Ore Peninsula Redevelopment Project

Municipality of Skagway
Skagway, Alaska

30% Basis of Design

Prepared by:

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1.0 PROJECT DESCRIPTION

The Municipality of Skagway (MOS) takes possession of the Ore Peninsula in March of 2023 and intends to replace several of the existing waterfront facilities to effectively accommodate cruise vessels. The following are the proposed design criteria for the Cruise Ship Dock and the Roll-On-Roll-Off (RORO) Dock and Ramp.

2.0 DESIGN CODES

Including, but not limited to:

- IBC 2012, International Building Code with Local Amendments
- ASCE/SEI 7-16, Minimum Design Loads for Buildings and Other Structures
- ASCE/COPRI 61-14 Seismic Design of Piers and Wharves
- ACI 318-14 Building Code Requirements for Structural Concrete
- AWS D1.1-15, D1.4-17, D1.8-16 – Structural Welding Code
- AISC 360-16 Specification for Structural Steel Buildings
- AISC 341-16 Seismic Provisions for Structural Steel Buildings (2005)
- AASHTO LRFD Bridge Design Manual 9th Edition
- AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges
- 2015 Uniform Plumbing Code
- 2018 International Fuel Gas Code
- 2021 International Mechanical Code
- 2021 International Fire Code

3.0 GENERAL

3.1 Site Datums

3.1.1 Vertical Datum:

Mean lower low water (MLLW=0.0') S.S. survey feet, based on the NOAA/NOS tidal bench mark list: 9452400 Skagway, Taiya inlet, Alaska published 05/02/2014.

3.1.2 Horizontal Datum:

Alaska State Plane, Zone 1, US Foot

3.1.3 General Tidal Range

• Extreme High Water	23.10 ft
• Mean Higher High Water	16.73 ft
• Mean Lower Low Water	00.00 ft
• Extreme Low Water	-6.10 ft

3.1.4 Dredge Depth -45.00 ft + 2 ft Over-dredge

The structures will be designed to accommodate this dredge depth based on the extreme low water and assuming that cruise ships have a 35 ft draft accounting for 3 ft of under draft.

3.1.5 Bathymetry: Soundings are in U.S. survey feet and are minus unless otherwise indicated. Bathymetry was collected by Hughes & Associates on April 6-7, 2022. Soundings were collected using a r2sonic 2022 multibeam echosounder operating at 400 KHZ. Sound velocity through the water column was determined with a Valeport swift sound velocity probe. Position and vessel orientation were measured using an Applanix pos mv system. RTK corrections were broadcast form a local base station occupying "SH-D 2000". Data was collected and processed using Hypack 2022 software. Horizontal and vertical control was surveyed using RTY GNSS equipment and techniques.

3.2 General Environmental Loading

3.2.1 Risk Category III

3.2.2 Wind Speed

- Ultimate Wind Speed 130 mph
- Operational Wind Speed 40 mph (Vessels at berth)
- Exposure Category C

3.2.3 Waves (Float Design)

- $S_{\text{WAN 50-YRP}}$, $H_s = 6.8$ ft, $T_p = 5.2$ s
- $S_{\text{WAN 100-YRP}}$, $H_s = 7.3$ ft, $T_p = 5.4$ s

3.2.4 Seismic Criteria

- S_S 0.78g (ATC Hazard Map)
- S_1 0.384g (ATC Hazard Map)
- Lateral Spreading: Slope stability, liquefaction and lateral spreading will be checked per the code defined ground motions. Ground Improvements may be used to stabilize the slope and prevent liquefaction in the developed areas where pedestrians may congregate.

3.2.5 Snow 185 psf

3.2.6 Temperature

- Temperature Range -5° F to 90° F
- Base Construction Temperature 30° F

4.0 FACILITY SPECIFIC LOADS

4.1 Cruise Dock

This dock is expected to primarily support the cruise vessels and limited vehicular traffic in the form of smaller vehicles and forklifts. See Appendix G for Float Bid Drawings.

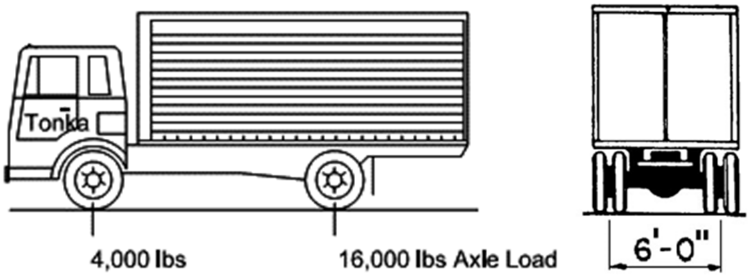
4.1.1 Gangway Point Loading 4,000 lbs

4.1.2 Live Loads 90 psf

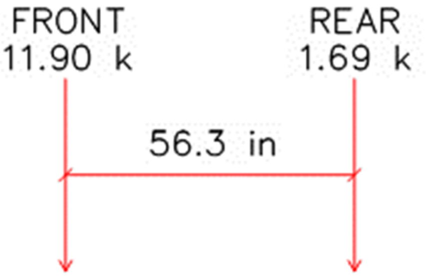
For floation the float considers 40 psf live load over the entire float or ¼ of the float with 90 psf at any location.

4.1.3 Design Vehicles

- AASHTO H 10 Truck Loading (Emergency Vehicles)



- Hyster Fortis 50 (S50FT) for movement of pallets and cruise ship gangways.



- Max forklift axle load 18 kips

4.1.4 Cruise Vessels

Vessel Characteristics – Quantum of the Seas Class

LOA	1141’-9”	348m
LBP (Length at Waterline)	1050’-2”	320.1m
Beam at Waterline	135’-10”	41.4m
Bow Mooring Above Keel (Deck 5)	68’-9”	20.95m
Stern Mooring Above Keel (Deck 3)	47’-1”	14.35m
Design Draft	27’-11”	8.5m
Air Draft	208’-2”	63.44 m
Max Displacement	76,876 LT	78110t
Long. Surface Area – Hull*	49,620 ft^2	4,610 m^2
Long. Surface Area – Superstructure *	113,130 ft^2	10,510 m^2
Transverse Surface Area**	25,460 ft^2	2,365 m^2

[1] value estimated from vessel elevation drawings

[2] value estimated to be 90% of (Beam at Waterline) x (Air Draft)

[3] A complete list of design vessels is provided in Appendix A

4.1.5 Vessel Mooring

Dolphins

Mooring Bollards	200 Ton
Range of Horizontal Pull	0 to 180 degrees
Range of Vertical Pull	-20 to 60 degrees

Float

Mooring Bollards	150 Ton
Range of Horizontal Pull	0 to 180 degrees
Range of Vertical Pull	-20 to 60 degrees

4.1.6 Vessel Berthing

Approach Velocity	0.2 knot (0.32 ft/s)
Accidental Berthing Factor	1.5

4.1.7 Tidal Ranges

Max Operating Tide	24.14 ft MLLW
Min Operating Tide	-6.10 ft MLLW

4.1.8 MEP Equipment/Lights/Ducts/Pipes 5 psf.

4.2 Roll-On Roll-Off (RORO) Dock

This dock is expected to support RORO operations including trucks and forklifts capable of moving fully loaded shipping containers.

4.2.1 Live Loads

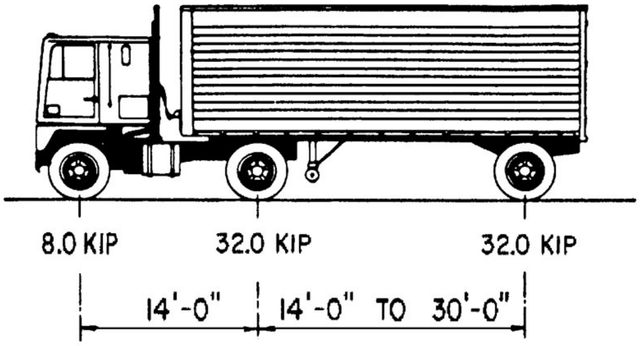
General Live Load	1000 psf

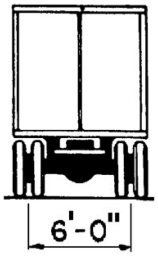
4.2.2 Ramp Loads/Design Vehicles

Front Axle	259 kip
Rear Axle	32 kip
Point Load Transverse Spacing	13’-11”

- Point Load Longitudinal Spacing 18’-8”

- AASHTO HL-93 Truck Loading





The HL-93 design truck is intended to represent a generic vehicle that could encompass Special Haul Vehicles (SHV) such as a dump truck up to 80,000 GVW.

- Tracked Crawler Crane
    - Tracked Load 460 kips

    - Minimum Track Length 18’-6”

(Example tracked crawler crane)

- CAT 395 Hydraulic Excavator
    - Track Gauge 11.60 ft
    - Crane Width 12.90 ft
    - Operating Weight 207.30 kips
    - Bucket 6.80 yd^3

- Wheeled Front End Loader
    - Operating Weight 300.00 kips

(Example Wheeled Front End Loader)

4.2.3 Barges - The following vessel information is representative of the typical vessels that may utilize the new AML dock.

AML Dock Vessel Data							
Vessel	Service	Draft (ft)	Length (ft)	Length w/Tug (ft)	Beam (ft)	Height (ft)	DWT (Long Tons)
AML Cargo Barge	AML	17.0	360	-	100	-	-
One Cure	Petro Mar.	16.5	111.3	-	36.0	-	-
Zidell Marine-277	Petro Mar.	20.5	421.5	495.7	76.5	-	13735.73
Dale R. Lindsey	Petro Mar.	16.0	90.9	-	37.9	-	-
Petro Mariner	Petro Mar.	-	222	282.6	64.5	-	5226.39

[1]A list of additional design vessels is provided in Appendix B

4.2.4 Vessel Mooring

• Mooring Bollards	50 Ton
• Range of Horizontal Pull	0 to 180 degrees
• Range of Vertical Pull	-10 to 10 degrees

4.2.5 Vessel Berthing

• Approach Velocity	1 knot (1.69 ft/s)
• Accidental Berthing Factor	1.5

4.2.6 Tidal Ranges

The RORO ramp designed for the maximum

• Max Operating Tide	19.00 ft MLLW 19’-1” Maximum Vessel Freeboard
• Min Operating Tide	-2.00 ft MLLW 3’-7” Minimum Vessel Freeboard

4.2.7 MEP Equipment/Lights/Ducts/Pipes	5 psf.

4.3 Marine Service Platform

4.3.1 All loads as defined for the RORO Dock

4.3.2 Liebherr LHM 280 Mobile harbor crane

5.0 SERVICEABILITY AND CATHODIC PROTECTION

- Structures will be designed for a standard 50-year service life with typical maintenance
- All exposed steel will be galvanized.
- Bollards will be galvanized, and epoxy coated
- Safety Ladders will be fiberglass reinforced polymer
- Cathodic Protection for exposed steel elements will be evaluated
- Epoxy coatings are assumed to have a 15-year service life. Following the assumed service life of epoxy coatings, members are assumed to experience 0.003 in/year of corrosion loss in the splash zone.
- RORO ramp and cruise dock access ramp epoxy coatings shall be maintained for the life of respective structures.

6.0 MATERIALS SPECIFICATIONS AND STRENGTHS

- Unit Weights

  Actual and available construction material weights shall be used for design. The following are typical unit weights:

Steel or cast steel	490 pcf
Concrete, reinforced (normal weight)	150 pcf
Concrete, reinforced (lightweight)	120 pcf
Compacted sand, earth, gravel, or ballast	150 pcf
Asphalt paving	150 pcf

- Concrete

Cast-in-place	$f'_c = 5,000$ psi

- Reinforcing Steel

Unless Noted Otherwise	ASTM A 615, Grade 60
Welded Rebar, Threaded Rebar	ASTM A 706, Grade 60
Smooth Welded Wire Fabric	ASTM A 185
Deformed Welded Wire Fabric	ASTM A 497
Deformed Bar Anchors	ASTM A 496

- Structural Steel

Wide Flange Shapes	ASTM A 992
Pipes	ASTM A 53, Grade B
Tubes – Round or Rect. HSS	ASTM A 500, Grade C
Angles and Channels	ASTM A 36
Plates	ASTM A 36 or A 572, Grade 50
Base Plates	ASTM A 36
Connection Material and Embedded Plates	ASTM A 36
Bolts	ASTM F 3125 Grade A 325
Threaded Rods	ASTM A 36, UNO
Anchor Rods in Concrete or Masonry	ASTM F1554, Grade 55, UNO
Welding Electrodes	ASTM E 70XX, UNO
Headed Shear Studs	ASTM A 108

7.0 CIVIL ENGINEERING

7.1 Demolition

Existing Structures to be demolished include the following:

- Demolition of existing timber, steel, and concrete docks, platforms, walkways, catwalks, and mooring dolphins as shown in plans.
- Demolition of existing fender panels and existing fender piles
- Partial demolition of the concrete dock currently serving cruise vessels.
- Demolition of existing Ore Loader and conveyor
- Demolition of existing Ore dock and walkways
- Demolition of the existing concrete AML dock on the northeast corner of the site.
- Demolition of existing overhead power lines.

Demolition of this infrastructure will generally occur as follows. Above-water infrastructure, including concrete pads, timber decking pile caps, utilities, and piping will be removed. Then timber piles will be extracted entirely or broken off at the mudline if extraction is not practical.

The project will be constructed in a manner to limit disruptions to existing fuel, cruise, and AML operations throughout construction. The Ore Dock is important to the Municipality of Skagway and connecting communities in Canada, and the ability to transport goods across this dock must be maintained throughout each phase of construction.

7.2 Earthwork

7.2.1 Site Grading

- Minimum site grades
    - ½ percent slope for concrete surfaces
    - 1-½ percent slope for asphalt surfaces

7.2.2 Existing Shoreline Riprap

It is assumed that the existing riprap on the shoreline bank will remain in place. Except, portions of the riprap in the Northeast Berth extension area will be removed to accommodate dredging and new slope design.

7.3 Utilities

7.3.1 Storm Drainage

The existing asphalt road and storm drain system will not be altered by this project. All proposed upland work will be designed and coordinated by RESPEC.

Stormwater on the Marine Service Platform will be collected in a series of trench drains then treated to local standards before outfalling the Skagway Harbor. Details on this design will be developed in the next design phase.

7.3.2 Potable Water

- Materials for water piping and fittings shall comply with the applicable standard referenced in the 2015 Uniform Plumbing Code and the Municipality of Skagway.
- Vessel supply connections will be provided at all proposed facilities.

7.3.3 Fire Suppression System

The following will be adhered to for fire protection for the floats and docks, except where more stringent requirements are required by the NFPA 303 or NFPA 30A.

- Fire protection system including pipes and appurtenances will adhere to the 2018 International Fire Code Chapter 36 for Marinas, and by 16.03 of the City of Everett Municipal Code.
- Fire protection system maintenance shall conform to NFPA 10, 25 and 72.
- The fuel header shall be equipped with portable fire extinguishers with a minimum rating of 40-B.
- The non-fueling section of the fuel float shall be equipped with portable fire extinguishers with a minimum rating of 4A (class A extra-hazard) and will be placed in pairs at a maximum of 150-foot intervals on the float, with no portion of the float being more than 75 feet from an extinguisher (NFPA 303, NFPA 10).
- Applicable signage as required by the IFC 36 is assumed to be on site, this will be confirmed prior to final design.
- All above water level piping associated with the fire protection system will be galvanized or stainless steel, below water level piping will be steel or HDPE pipe of a pressure class to withstand the requirements of the applicable NFPA and IFC code requirements.
- Water system will be sized utilizing WaterCAD to confirm flows to most extreme portions of float per IFC 36.
- Marinas shall be equipped throughout with standpipe systems in accordance with NFPA 303. Systems shall be provided with hose connections located such that no point on the float system exceeds 150 feet from a standpipe hose connection (ASCE MREP No. 50).
- A fire phone is required to be on site per NFPA 30A section 9.5.5.
- For Class III systems (piers that extend more than 500 feet - NFPA 30A), the minimum flow rate for the hydraulically most remote standpipe shall be 500 gpm with a minimum residual pressure of 100 psi for 2.5-inch hose connections (for use by fire department) and 65 psi for 1.5-inch hose stations. The minimum flow rate for additional standpipes shall be 250 gpm per standpipe with the total not to exceed 1250 gpm (NFPA 14).
- A fire department connection (FDC) for each standpipe system shall be located not more than 100 feet from the nearest fire hydrant connected to an approved water supply (NFPA 14).
- The water supply shall be sufficient to provide the system demand for at least 30 minutes.

7.3.4 Sanitary Sewer

- Existing Sanitary Sewer service will not be altered during this project phase.
- Dredging for the Northeast Berth Extension may conflict with an existing sewer outfall. Upland civil consultant is to field verify and reroute outfall as necessary in accordance with local standards.

7.3.5 Fueling Systems

- KPFF will demolish all upland fuel lines to a point just north of the proposed Roro ramp. A new fuel header and fuel line route is proposed.
- The fuel lines including all fittings and valves will be steel conforming to the following codes:
    - 2015 Uniform Plumbing Code
    - 2018 International Fuel Gas Code
    - 2021 International Mechanical Code
    - 2021 International Fire Code
- The fueling system will also adhere to NFPA 303 and NFPA 30A as applicable.
- All fittings and pipe connections are to be butt welded with the exception of flanged connections to the backflow and gate valves on the fuel header.
- Cathodic protection and isolation joints will be provided on each side of the buried line under the Roro ramp structure.

7.4 Fencing, Signage and Pavement Markings

Plastic traffic barriers will be used to separate the pedestrian route from the fuel transfer and AML wharf operations. In addition to the plastic traffic barriers, a 6-foot high fence is proposed to provide security to the fuel pier and AML wharf.

7.5 Dredging

Dredging will be conducted using mechanical methods with a clamshell bucket to remove sediments contaminated by historical activities and which are located adjacent to the Ore Dock. Data from a recent sediment quality investigation (conducted in January 2015) along with sampling to be conducted this year will be used to define the lateral and vertical extents of contaminants exceeding the remedial action objectives (RAOs) threshold concentrations, and to develop dredge prisms for the Northeast Berth Extension.

Mechanical dredging methods with a clamshell bucket is likely to be selected as the dredging method due to the following considerations:

- A large amount of water is typically generated through hydraulic dredging.
- Mechanical methods remove material in near in-situ condition, reducing the need to dewater sediment or treat generated water.
- Mechanical methods are better able to remove the expected dense and coarse material.
- Mechanical methods are better suited for removing debris.
- A standard clamshell bucket will have the ability to remove sands and gravels that are too dense to be removed by an enclosed environmental bucket.

7.5.1 Dredge Prism Design Elevations

The required dredge prism design elevations and adjacent slope dredge cuts were established at -37 MLLW with a 2-ft maximum allowable overdredge in the North Berth Extension area. Further separation of dredge material management units (DMMUs) will be established further along in project permitting.

7.5.2 Slope Dredging

The intent of the slope dredging is to remove surficial soft sediment that is assumed to be contaminated and to cut down to required dredge elevations for placement of riprap.

The dredge cut will extend from the required dredge elevations of the adjacent dredge units up the slope to above MHHW. As-built drawings of the existing riprap show the lower extent of the riprap to end in a keyway that daylights with a 6-foot-wide horizontal bench feature at -12 feet MLLW (Tippetts et al. 1968). The dredge cut proposed at the Northeast Berth Extension will completely remove existing riprap and cut at steeper slopes (2:1) then the original as-built riprap protected slopes.

The contractor will be required to remove any sediment that sloughs from the slope area into the lateral extents of the dredge prism above the required dredge elevation.

7.5.3 Dewatering

Based on the current understanding of sediment characteristics, it is assumed that passive dewatering of the dredged sediment will occur on the barges; however, additional dewatering actions may be required for either handling purposes or to facilitate future beneficial re-use of the material. These actions could occur on the barge, at the unloading facility, or in the upland stockpile area, at the contractor’s discretion.

Dredged material from the clamshell bucket will be placed directly onto a sealed barge. A sealed barge is proposed to allow for collection of effluent water on the barge itself (i.e., direct discharges to Skagway Harbor from the barge will not be allowed), and minimize the potential for dredged material and effluent water to enter Skagway Harbor.

Effluent from dewatering at both the barge and upland stockpile areas will be collected and pumped to either an upland- or barge-based water treatment system for collection and, as needed, treated to meet water quality certification discharge requirements. Permit requirements will dictate whether effluent water will require treatment prior to discharge back to the harbor, but it is currently assumed that treatment will be required prior to discharge to on-site receiving waters.

7.5.4 Dredging Best Management Practices

Best management practices (BMPs) may be required as permit conditions, or will be developed as part of the remedial dredging specifications to minimize, to the extent practical, potential water quality impacts and the magnitude of residual contamination, and to provide quality control of the work. Examples of dredging BMPs that may be incorporated into the project for dredging, transport, and disposal and placement operations include the following:

- Defining qualified contractor requirements for the procurement process, as allowable per MOS procurement regulations
- Contingency use of specialized equipment, such as a silt curtain
- Use of watertight barges
- Real-time environmental monitoring of contractor activities
- Use of real-time kinematic positioning system for dredging accuracy
- Contingency modifications to operational controls, such as:
    - Increasing the dredging bucket cycle time
    - Not allowing multiple bites
    - Not allowing underwater stockpiling
    - Controlling cut thickness along the toe of slope
    - Not allowing bottom leveling
    - Not allowing bucket overloading
    - Not allowing barge overloading

7.5.5 Material Offloading and Stockpiling

Disposal, offloading and stockpiling of dredge material will be established further along in project permitting.

7.5.6 Material Treatment

To be provided after North Berth Extension material sampling.

7.6 Slope Riprap Placement

Riprap will be placed on the post-dredged slope. The riprap will be a minimum of 3.5 feet thick and have an over placement allowance of 12 inches, while the underlying the filter material will have a minimum required thickness of 12 inches, with a 12-inch over placement allowance.

A keyway will be constructed at the toe of the riprap slope with the armor rock material on the post-dredge surface to provide a toe buttress for the riprap and filter material. The keyway will be constructed in advance of placing filter or riprap material on the slope. The keyway is currently designed to be placed on the post-dredge surface, but this assumption will be discussed with MOS to determine if final elevations meet either short- or long-term operational draft requirements for the site.

7.7 On-site and Off-site Re-use of Dredged Sediment

7.7.1 On-site Beneficial Reuse of Dredge Material

To be addressed in next phase of project permitting.

7.7.2 Potential Off-site Beneficial Reuse of Dredge Material

To be addressed in next phase of project permitting.

Appendix A – Design Cruise Vessel List

Ship	LOA [ft]	Operator
Quantum of the Seas	1142.00	Royal Caribbean
Ovation of Seas	1138.00	Royal Caribbean
Norwegian Bliss/Joy	1094.00	Norwegian Cruise Line
Norwegian Encore	1094.00	Norwegian Cruise Line
Regal/Royal Princess	1083.00	Princess Cruises
Discovery Princess	1083.00	Princess Cruises
Majestic Princess	1082.00	Princess Cruises
Eclipse Solstice	1040.00	Celebrity Cruises
Enchantment of the Sea (2023)	988.71	Royal Caribbean
Koningsdam	983.10	Holland America Line
Infinity Millennium Summit	965.00	Celebrity Cruises
Serenade/Radiance	965.00	Royal Caribbean
Norwegian Jewel	965.00	Norwegian Cruise Line
Serenade of the Sea	965.00	Royal Caribbean
Queen Elizabeth	964.50	Cunard Line
Coral/Island Princess	964.00	Princess Cruises
Disney Wonder	964.00	Disney Cruise Line
Carnival Miracle	963.00	Carnival Cruise Line
Radiance of the Sea	962.00	Royal Caribbean
Carnival Freedom	952.00	Carnival Cruise Line
Sapphire Princess	952.00	Princess Cruises
Crown/Ruby Princess	950.00	Princess Cruises
Grand Princess	949.00	Princess Cruises
Noordam/Oosterdam/Westerdam/Zuiderdam	936.00	Holland America Line
Eurodam	936.00	Holland America Line
Nieuw Amsterdam	936.00	Holland America Line
Norwegian Spirit	880.20	Norwegian Cruise Line
Norwegian Sun	848.00	Norwegian Cruise Line
Crystal Serenity	790.00	Crystal Cruises
Volendam (2023)	781.00	Holland America Line
Viking Orion	745.00	Viking Ocean Cruises
Seven Seas Explorer (2023)	735.00	Regent Seven Seas Cruises
Seven Seas Mariner	709.00	Regent Seven Seas Cruises
Silver Muse	698.00	Silversea
Silver Shadow	610.00	Silversea
Silver Whisper (2023)	610.00	Silversea
Regatta	593.70	Oceania Cruises

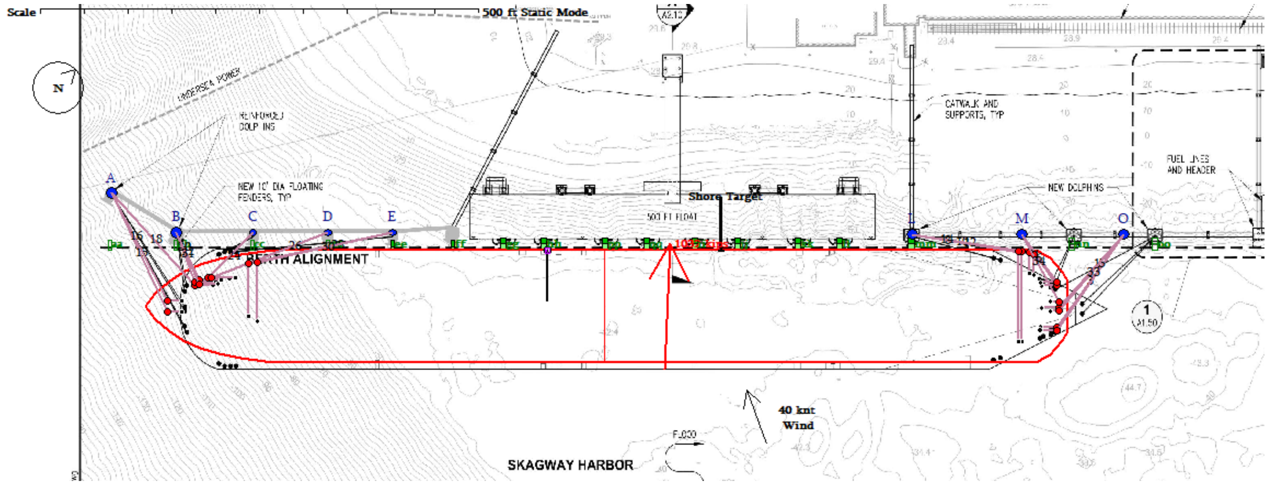
[1]Based on the 2022 and 2023 Cruise Ship Calendars provided by Cruise Line Agencies of Alaska on 2021-12-09

Appendix B – Design Barge List

Vessel Name	Operator	DWT	Overall Dimensions		
			L [ft]	W [ft]	D [ft]
Anchorage Provider	AML	15,300	420.00	100.00	24.00
Fairbanks Provider	AML	15,300	420.00	100.00	24.00
Arctic Provider	AML	15,202	420.00	100.00	24.00
Whittier Provider	AML	15,300	420.00	100.00	24.00
Aleutian Trader	AML	13,426	380.00	96.00	23.00
Hawaii Trader	AML	13,426	380.00	96.00	23.00
Pacific Trader	AML	13,426	380.00	96.00	23.00
Polar Trader	AML	13,349	380.00	96.00	23.00
Westward Trader	AML	13,426	380.00	96.00	23.00
Southeast Provider	AML	13,200	360.00	100.00	22.00
Stikine Provider	AML	13,200	360.00	100.00	22.00
Sitka Provider	AML	13,200	360.00	100.00	22.00
Skagway Provider	AML	12,408	360.00	100.00	22.00
Alaska Trader	AML	10,948	344.00	94.00	21.00
Anchorage Trader	AML	10,597	344.00	94.00	21.00
Bering Trader	AML	10,881	344.00	94.00	21.00
344	AML	10,500	330.00	86.00	21.00
Tongass Provider	AML	8,240	322.00	90.00	18.00
Taku Provider	AML	8,240	322.00	90.00	18.00
Chatham Provider	AML	6,417	286.00	76.00	17.00
Chichagof Provider	AML	6,417	286.00	76.00	17.00
Kenai Trader	AML	7,071	285.00	78.00	18.00
Naknek Trader	AML	7,071	285.00	78.00	18.00
Togiak Trader	AML	3,830	240.00	60.00	15.00
Yukon Trader	AML	4,271	240.00	60.00	15.00
Koyukuk	AML	811	150.00	50.00	7.00
Kamakani	AML	16,867	438.00	105.00	25.00
Namakani	AML	17,121	438.00	105.00	25.00
Alaska Provider	BMC	4,304	250.00	70.00	15.00
Baranof Provider	BMC	2,793	202.50	60.00	12.00
Cordova Provider	BMC	2,793	202.50	60.00	12.00
Stickeen	BMC	1,500	150.00	50.00	10.00
Tony Saganna	BMC		50.00	24.00	4.00
Western Carrier	WTB	9,100	300.00	84.00	19.00
Western Service	WTB	6,400	270.00	70.00	18.00
Western Provider	WTB	5,586	250.00	70.00	15.00

Appendix C – OPTIMOOR Analysis

Arrangement for QUANTUM at Skagway Ore Dock



Vessel Data for QUANTUM

(file C:\Users\pyoung\KPFF, Inc\KPFF SPRC 2021 Projects - Documents\10092100135 Skagway Ore Peninsula Multi-Use Dock\2.15 Engineering\Working\PEY\Optimoor\QoS-Stbd-Updated-22-06-09\QUANTUM-corrected-flat length fixed.vsl)
Units in ft, inches, & kips
Longitudinal datum at Midship

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                                   LBP:1050.2
                               Breadth: 135.8
                                 Depth:  68.9
                           Port Target:  70.0 fwd from midship  -67.9 from CL and     3.3 above deck
                           Stbd Target:  70.0 fwd from midship   67.9 from CL and     3.3 above deck
            End-on projected windage area: 19377 above deck level
              Side projected windage area:118500 above deck level
                  Fendering possible from: 0.364 LBP aft of midship
                                      to: 0.272 LBP fwd of midship
               Current drag data based on:  Cruise Ship (shallow water)
                  Wind drag data based on:  Cruise Ship
                Wave motion data based on:  User specified circular motion
  Radius of maximum wave-induced motion: 0.30 significant wave height
 Radius of maximum swell-induced motion: 0.50 significant swell height
```

```
Flatside Contour          Longitudinal datum at Midship
          X-dist  -382.2  275.4  286.0
           Depth    64.7   64.7   46.7
```

Midship Area

Line No.	Fair-Lead X	Fair-Lead Y	Ht on Deck	Dist to Winch	Brake Limit	Pre-Tension	Line Size-Type-BL	Tail Segment-1 Lgth-Size-Type-BL
1	-558.2	-2.0	-19.0	21.2	258	18	5.4 dm 355	
2	-558.2	2.0	-19.0	21.2	258	18	5.4 dm 328	
3	-556.6	-25.0	-19.0	20.3	258	18	5.4 dm 328	
4	-556.6	25.0	-19.0	19.2	258	18	5.4 dm 328	
5	-555.5	-29.0	-19.0	20.3	258	18	5.4 dm 328	
6	-555.5	29.0	-19.0	19.2	258	18	5.4 dm 328	
7	-527.7	-63.6	-19.0	104.5	258	18	5.4 dm 328	
8	-527.7	63.6	-19.0	25.5	258	18	5.4 dm 328	
9	-522.0	-66.0	-19.0	23.8	258	18	5.4 dm 328	
10	-522.0	66.0	-19.0	25.5	258	18	5.4 dm 328	
11	-512.8	-67.0	-19.0	22.8	258	18	5.4 dm 328	
12	-512.8	67.0	-19.0	110.3	258	18	5.4 dm 328	
13	-508.5	-67.0	-19.0	110.7	258	18	5.4 dm 328	
14	-508.5	67.0	-19.0	110.3	258	18	5.4 dm 328	
15	537.0	-6.6	3.0	17.4	258	18	5.4 dm 328	
16	537.0	6.6	3.0	17.4	258	18	5.4 dm 328	
17	502.7	-26.1	3.0	21.6	258	18	5.4 dm 328	
18	502.7	26.1	3.0	21.6	258	18	5.4 dm 328	
19	502.7	-30.1	9.5	25.1	258	18	5.4 dm 328	
20	502.7	30.1	9.5	25.1	258	18	5.4 dm 328	
21	498.5	-32.4	9.5	27.4	258	18	5.4 dm 328	
22	498.5	32.4	9.5	27.4	258	18	5.4 dm 328	
23	487.2	-34.3	3.0	26.2	258	18	5.4 dm 328	
24	487.2	34.3	3.0	26.2	258	18	5.4 dm 328	
25	483.4	-34.8	3.0	29.5	258	18	5.4 dm 328	
26	483.4	34.9	3.0	29.5	258	18	5.4 dm 328	
27	437.3	-51.7	3.0	63.7	258	18	5.4 dm 328	
28	437.3	51.7	3.0	63.7	258	18	5.4 dm 328	
29	426.4	-54.3	3.0	72.3	258	18	5.4 dm 328	
30	426.4	54.3	3.0	72.3	258	18	5.4 dm 328	
31	498.5	27.4	3.0	23.9	258	18	5.4 dm 328	
32	498.5	-27.4	3.0	23.9	258	18	5.4 dm 328	
33	-558.1	-6.0	-19.0	10.0		0.0	5.4 dm 328	
34	-558.1	6.0	-19.0	10.0		0.0	5.4 dm 328	

Codes for Types of Line:
dm: dynamax HMPE 12-strand (broken-in)

Berth Data for Skagway Ore Dock

(file C:\Users\pyoung\KPFF, Inc\KPFF SPRC 2021 Projects - Documents\10092100135 Skagway Ore Peninsula Multi-Use Dock\2.15 Engineering\Working\PEY\Optimoor\QoS-Stbd-Updated-22-06-09\berth-4-2-19.bth)
Units in ft & kips

Left to Right of Screen Site Plan Points:	45°
Width of Channel (for Current):	3281
Pier Height (Fixed) above Datum:	14.0
Seabed Depth in way of Ship below Datum:	65.6
Permissible Surge Excursion Fwd/Aft:	± 3.00
Permissible Sway Excursion Port/Stbd:	± 3.00
Permissible Vertical Movement:	± 3.00
Dist of Berth Target to Right of Origin:	0.0
Wind Speed Specified at Height:	32.8
Current Specified at Depth:	0.0

Hook/ Bollard	X-Dist to Origin	Dist to Fender Line	Ht above Pier	Allowable Load
A	-748.8	70.0	12.0	400
B	-669.0	22.0	12.0	400
C	-574.9	22.0	12.0	200
D	-483.2	22.0	12.0	200
E	-403.5	22.0	12.0	200
F	-329.7	25.0	12.0	200
G	-303.6	17.0	2.0	200
H	-170.8	17.0	2.0	200
I	51.3	17.0	2.0	200
J	184.5	17.0	2.0	200
L	235.3	20.0	15.0	400
M	370.0	20.0	15.0	400
O	495.0	20.0	15.0	400

```
       ______________________________________________________

______________________________________________________________________
Fender   X-Dist      Ht above     Width     Face Contact
        to Origin     Datum    Along Side    Area (ft²)
  aa    -750.5         3.0         4.0         48.4
  bb    -669.4         3.0         4.0         48.4
  cc    -575.4         3.0         4.0         48.4
  dd    -483.4         3.0         4.0         48.4
  ee    -403.5         3.0         4.0         48.4
  ff    -329.7         3.0         4.0         48.4
  gg    -267.7         3.0         7.0         98.0
  hh    -217.2         3.0         7.0         98.0
  ii     -31.7         3.0         7.0         98.0
  jj      20.9         3.0         7.0         98.0
  kk      94.8         3.0         7.0         98.0
  ll     146.0         3.0         7.0         98.0
  mm     234.0         3.0         7.0         98.0
  nn     431.6         3.0         7.0         98.0
  oo     533.6         3.0         7.0         98.0
  pp    -142.7         3.0         7.0         98.0
  qq     -90.9         3.0         7.0         98.0

Fender Load-Compression Data
  aa      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  bb      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  cc      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  dd      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  ee      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  ff      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  gg     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  hh     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  ii     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  jj     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  kk     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  ll     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  mm     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  nn     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  oo     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  pp     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft
```

```
  qq    18    38    58    78   100   126   152   186   221   257 kips
      0.38  0.80  1.19  1.56  1.93  2.35  2.75  3.24  3.73  4.19 ft
_________________________________________________________________
```

Static Mooring Response for QUANTUM at Skagway Ore Dock

```
(file C:\Users\pyoung\KPFF, Inc\KPFF SPRC 2021 Projects - Documents\10092100135 Skagway
                    Ore Peninsula Multi-Use Dock\2.15
     Engineering\Working\PEY\Optimoor\QoS-Stbd-Updated-22-06-09\mooring
                    analysis-4-2-19-updated.opt)
                         Units in ft & kips
Remarks:
          Static Analysis for Time: 1537 Jan 09 2019 (initialised at 1537 Jan 09 2019)
                       Water Level:  16.00 above Datum (initialised at this water level)
                             Draft:  26.20 (initialised at this draft))
                              Trim:   0.00 (initialised at this trim)
                  Bottom Clearance:  55.4
      Fwd Offset of Vessel Target: 213.0 from Berth Target
                Vessel Stbd Target:  48.0 above Pier
                        Wind Speed:    40 knots
               Wind Direction from:   All°

