CFR Parts 190-199).
- Resource Conservation and Recovery Act (42 USC 3251 et seq.).
- Comprehensive Environmental Response, Compensation and Liability Act and the Superfund Amendments and Reauthorization Act (42 USC 9601).
- Emergency Planning and Community Right-to-Know Act (42 USC 9601; 40 CFR 255, 370, and 372);
- Toxic Substances Control Act (15 USC 2601).

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- Hazardous Materials Transportation Act (49 USC 1801-1819).
- Occupational Safety and Health Administration (29 USC §§651-678).

In addition to complying with these regulations, the proposed Project would also follow several plans intended to ensure the proper handling and disposal of hazardous and nonhazardous wastes, including the waste management plan, spill prevention and response plan, etc. Therefore, construction of the proposed Project should not lead to significant exposure of the PACs to these substances.

The potential impact of the construction of the proposed Project from the Exposure to Hazardous Materials is estimated to be low, with individual impact criteria ratings as follows:

- Health effect score: Low (0), effects unlikely to be perceptible.
- Duration: High (2), medium-term, 6 to 8 years.
- Magnitude: Low (0), minor to moderate risk of exposure to hazardous materials in the PACs, with intervention potentially needed to mitigate the impacts of spills and leaks associated with increased truck and rail traffic.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Unlikely that the exposure to hazardous materials within individual households would increase during construction.

4.3.2. Potential Operations Impacts

Resource Report No. 9 describes the fugitive dust, criteria pollutants, and VOCs that would be generated by the proposed Project operations. Other than compressor station emissions, which are covered under regulatory permits, the pipeline alone, during operations, generally do not have any significant air emissions associated with its operation. There could be fugitive emissions from pipeline connections (i.e., valves). Such emissions would be generally very minor in nature and are not subject to the requirement to obtain a permit. Industry best practices to control fugitive emissions from valves and other mechanical equipment will be utilized during operations.

Operations of the GTP and liquefaction facility would emit combustion-related pollutants such as NO_x, CO, PM, VOCs, and SO₂. Preliminary emission estimates trigger the need for those facilities to obtain prevention of significant deterioration (PSD) and Title V operating permits. As discussed in Resource Report No. 9, upon meeting the permit requirements, the proposed Project as permitted by ADEC would not cause or contribute to a violation of any federal, state, or local air quality standards. Therefore, operation of the proposed Project should not significantly increase exposure of the PACs to these substances.

Other toxic and hazardous substances that would be generated by proposed Project operations include some components of natural gas and NGLs (isobutene, pentanes, hexanes, hydrogen sulfide, butane, and ethane), as well as pesticides, paints, solvents, petroleum products, and fertilizers (USACE 2012). The proposed Project would be subject to regulations regarding the use of toxic and hazardous materials. Therefore, operation of the proposed Project should not lead to exposure of the PACs to these substances.

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Finally, operation of the Project would result in various emissions when the natural gas was ultimately consumed in Fairbanks, Anchorage, and other communities. Compared to present emission levels, these emissions are expected to be much smaller.

The potential impact of the operations of the proposed Project from the Exposure to Hazardous Materials is estimated to be low, with individual impact criteria ratings as follows:

- Health effect score: Low (0), effects unlikely to be perceptible assuming compliance with NAAQS.
- Duration: Very High (3), long-term, 30 years.
- Magnitude: Low (0), minor risk of exposure to hazardous materials in the PACs.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Extremely unlikely

4.4. HEC 4: Food, Nutrition, and Subsistence Activity

This category considers health impacts related to food security, adequate nutrition, and availability of subsistence resources.

- This section depends on the subsistence analysis and nutritional surveys completed in Resource Report No. 5, Appendix D as well as ADF&G baseline subsistence data provided as an attachment and filed in response to FERC on submitted on December 1, 2017 (see accession no. 20171201-5211), and considers:
- Effect on Diet: This pathway considers how changes in wildlife habitat, hunting patterns, and food choices will influence the diet of and cultural practices of local communities. While nutritional surveys are the most effective way to assess dietary intake, conclusions can be drawn if certain assumptions are accepted.
- Effect on Food Security: This discussion considers Project-specific impacts that may limit or increase the availability of foods needed by local communities to survive in a mixed cash and subsistence economy present in rural Alaska.

4.4.1. Potential Construction Impacts

Impacts to subsistence during the construction phase are expected to be temporary in duration. The timing of pre-construction and construction activities would have direct effects on subsistence activities. Subsistence impacts would be most acute in the area around Minto Flats, and in communities along the Mainline route and near Cook Inlet that rely on subsistence resources that are of high importance.

The introduction of invasive species (both fish and/or aquatic plants) could impact fish habitat and/or productivity and impact fish availability to subsistence users. Unlike the other construction impacts which are expected to be short-term, the introduction of invasive species could become a long-term impact if their spread is uncontrolled, thus potentially signaling a long term reduced fish availability for subsistence users and users downstream of the impacted areas. Reduced fish availability could potentially occur and

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affect subsistence uses in all regions of the Project and have the greatest effect on communities in the Interior (where fish account for over 70% of harvest) and Southcentral (where fish account for over 50% of harvest) with less impact on communities in the North Slope (where fish account for less than 20% of the harvest) (USACE 2012).

User access to subsistence areas could be temporarily reduced due to both physical and regulatory barriers related to the use of water extraction efforts, pipe laydown, noise, traffic, and other construction activities.

Potential concern related to subsistence resources during construction is the possibility that workers might compete with subsistence users resulting in either diminished harvests or greater subsistence effort. The Project will prohibit workers from hunting or fishing while on the job or when company transportation has been used to bring them to a remote site.

Impacts to individuals and households (see information filed in response to FERC and submitted on December 1, 2017; Accession No. 20171201-5211) are primarily based on the long-term effect of increased access and competition from a cleared right-of-way (ROW) and access roads to areas previously undeveloped or with limited access options. Summary impact ratings of moderate are primarily a result of the proximity of PACs to the Project and high likelihood for effects to subsistence activities from construction (subsistence use area overlap). Summary impact ratings of minor are due to the lower potential for impacts during construction and operation. PACs that have a summary impact rating of negligible are communities that are generally located farthest from the Project, are in nonsubsistence areas and/or nonrural, and any potential effects would be unlikely and temporary.

The potential impact of the proposed Project construction on food, nutrition, and subsistence activity within each PAC would likely be low, with individual criteria ratings as follows:

- Health effect score: Medium (1), effect results in annoyance, minor injuries, or illnesses that do not require intervention.
- Duration: High (2) medium-term, 6–8 years.
- Magnitude: High (2), minor, moderate, or major severity, depending on the PAC, those impacted will be able to adapt to the health impact with some difficulty and will maintain pre-impact level of health with support.
- Extent: Medium (1), potential to affect individuals and households that rely on access and reduced competition for subsistence resources. Subsistence plans of cooperation and coordination with communities on construction activity are intended to reduce community-level impacts.
- Likelihood rating: Likely chance of impact to subsistence, which would in turn impact food security and nutrition.

4.4.2. Potential Operation Impacts

The potential impact of the proposed Project operations on food, nutrition, and subsistence activity within each PAC would likely be low, with individual criteria ratings as follows:

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- Health effect score: Medium (1).
- Duration: Very high (3), long-term, 30 years.
- Magnitude: Medium (1), operations impacts overall are minor, and those impacted will be able to adapt with ease and maintain preimpact level of health.
- Extent: Medium (1), potential to affect individuals and households that rely on access and reduced competition for subsistence resources. Some communities may be impacted and would be able to adapt to the impact with some difficulty and will maintain preimpact level of health with support.
- Likelihood rating: Unlikely.

4.5. HEC 5: Infectious Diseases

This HEC considers health impacts from infectious disease transmission and the development of new infectious diseases due to the Project. As described previously, influx can occur due to job seeking, commercial opportunities, small-scale trading, or extended-family in-migration. Influx can lead to changes in infectious disease prevalence (Neiderud, 2015). This category includes the Project's influence on patterns of infectious disease: The pathways include:

- Influx of non-resident personnel from outside the region.
- Crowded or enclosed living and working conditions and the mixing of low and high prevalence populations due to influx can create an increased risk for transmission of STIs such as syphilis, HIV, and chlamydia.

The public health concern with respect to evaluating proposed development Projects is that these diseases can be transmitted by infected construction workers (potentially from outside the area). In the Alaska context, the diseases of particular concern include infectious respiratory diseases (e.g., pneumonia, influenza) and STIs (AIDS, syphilis, gonorrhea, and chlamydia) (USACE, 2012).

4.5.1. Potential Construction Impacts

The interest in STIs in connection with proposed pipeline development Projects partially reflects experience and/or concerns with similar Projects in Canada (see e.g., Goldenberg et al. 2008a, b, c; Shandro et al. 2011), anecdotal reports from gas developments in the "lower 48" (AP 2011; Farnham 2012; Kulesza 2011; Schechter 2011), and less developed countries and partially because of concerns related to TAPS impacts (CEE Bankwatch Network, Gender Action 2006; Jobin 2003; Pacific Environment 2011; Sakhalin Environmental Watch 2011; for TAPS see e.g., anecdotal information presented in Cole 1997). A recent HIA on oil and gas development on Alaska's North Slope concluded that contact between oil workers and previously isolated Inupiat villages could result in increased rates of HIV and syphilis (Wernham 2007).

Moreover, as noted earlier in this section the rates of STIs in Alaska are relatively high, particularly for Chlamydia, but also for gonorrhea. Although there are effective tests for STIs, known methods for

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reducing the likelihood of transmission, and effective cures (if diagnosed), STIs are a valid public health concern (USACE 2012).

Other infectious diseases that could affect the worker population and potentially affect other persons include hepatitis (A, B, and C) and bacterial pneumonia (each of these conditions is reportable to public health authorities in Alaska). These diseases differ in the how they are spread, whether or not vaccination is possible, types of treatment required, and seriousness. Hepatitis A, B, and C, for example, can be spread by sexual activity, eating or drinking contaminated food or water (hepatitis A only), or sharing needles among drug users (hepatitis B and C). There are vaccines for hepatitis A and B, but not C. Bacterial pneumonia can be transmitted via inhalation of bacteria (contact with others) or by aspiration of the secretions from the throat, mouth, or nose. Bacterial pneumonia is treated using antibiotics. Because these diseases are contagious, isolation or removal of infected workers from camps would be required (USACE 2012).

It is anticipated that a rotational scheme would be employed wherein workers are transported by aircraft or bus from selected locations (e.g., Prudhoe, Fairbanks, and Anchorage) to camps. There they would work for a defined period (e.g., two weeks) and, upon shift completion, be transported back to their starting points. A work shift would typically be 12 hours, so the worker would have to use the remaining 12 hours for attending to personal chores, eating, and sleeping. While at the camps, there would be little opportunity for interaction (e.g., sexual contact) with other persons outside the camps. This is a policy designed (among other things) to lower opportunities to transmit STIs, particularly with persons living in the general area of the camps (USACE 2012).

In most cases the mitigation strategies proposed or implemented for dealing with STIs on mineral development Projects have included attempting to minimize the size of the transient workforce (generally determined to be infeasible) and provision of a health education and outreach program. As a practical matter, feasible mitigation measures are limited to an education and outreach program, which might also include providing condoms and test kits for STIs. More stringent alternatives (such as mandatory STI testing, or certain access restrictions) are unlikely to be feasible, or even legal in the U.S. (USACE, 2012).

Construction contractors would be required to have health and safety programs that provide adequate health and medical equipment and staff to respond to and prevent medical emergencies.

The potential impact of the proposed Project construction on infectious diseases would be medium, with individual criteria ratings as follows:

- Health effect score: High (2), moderate risk to injury or illness that may require intervention, primarily to minimize the transmission of STIs.
- Duration: High (2) medium-term, 6–8 years.
- Magnitude: High (2), those impacted will be able to adapt to the health impact with some difficulty (e.g., requiring testing and treatment for STIs) and will maintain pre-impact level of health and support.
- Extent: Medium (1), individual cases or households.

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- Likelihood rating: About as likely as not that the infectious disease rate would increase.

4.5.2. Potential Operations Impacts

For operations, the number of workers is significantly less during operations and so too would be the possible impacts. Moreover, unlike the case with the construction phase, where workers might include those from out of state, it is likely that all or nearly all of the workers would be Alaska residents.

The potential impact of the proposed Project operations on infectious diseases would be medium, with individual criteria ratings as follows:

- Health effect score: High (2), because those affected may require medical treatment in the event they develop an infectious disease.
- Duration: Very high (3), long-term, 30 years.
- Magnitude: High (2), affected individuals should be able to adapt, but may require medical intervention.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely because the number of workers involved in operations is smaller than the number of construction workers and there are fewer outside (non-resident) workers.

4.6. HEC 6: Chronic and non-communicable diseases

Increase in morbidity and mortality data for chronic diseases, such as obesity, diabetes, and hyperlipidemia. This category considers how the Project might change patterns of chronic diseases. The pathways include:

- Nutritional changes that could eventually produce obesity, impaired glucose tolerance, diabetes, cardiovascular disease.
- Pulmonary exposures that lead to tobacco related chronic lung disease, asthma; in-home heat sources; local community air quality; clinic visits for respiratory illness.
- Cancer rates secondary to diet changes or environmental exposures.
- Increased rates of other disorders, specific to the contaminant(s) of concern.

4.6.1. Potential Construction Impacts

The leading causes of death attributable to non-communicable chronic diseases in the proposed Project area are cancers, heart disease, and COPD. Following cancer, the most common chronic diseases statewide and within the proposed Project area are COPD, cardiac disease, vascular disease, and type-2 (adult onset) diabetes. Asthma should be included in the list of chronic respiratory diseases of concern because, although fatality rates are lower than for many of the other diseases included here, asthma results in a large number of hospitalizations and emergency department visits (ADHSS, 2001). Risk factors

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for cancer depend upon the type of cancer. Ranked in terms of mortality in Alaska the four leading types of cancer are lung and bronchus, female breast, prostate, and colorectal (ADHSS, 2006):

- Lung cancer risk factors are primarily related to smoking (including secondhand smoke), but also include medical conditions (fibrotic lung diseases), age, and exposure to certain toxic substances, such as asbestos and possibly PM (EPA, 2010; Wood, 2011).
- Reported risk factors for breast cancer include: age; number of first-degree relatives with breast cancer; ages at menarche (first menstrual cycle), first birth, and menopause; and prior breast biopsy for benign breast disease (Chlebowski et al., 2005).
- Reported risk factors for prostate cancer include age, race/ethnicity (African Americans have higher rates), high fat diet, lack of exercise, and family history (Zangwill, 2011).
- Reported risk factors for colorectal cancers include age, heredity, race/ethnicity (Alaska Natives have lower incidence rate compared to most other ethnicities (in particular Caucasians) diet, obesity, being a long-time smoker, alcohol use, and having type-2 diabetes (CDC, 2010; American Cancer Society, 2011).
- Reported risk factors for diabetes include weight, fat distribution, inactivity, family history, race, and age (ADHSS, 2003; Mayo Clinic, 2011).

Exposure to criteria pollutants can exacerbate and perhaps even cause several of the important chronic diseases, including asthma, COPD, and cardiovascular diseases. Thus, if the concentrations of criteria pollutants, particularly fine particulates (PM_{2.5}), were to exceed the NAAQS, adverse health effects would result. As noted previously, proposed Project construction activity has the potential to emit PM. However, these emission levels are unlikely to lead to exceedances of NAAQS. Although the potential exists for a negative effect, it would be limited and unlikely.

Changes in diet that might result from loss of subsistence resources have the potential to increase obesity, one of the risk factors for diabetes.

The potential impact of the proposed Project construction on chronic and non-communicable diseases would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), while increases in prevalence of the chronic diseases listed here could result in loss of life (from certain chronic illnesses) severe injuries, or chronic illness that requires intervention, the linkages between these and construction of the proposed Project are weak. Note that this assessment is consistent with results of the HIA for Point Thomson, which rated this “low” reflecting the possibility that a change in diet due to possible subsistence losses might lead to increased obesity (ADHSS, 2011).
- Duration: High (2), medium-term, 6–8 years.
- Magnitude: Low (0), those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health, which would justify a high rating, but the linkage between proposed Project construction and increases in chronic diseases is weak.

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- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely 1–10%.

4.6.2. Potential Operations Impacts

It is likely that any impacts of operation of the proposed Project on non-communicable diseases would be positive, chiefly because of improvements in air quality resulting from probable decreases in the frequency of exceedances of the PM_{2.5} NAAQS. However, realization of these benefits would require expansion of the gas distribution network in Fairbanks, etc.

The potential impact of the proposed Project operations on chronic and non-communicable diseases would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), while increases in prevalence of the chronic diseases listed here could result in loss of life (from certain chronic illnesses), severe injuries, or chronic illness that requires intervention, the linkage between these and operations and maintenance of the proposed Project is weak.
- Duration: Very High (3), long-term, 30 years.
- Magnitude: Low (0), those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health, which would justify a high rating, but the linkage between proposed Project operations and increases in chronic diseases is weak.
- Extent: Low (0) limited to individual cases.
- Likelihood rating: Very unlikely.

Note that this assessment changes when the benefits associated with the expansion of the gas distribution system are included.

4.7. HEC 7: Water and Sanitation

This category includes the changes to access, quantity, and quality of water supplies. The pathways include the following:

- Lack of adequate water service is linked to the high rates of lower respiratory infections observed in some regions, and to invasive skin infections.
- Revenue from the Project that supports construction and maintenance of water and sanitation facilities.
- Increased demand on water and sanitation infrastructure secondary to influx of non-resident workers.
- Increased potential for negative impacts to water quality.
- Increase in morbidity and mortality due to conditions affected by limited water access, quality or quantity of water, and sanitation facilities.

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4.7.1. Potential Construction Impacts

Water diseases are often strongly related to the absolute per capita volume of water available for personal hygiene, e.g., bathing, hand washing, etc. The lack of clean running water and proper sewage disposal is a leading cause of preventable disease in rural Alaska villages and is directly linked to certain infectious diseases. Respiratory, gastrointestinal, and skin diseases are common in areas without safe water supplies.

AGDC would obtain (and comply with provisions of) the necessary permits prior to water withdrawal, thereby minimizing any potential adverse effects to existing water rights and water supplies.

Camps would require food service, drinking water, wastewater treatment, and solid waste management. The Applicant would need to obtain the necessary permits and comply with relevant regulations (e.g., 40 CFR 122; 18 AAC 31.020; 18 AAC 72.010, 200, and 215; AAC 80.200; 18 AAC 60), and would manage waste according to the waste management plan. Therefore, an increased demand on water and sanitation infrastructure due to camps would be managed and mitigated accordingly through permits obtained from the ADEC, and contracts with local service providers.

The use of hazardous materials is not anticipated to affect water quality. Construction is expected to have no or negligible effect on Cook Inlet water quality through the use of hazardous materials. Other water quality impacts in Cook Inlet from pipe trenching and dredging would be localized and short term. Domestic wastewater produced from camps would be treated and discharged in accordance with applicable permits (i.e., domestic waste stream is covered under a required Alaska Pollutant Discharge Elimination System [APDES] permit). Construction of the proposed Project would therefore have negligible effects on water quality.

