APPENDIX C PROJECT GEOTECHNICAL AND GEOPHYSICAL (G&G) FIELD TESTING AND RESULTS

ALASKA LNG

PROJECT GEOTECHNICAL AND GEOPHYSICAL (G&G) FIELD TESTING AND RESULTS

USAI-PE-SGEIS-00-000033-000

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ACRONYMS AND TERMS

Abbreviation	Definition
APP	Alaska Pipeline Project
ASAP Project	Alaska Stand Alone Pipeline Project
FERC	Federal Energy Regulatory Commission
G&G	geophysical and geotechnical
GTP	Gas Treatment Plant
IMASW	Interferometric Multichannel Analysis of Surface Waves
LiDAR	Light Detection and Ranging
LNG	Liquefied Natural Gas
PBU	Prudhoe Bay Unit
PCPT	piezo-cone penetration testing
pre-FEED	preliminary front-end engineering design
PSHA	Probabilistic Seismic Hazard Assessment
PTU	Point Thomson Unit
PBTL	Prudhoe Bay Gas Transmission Line
PTTL	Point Thomson Gas Transmission Line

1. INTRODUCTION

The following report is a summary of geophysical and geotechnical (G&G) site investigation activities conducted to date for the Alaska LNG Project (Project) major facilities, including the Liquefaction Facility (composed of the LNG Plant and Marine Terminal), the Mainline Pipeline (including the Cook Inlet Pipeline Crossing), and the Gas Treatment Plant (GTP).

1.1 EXECUTION CONSTRAINTS

The G&G activities conducted were designed to gather sufficient information, while acknowledging the potential for circumstances that are unexpected or out of the Project entity's control; examples of these circumstances include permit approvals, access to land, site conditions, weather, tides, etc.

1.2 INFORMATION INCLUDED IN THE FERC APPLICATION

The geotechnical and geophysical assessments, provided in Appendix H, *Geological Hazard Assessments*, include:

- *USAP-WP-GRZZZ-00-000020-000 Onshore Geohazard Assessment Methodology and Results Summary;*
- *USAP-GP-YRZZZ-10-000006-000 Probabilistic Seismic Hazard Analysis;*
- *USAL-FG-GRZZZ-00-002016-008 Alaska LNG Facilities Seismic Engineering Report;*
- *USAP- WP-GRZZZ-00-000051-000 Seismic Liquefaction and Fault Displacement Hazard Assessment; and*
- *USAP-WP-GRZZZ-00-000050-000 Slope Stability and Mass Movement Assessment Update (Route C).*

These attachments to Appendix H are being submitted as business confidential and will not be released into the public domain as privileged and confidential information.

2. LIQUEFACTION FACILITY

G&G investigations were conducted in the vicinity of the proposed LNG Plant throughout 2014, 2015 and 2016 to explore and characterize conditions and to provide input for design. The site investigation programs were planned based on desktop studies and existing data, including an aerial survey flown for the Project in 2012. Historical information included geologic studies, data from ConocoPhillips' Kenai LNG Plant, BP's Gas-to-Liquids facility, and publicly available information from the Alaska Department of Environmental Conservation and the Alaska Department of Natural Resources' Well Log Tracking System database.

2.1.1 GEOPHYSICAL INVESTIGATIONS

Geophysical investigations were conducted in 2014 and 2015 in the area of the LNG Plant and are depicted in Figure 2-1. These investigations included:

1. **Topographic Surveys:** Field topographic surveys were performed in areas as access allowed, particularly where the available light detection and ranging (LiDAR) elevation data accuracy required validation and/or where there have been known changes to existing ground surface (e.g.

highway works, aggregate pits, etc.). Topographic data was collected in the necessary density to produce detailed contour maps and facilitate site grading and drainage design. A vessel-based LiDAR survey conducted in 2014 provided high point-density coverage of the bluff. The same beach and bluff area was surveyed again in 2015 with vehicle-mounted LiDAR to enable investigation of changes over the intervening period. The resulting data sets will be used in evaluation of slope stability and erosion hazards, as well as civil site design (earthworks and drainage).

2. **Deep Seismic Reflection:** Seismic reflection surveys using two high-energy vibroseis truck seismic sources (minimum hold-down weight of 50,000 pounds each) were conducted to image the deep geologic structure, including faults and folds. Three lines were surveyed, successfully imaging geologic structure to depths of 24,000 feet, clearly showing bedding planes in Tertiary sediments and the absence of tectonic fault structures in the more recent Quaternary deposits.

3. **Shallow Seismic Reflection/Refraction:** Shallow geophysical surveys, including seismic refraction/reflection/Interferometric Multichannel Analysis of Surface Waves (IMASW) methods were conducted in 2014 and 2015. Shallow seismic surveys were performed on a grid with a nominal spacing of 1,500 feet. These surveys imaged the subsurface material properties and geologic structure to depths up to 100 feet and penetrated farther in some areas. Subsets of the 2014 shallow seismic data were reprocessed with updated IMASW settings and acoustic waveform inversion. The data was used to interpolate subsurface conditions between borings, as well as provide data on shear wave velocity for seismic site response analysis and construction planning.

4. **Electrical Resistivity Tomography:** Resistivity survey lines were conducted at a nominal spacing of 700 feet north to south, with perpendicular tie lines running parallel to the bluff and existing roads as field conditions permit. The data will be used to interpolate subsurface conditions between borings, as well as provide data on likely topsoil thickness and potential aggregate sources. The data will also be used to inform electrical grounding design.

5. **Seismograph:** A seismograph was installed for the purpose of recording ground motions from earthquakes in the Magnitude 3–7 range scale. The ground motion data is recorded continuously and saved on local solid state storage. These files are downloaded nightly via a network interface and cross referenced to the Alaska Earthquake Information Center earthquake listings to extract local and regional earthquake ground motion records for subsequent analyses. The seismograph consists of two three-component accelerometer sensors in the single vault and two concurrent recording systems to ensure maximum operational reliability with target performance of 100% reliability and data recovery. Several small magnitude events have already been recorded, including a M3.3 earthquake on November 7, 2015, as well as the M7.1 event on January 24, 2016. The seismograph data was evaluated to inform seismic site response, including the ratio of horizontal to vertical accelerations.

2.1.2 GEOTECHNICAL INVESTIGATIONS

Geotechnical investigations were conducted in 2014, 2015, in and 2016 in the area of the LNG Plant, both on and offshore. These studies included:

1. **Geotechnical Boreholes:** The investigations to date include 130 borings using truck- and track-mounted geotechnical drill rigs. Downhole shear wave velocity tests were conducted in 34 select borings to inform the seismic site response analysis. The locations of the boreholes are depicted in Figure 2-2 and presented in Table 2-1.

2. **Monitoring Wells:** Monitoring wells were installed near some boreholes to evaluate groundwater conditions; a total of 26 have been installed to date. Shallow monitoring wells were completed within the upper aquifer (within approximately 70 feet below existing grade); in some locations, separate (paired) deep monitoring wells were completed adjacent, within the next (lower) aquifer (within approximately 160 feet below existing grade). Locations of monitoring wells are depicted in Figure 2-2.

3. **Test Pits:** Test pits were excavated at 14 locations to a target depth of 8 feet below grade to calibrate the geophysical survey data. Bulk samples were obtained at every one-foot depth interval and at any visible layer changes below existing grade. Bulk samples of soil materials were collected for subsequent laboratory testing (for testing such as organic content, California Bearing Ratio, and/or compaction, etc.). Logging and documentation of exposed deposits, features, and conditions were carried out by an onsite geotechnical engineer. Selected samples were tested for grain-size distribution, minimum/maximum density, and frost susceptibility. Samples tested had very low frost susceptibility, as expected from the lack of pavement distress or other indicators in the area.

4. **Geologic Field Mapping**: Geologic field mapping was conducted to identify and characterize major geologic hazards present at the site. The field mapping program focused on obtaining the following information:

   a. Observations of sea cliff exposures and other areas to document stratigraphy and structural features, and to observe evidence of coastal erosion processes; and

   b. Identification of geomorphic and stratigraphic features (e.g. surface faulting or lineaments, paleo-shorelines) that may record tectonic and isostatic uplift, deformation, or tilting.