         Total End-on Windage Area: 25176
           Total Side Windage Area:163344

                              Longitudinal  Transverse  Yaw Moment/LBP

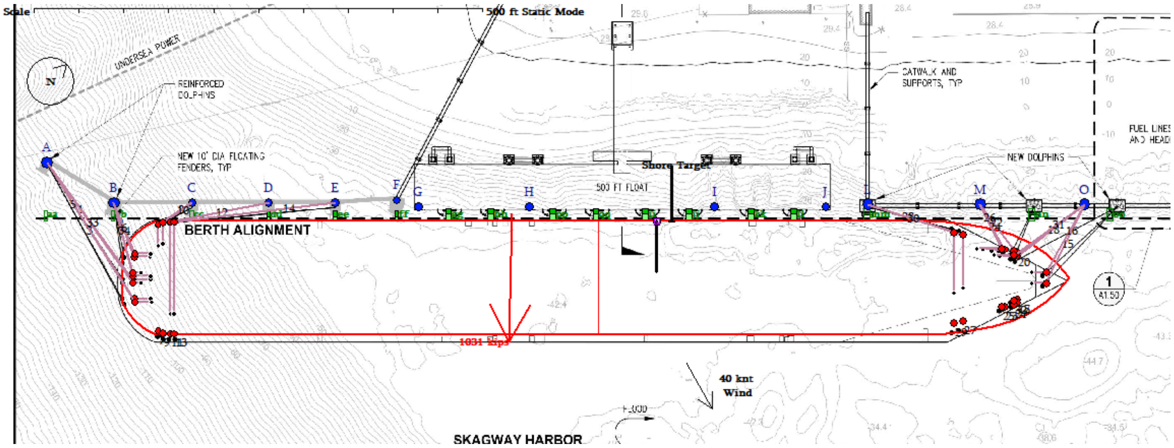
        Movement of Vessel   0.51 (fwd)   -0.94 (out)   0.1° (port)   0.00 (up)
        at its Stbd Target  -0.10 (aft)    2.04 (inw)  -0.2° (stbd)   0.00 (up)
________________________________________________________________________
  Line to      Pull  Tot.Line  In-Line  Winch   Worst Direction    Line   Percent
  Bollard      -in    Length  ±Motion   Slip  to Screen  True   Tension  Strength
  1-O          0.48   141.4                        -50°   355°    126.9      36%
  3-O          0.55   159.3                        -50°   355°    111.4      34%
  4-M          0.50    96.0                        -60°   345°    127.1      39%
  5-O          0.56   163.2                        -50°   355°    109.5      33%
  6-M          0.48    92.1                        -60°   345°    129.2      39%
  8-L          0.46   176.8                        165°   210°     26.5       8%
 10-L          0.45   170.8                        165°   210°     26.7       8%
 12-L          0.62   246.3                        165°   210°     25.2       8%
 14-L          0.61   242.0                        165°   210°     25.3       8%
 15-A          0.69   180.7                       -130°   275°     82.9      25%
 16-A          0.66   169.2                       -130°   275°     84.6      26%
 18-A          0.64   177.1                       -130°   275°     63.4      19%
 20-B          0.48   101.4                       -125°   280°    121.8      37%
 22-B          0.48   103.3                       -130°   275°    113.2      35%
 24-C          0.41   112.0                       -120°   285°    132.2      40%
 26-D          0.41   186.6                       -120°   285°     66.0      20%
 28-E          0.45   247.6                       -120°   285°     45.3      14%
 30-E          0.44   245.2                       -120°   285°     45.5      14%
 31-B          0.50   100.4                       -130°   275°    125.4      38%
 33-O          0.23   133.5             1.4        -50°   355°      1.0       0%
 34-M          0.33   103.8                        -60°   345°    109.6      33%
________________________________________________________________________
        Fender   Thrust  Compression  Pressure  Flatside Cover
          ee       193       2.54        8.8        100%
          ff       175       2.34        8.0        100%
          gg       115       2.18        2.6        100%
          hh       107       2.05        2.4        100%
          ii       100       1.92        2.2        100%
          jj       106       2.03        2.4        100%
          kk       116       2.19        2.6        100%
          ll       123       2.30        2.8        100%
          mm       135       2.50        3.0        100%
          pp        96       1.87        2.2        100%
          qq        92       1.80        2.1        100%
```

```
________________________________________________________________________
  Hook/      X-     Y-    Other  Other   Total %Bollard Direction Bollard
 Bollard   Force  Force  X-Load Y-Load   Force Strength  in Plan  Uplift
     A     113.7  192.1                  229.2    57%      31°     52.1
     B     119.0  284.2                    360    90%      23°    185.9
     C     -84.6   85.9                  132.2    66%     -45°     54.1
     D     -59.9   23.4                   66.0    33%     -69°     14.9
     E     -86.8   19.2                   90.7    45%     -78°     18.1
     L     102.1   15.8                  103.6    26%      81°      7.8
     M     195.4    305                    365    91%      33°     48.5
     O    -211.9  275.2                    348    87%     -38°     27.8
________________________________________________________________________

                  Approximate natural periods
             Surge: 35    Sway: 35    Roll: 29 secs
```

OPTIMOOR Licence 2742 Version 60709 Tension Technology International © 28 August 2020

Arrangement for QUANTUM at Skagway Ore Dock



Vessel Data for QUANTUM

(file C:\Users\pyoung\KPFF, Inc\KPFF SPRC 2021 Projects - Documents\10092100135 Skagway Ore Peninsula Multi-Use Dock\2.15 Engineering\Working\PEY\Optimoor\QoS-Port-Updated-22-06-09\QUANTUM-corrected-flat length fixed.vsl)
Units in ft, inches, & kips
Longitudinal datum at Midship

```
                        LBP:1050.2
                    Breadth: 135.8
                      Depth:  68.9
               Port Target:  70.0 fwd from midship  -67.9 from CL and    3.3 above deck
               Stbd Target: 250.8 fwd from midship   67.9 from CL and    3.3 above deck
   End-on projected windage area: 19377 above deck level
     Side projected windage area:118500 above deck level
         Fendering possible from: 0.364 LBP aft of midship
                              to: 0.272 LBP fwd of midship
      Current drag data based on:  Cruise Ship (shallow water)
         Wind drag data based on:  Cruise Ship
       Wave motion data based on:  User specified circular motion
Radius of maximum wave-induced motion: 0.30 significant wave height
Radius of maximum swell-induced motion: 0.50 significant swell height
```

```
Flatside Contour          Longitudinal datum at Midship
          X-dist  -382.2  275.4  286.0
           Depth    64.7   64.7   46.7
```

```
Line Fair-  Fair-  Ht on Dist to Brake   Pre-        Line           Tail Segment-1
 No. Lead X Lead Y  Deck  Winch  Limit Tension   Size-Type-BL     Lgth-Size-Type-BL
  1 -558.2   -2.0  -19.0   21.2   258     18       5.4 dm  328
  2 -558.2    2.0  -19.0   21.2   258     18       5.4 dm  328
  3 -556.6  -25.0  -19.0   20.3   258     18       5.4 dm  328
  4 -556.6   25.0  -19.0   19.2   258     18       5.4 dm  328
  5 -555.5  -29.0  -19.0   20.3   258     18       5.4 dm  328
  6 -555.5   29.0  -19.0   19.2   258     18       5.4 dm  328
  7 -527.7  -63.6  -19.0  104.5   258     18       5.4 dm  328
  8 -527.7   63.6  -19.0   25.5   258     18       5.4 dm  328
  9 -522.0  -66.0  -19.0   23.8   258     18       5.4 dm  328
 10 -522.0   66.0  -19.0   25.5   258     18       5.4 dm  328
 11 -512.8  -67.0  -19.0   22.8   258     18       5.4 dm  328
 12 -512.8   67.0  -19.0  110.3   258     18       5.4 dm  328
 13 -508.5  -67.0  -19.0  110.7   258     18       5.4 dm  328
 14 -508.5   67.0  -19.0  110.3   258     18       5.4 dm  328
 15  537.0   -6.6    3.0   17.4   258     18       5.4 dm  328
 16  537.0    6.6    3.0   17.4   258     18       5.4 dm  328
 17  502.7  -26.1    3.0   21.6   258     18       5.4 dm  328
 18  502.7   26.1    3.0   21.6   258     18       5.4 dm  328
 19  502.7  -30.1    9.5   25.1   258     18       5.4 dm  328
 20  502.7   30.1    9.5   25.1   258     18       5.4 dm  328
 21  498.5  -32.4    9.5   27.4   258     18       5.4 dm  328
 22  498.5   32.4    9.5   27.4   258     18       5.4 dm  328
 23  487.2  -34.3    3.0   26.2   258     18       5.4 dm  328
 24  487.2   34.3    3.0   26.2   258     18       5.4 dm  328
 25  483.4  -34.8    3.0   29.5   258     18       5.4 dm  328
 26  483.4   34.9    3.0   29.5   258     18       5.4 dm  328
 27  437.3  -51.7    3.0   63.7   258     18       5.4 dm  328
 28  437.3   51.7    3.0   63.7   258     18       5.4 dm  328
 29  426.4  -54.3    3.0   72.3   258     18       5.4 dm  328
 30  426.4   54.3    3.0   72.3   258     18       5.4 dm  328
 31  498.5   27.4    3.0   23.9   258     18       5.4 dm  328
 32  498.5  -27.4    3.0   23.9   258     18       5.4 dm  328
 33 -558.1   -6.0  -19.0   10.0          0.0       5.4 dm  328
 34 -558.1    6.0  -19.0   10.0          0.0       5.4 dm  328

  Codes for Types of Line:
  dm: dynamax HMPE 12-strand (broken-in)
```

Berth Data for Skagway Ore Dock

(file C:\Users\pyoung\KPFF, Inc\KPFF SPRC 2021 Projects - Documents\10092100135 Skagway Ore Peninsula Multi-Use Dock\2.15 Engineering\Working\PEY\Optimoor\QoS-Port-Updated-22-06-09\berth-4-2-19.bth)
Units in ft & kips

```
 Left to Right of Screen Site Plan Points:    45°
           Width of Channel (for Current):   3281
          Pier Height (Fixed) above Datum:   14.0
  Seabed Depth in way of Ship below Datum:   65.6
      Permissible Surge Excursion Fwd/Aft: ±  3.00
     Permissible Sway Excursion Port/Stbd: ±  3.00
            Permissible Vertical Movement: ±  3.00
  Dist of Berth Target to Right of Origin:    0.0
           Wind Speed Specified at Height:   32.8
               Current Specified at Depth:    0.0

 Hook/      X-Dist      Dist to      Ht above  Allowable
Bollard   to Origin   Fender Line      Pier      Load
   A       -748.8        70.0          12.0       400
   B       -669.0        22.0          12.0       400
   C       -574.9        22.0          12.0       200
   D       -483.2        22.0          12.0       200
   E       -403.5        22.0          12.0       200
   F       -329.7        25.0          12.0       200
   G       -303.6        17.0           2.0       200
   H       -170.8        17.0           2.0       200
   I         51.3        17.0           2.0       200
   J        184.5        17.0           2.0       200
   L        235.3        20.0          15.0       400
   M        370.0        20.0          15.0       400
   O        495.0        20.0          15.0       400
```

```
Fender   X-Dist     Ht above    Width    Face Contact
        to Origin    Datum   Along Side    Area (ft²)
  aa    -750.5        3.0        4.0        48.4
  bb    -669.4        3.0        4.0        48.4
  cc    -575.4        3.0        4.0        48.4
  dd    -483.4        3.0        4.0        48.4
  ee    -403.5        3.0        4.0        48.4
  ff    -329.7        3.0        4.0        48.4
  gg    -267.7        3.0        7.0        98.0
  hh    -217.2        3.0        7.0        98.0
  ii     -31.7        3.0        7.0        98.0
  jj      20.9        3.0        7.0        98.0
  kk      94.8        3.0        7.0        98.0
  ll     146.0        3.0        7.0        98.0
  mm     234.0        3.0        7.0        98.0
  nn     431.6        3.0        7.0        98.0
  oo     525.6        3.0        7.0        98.0
  pp    -142.7        3.0        7.0        98.0
  qq     -90.9        3.0        7.0        98.0

Fender Load-Compression Data
  aa      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  bb      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  cc      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  dd      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  ee      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  ff      6     12     30     36     48     63     78    101    144    199 kips
       0.10   0.20   0.50   0.60   0.80   1.00   1.20   1.50   2.00   2.60 ft

  gg     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  hh     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  ii     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  jj     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  kk     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  ll     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  mm     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  nn     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  oo     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft

  pp     18     38     58     78    100    126    152    186    221    257 kips
       0.38   0.80   1.19   1.56   1.93   2.35   2.75   3.24   3.73   4.19 ft
```

```
    qq    18    38    58    78   100   126   152   186   221   257 kips
        0.38  0.80  1.19  1.56  1.93  2.35  2.75  3.24  3.73  4.19 ft
  _________________________________________________________________
```

Static Mooring Response for QUANTUM at Skagway Ore Dock

```
 (file C:\Users\pyoung\KPFF, Inc\KPFF SPRC 2021 Projects - Documents\10092100135 Skagway
                          Ore Peninsula Multi-Use Dock\2.15
          Engineering\Working\PEY\Optimoor\QoS-Port-Updated-22-06-09\mooring
                             analysis-4-2-19-updated.opt)
                                  Units in ft & kips
Remarks:
          Static Analysis for Time: 1537 Jan 09 2019 (initialised at 1537 Jan 09 2019)
                       Water Level:  16.00 above Datum (initialised at this water level)
                             Draft:  26.20 (initialised at this draft))
                              Trim:   0.00 (initialised at this trim)
                  Bottom Clearance:  55.4
       Fwd Offset of Vessel Target: -18.0 from Berth Target
                Vessel Port Target:  48.0 above Pier
                        Wind Speed:    40 knots
               Wind Direction from:   All°

         Total End-on Windage Area: 25176
           Total Side Windage Area:163344

                           Longitudinal  Transverse  Yaw Moment/LBP

        Movement of Vessel   0.49 (fwd)    2.36 (inw)   0.2° (port)   0.00 (up)
        at its Port Target  -0.33 (aft)   -0.64 (out)  -0.1° (stbd)   0.00 (up)
 ________________________________________________________________________
   Line to    Pull  Tot.Line  In-Line  Winch    Worst Direction    Line    Percent
   Bollard    -in    Length   ±Motion   Slip   to Screen  True    Tension  Strength
   1-A        0.68   194.4                      -130°     275°     50.6      15%
   2-B        0.59   112.2                      -130°     275°     90.0      27%
   3-A        0.74   213.3                      -130°     275°     49.3      15%
   4-B        0.53    89.0                      -130°     275°    105.0      32%
   5-A        0.74   217.2                      -130°     275°     48.9      15%
   6-B        0.52    85.8                      -130°     275°    106.6      32%
   8-C        0.35    75.2                      -120°     285°     91.2      28%
  10-C        0.35    69.3                      -120°     285°     99.3      30%
  12-D        0.53   230.1                      -110°     295°     30.2       9%
  14-E        0.64   304.4                        20°      65°     25.8       8%
  15-O        0.58   127.3                       -50°     355°    118.1      36%
  16-O        0.55   116.3                       -50°     355°    122.8      37%
  18-O        0.48   128.0                       -50°     355°     83.7      26%
  22-M        0.48   106.7                       -60°     345°    110.5      34%
  24-M        0.48    95.6                       -60°     345°    132.1      40%
  26-M        0.49    96.9                       -60°     345°    132.4      40%
  28-L        0.47   187.6                       160°     205°     38.8      12%
  30-L        0.46   185.5                       -60°     345°     39.0      12%
  31-O        0.48   132.8                       -50°     355°     78.5      24%
  33-A        0.32   186.9              0.6     -130°     275°      1.0       0%
  34-B        0.38    97.4                      -130°     275°     80.4      25%
 ________________________________________________________________________
        Fender   Thrust  Compression  Pressure  Flatside Cover
          dd       110     1.61       10.0          0%
          ee       151     2.07        6.9        100%
          ff       140     1.95        6.4        100%
          gg        95     1.85        2.1        100%
          hh        92     1.79        2.1        100%
          ii       124     2.32        2.8        100%
          jj       134     2.48        3.0        100%
          kk       149     2.71        3.4        100%
          ll       160     2.87        3.6        100%
          pp       103     1.98        2.3        100%
          qq       113     2.14        2.5        100%
```

```
  Hook/      X-     Y-    Other  Other   Total %Bollard Direction Bollard
 Bollard   Force  Force  X-Load Y-Load   Force Strength  in Plan  Uplift
     A       82.8  124.4                   149.8    37%      34°      9.6
     B      119.1    357                     381    95%      18°     59.5
     C     -152.7  102.8                   190.4    95%     -56°     48.5
     D      -29.5    5.8                    30.2    15%     -79°      3.0
     E      -25.6    3.0                    25.8    13%     -83°      1.6
     F
     G
     H
     I
     J
     L       70.9   23.2                    77.5    19%      73°     22.1
     M      159.2  283.7                     374    93%      29°    184.8
     O     -228.2  294.9                     394    98%     -38°    128.5