Operation of the proposed Project is not likely to affect water quality through the exposure of hazardous materials (see construction impacts scoring below and in the exposure to hazardous materials section above). Under the waste management plan, which would be developed for the proposed Project, solid waste would be reused, recycled, burnt, or disposed of in accordance with applicable regulations. Operation of the proposed Project would therefore have negligible effects on water quality.

The potential impact of the proposed Project construction on water and sanitation would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), unlikely to be perceptible.
- Duration: High (2), medium-term, 6–8 years.
- Magnitude: Low (0), minor intensity.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely.

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4.7.2. Potential Operations Impacts

The use of water for operations would require necessary permits prior to water withdrawal, thereby minimizing any potential effects to existing water rights or water supplies. It is anticipated most workers during operations would be concentrated at the facilities in Nikiski and Prudhoe Bay and in Anchorage. The increased demand on existing water and sanitation infrastructure would be negligible. Other operations impacts to water and sanitation are provided in Resource Report No. 3.

The potential impact of the proposed Project operations on water and sanitation would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), Project facilities are in water service and sanitation areas.
- Duration: Very high (3), long-term, 30 years.
- Magnitude: Low (0), minor or negligible impacts.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely.

4.8. HEC 8: Health Services Infrastructure and Capacity

Health services infrastructure and capacity refers to physical infrastructure, staffing levels and competencies, and technical capabilities of health care facilities. Access to health care and health care capacity is often influenced by natural resources development projects. Projects can adversely impact a community's access to care if local capacity is overwhelmed.

This category considers how the Project will influence health services infrastructure and capacity. The pathways include the following:

- Increased revenues can be used to support or bolster local/regional services and infrastructure.
- Increased demands on infrastructure and services by incoming nonresident employees or residents injured on the job, especially during construction phases.

4.8.1. Potential Construction Impacts

The temporary construction camps built by the Project would provide onsite healthcare to respond to minor medical needs for the construction workforce. Most construction camps would have trained medical staff and dedicated transportation (i.e., ambulances or helicopters) to handle routine and emergency response situations. An exception would be the GTP construction camp, which would have first aid capabilities only and would rely on the Fairweather Deadhorse Medical Clinic and Prudhoe Bay Operations Center in the Prudhoe Bay CDP for emergency medical response. Both medical facilities currently have excess capacity due to the decline in the oil and gas industry workforce on the North Slope. At times, the Fairweather Deadhorse Medical Clinic has been temporarily closed because of low patient volume (Stephens, 2017). Moreover, additional medical clinics on the North Slope could be available for use by the Project, such as the clinics operated by ConocoPhillips Alaska at the Alpine and Kuparuk oil

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fields. Therefore, any increase in demand for emergency medical services on the North Slope resulting from Project construction would readily be accommodated by existing clinics. The Project would implement “fit-for-duty” screenings of incoming construction workers to decrease the number of Project non-related injuries/illnesses requiring medical treatment at worksite facilities or community medical facilities.

Illness or injuries requiring advanced medical care would be treated in existing hospitals, including those located in Barrow, Fairbanks, Palmer, Anchorage, and Soldotna. In the event of an accident at a Project construction site, and if local hospitals are at capacity, medical evacuation to another hospital would be provided by the Project. Existing larger medical facilities, such as those in Fairbanks and Anchorage, are adequate to handle the increase in the demand for medical services during Project construction, including the increase resulting from the influx of in-migrants seeking work, and the additional families that may move to areas of the State. However, some smaller health care facilities are currently sometimes operating at full capacity. As described in Section 5.3.4.2 of Resource Report No. 5, the medical/surgical floor at Central Peninsula Hospital in Soldotna has been at capacity in recent years. An unplanned increase in demand would necessitate either expensive transfers to Anchorage or building more bed capacity. Moreover, the hospital’s emergency department could handle a moderate increase in volume, but anything substantial would require expansion of the department. Therefore the Project would have to transport any personnel requiring hospital care to the nearest available hospital with capacity.

Another concern is that some economic in-migrants would have no regular health care provider and would use hospital emergency rooms as primary care access points (Information Insights 2004). In addition to experiencing overburdened emergency rooms, healthcare facilities may encounter an increase in uncollectable debt as the number of uninsured patients increases. Moreover, given that many in-migrants would have transient living situations, an increase in unreimbursed care could result due to an inability to bill patients because of inaccurate billing information.

These impacts to medical facilities and services may be mitigated by impact payments as described in Section 5.4.2.6.1 or Resource Report No. 5. If municipal impact aid grants are available, they may fund projects that address impacts to hospitals, clinics, emergency medical facilities, alcohol and drug abuse facilities, and mental health facilities. For example, potential grant funds could be used for expanding the capacity of medical facilities or hiring additional medical personnel during the period of Project construction. The Applicant will initiate discussions with the Alaska State Hospital and Nursing Home Association and the ANTHC to identify ways to minimize impacts.

The Liquefaction Facility worksite would be largely self-sufficient with respect to emergency response services, including medical facilities and small-scale fire response. Resource Report No. 11 provides additional information on Project impacts on local fire departments and emergency response agencies and mitigation measures addressing those impacts.

A rise in emergency ambulance and fire calls is possible as a result of an increase in auto accidents and injuries that result from Project-related traffic on area roads, and from Project-related population change. As shown in Table 5.4.2 1 of Resource Report No. 5, the Municipality of Anchorage, the MSB and KPB are expected to experience significant population increases during Project construction.

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As discussed in Section 5.3.4.3 or Resource Report No. 5, during many days, EMS services in Nikiski, Seward, Kenai, and Soldotna are currently understaffed relative to the number of calls received, and the KPB's multi-agency 911 dispatch center is shorthanded. Any increase in call volume during Project construction would exacerbate these understaffing problems. Moreover, as discussed above, ambulance services and fire departments may find it more difficult to retain and recruit volunteers as a result of the high-paying jobs created during Project construction. The Nikiski Fire Department, which provides fire protection and emergency medical services for the community, has a high percentage of volunteer personnel. Central Mat-Su Emergency Services, which provides EMS services in the MSB outside of Palmer and Wasilla, also relies heavily on volunteers. Should the workload of EMS service providers increase as a result of emergencies related to Project construction, they may be compelled to hire full-time paid professionals, rather than continuing to rely on volunteers.

Consultations would be held with local emergency response services prior to construction. Any adverse impacts to these services may be mitigated by impact payments as described in Section 5.4.2.6.1 of Resource Report No. 5. The impacts might be eligible if there are municipal impact aid grants and they include impacts to search and rescue, fire protection, and emergency medical services. Potential grant funds could be used for hiring additional fire fighters and emergency medical service personnel during the period of construction. The Applicant will also initiate discussions with the State Emergency Response Commission to identify ways to minimize impacts.

The potential impact of the proposed Project construction on health services infrastructure and capacity would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), effects unlikely to be perceptible.
- Duration: High (2), medium-term, 6–8 years.
- Magnitude: Low (0), minor intensity.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely.

4.8.2. Potential Operations Impacts

The effect of Project operation on health care services and facilities would depend on the number of persons that migrate into affected communities during operation. As shown in Table 5.4.3 1 of Resource Report No. 5, the MSB and the KPB are expected to experience significant population increases during Project operation. As discussed in Section 5.4.2.6.3 of Resource Report No. 5, Central Peninsula Hospital in Soldotna is sometimes at capacity for certain services, and a larger population in the KPB would further increase the number of times when the hospital is at capacity. The Mat-Su Regional Medical Center in Palmer would also experience an increase in patients with the significant population growth in the MSB.

These impacts to medical facilities and services may be mitigated by payments in lieu of property tax as described in Section 5.4.3.5.1 of Resource Report No. 5. If payments are available, they may fund projects that address impacts to hospitals, clinics, emergency medical facilities, alcohol and drug abuse facilities,

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and mental health facilities. For example, potential payments could be used for expanding the capacity of medical facilities or hiring additional medical personnel during the period of Project operation.

The effect of Project operation on emergency services, including EMS and fire response, would depend on the number of households that migrate into the affected communities during operation, and the additional traffic generated by the Project. As shown in Table 5.4.3 1 in Resource Report No. 5, the MSB and the KPB are expected to experience significant population increases during Project operation.

As discussed in Section 5.3.4.3 in Resource Report No. 5, during many days, EMS services in Nikiski, Kenai, and Soldotna are understaffed relative to the number of calls received. Any increase in call volume would exacerbate these understaffing problems. In addition, should the workload of EMS service providers increase as a result of population increases related to Project operation, they may be compelled to hire full-time paid professionals, rather than continuing to rely on volunteers.

Any adverse impacts to emergency services may be mitigated by payments in lieu of property tax as described in Section 5.4.3.5.1 in Resource Report No. 5. For example, potential payments could be used for hiring additional fire fighters and emergency medical service personnel during the period of Project operation.

The potential impact of the proposed Project operation on health services infrastructure and capacity would be low, with individual criteria ratings as follows:

- Health effect score: Low (0).
- Duration: Very high (3), long-term, 30 years.
- Magnitude: Low (0), effects are of minor intensity.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Extremely unlikely.

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5. SUMMARY OF POTENTIAL IMPACTS AND MITIGATION MEASURES

The Tables 39 through 46 provide summaries of potential impacts and mitigation measures to reduce impacts.

Table 39. HEC 1: Social Determinants of Health

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Increase in depression and anxiety	(-)	Medium (1)	High (2)	High (2)	Medium (1)	6	Likely	Medium ♦ ♦
Change in employment and median household income	(+)	High (2)	High (2)	High (2)	Medium (1)	7	Likely	High ♦ ♦ ♦
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Perceptions that the Project threatens a way of life	(-)	Medium (1)	Very High (3)	Low (0)	Medium (1)	5	About as likely as not	Medium ♦ ♦
Changes in long-term employment and median household income	(+)	Medium (1)	Very High (3)	Low (0)	Medium (1)	5	About as likely as not	Medium ♦ ♦
Mitigation Measures								
<p>Potential adverse impacts during construction would be reduced by keeping camps closed to reduce the presence of outside workforce in communities; keeping local communities and their leaders informed of the Project schedule; and, providing community-based participatory monitoring and community engagement to stay aware of and respond to community concerns. Employment opportunities during construction could alleviate family stress by improving family income and the local economy during construction (see descriptions provided in Table 38).</p> <p>Potential adverse impacts during operations would be reduced by maintaining community engagement in order to keep operators aware of and respond to community concerns.</p>								

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Table 40. HEC 2: Accidents and Injuries

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential for fatal and nonfatal injuries from construction activity; and increased rail, truck, and sea transport activity	(-)	Medium (1)	High (2)	Medium (1)	Low (0)	4	Extremely Unlikely	Low ♦
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential for fatal and nonfatal injuries due to leaks, fires, or explosions	(-)	Medium (1)	Very High (3)	Medium (1)	Low (0)	5	Extremely Unlikely	Low ♦
Mitigation Measures								
Potential adverse impacts during construction would be reduced by providing training for drivers and requiring transportation equipment to meet legal requirements and be in working order; following systematic approaches to transportation safety such as having written safety plans, safety meetings, and accident investigation and driver retraining procedures; and developing and implementing emergency response plans and drills for accidents, injuries, or hazardous material release events. Health and safety are taken very seriously both on the job and at home by those in the industry. Potential adverse impacts during operations would be reduced by implementing a systematic contractor oversight program that addresses equipment and maintenance standards. Maintenance requires ongoing inspections of equipment. AGDC would promptly notify applicable regulatory agencies of any fires on, or which may threaten any portion of the Project and facilities. AGDC would take measures necessary for the prevention and suppression of fires in accordance with applicable law.								

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Table 41. HEC 3: Exposure to Potentially Hazardous Materials

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Human exposure linked to air emissions (e.g., fugitive dust, criteria pollutants, VOCs) from increased diesel-powered mobile equipment and truck and rail traffic in PACs along the rail line and highways.	(-)	Low (0)	High (2)	Low (0)	Low (0)	2	Unlikely	Low ♦
Fugitive dust due to vehicle traffic on unpaved roads and general construction activities (especially during summer).								
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential fugitive emissions from pipeline connections, operations of GTP would emit combustion related pollutants, such as NO _x , CO, PM, VOCs, and SO ₂ .	(-)	Low (0)	Very High (3)	Low (0)	Low (0)	3	Extremely unlikely	Low ♦
Potential for other toxic / hazardous substances – components of natural gas and NGLs (e.g., isobutene, pentanes, hexanes, hydrogen sulfide, butane, and ethane) as well as paints, solvents, petroleum products and fertilizers.								
Potential decrease in harmful emissions from other sources other than those from natural gas when natural gas is used in Fairbanks, Anchorage, or other communities.	(+)	Medium (1)	Very High (3)	Medium (1)	Medium (1)	6	About as likely as not	Medium ♦♦
Mitigation Measures								
Potential adverse impacts during construction would be reduced by implementing BMPs that mitigate fugitive dust; meeting regulatory requirements that mitigate fugitive dust and reduce PM emissions; and, implementing BMPs that manage the use of hazardous substances, including tracking and reporting. AGDC will follow the Project Fugitive Dust Control Plan and the Unanticipated Contamination Discovery Plan.								
Potential adverse impacts during operations would be reduced by implementing the best available control technology (BACT) as defined under the ADEC air permitting process.								

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Table 42. HEC 4: Food, Nutrition, and Subsistence Activity

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Construction activities (e.g., construction noise, traffic, human presence, barging, and water use requirements) causing removal or disruption of subsistence use areas; temporary decrease in resource availability; temporary reduction in harvester access; and contamination (real or perceived).	(-)	Medium (1)	High (2)	High (2)	Medium (1)	6	About as likely as not	Low ♦
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential decrease in consumption of subsistence resources and decrease in food security due to competition from increased access; and increase in traffic and noise that could displace or reduce availability of subsistence resources.	(-)	Medium (1)	Very High (3)	Medium (1)	Medium (1)	6	Unlikely	Low ♦
Mitigation Measures								
<p>Potential adverse impacts during construction would be reduced by developing a subsistence plan of cooperation to minimize work during times when subsistence activities would occur to the extent practicable; keeping local communities and their leaders informed of the Project schedule; and, providing community-based participatory monitoring and community engagement to stay aware of and respond to community concerns. The AGDC Wildlife Avoidance and Interaction Plan would be developed in consultation with ADF&G and USFWS.</p> <p>Potential adverse impacts during operations would be reduced by maintaining community engagement in order to keep operators aware of and respond to community concerns.</p>								

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Table 43. HEC 5: Infectious Disease

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential increases in the transmission of pediatric or adult respiratory disease rates. Increases in STI rates, gastro intestinal outbreaks, and antibiotic-resistant staph skin infections.	(-)	High (2)	High (2)	High (2)	Medium (1)	7	About as likely as not	High ◆◆◆
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential increases in the transmission of pediatric or adult respiratory disease rates. Increases in STI rates, gastro intestinal outbreaks, and antibiotic-resistant staph skin infections.	(-)	High (2)	Very High (3)	High (2)	Low (0)	7	Very Unlikely	Medium ◆◆
Mitigation Measures								
<p>Potential adverse impacts during construction would be reduced by reducing opportunity for interaction with other persons outside the camps; and providing health education and outreach programs. Construction contractors would be required to have health and safety programs that provide adequate health and medical equipment and staff to respond to and prevent medical emergencies.</p> <p>Potential adverse impacts during operations would be reduced by continuing health education and outreach programs. The number of workers is significantly less during operations (as compared to construction) and so too would be the potential impacts. Moreover, unlike the case with the construction phase, where workers might include those from out of state, it is likely that all or nearly all of the workers would be Alaska residents.</p>								

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Table 44. HEC 6: Non-Communicable Chronic Disease

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential increased rates of asthma, chronic obstructive, pulmonary disease, and cardiovascular disease from project emissions of criteria pollutants, particularly PM _{2.5} .	(-)	Low (0)	High (2)	Low (0)	Low (0)	2	Very Unlikely	Low ♦
Potential increased rates of diabetes from change in diet from loss of access to or opportunity to harvest subsistence resources.								
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential increased rates of asthma, chronic obstructive, pulmonary disease, and cardiovascular disease from project emissions of criteria pollutants, particularly PM _{2.5} .	(-)	Low (0)	Very High (3)	Low (0)	Low (0)	3	Very Unlikely	Low ♦
Changes in air quality in Fairbanks and other places of expansion of the gas distribution network.	(+)	Medium (1)	Very High (3)	Medium (1)	Low (0)	5	About as likely as not	Medium ♦♦
Mitigation Measures								
There is a low potential for adverse impacts.								
Any adverse impacts during construction would be reduced by the implementation of regulatory requirements regarding the mitigation of fugitive dust and reduction of particulate matter emissions.								
Potential adverse impacts during operations would be reduced by the implementation of the BACT for combustion equipment to mitigate emissions of NOx and CO.								

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Table 45. HEC 7: Water and Sanitation

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Change in potable water access.	(-)	Low (0)	High (2)	Low (0)	Low (0)	2	Very Unlikely	Low ♦
Positive or negative change in water quantity or quality.								
Change in demand on water and sanitation infrastructure due to the influx of non-resident workers.								
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Change in water quantity or quality.	(-)	Low (0)	Very High (3)	Low (0)	Low (0)	3	Very Unlikely	Low ♦
Change in demand on water and sanitation infrastructure due to the influx of non-resident workers.								
Mitigation Measures								
There is a low potential for adverse impacts. Any adverse impacts during construction would be reduced by the implementation of regulatory requirements and BMPs.								

Table 46. HEC 8: Health Services Infrastructure and Capacity

Construction Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential increased use of health infrastructure resources / clinic burden due to resident or worker injuries or illness.	(-)	Low (0)	High (2)	Low (0)	Low (0)	2	Very Unlikely	Low ♦
Operations Health Impacts	+/-	Effect	Duration	Magnitude	Extent	Total	Likelihood	Rating
Potential increased use of health infrastructure resources / clinic burden due to resident or worker injuries or illness.	(-)	Low (0)	Very High (3)	Low (0)	Low (0)	3	Extremely Unlikely	Low ♦
Mitigation Measures								
There is a low potential for adverse impacts. Any adverse impacts during construction would be reduced by the implementation of regulatory requirements and BMPs.								

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In addition, the following measures were developed as part of AGDC's ASAP Project and were included in the SEIS prepared by USACE (USACE, 2018). The ASAP Project shares the same alignment as the Alaska LNG Project's 807-mile Mainline pipeline for the first 670 miles (83%), including 350 miles within the approved Dalton Highway utility corridor. These proposed mitigation measures and/or BMPs would apply to public land use Project areas as incorporated into ROW lease, as required by the State Pipeline Coordinator's Section (SPCS) or a federal ROW grant from the Bureau of Land Management (BLM).