Table 2-1: LNG Geotechnical Borehole Locations

Borehole ID	Year	Location	Coordinates (NAD83)			Proposed Depth
			Latitude (degrees)	Longitude (degrees)	Elevation (feet, NAVD88)	(feet)
B-49	2014	Onshore	-151.36275	60.675268	128.24	100
B-50	2014	Onshore	-151.35336	60.675246	132.00	150
B-9	2014	Onshore	-151.35641	60.671854	132.00	100
B-10	2014	Onshore	-151.35002	60.671882	132.41	100
B-11	2014	Onshore	-151.34367	60.671929	136.02	100
B-14	2014	Onshore	-151.35376	60.670037	134.55	100
B-17	2014	Onshore	-151.35723	60.66846	132.02	100
B-18	2014	Onshore	-151.35041	60.668263	131.53	100
B-26	2014	Onshore	-151.35536	60.664813	125.25	100
B-27	2014	Onshore	-151.35039	60.664611	124.00	100
B-28	2014	Onshore	-	60.664756	119.05	100

Table 2-1: LNG Geotechnical Borehole Locations

Borehole ID	Year	Location	Coordinates (NAD83)			Proposed Depth
			Latitude (degrees)	Longitude (degrees)	Elevation (feet, NAVD88)	(feet)
			151.34486			
B-32	2014	Onshore	-151.35085	60.661093	123.57	100
B-34	2014	Onshore	-151.35362	60.659519	112.06	100
B-36	2014	Onshore	-151.35789	60.657683	112.06	100
B-37	2014	Onshore	-151.35022	60.657179	107.00	100
B-38	2014	Onshore	-151.3436	60.657463	123.89	150
B-39	2014	Onshore	-151.35615	60.655594	95.62	150
B-40	2014	Onshore	-151.34722	60.655477	121.00	100
B-42	2014	Onshore	-151.3503	60.654531	119.86	100
B-43	2014	Onshore	-151.34363	60.654054	121.99	100
B-45	2014	Onshore	-151.3576	60.654657	109.00	100
B-24	2014	Onshore	-151.36864	60.665239	120.21	100
B-47	2014	Onshore	-151.36972	60.66227	120.18	150
B-23	2014	Onshore	-151.37289	60.664946	125.00	150
B-15	2014	Onshore	-151.37106	60.66836	123.13	100
B-66	2015	Onshore	-151.37373	60.671855	127.44	100
B-67	2015	Onshore	-151.36404	60.671966	124.43	100
B-68	2015	Onshore	-151.37962	60.670178	122.52	200
B-69	2015	Onshore	-151.37591	60.670151	123.86	100
B-73	2015	Onshore	-151.37759	60.668335	121.78	100
B-76	2015	Onshore	-151.34364	60.668241	130.31	100
B-79	2015	Onshore	-151.36374	60.666538	123.61	100
B-86	2015	Onshore	-151.36454	60.663004	124.85	100
B-88	2015	Onshore	-151.35381	60.662889	93.98	100
B-91	2015	Onshore	-151.36861	60.661306	117.20	100
B-98	2015	Onshore	-151.35998	60.659512	122.67	100
B-99	2015	Onshore	-151.34653	60.65949	123.82	150
B-97	2015	Onshore	-151.3667	60.659461	109.47	200

Table 2-1: LNG Geotechnical Borehole Locations

Borehole ID	Year	Location	Coordinates (NAD83)			Proposed Depth
			Latitude (degrees)	Longitude (degrees)	Elevation (feet, NAVD88)	(feet)
B-60	2015	Onshore	-151.34975	60.675382	134.87	75
B-61	2015	Onshore	-151.34333	60.675309	137.58	75
B-72	2015	Onshore	-151.34696	60.670377	134.64	75
B-83	2015	Onshore	-151.36694	60.665142	125.40	100
B-85	2015	Onshore	-151.37103	60.662843	119.50	200
B-92	2015	Onshore	-151.36625	60.661356	118.52	100
B-62	2015	Onshore	-151.36898	60.673708	127.33	100
B-81	2015	Onshore	-151.35028	60.666677	128.79	100
B-74	2015	Onshore	-151.36389	60.668241	111.80	150
B-93	2015	Onshore	-151.35682	60.660951	118.69	100
B-105	2015	Onshore	-151.35368	60.654696	95.40	100
B-110	2015	Onshore	-151.35349	60.652056	117.07	150
B-112	2015	Onshore	-151.35847	60.651249	116.41	100
B-94	2015	Onshore	-151.34347	60.66107	127.39	100
B-113	2015	Onshore	-151.3508	60.650528	112.53	100
B-114	2015	Onshore	-151.3563	60.64908	114.99	100
B-71	2015	Onshore	-151.36427	60.669961	116.20	100
B-64	2015	Onshore	-151.35381	60.673997	133.05	75
B-80	2015	Onshore	-151.35803	60.666531	130.85	100
B-124	2015	Onshore	-151.37585	60.665512	13.68	100
B-126	2015	Onshore	-151.3792	60.668293	14.43	150
B-82	2015	Onshore	-151.34355	60.666517	118.68	150
B-78	2015	Onshore	-151.37193	60.666549	118.09	100
B-127	2015	Onshore	-151.38148	60.670099	14.66	100
B-122	2015	Onshore	-151.37038	60.66126	16.53	100
B-121	2015	Onshore	-151.36839	60.659559	16.43	150
B-123	2015	Onshore	-151.37231	60.66279	15.78	150
B-120	2015	Onshore	-	60.657683	14.95	100

Table 2-1: LNG Geotechnical Borehole Locations

Borehole ID	Year	Location	Coordinates (NAD83)			Proposed Depth
			Latitude (degrees)	Longitude (degrees)	Elevation (feet, NAVD88)	(feet)
			151.36609			
B-107	2015	Onshore	-151.35511	60.653374	96.91	100
B-101	2015	Onshore	-151.35402	60.657446	94.98	150
B-104	2015	Onshore	-151.35358	60.655474	95.22	100
B-87	2015	Onshore	-151.35824	60.662915	107.12	150
B-89	2015	Onshore	-151.35055	60.662871	126.64	100
B-84	2015	Onshore	-151.36124	60.665034	127.53	100
B-75	2015	Onshore	-151.36026	60.668881	130.05	100
B-96	2015	Onshore	-151.35473	60.660549	97.65	100
B-90	2015	Onshore	-151.36185	60.662131	110.48	100
B-95	2015	Onshore	-151.36332	60.660783	96.728	100
B-125	2015	Onshore	-151.37752	60.666845	14.432	100
B-77	2015	Onshore	-151.37511	60.666551	116.008	200
B-117	2015	Onshore	-151.36079	60.652281	14.924	100
B-102	2015	Onshore	-151.35834	60.656459	97.951	100
B-131	2015	Onshore	-151.35226	60.672748	133.254	100
B-132	2015	Onshore	-151.36911	60.669868	122.736	100
B-133	2015	Onshore	-151.37245	60.675408	125.631	100
B-135	2015	Onshore	-151.35587	60.646793	112.662	150
B-136	2015	Onshore	-151.35713	60.646921	15.946	100
B-137	2015	Onshore	-151.35942	60.65249	116.646	100
B-138	2015	Onshore	-151.3497	60.659267	103.218	145
B-157	2016	Onshore	-151.36067	60.664488	124.509	150
B-156	2016	Onshore	-151.3624	60.663934	124.836	150
B-158	2016	Onshore	-151.36164	60.663298	120.626	150
B-159	2016	Onshore	-151.35991	60.663852	118.838	150
B-147	2016	Onshore	-151.36753	60.66208	119.28	200
B-161	2016	Onshore	-	60.662253	105.025	150

Table 2-1: LNG Geotechnical Borehole Locations

Borehole ID	Year	Location	Coordinates (NAD83)			Proposed Depth
			Latitude (degrees)	Longitude (degrees)	Elevation (feet, NAVD88)	(feet)
			151.36002			
B-160	2016	Onshore	-151.36011	60.663352	115.349	150
B-162	2016	Onshore	-151.35926	60.661516	111.454	150
B-166	2016	Onshore	-151.36251	60.661293	103.098	150
B-165	2016	Onshore	-151.3651	60.660115	103.535	150
B-167	2016	Onshore	-151.36391	60.659211	111.91	150
B-168	2016	Onshore	-151.36135	60.660017	118.889	150
B-153	2016	Onshore	-151.36398	60.665119	126.813	150
B-169	2016	Onshore	-151.3618	60.658853	122.823	150
B-170	2016	Onshore	-151.35783	60.65956	123.01	150
B-154	2016	Onshore	-151.36229	60.665627	127.458	150
B-171	2016	Onshore	-151.35643	60.660266	116.532	150
B-172	2016	Onshore	-151.35294	60.661354	119.914	150
B-173	2016	Onshore	-151.35168	60.660139	121.022	150
B-152	2016	Onshore	-151.36303	60.666266	125.791	150
B-149	2016	Onshore	-151.36585	60.662653	126.3	200
B-148	2016	Onshore	-151.36726	60.66278	122.26	200
B-151	2016	Onshore	-151.36477	60.665711	125.849	200
B-155	2016	Onshore	-151.36228	60.665028	126.76	150
B-146	2016	Onshore	-151.36648	60.662437	111.74	200
B-150	2016	Onshore	-151.3661	60.661956	110.97	200
B-163	2016	Onshore	-151.35752	60.662106	104.852	150
B-164	2016	Onshore	-151.35774	60.661571	105.429	150
B-176	2016	Onshore	-151.39779	60.68728	27.142	200
B-178	2016	Onshore	-151.39454	60.687533	34.2	50
B-179	2016	Onshore	-151.39339	60.687601	43.66	50
B-180	2016	Onshore	-151.39343	60.688278	77.76	50
B-181	2016	Onshore	-151.39334	60.688897	87.192	50