                  Approximate natural periods
             Surge: 35    Sway: 32    Roll: 29 secs
```

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Appendix D – Preliminary Geotechnical Recommendations for Skagway Ore Peninsula Dock and Transfer Bridge Skagway, Alaska prepared by Hart Crowser

HART CROWSER
A division of Haley & Aldrich

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MEMORANDUM

STATE OF ALASKA
49TH
GARRY E. HORVITZ
No. AELC5528
REGISTERED PROFESSIONAL ENGINEER
3/8/2022

8 March 2022
File No. 203404-000

TO:	KPFF Consulting Engineers Bob Riley, P.E., S.E., and Ed Debroeck, P.E.
FROM:	Hart Crowser, a division of Haley & Aldrich Garry Horvitz, P.E., L.E.G., Brice Exley, P.E., and Jeff Bruce, P.E.
Subject:	Preliminary Geotechnical Recommendations for Skagway Ore Peninsula Dock and Transfer Bridge Skagway, Alaska

This memorandum presents a summary of Hart Crowser's, a division of Haley & Aldrich (Hart Crowser's), geotechnical recommendations associated with the alternatives analysis of the Ore Peninsula Dock and Transfer Bridge, in Skagway, Alaska. The recommendations are based on the project development information presented in the Port of Skagway's Request for Proposal, information provided by KPFF Consulting Engineers (KPFF), as well as our previous exploration, testing, and analytical work completed for the Municipality under contract to KPFF. We completed this work in accordance with generally accepted geotechnical engineering practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. We make no other warranty, express or implied.

Project Understanding

This work is intended to assist KPFF in the geotechnical aspects of the alternatives assessment for the Port of Skagway Ore Peninsula Dock and adjacent waterfront structures. We understand that the proposed construction for the current assessment includes a new Roll-on/Roll-off (Ro-Ro) dock and associated ramp near the north end of the peninsula, as well as a new shared-use T-shaped ore dock (T-dock) near the south end of the peninsula. The T-dock will be designed as either a concrete or steel dock bearing on open ended steel pipe piles. Both alternatives will require dredging to allow for proper berthing of the proposed cruise ships.

The location of the site and historical soil explorations are shown on Figure 1. Historical soil exploration logs are in Attachment 1 and the results of historical geotechnical laboratory testing are in Attachment 2. The elevation datum used throughout this report is the mean lower low water datum (MLLW), unless otherwise noted.

SOIL CONDITIONS

Our understanding of the subsurface conditions in the Municipality of Skagway is based on ten historical mud rotary borings performed by Hart Crowser; on results of both historical laboratory tests of soil samples, and geophysical testing on the peninsula adjacent to the proposed ore dock improvements. Figure 1 shows the location of historical explorations. Details of the conditions found at the boring locations are shown on the logs in Attachment 1 and lab results in Attachment 2. The results of geophysical testing are shared in Attachment 3.

Our understanding of the subsurface soil conditions is based on explorations at discrete locations at the site. Soil properties inferred from the field and laboratory tests formed the basis for developing the geotechnical recommendations contained in this memorandum. Soil conditions may vary in the areas between the explorations, and the nature and extent of the variations may not be evident until construction. If variations appear, it may be necessary to reevaluate the recommendations in this memorandum.

The soil conditions can be generalized as follows:

- the ore terminal peninsula contains fill material for consisting of sandy gravel to gravelly sand; and
- the harbor contains native material consisting of gravelly sand to sandy gravel with discrete layers of silt and sandy silt.

Surficial geologic maps of the area identify the soils in the harbor as beach and alluvial fan deposits, which is consistent with our observations. These materials are typically considered young (Holocene age) deposits, which tend to be susceptible to liquefaction.

GROUNDWATER

Groundwater at the site is influenced by tidal fluctuations in Taiya Inlet. We did not observe the groundwater table in the upland soil borings because of the drilling method that was used, though inferences are usually made during drilling to the level of the groundwater table. At the time of this memorandum, we have assumed the groundwater level within the peninsula to be influenced by the tide cycle of the adjacent Chilkoot Inlet. Regarding a design groundwater elevation our analyses assumed the following:

- Global stability and lateral earth pressure analyses assumed a tidal lag based on mean high water (MHW) within the peninsula and mean sea level (MSL) in the Inlet.
- Liquefaction and lateral spreading analysis assumed a groundwater elevation within the peninsula equal to the average of MSL and MHW.

SEISMIC SETTING

The site is in a seismically active area. Southeastern Alaska has several major faults, including the Queen Charlotte, Fairweather, and Chatham Strait Faults. The eastern ends of the Denali and Transition Faults are within the region as well. Minor faults in the region include the Clarence Strait and the Peril Strait Faults.

The major faults in general are a result of the Pacific Plate boundary interacting with the North American Plate. The Queen Charlotte and Fairweather Faults are right lateral strike-slip faults and are similar in function to the San Andreas Fault. These faults have produced several earthquakes in excess of magnitude 7 since 1900, including the Lituya Bay earthquake. Few earthquakes are directly related to the large Chatham Strait Fault, although a moderately sized earthquake occurred nearby in 1987. The Chatham Strait Fault is the closest major fault to Skagway and runs along the Taiya Inlet. The Denali and Transition Faults are northwest of Skagway. The Transition Fault likely intersects with the Queen Charlotte-Fairweather Fault system, while the Denali Fault likely intersects the Chatham Strait Fault (Alaska Earthquake Center 2015 and 2018).

The U.S. Geological Survey (USGS) deaggregation tool (USGS 2008a) identifies shallow random earthquakes with magnitudes between 5 and 7.3 as the primary sources of peak ground acceleration (PGA), with an average distance from Skagway of approximately 7 miles. The Denali Fault contributes approximately 18 percent of the hazard from a distance of about 20 miles from Skagway, with a mean magnitude of approximately 7.9. As the period of interest increases up to 1.0 second, the Transition and Denali Faults contribute a higher portion of the seismic hazard, at a larger average distance, with each producing mean magnitudes of approximately 7.8 and 8.2, respectively.

There has not been an earthquake comparable to the risk-targeted maximum considered earthquake (MCE_R) design-level earthquake within a 50-mile radius of Skagway in the last 100 years (COSMOS Virtual Data Center). Recent regional earthquakes have been either too small or too far away to cause significant damage or liquefaction in Skagway.

SEISMIC BASIS OF DESIGN

We developed design response spectra at the ground surface using simplified code-based methods. We referred to the 2018 International Building Code (IBC) and to American Society of Civil Engineers (ASCE) 61-14, Seismic Design of Piers and Wharves, as appropriate.

The basis of design for the 2018 IBC is two-thirds of the hazard associated with the MCE_R. The MCE_R has a 2 percent probability of exceedance in 50 years, which corresponds with a return period of 2,475 years.

DESIGN RESPONSE SPECTRA AND PGA

We determined the site class in accordance with the 2018 IBC, based on standard penetration test (SPT) data collected from our explorations at the project site. The site contains liquefiable soil, which requires a classification of Site Class F. Neglecting liquefaction susceptibility, the site would be categorized as a Site

Class D site. The code requires a site-specific analysis for Site Class F if the period of the structure is greater than 0.5 second.

We obtained the seismic hazard parameters from the ASCE 7-16 Seismic Design Web Service for the site location at latitude 59.450 and longitude –135.326. Code-based design response spectra and seismic design parameters for the MCE_R are provided in Table 1fort. Table 1 shows spectral accelerations at periods of 0.2 and 1 second (S_S and S_1, respectively) for the MCE_R, with the seismic coefficients for adjustment to the MCE. These spectral accelerations, along with the site classification, may be used to develop a code-based response spectrum.

Table 1
ASCE 7-16 Seismic Design Parameters

Parameter	Value
Latitude	59.450
Longitude	–135.326
Site class	D
Risk category	I, II, III
Spectral response acceleration at short periods, S_S	0.781 g
Spectral response acceleration at 1-second periods, S_1	0.384 g
Mapped MCE geometric mean peak ground acceleration, PGA	0.314 g
Seismic coefficient, F_a	1.188
Seismic coefficient, F_v	1.633
Seismic coefficient, F_{PGA}	1.286

LIQUEFACTION POTENTIAL

Liquefaction is caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles, resulting in the sudden loss of shear strength in the soil. Granular soils that rely on interparticle friction for strength are susceptible to liquefaction until the excess pore pressures can dissipate. Sand boils and flows at the ground surface after an earthquake result from excess pore pressure dissipating upward, carrying soil particles with the draining water. In general, loose, saturated sandy soils with low silt and clay contents are the most susceptible to liquefaction. Silty soils with low plasticity are moderately susceptible to liquefaction under relatively higher levels of ground shaking. For any soil type, the soil must be saturated for liquefaction to occur.

We used empirical methods to estimate liquefaction potential using the SPT data obtained at the site. Procedures after Idriss and Boulanger (2008) incorporating the SPT data were used for the liquefaction analysis. For the MCE hazard level, we used an earthquake magnitude of 6.6 and a PGA 0.404 g in our analysis. These values are derived from the 2007 USGS mapped values of Alaska for the MCE event. These accelerations correspond to Site Class D, as appropriate for this site under non-liquefied conditions. According to our analysis, the site is intermittently susceptible to liquefaction in soil units below the groundwater table in some areas. While the entire project area holds liquefaction potential, in general, it appears the southern portion of the site is the most susceptible.

To further assess the impact of gravels on the liquefaction estimates, we contracted a geophysical testing service to perform Refraction Micrometer (ReMi) and Multichannel Analysis of Surface Waves (MASW) surveys. These surveys provided shear wave data that we used to better estimate both the stiffness and liquefaction susceptibility of the native soils. We used methods for the liquefaction analysis detailed by Andrus and Stokoe (2004) for the MCE event, as described above. Per this updated analysis, the peninsula fill soils are liquefiable beneath the groundwater table. The underlying native sands and gravels displayed marginal liquefaction susceptibility based on SPT blow counts but did not show liquefaction susceptibility based on shear wave data. We consider this unit to generally be not susceptible to post-seismic residual strength loss for post-seismic slope stability.

SEISMICALLY INDUCED SLOPE DEFORMATIONS

If sloping ground or soil near a slope liquefies, large lateral deformations of the soil, called lateral spreading, can occur. Additionally, strong inertial shaking of slope material can result in failure and, thus, movement of the slope soils. The seismic hazard and liquefaction susceptibility for the soils within the peninsula make both seismically induced slope failure and liquefaction induced lateral spreading potential hazards at the site. The slope stability section of this memorandum addresses our analysis on conclusions regarding these topics.

Geotechnical Engineering Conclusions and Recommendations