1. Surveillance and Monitoring – a surveillance and monitoring program for the proposed pipeline would be approved prior to start-up of the proposed pipeline per SPCS and BLM ROW lease and grant. The program shall be designed, at a minimum, to provide for and protect public health and safety. AGDC would develop education programs on pipeline damage prevention.
2. Hazards and Incidents – As required by the SPCS and BLM, AGDC would implement measures necessary to protect the health and safety of persons affected by its activities performed in connection with the construction, operation, maintenance, or termination of the pipeline. AGDC, or the appropriate contracting party, would immediately notify the appropriate regulatory agency of all serious accidents, as required, which occur in connection with such activities.
3. Pesticides, Herbicides, Preservatives, and Other Chemicals – AGDC would use only non-persistent and immobile types of pesticides, herbicides, preservatives, and other chemicals. Each chemical to be used and its application constraint would be approved by regulatory agencies (as applicable) prior to use. The use of pesticides and herbicides are regulated by ADEC's Environmental Health Division through 18 AAC 90 and may require a permit.
4. Public Access – AGDC would work with applicable agencies to manage public access and vehicular traffic on roads on state land, which are not managed or owned by the ADOT&PF, as required for activities in the immediate vicinity of the Mainline and Project facilities. AGDC would provide appropriate warnings, flagging, barricades, and other safety measures. AGDC would work with applicable agencies to make provisions for suitable crossings for the public, where the leasehold or access roads cross existing roads, foot trails, winter trails, easements, or other ROW, unless otherwise authorized and per any regulatory requirements.
5. Off-ROW Traffic – AGDC would not operate mobile ground equipment off of any leased area, access roads, state highways, or authorized areas, unless approved or when necessary to prevent harm to any person.
6. Fire Hazards – AGDC would promptly notify regulatory agencies (according to the emergency response plan) of any fires on, or which may threaten any portion of the Project and shall take measures necessary for the prevention and suppression of fires in accordance with applicable law. Use of open fires in connection with the pipeline activities is prohibited on state land unless approved and performed in accordance with state law.

Management of air quality impacts will be done consistent with ADEC legal requirements, including extensive permitting obligations.

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APPENDIX W

Past, Present, and Reasonably Foreseeable Actions

APPENDIX W: PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

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Table of Past, Present, and Reasonably Foreseeable Actions

APPENDIX W-1: TABLE OF PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

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Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources						
Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Non-jurisdictional Facilities						
Point Thomson Unit (PTU) Expansion Project	Expansion of Central Pad, drilling of three new production wells, one new injection well, and conversion of one injection well to a production well. Dredging of 5,000 cubic yards for delivery of facilities and material, with screeding as required. Removal of three existing mooring dolphins. Annual winter ice road and barging/sealift for transportation of personnel, materials, equipment, and equipment modules.	14 acres	Construction of East Pad and its associated access road previously permitted, but not constructed. Some drilling and construction of facilities commenced in 2009 to initiate production of condensate through gas reinjection. This initial development is intended to support full-field development upon completion of the Alaska LNG Project. Initial facilities commenced operation in 2016. Expansion proposal approved by Alaska Department of Natural Resources (ADNR) Division of Oil and Gas (DOG) in December 2017 (ADNR, 2017d). Construction of planned facilities, previously planned to commence in 2019, has been deferred based on a 2018 agreement with the ADNR to stay a deadline in a 2012 agreement with Exxon (Petroleum News, 2018d).	Except for an annual winter ice road, most facilities are about 60 miles east of the Alaska LNG Project's GTP and Mainline Pipeline. The Alaska LNG Project's PTTL extends to the PTU East Pad.	PTU facilities are within the Maguire Islands-Frontal Beaufort Sea watershed, which also contains a portion of the PTTL.	A, AR, C, GS, GW, LS, LU, M, N, R, RT, S, SW, V, VG, WL, VT, W
Prudhoe Bay Unit (PBU) Major Gas Sales (MGS) Expansion Project	Expansion of one well pad, three 48-inch aboveground gas pipelines, four aboveground byproduct pipelines of undetermined diameter totaling 44 miles in length, about 10 new production and injection wells, an undetermined number of well makeovers, possible 5-mile-long gas pipeline of undetermined diameter, possible construction work camp on existing pad.	514 acres	In planning stage. Permit applications have not been submitted.	Some facilities are in immediate vicinity of Alaska LNG Project.	Yes	A, AR, C, GS, GW, LS, LU, M, N, R, RT, S, SW, V, VG, WL, W

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Kenai Spur Highway Relocation	Relocation of a 1.3-mile segment of the highway, which currently traverses the Alaska LNG Liquefaction Facilities site.	93 acres	Routing studies complete, public involvement is in progress. As of August 2018, a preferred alignment has been selected, with a length of 3.9 miles.	Facilities are in immediate vicinity of Alaska LNG Project.	Yes	A, C, GS, LU, N, RT, V, VG, WL
In-state Gas Interconnections	A minimum of three offtake points to facilitate future natural gas pipeline laterals extending from the Alaska LNG Project Mainline Pipeline to various end users.	Fairbanks lateral would be a minimum of 30 miles long, affecting at least 364 acres. Interconnects for Anchorage and Kenai would tie into existing pipelines, and consequently may not require lateral pipelines; aboveground facilities (i.e., metering, valving, pressure regulating, etc.) assumed to affect approximately 5-10 acres for each interconnect.	Three interconnection points have been planned along the Alaska LNG Project's Mainline Pipeline. Any laterals would be built by third parties; none are currently proposed.	Pipeline laterals would tap off Alaska Project LNG Mainline Pipeline.	Yes	A, AR, C GS, GW, LS, LU, N, R, RT, S, SW, V, VG, WL, W
Kenai Water System Upgrades	To provide water for the proposed Liquefaction Facilities, the City of Kenai would upgrade its municipal water system with two new wells, yard piping at an existing well site, and possible expansion of its water treatment plant from 1.5 to 2.5 million gal/day. The City would also erect two new distribution pumphouses, replace about 500 feet of distribution piping, and lay a new 6.1-mile-long, 16-inch-diameter water pipeline extending from the western end of the existing water distribution system to the Liquefaction Facilities.	Unknown	AGDC and the City of Kenai have engaged in preliminary discussions regarding extension of service and water system upgrades; preliminary engineering studies have been completed.	Pipeline would connect with Liquefaction Facilities. Other water system upgrades would be within several miles of Liquefaction Facilities.	Yes	A, GS, GW, LU, N, RT, S, V, VG, WL, W

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Energy Infrastructure Projects						
Accumulate Energy Alaska	Drilling and testing of an exploratory well from the Franklin Bluffs pad adjacent to the Dalton Highway near Alaska LNG MP 40. The surface area occupied by the Icewine No. 2 Project will be about the same as used for the Icewine No. 1 (ADNR, 2016a). Exploration wells (Charlie No. 1 and Bravo No. 1) are also planned in the Kuparuk basin, which entails building 32 miles of ice road from the Franklin Bluffs pad, crossing the Alaska LNG Project corridor.	98,182 acres under lease	Icewine No. 1 completed in 2015 and 2-D seismic information acquired in 2016. Icewine No. 2 drilled in June 2017, and is in production. Two new exploration wells (Bravo No. 1 and Charlie No. 1) approved; drilling planned in 2019 (Petroleum News, 2018e), (Alaska Journal of Commerce [AJC], 2018d).	4 miles east (Icewine) and 25/30 miles west (Charlie/Bravo) of Alaska LNG Project	Icewine wells – Yes Charlie/Bravo wells – No	A, AR, GS, GW, LS, LU, R, RT, S, SW, V, VT, VG, WL, W
Alliance Exploration	Alliance proposes to conduct exploratory drilling on newly unitized state oil and gas (O&G) leases (Guitar Unit). A test well is planned for 2019 with a second well a year later (Petroleum News, 2017a). Full development is dependent on results of the test well program.	Unknown, pending permit application	Unitization and plan of exploration approved by ADNR DOG in August 2017. Initial exploratory well is planned for 2019, pending permitting.	6 miles west of Alaska LNG Project	No	A, RT, S, V
Nanushuk Project	Armstrong Energy LLC proposed to develop its oil and gas leasehold. The Nanushuk Project consists of three drill pads, one of which will include a central processing facility, an operations center, 25 miles of new access roads, 14 miles of in-field pipelines, and a 25-mile-long oil export pipeline. The project also includes temporary discharges to 5.8 acres of jurisdictional waters of the U.S. for screeding activities at the existing Oliktok Dock (COE, 2018b).	288 acres	Draft Environmental Impact Statement (EIS) released by the U.S. Army Corps of Engineers (COE) in September 2017. Final EIS issued in November, 2018. Project expected to come online 2021. Associated Pikka B and C exploratory wells planned for February, 2019 (AJC, 2018a).	52 miles west of Alaska LNG Project	No	S

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Beaufort Sea and Chukchi Sea area oil and gas leasing	Oil and gas development with target area focus on the northern Yukon Territory, Banks Island, Victoria Island, and Beaufort Sea (Lin Callow and LTLC Consulting, 2013). In 2008, 29.3 million acres were offered for lease and 2.7 million were leased in the Chukchi Sea. In 2007, 8.7 million acres were offered in the Beaufort Sea and 0.5 million acres were leased (BOEM, 2017c). Department of the Interior proposed in January 2018 to expand oil and gas leasing in both Beaufort and Chukchi Sea areas, and is preparing an EIS for a 2019 lease sale.	Chukchi Sea – unknown; no specific projects proposed. Beaufort Sea – Specific projects in the Beaufort Sea are identified in this table. Department of the Interior's planned 2019 lease sale could open up to 65 million acres of federal Arctic waters to oil and gas drilling.	Beaufort Sea: Ongoing Chukchi Sea: No known exploration plans in the Chukchi Sea. Department of the Interior is planning an oil and gas lease auction in 2019 (SB Global Platts, 2018)	Use of the same marine transportation corridors as Project construction	Yes	A, AR, LS, M, S
Brooks Range Petroleum (BRP) Development - Mustang Oil Project	BRP has conducted exploratory drilling for onshore oil on Alaska's North Slope. Ultimate development would potentially include an oil processing facility and drilling up to 31 production and injection wells (AJC, 2018c).	BRP currently holds 8,960 lease acres on the Southern Miluvecach Unit and 16,487 acres at the Kachemach Unit. In July 2017, BRP requested an additional 19,552 acres from 11 leases north, west, and northeast of the North Slope Unit (Petroleum News, 2017e).	Ongoing. In November 2017, BRP conducted flow tests on its North Tarn Well No. 1. BRP's plan envisages production commencing in 2019 (Petroleum News, 2018a).	41 miles west of Alaska LNG Project	No	S
Caelus Energy LLC, Nuna Development	Nuna Development is an onshore pad designed to develop the southern part of the Torok reservoir that cannot be reached from Oooguruk Drill Site (ODS). Nuna, like ODS, would pay to use Kuparuk facilities to process its oil (ADNR, 2014c).	22 acres (gravel pad) and 4-mile-long gravel road	The project was permitted in 2015. However, development has slowed due to low oil prices and oil tax credit uncertainty (Caelus Energy LLC, 2017).	42 miles west of Alaska LNG Project	No	S

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Caelus Energy LLC, Oooguruk Unit	The existing Oooguruk Project includes a 6-acre gravel island about 5 miles offshore in 4.5 feet of water in Harrison Bay and a subsea flowline bundle connecting to an onshore tie-in pad (Caelus Energy LLC, 2017). As noted in ADNR DOG August update, drilling activities at currently postponed, but future, activities are planned with the pursuit of six new wells (ADNR, 2017c).	No specific additional acreage identified.	Drilling activities at Oooguruk Unit postponed through 2018 (Petroleum News, 2018f); planning future workover campaign and pursuit of six new wells.	42 miles west of Alaska LNG Project	No	S
Cook Inlet Gas Gathering System (CIGGS) – Marine Pipeline Conversion	CIGGS proposes to convert a 10-inch-diameter, 21-mile-long natural gas pipeline that lies on the seabed of Cook Inlet to oil service. No physical changes to the existing pipeline are proposed. No heating or refrigeration is proposed. No changes to existing pump stations are proposed (Harvest Alaska, 2017).	No land or sea disturbance is anticipated from the conversion. Converted pipeline operation involves annual line inspection and remediation of any seabed support erosion beneath the line, utilizing sacks of custom-made cement mix for Cook Inlet.	Application for a right-of-way lease filed with ADNR September 2017. Conversion completed in October, 2018	4 miles northwest of Alaska LNG Project	Yes	None

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Cook Inlet area oil and gas development	<p>Cook Inlet is a mature, petroleum-producing basin that has seen extensive exploration and development over the past 40 years (AOGA, 2015a).</p> <p>Hilcorp Alaska has acquired numerous leases in the lower and middle Cook Inlet for oil and gas exploration and potential development.</p> <p>Planned activities between 2019 and 2024 include two seismic surveys, approximately 22 exploratory wells, platform and pipeline maintenance/repair, three geohazard surveys, a well abandonment, and marine construction associated with land-based exploration and development on the Iniskin Peninsula.</p>	<p>In 2017, 1.09 million acres were offered for lease. A total of 76,615 acres of lease sales were completed (BOEM, 2017a).</p> <p>Acreage affected by Hilcorp's activities is unknown.</p>	In 2018 Hilcorp Alaska and Harvest Alaska, together with Alaska LNG, submitted a joint Petition for Incidental Take Regulations to U.S. Fish and Wildlife Service. The petition identifies numerous planned operational and exploratory oil and gas activities within Hilcorp's and Harvest Alaska's leaseholds in Cook Inlet between 2019 and 2024.	Various activities within middle and lower Cook Inlet; some are within 5 miles of Alaska LNG Mainline Pipeline crossing of Cook Inlet.	Yes	A, LS, M, RT, S, V, WL
Eni – Spy Island	Eni US proposes drilling up to four exploration wells, consisting of two extended reach mainbores and two sidetracks from Spy Island to Outer Continental Shelf, to evaluate the oil and gas resource potential of three of the company's Outer Continental Shelf (OCS) leases in the U.S. Beaufort Sea. Spy Island is located about 3 miles offshore in 6 to 8 feet of water off Oliktok Point (BOEM, 2017b).	None. Wells would be drilled from existing artificial island. The use of extended reach drilling allows for use of existing facilities.	BOEM approved the Initial Exploration Plan in 2017, and approved a revision to the Plan in April 2018 (BOEM, 2018). Development drilling at Nikaitchuq Unit may resume late 2018 to 2019 (Petroleum News, 2018h).	38 miles northwest of Alaska LNG Project	No	S
Furie Operating Alaska	New offshore gas wells and workover of existing offshore wells in Cook Inlet. The company's 2017 development plan called for completing the KLU-A1 well and drilling another to be completed later.	Uncertain. Work will use existing platforms; one or more new rigs could be erected in Cook Inlet.	The company has completed three wells in 2018 and plans to complete another by the end of 2018 (Petroleum News, 2018b).	2 miles east of Alaska LNG Project	Yes	A, AR, GS, GW, LS, LU, M, R, RT, S, SW, V, VG, WL, VT, W
Hilcorp, Beluga River Unit	In early 2016, Hilcorp Alaska, LLC, became operator of the Beluga River Unit, one of the numerous units operated by Hilcorp in the Cook Inlet area (Petroleum News, 2017d).	None identified	Continued operation; no new wells identified	5 miles east of Alaska LNG Project	Yes	A, AR, GS, GW, LS, LU, R, RT, S, SW, V, VG, WL, W

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Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Hilcorp, Moose Pad	Hilcorp is building a new pad, the Moose Pad, on the west side of the Milne Point Unit (MPU). The new pad will provide Hilcorp access to about 7 square miles of undeveloped oil reserves within the MPU. Initial development plans for Moose Pad will include developing up to 44 new wells. To support new oil production wells on Moose Pad, an oil production pipeline, a small tie-in pad, and new pad infrastructure will be installed (Mat-Su Valley Frontiersman, 2017). In August 2017, modification to flowline route was requested.	17.2 acres (new well pad) 14 acres (est.) access road, aboveground oil pipeline (2.8 miles) 1 acre flowline realignment	Expected to commission new pad by January, 2019 (Petroleum News, 2018i).	18 miles west of Alaska LNG Project	No	A, RT, S
Hilcorp, Liberty Development Project	Construction of artificial island to support drilling and production facilities, with 5.6 miles of buried offshore oil pipeline and 1.5 miles of onshore aboveground oil pipeline. Associated onshore activities include use of permitted water sources, construction of onshore gravel pads to support the pipeline tie-in location, onshore and offshore ice roads and ice pad construction, hovercraft shelter, small boat dock, and gravel mine site development west of the Kadleroshilik River (BOEM, 2017d).	24-acre seabed footprint 25-acre mine site Offshore pipeline would use a 1,500-foot-wide temporary strip for pipe burial (1,018 acres).	Final EIS issued by BOEM in September 2018 (Petroleum News, 2018i). Construction would occur over a 3-year period following permitting.	25 miles east of Alaska LNG Project	No	A, RT, S, WL
Eva Creek Wind Project expansion and maintenance	Golden Valley Electric Association (GVEA) constructed a 24-megawatt wind farm on the ridges above the Eva Creek Valley, east of the Nenana River about 15 miles northeast of Healy, Alaska. The public and charitable lease to GVEA for constructing and operating the wind farm is for 25 years, subject to standard and special lease terms (GVEA, 2014).	170 acres (GVEA, 2014)	Completed 2013. Operations and maintenance ongoing.	9 miles east of Alaska LNG Project	No	A, RT, S, V, WL

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Golden Valley Electric Plant and Transmission Line	Proposed new gas-fired generating plant and electric transmission line from North Pole to Livengood (GVEA, 2017).	Unavailable	The North Pole Expansion Power Plant was completed in 2006 (GVEA, 2017). A transmission line to Livengood would most likely be dependent on the status of the Livengood Gold Project. A pre-feasibility study for the proposed mine was completed in 2016 (Tower Hill Mines, Ltd [Tower Hill], 2017). Within the same footprint as the Mainline Pipeline.	30 miles east of Alaska LNG Project	No	A, RT, S
ConocoPhillips, GMT-1, GMT-2, and Willow Oil Development	ConocoPhillips Alaska, Inc., has been approved for placement of 72.5 acres of fill material to construct the Greater Mooses Tooth 1 (GMT-1) and has filed an application for Greater Mooses Tooth 2 (GMT-2). GMT-1 includes a drill site, an access road, pipeline valve pads, pipelines, bridge abutments, communication equipment, and power lines for O&G production. GMT-2 would include a 14-acre drill pad, an 8.2-mile access road, an 8.6-mile pipeline, and up to 48 wells (BLM, 2018a). Oil, gas, and water produced from the reservoir would be carried via pipeline for processing. Sales-quality crude would be transported via the Alpine Oil Pipeline and Kuparuk Pipeline to the Trans Alaska Pipeline System (TAPS). Lean gas and Kuparuk-supplied seawater would be delivered via pipelines to the drill sites for injection into the reservoirs. Willow is a new discovery near GMT-2; reserves need to be better defined.	GMT-1 installed 12 miles of pipeline, 7.7 miles of gravel road, and 11 acres of gravel pad in 2017 (Petroleum News, 2017c). The gravel footprint for the GMT-2 Project would total 78 acres (BLM, 2018a).	GMT-1 facility construction is in progress and expected to begin producing by the end of 2018. DOI issued a Final Supplemental EIS for the GMT-2 project in 2018 (Petroleum News, 2018g). Willow is in the early permitting phase; BLM initiated a scoping period in August 2018 (AJC, 2018d).	74 miles west of Alaska LNG Project	No	S