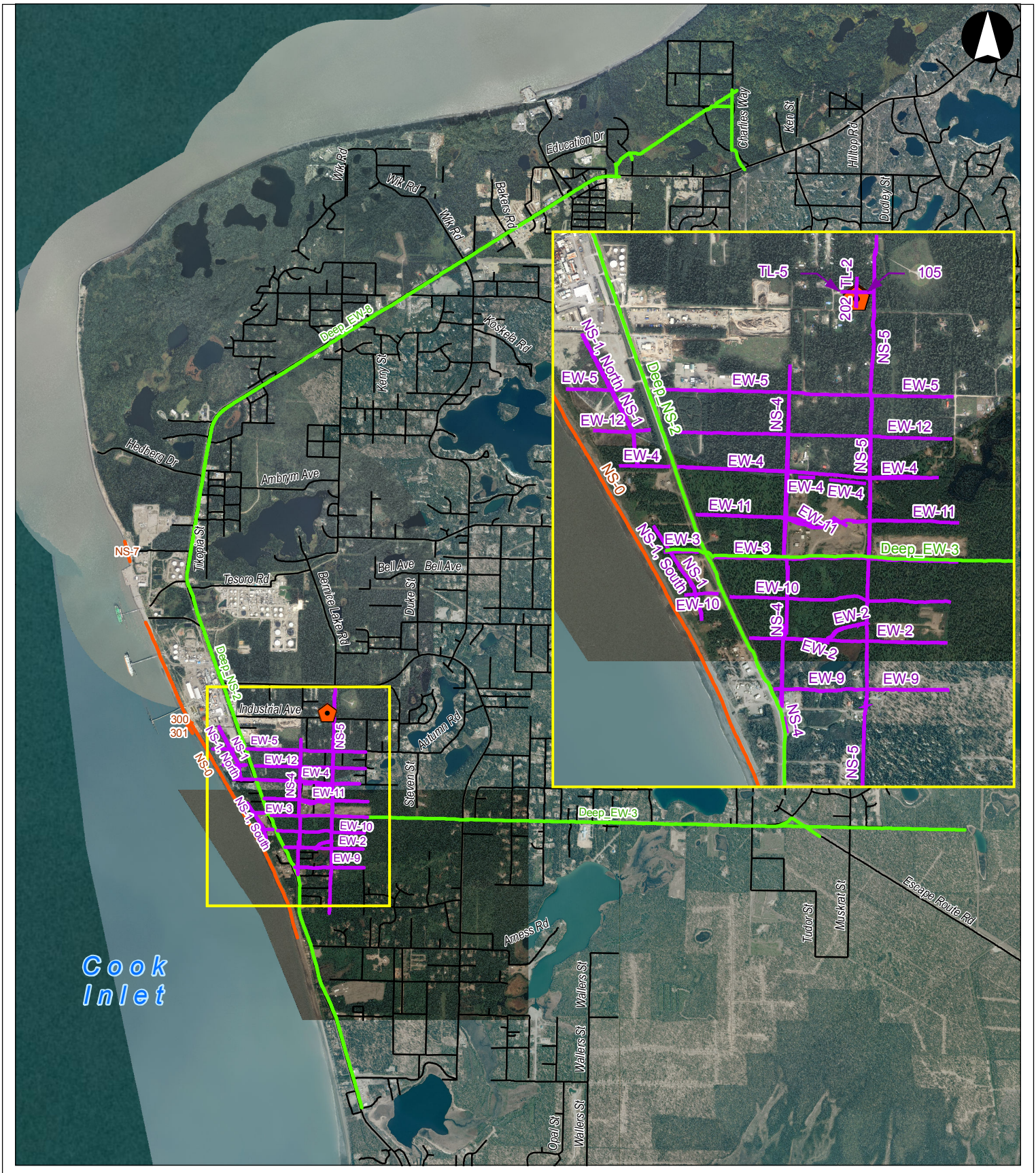
Table 2-1: LNG Geotechnical Borehole Locations

Borehole ID	Year	Location	Coordinates (NAD83)			Proposed Depth
			Latitude (degrees)	Longitude (degrees)	Elevation (feet, NAVD88)	(feet)
B-182	2016	Onshore	-151.39315	60.689566	85.6	50
B-183	2016	Onshore	-151.39333	60.690154	98.759	100
E-1	2016	Onshore	-151.35071	60.660117	122.07	N/A
E-2	2016	Onshore	-151.35507	60.659622	106.1	N/A
E-3	2016	Onshore	-151.35611	60.658412	116.7	N/A
E-4	2016	Onshore	-151.34582	60.663354	109.14	N/A
E-5	2016	Onshore	-151.3579	60.65645	95.43	N/A
E-6	2016	Onshore	-151.35301	60.661989	94.76	N/A
E-7	2016	Onshore	-151.36016	60.65905	122.3	N/A
E-8	2016	Onshore	-151.351	60.667474	130.8	N/A
E-9	2016	Onshore	-151.35725	60.661488	106.54	N/A
B-190	2016	Onshore	-151.36215	60.65382	20.56	200
B-189	2016	Onshore	-151.36061	60.653859	119.97	200
B-177	2016	Onshore	-151.39578	60.687476	29.39	50
B-191	2016	Onshore	-151.37338	60.663658	20.5	200
B-192	2016	Onshore	-151.3721	60.663711	123.188	200
B-195	2016	Onshore	-151.36925	60.664872	119.969	200
B-197	2016	Onshore	-151.36922	60.663819	122.739	200
B-198	2016	Onshore	-151.36747	60.664358	117.985	200
MB-31	2015	Offshore	60.649812	-151.37039	-24.6	50
MB-21	2016	Offshore	60.655536	-151.37254	-18.2	150
MB-22	2017	Offshore	60.653562	-151.37929	-40.5	150
MB-14	2018	Offshore	60.65939	-151.38159	-38.8	50
MB-6	2019	Offshore	60.665011	-151.38379	-34.9	150
MB-2	2020	Offshore	60.669652	-151.38962	-34	50
MB-4	2021	Offshore	60.667329	-151.38667	-36.3	150
MB-9	2022	Offshore	60.662496	-151.38079	-29.7	150
MB-25	2023	Offshore	60.653224	-	-17.1	50

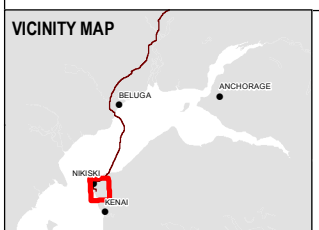
Table 2-1: LNG Geotechnical Borehole Locations

Borehole ID	Year	Location	Coordinates (NAD83)			Proposed Depth
			Latitude (degrees)	Longitude (degrees)	Elevation (feet, NAVD88)	(feet)
				151.36968		
MB-20	2024	Offshore	60.656614	-151.36889	-10.8	150
MB-23	2025	Offshore	60.654547	-151.37617	-28.2	150
MB-13	2026	Offshore	60.660309	-151.37814	-25	150
MB-12	2027	Offshore	60.661321	-151.37457	-16.7	150
MB-5	2028	Offshore	60.666051	-151.38018	-19.7	150
MB-3	2029	Offshore	60.668335	-151.38318	-22.2	150
MB-8	2030	Offshore	60.663673	-151.3774	-16.8	300
MB-18	2031	Offshore	60.655275	-151.37954	-38.7	300
MB-17	2032	Offshore	60.656811	-151.37898	-36.8	150
MB-16	2033	Offshore	60.657964	-151.37525	-21.9	150
MB-15	2034	Offshore	60.658981	-151.37166	-13.2	150
MB-24	2035	Offshore	60.65394	-151.36731	-11.4	150
MB-19	2036	Offshore	60.658543	-151.37877	-32.2	150
MB-26	2037	Offshore	60.65217	-151.37328	-25.4	50
MB-27	2038	Offshore	60.651116	-151.37647	-39.7	150
MB-28	2039	Offshore	60.664398	-151.38078	-29.1	50
DS-5A	2040	Offshore	60.655579	-151.36915	-11.7	N/A
DS-5B	2041	Offshore	60.655545	-151.3692	-11.7	N/A
DS-4A	2042	Offshore	60.655884	-151.36719	-7.8	N/A
DS-4B	2043	Offshore	60.655808	-151.36712	-7.8	N/A

*Locations identified by “B-“ are borehole locations; “MW-” identifies groundwater monitoring wells adjacent to boreholes with the corresponding number.



VICINITY MAP



LEGEND

- Seismograph Location
- 2015 Deep Geophysical
- 2015 Shallow Geophysical
- 2015 Reflection Line
- Roads

0 0.5 1 2 Miles

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SCALE:	1:63,360		
DATE:	2016-09-08	SHEET:	1 of 1