This section presents our preliminary conclusions and recommendations for the geotechnical aspects of design and construction on the project site. We developed our recommendations based on our current understanding of the project and the subsurface conditions encountered by our explorations. If the nature or location of the development is different than we assumed, we should be notified so we can change or confirm our recommendations.

VERTICAL PILE CAPACITY

Vertical compressive loads can be resisted by friction along the pile sides and by end bearing at the tip. Because we did not encounter a consistent very dense bearing layer, required pile lengths can only be approximated based on field boring logs at discrete locations. Actual pile lengths needed will depend on driving resistance and other factors, and may need to be adjusted in the field after test piles are installed.

Considering the soil conditions at the project site, we determined pile capacities using effective stress analysis methods. We used the software, APILE, to model the vertical resistance of 24-, 30-, 36-, 42- and 48-inch open-ended pipe piles, basing the subsurface profile on the results of boring G02 and G01. We used existing pile installation logs to calibrate these recommendations using the Danish pile driving formula. The approximate location of these existing piles is shown on Figure 1. We used a compressive factor of safety of 2.0 for static conditions. To use a factor of safety of 2.0, the capacities must be verified in the field by a load test, as defined by the IBC, which allows Pile Driving Analyzer (PDA)/Case Pile Wave

Analysis Program (CAPWAP) to be the load test method. For open-ended piles, plugging was assumed to occur. If open-ended pipe piles are used and tip resistance is critical, a load test such as Statnamic loading may be recommended as part of final design, if axial capacity becomes the critical factor. This test is recommended to reduce the risk of dislodging the soil plug during testing.

The estimated resistance profiles are in Figures 2 and 3. These resistance charts apply to offshore RoRo Dock and Float Guide piles only.

POST-LIQUEFACTION DOWNDRAG

During and after liquefaction, as pore water pressures dissipate, liquefied soil and overlying non-liquefied soil will settle relative to piles tipped into the bearing layer. The pile capacity recommendations, above, do not include the effects of downdrag loads. Our liquefaction analysis indicated the presence of a non-liquefiable crust from the ground surface underlain by a liquefiable layer from elevation 9 feet to elevation –9 feet. The geometry of these layers vary as the slope descends away from the shoreline. As a result, the downdrag loads will vary based on the pile location, relative to the shoreline. Table 2, below, presents our recommendations for downdrag load presented as a function of distance from the crest of the slope adjacent to the shoreline and pile diameter. We present these values as preliminary recommendations based on historical analysis and are subject to change based on the final design direction.

Table 2
Downdrag Load Equations

Approximate Distance from Crest of Slope in Feet	Downdrag Load in ksf
0 to 60	0.53*π*(60-x)*D+10.8* π*D
60 to 125	0.27*(125-x)* π*D

Where:

D = Pile diameter in feet,
x = Distance from crest of slope towards the water in feet.

LATERAL PILE RESISTANCE AND LOADING

Lateral resistance and deflections of vertical pile foundations are often governed by the lateral capacity of near-surface soils and the strength of the pile itself. The design lateral capacity of the vertical piles will depend, to a large extent, on the allowable lateral deflections of the piles. However, if the ground is not improved, under severe seismic loading, the piles will have minimal lateral resistance in the zone of liquefaction. Input parameters for lateral pile analysis in the program LPILE are provided in Table 3. These input parameters are for piles spaced farther apart than 8B, where *B* is the pile diameter.

Table 3
LPILE Input Parameters

Soil Type	Soil Model	Elevation Range (ft)	Effective Unit Weight (pcf)	Friction Angle (degrees)	P-Y Modulus (pci)	Liquefied P-Multiplier
Sandy gravel to gravelly sand (above water table)	API Sand	30 to 9	65	35	132	1
Sandy gravel to gravelly sand (below water table)	API Sand	9 to –9	65	35	80	0.1
Gravelly sand/silty sand	API Sand	Below –9	65	36	93	See Note

Notes:

1) *Seismic conditions not incorporated*
2) *pcf = pounds per cubic foot*
3) *Check sensitivity to varying from 0.3 to 1.0*

SLOPE STABILITY

The proposed project area sits along the east edge and north end of the peninsula, where an approximately 3H:1V slope extends down from the crest of the peninsula to about elevation –40 feet. Slide 9.020, a slope stability analysis computer program, was used to model and calculate the factors of safety for the static case and pseudostatic cases for the MCE event. Minimum factors of safety were chosen for each case based on published standards from ASCE 61-14. Table 4 below presents the minimum factors of safety used as the basis of our analysis.

Table 4
Minimum Required Factors for Slope Stability

Static	Pseudostatic Non-Liquefied
1.5	1.1

To model the inertial effects on the slope due to seismic shaking, a horizontal pseudostatic acceleration was applied to the model. This horizontal acceleration coefficient, K_h, was calculated from the PGA produced by the 2007 USGS design mapped values of Alaska. K_h includes a reduction factor of 0.5, allowing for 1 to 2 inches of permanent deformation, and a factor, α, to account for wave scattering for slopes greater than 20 feet tall following the simplified method from NCHRP 611. We calculated a pseudo-static horizontal acceleration coefficient of 0.202g.

We analyzed the stability of the slope using non-circular search methods following the Spencer and Morgenstern-Price search methods. We ignored shallow surficial failures of the slope material when estimating the critical factor of safety. Table 5, below, presents the minimum calculated factors of safety for the five loading cases analyzed.

Table 5
Estimated Factors of Safety without Ground Improvement

Case	Factor of Safety
Static: No Ground Improvement	1.7
Post Seismic: Liquefied	1.0
Pseudostatic: Non-Liquefied, No Ground Improvement	1.0

The results show that the slope meets the minimum required factors of safety for the static scenario. However, the slope does not meet the minimum required factors of safety under pseudostatic loading of the design event or under post-seismic liquefied strengths. To reduce the risk of significant slope failure in the seismic scenarios, ground improvement may be employed. We evaluated the stability of a conceptual 30-foot-wide by 30-foot-deep block of ground improvement with a preliminary area replacement ratio of 40 percent. Table 6 below presents the results of these updated models.

Table 6
Estimated Factors of Safety with Ground Improvement

Case	Factor of Safety
Post Seismic: Liquefied, With Ground Improvement	1.4
Pseudostatic: Non-Liquefied, With Ground Improvement	1.1

The results estimate that the modeled ground improvement geometry and area replacement ratio results in the minimum factors of safety being met for both seismic scenarios.

The attached Figures 4 through 8, show slope stability model output for the five cases analyzed.

Lateral Earth Pressure Recommendations

We understand a sheet pile wall is being considered along the peninsula, to retain new backfill acting to extend the working width of the peninsula area. Based on borings G02 and G06, we anticipate the wall to retain fill predominately composed of medium dense to very dense sandy gravel to gravely sand, and native material consisting of lose to very dense gravely sand to sandy gravel. To assist in design of the new retaining wall to retain these soils, we present lateral earth pressure recommendations in Figures 9 through 11. These figures present lateral earth pressure recommendations for the following scenarios:

- static and pseudostatic lateral earth pressures without ground improvement;
- static and pseudostatic lateral earth pressures with ground improvement; and
- liquefied lateral earth pressures without ground improvement.

For final design we recommend placement of 18 inches of free-draining, well-graded sand and gravel (less than 3 percent fines based on 3/4-inch fraction) against backfilled walls to prevent excessive build-up of hydrostatic pressures. However, the lateral earth pressures recommended above do include consideration for a tidal lag in the between the retained backfill material and the adjacent Inlet water elevation.

Attachments:

- Figure 1 - Site and Exploration Plan
- Figure 2 - Allowable Vertical Resistance for Offshore Steel Pipe Piles
- Figure 3 - Nominal Unit Skin Friction for Offshore Steel Pipe Piles
- Figure 4 - Static: No Ground Improvement
- Figure 5 - Post-Seismic, Liquefied: No Ground Improvement
- Figure 6 - Pseudostatic, Non-Liquefied: No Ground Improvement
- Figure 7 - Post-Seismic, Liquefied: With Ground Improvement
- Figure 8 - Pseudostatic, Non-Liquefied: With Ground Improvement
- Figure 9 - Static and Pseudostatic Lateral Earth Pressure No Ground Improvement
- Figure 10 - Static and Pseudostatic Lateral Earth Pressure with Ground Improvement
- Figure 11 - Liquified Lateral Earth Pressure No Ground Improvement

- Attachment 1 - Historic Borings
- Attachment 2 - Historic Lab Data
- Attachment 3 - Geophysical Data

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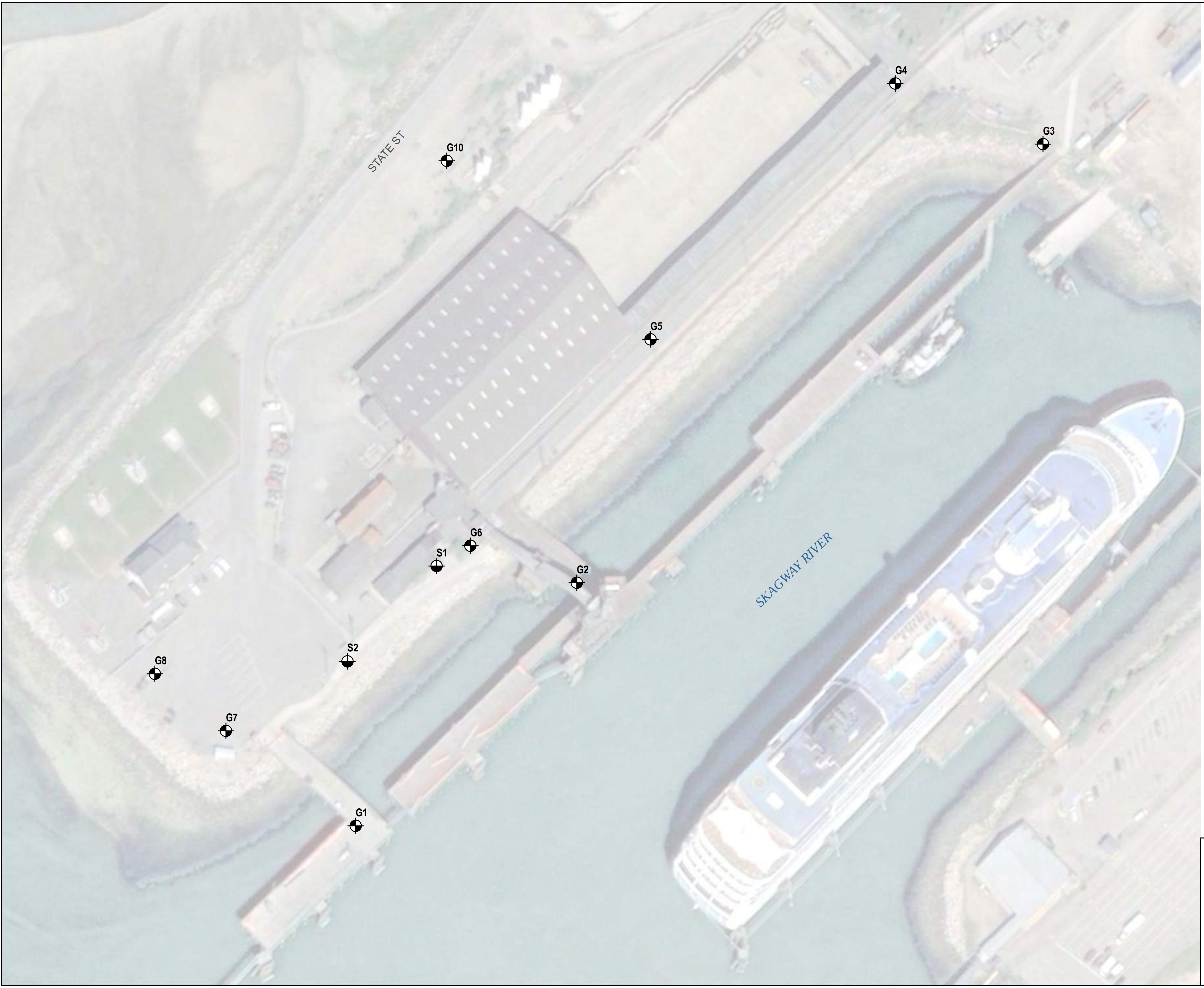


LEGEND

⊕ GEOPHYSICAL EXPLORATION

⊕ SURFACE EXPLORATION, HART CROWSER

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

2. AERIAL IMAGERY SOURCE: ESRI

N

0 120 240
SCALE IN FEET

HARTCROWSER
A division of Haley & Aldrich

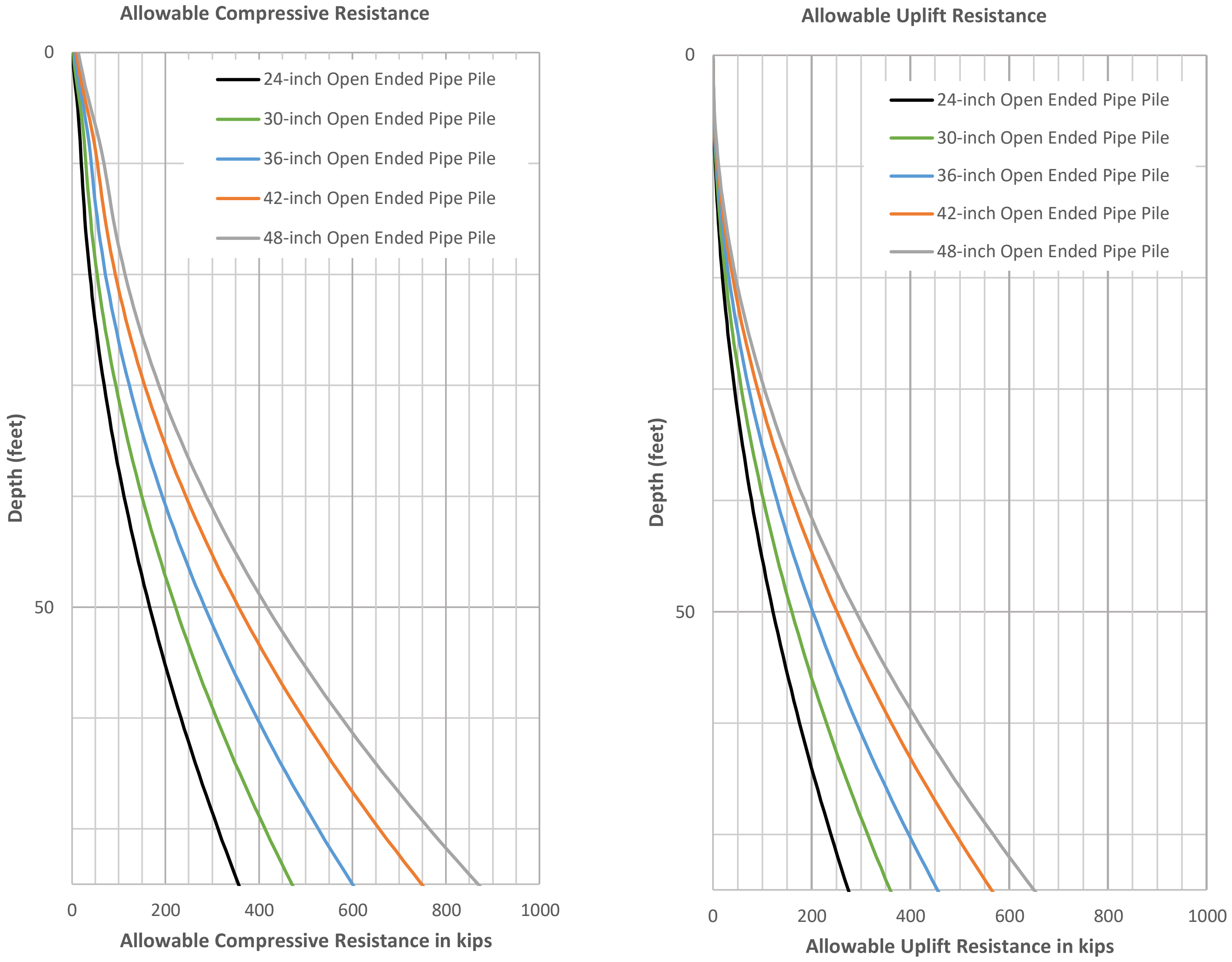
SKAGWAY ORE DOCK IMPROVEMENTS
SKAGWAY, ALASKA

SITE AND EXPLORATION PLAN

MARCH 2022

FIGURE 1

GIS: \\haleyaldrich.com\share\sea_projects\Notebooks\P203404-000_Port_of_Skagway_Ore_Dock\GIS\Maps\2022_03\203404_000_0001_SITE_AND_EXPLORATION_PLAN.mxd - mschweitzer - 3/7/2022 10:53:51 AM



Notes:

1) Allowable resistance is the sum of the allowable skin friction and end bearing. The allowable resistance was obtained by applying a factor of safety of 2.0 for compression and 2.0 for uplift.

2) Allowable resistances should assume a plug is formed. Verification of toe resistance is dependent on field verification procedure. Neglect tip resistance by reducing the capacity by 50% if a static load test or similar is not performed.

3) Assumes soil conditions are consistent with those observed near shore at previous exploration locations.

4) No seismic resistances are shown.

Skagway Ore Dock Improvements
Skagway, Alaska

Allowable Vertical Resistance for Offshore Steel Pipe Piles

203404-000

Mar-22

HARTCROWSER

Figure
2

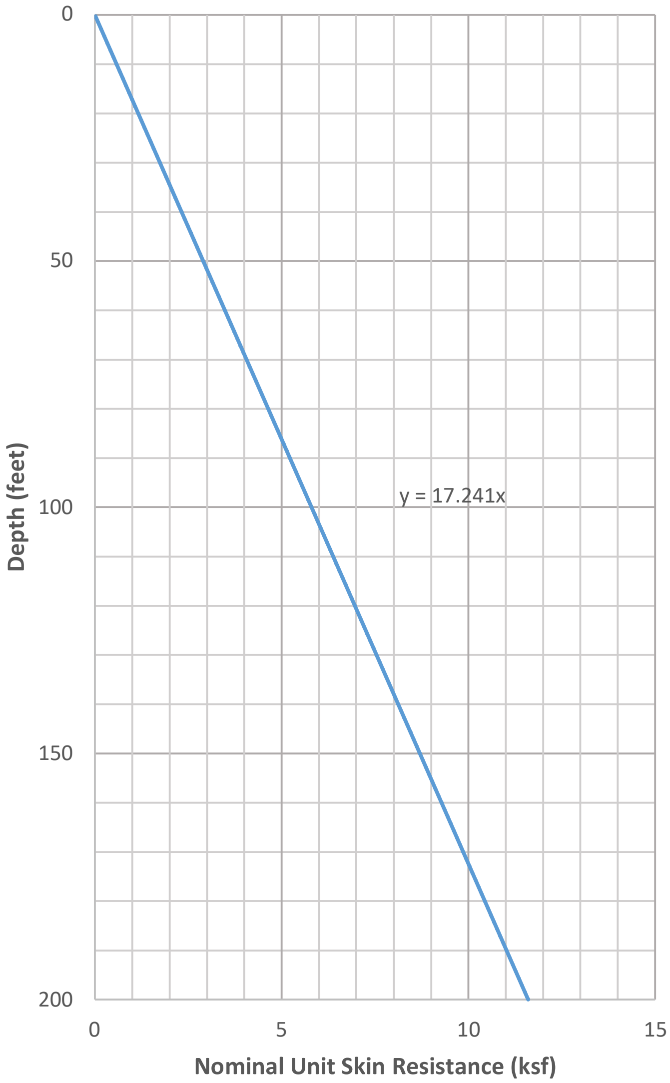
Skagway Ore Dock Improvements
Skagway, Alaska

Nominal Unit Skin Friction for Offshore Steel Pipe Piles

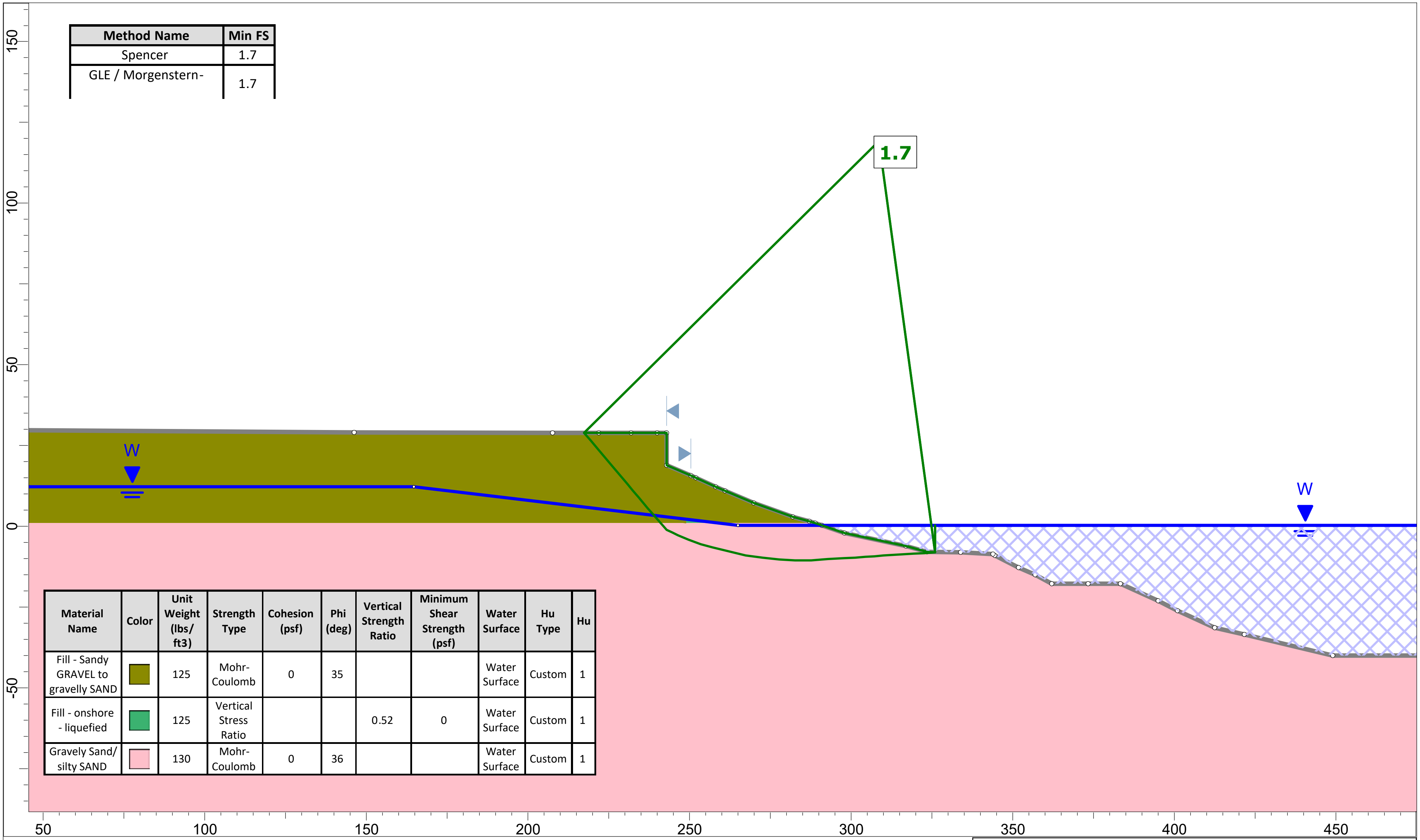
203404-000

Mar-22

Figure
3



Notes:
1) Resistances presented are nominal with no factor of safety applied.
2) Assumes soil conditions are consistent with those observed near shore at previous exploration locations.
3) No seismic resistances are shown.



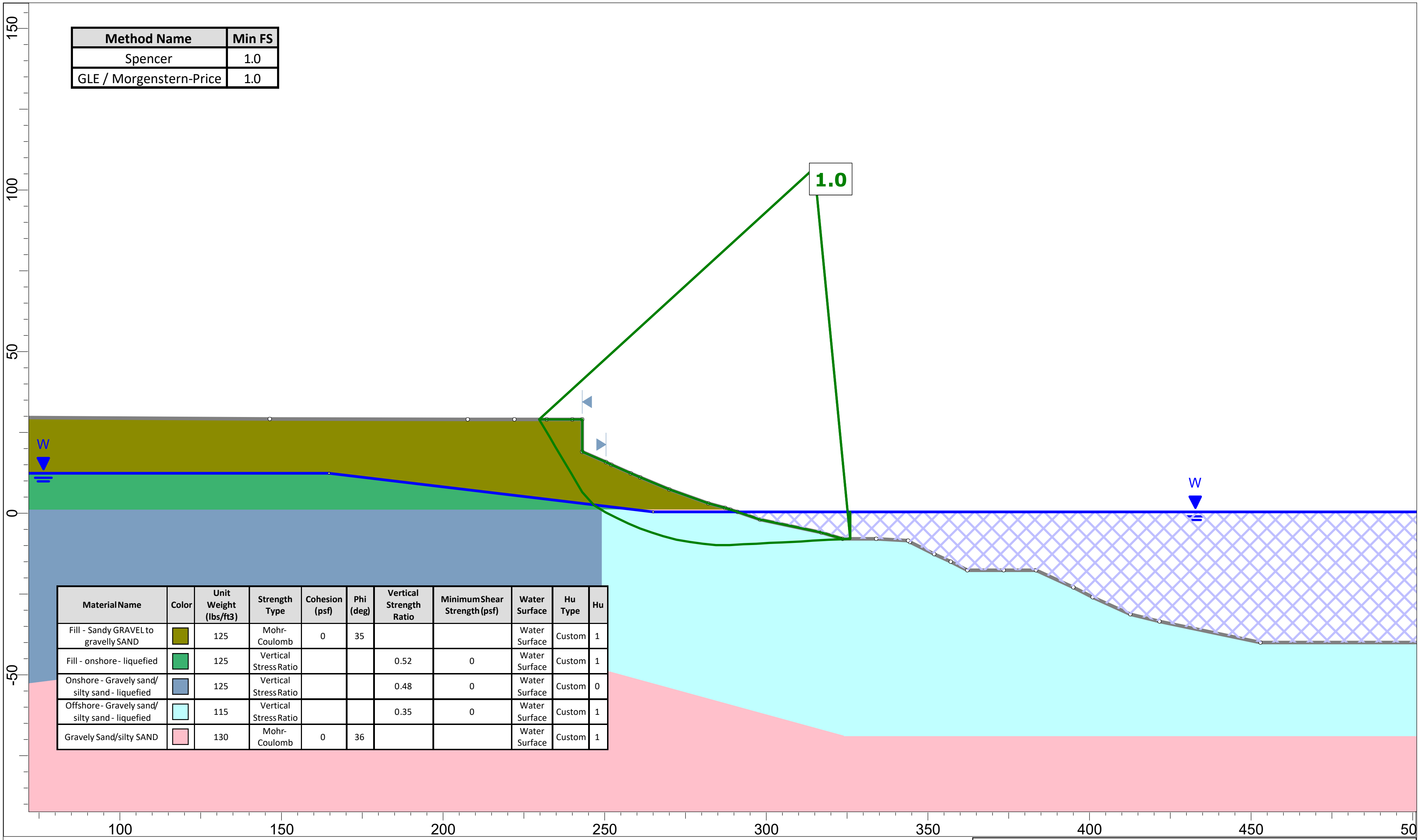
Method Name	Min FS
Spencer	1.7
GLE / Morgenstern-	1.7

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Fill - Sandy GRAVEL to gravelly SAND	🟫	125	Mohr-Coulomb	0	35			Water Surface	Custom	1
Fill - onshore - liquefied	🟩	125	Vertical Stress Ratio			0.52	0	Water Surface	Custom	1
Gravely Sand/ silty SAND	🟥	130	Mohr-Coulomb	0	36			Water Surface	Custom	1

Ore Peninsula Dock Alternatives Analysis
Skagway, Alaska

Static: No Ground Improvement

203404-000	Scale 1:500	3/1/2022
HARTCROWSER A division of Haley & Aldrich		Figure 4



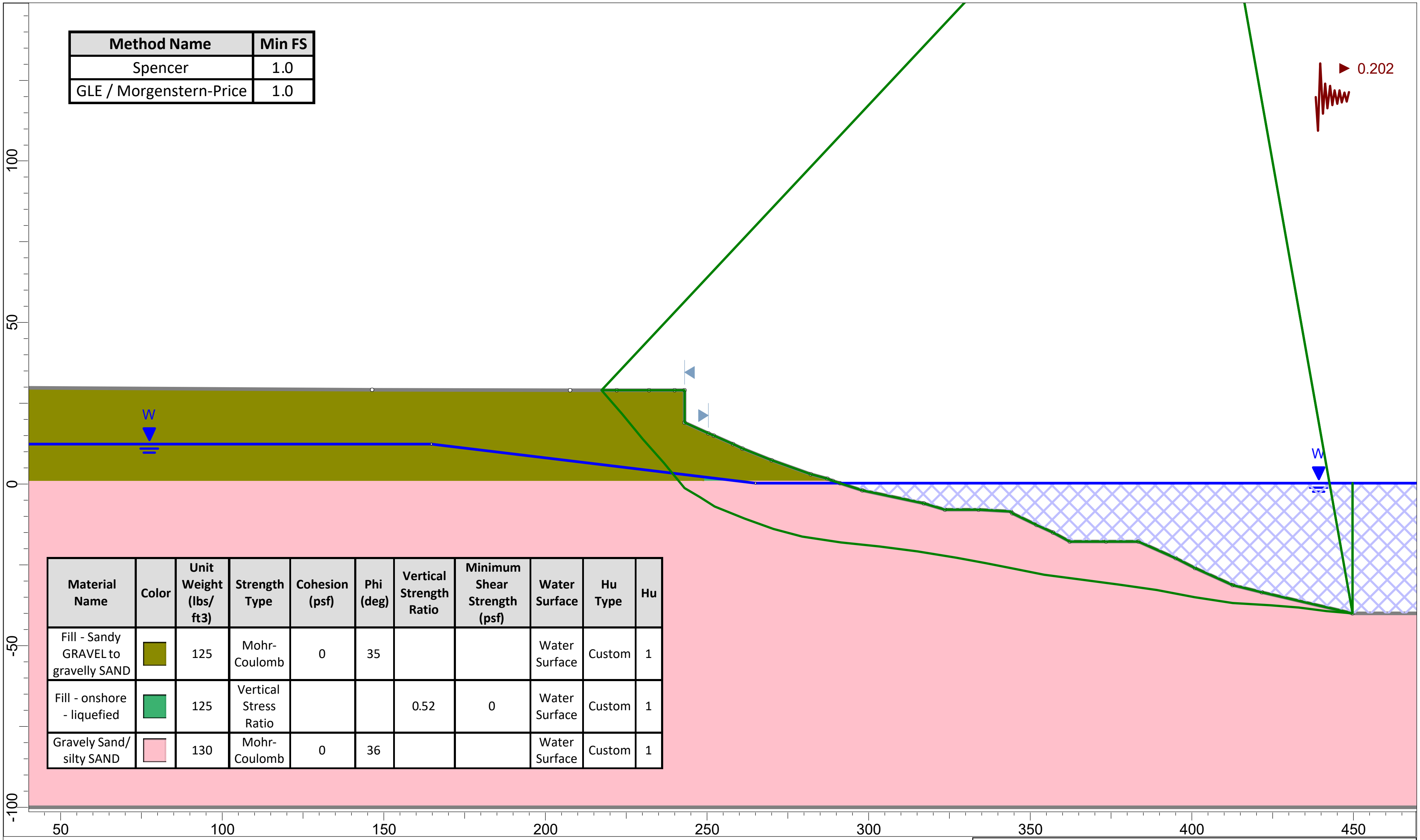
Method Name	Min FS
Spencer	1.0
GLE / Morgenstern-Price	1.0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Fill - Sandy GRAVEL to gravelly SAND	🟫	125	Mohr-Coulomb	0	35			Water Surface	Custom	1
Fill - onshore - liquefied	🟩	125	Vertical Stress Ratio			0.52	0	Water Surface	Custom	1
Onshore - Gravely sand/ silty sand - liquefied	🟦	125	Vertical Stress Ratio			0.48	0	Water Surface	Custom	0
Offshore - Gravely sand/ silty sand - liquefied	🟦	115	Vertical Stress Ratio			0.35	0	Water Surface	Custom	1
Gravely Sand/silty SAND	🟪	130	Mohr-Coulomb	0	36			Water Surface	Custom	1