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
ConocoPhillips, Kuparuk River Unit	Working to improve production at existing pads in Kuparuk River Unit and slowly expand facilities designed to target undeveloped areas in unit.	Unknown	Five rotary wells and 17 coiled tubing drilling sidetracks completed in 2018. Additional well workovers planned for 2019 (Petroleum News, 2018g).	28 miles west of Alaska LNG Project	No	A, RT, S
Great Bear Shale Oil Development	A single project is proposed to develop a source reservoir resource. Great Bear Petroleum plans exploration and evaluation wells along the Dalton Highway. Their success in the last two Central North Slope lease sales has secured leases that straddle about 20 miles of the highway, about 30 miles south of Prudhoe Bay (ADNR, 2015c).	Unknown. 500,000-acre lease purchased in 2010. Six leases terminated in 2017.	Over 1,000 square miles of seismic surveys have been completed south and southwest of Deadhorse and south of Nuiqsut. To date only one exploration well has been drilled (Petroleum News, 2017b).	3 miles east of Alaska LNG Project	Yes	A, AR, GS, GW, LS, LU,R, RT, S, SW, VG, WL, W
Nenana Basin area oil and gas development	Continued oil field development: 400,000+ acres of state oil and gas leases (ADNR, 2015d)	Leased acreage: 400,000 (state), 43,000 (Doyon), and 9,500 (Mental Trust Land)	Ongoing. Exploratory drilling planned for 2018 (Petroleum News, 2018c). One exploratory well completed in July, 2018 (Daily News-Miner, 2018).	12 miles west of Alaska LNG Project	No	A, RT, S, V
Kenai LNG Plant	The Kenai LNG Plant has been in "warm standby" since 2015 (Alaska Dispatch News [ADN], 2017). Trans-Foreland Pipeline Co. is proposing to cool down the facilities by importing LNG into its storage tanks, and to install a boil-off gas system that would provide up to 7 million cfd of gas to the adjacent Kenai Refinery.	None. All improvements would be within current site.	Trans-Foreland filed an application with FERC for authorization to install the proposed improvements under Section 3 of the NGA in March 2019. An application for authorization to import LNG for storage is pending.	1 mile south of Alaska LNG Project	Yes	A, AR, GW, LS, M, N, S, VT

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
ORPC Cook Inlet Tidal Energy Project	ORPC's Cook Inlet Tidal Energy Project proposes installing turbine generator units in Cook Inlet that would capture energy from tides and deliver power to a utility grid. Would begin with a project at its East Foreland site, near the town of Nikiski, Alaska. The project includes a pilot project for Homer Electric (Turnagain Arm Tidal Energy Corporation, 2012).	Unknown	Active FERC Hydro Kinetic Preliminary Permit: expired May 31, 2016. In 2016, ORPC applied to FERC to surrender the preliminary license for the proposed tidal energy project (Energy Policy Update, 2016). Use of same marine, air, and highway transportation corridors as Alaska LNG Project.	1 mile northwest of Alaska LNG Project	Yes	A, AR, C, GS, GW, LS, LU, M, N, R, RT, S, SW, V, VG, WL, VT
Susitna-Watana Hydroelectric Project	The Susitna-Watana Hydroelectric project would include construction of a dam, reservoir, and related facilities in a remote part of the Susitna River, 184 river miles from Cook Inlet, 87 river miles beyond Talkeetna, and 22–32 river miles above Devils Canyon, which acts as a natural impediment to salmon migration. Transmission lines connecting to the existing Railbelt transmission system and an access road would also be constructed. Initial models show Susitna-Watana hydropower rates would be competitive with other fuel sources at start-up (Susitna-Watana Hydro, 2017).	42-mile-long by 1-mile-wide reservoir – about 26,900 acres	The project was shut down by Alaska Governor Walker in 2016 as a result of the state's fiscal situation (State of Alaska [SOA], 2016).	40 miles southeast of Alaska LNG Project	No	RT, S
TAPS maintenance and upgrades	The operation and maintenance of the existing 800-mile-long, 48-inch-diameter hot oil pipeline (BLM, 2002).	Unknown. Most activities would take place within existing TAPS footprint.	Ongoing	In same corridor as Alaska LNG from Prudhoe to Livengood	Yes	A, AR, C, GS, GW, LS, N, RT, S, SW, V, VG, WL, W

TABLE W-1 (cont'd)						
Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources						
Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Andeavor Kenai Refinery	The Andeavor Kenai Refinery can process up to 72,000 barrels per day (bpd). The refinery produces gasoline and gasoline blendstocks, jet fuel, diesel fuel, heating oil, heavy fuel oils, propane, and asphalt. Crude oil is delivered by double-hulled tankers through Cook Inlet and by pipeline from the Kenai Peninsula and Cook Inlet. A 68-mile-long, 42,000 bpd common-carrier products pipeline transports jet fuel, gasoline, and diesel fuel to the Port of Alaska (POA) and the Anchorage International Airport. Wholesale delivery occurs through terminals in Kenai, Anchorage, and Tesoro's Nikiski dock (Andeavor, 2018).	Unknown	Ongoing operations; no known expansion plans.	1 mile southwest of Alaska LNG Project	Yes	A, GW, N, S,
Umiat Development	Continued oil field development in the National Petroleum Reserve-Alaska (Linc Energy, 2014).	Unknown	No specific future actions identified. Exploratory wells were drilled in 2013-2014.	80 miles west of Alaska LNG Project	No	RT, S
Yukon Flats area oil and gas development	The Yukon Flats basin is an underexplored part of interior Alaska. Surface hydrocarbons in soils, along with oil and gas in lakebed sediment cores, indicate the presence of an active thermogenic hydrocarbon system. Oil export is readily available via the TAPS (where capacity is available), and potential gas export availability with the development of the Project (Doyon Limited Oil and Gas Exploration [Doyon], 2015).	Doyon Limited controls 1.4 million acres in the Yukon Flats area, and in 2010 acquired 96 miles of 2D seismic data.	Seismic exploratory activities ongoing. In December 2017, Congress opened up an additional 1.5 million acres for drilling in the Arctic National Wildlife Refuge.	26 miles northeast of Alaska LNG Project	No	A, RT, S

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Transportation Projects						
Alaska Roads to Resources – proposed new road construction	State and private road construction projects to access natural resources (Alaska Department of Transportation and Public Facilities [ADOT&PF], 2011a)	<p>Ambler road: 211-mile-long road to Ambler Mining District. About 80 acres of wetlands within the Alaska LNG Project's HUC-12 watershed would be affected.</p> <p>West Susitna road: 72-mile-long road extension, Umiat: 100-mile-long road</p>	<p>Ambler: BLM expects to issue a Draft EIS by spring 2019, with Final EIS by end of 2019 (The Arctic Sounder, 2018). Company expects permit decision on Ambler Road by 2020 (AJC, 2018b).</p> <p>West Susitna 2014: ADOT&PF released a reconnaissance study assessing five possible routes.</p> <p>Umiat 2015: ADOT&PF requested work on the EIS be halted. Project proponent states work can be completed using ice roads (AJC, 2015).</p>	<p>Ambler and Umiat Roads would intersect the Dalton Highway in the same corridor as the Alaska LNG Project in the Brooks Range (about MP 254), and extend west from that point. Routes for the West Susitna Road are under investigation; it is possible that the road would cross the Mainline Pipeline corridor south of Denali Park and Preserve in the Trapper Creek vicinity.</p>	Yes; about 9 miles of the Ambler Road alignment would lie within the same HUC-12 watershed as Alaska LNG.	A, AR, C, GS, GW, LS, LU, N, R, RT, S, SW, V, VG, WL, W
Fairbanks Intermodal Yard	Increase staging and laydown yard acreage in Fairbanks near ARRC site. Part of a long-term rail plan.	Unknown	Public comment period for Alaska State Rail Plan ended March 10, 2018 (Fairbanks Daily News Miner, 2018).	30 miles east of Alaska LNG Project	No	A, RT, S

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Highway maintenance and upgrades	ADOT&PF plans highway maintenance to the Parks, Dalton, Seward, and Sterling Highways. Proposing to reconstruct the Dalton Highway from its junction of the Elliott Highway near Livengood Highway MP 0 to MP 9. Proposing improvements to the Sterling Highway between its eastern intersection with Skilak Lake Road (near historic MP 58) and Kenai Keys Road (near historic MP 79). Plan to rehabilitate and improve the safety of 5.5 miles of the Seward Highway between the communities of Moose Pass and Seward, Alaska (ADOT&PF, 2011b,c).	Unknown	Ongoing Use of the same marine, air, and highway transportation corridors as Alaska LNG Project.	Some locations are near or adjacent to highways.	Yes	A, AR, C, GS, GW, LS, LU, N, R, RT, S, SW, VG, WL, W
Homer Capital Improvement Plan (CIP)	City of Homer CIP includes water storage/distribution improvements, road system improvements, and improvements to port and harbor facilities (City of Homer, 2017).	Over 100 acres	2018-2023 Plan included a Legislative Request for over \$123 million FY19 capital budget. Use of the same marine and highway transportation corridors as Alaska LNG Project.	72 miles south of Alaska LNG Project	No	RT, S
Knik Arm Bridge	The Knik Arm Crossing is an ADOT&PF project to construct a 1.7-mile toll bridge over Cook Inlet's Knik Arm, connecting Anchorage, Alaska's largest city, with the MSB, Alaska's fastest-growing region (U.S. Department of Transportation [DOT], 2015).	1.7-mile-long bridge	In 2014, legislation establishing public finance passed the House and the Senate; design and construction was transferred to ADOT&PF. In June 2016, the project was halted and all funding removed from the state's FY18 operating budget. At that time the project was being finalized for closeout with the Federal Highway Administration (SOA, 2017a). Would use the same highway transportation corridors as Alaska LNG Project.	29 miles east of Alaska LNG Project	No	A, M, RT, S

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Port MacKenzie Rail Extension	The Port MacKenzie Rail Extension is a 32-mile rail line in the Susitna River valley. The rail line travels north from the port facility and connects to the existing rail system near Houston, Alaska. The new rail line would establish a rail link between Port MacKenzie and the ARRC system, which currently connects ports in Seward, Whittier, and Anchorage with interior Alaska, including Denali National Park, Fairbanks, and North Pole. The MSB is the operator of Port MacKenzie, project sponsor, and co-manager of the project. The project would provide Port MacKenzie customers/shippers efficient rail transportation between the Port and interior Alaska (ARRC and MSB, 2014).	8,940 acres (ARRC, 2016)	Project is 75% complete, but is currently on hold. In January 2017, the McDowell Group prepared a Market Analysis for the MSB to evaluate necessity and benefit of the project (McDowell Group, 2017b).	21 miles east of Alaska LNG Project	No	A, RT, S
Ted Stevens Airport Expansion	Airport management and ADOT&PF plan to expand the Ted Stevens Anchorage International Airport to strategically position the airport for the future by maximizing operational efficiency and business effectiveness, and by maximizing property availability for aeronautical development through efficient planning. The planning horizon for the Master Plan Update is 20 years and considers terminal, runway, and security expansions on airport property (ADOT&PF, 2014b).	4,612 acres with hundreds of acres available for development, including Kulis Business Park (SOA, 2017b).	2015 to 2035	28 miles southeast of Alaska LNG Project	No	A, RT, S

TABLE W-1 (cont'd)						
Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources						
Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Mining Projects						
Chuitna Coal Mine	The Chuitna Coal Mine Project, designed by PacRim Coal, LP, is a surface coal mine with contemporaneous reclamation to recover an estimated 300 million tons of sub-bituminous ultra-low-sulfur coal. Project permitting began in 2006 and is currently in the advanced permitting phase. Production is expected to average 12 million metric tons per year depending on market demand. Major components are the mine area, infrastructure, and port facilities (PacRim Coal, LP [PRC], 2012).	About 5,000 acres (AJC, 2017)	Preliminary Draft Supplemental EIS Released for cooperating agency review in November 2015. March 31, 2017, all permitting activities related to the Chuitna Coal Project were suspended (ADNR, 2017a).	6 miles west of Alaska LNG Project	No, but lies within HUC10 watershed	A, RT, S, WL
Donlin Gold Mine	Gold mine with infrastructure plans for a gas-fired power generation plant, water treatment plant, access roads, housing, a new port, a 316-mile, 14-inch natural gas pipeline, and an airstrip. The mine is estimated to produce on average 1.3 million ounces of gold annually during operation (Donlin Gold, 2015), (COE, 2018b).	Near the end of operation, the resulting pit would be about 2.2 miles long by 1 mile wide. Tailing storage would encompass 2,351 acres. The pipeline and a related fiber optic cable would be built within a 150-foot construction right-of-way. The pipeline would affect about 408 acres within Cook Inlet Basin, including roughly 84 acres of wetland impacts within HUC12 watersheds crossed by the Alaska LNG Project (COE, 2018b).	The COE released the Final EIS in April 2018 (Alaska Public Media, 2018a), and issued Section 10 and 404 permits for the project in August 2018 (Mining Journal, 2018).	Mine site is 228 miles west of Alaska LNG Project. Natural gas pipeline would cross alignment of Alaska LNG Mainline Pipeline at about MP 749.	Pipeline would cross alignment of Alaska LNG Mainline Pipeline. Use of the same marine, air, and highway transportation corridors as Alaska LNG Project.	A, AR, C, GS, GW, LS, LU, N, R, RT, S, SW, VG, WL, W

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Livengood Gold Project	The Livengood Gold Project is in the Tolovana mining district within the Tintina Gold Belt. The project area centers on a local topographic high point named Money Knob. This feature and the adjoining ridgelines have been considered by many to be the lode gold source for placer gold deposits that lie in the adjacent valleys and that have been actively mined since 1914, with the production of more than 500,000 ounces of gold (Tower Hill, 2018).	48,300 acres	Development during later years of Alaska LNG construction to commence operations when gas is available to Fairbanks. As of 2018, developer was continuing optimization and environmental baseline studies (North of 60 Mining News, 2018).	17 miles northeast of Alaska LNG Project	No, but lies within HUC10 watershed	A, RT, S, WL
Usibelli Coal Mine expansion, operations, and maintenance	Usibelli Coal Mine (UCM) currently has a workforce of about 130 employees, and operates year-round. Mine production has grown from 10,000 tons in 1943 to an average above 2 million tons of coal per year. UCM supplies coal to six interior Alaska power plants and exports coal to Chile, South Korea, and several other Pacific Rim destinations (UCM, 2015).	35,100 acres under coal lease from the State of Alaska (UCM, 2015).	Operations and maintenance are ongoing; no specific future actions identified. However, Governor Bill Walker announced in February 2018 that China might have an interest in importing coal from Alaska, which could lead to expansion of the mine site (Juneau Empire, 2018).	3 miles northeast of Alaska LNG Project	Yes	A, AR, GS, GW, LS, LU, R, RT, S, SW, V, VG, WL, W
Marine Projects						
Alaska Deep-Draft Arctic Port at Nome.	A feasibility report and draft Environmental Assessment (EA) was completed in 2015 for constructing navigation improvements as part of a larger system of port facilities in the Arctic and sub-Arctic region. The outcome of the study was to select project sites, develop measures and alternatives, and select the recommended alternative (COE, 2015a).	Census Area. The extension would increase the existing 22.5 mean lower low water (MLLW) deep causeway to - 35 MLLW. Existing causeway includes a 270-foot spur at the end and a 3,025-foot protective breakwater.	Project had been shelved since 2015. In early 2018, COE and the City of Nome entered into an agreement to split the cost of a new study of potential regional benefits of a deepwater port (Alaska Public Media, 2018b). COE feasibility study in progress as of late 2018.	375 miles west of Alaska LNG Project	No	RT, S

TABLE W-1 (cont'd)						
Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources						
Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
POA Expansion	The U.S. Department of Transportation, Maritime Administration (MARAD) in cooperation with the POA originally proposed to expand, reorganize, and improve the POA. This Marine Terminal Redevelopment Project would double the size of the POA, and provide about 8,880 linear feet of waterfront structures west, northwest, and southwest of the existing POA (POA, 2017a). The Port was renamed POA in October 2017.	Unavailable	On hold. The Anchorage municipality is currently in Phase I of a new port modernization project intended to update, repair, and replace existing infrastructure. The project is scheduled for completion in 2022 (POA, 2017a). Use of the same marine, air, highway, and rail transportation corridors as Alaska LNG Project.	30 miles southeast of Alaska LNG Project	No	A, M, RT, S
Seward Marine Terminal Expansion	The Seward Marine Terminal Expansion Planning Project would provide a comprehensive master planning effort, inclusive of all relevant transportation and engineering disciplines, and result in a Seward Marine Terminal Expansion Master Plan for ARRC's Seward port facilities and conceptual/preliminary designs of the port and upland support facilities. A completed expansion effort would accommodate a variety of vessel types including freight, passenger, ferry, research, military, fishing, and barges. It would also improve Port of Seward safety and efficiency; preserve and enhance the intermodal operations of 40+ existing freight and passenger vessel docking customers; accommodate demonstrated and projected increases in traffic volumes and types; promote economic growth, employment, and sustainability; and ensure the long-term utility of Seward facilities (ARRC, 2015).	Unavailable	In summer 2017, ARRC held public meetings in Seward to discuss the expansion Master Plan. Passenger and Freight Traffic Report completed as of May 2017 (ARRC, 2017a). Use of the same marine, air, highway, and rail transportation corridors as Alaska LNG Project.	77 miles southeast of Alaska LNG Project	No	M, RT, S

TABLE W-1 (cont'd)						
Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources						
Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Other Projects						
Agrium Kenai Nitrogen Operations Facility	The Agrium Kenai Nitrogen Operations Facility is at Mile 21 of the Kenai Spur Highway near Kenai, Alaska. It is classified as a nitrogenous fertilizer manufacturing facility under Standard Industrial Classification code 2873 and under North American Industrial Classification code 325311. The facility will produce ammonia and urea for bulk sale (Alaska Department of Environmental Conservation [ADEC], 2014).	N/A – would use existing plant	Facility closed in 2007. An ADEC Air Quality Control Construction Permit was issued for 2015-2020. Agrium also applied for an ADEC discharge permit for the facility under the scenario the plant would reopen in 2018 (ADEC, 2017b). Reopening still on hold as of early 2018 (Peninsula Clarion, 2018).	1 mile south of Alaska LNG Project	Yes	A, AR, C, GW, N, RT, S, SW
F-35 Beddown	The Alaska LNG Project would base up to 54 F-35A aircraft at Eielson Air Force Base, Alaska, as an additive operational mission to the 354th Fighter Wing (U.S. Air Force [USAF], 2015).	135 acres (USAF, 2017)	Record of Decision was signed April 2016. The Supplemental EIS finalized June 2017. The first aircraft would be delivered in 2020, allowing full operational capabilities for both squadrons by 2021.	45 miles east of Alaska LNG Project	No	RT, S
Four Lakes Warming Research	Researchers would experimentally raise upper layer lake temperatures by 2-4 degrees Celsius, delaying ice formation by approximately 30 days, over a period of five years. Data gathered from the project is to gauge the effect of long and warmer growing seasons on ecosystem and community composition and to predict lake temperatures with a coupled, lake climate model (BLM, 2017a).	Minimal ground disturbance from foot traffic to and from lakes.	Environmental Assessment completed, 2017	0.75 mile from Alaska LNG Project	No (within HUC10 watershed)	WL