GEOPHYSICAL INVESTIGATIONS FOR THE LNG PLANT SITE

FIGURE 2-1

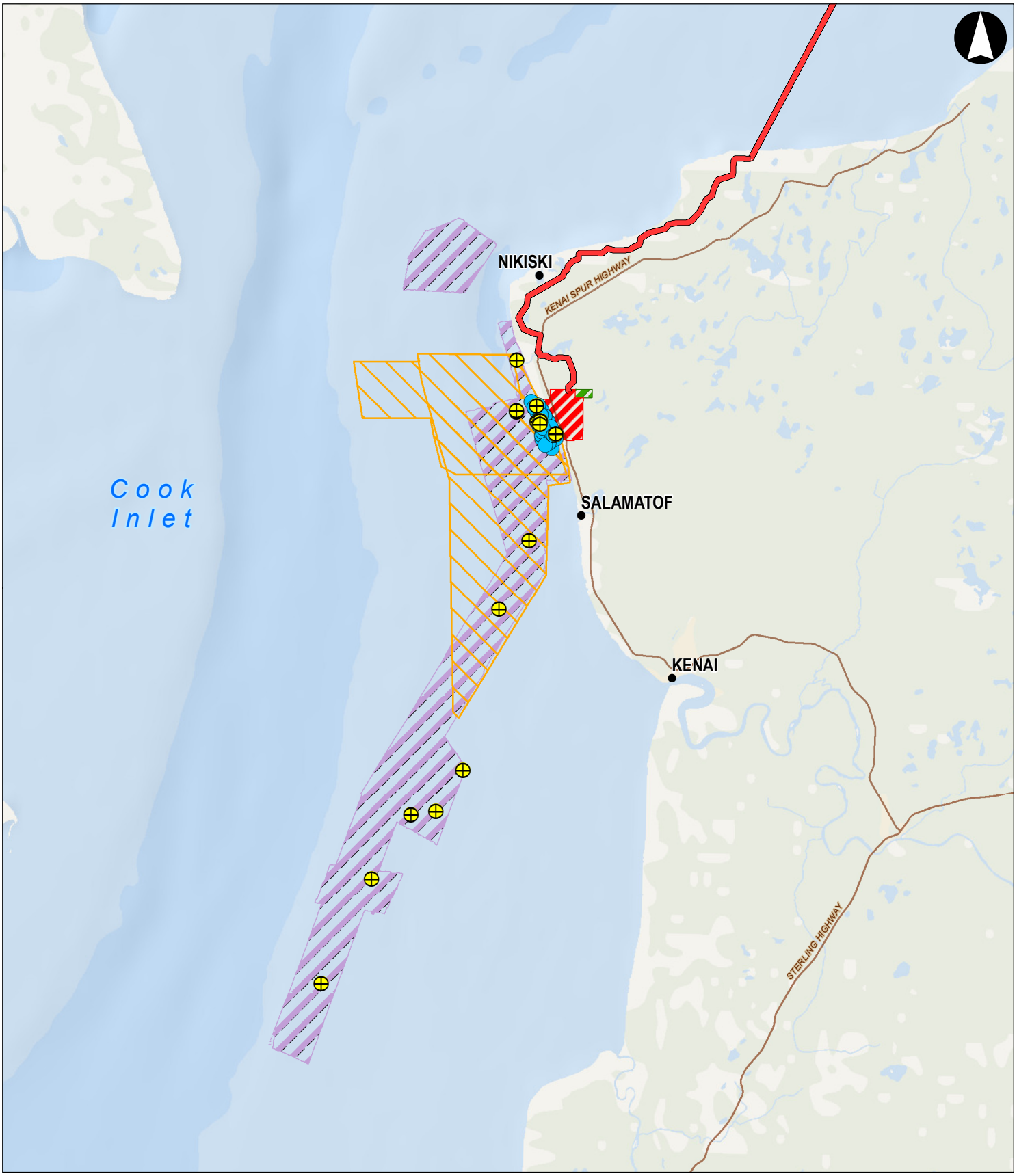
Alaska LNG™

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 2_1 Geophysical Investigations for the LNG Plant Site.mxd

Table 3-1: 2015 Marine Terminal Geotechnical Borehole Locations

Borehole	Coordinates * (decimal degrees)		Actual Depth	PS Logging
	Latitude	Longitude	ft(m)	
MB-2	60.6697	-151.3896	50	-
MB-3	60.6684	-151.3831	150	Yes
MB-4	60.6673	-151.3867	150	-
MB-5	60.666	-151.3803	150	-
MB-6	60.665	-151.3839	150	Yes
MB-8	60.6637	-151.3774	300	-
MB-9	60.6626	-151.381	150	-
MB-12	60.6613	-151.3746	150	-
MB-13	60.6603	-151.3782	150	Yes
MB-14	60.6594	-151.3816	50	Yes
MB-15	60.659	-151.3717	150	-
MB-16	60.6579	-151.3753	150	-
MB-17	60.6569	-151.379	150	Yes-
MB-18	60.6553	-151.3795	300	-
MB-19	60.6586	-151.3788	150	Yes
MB-20	60.6566	-151.3689	150	-
MB-21	60.6556	-151.3725	150	Yes
MB-22	60.6535	-151.3793	50	Yes-
MB-23	60.6545	-151.3761	150	Yes
MB-24	60.6539	-151.3672	150	-
MB-25	60.6532	-151.3696	50	-
MB-26	60.6522	-151.3733	50	-
MB-27	60.6511	-151.3765	150	Yes
MB-31	60.6498	-151.3704	50	-

*calculated in NAD83_NSRS2007_AlaskaZone4_ftUS_54392



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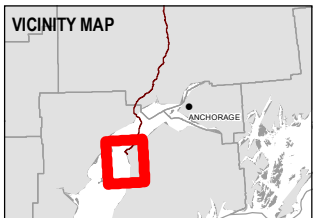

LEGEND

- Grab Sample Locations
- Alaska Place Names
- LNG Marine Boreholes
- Current Preferred Route
- Major Highways
- LNG Operations Area
- LNG Construction Camp
- 2015 Geophysical Survey
- Seafloor Mapping

0 1.5 3 6 Miles

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 3_1 Geophysical Surveys and Geotechnical Borings Marine Terminal Area.mxd

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GEOPHYSICAL SURVEYS AND GEOTECHNICAL BORINGS: MARINE TERMINAL AREA

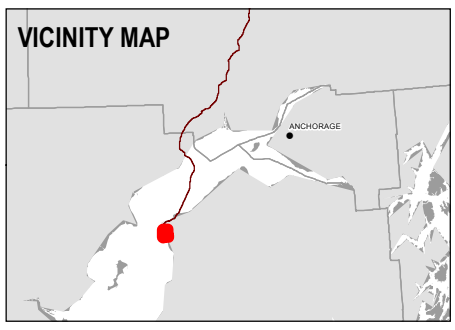
FIGURE 3-1

Alaska LNG™

Port Nikiski
Tesoro Rd
Salamatof Rd
Kenai Spur Hwy
Wallace St
Boondocker
Bell Ave
Duke St
Jeffery Ave
Taiga Way
Birchwood Dr
Sequoya Dr
Timber Ln
Forest Ln
Forest Ln
N Miller Loop Rd
Jackpot St
Alto St
Alto St
Stratus Ave
Cabin Lake Dr
Industrial Ave
Baranof Dr
Interlake
Nichols St
Cabin Lake Dr
Autumn Rd
Autumn Rd
Day Cir
Dale St
Partnership St
Walter St
Top Gun St
Steven St
Russ Ct
Hinerman Rd
Hinerman Rd
Rena Ct
Cirrus St
Gina St
Robert Walker Ave
Englestad Ave
Showalter Rd
Joyce Cir
Kevin St
Kenai Spur Hwy
Aaron Ave
Walker St
Oak St
Lori Ave
Redoubt Dr
Lumber Ct
Lovers Loop
Foley Dr
Fireweed Pl
Birch Ln
Treetop St
S Miller Loop Rd
S Miller Loop
Clayton St
Inlet Breeze St
Kenai Spur Hwy

MB-2
MB-3
MB-4
MB-5
MB-6
MB-28
MB-8
MB-9
MB-13
MB-12
MB-14
MB-15
MB-19
MB-16
MB-17
MB-20
DS-4A
MB-18
MB-21
DS-4B
DS-5B
DS-5A
MB-23
MB-24
MB-22
MB-25
MB-26
MB-27
MB-31

VICINITY MAP



LEGEND

- Marine Terminal Boreholes
- P-S Logging Locations
- LNG Operations Area
- LNG Construction Camp
- Marine Facility

0 0.15 0.3 0.6 Miles

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MARINE TERMINAL AREA 2015 GEOTECHNICAL BOREHOLES

FIGURE 3-2

Alaska LNG™

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 3_2 Marine Terminal Area 2015 Geotechnical Boreholes.mxd

4. PIPELINE

4.1 COOK INLET PIPELINE

G&G investigations were conducted for the Cook Inlet Pipeline in order to characterize the seabed surface and subsurface to support suitability evaluation of the proposed Cook Inlet crossing corridor. Ancillary survey objectives were to:

- Establish seabed bathymetry along the pipeline route corridors across Cook Inlet.
- Collect detailed high-resolution seabed bed data, sub-seabed data, and magnetometer data along the route option corridors.
- Collect detailed LiDAR data at the shore crossing locations.
- Establish the seafloor character and features;
- Establish seabed and shallow sub-seabed strata and geology;
- Produce isopach charts to show sediment thickness of the upper, loose, and any mobile material, and of any other significant reflector levels that might impact on the engineering design;
- Where possible, delineate potential geohazards such as active channels, faulting, scarps, mudflows, and other slope failures and possible seabed instability;
- Where possible, identify areas of shallow gas and venting of shallow gas or mud;
- Identify areas of potential hard ground;
- Identify and map any manmade structures or significant debris within the survey corridors;
- Map fishing gear scars to provide an assessment of density and orientation;
- Map any other features, natural or manmade, that may be a concern to pipeline design;
- Identify magnetic anomalies if any, in the pipeline route corridors;
- Collect soil samples for testing to develop representative soil geotechnical parameters and to provide ground-truthing details for the geophysical data interpretation; and
- Deploy current and ice measurement apparatus along the proposed pipeline corridor to collect surface and bottom current and ice data.

Area extents of the geophysical surveys and geotechnical investigations acquired for the Cook Inlet pipeline crossing between 2014 and 2016 are shown in Figures 4-1 and 4-2. In total, over 700 square miles of bathymetry data and over 300 line miles of sub-bottom profiler data were collected in the vicinity of the Cook Inlet pipeline crossing corridor.