Ore Peninsula Dock Alternatives Analysis
Skagway, Alaska

Post-Seismic, Liquefied: No Ground Improvement

203404-000	Scale 1:500	3/1/2022
HARTCROWSER A division of Haley & Aldrich		Figure 5



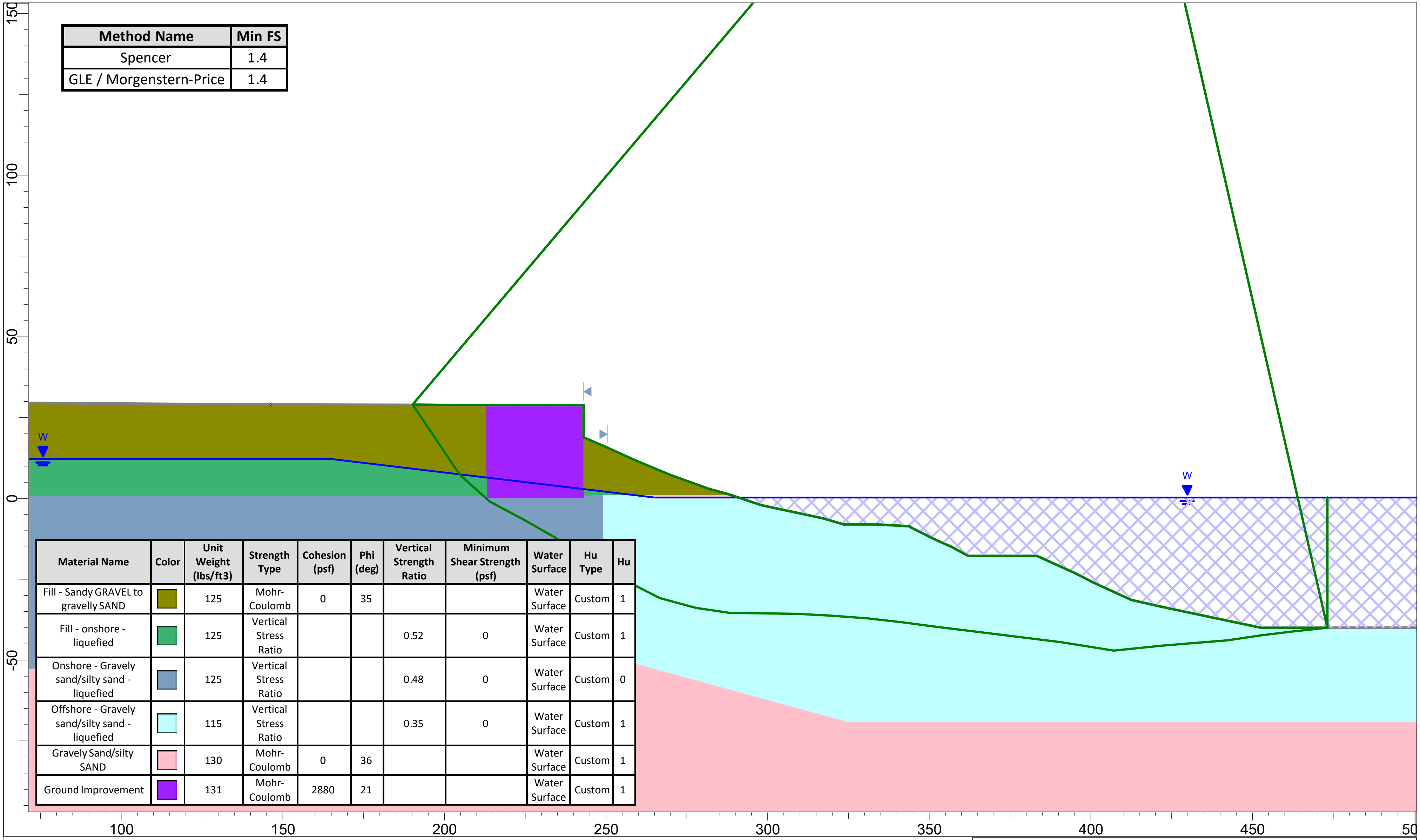
Method Name	Min FS
Spencer	1.0
GLE / Morgenstern-Price	1.0

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Fill - Sandy GRAVEL to gravelly SAND	🟫	125	Mohr-Coulomb	0	35			Water Surface	Custom	1
Fill - onshore - liquefied	🟩	125	Vertical Stress Ratio			0.52	0	Water Surface	Custom	1
Gravely Sand/ silty SAND	□	130	Mohr-Coulomb	0	36			Water Surface	Custom	1

Ore Peninsula Dock Alternatives Analysis
Skagway, Alaska

Pseudostatic, Non-Liquefied: No Ground Improvement

203404-000	Scale 1:500	3/1/2022
HARTCROWSER A division of Haley & Aldrich		Figure 6



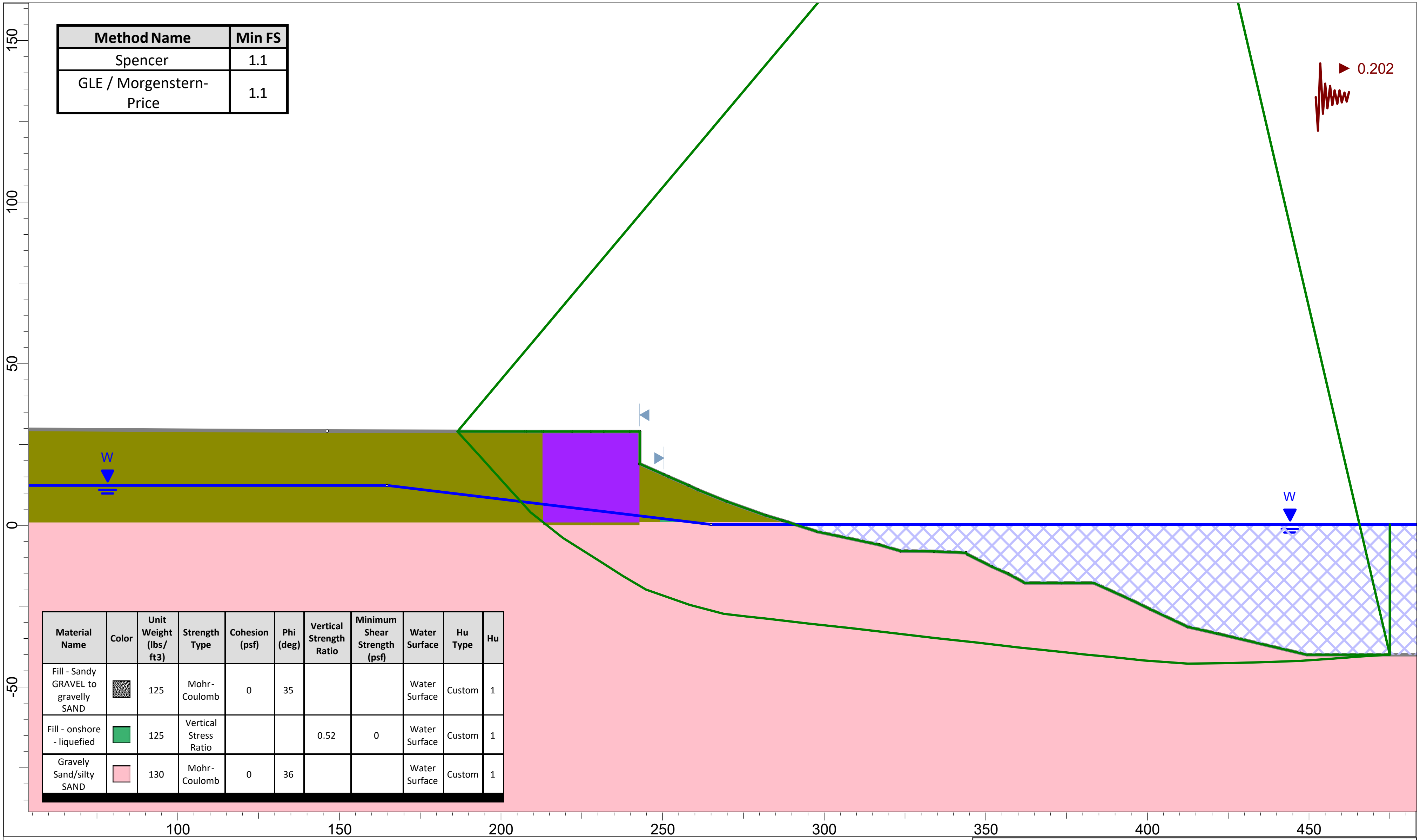
Method Name	Min FS
Spencer	1.4
GLE / Morgenstern-Price	1.4

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Fill - Sandy GRAVEL to gravelly SAND	🟫	125	Mohr-Coulomb	0	35			Water Surface	Custom	1
Fill - onshore - liquefied	🟩	125	Vertical Stress Ratio			0.52	0	Water Surface	Custom	1
Onshore - Gravely sand/silty sand - liquefied	🟦	125	Vertical Stress Ratio			0.48	0	Water Surface	Custom	0
Offshore - Gravely sand/silty sand - liquefied	⬜	115	Vertical Stress Ratio			0.35	0	Water Surface	Custom	1
Gravely Sand/silty SAND	🟥	130	Mohr-Coulomb	0	36			Water Surface	Custom	1
Ground Improvement	🟪	131	Mohr-Coulomb	2880	21			Water Surface	Custom	1

Ore Peninsula Dock Alternatives Analysis
Skagway, Alaska

Post-Seismic, Liquefied: With Ground Improvement

203404-000	Scale 1:500	3/1/2022
HARTCROWSER A division of Haley & Aldrich		Figure 7



Method Name	Min FS
Spencer	1.1
GLE / Morgenstern-Price	1.1

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Fill - Sandy GRAVEL to gravelly SAND	▨	125	Mohr-Coulomb	0	35			Water Surface	Custom	1
Fill - onshore - liquefied	🟩	125	Vertical Stress Ratio			0.52	0	Water Surface	Custom	1
Gravely Sand/silty SAND	🟥	130	Mohr-Coulomb	0	36			Water Surface	Custom	1

Ore Peninsula Dock Alternatives Analysis
Skagway, Alaska

Pseudostatic, Non-Liquefied: With Ground Improvement

203404-000
Scale 1:500
3/1/2022

HARTCROWSER
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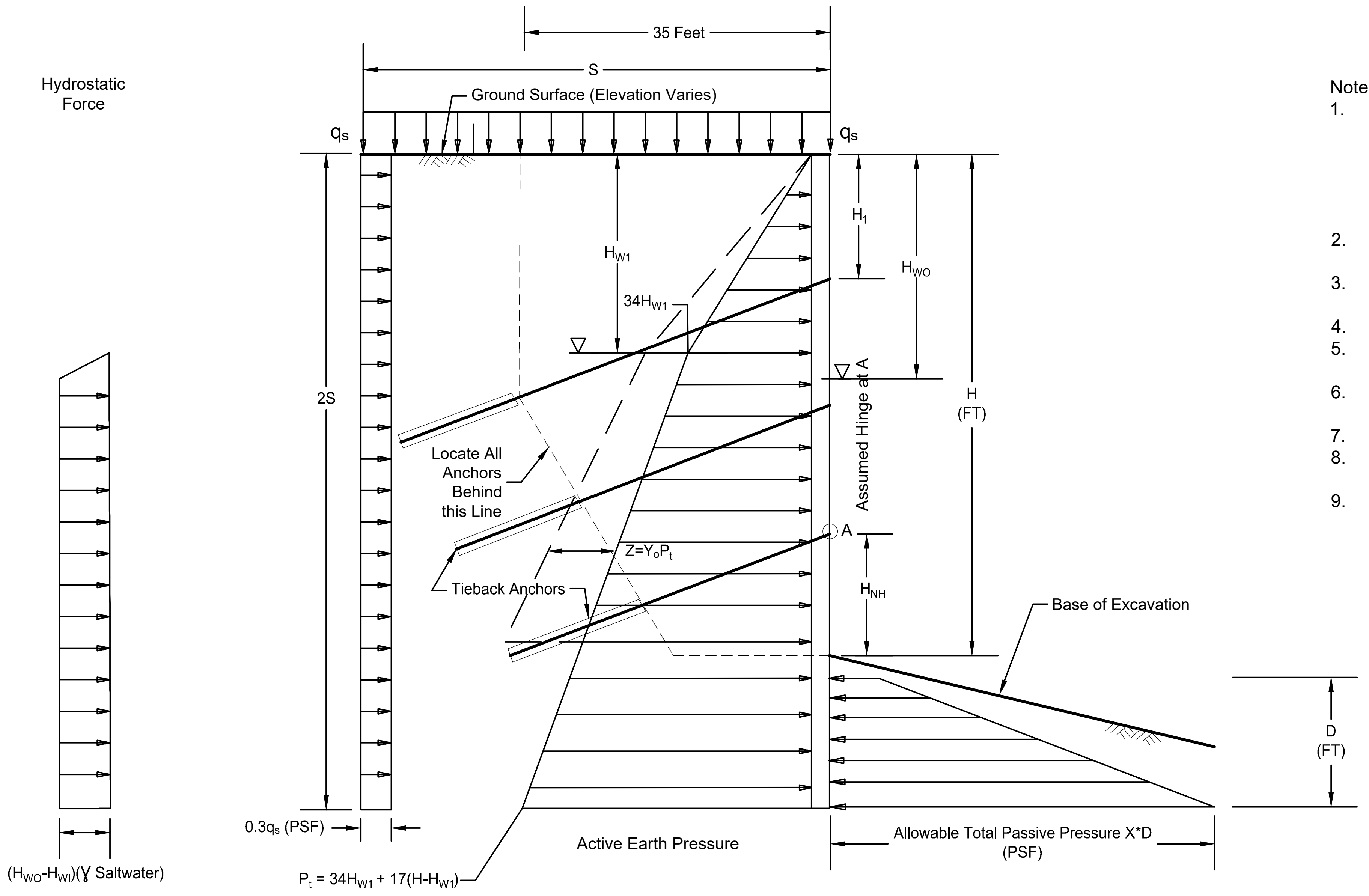
Figure
8

Static and Pseudostatic Lateral Earth Pressure for Sheetpile Retaining Structure and One Level of Ground Anchors
NO GROUND IMPROVEMENT



Notes:
1. Determine depth of embedment (D) by moment equilibrium of lateral soil pressures about point A. Neglect moment resistance of soldier pile member at point A. D must also be sufficient to provide necessary vertical capacity.
2. Active pressure assumed to act over sheet pile width.
3. Passive pressures include Factor of Safety of Passive about 1.5.
4. All dimensions in feet.
5. Do not use these design criteria for design of any other type of shoring wall.
6. See Figure 7 to evaluate additional surcharge pressures.
7. P is based on a total load of PxH^2.
8. Seismic passive pressure includes ~15% reduction.
9. Assume 15 ft. slough for liquefied condition.

Dynamic Inertial Increment $Z=Y_oP$	
Seismic Event	Y_o
IBC	0.29

Allowable Total Passive Pressure		
	Static	Seismic
X	75	60

q_s = 250 psf (Traffic and Temporary Loads) + Additional Surcharge Loads
H_{WO} = depth to tidal water level
H_{WI} = depth to retained groundwater table

Note: If sheetpile wall is designed to fully drain, there is no unbalanced hydrostatic force.

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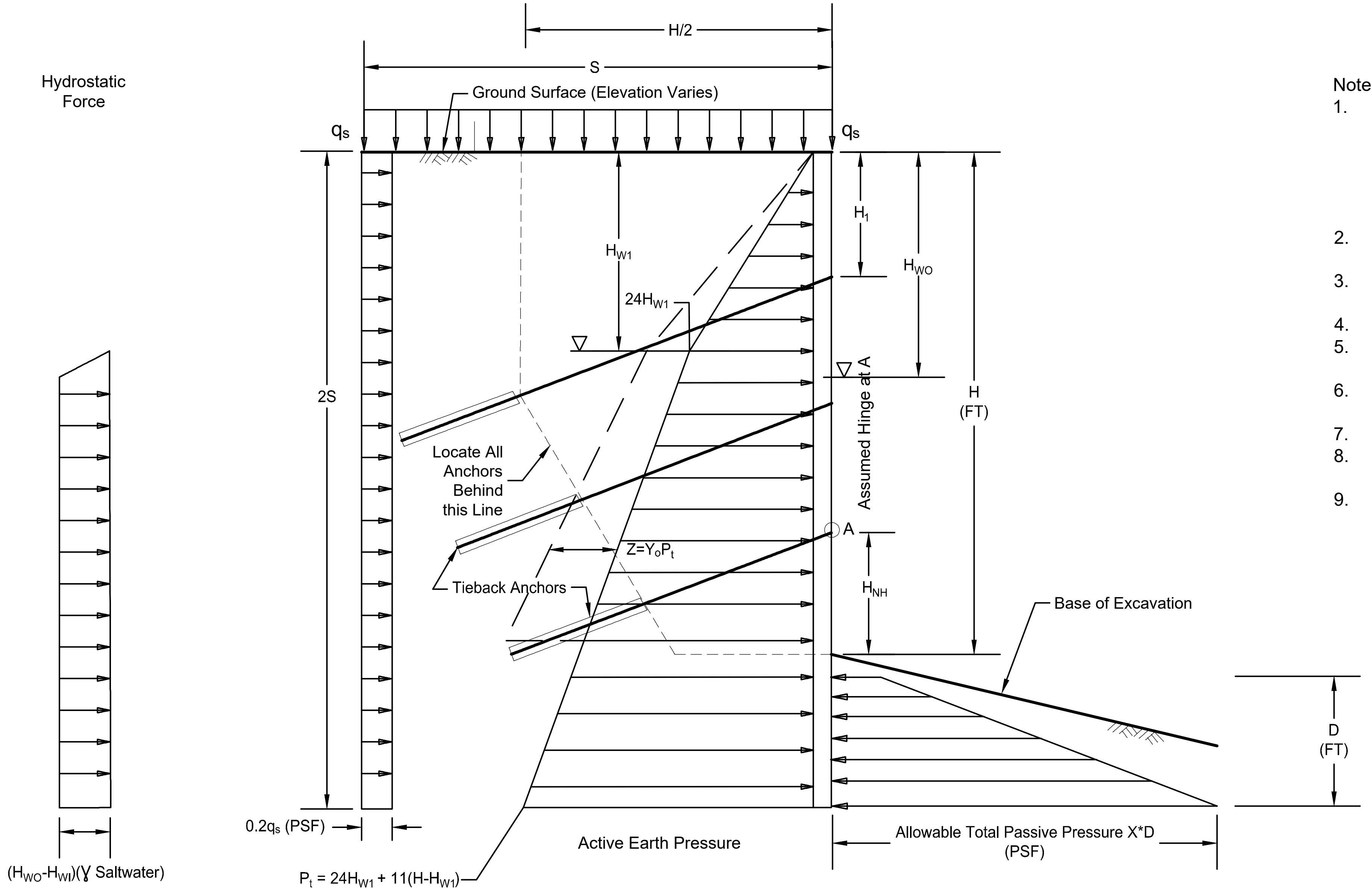
SKAGWAY ORE DOCK IMPROVEMENTS
SKAGWAY, ALASKA

STATIC AND PSEUDOSTATIC
LATERAL EARTH PRESSURE
NO GROUND IMPROVEMENT

NOT TO SCALE
MARCH 2022

FIGURE 9

Static and Pseudostatic Lateral Earth Pressure for Sheetpile Retaining Structure and One Level of Ground Anchors
WITH GROUND IMPROVEMENT



Notes:
1. Determine depth of embedment (D) by moment equilibrium of lateral soil pressures about point A. Neglect moment resistance of soldier pile member at point A. D must also be sufficient to provide necessary vertical capacity.
2. Active pressure assumed to act over sheet pile width.
3. Passive pressures include Factor of Safety of Passive about 1.5.
4. All dimensions in feet.
5. Do not use these design criteria for design of any other type of shoring wall.
6. See Figure 7 to evaluate additional surcharge pressures.
7. P is based on a total load of PxH^2.
8. Seismic passive pressure includes ~15% reduction.
9. Assume 15 ft. slough for liquefied condition.

Dynamic Inertial Increment $Z=Y_oP$	
Seismic Event	Y_o
IBC	0.37

Allowable Total Passive Pressure		
	Static	Seismic
X	75	60

q_s = 250 psf (Traffic and Temporary Loads) + Additional Surcharge Loads
H_{WO} = depth to tidal water level
H_{WI} = depth to retained groundwater table

Note: If sheetpile wall is designed to fully drain, there is no unbalanced hydrostatic force.

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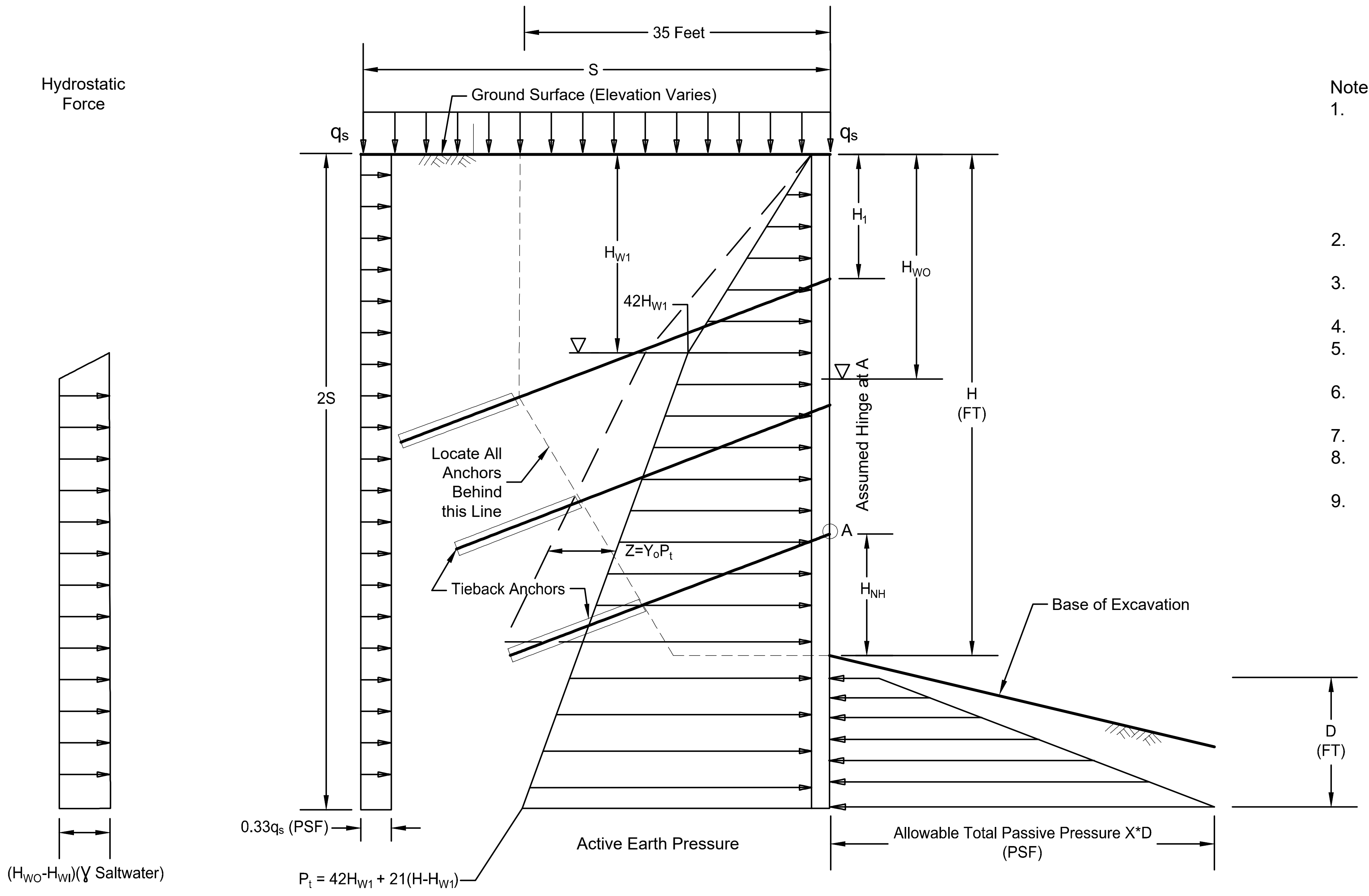
SKAGWAY ORE DOCK IMPROVEMENTS
SKAGWAY, ALASKA

STATIC AND PSEUDOSTATIC
LATERAL EARTH PRESSURE
WITH GROUND IMPROVEMENT

NOT TO SCALE
MARCH 2022

FIGURE 10

Liquified Lateral Earth Pressure for Sheetpile Retaining Structure and One Level of Ground Anchors
NO GROUND IMPROVEMENT



Notes:
1. Determine depth of embedment (D) by moment equilibrium of lateral soil pressures about point A. Neglect moment resistance of soldier pile member at point A. D must also be sufficient to provide necessary vertical capacity.
2. Active pressure assumed to act over sheet pile width.
3. Passive pressures include Factor of Safety of Passive about 1.5.
4. All dimensions in feet.
5. Do not use these design criteria for design of any other type of shoring wall.
6. See Figure 7 to evaluate additional surcharge pressures.
7. P is based on a total load of $P \times H^2$.
8. Seismic passive pressure includes ~15% reduction.
9. Assume 15 ft. slough for liquefied condition.

Dynamic Inertial Increment	$Z=Y_oP$
Seismic Event	Y_o

Allowable Total Passive Pressure	
	Liquified
X	37

q_s = 250 psf (Traffic and Temporary Loads) + Additional Surcharge Loads
H_{WO} = depth to tidal water level
H_{WI} = depth to retained groundwater table

Note: If sheetpile wall is designed to fully drain, there is no unbalanced hydrostatic force.

HARTCROWSER
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SKAGWAY ORE DOCK IMPROVEMENTS
SKAGWAY, ALASKA

LIQUIFIED LATERAL EARTH
PRESSURE
NO GROUND IMPROVEMENT

NOT TO SCALE
MARCH 2022

FIGURE 11

Saved by: MSCHWEITZER Printed: 3/4/2022 4:17 PM Sheet: LIQUIFIED_NO_GROUND
\\HALEYALDRICH.COM\SHARE\SEA_PROJECTS\NOTEBOOKS\P203404-000_PORT_OF_SKAGWAY_ORE_DOCK\CAD\203404_000_EPDIA.DWG

ATTACHMENT 1

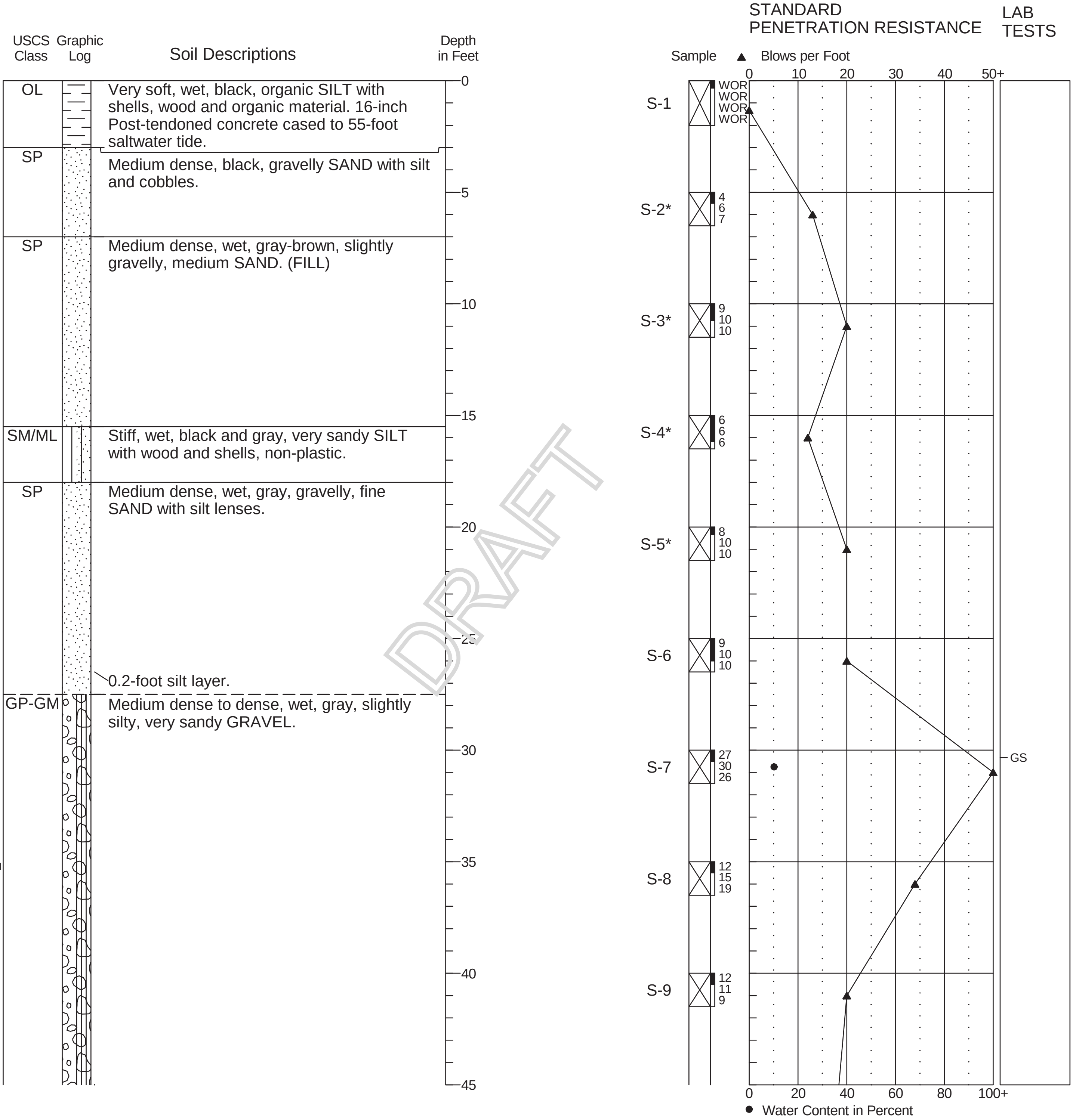
Historic Borings

Boring Log G01

Location: N 2785727.3869 E 2376494.4484
Approximate Ground Surface Elevation: -11.3 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions
OL	Very soft, wet, black, organic SILT with shells, wood and organic material. 16-inch Post-tendoned concrete cased to 55-foot saltwater tide.
SP	Medium dense, black, gravelly SAND with silt and cobbles.
SP	Medium dense, wet, gray-brown, slightly gravelly, medium SAND. (FILL)
SM/ML	Stiff, wet, black and gray, very sandy SILT with wood and shells, non-plastic.
SP	Medium dense, wet, gray, gravelly, fine SAND with silt lenses. 0.2-foot silt layer.
GP-GM	Medium dense to dense, wet, gray, slightly silty, very sandy GRAVEL.



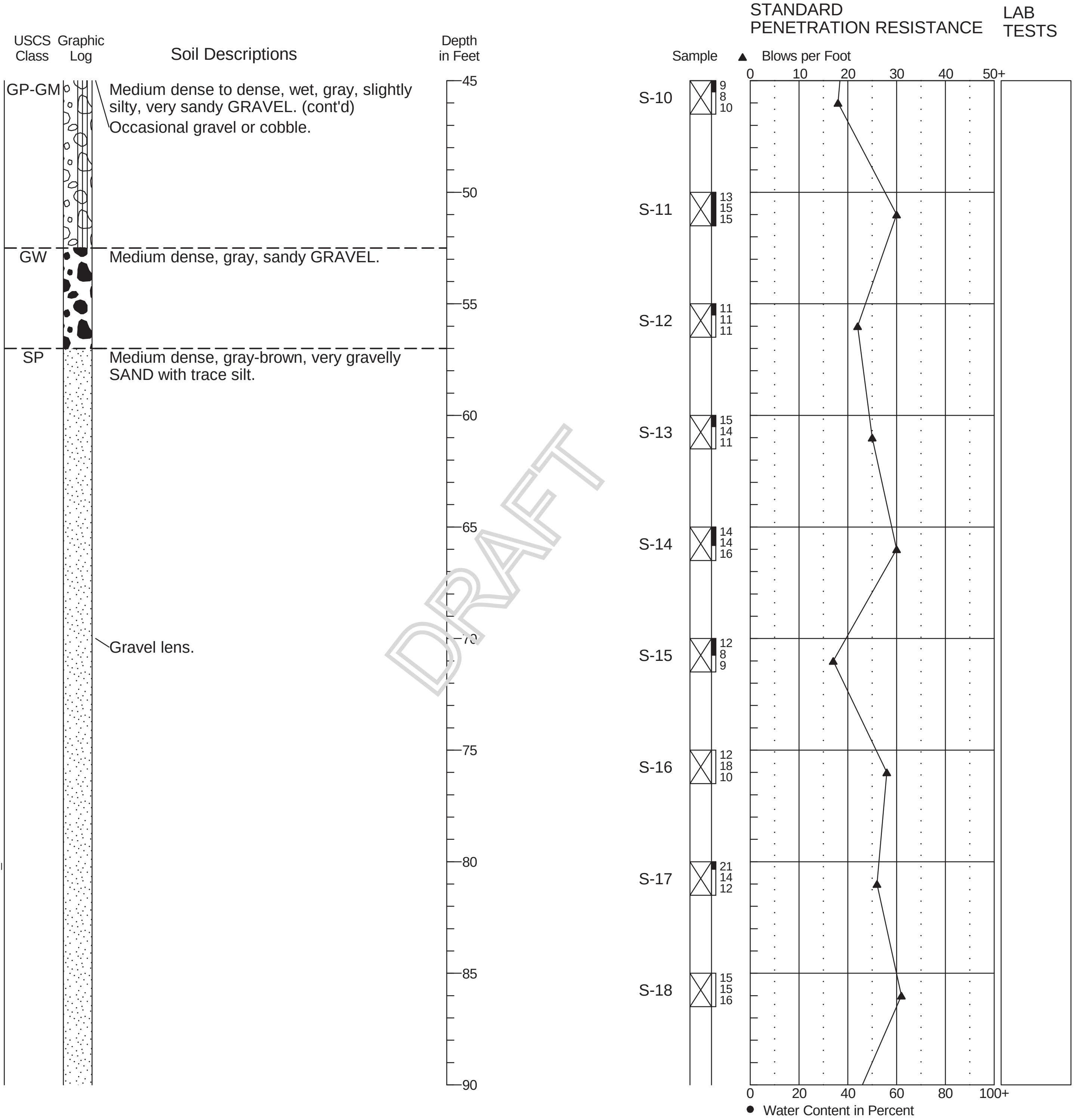
S-1	WOR WOR WOR WOR
S-2*	4 6 7
S-3*	9 10 10
S-4*	6 6 6
S-5*	8 10 10
S-6	9 10 10
S-7	27 30 26
S-8	12 15 19
S-9	12 11 9

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G01

Location: N 2785727.3869 E 2376494.4484
Approximate Ground Surface Elevation: -11.3 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



USCS Class	Soil Descriptions
GP-GM	Medium dense to dense, wet, gray, slightly silty, very sandy GRAVEL. (cont'd) Occasional gravel or cobble.
GW	Medium dense, gray, sandy GRAVEL.
SP	Medium dense, gray-brown, very gravelly SAND with trace silt. Gravel lens.

S-10	9	8	10
S-11	13	15	15
S-12	11	11	11
S-13	15	14	11
S-14	14	14	16
S-15	12	8	9
S-16	12	18	10
S-17	21	14	12
S-18	15	15	16

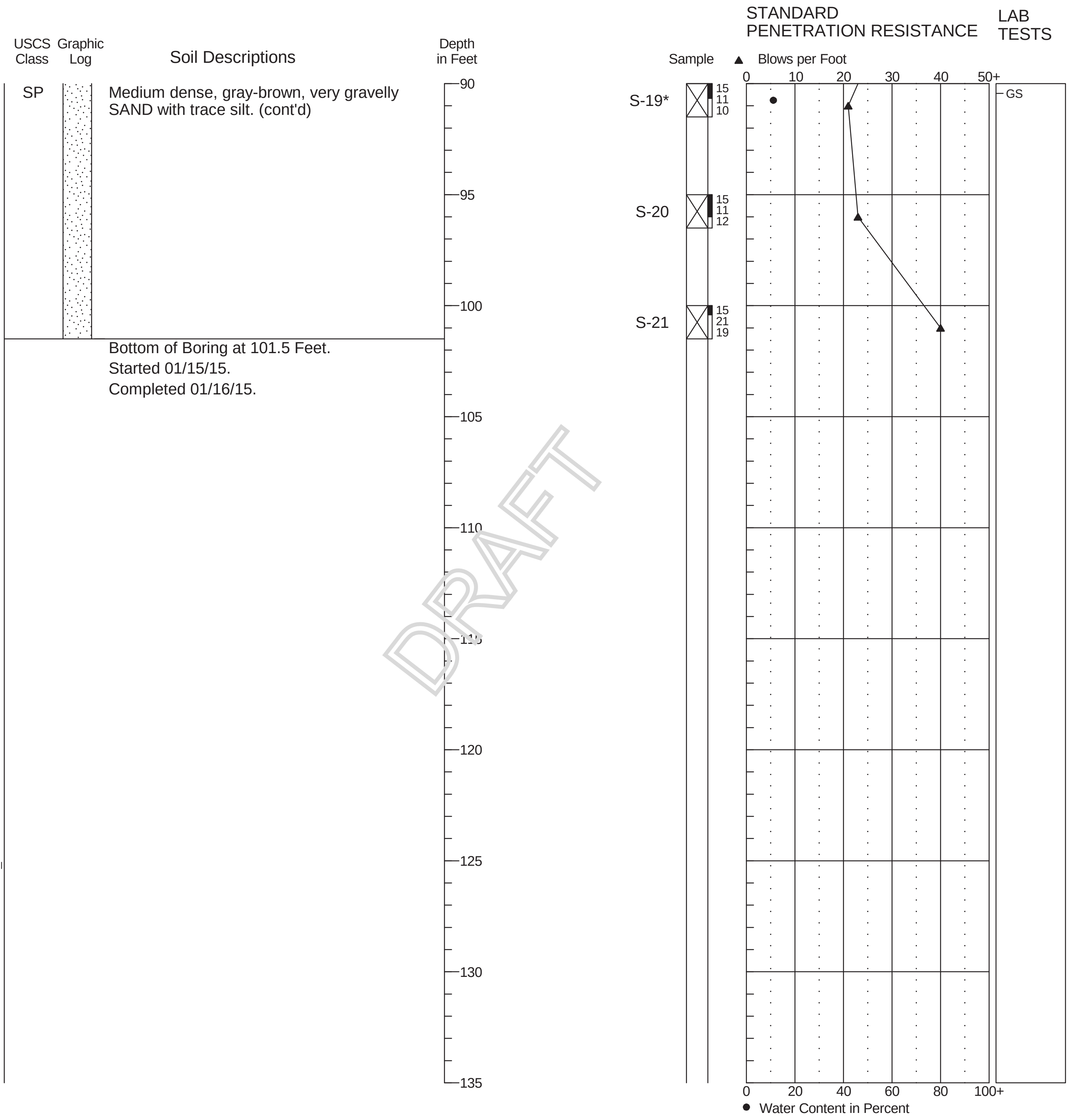
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

Boring Log G01

Location: N 2785727.3869 E 2376494.4484
Approximate Ground Surface Elevation: -11.3 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



Medium dense, gray-brown, very gravelly SAND with trace silt. (cont'd)

Bottom of Boring at 101.5 Feet.
Started 01/15/15.
Completed 01/16/15.

NEW BORING LOG 1908100-BL.GPJ HC_CORP.GDT 4/28/15

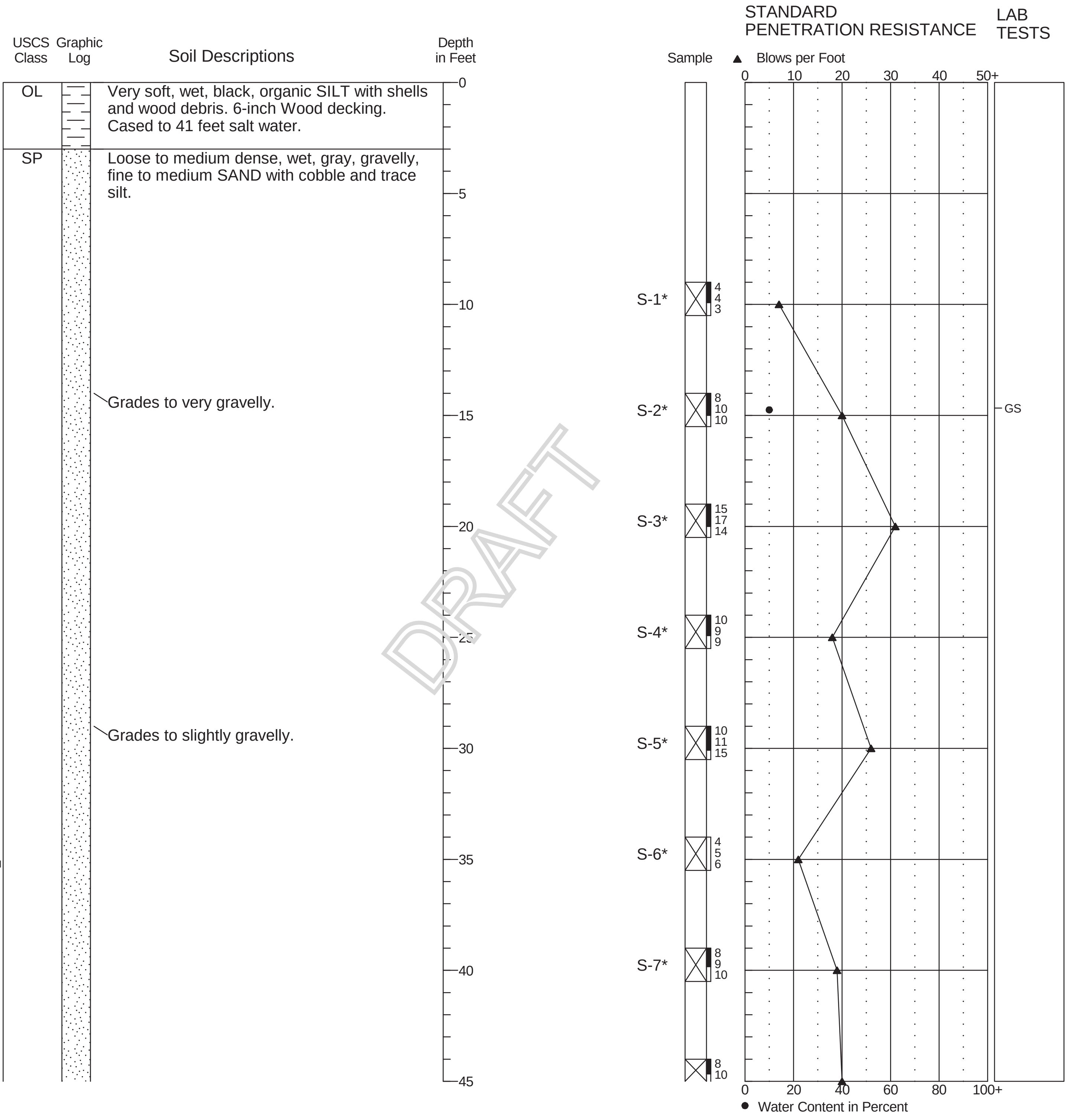
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G02

Location: N 2786024.1941 E 2376764.8168
Approximate Ground Surface Elevation: -8.6 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions
OL	Very soft, wet, black, organic SILT with shells and wood debris. 6-inch Wood decking. Cased to 41 feet salt water.
SP	Loose to medium dense, wet, gray, gravelly, fine to medium SAND with cobble and trace silt.
	Grades to very gravelly.
	Grades to slightly gravelly.

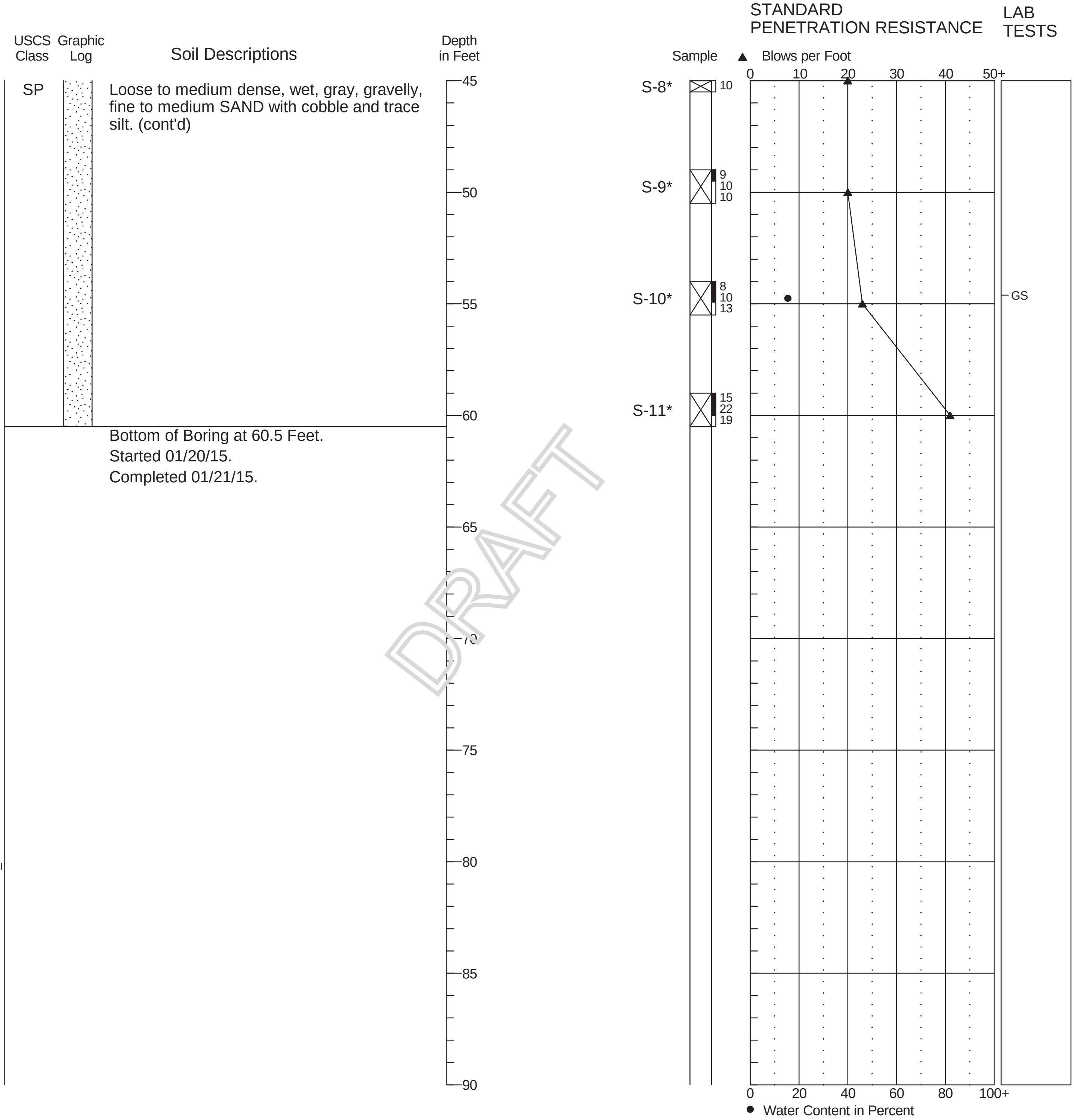


1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G02

Location: N 2786024.1941 E 2376764.8168
Approximate Ground Surface Elevation: -8.6 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



SP — Loose to medium dense, wet, gray, gravelly, fine to medium SAND with cobble and trace silt. (cont'd)

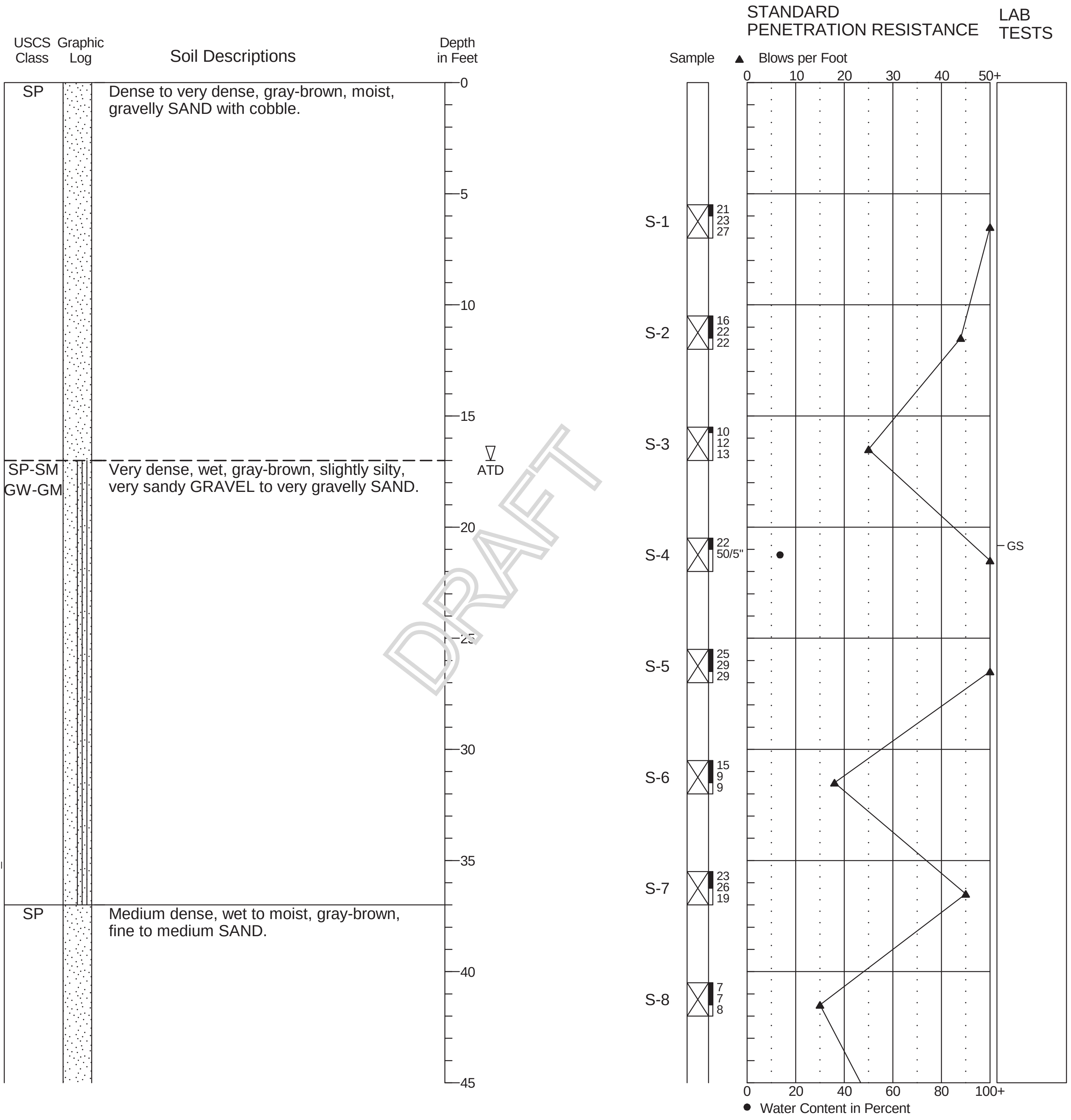
Bottom of Boring at 60.5 Feet.
Started 01/20/15.
Completed 01/21/15.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G03

Location: N 2786559.7346 E 2377333.8577
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



SP — Dense to very dense, gray-brown, moist, gravelly SAND with cobble.

SP-SM GW-GM — Very dense, wet, gray-brown, slightly silty, very sandy GRAVEL to very gravelly SAND.

SP — Medium dense, wet to moist, gray-brown, fine to medium SAND.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

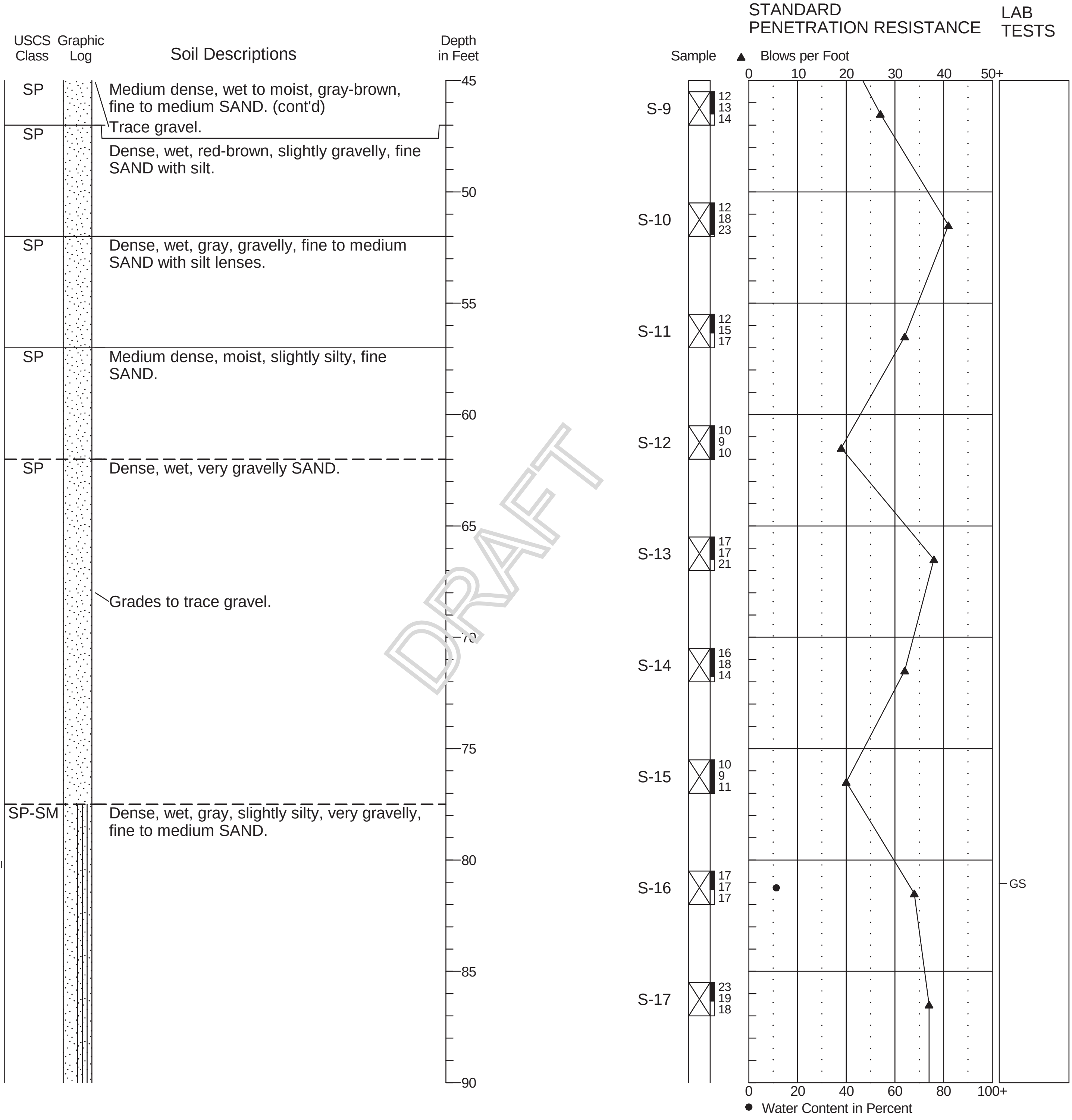
19081-00 ***1/15***

Figure A-4 ***1/3***

Boring Log G03

Location: N 2786559.7346 E 2377333.8577
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



USCS Class	Soil Descriptions
SP	Medium dense, wet to moist, gray-brown, fine to medium SAND. (cont'd) Trace gravel.
SP	Dense, wet, red-brown, slightly gravelly, fine SAND with silt.
SP	Dense, wet, gray, gravelly, fine to medium SAND with silt lenses.
SP	Medium dense, moist, slightly silty, fine SAND.
SP	Dense, wet, very gravelly SAND. Grades to trace gravel.
SP-SM	Dense, wet, gray, slightly silty, very gravelly, fine to medium SAND.

Sample	Blows
S-9	12 13 14
S-10	12 18 23
S-11	12 15 17
S-12	10 9 10
S-13	17 17 21
S-14	16 18 14
S-15	10 9 11
S-16	17 17 17
S-17	23 19 18

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

Boring Log G03

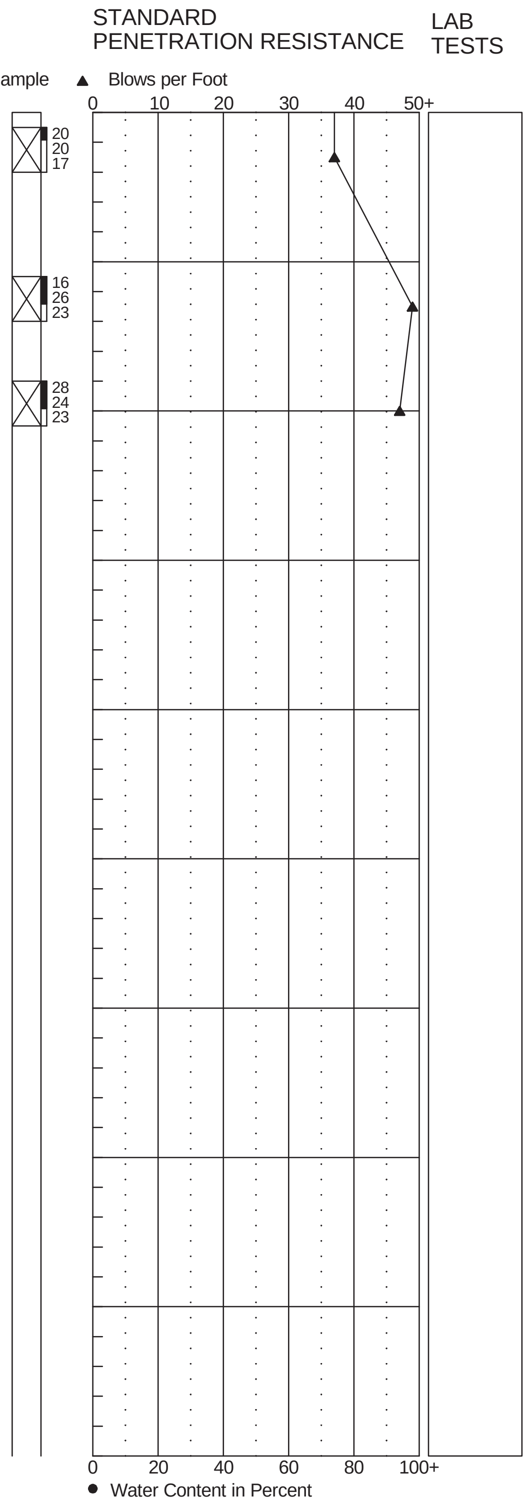
Location: N 2786559.7346 E 2377333.8577
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions
SP-SM	Dense, wet, gray, slightly silty, very gravelly, fine to medium SAND. (cont'd)
SP	Dense, moist, gray, slightly gravelly, fine SAND.
SP	Dense, wet, gray, gravelly, slightly silty, fine to medium SAND.
	Bottom of Boring at 100.5 Feet. Started 01/07/15. Completed 01/07/15.

Depth in Feet: 90 – 135

Sample	Blows
S-18	20 20 17
S-19	16 26 23
S-20	28 24 23



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

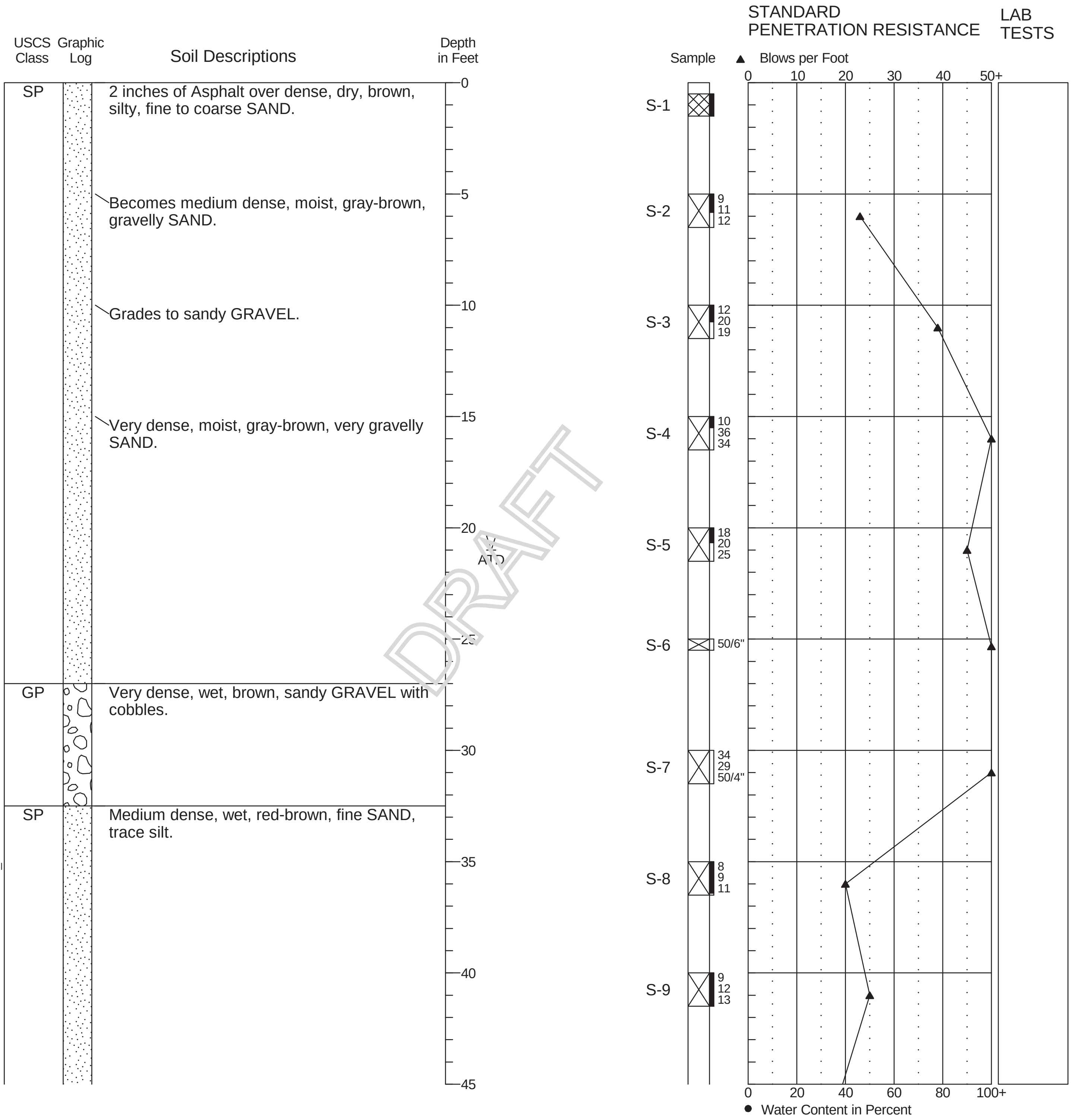
HARTCROWSER

19081-00 ***1/15***
Figure A-4 ***3/3***

Boring Log G04

Location: N 2786633.7918 E 2377153.5044
Approximate Ground Surface Elevation: 30.0 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



USCS Class	Depth in Feet	Soil Descriptions
SP	0	2 inches of Asphalt over dense, dry, brown, silty, fine to coarse SAND.
	5	Becomes medium dense, moist, gray-brown, gravelly SAND.
	10	Grades to sandy GRAVEL.
	15	Very dense, moist, gray-brown, very gravelly SAND.
GP	27	Very dense, wet, brown, sandy GRAVEL with cobbles.
SP	32.5	Medium dense, wet, red-brown, fine SAND, trace silt.

Sample	Blows
S-1	
S-2	9 11 12
S-3	12 20 19
S-4	10 36 34
S-5	18 20 25
S-6	50/6"
S-7	34 29 50/4"
S-8	8 9 11
S-9	9 12 13

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

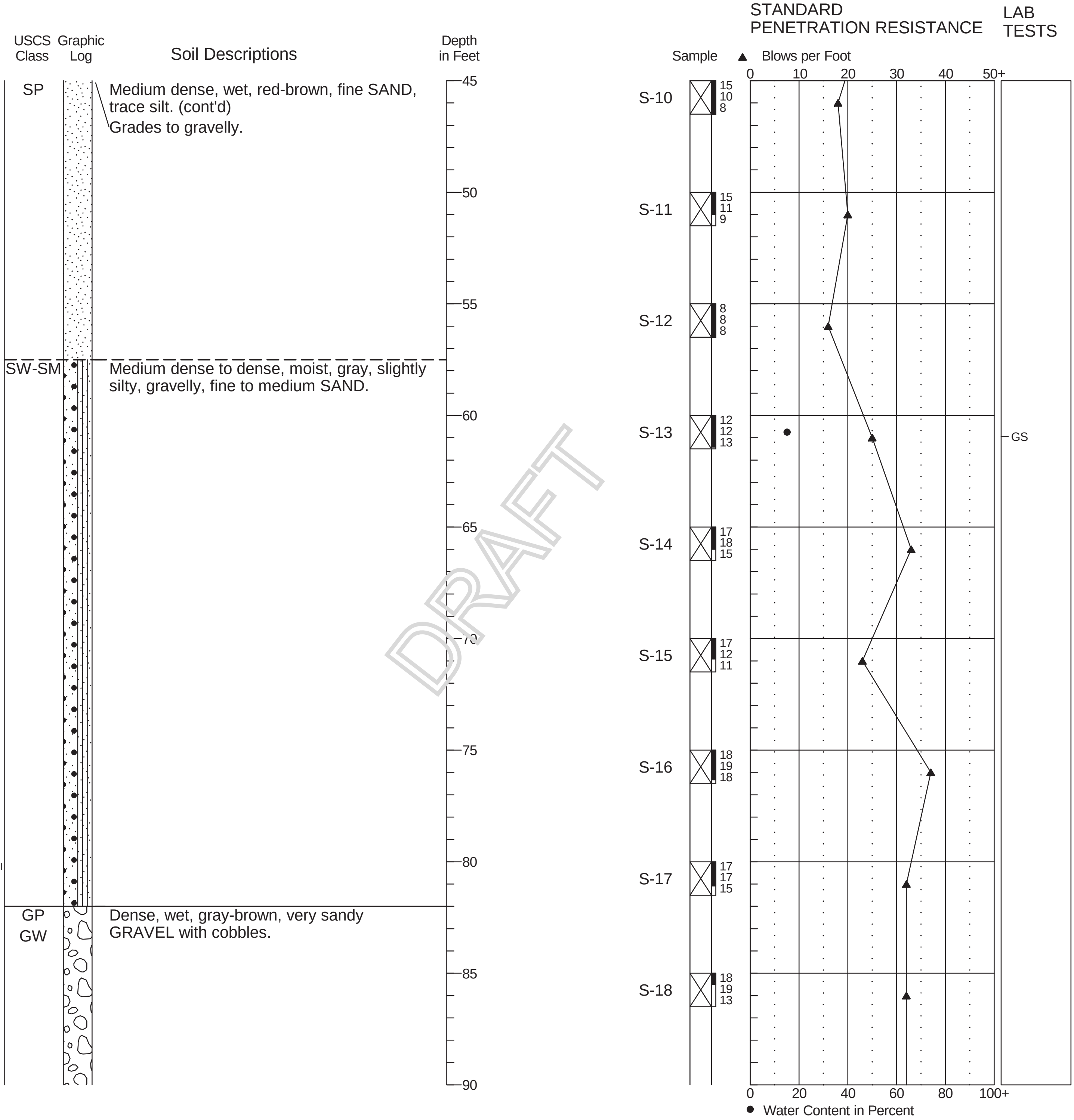
HARTCROWSER

19081-00 *1/15*
Figure A-5 *1/3*

Boring Log G04

Location: N 2786633.7918 E 2377153.5044