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
South Denali Visitor Center	The project would enhance recreation and access throughout the South Denali region, design expanded visitor facilities and recreational opportunities in the South Denali region, protect the cultural and natural resource values of the area, and preserve quality of life for residents in nearby communities. The plan is to develop new facilities and enhancements; project partners are exploring cooperative efforts for implementation and maintenance through public and private sector support (National Park Service [NPS], 2006b).	2.5 acres plus 31 miles of trails (NPS, 2006b)	Opened in 2017, it includes a 3,300-square-foot interpretive center, 32 recreational vehicle campsites, 10 walk-in campsites, three public-use cabins, and a 34-mile-long power extension along the Parks Highway (ADNR, 2017g).	2 miles northwest of Alaska LNG Project	Yes	AR, GS, LS, R, RT, V, VG, WL, W
U.S. Army Corps of Engineers Anchorage Harbor Maintenance Dredging	Annual maintenance dredging, Anchorage Harbor	Volume has ranged from 600,000 to 1.1 million cubic yards annually (COE, 2017b).	Ongoing	Dredge disposal area lies 35 miles from Alaska LNG facilities.	Yes	A,R,M, VT
Quintillion Terrestrial and GCI Alaska United Fiber Optic Projects	The two fiber optic projects were installed adjacent to the Dalton Highway in 2017.	Unknown. Estimated permafrost thaw area up to 12 acres (based on 20 locations measuring 500' by 50').	Projects went into service in 2017. Permafrost thawing along the trenchline has been observed at about 20 locations; restoration/remediation efforts are in progress (Alaska Public Media, 2018c).	In same corridor as Alaska LNG between MPs 25 and 400.	Yes	A, AR, C, GS, GW, LS, LU, N, R, RT, S, SW, V, VG, WL, VT, W

TABLE W-1 (cont'd)

Past, Present, and Reasonably Foreseeable Actions that Could Cumulatively Affect Resources

Project/Activity	Project Description	Area Affected	Status	Location Relative to Nearest Project Facility	HUC12 Watershed Shared with Alaska LNG	Resources with Potential Cumulative Impacts ^a
Resources Affected Acronyms:		Acronyms:				
A	Air	ADEC	Alaska Department of Environmental Conservation	GVEA	Golden Valley Electric Association	
AT	Air Travel	ADN	Alaska Dispatch News	HUC	Hydrologic Unit Code	
AR	Aquatic Resources	ADNR	Alaska Department of Natural Resources	LLC	Limited Liability Company	
C	Cultural Resources	ADOT&PF	Alaska Department of Transportation and Public Facilities	LP	Limited Partnership	
GS	Geology and Soils	AGDC	Alaska Gasline Development Corporation	Ltd.	Limited	
GW	Groundwater	AJC	Alaska Journal of Commerce	LNG	liquefied natural gas	
LS	Listed Species	ANILCA	Alaska National Interest Lands Conservation Act	MARAD	Maritime Administration	
LU	Land Use	AOGA	Alaska Oil and Gas Association	MGS	Major Gas Sales	
M	Marine Offshore Biological	ARRC	Alaska Railroad Corporation	MLLW	mean lower low water	
N	Noise	BLM	Bureau of Land Management	MPU	Milne Point Unit	
R	Recreation	BOEM	Bureau of Ocean Energy Management	MP	milepost	
RT	Road or Rail Traffic	bpd	barrels per day	N/A	not applicable	
S	Socioeconomics	BRP	Brooks Range Petroleum	NPS	National Park Service	
SW	Surface Water	cfd	cubic feet per day	O&G	oil and gas	
V	Visual	CIP	Capital Improvement Plan	OCS	Outer Continental Shelf	
VG	Vegetation	CIGGS	Cook Inlet Gathering System	ODS	Oooguruk Drill Site	
WL	Wildlife	COE	United States Army Corps of Engineers	ORPC	Ocean Renewable Power Company	
VT	Vessel Traffic	DOG	ADNR Division of Oil and Gas	PBU	Prudhoe Bay Unit	
W	Wetlands	DOI	United States Department of the Interior	POA	Port of Alaska	
		DOT	United States Department of Transportation	PRC	PacRim Coal	
		EA	Environmental Assessment	PTTL	Point Thomson Unit Gas Transmission Line	
		EIS	Environmental Impact Statement	PTU	Point Thomson Unit	
		FERC	Federal Energy Regulatory Commission	SOA	State of Alaska	
		gal	gallons	TAPS	Trans Alaska Pipeline System	
		GCI	General Communication Inc.	UCM	Usibelli Coal Mine	
		GMT	Greater Mooses Tooth	USAF	U.S. Air Force	

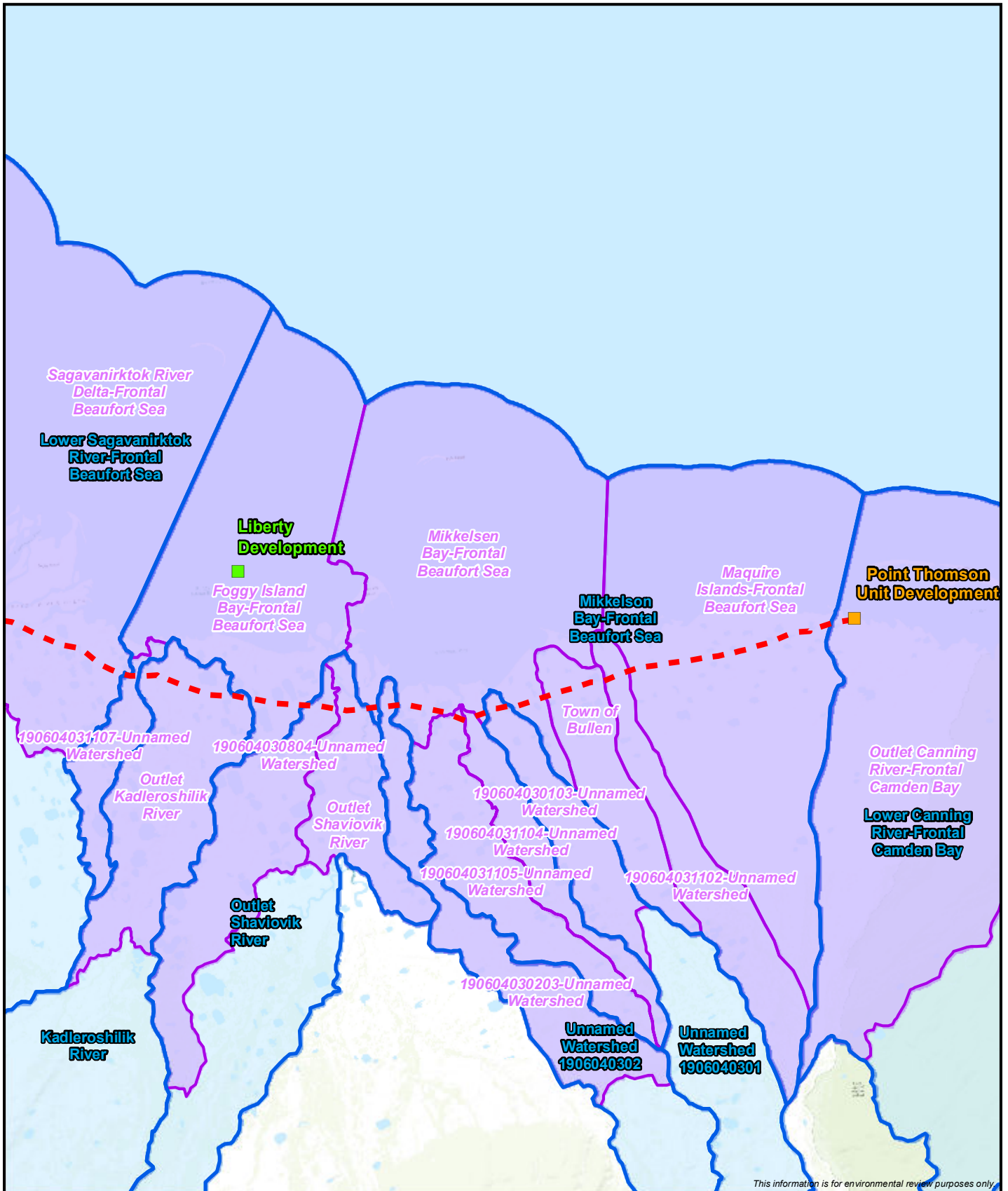
Appendix W-2

Maps of Past, Present, and Reasonably Foreseeable Actions

APPENDIX W-2: MAPS OF PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

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- Non-Jurisdictional Facility
- Existing/Future Project
- Point Thomson Transmission Line
- HUC 10 Watershed
- HUC 12 Watershed

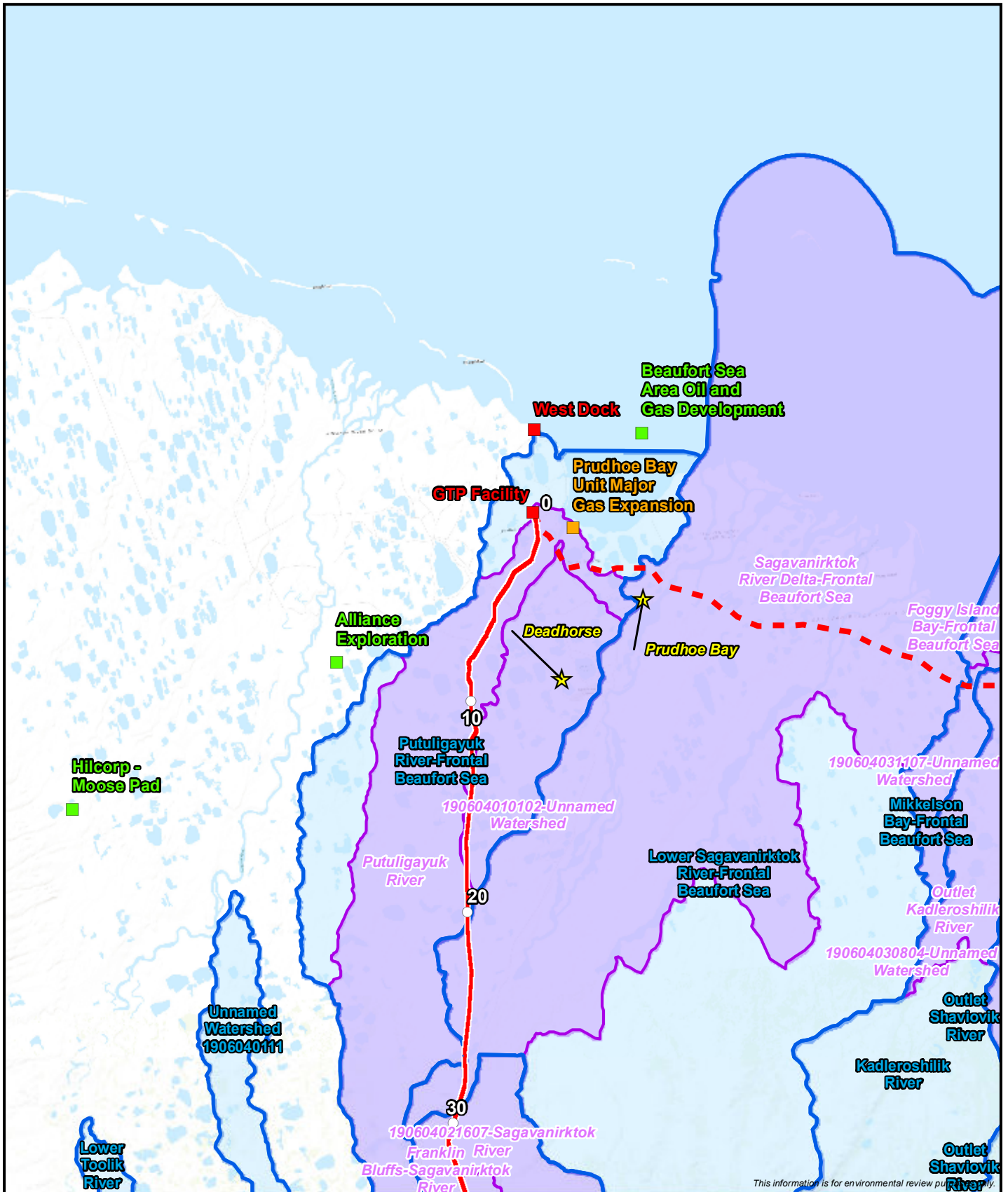


0 5 10 Miles

Date: 06/14/2019 | SCALE: 1:400,000 when printed at 8.5x11

Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable Actions in
HUC10 and HUC12 Watersheds, PTTL Eastern Portion



This information is for environmental review purposes only.

- Alaska LNG Major Aboveground Facility
- Community
- Non-Jurisdictional Facility
- Existing/Future Project
- Milepost
- Alaska LNG Proposed Mainline Route
- Point Thomson Transmission Line
- HUC 10 Watershed
- HUC 12 Watershed



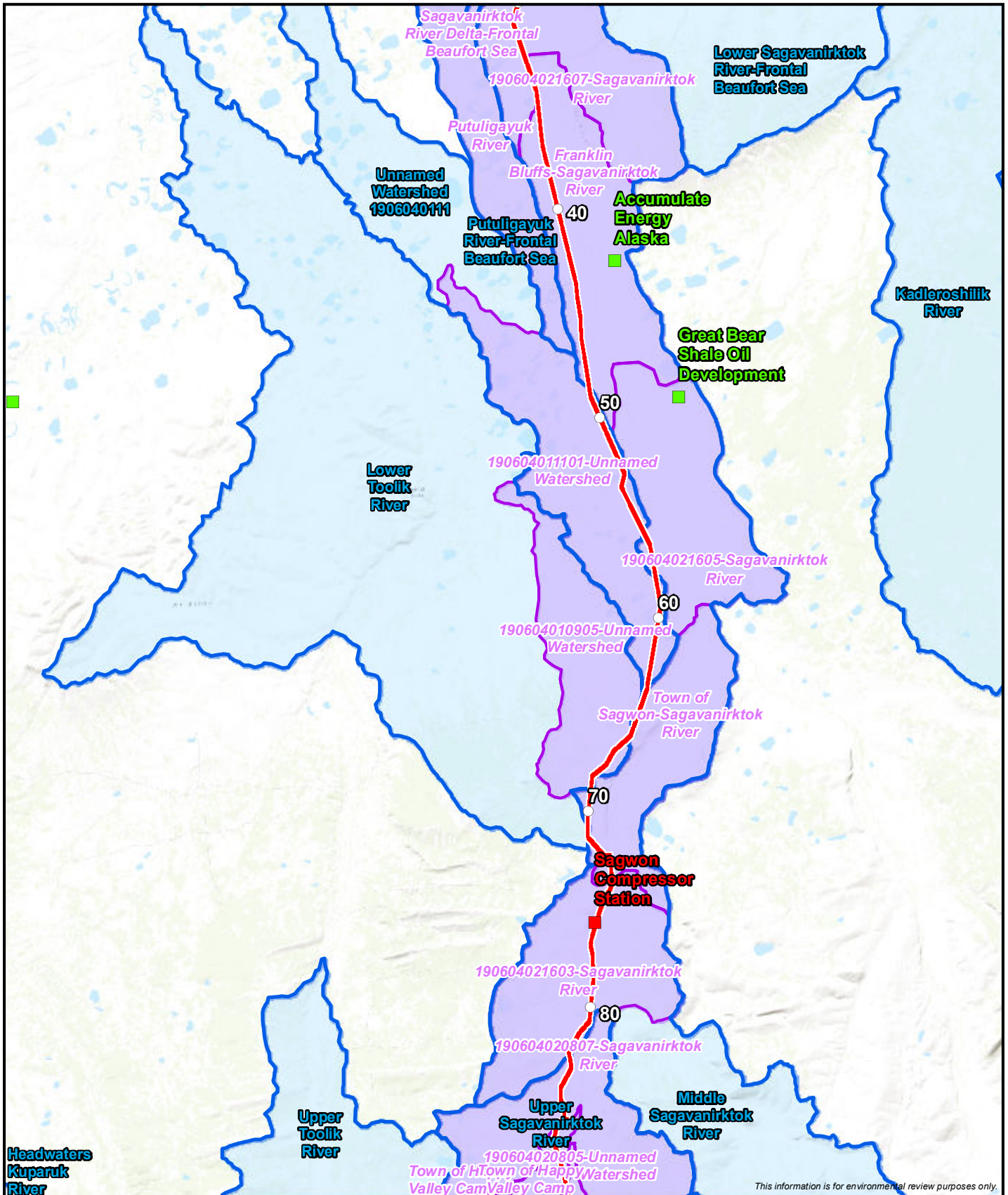
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Appendix W-2

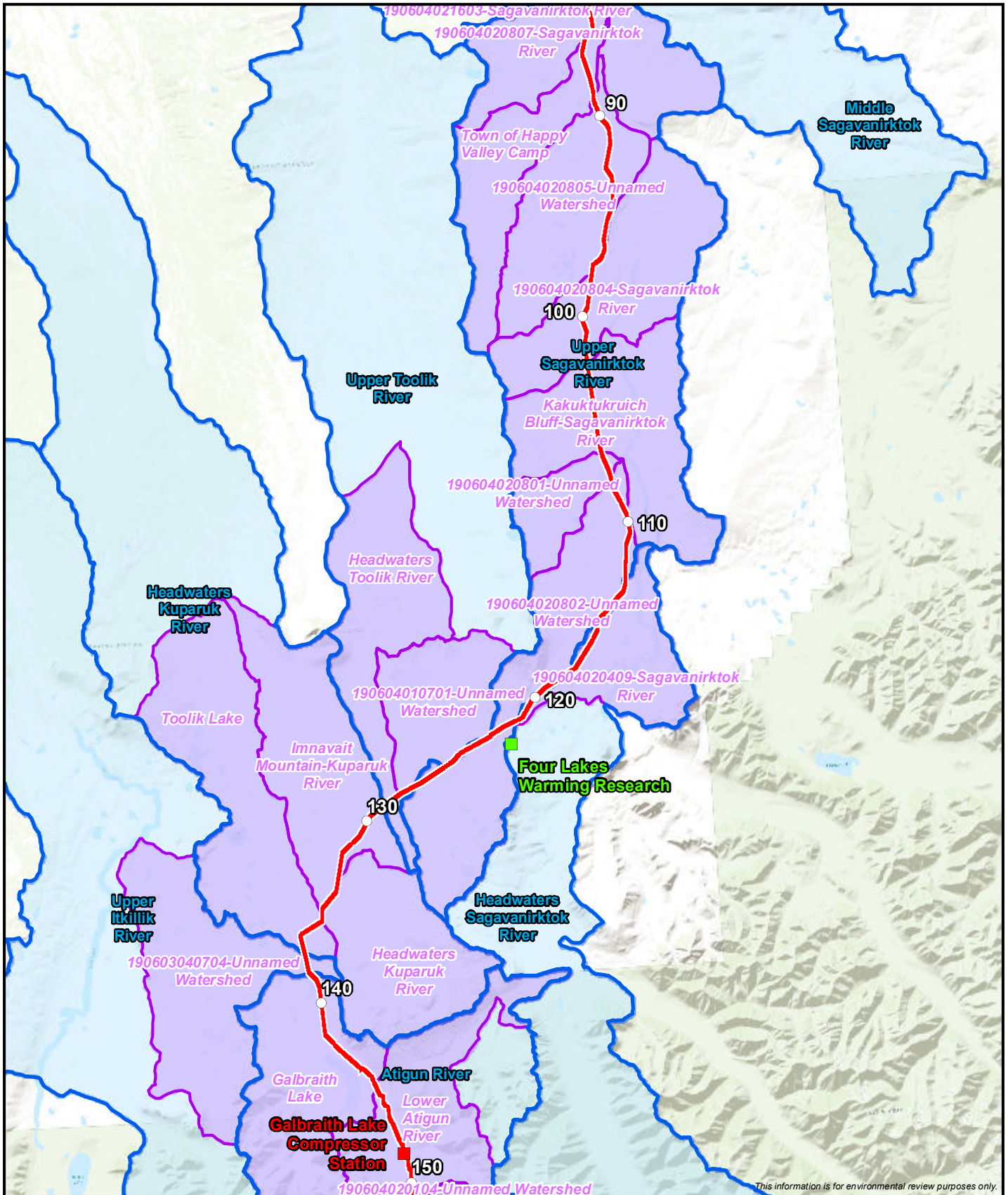
Alaska LNG Project

Past, Present, and Reasonably Foreseeable Actions in Project HUC10 and HUC12 Watersheds, PTTL Western Portion, Mainline Pipeline MP 0-35



Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 35–90



This information is for environmental review purposes only.