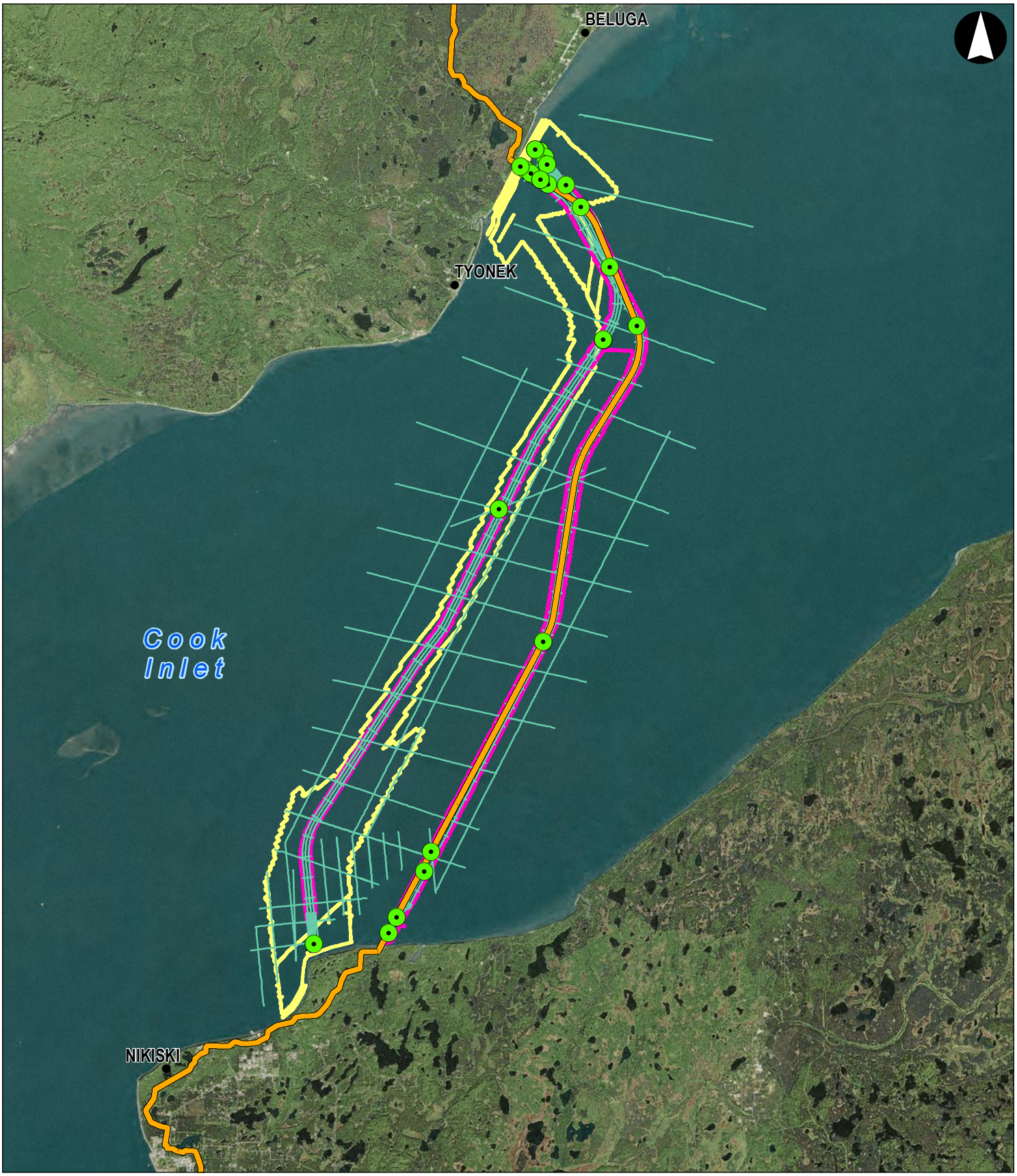
4.1.1 GEOPHYSICAL INVESTIGATIONS

Geophysical investigations were conducted in 2014 and 2015 in the area of the Cook Inlet Pipeline and are depicted in Figure 4-1. These investigations included:

1. **2014 Reconnaissance-Level Seafloor Mapping** - In 2014, a reconnaissance-level seafloor mapping survey was carried out along each potential pipeline route for the Cook Inlet pipeline crossing. Multibeam bathymetry, sidescan imagery and backscatter data,

Table 4-1: Cook Inlet 2016 Marine Terminal Vibracore and Grab Sample Location

Feature ID	Type	Latitude	Longitude	Recorded Pentration (meters)	Recovery (meters)
GS16-04	Grab	61.082646	-151.00334	N/A	N/A
GS16-01	Grab	61.126538	-151.06789	N/A	N/A
GS16-02B	Grab	61.112905	-151.06402	N/A	N/A
GS16-02C	Grab	61.112899	-151.06402	N/A	N/A
GS16-02D	Grab	61.112898	-151.06403	N/A	N/A
GS16-08	Grab	60.9806	-151.03049	N/A	N/A
GS16-08A	Grab	60.980873	-151.02936	N/A	N/A
GS16-08B	Grab	60.981828	-151.02723	N/A	N/A
GS16-06	Grab	61.012534	-151.05118	N/A	N/A
GS16-11	Grab	60.869123	-151.10097	N/A	N/A
GS16-14	Grab	60.834763	-151.25581	N/A	N/A
GS16-14A	Grab	60.834762	-151.25582	N/A	N/A
GS16-14B	Grab	60.834766	-151.25583	N/A	N/A
GS16-12	Grab	60.822133	-151.12926	N/A	N/A
GS16-12A	Grab	60.820495	-151.12323	N/A	N/A
GS16-13	Grab	60.788397	-151.25853	N/A	N/A
GS16-10	Grab	60.932219	-151.13116	N/A	N/A
GS16-10A	Grab	60.933044	-151.12965	N/A	N/A
GS16-09	Grab	60.944145	-151.04167	N/A	N/A
GS16-09A	Grab	60.943481	-151.03947	N/A	N/A



VICINITY MAP

LEGEND

- 2016 Vibracore Locations
- Alaska Place Names
- Current Preferred Route
- 2015 Geophysical Survey Lines
- 2015 Multibeam Echo Sounder (MBES) Coverage
- 2014 Multibeam Echo Sounder (MBES) Coverage

0 1.5 3 6 Miles

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 4_1 Project Geophysical Data Coverage for the Western Cook Inlet Pipeline Corridor (acquired 2014-2015).mxd

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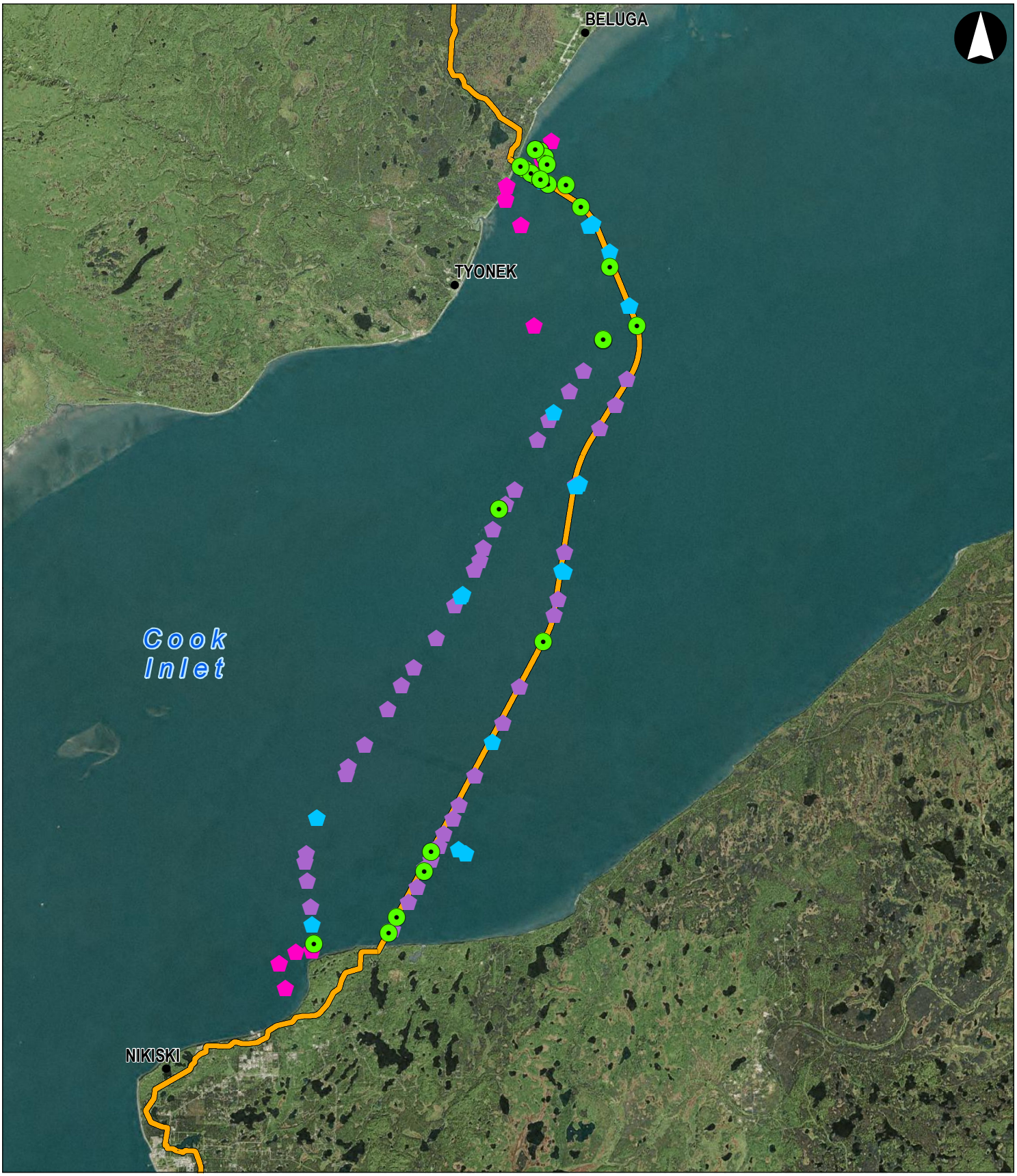
PROJECT GEOPHYSICAL DATA COVERAGE FOR THE WESTERN COOK INLET PIPELINE CORRIDOR (ACQUIRED 2014-2015)

FIGURE 4-1

Alaska LNG™



VICINITY MAP

LEGEND

- 2016 Vibracore Locations
- 2014 Sediment Grab Samples
- 2015 Sediment Grab Samples
- 2016 Sediment Grab Samples
- Alaska Place Names
- Pipeline Rev C2 Route

0 1.5 3 6 Miles

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 4_2 Project Geotechnical Data Coverage for the Western Cook Inlet Pipeline Corridor (acquired 2014-2016).mxd

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PROJECT GEOTECHNICAL DATA COVERAGE FOR THE WESTERN COOK INLET PIPELINE CORRIDOR (ACQUIRED 2014-2015)

FIGURE 4-2

Alaska LNG™

4.2 MAINLINE

G&G investigations were conducted for the Mainline throughout 2014, 2015 and 2016 to explore and characterize conditions and to provide input for design.