Approximate Ground Surface Elevation: 30.0 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade Reviewed By: N. Campbell



USCS Class	Soil Descriptions
SP	Medium dense, wet, red-brown, fine SAND, trace silt. (cont'd) Grades to gravelly.
SW-SM	Medium dense to dense, moist, gray, slightly silty, gravelly, fine to medium SAND.
GP GW	Dense, wet, gray-brown, very sandy GRAVEL with cobbles.

S-10	15 10 8
S-11	15 11 9
S-12	8 8 8
S-13	12 12 13
S-14	17 18 15
S-15	17 12 11
S-16	18 19 18
S-17	17 17 15
S-18	18 19 13

NEW BORING LOG 1908100-BL.GPJ HC_CORP.GDT 4/28/15

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

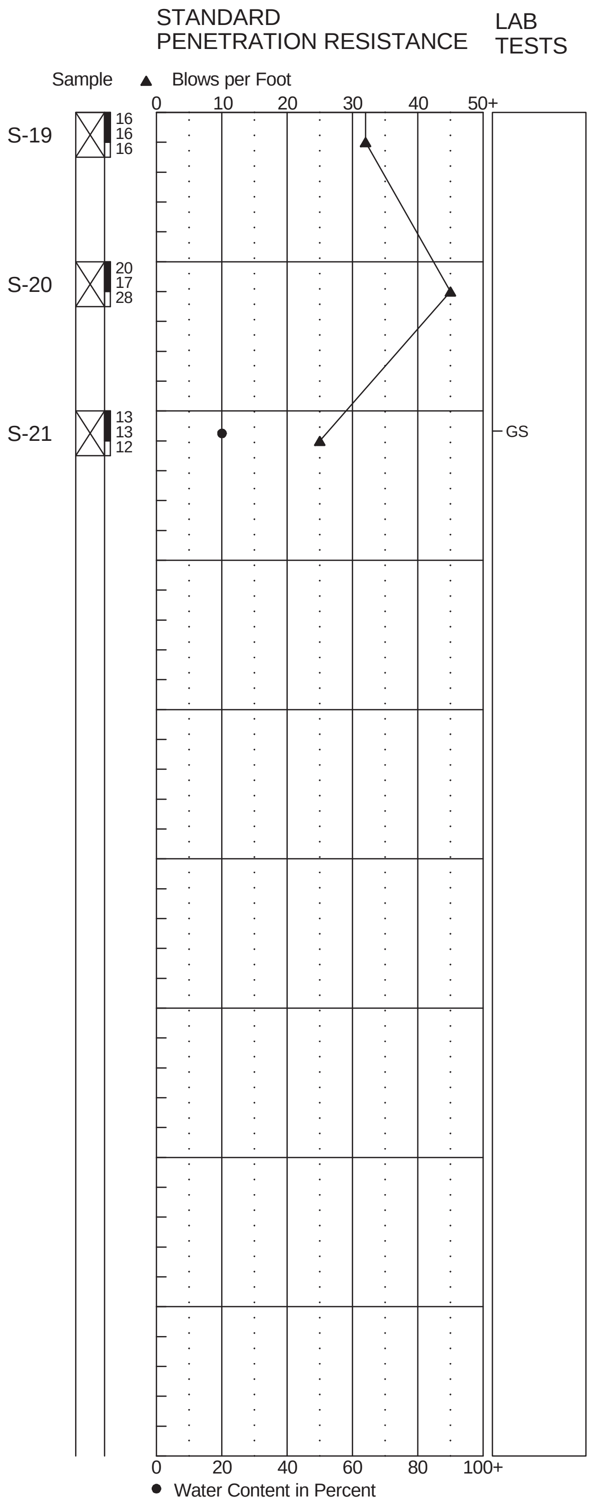
HARTCROWSER

Boring Log G04

Location: N 2786633.7918 E 2377153.5044
Approximate Ground Surface Elevation: 30.0 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions	Depth in Feet
GP	Dense, wet, gray-brown, very sandy GRAVEL with cobbles. (cont'd)	90
SP-SM	Medium dense to dense, moist, gray SAND with trace slightly silty gravel.	92.5
	Bottom of Boring at 101.5 Feet. Started 01/09/15. Completed 01/10/15.	101.5



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

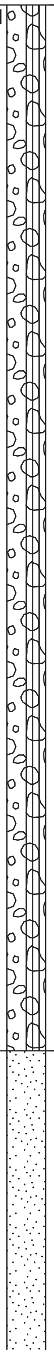
HARTCROWSER

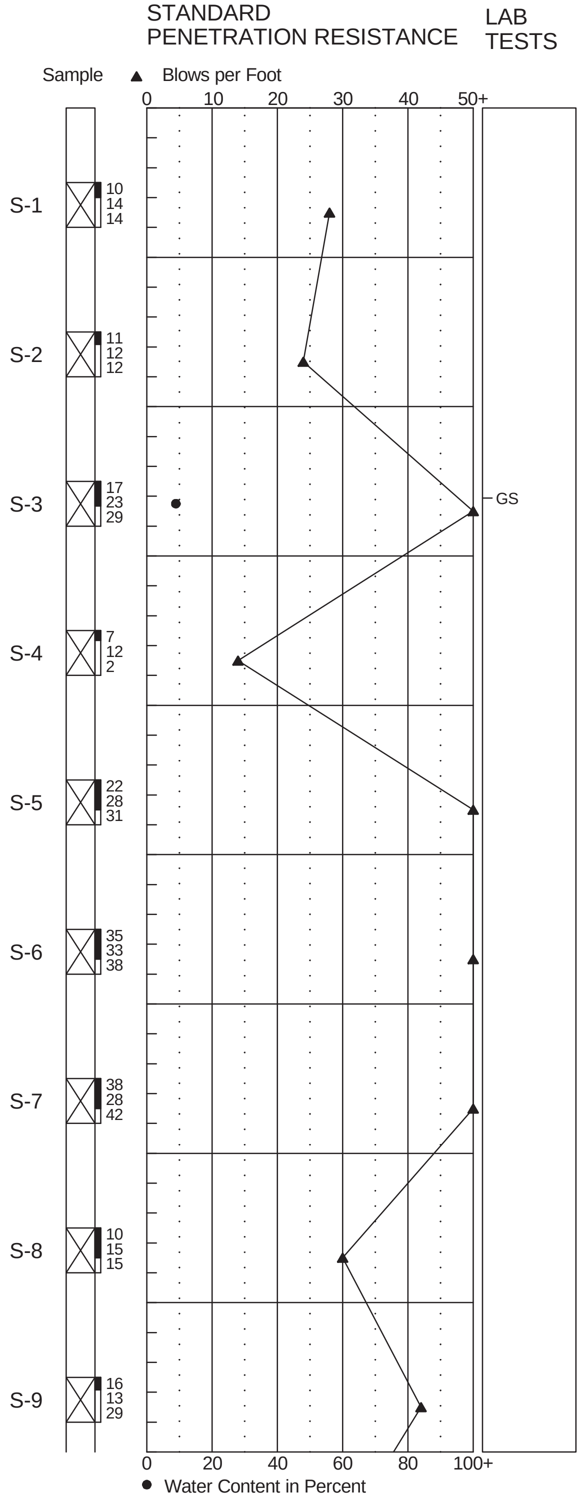
Boring Log G05

Location: N 2786321.3295 E 2376854.6224
Approximate Ground Surface Elevation: 29.1 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions	Depth in Feet
GP-GM	Medium dense to dense, moist, red-gray-brown, slightly silty, very sandy GRAVEL.	0
SP	Medium dense to dense, brown, very gravelly SAND with silt.	35





Sample	Blows
S-1	10 14 14
S-2	11 12 12
S-3	17 23 29
S-4	7 12 2
S-5	22 28 31
S-6	35 33 38
S-7	38 28 42
S-8	10 15 15
S-9	16 13 29

Depth in Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45

NEW BORING LOG 1908100-BL.GPJ HC_CORP.GDT 4/28/15

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

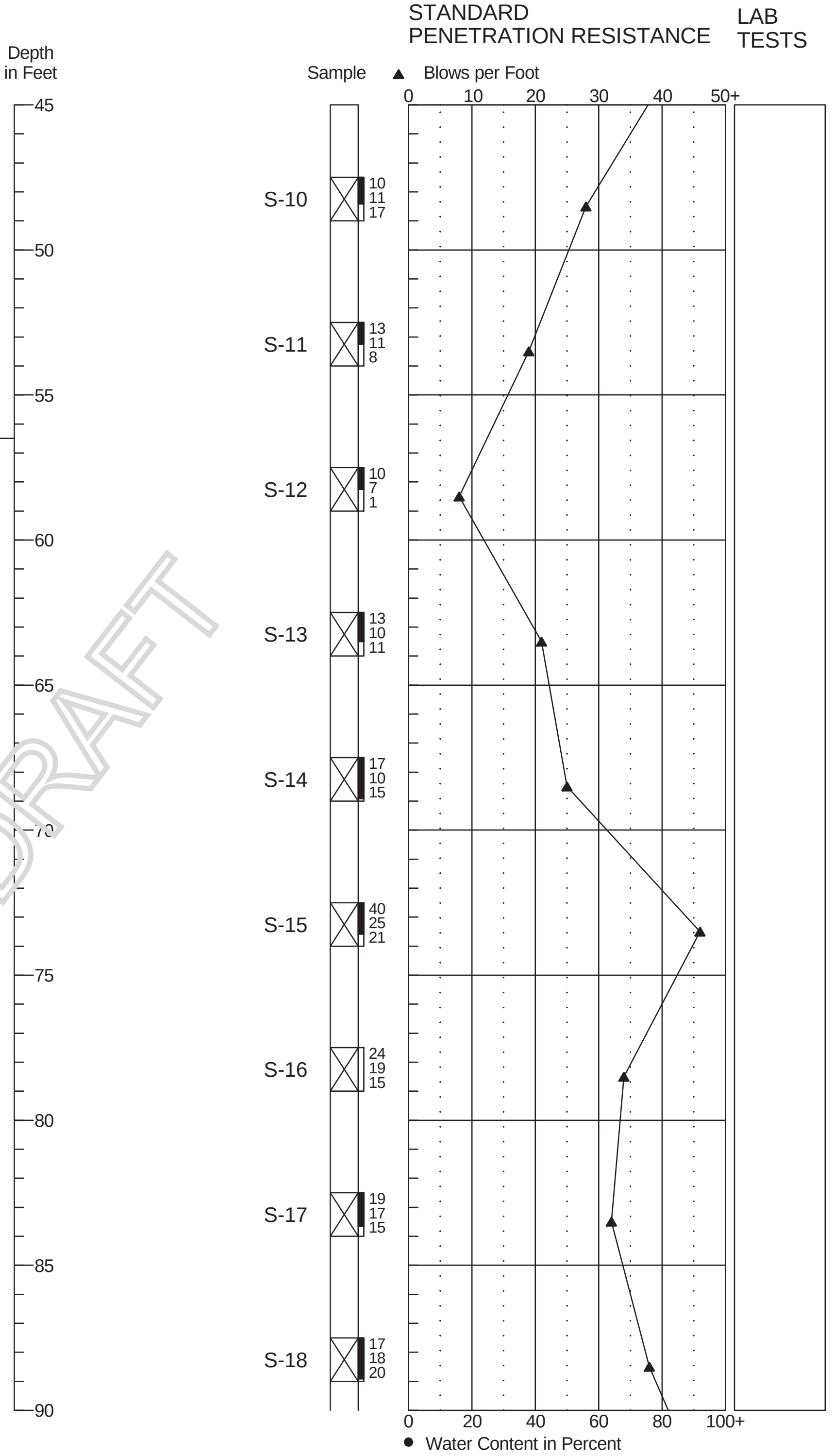
Boring Log G05

Location: N 2786321.3295 E 2376854.6224
Approximate Ground Surface Elevation: 29.1 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions	Depth in Feet
SP	Medium dense to dense, brown, very gravelly SAND with silt. (cont'd)	45
SP	Medium dense, wet, gray, gravelly, slightly silty SAND.	56

Sample	Blows
S-10	10 11 17
S-11	13 11 8
S-12	10 7 1
S-13	13 10 11
S-14	17 10 15
S-15	40 25 21
S-16	24 19 15
S-17	19 17 15
S-18	17 18 20



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

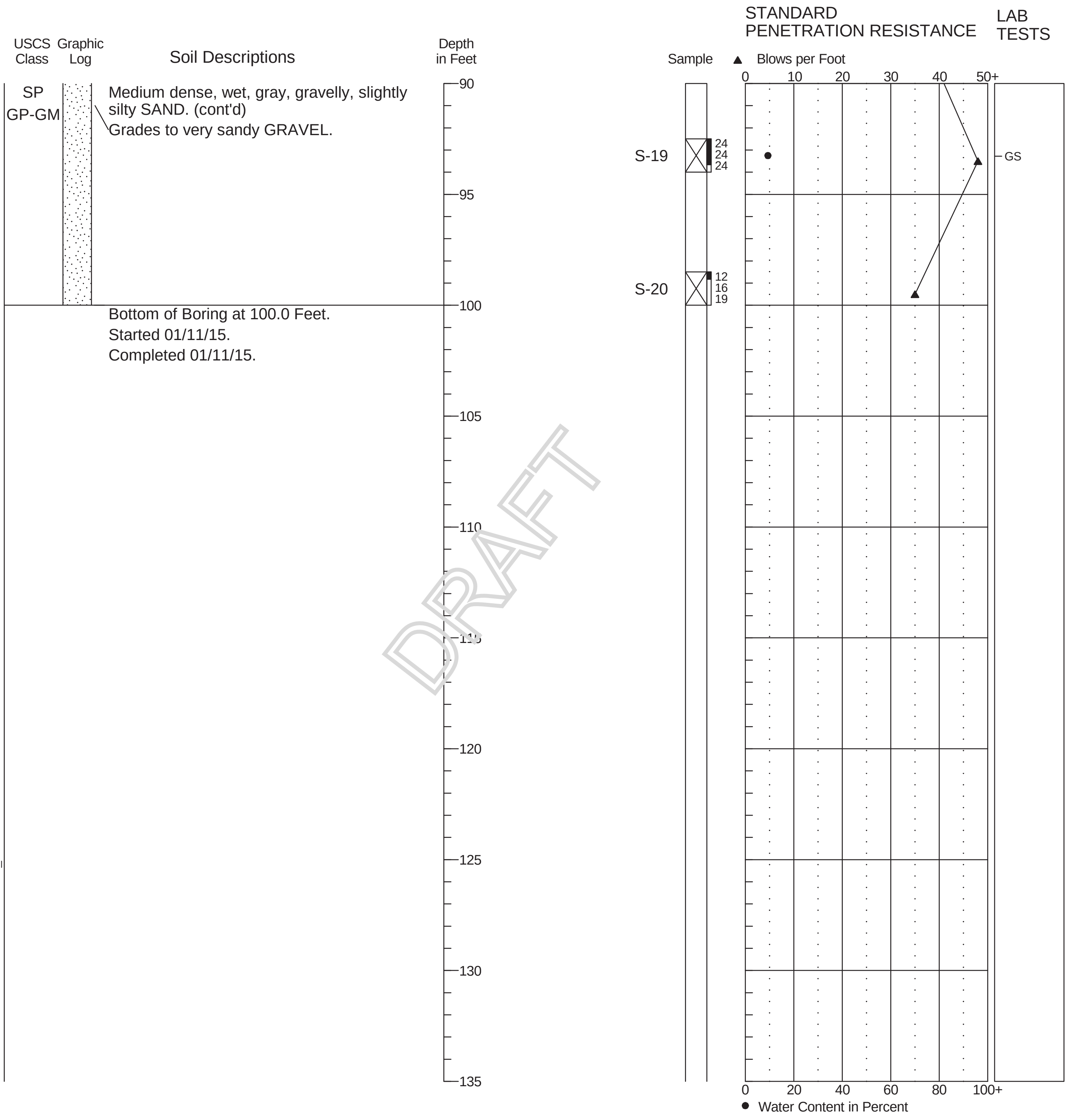
19081-00 **1/15**

Figure A-6 **2/3**

Boring Log G05

Location: N 2786321.3295 E 2376854.6224
Approximate Ground Surface Elevation: 29.1 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



Medium dense, wet, gray, gravelly, slightly silty SAND. (cont'd)

Grades to very sandy GRAVEL.

Bottom of Boring at 100.0 Feet.

Started 01/11/15.

Completed 01/11/15.

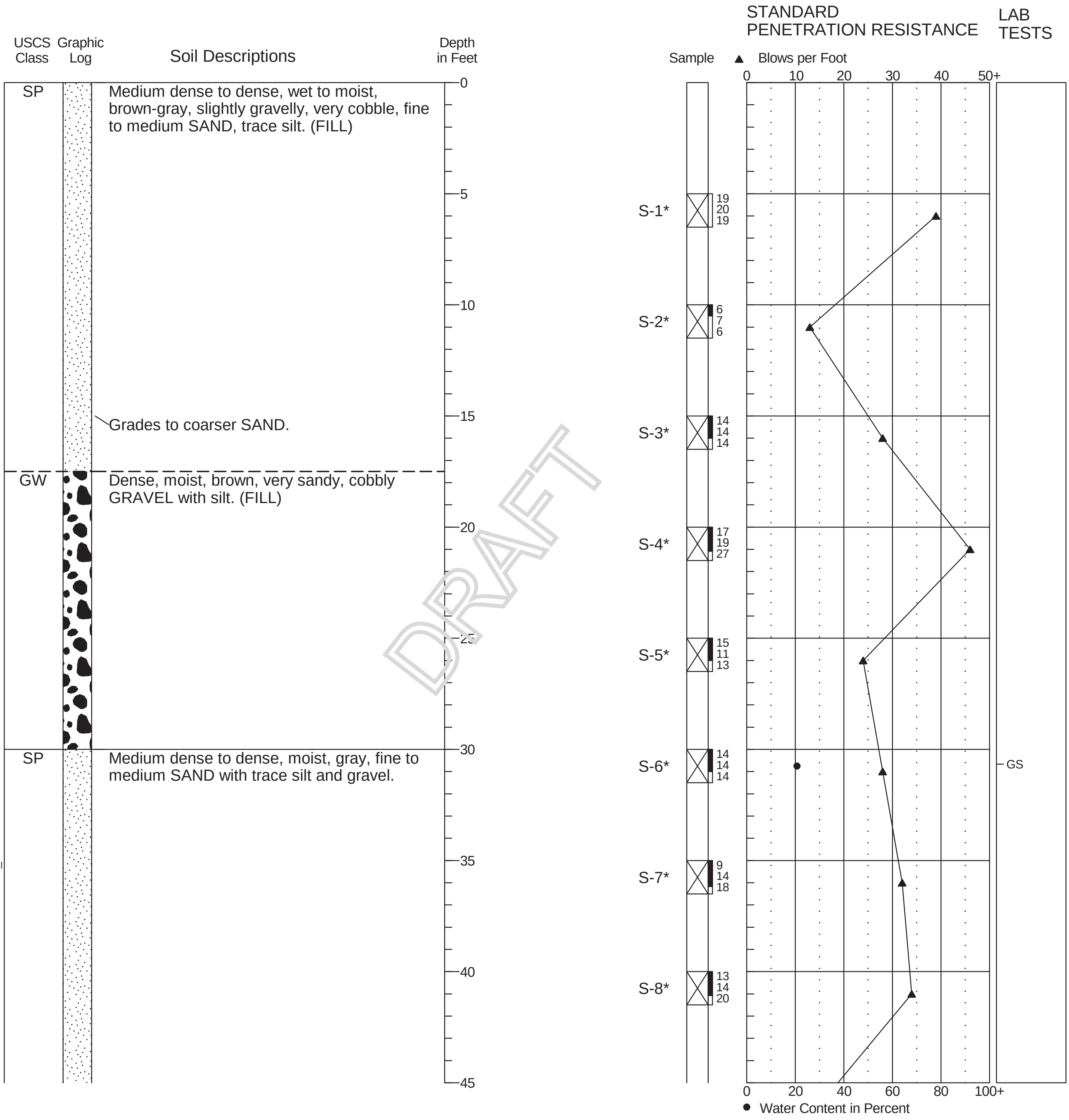
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

Boring Log G06

Location: N 2786069.2094 E 2376634.6097
Approximate Ground Surface Elevation: 29.8 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 6 inches
Logged By: A. Wade   Reviewed By: N. Campbell



USCS Class	Soil Descriptions
SP	Medium dense to dense, wet to moist, brown-gray, slightly gravelly, very cobble, fine to medium SAND, trace silt. (FILL) Grades to coarser SAND.
GW	Dense, moist, brown, very sandy, cobbly GRAVEL with silt. (FILL)
SP	Medium dense to dense, moist, gray, fine to medium SAND with trace silt and gravel.

Sample	Blows
S-1*	19 20 19
S-2*	6 7 6
S-3*	14 14 14
S-4*	17 19 27
S-5*	15 11 13
S-6*	14 14 14
S-7*	9 14 18
S-8*	13 14 20

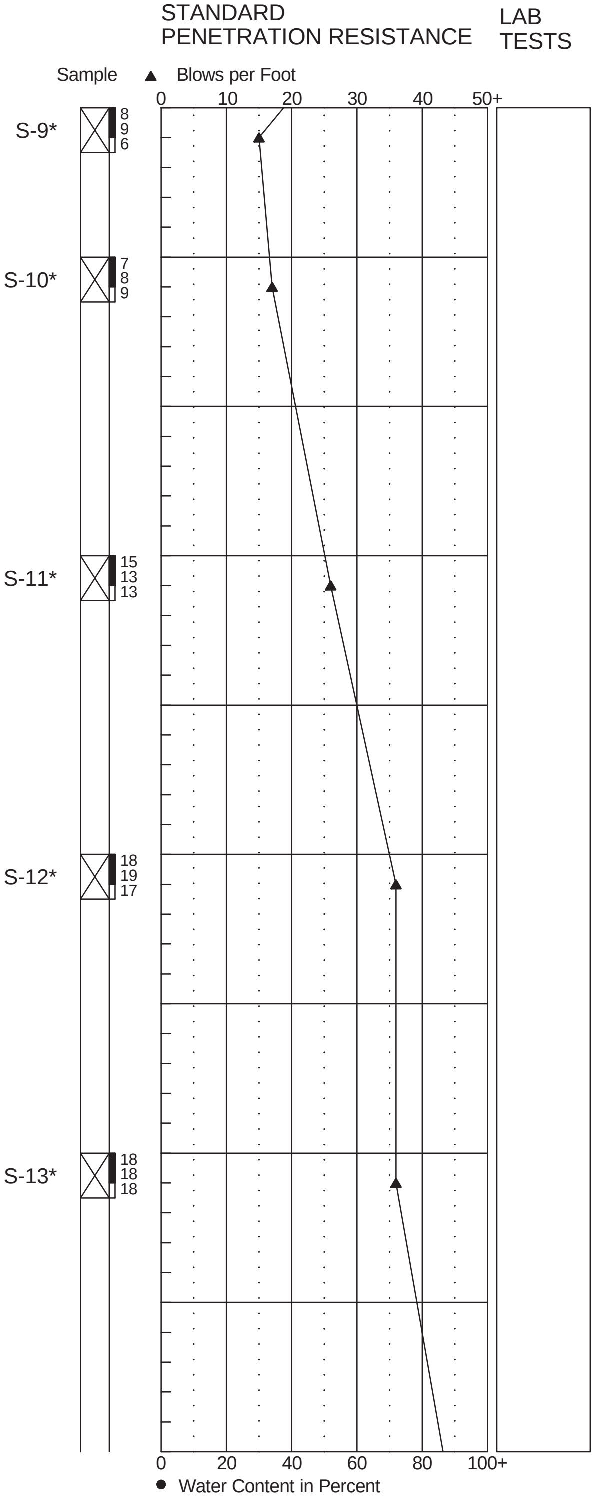
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G06

Location: N 2786069.2094 E 2376634.6097
Approximate Ground Surface Elevation: 29.8 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 6 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet
SP		Medium dense to dense, moist, gray, fine to medium SAND with trace silt and gravel. (cont'd)	45
SP		Medium dense to dense, moist to wet, gray, very gravelly, fine to medium SAND with cobbles.	55



S-9*	8 9 6
S-10*	7 8 9
S-11*	15 13 13
S-12*	18 19 17
S-13*	18 18 18

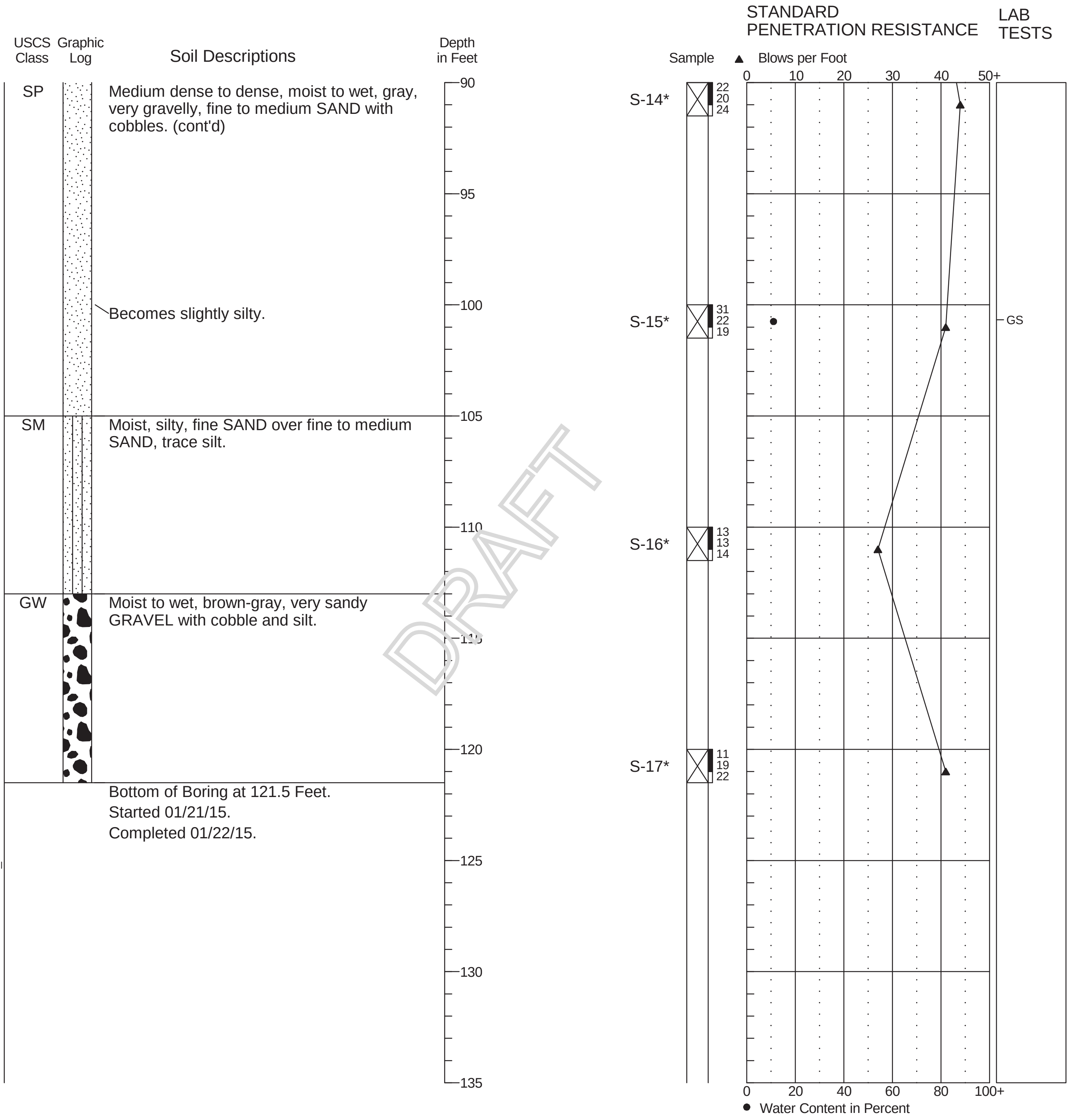
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

Boring Log G06

Location: N 2786069.2094 E 2376634.6097
Approximate Ground Surface Elevation: 29.8 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 6 inches
Logged By: A. Wade   Reviewed By: N. Campbell



Medium dense to dense, moist to wet, gray, very gravelly, fine to medium SAND with cobbles. (cont'd)

Becomes slightly silty.

Moist, silty, fine SAND over fine to medium SAND, trace silt.

Moist to wet, brown-gray, very sandy GRAVEL with cobble and silt.

Bottom of Boring at 121.5 Feet.
Started 01/21/15.
Completed 01/22/15.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G07

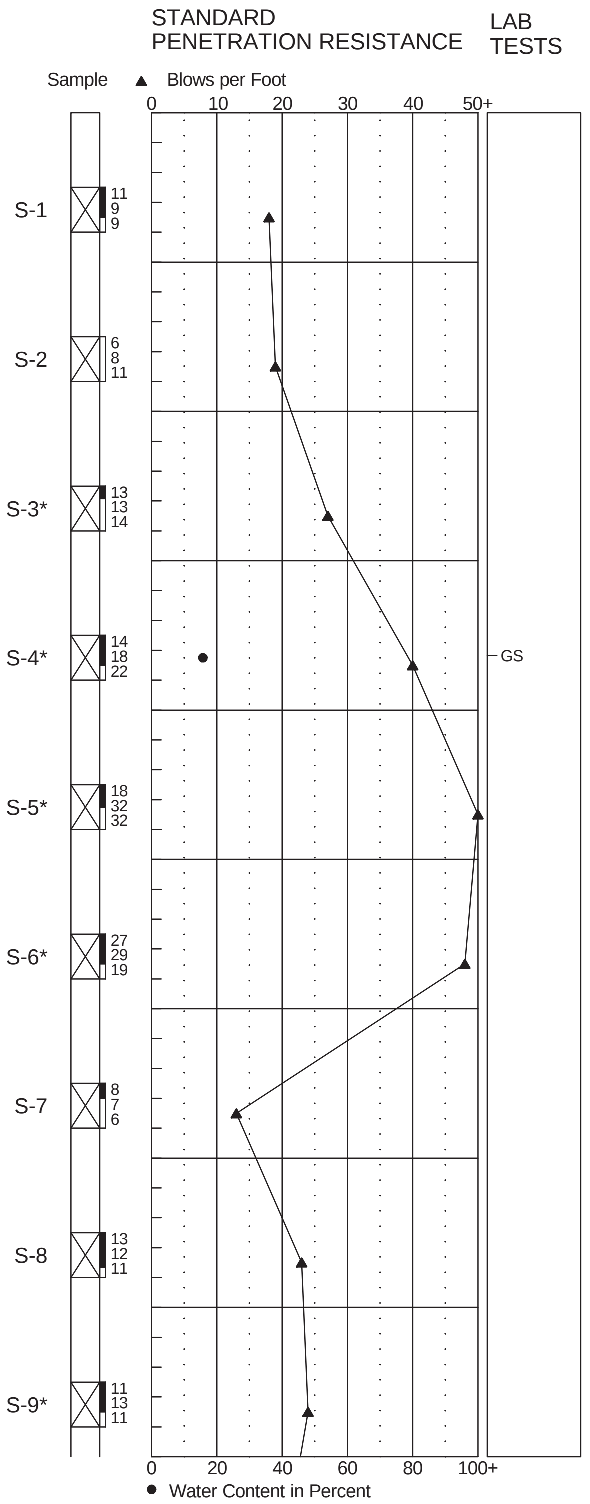
Location: N 2785843.2181 E 2376336.1308
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions
SP	Medium dense, moist, gray-brown, slightly silty, gravelly, fine to medium SAND. (FILL)
GP	Medium dense, moist, brown, sandy GRAVEL with cobbles and sand lenses. (FILL)
SM	Dense, moist, gray-brown, slightly silty, fine SAND with trace gravel. (FILL)
GP	Very dense, wet, brown, sandy GRAVEL with abundant cobbles and occasional boulder. (FILL)
SP	Dense, wet, brown, very gravelly SAND with cobbles.
SP	Medium dense, wet, slightly gravelly, fine to medium SAND with trace silt and cobbles.

Depth in Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45

ATD



S-1	11 9 9
S-2	6 8 11
S-3*	13 13 14
S-4*	14 18 22
S-5*	18 32 32
S-6*	27 29 19
S-7	8 7 6
S-8	13 12 11
S-9*	11 13 11

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

19081-00 ***1/15***
Figure A-8 ***1/3***

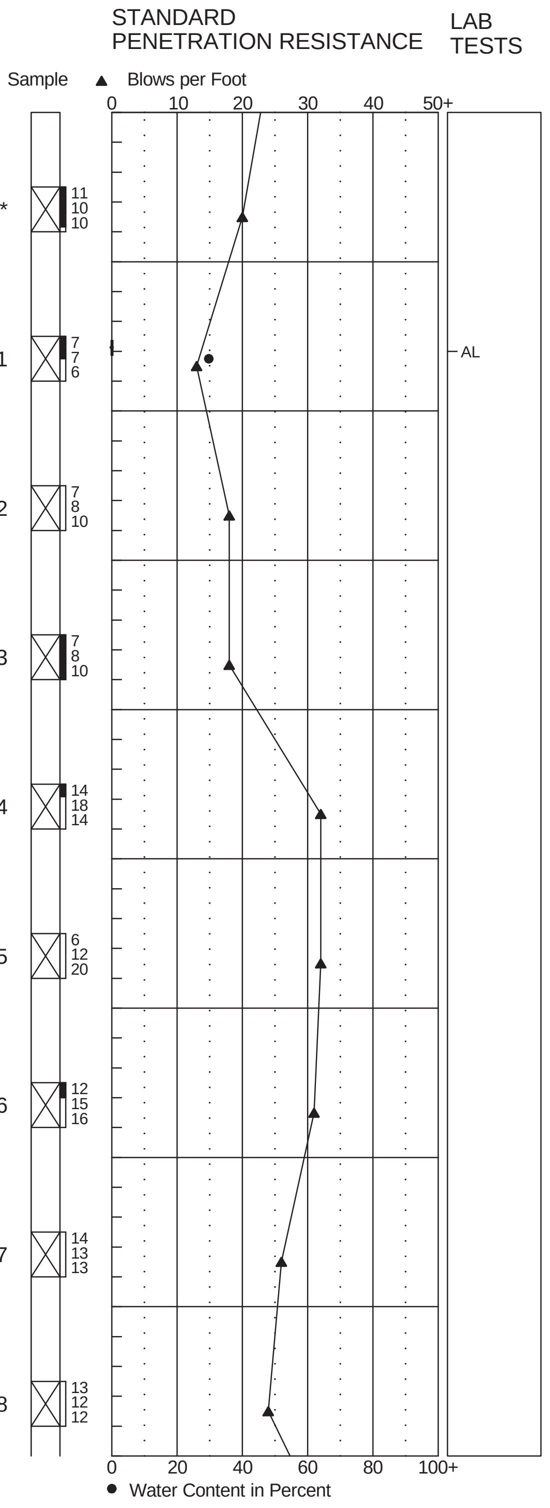
Boring Log G07

Location: N 2785843.2181 E 2376336.1308
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions	Depth in Feet
SP	Medium dense, wet, slightly gravelly, fine to medium SAND with trace silt and cobbles. (cont'd) Sandy SILT lens.	45
SM	Medium dense, wet, gray, very silty SAND.	
SP	Medium dense, moist to wet, medium SAND.	55
ML	Very stiff, gray, fine sandy SILT with gravel lenses.	60
SP	Dense, wet, silty, gravelly, fine to medium SAND.	65
SP	Dense, wet, gray-brown, medium SAND with trace silt and gravel. Grades to gravelly.	70
SP	Medium dense, wet, gray, medium SAND, trace silt.	85

Sample	Blows
S-10*	11 10 10
S-11	7 7 6
S-12	7 8 10
S-13	7 8 10
S-14	14 18 14
S-15	6 12 20
S-16	12 15 16
S-17	14 13 13
S-18	13 12 12



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

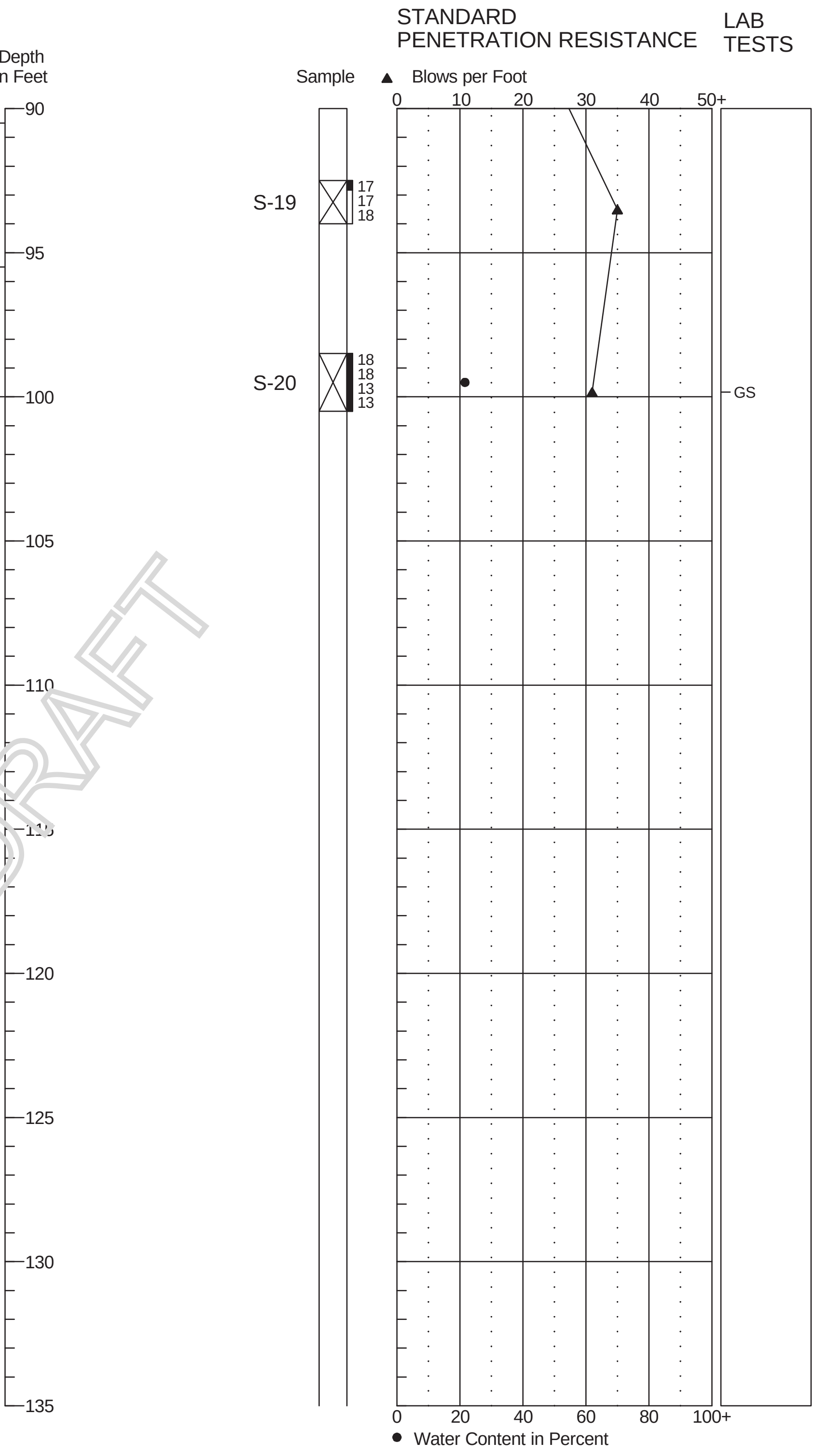
HARTCROWSER

Boring Log G07

Location: N 2785843.2181 E 2376336.1308
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Graphic Log	Soil Descriptions
GP		Dense, wet, gray-brown, sandy GRAVEL.
SM		Medium dense, wet, slightly gravelly, very silty, fine SAND.
		Bottom of Boring at 100.0 Feet. Started 01/12/15. Completed 01/13/15.



NEW BORING LOG 1908100-BL.GPJ HC_CORP.GDT 4/28/15

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

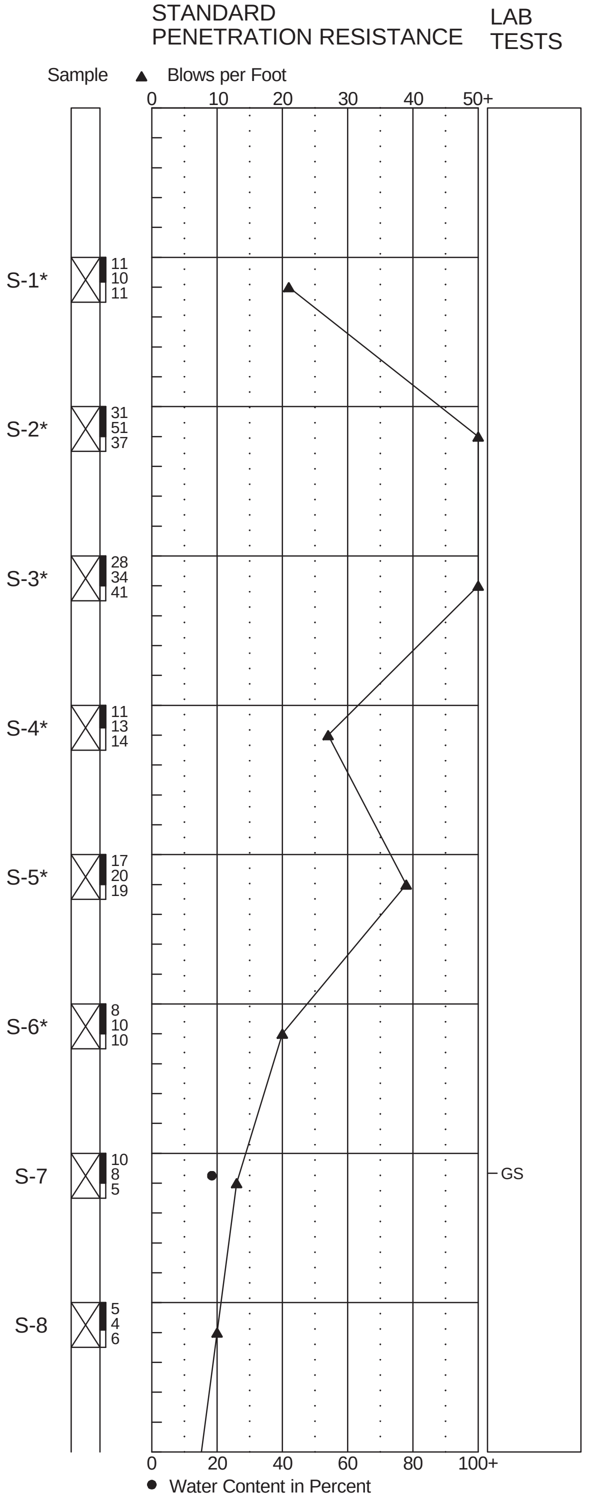
Boring Log G08

Location: N 2785912.9858 E 2376249.2784
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Graphic Log	Soil Descriptions
SP		Medium dense to very dense, damp, gray-brown, fine to medium SAND with trace silt and gravel/cobble. (FILL) Grades to gravelly. Cobble lens. Trace gravel.
SM/ML		Medium dense, wet, brown and gray, gravelly, fine SAND and SILT with organic material and trace shells.
SP		Medium dense, wet, gray-brown, fine to medium SAND.

Depth in Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45



S-1*	11	10	11
S-2*	31	51	37
S-3*	28	34	41
S-4*	11	13	14
S-5*	17	20	19
S-6*	8	10	10
S-7	10	8	5
S-8	5	4	6

NEW BORING LOG 1908100-BL.GPJ HC_CORP.GDT 4/28/15

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

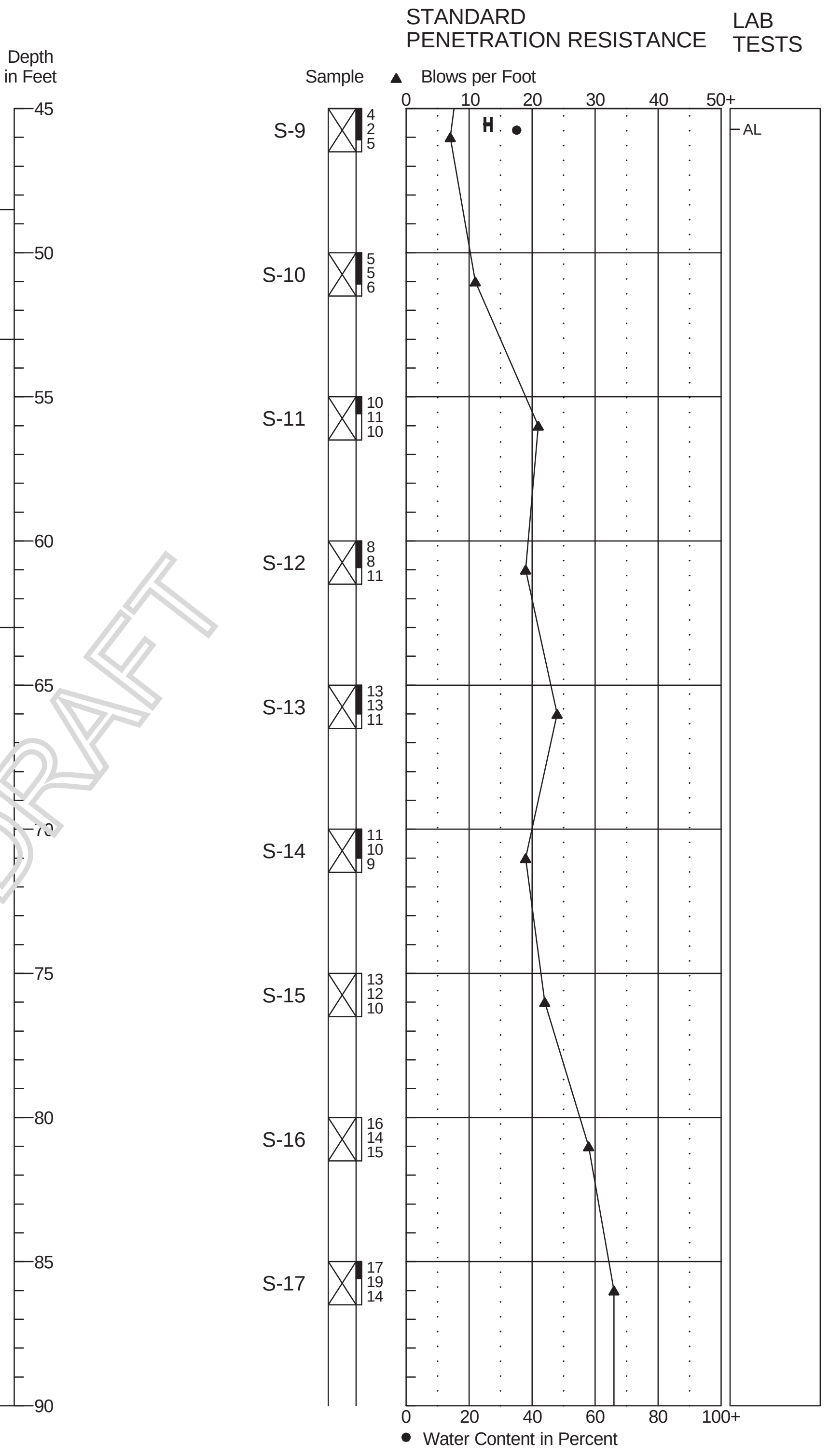
19081-00 *1/15*
Figure A-9 *1/3*

Boring Log G08

Location: N 2785912.9858 E 2376249.2784
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions
ML OL	Medium stiff, wet, black, sandy SILT with shells and organic material.
SM	Loose, wet, brown-gray, very silty SAND.
SP	Medium dense, wet, gray-brown, fine to medium SAND with silt.
SP	Medium dense, wet, gray-brown, gravelly, fine to medium SAND with silt.



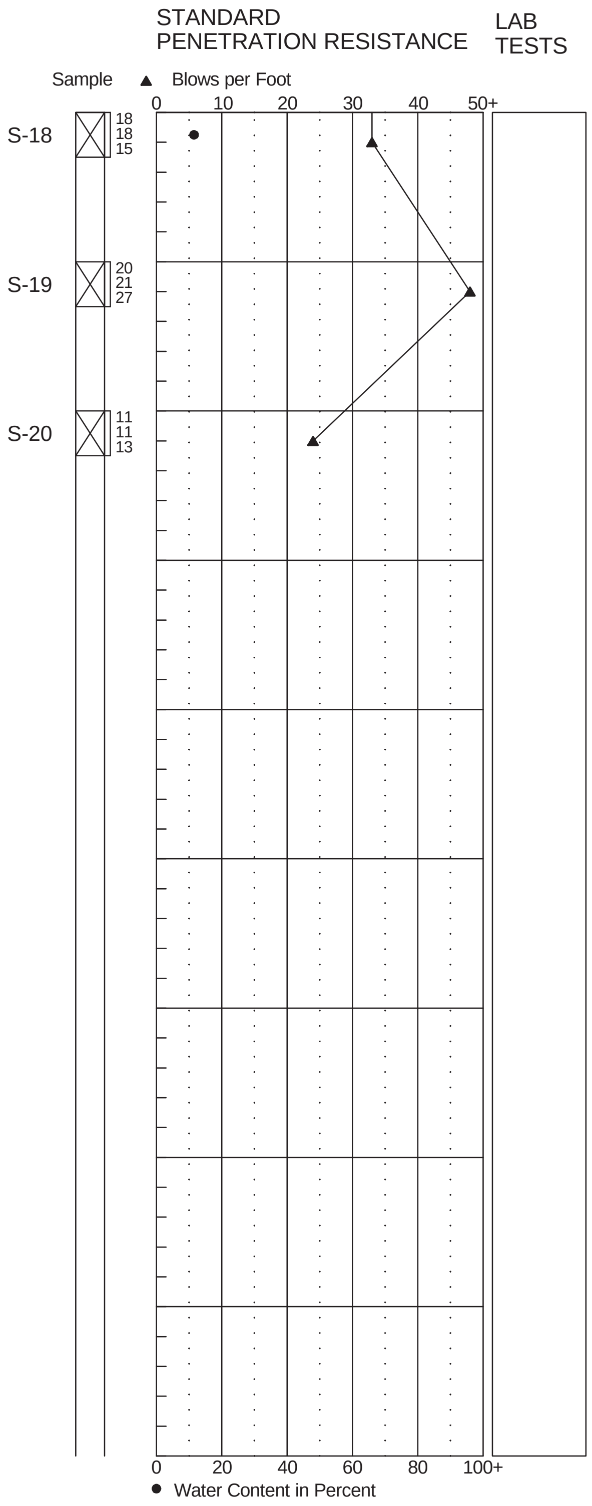
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G08

Location: N 2785912.9858 E 2376249.2784
Approximate Ground Surface Elevation: 28.9 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell

USCS Class	Soil Descriptions	Depth in Feet
SP-SM	Medium dense, wet, gray-brown, slightly silty, very gravelly, fine to medium SAND. Gravel lens.	90 95
SP	Medium dense, wet, gray-brown, fine to medium SAND.	100
	Bottom of Boring at 101.5 Feet. Started 01/13/15. Completed 01/14/15.	105 110 115 120 125 130 135



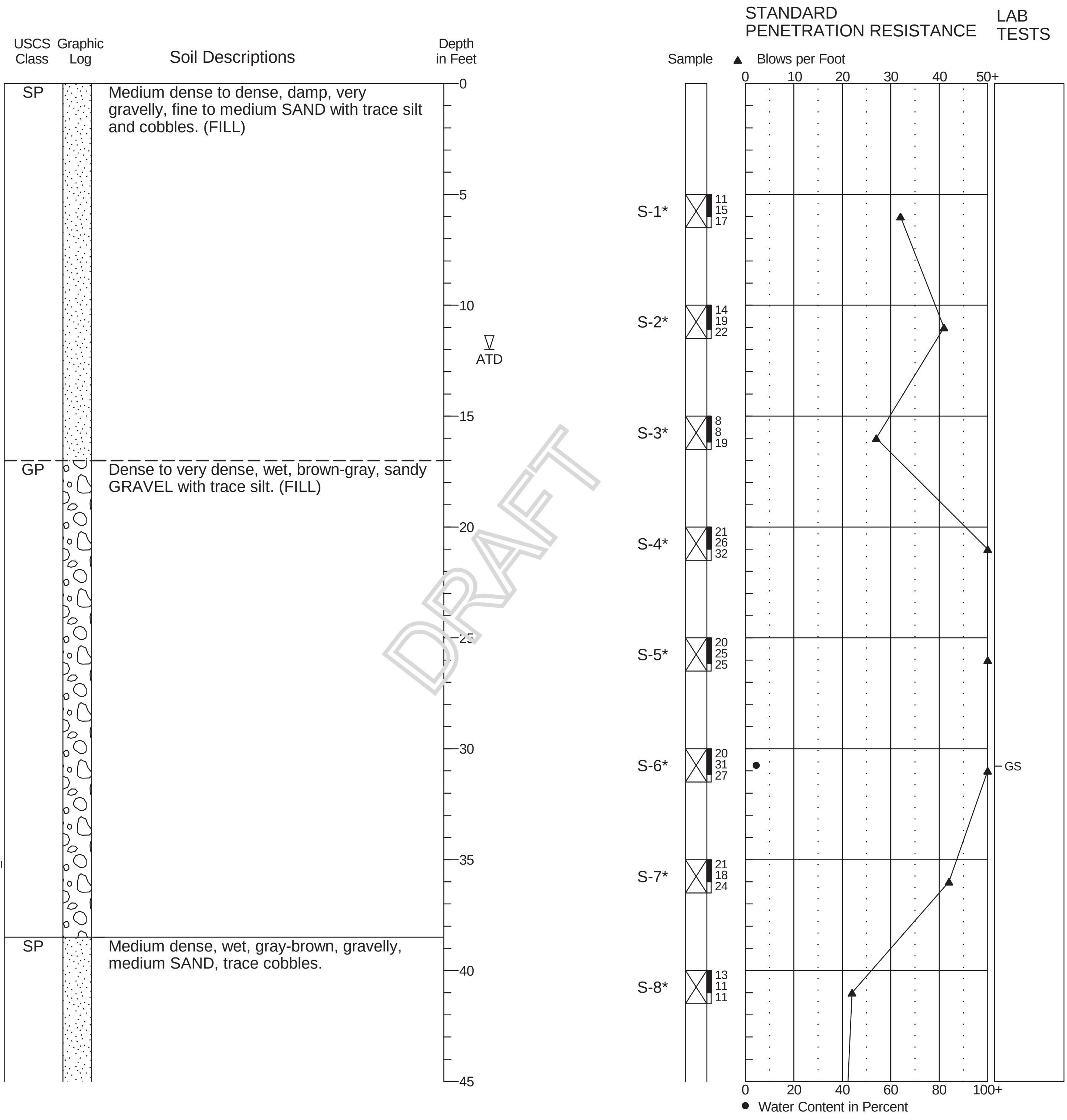
NEW BORING LOG 1908100-BL.GPJ HC_CORP.GDT 4/28/15

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G10

Location: N 2786539.2333 E 2376605.9071
Approximate Ground Surface Elevation: 30.0 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



USCS Class	Soil Descriptions
SP	Medium dense to dense, damp, very gravelly, fine to medium SAND with trace silt and cobbles. (FILL)
GP	Dense to very dense, wet, brown-gray, sandy GRAVEL with trace silt. (FILL)
SP	Medium dense, wet, gray-brown, gravelly, medium SAND, trace cobbles.

Sample			
S-1*	11	15	17
S-2*	14	19	22
S-3*	8	8	19
S-4*	21	26	32
S-5*	20	25	25
S-6*	20	31	27
S-7*	21	18	24
S-8*	13	11	11

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

HARTCROWSER

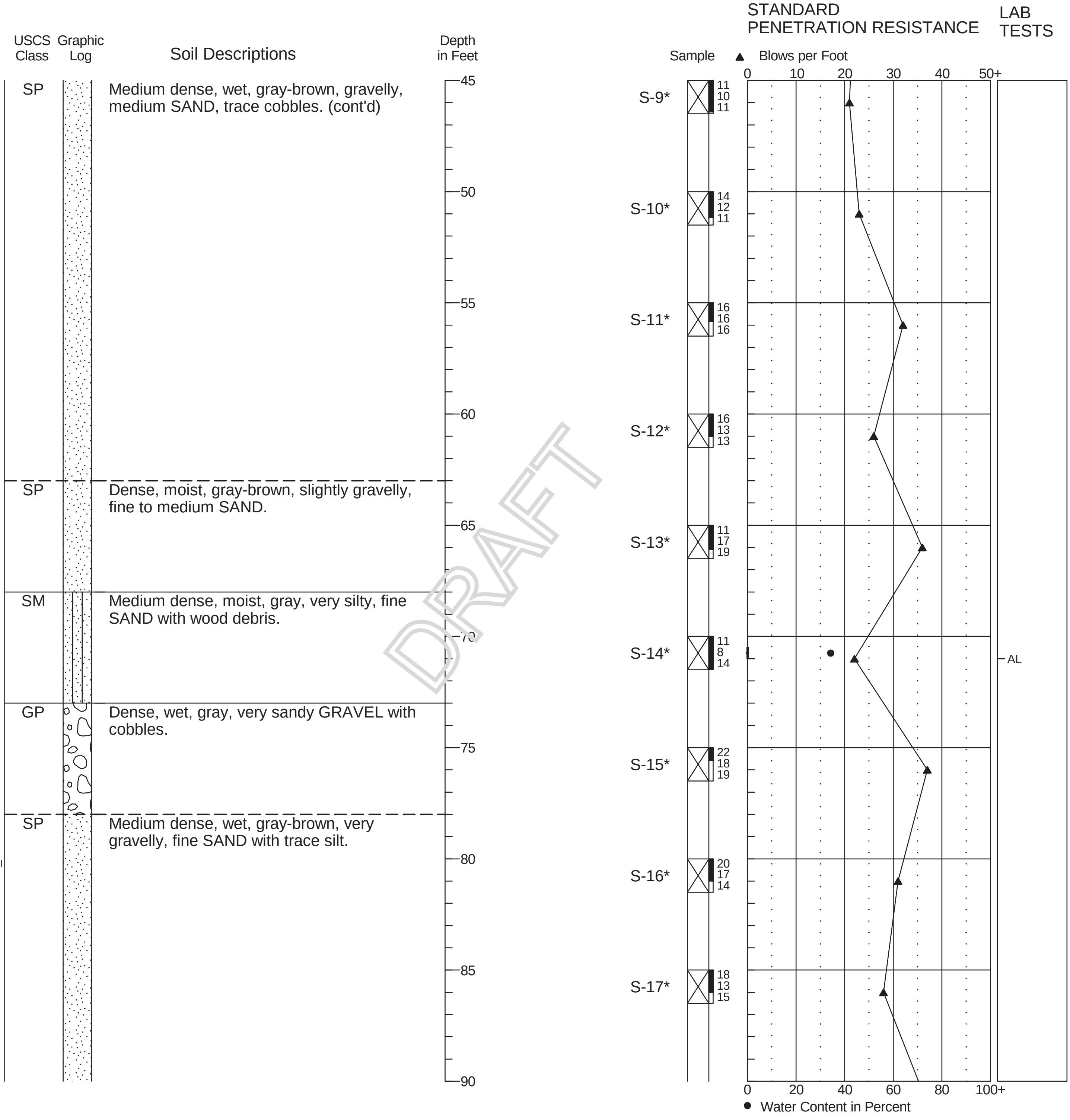
19081-00 *1/15*

Figure A-10

Boring Log G10

Location: N 2786539.2333 E 2376605.9071
Approximate Ground Surface Elevation: 30.0 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



USCS Class	Soil Descriptions
SP	Medium dense, wet, gray-brown, gravelly, medium SAND, trace cobbles. (cont'd)
SP	Dense, moist, gray-brown, slightly gravelly, fine to medium SAND.
SM	Medium dense, moist, gray, very silty, fine SAND with wood debris.
GP	Dense, wet, gray, very sandy GRAVEL with cobbles.
SP	Medium dense, wet, gray-brown, very gravelly, fine SAND with trace silt.

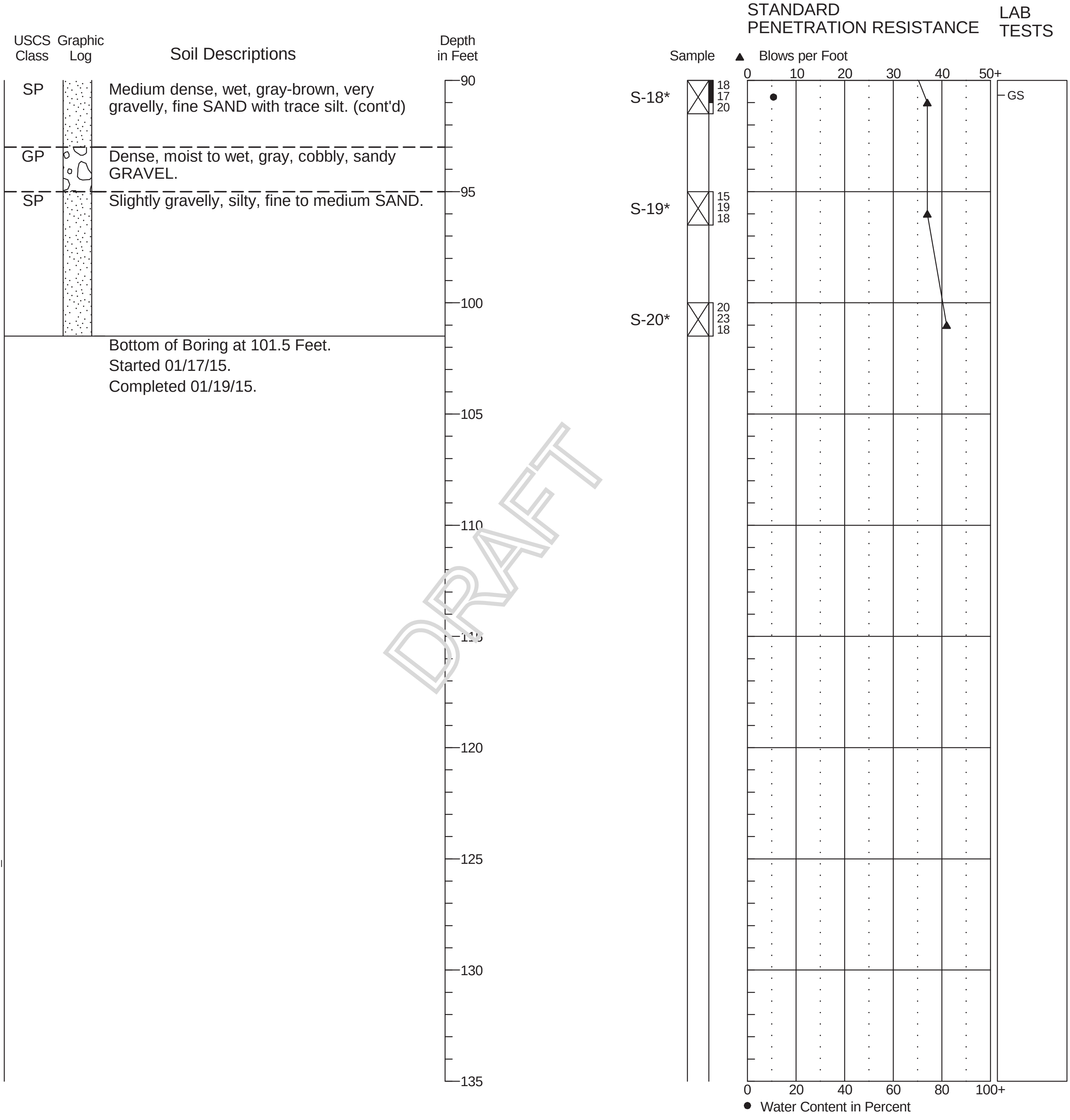
Sample	Blows
S-9*	11 10 11
S-10*	14 12 11
S-11*	16 16 16
S-12*	16 13 13
S-13*	11 17 19
S-14*	11 8 14
S-15*	22 18 19
S-16*	20 17 14
S-17*	18 13 15

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

Boring Log G10

Location: N 2786539.2333 E 2376605.9071
Approximate Ground Surface Elevation: 30.0 Feet
Horizontal Datum: Alaska State Plane Zone 1, NAD83, US Feet
Vertical Datum:

Drill Equipment: Mobil B-59/Mud Rotary
Hammer Type: SPT w/140 lb. Autohammer
Hole Diameter: 5 inches
Logged By: A. Wade   Reviewed By: N. Campbell



Medium dense, wet, gray-brown, very gravelly, fine SAND with trace silt. (cont'd)

Dense, moist to wet, gray, cobbly, sandy GRAVEL.

Slightly gravelly, silty, fine to medium SAND.

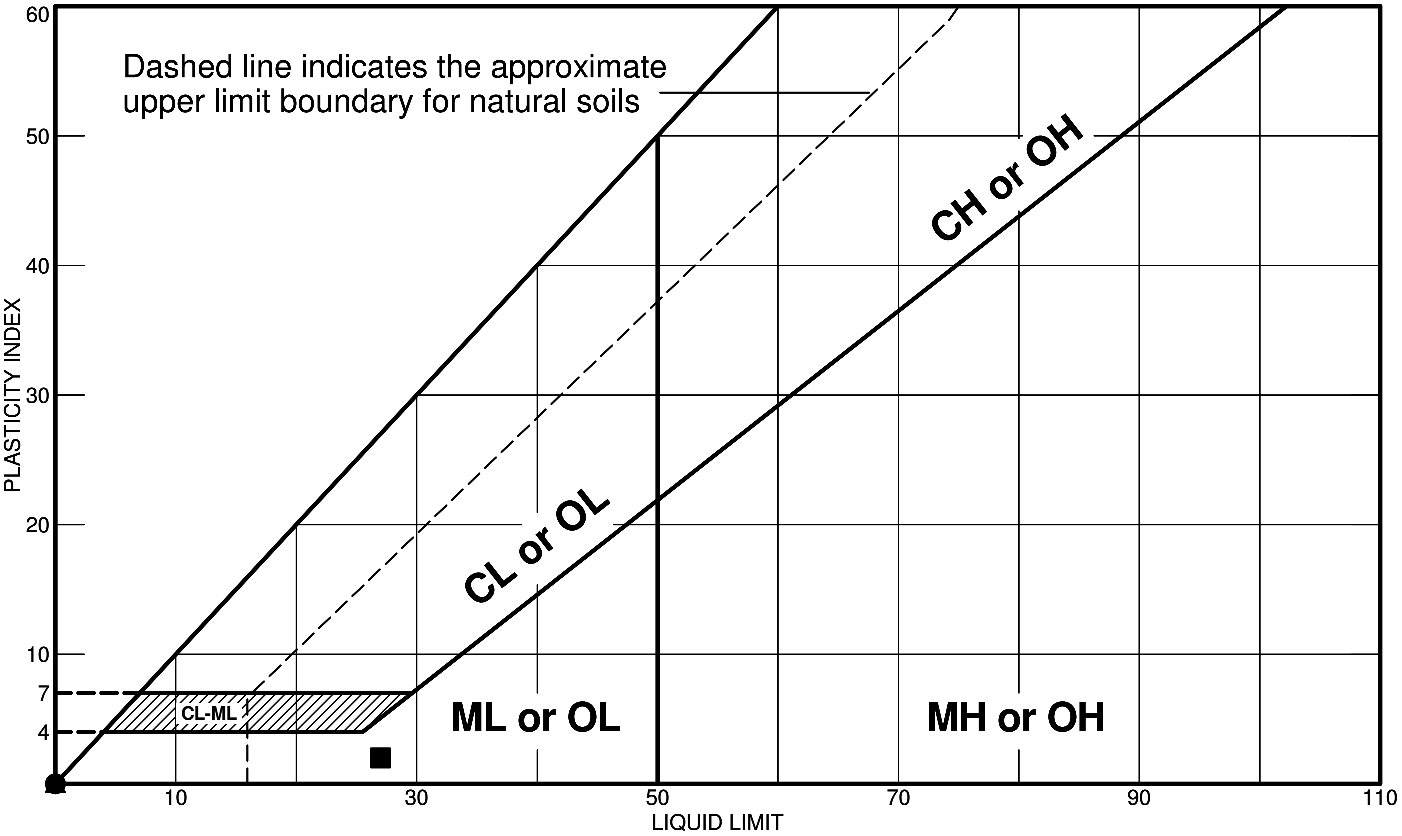
Bottom of Boring at 101.5 Feet.
Started 01/17/15.
Completed 01/19/15.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. * Samples taken with 2.5" I.D. 3" O.D. Dames & Moore Sampler with 140 lb. SPT hammer and 30" drop height. Blow counts shown have been converted to SPT equivalent values.

ATTACHMENT 2

Historic Lab Data

Liquid and Plastic Limits Test Report



Location + Description	LL	PL	PI	-200	USCS
● Source: G07 Sample No.: S-11 Depth: 52.5	NP	NP	NP		SM
■ Source: G08 Sample No.: S-9 Depth: 45 sandy SILT	27	25	2		ML
▲ Source: G10 Sample No.: S-14* Depth: 70	NP	NP	NP		SM

Remarks:

●

■

▲

Project: Gateway Project - Skagway AK

Client:

Location:

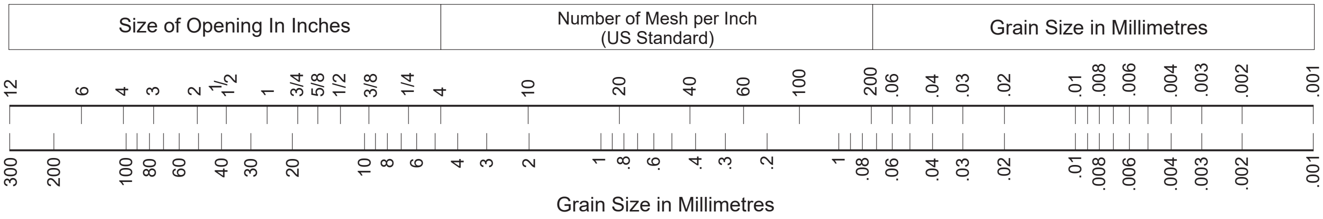
HARTCROWSER

19081-00 *1/15*

Figure B- 8

ATTERBERG LIMITS 1908100-BL.GPJ HC_CORP.GDT 4/3/15

Unified Soil Classification (USC) System
Soil Grain Size



COBBLES	GRAVEL	SAND	SILT and CLAY
Coarse-Grained Soils			Fine-Grained Soils

Coarse-Grained Soils

G W	**G P**	**G M**	**G C**	**S W**	**S P**	**S M**	**S C**
Clean GRAVEL <5% fines	*	GRAVEL with >12% fines		Clean SAND <5% fines	*	SAND with >12% fines	
GRAVEL >50% coarse fraction larger than No. 4				SAND >50% coarse fraction smaller than No. 4			
Coarse-Grained Soils >50% larger than No. 200 sieve							

G W and S W $\left(\frac{D_{60}}{D_{10}}\right)$ >4 for G W, >6 for S W & $1 \leq \left(\frac{(D_{30})^2}{D_{10} \times D_{60}}\right) \leq 3$

G P and S P Clean GRAVEL or SAND not meeting requirements for G W and S W

G M and S M Atterberg limits below A line with PI <4