- Alaska LNG Major Aboveground Facility
- Existing/Future Project
- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed
- HUC 12 Watershed

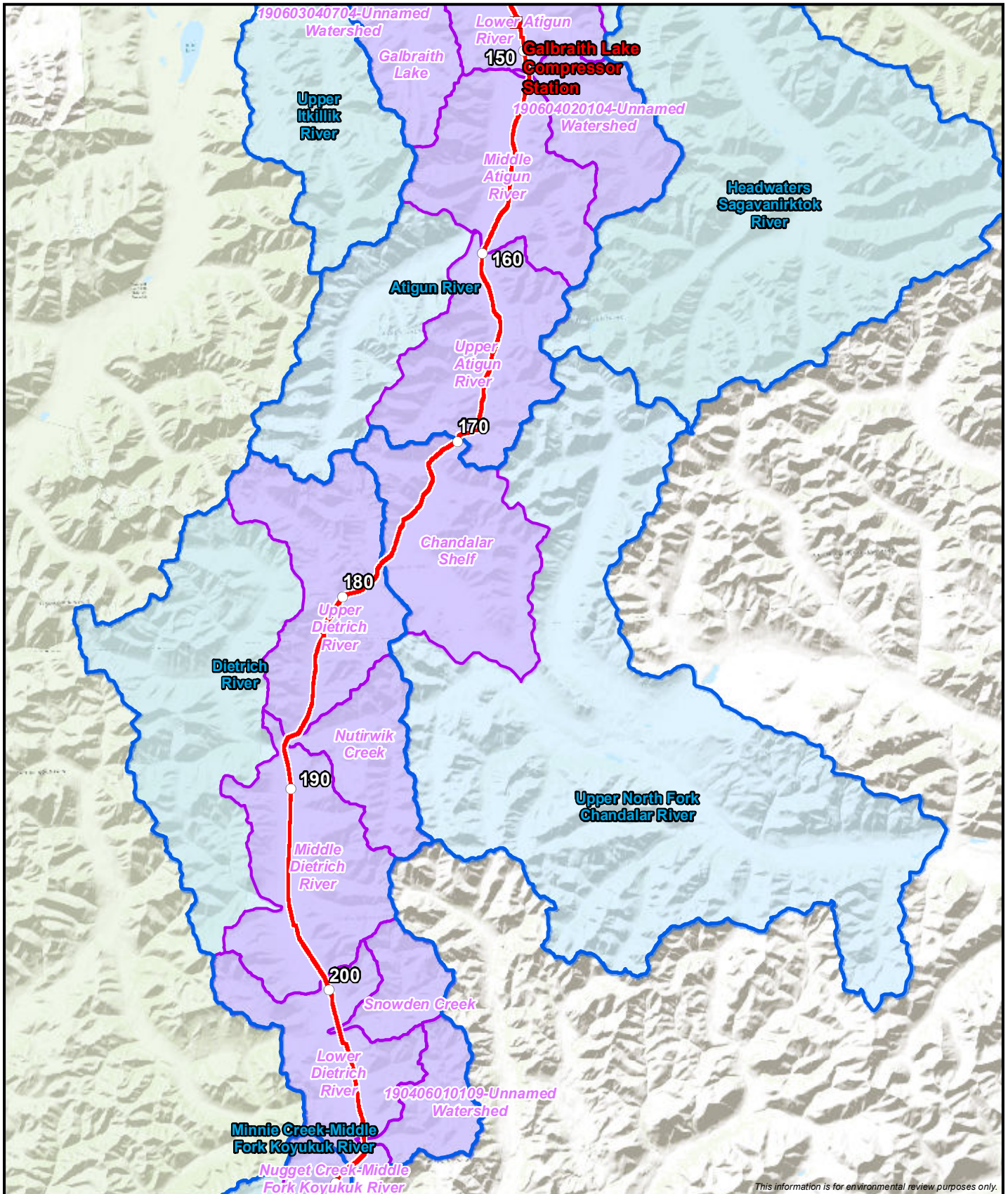


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Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 90–150



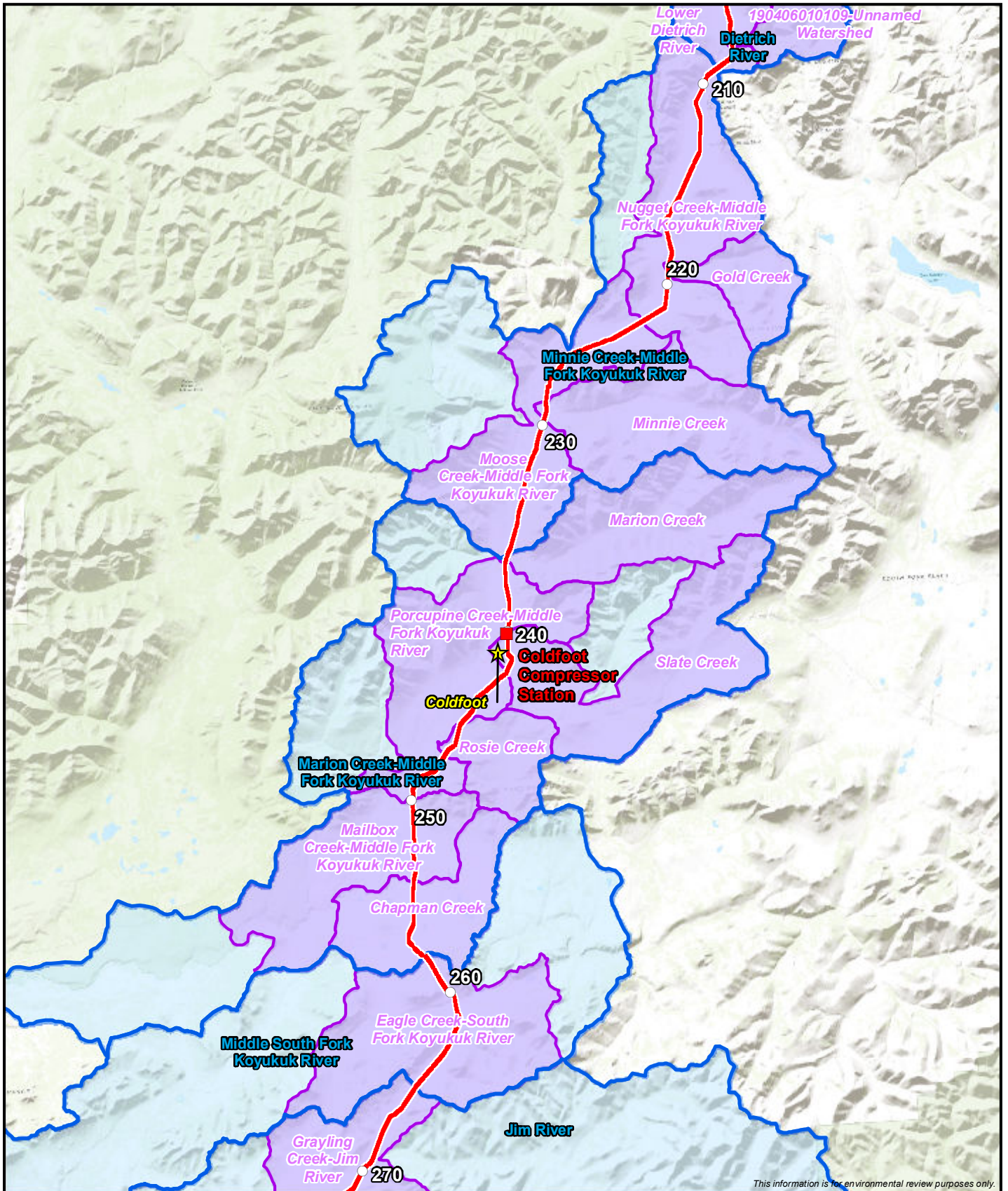
This information is for environmental review purposes only.

- Alaska LNG Major Aboveground Facility
- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed
- HUC 12 Watershed



0 5 10 Miles

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- Alaska LNG Major Aboveground Facility
- HUC 12 Watershed
- ★ Community
- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed

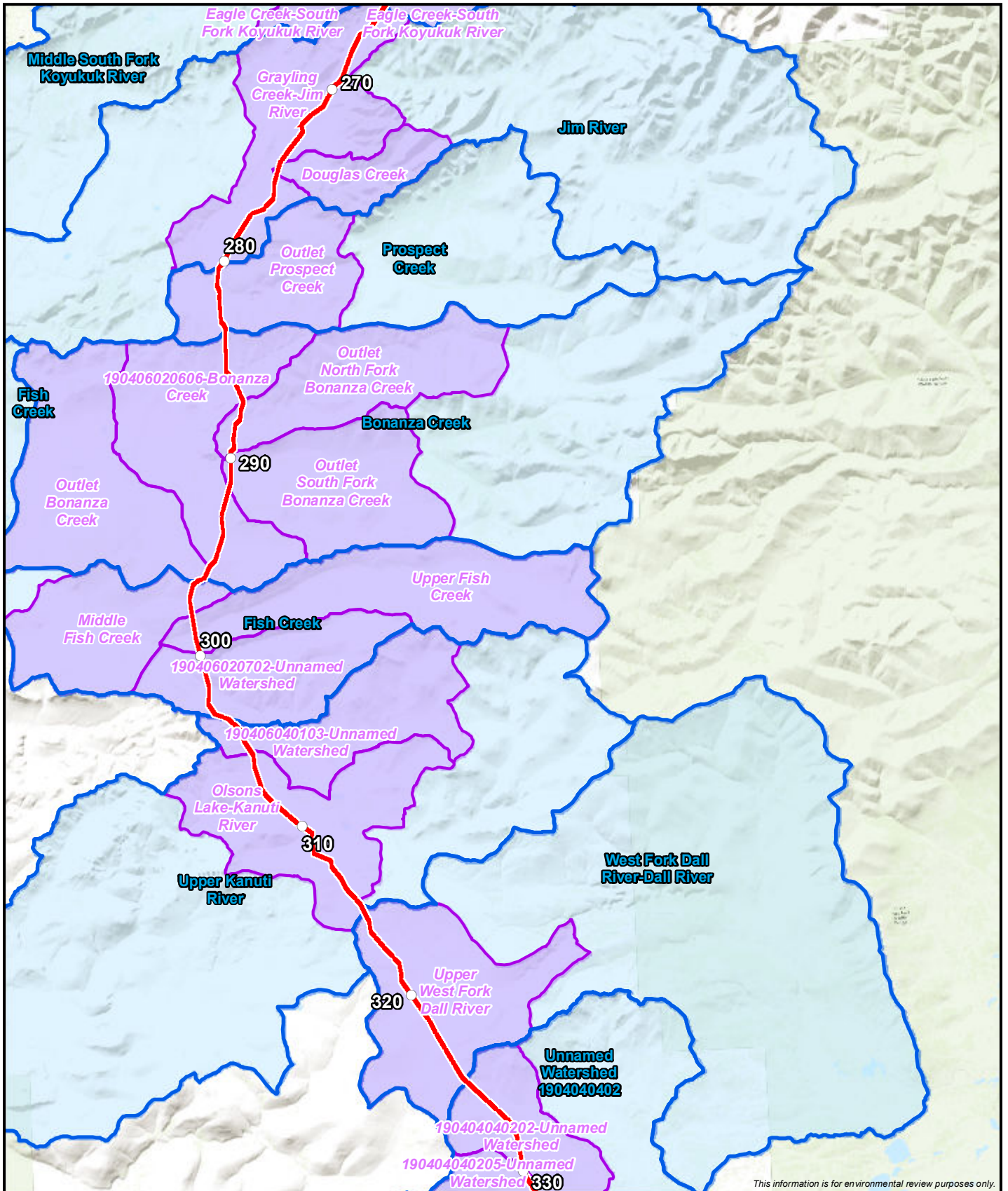


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Date: 06/14/2019 | SCALE: 1:400,000 when printed at 8.5x11

Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 210–270



This information is for environmental review purposes only.

- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed
- HUC 12 Watershed

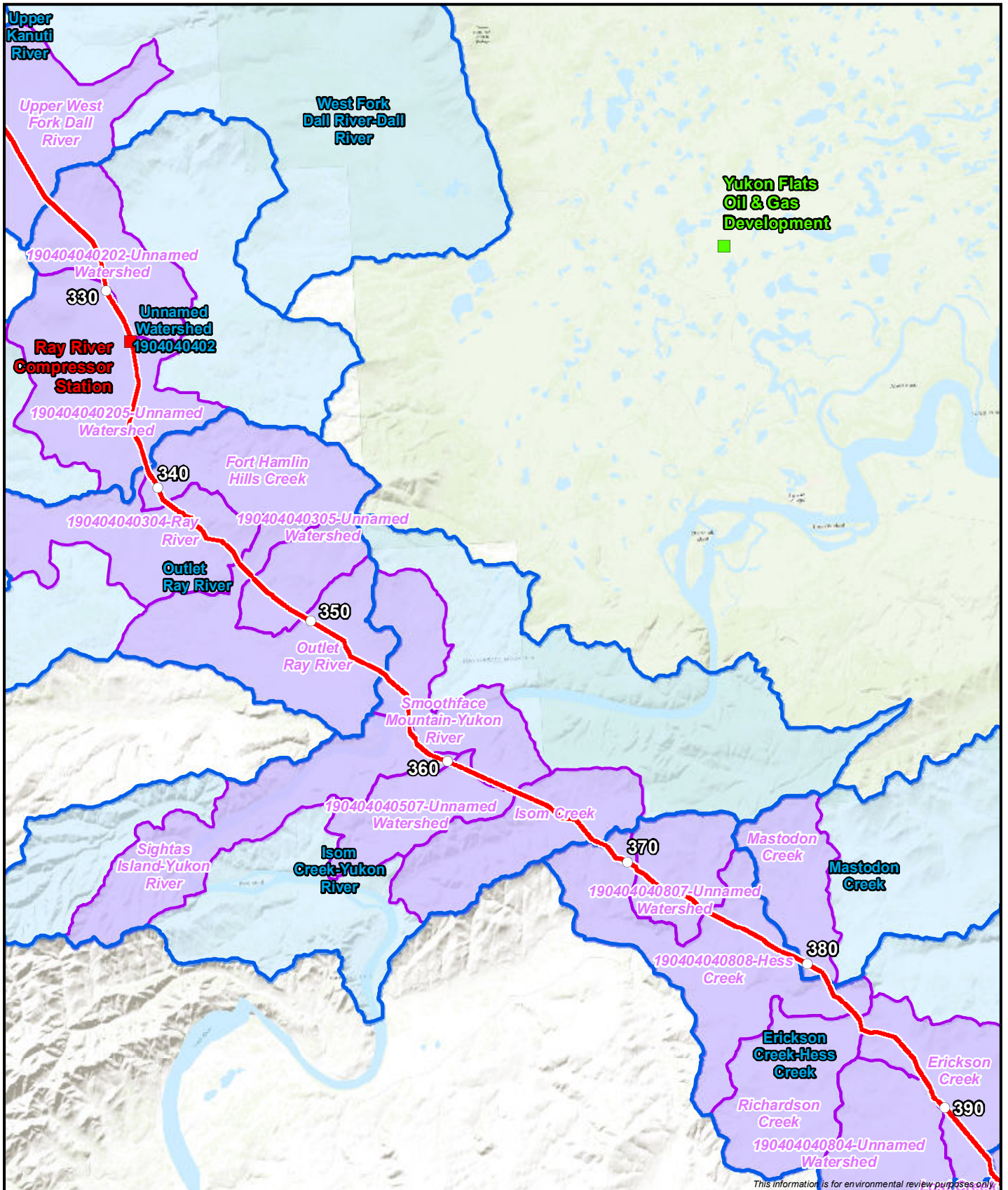


0 5 10 Miles

Date: 06/14/2019 | SCALE: 1:400,000 when printed at 8.5x11

Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 270–330



- Alaska LNG Major Aboveground Facility
- Existing/Future Project
- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed
- HUC 12 Watershed