Existing remote sensing and borehole data sets from previous and concurrent pipeline Projects in Alaska (e.g., Alaska Pipeline Project [APP], Alaska Stand Alone Pipeline [ASAP] Project, etc.) were reviewed. These data sets included LiDAR, imagery, and thousands of geotechnical boreholes.

Studies targeted such issues as slope stability, water crossings, soil thermal state, fault rupture hazard, seismic-induced liquefaction, and other geohazards. Construction geotechnical issues such as trafficability, thermal stability, excavatability, and granular material sources were also addressed. A separate study focused specifically on geotechnical and geohazard conditions at candidate compressor station sites.

Existing data were also used to develop a one-dimensional (1D) description of geotechnical and thermal conditions for the entire pipeline route. This model describes stratigraphy and geotechnical conditions along the centerline to a depth of 50 feet below ground surface. The model was used for desktop assessment of both geohazards and construction geotechnical aspects, and has been updated as the Project has progressed.

4.2.1 GEOPHYSICAL INVESTIGATIONS

Non-intrusive field investigations were conducted throughout 2014, 2015 and 2016 for the Mainline. Field work, including several targeted walkover investigations and helicopter reconnaissance by teams of specialists, focused on slope and rock mass instability, fault rupture, water and shore crossings, granular material sources, and other conditions. The results of these investigations form the basis for certain Mainline designs.

4.2.2 GEOTECHNICAL INVESTIGATIONS

In cooperation with ASAP Project in 2014 and 2015, the Project entity obtained geotechnical data from 156 boreholes. The target depth of the Project boreholes was 50 feet below ground level, corresponding to the depth of the 1D model. Selected boreholes, such as those at water crossings, were extended to a target depth of 150 feet below ground level. The boreholes were drilled south of Milepost 400 and targeted critical areas such as water crossings, suspected frost heave areas, interpreted instability areas, and Cook Inlet shore crossings.

Borehole data was used in conjunction with the non-intrusive findings to further evaluate critical areas and update the 1D model. For example, shear strength data from boreholes may be used to evaluate slope stability in critical areas where collapsible soils are suspected and previous failures have been interpreted.

2016 field investigations were conducted primarily at the southern end of the route to reduce uncertainty at the Beluga, Yentna, and Deshka river crossings, as well as at an interpreted instability area on the flank of Mt. Susitna. Field work consisted of boreholes and electrical resistivity tomography techniques. Also, geotechnical reconnaissance at selected compressor stations was also conducted in the summer of 2016.

An overview of geotechnical data collected by the Project to date can be found in Table 4-2–and in Figure 4-3.

Table 4-2 – Geotechnical Boreholes along the Mainline

Borehole ID	Year	Latitude	Longitude	Depth (feet)
ASAP_0890a	2015	63.5515	-148.8129	N/A
ASAP_0896a	2015	63.4927	-148.8199	N/A
ASAP_1384	2015	63.796	-148.9225	N/A
ASAP_1385	2015	63.795799	-148.92239	N/A
ASAP_1393a	2015	63.5413	-148.8054	N/A
ASAP_1995	2015	64.5723	-149.1177	N/A
ASAP_2006	2015	64.5379	-149.1414	N/A
ASAP_2008a	2015	64.5215	-149.149	N/A
ASAP_2009a	2015	64.5264	-149.1488	N/A
ASAP_2010a	2015	64.5268	-149.1489	N/A
ASAP_2011a	2015	64.5277	-149.1487	N/A
ASAP_2025a	2015	64.4314	-149.2392	N/A
ASAP_2027a	2015	64.4189	-149.2501	N/A
ASAP_2039a	2015	64.3522	-149.2978	N/A
ASAP_2040a	2015	64.3498	-149.3042	N/A
ASAP_2041a	2015	64.351	-149.3011	N/A
ASAP_2046a	2015	64.3154	-149.3024	N/A
ASAP_2047a	2015	64.3088	-149.3023	N/A
ASAP_2048a	2015	64.3029	-149.3023	N/A
ASAP_2049a	2015	64.2934	-149.3022	N/A
ASAP_2050a	2015	64.2857	-149.3021	N/A
ASAP_2051a	2015	64.2784	-149.3021	N/A
ASAP_2058a	2015	64.2276	-149.2981	N/A
ASAP_2402	2015	63.82	-148.99	N/A
ASAP_2409a	2015	63.4957	-148.8173	N/A
ASAP_2416a	2015	63.4557	-148.8058	N/A
ASAP_2417a	2015	63.4553	-148.8064	N/A
ASAP_2450a	2015	63.2111	-149.3262	N/A
ASAP_2451	2015	63.2084	-149.329	N/A
ASAP_2501a	2015	63.02	-149.5364	N/A
ASAP_2502a	2015	63.0146	-149.5427	N/A

Table 4-2 – Geotechnical Boreholes along the Mainline

Borehole ID	Year	Latitude	Longitude	Depth (feet)
ASAP_2508	2015	62.9898	-149.5844	N/A
ASAP_2510a	2015	62.9809	-149.6136	N/A
ASAP_2517	2015	62.9479	-149.6626	N/A
ASAP_2525	2015	62.9178	-149.7065	N/A
ASAP_2529	2015	62.8959	-149.7688	N/A
ASAP_2539	2015	62.8787	-149.8297	N/A
ASAP_2545a	2015	62.8565	-149.8795	N/A
ASAP_2551	2015	62.7827	-150.0235	N/A
ASAP_2562a	2015	62.7218	-150.1787	N/A
ASAP_2809a	2015	62.6222	-150.2324	N/A
ASAP_2810a	2015	62.6213	-150.2387	N/A
ASAP_2811a	2015	62.6203	-150.2454	N/A
ASAP_2812a	2015	62.62	-150.248	N/A
ASAP_2813a	2015	62.6195	-150.2512	N/A
ASAP_2814a	2015	62.6169	-150.2542	N/A
ASAP_2815a	2015	62.6187	-150.2554	N/A
ASAP_2816a	2015	62.6182	-150.2607	N/A
ASAP_2817a	2015	62.6171	-150.2677	N/A
B_03 (2014_395)	2015	62.9528	-149.6585	N/A
B_26 (2014_397)	2015	62.9111	-149.7149	N/A
B_27 (2014_398)	2015	62.9012	-149.7332	N/A
B_28 (2014_403)	2015	62.8792	-149.8182	N/A
B_50	2015	62.5819	-150.2746	N/A
BP_01a	2015	60.7793	-151.1927	330
BP_02	2015	60.7762	-151.1927	330
CL_01	2015	61.54645	-150.56639	35-45
CWC_02	2015	64.6207	-149.1387	164
CWC_06	2015	64.6173	-149.132	164
CWC_07	2015	64.622	-149.1428	164
CWC_08	2015	64.6153	-149.1288	164
CWC_11 (2014_003)	2015	62.6198	-150.2555	Drill path 114 deep, boreholes 164 deep

Table 4-2 – Geotechnical Boreholes along the Mainline

Borehole ID	Year	Latitude	Longitude	Depth (feet)
CWC_12 (2014_004)	2015	62.619102	-150.25847	Drill path 114 deep, boreholes 164 deep
CWC_13 (2014_001)	2015	62.6206	-150.2455	Drill path 114 deep, boreholes 164 deep
CWC_14 (2014_310)	2015	63.8041	-148.9359	60
CWC_15 (2014_002)	2015	62.6211	-150.2417	60
CWC_16 (LF_1)	2015	61.1326	-151.0804	330
CWC_17 (LF_2)	2015	61.1348	-151.084	330
CWC_18a	2015	60.7727	-151.2478	330
CWC_19a (LF_4)	2015	60.7646	-151.2554	330
DF_01a	2015	63.4525	-148.7909	50-75
DF_02a	2015	63.4508	-148.7903	50-75
ES_01	2015	62.2764	-150.2502	35-45
ES_02	2015	62.11	-150.2277	35-45
FH_01	2015	63.8157	-148.9783	35-45
FH_02	2015	63.804	-148.9443	35-45
FH_03	2015	63.804	-148.9491	35-45
FH_04 (2014_307)	2015	63.8048	-148.955	35-45
FH_05 (2014_308)	2015	63.8025	-148.9419	35-45
FH_06 (2014_309)	2015	63.805	-148.9476	35-45
FH_11 (2014_305)	2015	63.8176	-148.9842	30
FH_12 (2014_304)	2015	63.8182	-148.9868	35-45
FH_13 (2014_303)	2015	63.8184	-148.9879	35-45
FH_14 (2014_302)	2015	63.8188	-148.9894	35-45
FH_18	2015	63.6833	-148.7736	N/A
FH_19	2015	63.6826	-148.7731	N/A
FP_53	2015	62.6665	-150.2269	N/A