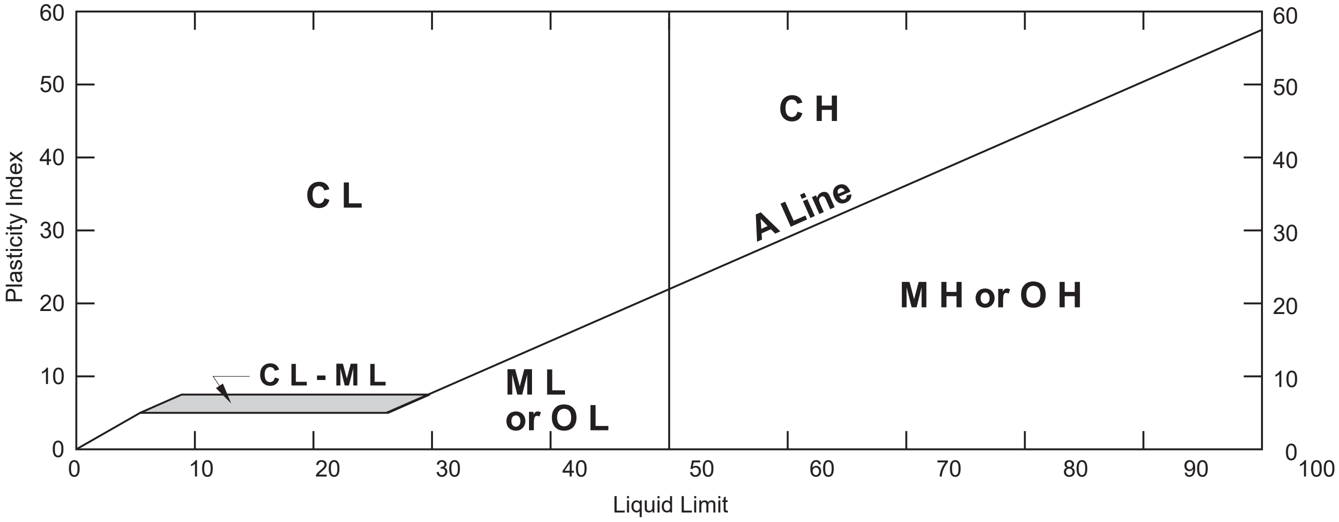
G C and S C Atterberg limits above A Line with PI >7

* Coarse-grained soils with percentage of fines between 5 and 12 are considered borderline cases requiring use of dual symbols.

D_{10}, D_{30}, and D_{60} are the particles diameter of which 10, 30, and 60 percent, respectively, of the soil weight are finer.

Fine-Grained Soils

M L	**C L**	**O L**	**M H**	**C H**	**O H**	**Pt**
SILT	CLAY	Organic	SILT	CLAY	Organic	Highly Organic Soils
Soils with Liquid Limit <50%			Soils with Liquid Limit >50%			
Fine-Grained Soils >50% smaller than No. 200 sieve						

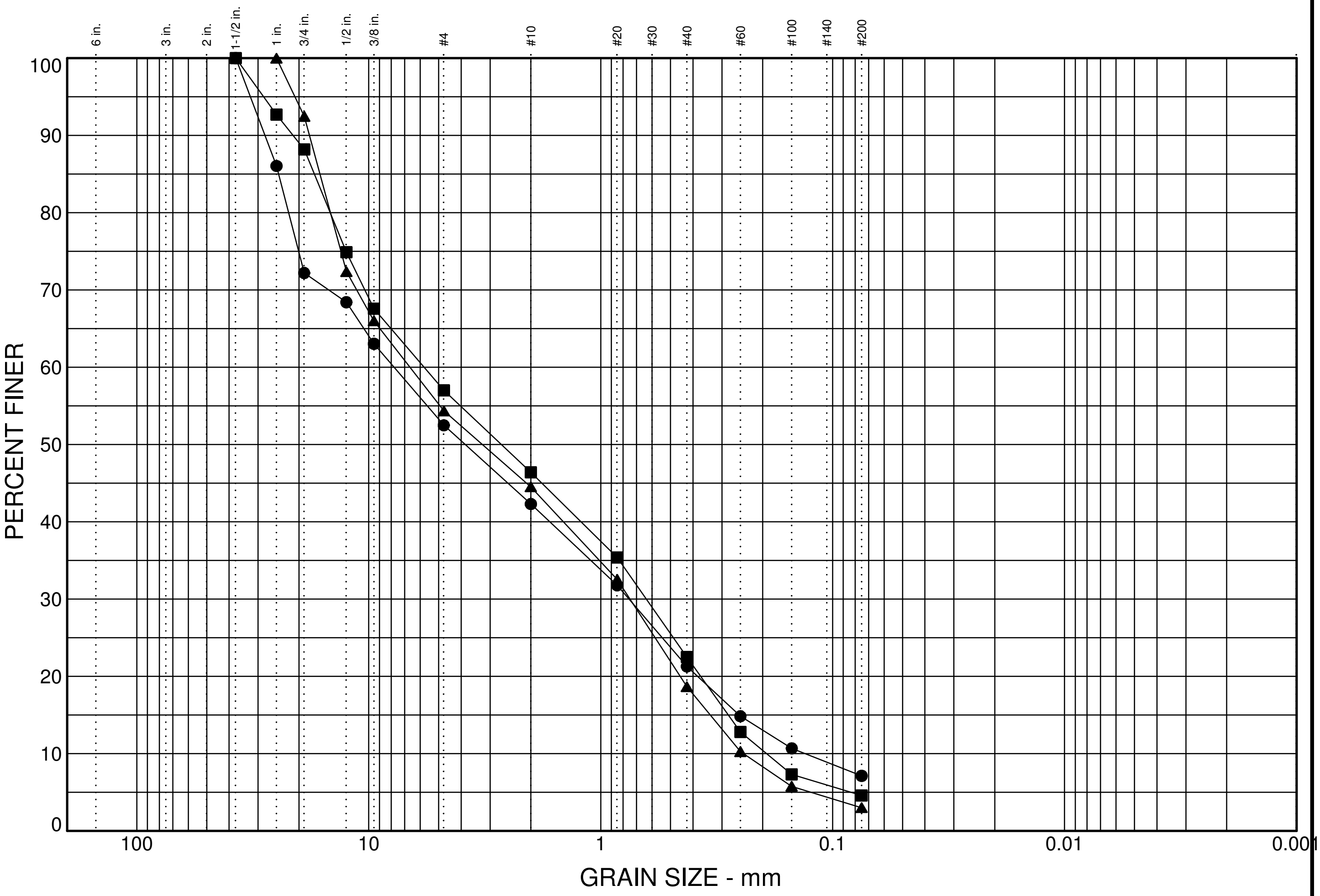


HARTCROWSER

SRF Grain Size (B-1).cdr 3/06

19081-00 1/15
Figure B-1

Particle Size Distribution Test Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	47.5	45.4	7.1	
■	0.0	43.0	52.4	4.6	
▲	0.0	45.6	51.3	3.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			24.485	7.781	3.845	0.755	0.253	0.131	0.56	59.24
■			17.179	5.78	2.683	0.636	0.282	0.193	0.36	29.98
▲			16.259	6.647	3.238	0.749	0.337	0.242	0.35	27.42

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
● slightly silty, very sandy GRAVEL	GP-GM	10.2%
■ very gravelly SAND, trace silt	SP	11.1%
▲ very gravelly SAND, trace silt	SP	10.0%

Remarks:
●

■

▲

Project: Gateway Project - Skagway AK

Client:

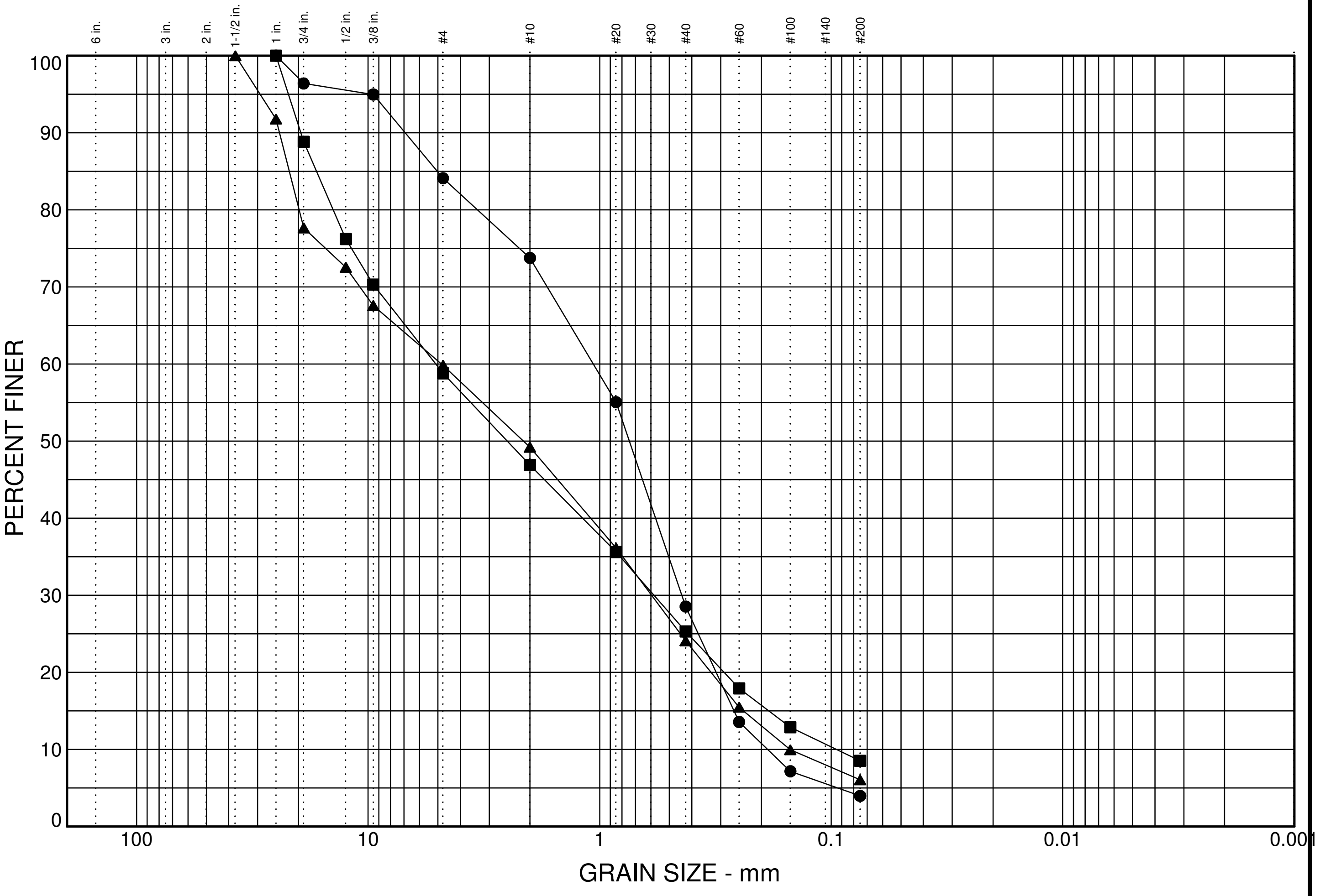
● Source: G01	Sample No.: S-7	Depth: 30.0 to 31.5
■ Source: G01	Sample No.: S-19*	Depth: 90.0 to 91.5
▲ Source: G02	Sample No.: S-2*	Depth: 14.0 to 15.5

HARTCROWSER

19081-00 1/15

Figure B-2

Particle Size Distribution Test Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	15.9	80.1	4.0	
■	0.0	41.2	50.3	8.5	
▲	0.0	40.2	53.8	6.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			5.026	1.066	0.745	0.442	0.263	0.188	0.97	5.67
■			16.735	5.105	2.504	0.583	0.186	0.095	0.70	53.96
▲			21.915	4.827	2.133	0.597	0.239	0.151	0.49	32.04

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
● gravelly SAND, trace silt	SP	15.4%
■ slightly silty, very gravelly SAND	SP-SM	13.6%
▲ slightly silty, very gravelly SAND	SP-SM	11.3%

Remarks:
●

■

▲

Project: Gateway Project - Skagway AK

Client:

● Source: G02	Sample No.: S-10*	Depth: 54.0 to 55.5
■ Source: G03	Sample No.: S-4	Depth: 20.5 to 22.0
▲ Source: G03	Sample No.: S-16	Depth: 80.5 to 82.0

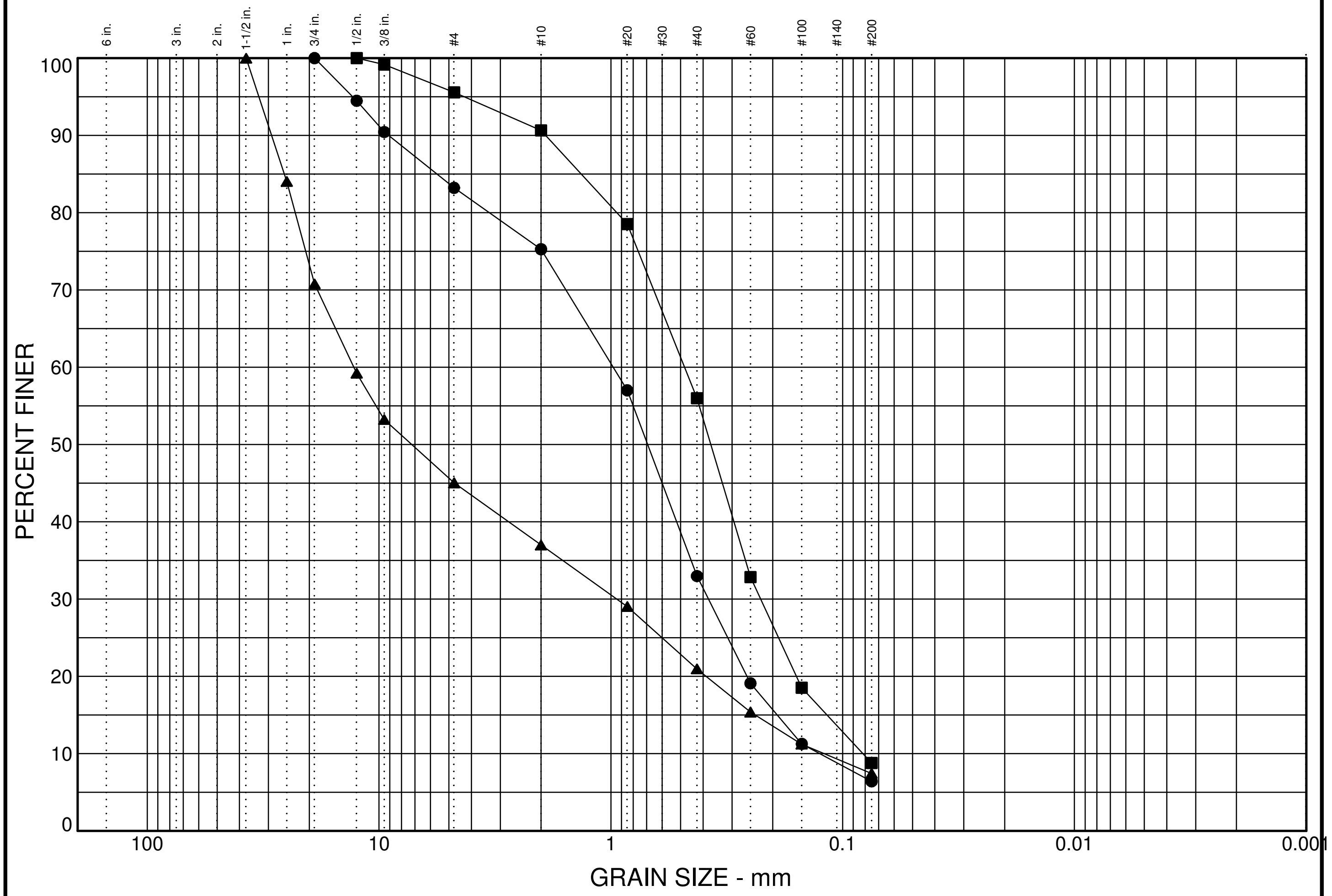
HARTCROWSER

19081-00 *1/15*

Figure B-3

GRAIN SIZE 1908100-BL.GPJ HC_CORP.GDT 4/3/15

Particle Size Distribution Test Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	16.8	76.8	6.4	
■	0.0	4.4	86.7	8.8	
▲	0.0	55.0	37.6	7.4	

☒	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			5.635	0.977	0.694	0.379	0.191	0.125	1.18	7.82
■			1.342	0.481	0.37	0.226	0.117	0.082	1.30	5.89
▲			25.625	12.856	7.223	0.942	0.238	0.12	0.58	107.37

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
● slightly silty, gravelly SAND	SW-SM	15.1%
■ slightly silty SAND, trace gravel	SP-SM	20.1%
▲ slightly silty, very sandy GRAVEL	GP-GM	8.9%

Remarks:

●

■

▲

Project: Gateway Project - Skagway AK

Client:

● Source: G04	Sample No.: S-13	Depth: 60.0 to 61.5
■ Source: G04	Sample No.: S-21	Depth: 100.0 to 101.5
▲ Source: G05	Sample No.: S-3	Depth: 12.5 to 14.0

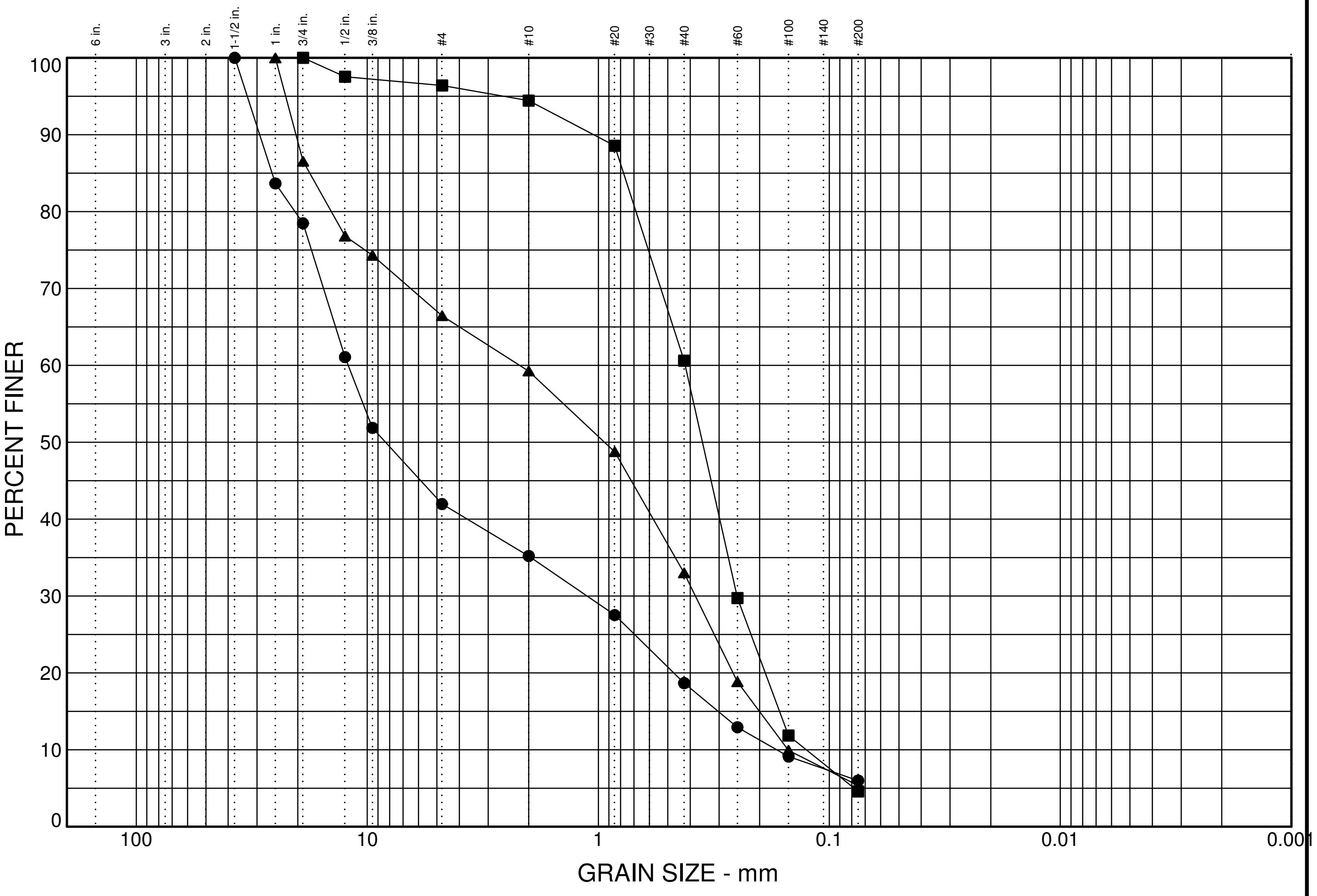
HARTCROWSER

19081-00 *1/15*

Figure B-4

GRAIN SIZE 1908100-BL.GPJ HC_CORP.GDT 4/3/15

Particle Size Distribution Test Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	58.0	36.0	6.0	
■	0.0	3.6	91.8	4.6	
▲	0.0	33.5	61.1	5.3	

☒	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			25.843	12.103	8.332	1.119	0.303	0.168	0.61	71.86
■			0.778	0.421	0.354	0.251	0.164	0.126	1.19	3.35
▲			17.778	2.186	0.94	0.38	0.2	0.15	0.44	14.53

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
● slightly silty, very sandy GRAVEL	GP-GM	9.3%
■ SAND, trace silt and gravel	SP	20.7%
▲ slightly silty, very gravelly SAND	SP-SM	11.0%

Remarks:

●

■

▲

Project: Gateway Project - Skagway AK

Client:

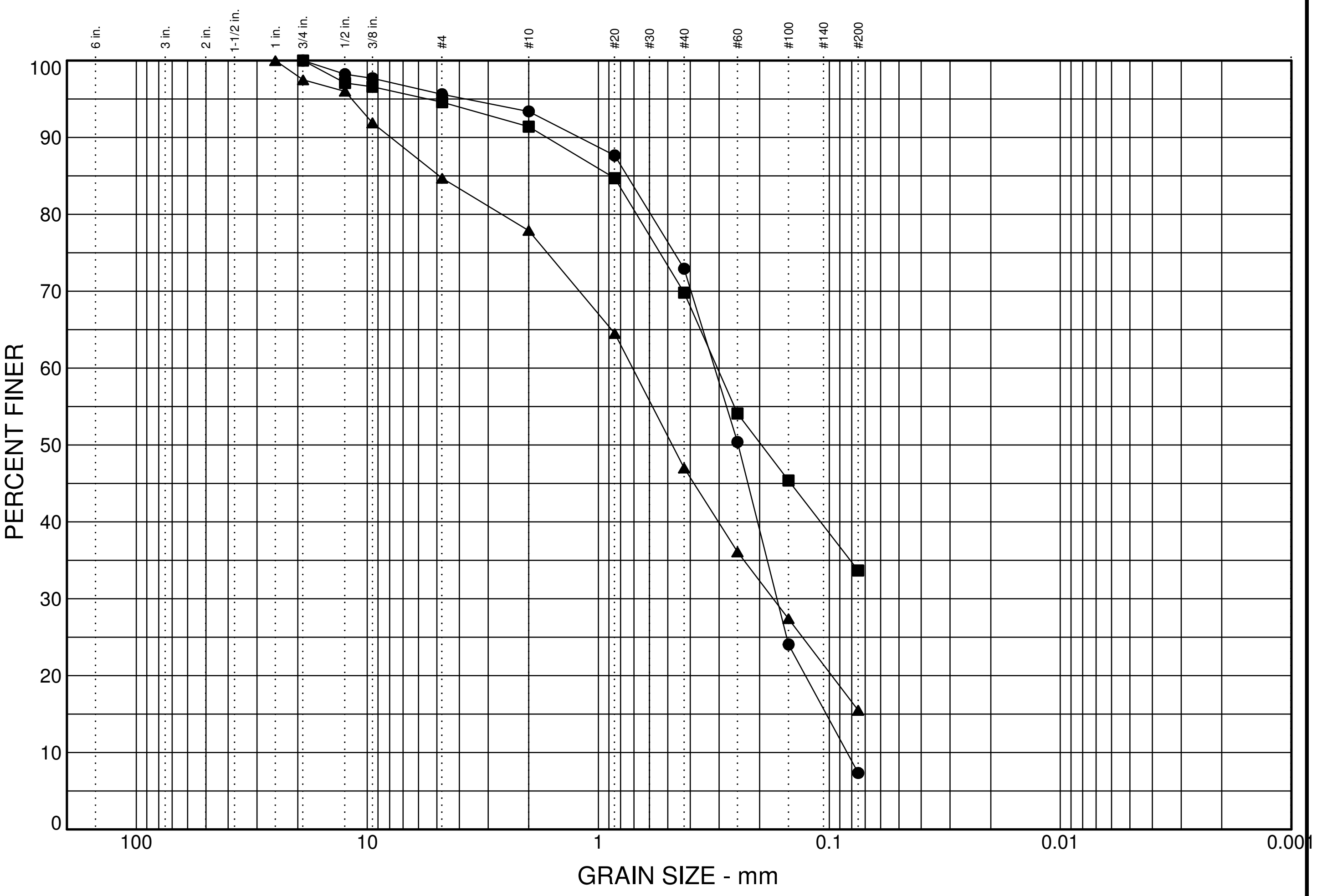
● Source: G05	Sample No.: S-19	Depth: 92.5 to 94.0
■ Source: G06	Sample No.: S-6*	Depth: 30.0 to 31.5
▲ Source: G06	Sample No.: S-15*	Depth: 100.0 to 101.5

HARTCROWSER

19081-00 *1/15*

Figure B-5

Particle Size Distribution Test Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	4.4	88.3	7.3	
■	0.0	5.4	60.9	33.7	
▲	0.0	15.3	69.2	15.5	

☒	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.75	0.313	0.248	0.168	0.103	0.084	1.08	3.74
■			0.883	0.305	0.197					
▲			4.889	0.711	0.479	0.175				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
● slightly silty SAND, trace gravel	SP-SM	15.7%
■ slightly gravelly, very silty SAND	SM	21.6%
▲ gravelly silty SAND	SM	18.4%

Remarks:

●

■

▲

Project: Gateway Project - Skagway AK

Client:

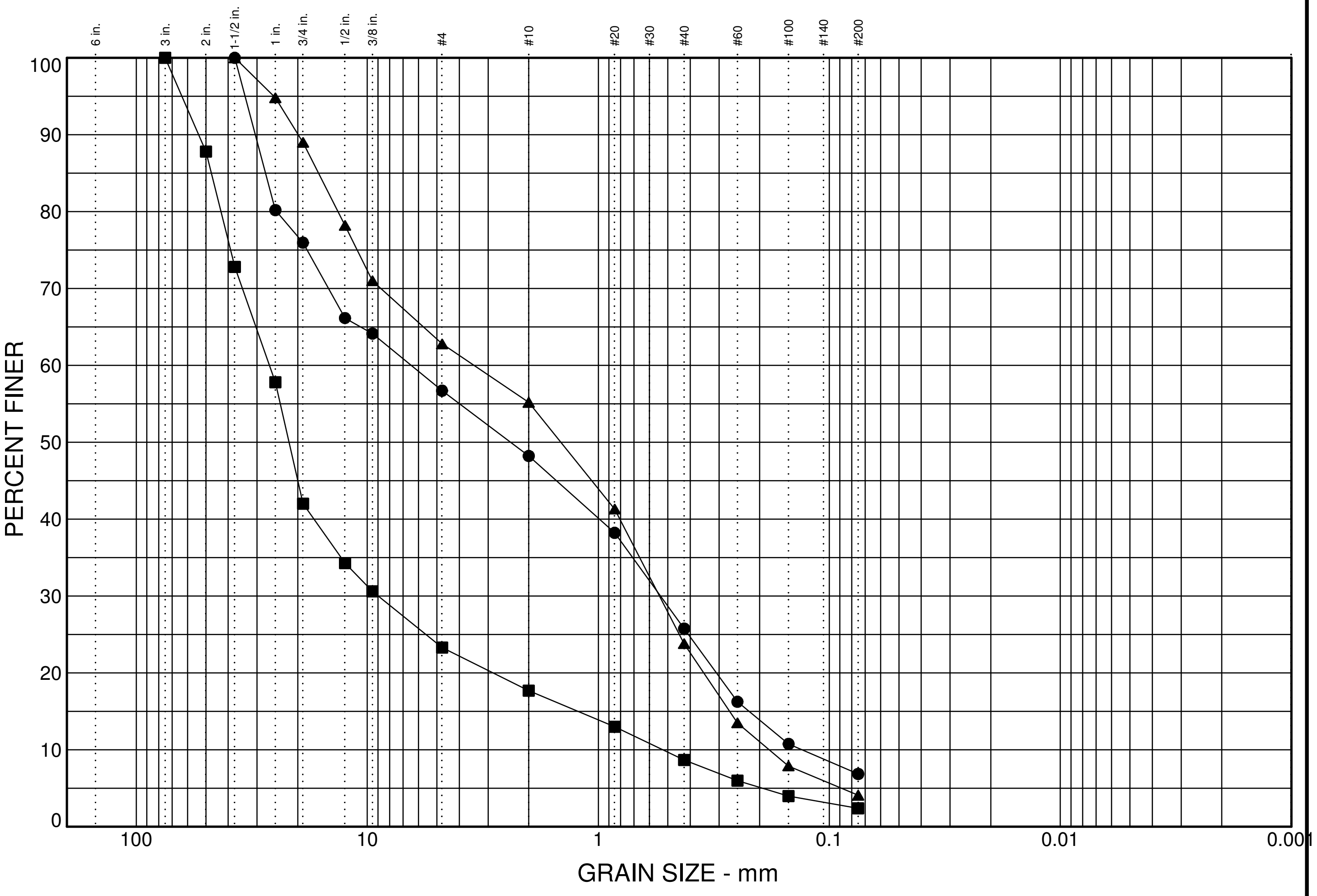
● Source: G07 Sample No.: S-4* Depth: 17.5 to 19.0
■ Source: G07 Sample No.: S-20 Depth: 98.5 to 100.0
▲ Source: G08 Sample No.: S-7 Depth: 35.0 to 36.5

HARTCROWSER

19081-00 *1/15*

Figure B-6

Particle Size Distribution Test Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	43.3	49.8	6.9	
■	0.0	76.7	20.9	2.4	
▲	0.0	37.2	58.7	4.1	

☒	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			27.583	6.455	2.397	0.538	0.223	0.131	0.34	49.32
■			47.386	26.532	21.832	8.974	1.223	0.524	5.79	50.63
▲			16.271	3.454	1.452	0.543	0.27	0.182	0.47	19.01

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
● slightly silty, very gravelly SAND	SP-SM	11.5%
■ sandy GRAVEL, trace silt	GP	4.5%
▲ very gravelly SAND, trace silt	SP	10.7%

Remarks:

●

■

▲

Project: Gateway Project - Skagway AK

Client:

● Source: G08	Sample No.: S-18	Depth: 90.0 to 91.5
■ Source: G10	Sample No.: S-6*	Depth: 30.0 to 31.5
▲ Source: G10	Sample No.: S-18*	Depth: 90.0 to 91.5

HARTCROWSER

19081-00 *1/15*

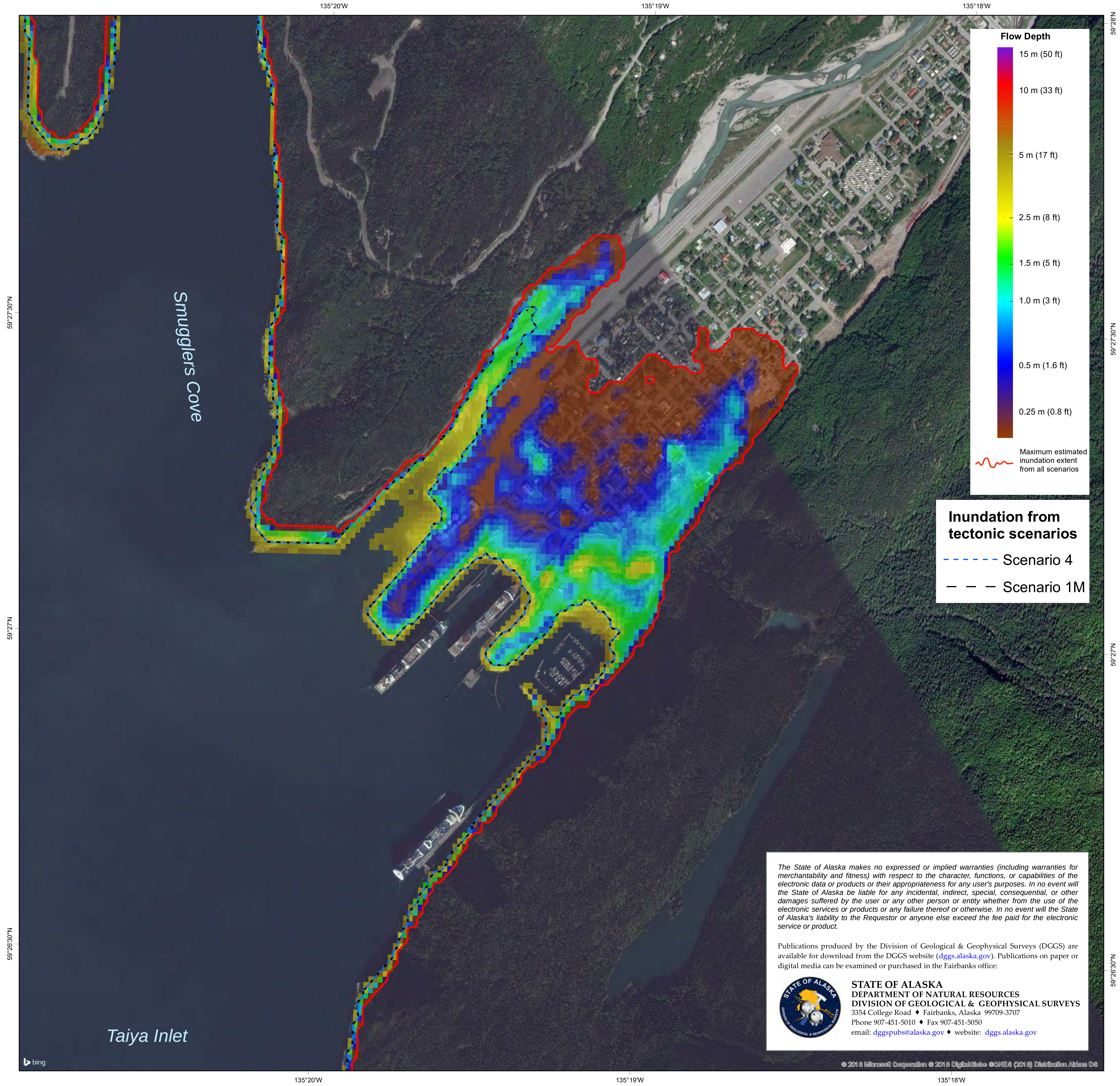
Figure B-7

ATTACHMENT 3

Geophysical Data

**ALASKA DIVISION OF GEOLOGICAL &
GEOPHYSICAL SURVEYS**

**REPORT OF INVESTIGATION 2018-2
Nicolsky and others, 2018
SHEET 1 OF 3**
Explanatory text accompanies map



Publications produced by the Division of Geological & Geophysical Surveys (DGGS) are available for download from the DGGS website (dggs.alaska.gov). Publications on paper or digital media can be examined or purchased in the Fairbanks office:

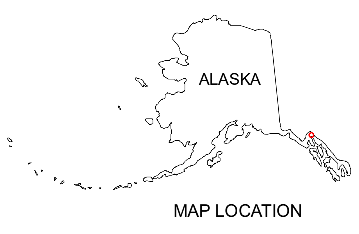
**STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS**
3354 College Road ♦ Fairbanks, Alaska 99709-3707
Phone 907-451-5010 ♦ Fax 907-451-5050
email: dggspubs@alaska.gov ♦ website: dggs.alaska.gov

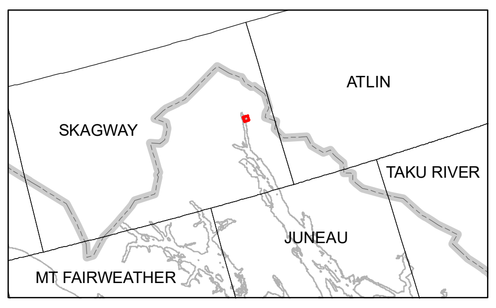
MAXIMUM ESTIMATED TSUNAMI INUNDATION FROM TECTONIC AND LANDSLIDE SOURCES, SKAGWAY, ALASKA

by

D.J. Nicolsky[1], E.N. Suleimani[1], and J.B. Salisbury[2]

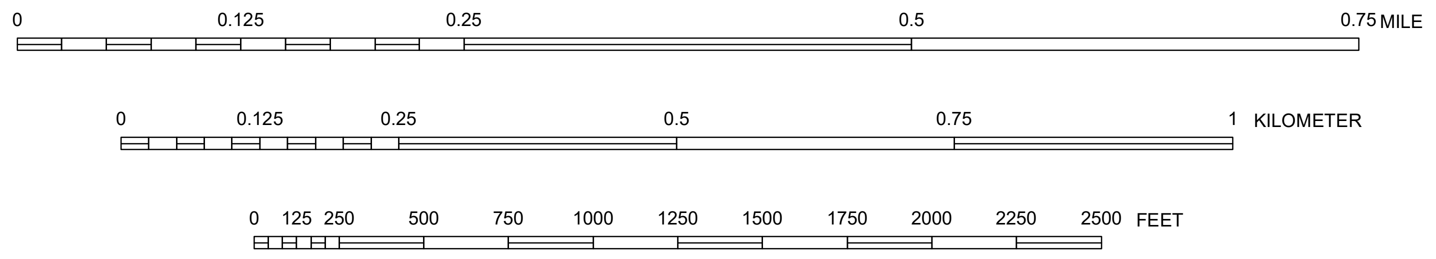
2018





Location of Map Area

SCALE 1:6800



N

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[2] Alaska Division of Geological & Geophysical Surveys, 3354 College Road,
Fairbanks, AK 99709-3707

Base map from:
Bing maps, DigitalGlobe 2017
Projection:
Alaska State Plane Zone 1 (Feet)
Datum:
North American Datum of 1983
Cartography by:
L. Gardine[1] (2018)
Cartographic review by:
P.E. Gallagher[2] (2018)
Peer review by:
De Anne S.P. Stevens[2] (2018)

Appendix E – Skagway Cruise Ship Dock Float Motions and Pile Loads prepared by Glosten

SKAGWAY CRUISE SHIP DOCK

Float Motions and Pile Loads

PREPARED FOR:
KPFF
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References

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2. *Skagway Ore Dock, Skagway, AK, Pontoon Layout*, Transpac, Drawing No. 18_141_A, Preliminary, 4 January 2022.
3. Pile Stiffness Tables, KPFF, OPT 1-Guide Pile Stiffness 1-20-2022.xlsx, 20 January 2022.
4. *ACES* [software], VeriTech Inc. v4.01, 2019.
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6. *Ore Dock Improvements, Skagway, Alaska*, *Option 1, 50' × 175' Concrete Float Plan,* KPFF, Drawing No. FL1.1, 17 January 2019.
7. 42-inch Pile Stiffness Tables, KPFF, OPT 1-Guide Pile Stiffness_Concrete Float 42inch Pile 2-22-2022.xlsx, 22 February 2022.
8. 36-inch Pile Stiffness Tables, KPFF, OPT 1-Guide Pile Stiffness_Steel Float 36inch Pile 2-22-2022.xlsx, 22 February 2022.

Introduction

A new cruise ship dock is being constructed in Skagway, AK at the location of an unused ore dock. Float designs are being considered to replace the old dock, including a concrete pontoon and a tubular steel dock. The location of the dock has a shallow depth; therefore, float draft and vertical motions are important considerations for float design. The purpose of this study was to analyze two floating dock designs to determine their expected motions and pile loads to assist with design selection. Figure 1 shows layout of the existing ore dock's orientation relative to true north.

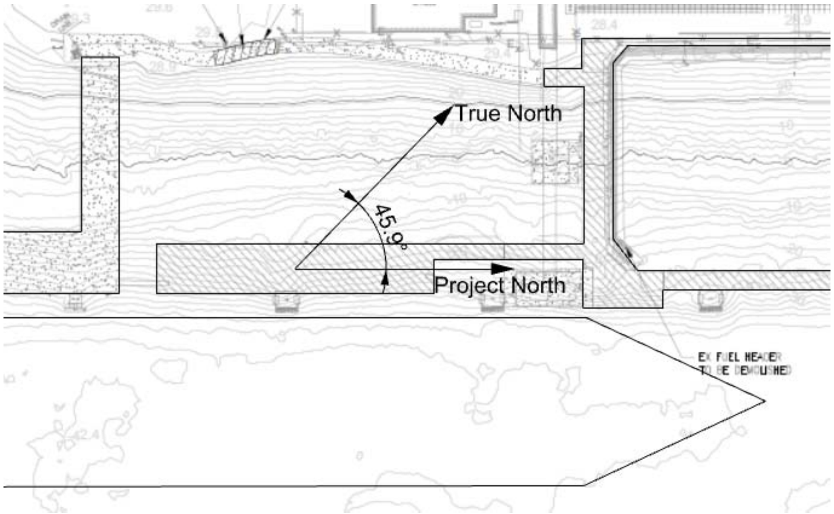


Figure 1 Existing ore dock

Float Options

Two float options were considered, a rectangular concrete pontoon and a steel Transpac float. The particulars of each of the floats are given in Table 1.

Table 1 Float particulars

Float Option	Construction	Length (ft)	Breadth (ft)	Draft (ft)	Displacement (LT)
Option 1	Concrete	250	50	9.56	3400
Option 2	Steel	250	50	4.95	720

Option 1

Option 1 is a 250ft×50ft concrete float. The float's geometry, mass, and inertia characteristics were taken from Reference 1.

Option 2

Option 2 is a Transpac designed steel float made up of six cylindrical pontoons arranged as shown in Figure 2 (Reference 2). The float's mass and inertia characteristics were taken from centers of gravity provided in Reference 1.

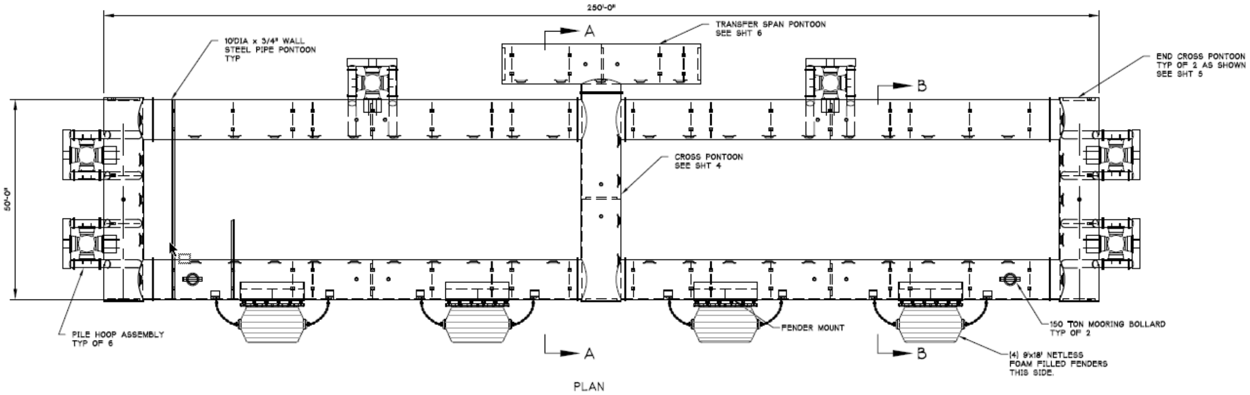


Figure 2 Option 2 steel float plan view

Pile Configurations

The pile configuration used for Option 1 is shown in Figure 3, and the pile locations for Option 2 are shown in Figure 4.

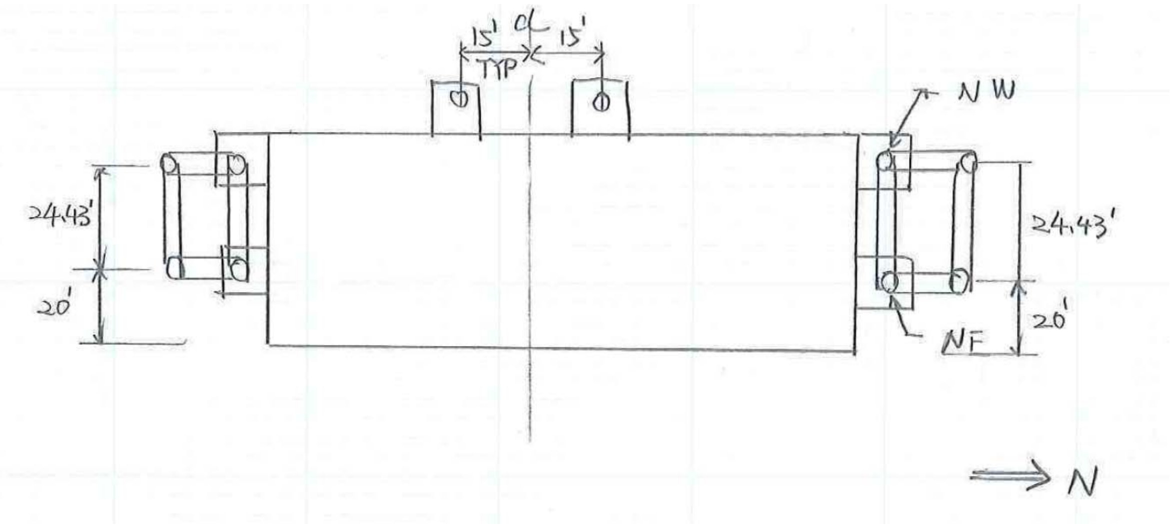


Figure 3 Pile locations for Option 1 float

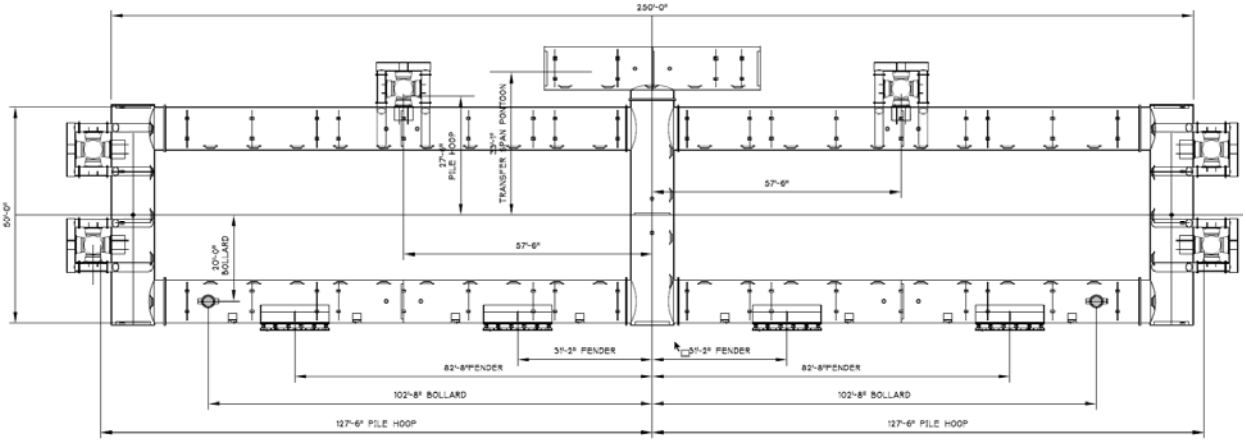


Figure 4 Pile locations for Option 2 float

Pile stiffnesses were assumed to be the same between float designs, corresponding to 48” piles (Reference 3). After consideration of initial pile loads, additional cases with updated pile stiffnesses were simulated. The stiffnesses for these cases corresponded to 42" piles for the Option 1 float (Reference 7) and 36" piles for the Option 2 float (Reference 8).

Wind and Wave Climatology

Wind Speed

A 45-year record of wind speeds at Skagway airport was analyzed to estimate extreme wind speeds from the south in 50-year return period and 100-year return period storms. Northerly winds are not of interest at the site because they do not generate limiting wave heights at the berth. Annual maximum wind speeds, for a directional sector from 170°N to 255°N, were derived from the site data assuming that these directions provide the dominant fetch-based wave direction. The available wind data are sampled at one-hour intervals, so the samples measured are taken as estimates of the one-hour average wind speed.

The annual data were fitted to a Fischer-Tippet Type I extremal probability distribution. To improve the fit to the upper end of the wind speed range annual maxima below 28 knots were eliminated from the fitted data points.

Extreme one-hour wind speeds in the 50-year and 100-year return period storms were computed from the fits to the Skagway Airport data.

Wave Height

Wave heights for 50-year and 100-year return period storms were computed by the 1D wave generation model in ACES (Reference 4) which computes fetch-limited wave conditions. Winds are assumed to blow at a constant speed over a straight-line fetch direction toward the site. Wave heights increase with time until the energy input from the wind balances the dissipation due to white-capping and other dissipative effects. The maximum computed wave height is used as the characteristic wave height for the specified wind speed. ACES requires, as inputs, the measured wind speed, the averaging time of the measured wind speed, the height of the anemometer, and the temperature difference between the air and water. From these parameters it computes the equivalent wind speed at a standard 10m height, which is used in its wave generation algorithm.

The fetch lengths at the Skagway ore dock are shown in Figure 5.

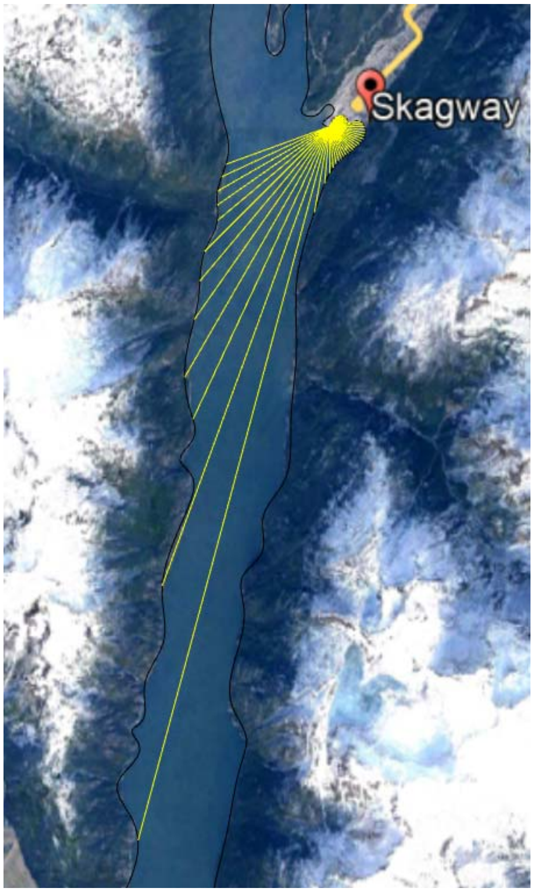


Figure 5 Fetch radials from Skagway ore dock