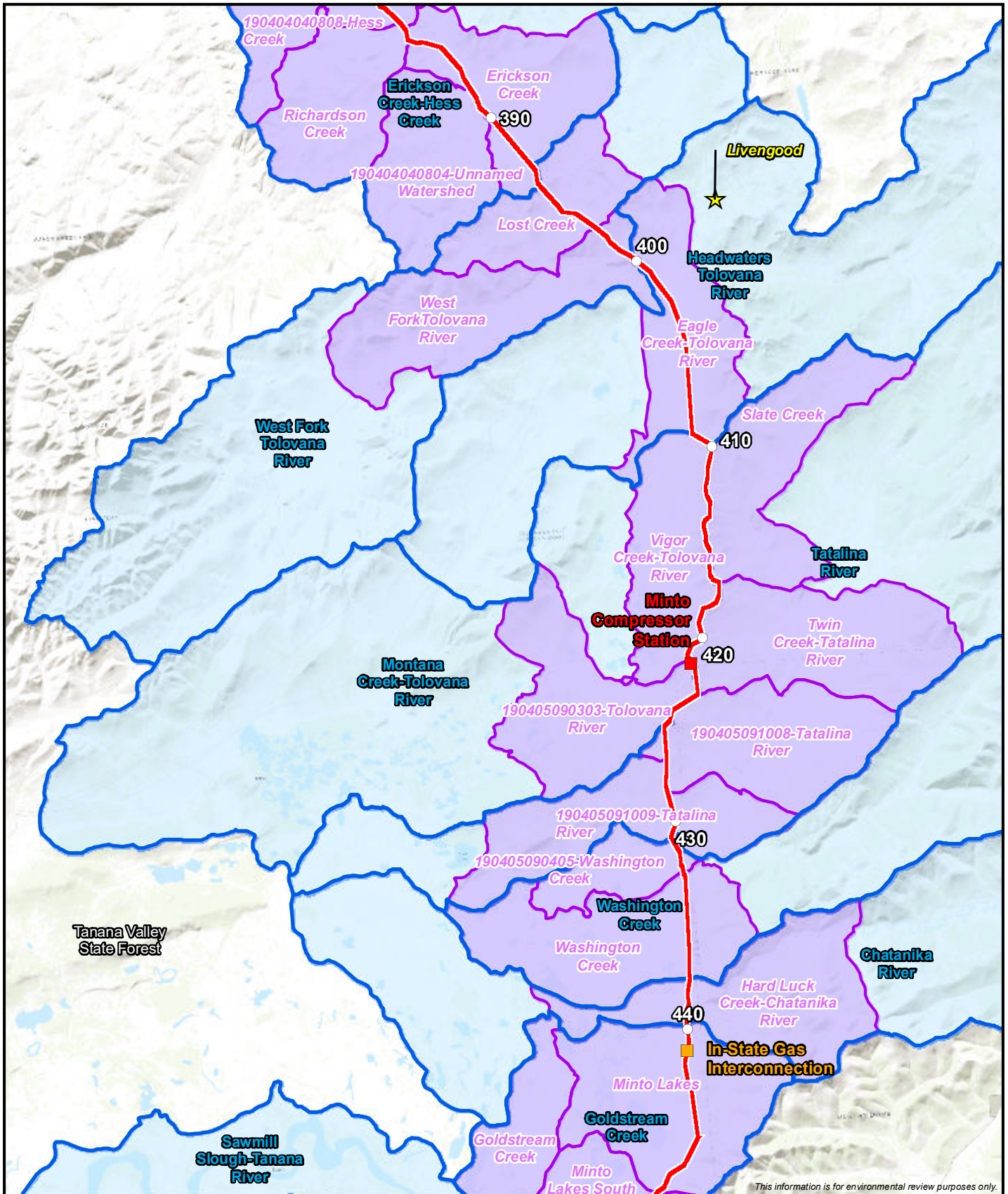
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Appendix W-2 Alaska LNG Project

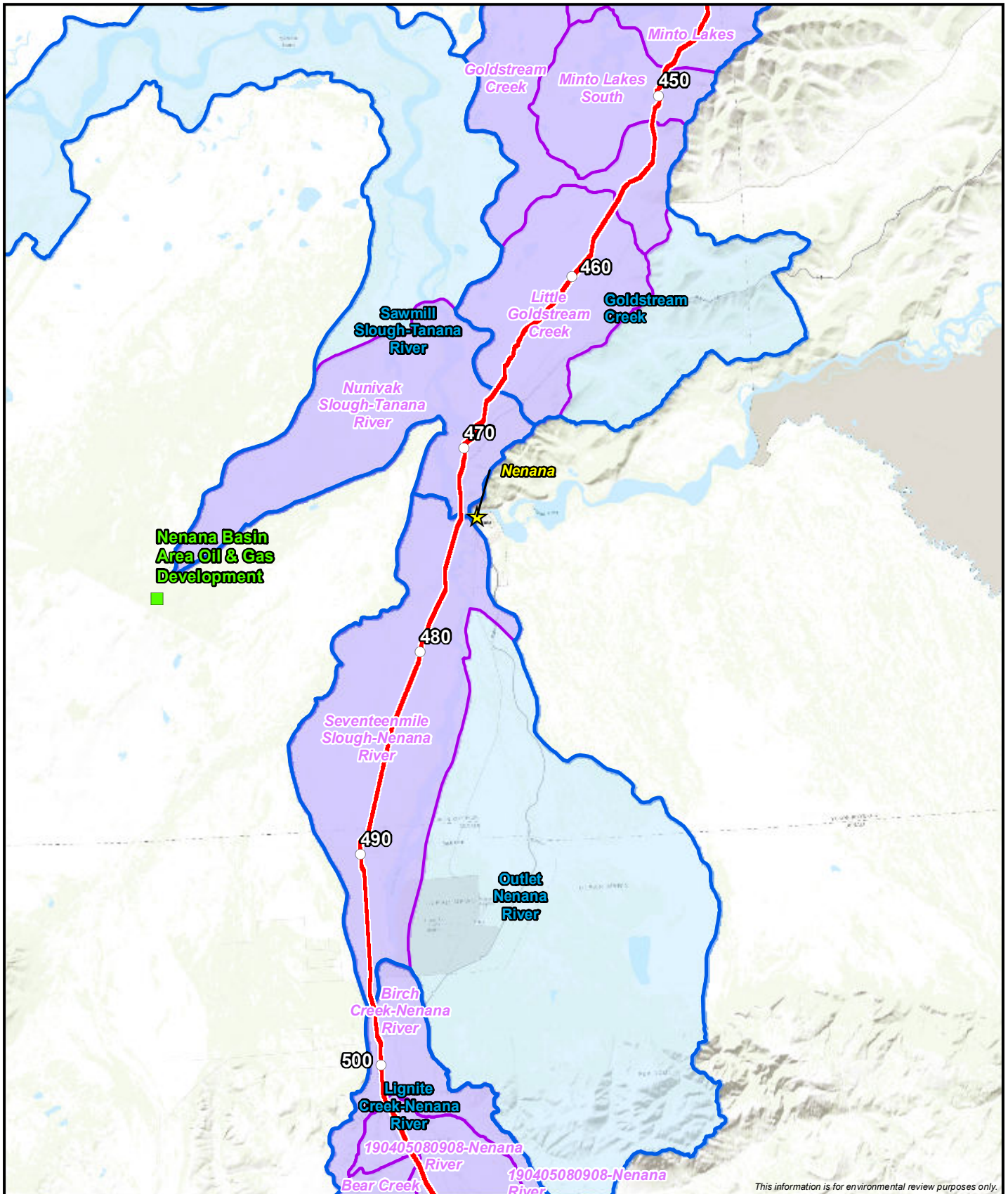
Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC 12
Watersheds, Mainline Pipeline MP 330-390



This information is for environmental review purposes only.

Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC 12
Watersheds, Mainline Pipeline MP 390–450



This information is for environmental review purposes only.

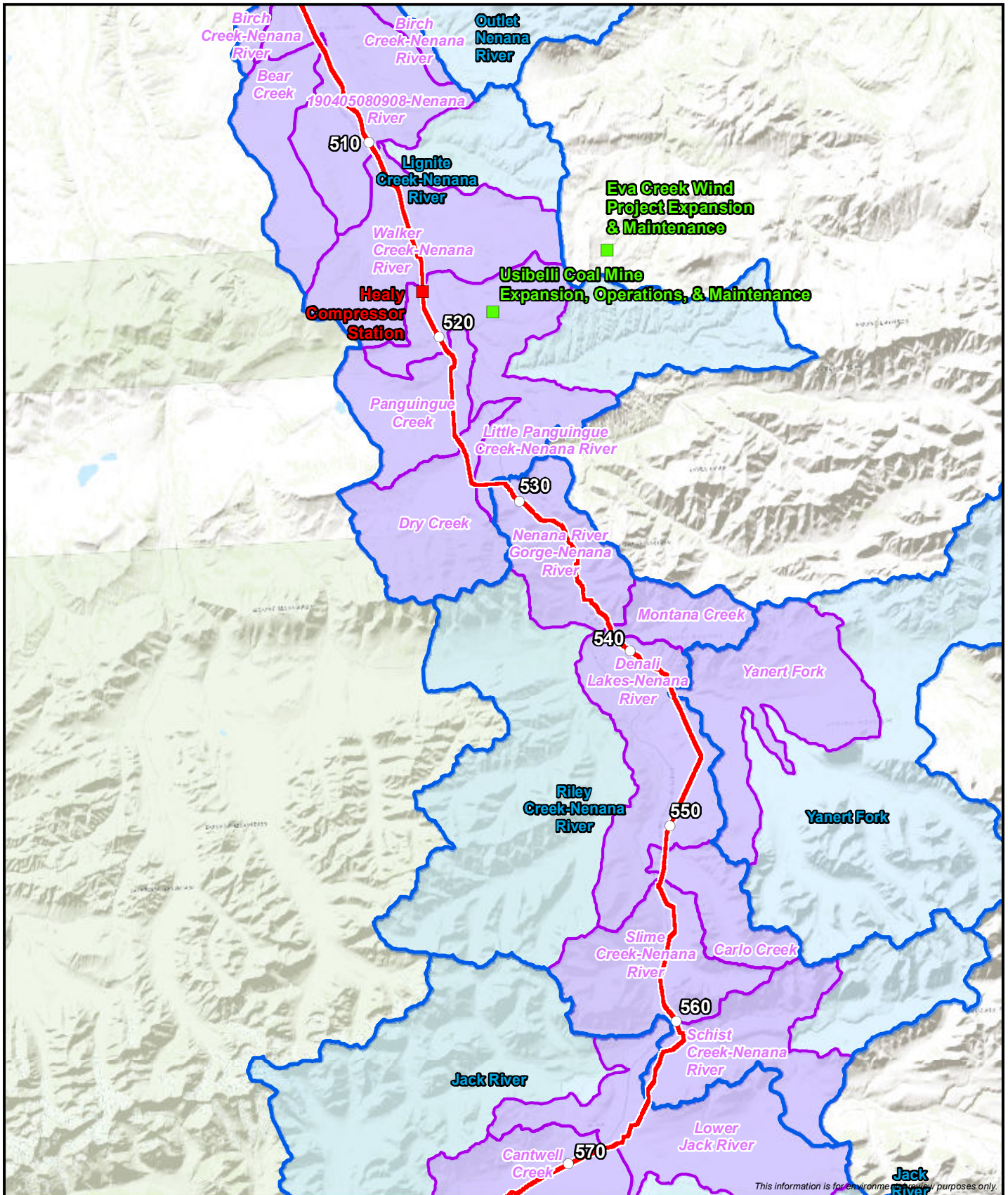
- Community
- Existing/Future Project
- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed
- HUC 12 Watershed



0 5 10 Miles
Date: 06/14/2019 | SCALE: 1:400,000 when printed at 8.5x11

Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 450–510



This information is for environmental review purposes only.

- Alaska LNG Major Aboveground Facility
- Existing/Future Project
- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed
- HUC 12 Watershed



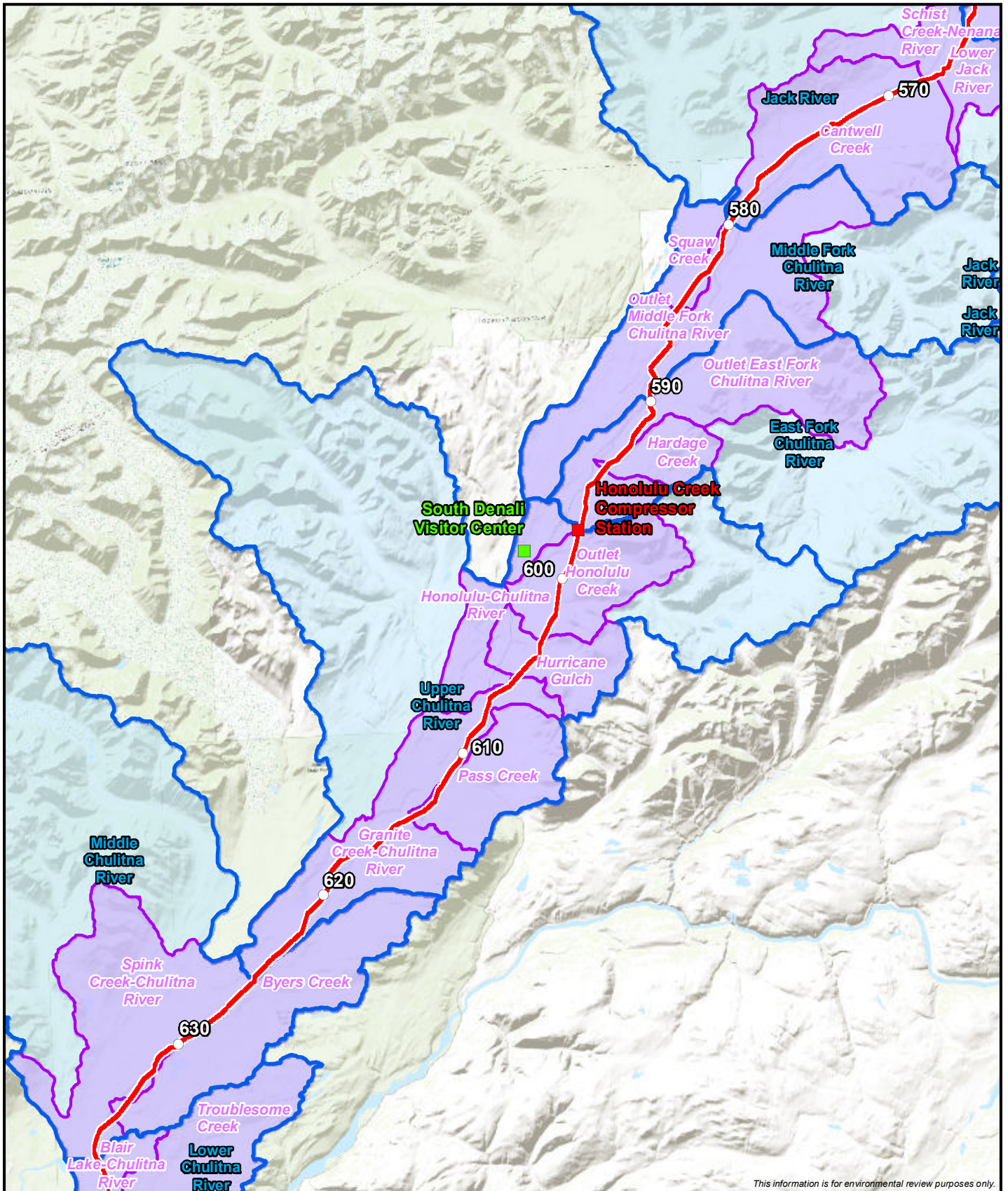
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Appendix W-2

Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 510–570



- Alaska LNG Major Aboveground Facility
- Existing/Future Project
- Milepost
- Alaska LNG Proposed Mainline Route
- HUC 10 Watershed
- HUC 12 Watershed

0 5 10 Miles

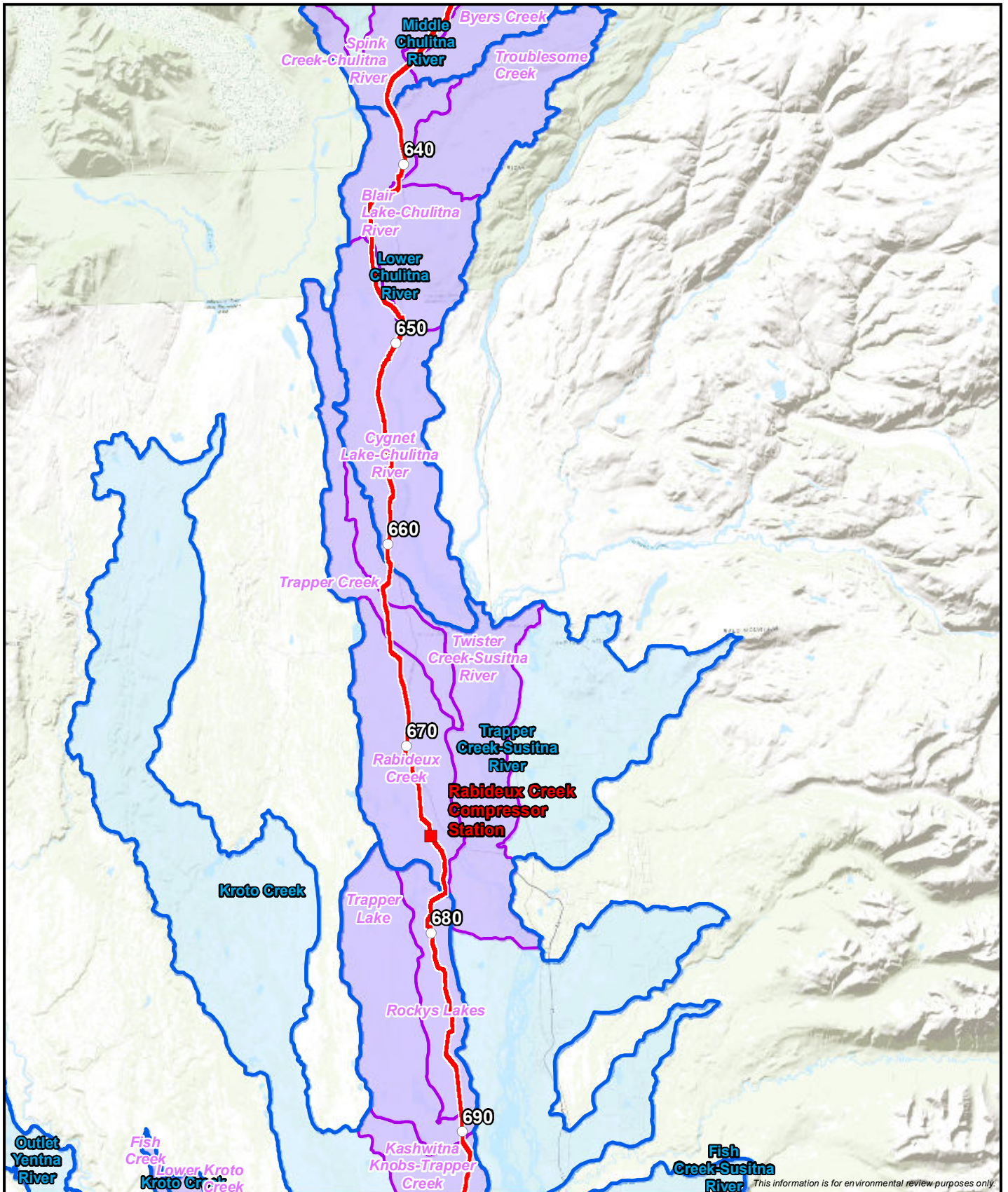
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Appendix W-2