Table 4-2 – Geotechnical Boreholes along the Mainline

Borehole ID	Year	Latitude	Longitude	Depth (feet)
FP_72	2015	62.8951	-149.77193	N/A
FS_01	2015	64.546	-149.1342	35-45
FS_03	2015	64.5036	-149.1661	35-45
FS_04	2015	64.4716	-149.197	35-45
GT_01a	2015	63.7506	-148.8991	35-45
GT_02a	2015	63.3634	-149.0094	35-45
GT_03a	2015	63.3389	-149.1184	35-45
GT_04a	2015	63.2651	-149.2508	35-45
GT_05	2015	63.1912	-149.3555	35-45
GT_06	2015	61.5997	-150.5138	35-45
GT_07	2015	61.249	-151.1076	35-45
GT_08	2015	61.2964	-151.041	35-45
MED_03	2015	61.6161	-150.4885	100
MED_05a	2015	61.6333	-150.4885	100
MED_06	2015	61.5387	-150.584	100
MED_07a	2015	61.527154	-150.61526	100
MED_08	2015	61.1478	-151.1177	100
MED_10a	2015	61.154	-151.1345	100
MED_17	2015	61.7416	-150.3358	100
MED_18	2015	61.7252	-150.3549	100
MED_19	2015	61.6607	-150.4874	100
MED_20	2015	61.657	-150.4868	100
MED_21	2015	61.5522	-150.5414	N/A
MED_22	2015	61.5326	-150.5968	N/A
O_04	2015	63.3103	-149.1865	30-35
O_05	2015	63.1042	-149.466	30-35
O_07	2015	62.0506	-150.2088	30-35
O_08	2015	61.9689	-150.1964	30-35
O_09	2015	61.9646	-150.1951	30-35
O_14	2015	61.7211	-150.3806	30-35
SC_01a	2015	61.1209	-151.0904	300
SC_02a	2015	61.1221	-151.0945	300
Beluga River E	2016	61.231675	-151.12734	N/A

Table 4-2 – Geotechnical Boreholes along the Mainline

Borehole ID	Year	Latitude	Longitude	Depth (feet)
Beluga River F	2016	61.22877	-151.12987	N/A
Deshka A	2016	61.794526	-150.34459	N/A
Deshka B	2016	61.79224	-150.34432	N/A
USB-1	2016	61.391544	-150.76787	N/A
USB-SI-1	2016	61.394208	-150.7729	N/A
Yentna A	2016	61.605198	-150.50458	N/A
Yentna B	2016	61.601437	-150.51018	N/A

Tanana Valley State Forest

Tanana River

475

NENANA

PARKS HIGHWAY

ANDERSON

500

525

HEALY

McKINLEY PARK

McKINLEY VILLAGE

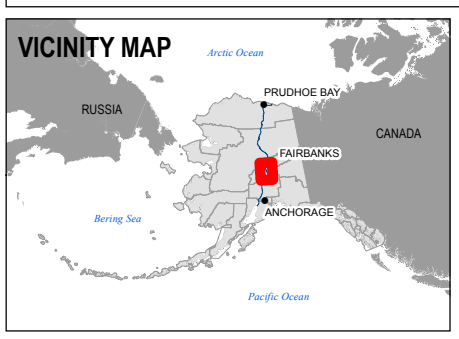
550

Denali National Park & Preserve

CANTWELL

575

VICINITY MAP



LEGEND

- Alaska LNG 2015 Boreholes
- Rev C2 Milepost (25 mi)
- Place Names
- Major Highways
- Alaska LNG Rev C2 Route
- State and Federal Conservation Lands

0 5 10 20 Miles

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ALASKA LNG PROJECT GEOTECHNICAL BOREHOLES

FIGURE 4-3

ALASKA LNG

X:\AKLNG\Resource Reports\RR06\Appendix C\Figure 4_3 1 of 3 Project Geotechnical Data Coverage for the Pipeline Corridor (acquired 2015-2016).mxd

CANTWELL

575

600

PARKS HIGHWAY

Denali National Park & Preserve

625

Denali State Park

Susitna River

Nelchina Public Use Area

650

TRAPPER CREEK

TALKEETNA

675

700

VICINITY MAP

LEGEND

- Alaska LNG 2016 Boreholes
- Alaska LNG 2015 Boreholes
- Rev C2 Milepost (25 mi)
- Place Names
- Major Highways
- Alaska LNG Rev C2 Route
- State and Federal Conservation Lands

0 5 10 20 Miles

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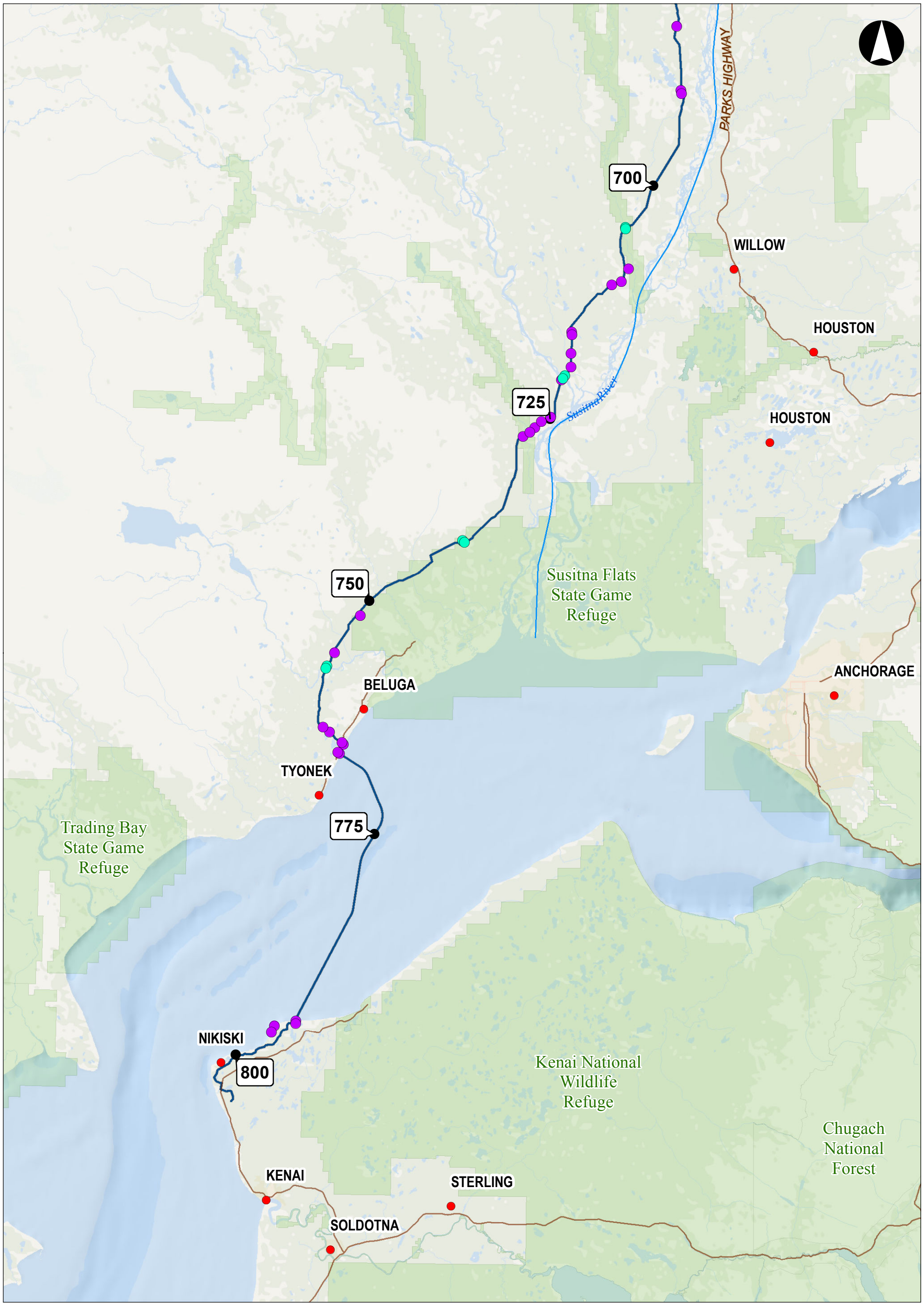
ALASKA LNG PROJECT GEOTECHNICAL BOREHOLES

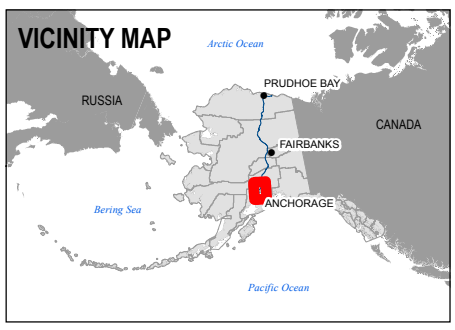
FIGURE 4-3

ALASKA LNG

X:\AKLNG\Resource Reports\RR06\Appendix C\Figure 4_3 2 of 3 Project Geotechnical Data Coverage for the Pipeline Corridor (acquired 2015-2016).mxd



VICINITY MAP



LEGEND

- Alaska LNG 2016 Boreholes
- Alaska LNG 2015 Boreholes
- Rev C2 Milepost (25 mi)
- Place Names
- Major Highways
- Alaska LNG Rev C2 Route
- State and Federal Conservation Lands

0 5 10 20 Miles

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ALASKA LNG PROJECT GEOTECHNICAL BOREHOLES

FIGURE 4-3

ALASKA LNG

X:\AKLNG\Resource Reports\RR06\Appendix C\Figure 4_3 3 of 3 Project Geotechnical Data Coverage for the Pipeline Corridor (acquired 2015-2016).mxd

GAS TREATMENT PLANT (GTP)

G&G investigations have been conducted to explore and characterize the vicinity of the proposed GTP and associated infrastructure to provide input for pre-FEED design and execution planning. The site investigation programs were planned based on desktop studies and existing data. Future programs will be executed to develop G&G data to required levels as the Project advances into its later stages.