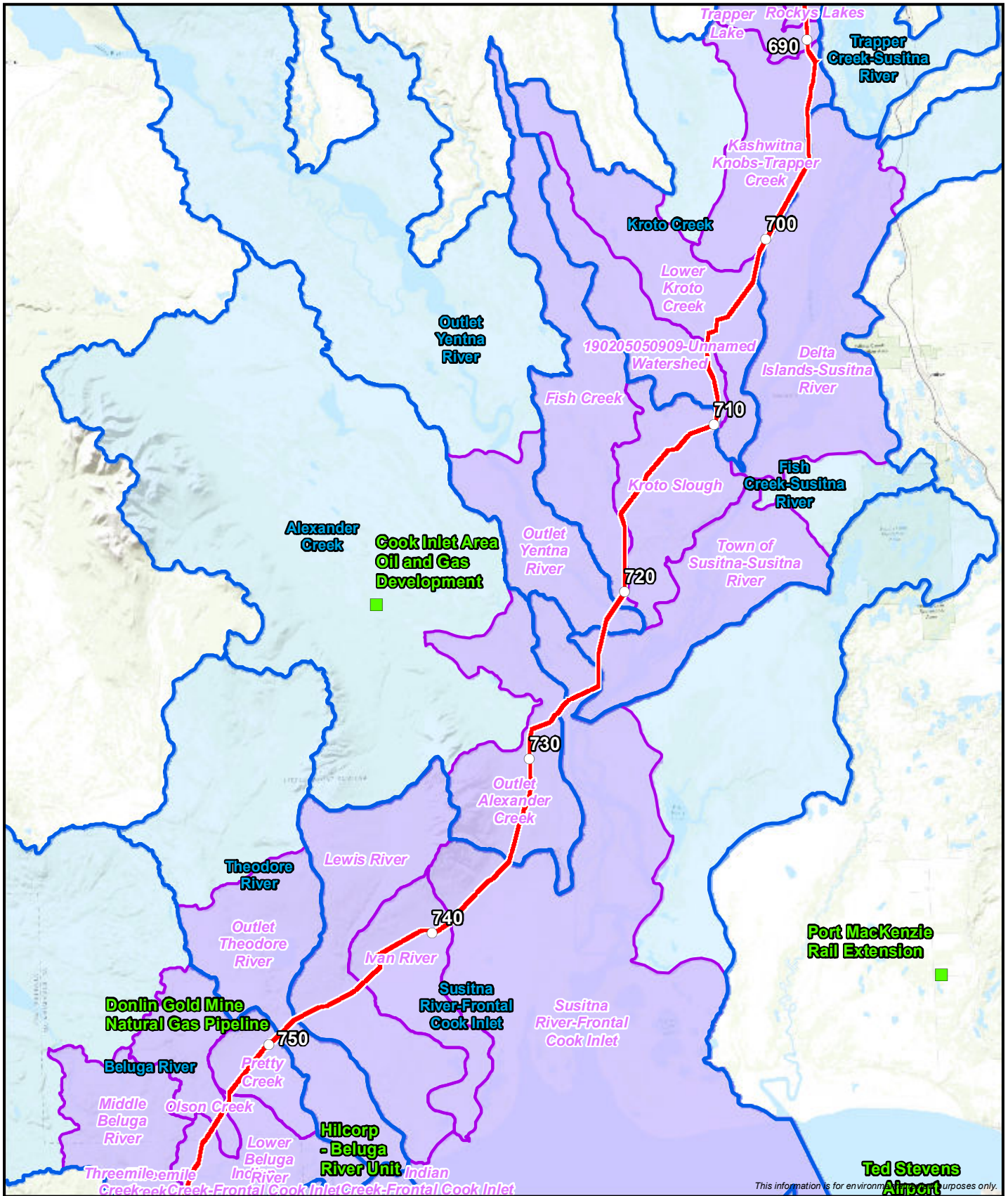
Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 570–640



Appendix W-2 Alaska LNG Project

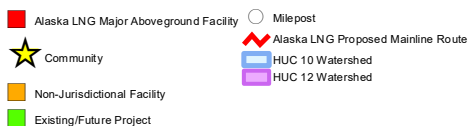
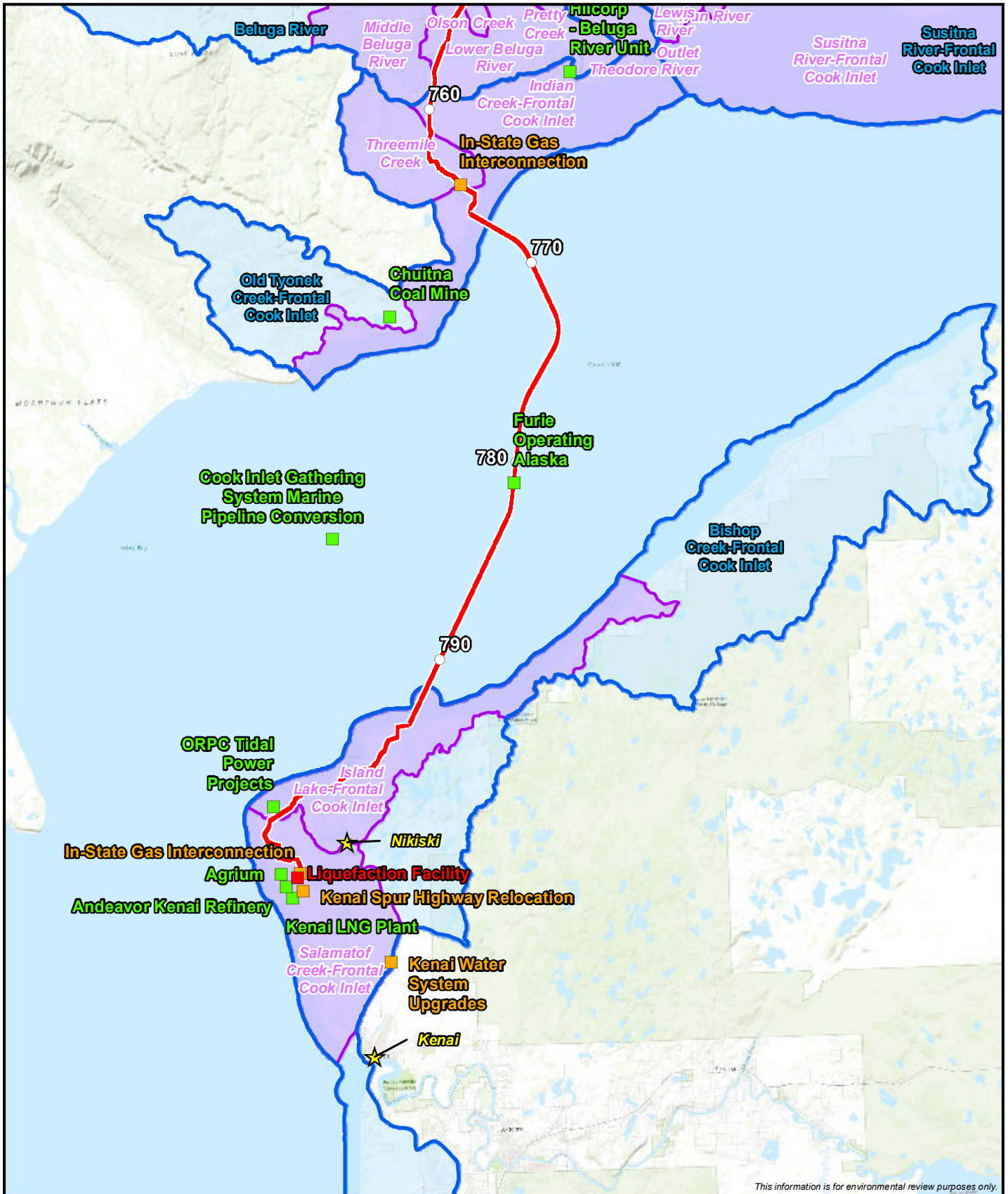
Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 640–690



This information is for environmental purposes only.

Appendix W-2 Alaska LNG Project

Past, Present, and Reasonably Foreseeable
Actions in Project HUC10 and HUC12
Watersheds, Mainline Pipeline MP 690–760



0 5 10 Miles
 Date: 06/14/2019 | SCALE: 1:400,000 when printed at 8.5x11



APPENDIX X

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APPENDIX X: REFERENCES

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APPENDIX Y

List of Preparers

APPENDIX Y: LIST OF PREPARERS

Federal Energy Regulatory Commission

Martin, James – Project Manager; Alternatives; Wetlands; Cumulative Impacts

Ph.D., Environmental Science and Policy, George Mason University
M.S., Environmental Science, Indiana University
M.P.A., Indiana University
B.S., Biology, Indiana University

Laffoon, Danny – Deputy Project Manager; Fisheries; Essential Fish Habitat Assessment

B.S., Fisheries and Wildlife, Virginia Tech

Peconom, John – Deputy Project Manager; Vegetation; Avian Resources; Marine Mammals; Terrestrial Wildlife; Threatened, Endangered, and Other Special Status Species; Subsistence; Freshwater; Biological Assessment

B.S., Biology and Management, University of California- Davis

Balsom, Ari – Fisheries; Marine Benthic Invertebrates; Marine Plankton

M.S., Ecology and Evolutionary Biology, University of Tennessee
B.S., Ecology and Evolutionary Biology, University of Tennessee
B.A., Marine Biology, University of Tennessee

Bathrick, Karla – LNG Reliability and Safety

M.E., Environmental Engineering/Project Management, University of Maryland
B.S., Chemical Engineering, University of Maryland

Baum, Elaine – Socioeconomics; Transportation

M.P.A., Florida State University
B.S., Environmental Policy and Planning, Virginia Tech

Boros, Laurie – Cultural Resources

B.A., Anthropology/Archaeology, Queens College, City University of New York

Bowman, Kevin – Cumulative Impacts

B.S., Environmental Science and Chemistry, McDaniel College

Crosley, Shannon – Alternatives

B.S., Natural Resources Management, University of Maryland

Dague, Brady – LNG Reliability and Safety

B.S., Civil Engineering, University of Maryland

Ferree, Heather – LNG Reliability and Safety

M.S., Mechanical Engineering, Pennsylvania State University
B.S., Mechanical Engineering, Pennsylvania State University

Fink, Jenny – Land Use; Recreation; and Special Interest Areas; Visual Resources

M.S., Environmental Policy, George Washington University
B.S., Environmental Science, University of Delaware

Fox-Fernandez, Nancy – Vegetation; Avian Resources

M.S., Natural Resources: Wildlife, Humboldt State University

B.A., Psychology, Skidmore College

Gray III, Joseph – LNG Reliability and Safety

B.S., Petroleum & Natural Gas Engineering, Pennsylvania State University

Griffin, Robin – Land Use, Recreation, and Special Interest Areas; Visual Resources

M.S., Environmental Management, Illinois Institute of Technology

B.A., English Composition, DePauw University

Hanobic, David – Freshwater; Marine Waters; Water Use; Wetlands

B.S., Biology, Lock Haven University of Pennsylvania

Howard, Eric – Government-to-Government Consultation

M.A., Anthropology, University of Tennessee

B.A., Anthropology, University of Tennessee

Jensen, Andrea – Geologic Resources and Geologic Hazards; Soils and Sediments; Groundwater Resources

B.S., Environmental Geology, College of William and Mary

Jeudy, Harry – Air Quality; Noise; Reliability and Safety

B.S., Mechanical Engineering, Pennsylvania State University

Johnson, Gertrude – Reliability and Safety

B.S., Mechanical Engineering, Virginia Commonwealth University

Long, James – LNG Reliability and Safety

M.B.A., West Virginia University

B.S., Petroleum & Natural Gas Engineering, West Virginia University

Mardiney, Amanda – Water Use; Wetlands; Terrestrial Wildlife; Avian Resources; Marine Mammals; Threatened, Endangered, and Other Special Status Species; Biological Assessment

M.A., Environmental Resource Policy, George Washington University

B.S., Biology, University of Maryland, College Park

McCullough, Erin – LNG Reliability and Safety

M.Eng., Mining Engineering, Virginia Tech

B.S., Mining Engineering, South Dakota School of Mines and Technology

Muñoz, Kelley – Subsistence; Health Impacts

B.S., Environmental Science, Lubbock Christian University

Patel, Ghanshyam – LNG Reliability and Safety

B.S., Chemical Engineering, Pennsylvania State University

Peng, Andrew – LNG Reliability and Safety

B.C.E., Civil Engineering, University of Delaware

Rana, Anthony – Geologic Resources and Geologic Hazards; Soils and Sediments; Groundwater Resources

M.S., International Development, Tulane University

Graduate Studies, Hydrogeology and Geochemistry, Oklahoma State University

B.S., Geology, New Jersey City University

Shi, Ting – LNG Reliability and Safety

M.S., Engineering, Marshall University Graduate College

B.S., Civil Engineering, West Virginia University Institute of Technology

Tomasi, Eric – Air Quality; Noise

B.S., Aerospace Engineering, Boston University

Federal Energy Regulatory Commission Engineering Consultants

Bachman, Robert – LNG Reliability and Safety

M.S., Structural Engineering, University of California at Berkeley

B.S., Civil Engineering, University of California at Berkeley

Bhushan, Kul – LNG Reliability and Safety

Ph.D., Geotechnical Engineering, Duke University

M.S., Highway Engineering, Panjab University, India

B.S., Civil Engineering, Panjab University, India

Stebbing, Roger – LNG Reliability and Safety, Process Design

B.S., Chemical Engineering, University of Salford, England

Environmental Resources Management, Inc.

Lee, Jennifer – Project Manager; Quality Assurance Review; Introduction; Reliability and Safety

B.S., Environmental Studies and Geography, University of St. Thomas

Dolezal, Elizabeth – Deputy Project Manager; Project Description

M.A., Public Administration, George Washington University

B.A., International Business, University of Minnesota

Miller, Bill – Deputy Project Manager (Pre-filing)

B.A., Environmental Studies, University of Kansas

Robblee, Pat – Deputy Project Manager; Executive Summary; Conclusions and Recommendations; Cumulative Impacts

M.A., Anthropology, College of William and Mary

B.A., Anthropology, University of Massachusetts

Acker, Kate – Introduction; Project Description

B.S., Civil Engineering, University of Minnesota- Twin Cities

Bernard, Shane – GIS Support

Graduate Certificate, GIS, University of Denver

B.A., GIS, University of Minnesota- Duluth

Boentje, John – GIS Support

M.S., GIS, Saint Cloud State University

B.S., Geography, University of Wisconsin- River Falls

Bromberg, Ashley – Project Assistant

B.S., Environmental Science and Biology, Eastern Washington University

Buckless, Michael – Soils

B.S., Environmental Science and Management, University of Rhode Island

Brunner, Tracy – Avian; Marine Mammals; Fisheries; Marine Benthic Invertebrates; Plankton; Threatened, Endangered, and Other Special Status Species; Essential Fish Habitat Assessment; Biological Assessment

M.S., Marine Biology, University of Delaware

B.S., Marine Biology, Richard Stockton College of New Jersey

Cassady, John – Alternatives; Cumulative Impacts

M.S., Geography, Western Illinois University

B.S., Geography, California State University- Stanislaus

Cline, Mark – Freshwater; Wetlands

B.S., Biology, Millersville University

Colwell, Lauren – Geologic Resources and Geologic Hazards; Groundwater

M.S., Geology and Natural Resources, University of Wyoming

B.A., Geology, Carleton College

DiNicolantonio, Lisa – Project Description; Land Use, Recreation, and Special Interest Areas; Visual Resources; Project Assistant

B.S., Environmental Science and Management, University of California- Davis

Enright, Troy – Air Quality; Noise

B.S., Environmental Science, University of Minnesota- Twin Cities

Hammer, Wade – Marine Waters

M.S., Conservation Biology, University of Minnesota- Twin Cities

B.S., Biology, St. Olaf College

Hempy-Mayer, Kara – Vegetation; Landfills, Mines, and Hazardous Waste Sites; Document Coordinator

M.S., Microbiology and Botany, Oregon State University

B.S., Plant Biology, University of Massachusetts

Holden, Steve – Geologic Resources and Geologic Hazards; Groundwater

M.S., Environmental Sciences, University of Rhode Island

B.S., Soil and Water Science, University of Rhode Island

Jensen, Bart – Alternatives

B.S., Natural Resources and Environmental Studies, University of Minnesota

Lagerloef, Kara –Public Health

M.A., Public Policy, University of Washington- Seattle
B.A., Anthropology, University of California- Santa Cruz

Mason, Mark – Landfills, Mines, and Hazardous Waste Sites; Noise

B.S., Biology and Geology, Winona State University

McKim, Julie – Freshwater; Wetlands

Graduate Certificate, Environmental Regulations and Permitting, University of Alaska- Anchorage
B.S., Environmental Science and Hydrology, Colorado State University

Quiring, Sharon – Public Health

B.S., Environmental Health, University of Washington- Seattle

Rodman-Jaramillo, Leslie – Avian; Threatened, Endangered, and Other Special Status Species; Biological Assessment

M.S., Zoology, Southern Illinois University- Carbondale
B.S., Zoology and Chemistry, Southern Illinois University- Carbondale

Slayton, Sandy – Terrestrial Wildlife

M.A., Ecology, University of North Carolina at Chapel Hill
B.A., Environmental Science, University of Virginia

Sussman, Ben – Land Use, Recreation, and Special Interest Areas; Visual Resources; Transportation

M.C.R.P., Georgia Tech
B.S., Science Technology and Society, Stanford University

Thornton, Andrea – Geologic Resources and Geologic Hazards; Soils and Sediments; Groundwater Resources; Water Use

B.A., Geology and Environmental Studies, Northeastern University

Trocki, Patti – Cultural Resources; Subsistence

M.A., Anthropology, University of Wisconsin- Madison
B.A., Anthropology, University of Illinois at Chicago

Vaillancourt, Jason – Socioeconomics

B.A., History, Union College

Whitsett, Jane – Essential Fish Habitat Assessment

M.S., Biochemistry, University of Alaska- Anchorage
B.S., Biology and Chemistry, Immaculata University

Yamashiro, Daniel – Reliability and Safety

M.S., Geology, California State University
B.S., Geology, California State University

Ecology and Environment, Inc.

Richards, William – E & E Project Manager; Hazardous Waste Analyst

B.S., Environmental Science, Washington State University

Boyle, Michael – Strategic Advisor, Socioeconomics

B.A., Environmental Science, University of Virginia

Donaldson, Joseph – Visual Resources (Pre-filing)

M.L.A., Landscape Architecture, Utah State University

B.A., Architecture, University of California-Berkley

McCloe, Deepali – Environmental Justice

M.U.P., Urban Planning, University at Buffalo

B.A., English, University at Buffalo

Sadowski, Carl – Land Transportation

M.U.P., Urban Planning, University at Buffalo

B.A. Environmental Design, University at Buffalo

Shelly, Kirsten – Socioeconomics

M.S., Environmental/Resource Economics, University of London

B.A., Economics, Colgate University

RPS

Rowe, Jill – RPS Project Manager; Marine Waters

M.S., Marine Biology, College of Charleston

B.A., Biology, DePauw University

Crowley, Deborah – Marine Waters

M.S., Civil & Environmental Engineering, University of Rhode Island

B.S., Mechanical Engineering, Worcester Polytechnic Institute

Morandi, Alicia – Marine Benthic; Plankton

M.S., Natural Resources and the Environment, University of Connecticut

B.S., Biological Sciences, Ecology and Evolution with Distinction in Research, Cornell University

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