The proposed location of the GTP is in a low seismicity area and, therefore, all structural design will be governed by non-seismic load combinations, such as ocean transportation/barge accelerations with respect to module stability. These low seismic accelerations (e.g., S_S=0.26 g and S_1=0.10 g) do not require geotechnical data to support design at this stage in Project development; however, the data required to support later stages of the Project will include sufficient seismic investigation parameters (e.g., site class). Also, per applicable regulation (18 CFR 380.12.O.15), the proposed location of the GTP is located in a seismic zone 0, which does not require seismic design considerations.

5.1 EXISTING DATA

The APP conducted a 2011 field sampling program consisting of 16 vibracores collected across the proposed West Dock dredge study area. Each vibracore extended to a depth of -16 feet mean lower low water or until refusal. The purpose of the investigation was to characterize sediment within the proposed dredge area to facilitate an assessment of dredging feasibility. A summary of APP vibracores is provided in Table 5-1.

As the GTP design progresses, geotechnical data from the ASAP Project may be pursued. Existing borehole data in the vicinity of the GTP footprint is shown in Figures 5-1 through 5-3.

5.2 GEOPHYSICAL INVESTIGATIONS

Bathymetric survey data was collected by the Project during the summer of 2014 near West Dock, Prudhoe Bay. Single-beam, multi-beam, and side-scan sonar techniques were used to develop a seafloor contour map and identify areas of potential hard-bottom habitat, possible hazards to construction, or potential archeological features.

Two test trenches near the potential dredge channel were excavated in the winter of 2015. Bathymetric surveys are planned for 2015 through 2017 at the test trench sites. The surveys will be used in conjunction with a numeric sedimentation model to estimate potential sediment infill rates within the Project's dredge channel.

5.3 GEOTECHNICAL INVESTIGATIONS

Geotechnical investigation located the GTP water reservoir and granular material mine to source granular material and other construction material for roads, pads, staging areas, West Dock, and other earthen structures.

Twenty-eight boreholes were drilled to a depth of approximately 80 feet to delineate the required granular material quantities with expectations for footprint minimization, cost-effective mining, and sufficient granular material quality for construction (24 air rotaries drilled for a quick soils assessment and four continuous cores drilled to acquire a detailed soil profile from grade to depth). A summary of the boreholes from the water reservoir and granular material mine investigation is provided in Table 5-2.

Table 5-1: APP Marine Vibracores near West Dock, Prudhoe Bay

Borehole ID	Sediment Depth (feet)	Coordinates (Decimal Degrees)	
		Latitude	Longitude
02G-VC-01	4.9	70.3992	-148.5074
03A-VC-01	8.5	70.3869	-148.5126
03C-VC-01	7.3	70.3878	-148.5108
03D-VC-01	6	70.3891	-148.5083
01D-VC-01	5.8	70.3906	-148.5138
03E-VC-01	5.4	70.3911	-148.5035
01F-VC-01	4.6	70.3932	-148.4988
01J-VC-01	7	70.4021	-148.4795
05D-VC-01	4.9	70.3879	-148.5045
02I-VC-01	4.8	70.403	-148.4947
02K-VC-01	8.7	70.4089	-148.4906
02M-VC-01	7.8	70.409	-148.4639
04I-VC-01	4.9	70.3999	-148.4835
04G-VC-01	4.3	70.3955	-148.4934
04K-VC-01	5.5	70.4021	-148.4655
01B-VC-01	5.2	70.3882	-148.5157

Table 5-2: Project Geotechnical Boreholes near the GTP Potential Granular Material Mine and Water Reservoir

Borehole ID	Depth (feet)	Coordinates (Decimal Degrees)	
		Latitude	Longitude
A-1	79	70.2888	-148.5958
A-2	66	70.2858	-148.6
A-8	72.5	70.2874	-148.6027
M-1	67.5	70.2912	-148.5999
M-2	60	70.2909	-148.6089
M-3	77.5	70.2886	-148.6048
R1 BH-1	82.5	70.2965	-148.5851
R1 BH-2	82.5	70.294	-148.5964
R1 BH-3	77.5	70.2915	-148.6081
R1 BH-4	82.5	70.2877	-148.6036
R1 BH-5	77.5	70.2902	-148.5922

Table 5-2: Project Geotechnical Boreholes near the GTP Potential Granular Material Mine and Water Reservoir

Borehole ID	Depth (feet)	Coordinates (Decimal Degrees)	
		Latitude	Longitude
R1 BH-6	72.5	70.2927	-148.5808
R1 BH-9	77.5	70.2864	-148.5878
X-1	82.5	70.2958	-148.5845
X-2	67.5	70.2939	-148.5859
X-3	82.5	70.2921	-148.5873
X-4	77.5	70.2912	-148.5882
X-5	77.5	70.2937	-148.5949
X-6	70	70.2932	-148.5894
X-7	77.5	70.2927	-148.5838
X-11	77.5	70.2914	-148.5908
X-14	82.5	70.2951	-148.588
Z1	75	70.2891	-148.619
Z2	77.5	70.2852	-148.6153
Z3	77.5	70.2884	-148.6118
Z-4	79	70.2923	-148.602
Z-8	74	70.2946	-148.591

MP 0

MP 1

MP 2

MP 3

MP 4

MP 5

VICINITY MAP

LEGEND

- Mile Post
- ASAP Boreholes
- AKLNG Boreholes
- APP Vibracore
- Pipeline Rev C2 Route
- Dock Improvement
- Footprint
- Road
- ROW
- Reservoir

0 0.5 1 2 Miles

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GAS TREATMENT PLANT BOREHOLES OVERVIEW

FIGURE 5-1

Alaska LNG™

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 5_1 Gas Treatment Plant Boreholes Overview.mxd

VICINITY MAP

LEGEND

- APP Vibracore
- ASAP Boreholes
- Dock Improvement
- Causeway Widening

0 0.1 0.2 0.4 Miles

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GAS TREATMENT PLANT BOREHOLES: APP VIBRACORE

FIGURE 5-2

Alaska LNG™

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 5_2 Gas Treatment Plant Boreholes APP Vibracore.mxd

Gravel Haul Road

Preliminary GTP Pad

Preliminary Water Reservoir

MP 0

MP 1

MP 2

3097 3077 3076 3078 17 16 6 15 5 21 7 4 2896 2897 3094 3096 8 22 3 9 13 14 3081 20 12 23 18 1 3080 2901 3084 3095 3083 2898 307911 10 3091 3090 3082 3089 2900 3087 3088 2899 3086 3085 TH-13 TH-14 TH-15 1656a 1657a TH-12 TH-10 1658a TH-11 TH-09 TH-07 TH-08 TH-06 TH-05 TH-04 TH-02 TH-03 TH-01 2 R1 BH-1 X-14 X-1 R1 BH-2 Z-8 X-2 X-5 X-6 X-3 R1 BH-6 X-7 Z-4 X-11 M-1 X-4

VICINITY MAP

LEGEND

- Mile Post
- ASAP Boreholes
- AKLNG Boreholes
- Pipeline Rev C2 Route
- Road
- Footprint
- ROW
- Reservoir

0 0.15 0.3 0.6 Miles

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GAS TREATMENT PLANT BOREHOLES: ASAP AND AKLNG

FIGURE 5-3

Alaska LNG™

X:\Projects\ExxonMobil\SCLNG\Mapping\20160811_Resource_Report_Draft2_RevC_Footprint\RR6\Appendix C\Figure 5_3 Gas Treatment Plant Boreholes ASAP and AKLNG.mxd

6. FUTURE

No additional geophysical and geotechnical investigations are currently planned for 2017. Further geotechnical investigations will be pursued in later stages of the Project after the GTP facility plot plan is confirmed. The investigation will include the following:

- General site conditions – Active layer and permafrost properties, ice lens, ice-rich or ice-poor conditions, and other subsurface conditions.
- Barge channel – Determine if seabed material is uniform along channel, cohesiveness, side slope, sloughing, permafrost, sediment sampling, etc.
- West Dock – Data gathering to support widening the existing infrastructure (e.g., causeway, bridges, etc.).
- Dock head expansion – Sheet pile depths, tie-back lengths and corrosion rates, barge grounding pad, etc.
- Roads – Haul road, staging area, other locations supporting high self-propelled module transporters, loads, pipe crossings, and water crossings.
- Static foundation analysis – All plant and camp modules, flare, pipeline.
- Dynamic foundation analysis – Carbon dioxide compression module, power generation, sales gas compression, etc.
- Granular material haul bridge – Pile depths and capacity calculations.
- Granular material mine and water reservoir – Side slope, offset between reservoir and mine, salinity intrusion, size, perimeter, depth, any additional resource identification required, etc.
- Embankments and lake fill areas.
- Pipelines – Vertical support member size and depth, thermal properties.