As shown in Figure 5, Taiya Inlet is long and narrow, with a limited range of wind headings with long fetches. For conservatism, it is assumed that the extreme southerly winds in the 170°N - 255°N sector blow along the longest-fetch direction, 195°N. In sites with rapidly varying fetch lengths, such as Skagway, ACES implements energy-averaging algorithms to find the effective fetch length in the along-wind direction, from the input fetch lengths.

The 50-year and 100-year return period wind speeds and wave heights found are summarized in Table 2. Float motions were analyzed for waves with the given modal periods as well as periods ±0.5 seconds to capture motions experienced for a range of periods.

Table 2 50-YRP and 100-YRP wind speeds and wave heights at Skagway ore dock

	50-YRP	100-YRP
One-hour average wind speed (kts)	59.61	63.76
ACES significant wave height (ft)	6.89	7.49
ACES wave modal period (sec)	4.98	5.09

Methodology

Float motions and pile loads were computed using the 3D radiation-diffraction code WAMIT (Reference 5). In a WAMIT model the underwater surface of a floating body is represented by a mesh of quadrilateral panels, at which fluid flow equations are solved to compute velocities and pressures arising in response to incoming wave excitation and body acceleration. Pressures are integrated over the underwater hull surface to compute wave excitation forces, hydrodynamic added mass, and wave radiation damping.

The meshes representing the Option 1 and 2 floats are shown in Figure 6 and Figure 7, respectively.

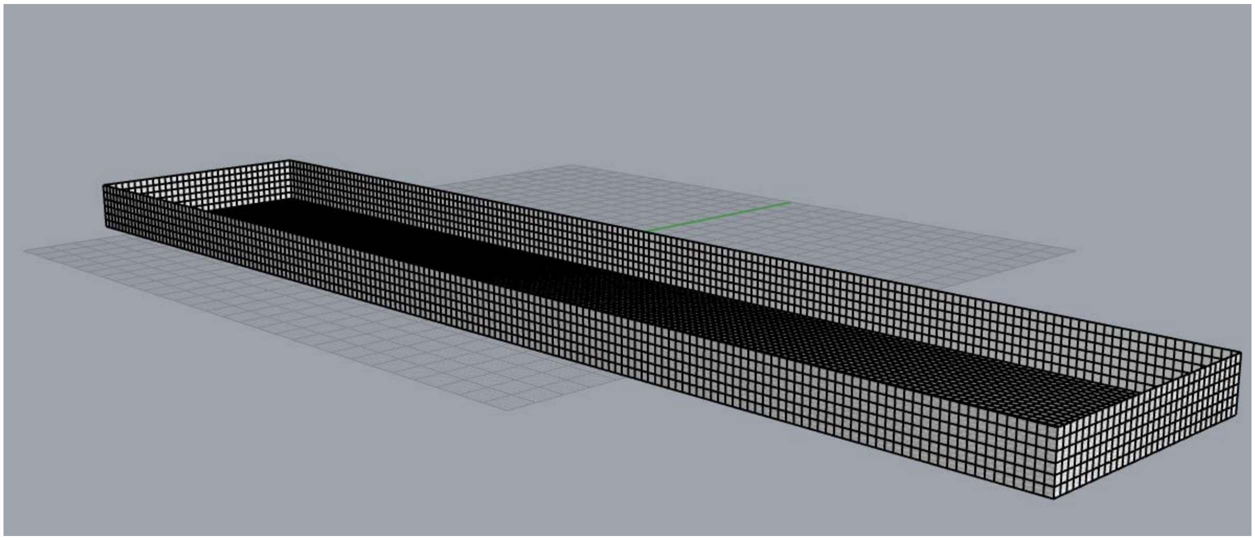


Figure 6 Option 1 WAMIT mesh

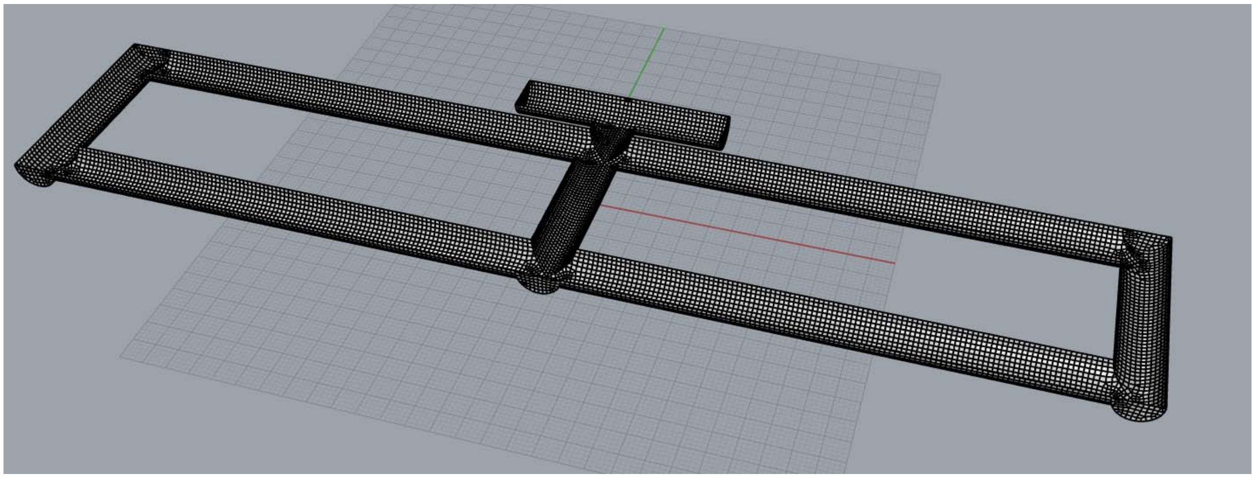


Figure 7 Option 2 WAMIT mesh

A long-crested, irregular JONSWAP wave spectrum is assumed for the analysis. The wave spectrum is represented as a series of superimposed regular waves at a range of frequencies spanning the energy content of the spectrum. At each frequency the wave amplitude is fixed by the spectral energy at that frequency, and the phase is assumed to be random.

At each frequency the rigid-body motion responses of the float are computed from the 6-DOF equations of motion.

To compute the extreme response in one hour, with 10% probability of exceedance, the exposure time $T_{exposure}$ is ten hours, which gives approximately 10,000 response cycles in the 50-year and 100-year return period storms.

Motions were calculated for wave headings ±40° from 0° which coincides with “project north” as given in Reference 6, 45.9° clockwise from true north.

Pile motions were multiplied by maximum pile stiffness values to determine pile loads in the longitudinal and transverse directions. It was assumed that pile stiffnesses are constant. As shown in Reference 3, pile stiffnesses are inversely related to pile deflection. However, due to the relatively low deflections, less than 0.7 ft in either direction, pile reactions are assumed to be their maximum.

Float motions and pile stiffnesses were calculated at mean higher high water (MHHW) and mean lower low water (MLLW). The values presented in the tables below are the maximum values occurring between MHHW and MLLW.

The WAMIT analysis performed is linear, meaning the geometry above the waterline is not modeled and the waterline shape is assumed constant as the free surface varies. This assumption is valid for small motions. As a float responds to waves in extreme conditions, there are changes in its submerged geometry that impact its behavior nonlinearly. This type of behavior is most apparent for roll and pitch where geometry changes are largest for small motions. WAMIT does not compute the nonlinear effects of the geometry above the free surface. Some wave overtopping is expected during extreme wave events, and these events are not captured by the model. These effects have a greater effect on the steel float due to the complexity of its shape and the free surface between pontoons beneath the float deck. The analysis does not account for wave loading on the cross-deck structure of the steel float.

Float Motions

Figure 8 presents the float axes used to define motions. The +X axis is aligned with project north.

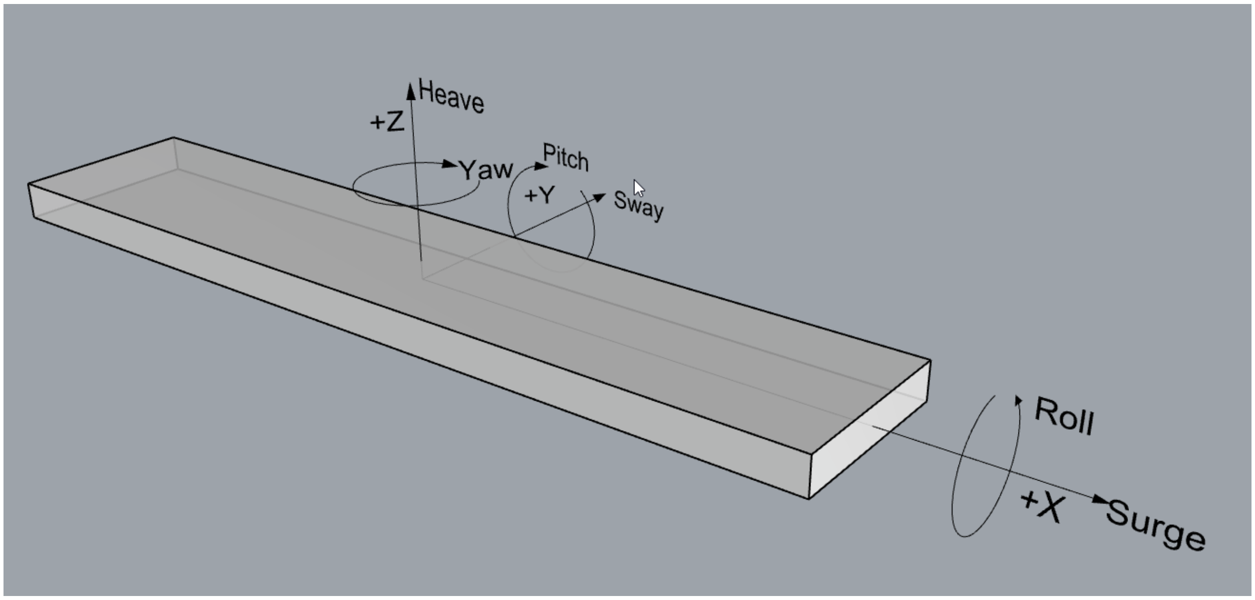


Figure 8 Float axis definitions and naming conventions

Table 3 summarizes the maximum motions of each float under 50-YRP and 100-YRP waves.

Table 3 Summary of maximum float motions

Motion	Concrete 48" Piles		Concrete 42" Piles		Steel 48" Piles		Steel 36" Piles	
	50-YRP	100- YRP	50-YRP	100-YRP	50-YRP	100-YRP	50-YRP	100-YRP
Surge (ft)	0.38	0.44	0.64	0.68	0.09	0.10	0.18	0.19
Sway (ft)	0.33	0.39	0.27	0.32	0.06	0.07	0.18	0.19
Heave (ft)	0.98	1.10	0.98	1.10	1.41	1.46	1.41	1.46
Roll (deg)	2.43	2.90	1.79	2.14	2.50	2.74	2.50	2.74
Pitch (deg)	2.04	2.42	2.04	2.43	1.13	1.31	1.13	1.31
Yaw (deg)	0.08	0.09	0.13	0.15	0.02	0.02	0.04	0.05

Pile Loads

Table 4 summarizes the maximum pile loads on each of the float options.

Table 4 Summary of maximum pile loads in kips

Pile	Direction	Concrete 48" Piles		Concrete 42" Piles		Steel 48" Piles		Steel 36" Piles	
		50-YRP	100-YRP	50-YRP	100-YRP	50-YRP	100-YRP	50-YRP	100-YRP
NW	+X	148	158	183	195	61	65	37	40
	+Y	157	184	126	145	90	99	47	54
SW	+X	148	158	183	195	61	65	37	40
	+Y	157	184	126	145	101	111	53	61
NE	+X	121	130	150	159	47	50	29	31
	+Y	110	129	86	99	63	69	32	36
SE	+X	121	130	150	159	47	50	29	31
	+Y	103	120	81	93	70	77	36	41
N Mid	+X	100	107	105	112	47	50	22	28
	+Y	75	89	48	57	50	55	24	27
S Mid	+X	86	92	123	130	41	44	26	32
	+Y	67	79	56	66	43	48	27	30

Appendix A Float Motions

Tables 5 through 16 present the motions of the Option 1 float for each wave heading relative to project north. Tables 17 through 28 show the float motions for the Option 2 float by heading.

Option 1 – Concrete Float – 48-inch Piles

Table 5 +X motions (ft) – Option 1 – 48" Piles

Hs (ft)	Tp (ft)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.25	0.25	0.29	0.35	0.38	0.33	0.27	0.23	0.22
	4.98	0.30	0.28	0.30	0.35	0.36	0.33	0.28	0.26	0.29
	5.48	0.38	0.33	0.33	0.35	0.36	0.34	0.31	0.32	0.37
7.49	4.59	0.28	0.28	0.31	0.38	0.41	0.36	0.29	0.25	0.25
	5.09	0.35	0.32	0.34	0.38	0.39	0.36	0.31	0.30	0.33
	5.59	0.44	0.38	0.36	0.38	0.39	0.37	0.35	0.37	0.43

Table 6 +Y motions (ft) – Option 1 – 48" Piles

Hs (ft)	Tp (ft)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.13	0.08	0.08	0.06	0.00	0.06	0.08	0.08	0.13
	4.98	0.22	0.14	0.12	0.10	0.00	0.10	0.12	0.14	0.22
	5.48	0.33	0.21	0.17	0.14	0.00	0.14	0.18	0.21	0.33
7.49	4.59	0.17	0.10	0.09	0.07	0.00	0.07	0.10	0.10	0.17
	5.09	0.27	0.17	0.14	0.11	0.00	0.11	0.14	0.17	0.27
	5.59	0.39	0.26	0.21	0.17	0.00	0.17	0.21	0.26	0.39

Table 7 +Z motions (ft) – Option 1 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.53	0.47	0.43	0.41	0.41	0.41	0.43	0.47	0.53
	4.98	0.81	0.74	0.66	0.61	0.60	0.61	0.66	0.74	0.81
	5.48	0.95	0.98	0.92	0.86	0.84	0.86	0.92	0.98	0.95
7.49	4.59	0.65	0.57	0.52	0.50	0.49	0.50	0.52	0.57	0.65
	5.09	0.93	0.88	0.78	0.72	0.70	0.72	0.78	0.88	0.93
	5.59	1.04	1.10	1.05	1.00	0.97	1.00	1.05	1.10	1.04

Table 8 Roll motions (deg) – Option 1 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.98	0.57	0.53	0.38	0.00	0.38	0.53	0.57	0.98
	4.98	1.70	1.02	0.82	0.62	0.00	0.63	0.82	1.01	1.69
	5.48	2.43	1.54	1.19	0.93	0.00	0.94	1.20	1.54	2.43
7.49	4.59	1.24	0.72	0.63	0.46	0.00	0.47	0.64	0.72	1.23
	5.09	2.01	1.22	0.97	0.74	0.00	0.75	0.97	1.22	2.00
	5.59	2.90	1.84	1.42	1.12	0.00	1.12	1.42	1.84	2.89

Table 9 Pitch motions (deg) – Option 1 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.75	0.58	0.53	0.52	0.52	0.52	0.53	0.58	0.75
	4.98	1.27	0.95	0.86	0.85	0.85	0.85	0.86	0.95	1.27
	5.48	2.03	1.42	1.20	1.17	1.17	1.17	1.20	1.42	2.04
7.49	4.59	0.92	0.72	0.65	0.63	0.63	0.63	0.65	0.72	0.92
	5.09	1.54	1.13	1.02	1.01	1.01	1.01	1.02	1.13	1.54
	5.59	2.42	1.69	1.39	1.34	1.33	1.34	1.39	1.69	2.42

Table 10 Yaw motions (deg) – Option 1 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.08	0.07	0.06	0.06	0.06	0.05	0.04	0.05	0.07
	4.98	0.08	0.07	0.06	0.05	0.05	0.04	0.05	0.06	0.07
	5.48	0.08	0.07	0.06	0.05	0.04	0.03	0.04	0.06	0.08
7.49	4.59	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.06	0.08
	5.09	0.08	0.08	0.07	0.06	0.05	0.04	0.05	0.06	0.08
	5.59	0.09	0.07	0.06	0.05	0.04	0.04	0.05	0.06	0.09

Option 1 – Concrete Float – 42-inch Piles

Table 11 +X motions (ft) – Option 1 – 42" Piles

Hs (ft)	Tp (ft)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.36	0.42	0.52	0.61	0.64	0.58	0.47	0.37	0.31
	4.98	0.41	0.43	0.50	0.56	0.58	0.54	0.45	0.38	0.38
	5.48	0.48	0.46	0.49	0.53	0.54	0.51	0.46	0.44	0.47
7.49	4.59	0.40	0.46	0.56	0.65	0.68	0.62	0.51	0.41	0.35
	5.09	0.47	0.48	0.54	0.60	0.62	0.57	0.49	0.43	0.44
	5.59	0.54	0.51	0.54	0.57	0.59	0.55	0.50	0.49	0.53

Table 12 +Y motions (ft) – Option 1 – 42" Piles

Hs (ft)	Tp (ft)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.14	0.13	0.12	0.08	0.00	0.08	0.12	0.13	0.14
	4.98	0.18	0.15	0.17	0.11	0.00	0.11	0.17	0.15	0.18
	5.48	0.27	0.19	0.23	0.15	0.00	0.15	0.23	0.19	0.27
7.49	4.59	0.15	0.14	0.14	0.09	0.00	0.09	0.14	0.14	0.15
	5.09	0.22	0.17	0.19	0.12	0.00	0.12	0.19	0.17	0.22
	5.59	0.32	0.23	0.27	0.18	0.00	0.18	0.27	0.23	0.32

Table 13 +Z motions (ft) – Option 1 – 42" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.53	0.47	0.43	0.41	0.41	0.41	0.43	0.47	0.53
	4.98	0.81	0.74	0.66	0.61	0.60	0.61	0.66	0.74	0.81
	5.48	0.95	0.98	0.92	0.86	0.84	0.86	0.92	0.98	0.95
7.49	4.59	0.65	0.57	0.52	0.50	0.49	0.50	0.52	0.57	0.65
	5.09	0.93	0.88	0.78	0.72	0.70	0.72	0.78	0.88	0.93
	5.59	1.04	1.10	1.05	1.00	0.97	1.00	1.05	1.10	1.04

Table 14 Roll motions (deg) – Option 1 – 42" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.74	0.78	0.75	0.45	0.00	0.45	0.75	0.78	0.74
	4.98	1.10	1.20	1.21	0.74	0.00	0.73	1.21	1.20	1.10
	5.48	1.64	1.69	1.79	1.09	0.00	1.09	1.79	1.69	1.64
7.49	4.59	0.88	0.93	0.92	0.55	0.00	0.55	0.92	0.93	0.88
	5.09	1.31	1.42	1.44	0.87	0.00	0.87	1.44	1.41	1.32
	5.59	1.96	1.98	2.14	1.31	0.00	1.31	2.14	1.98	1.96

Table 15 Pitch motions (deg) – Option 1 – 42" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.75	0.58	0.53	0.52	0.52	0.52	0.53	0.58	0.75
	4.98	1.27	0.95	0.86	0.85	0.85	0.85	0.87	0.95	1.27
	5.48	2.04	1.42	1.20	1.17	1.17	1.17	1.20	1.42	2.04
7.49	4.59	0.92	0.72	0.65	0.63	0.63	0.63	0.65	0.72	0.92
	5.09	1.54	1.13	1.02	1.01	1.01	1.01	1.02	1.13	1.54
	5.59	2.43	1.69	1.39	1.34	1.34	1.34	1.39	1.69	2.43

Table 16 Yaw motions (deg) – Option 1 – 42" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.13	0.12	0.11	0.11	0.10	0.09	0.08	0.09	0.11
	4.98	0.12	0.12	0.11	0.10	0.09	0.08	0.08	0.09	0.10
	5.48	0.13	0.11	0.10	0.09	0.07	0.07	0.07	0.09	0.12
7.49	4.59	0.15	0.13	0.12	0.12	0.11	0.10	0.09	0.10	0.12
	5.09	0.13	0.13	0.12	0.11	0.09	0.08	0.08	0.10	0.11
	5.59	0.14	0.11	0.10	0.09	0.08	0.07	0.08	0.10	0.14

Option 2 – Steel Float – 48-inch Piles

Table 17 +X motions (ft) – Option 2 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.07	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.08
	4.98	0.06	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.06
	5.48	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.05
7.49	4.59	0.08	0.10	0.10	0.09	0.09	0.09	0.09	0.10	0.08
	5.09	0.06	0.08	0.09	0.09	0.09	0.09	0.09	0.08	0.07
	5.59	0.05	0.06	0.07	0.08	0.08	0.07	0.07	0.06	0.06

Table 18 +Y motions (ft) – Option 2 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.06	0.05	0.04	0.03	0.02	0.03	0.04	0.05	0.05
	4.98	0.06	0.04	0.03	0.02	0.02	0.03	0.04	0.05	0.04
	5.48	0.05	0.04	0.03	0.02	0.02	0.02	0.03	0.04	0.04
7.49	4.59	0.07	0.05	0.04	0.03	0.02	0.03	0.04	0.06	0.05
	5.09	0.06	0.04	0.03	0.03	0.02	0.03	0.04	0.05	0.04
	5.59	0.06	0.04	0.03	0.02	0.02	0.02	0.03	0.04	0.04

Table 19 +Z motions (ft) – Option 2 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	1.41	1.25	1.03	0.91	0.85	0.84	0.96	1.19	1.35
	4.98	1.13	1.02	0.93	0.88	0.85	0.82	0.84	0.92	0.99
	5.48	1.03	0.87	0.78	0.76	0.75	0.71	0.69	0.76	0.88
7.49	4.59	1.46	1.31	1.12	1.00	0.93	0.93	1.03	1.24	1.36
	5.09	1.19	1.06	0.97	0.94	0.91	0.87	0.88	0.95	1.03
	5.59	1.10	0.93	0.82	0.80	0.78	0.74	0.72	0.81	0.95

Table 20 Roll motions (deg) – Option 2 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	2.45	2.50	2.16	1.69	1.31	1.14	1.17	1.45	1.82
	4.98	2.19	2.44	2.26	1.82	1.38	1.22	1.29	1.58	2.06
	5.48	2.06	2.26	2.17	1.85	1.58	1.53	1.62	1.87	2.23
7.49	4.59	2.61	2.74	2.40	1.88	1.44	1.22	1.26	1.56	1.94
	5.09	2.33	2.60	2.44	1.98	1.54	1.40	1.48	1.80	2.30
	5.59	2.23	2.42	2.34	2.02	1.76	1.72	1.83	2.06	2.48

Table 21 Pitch motions (deg) – Option 2 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.91	0.77	0.66	0.62	0.62	0.64	0.72	0.85	0.97
	4.98	0.98	0.89	0.75	0.70	0.70	0.73	0.80	0.96	1.05
	5.48	1.11	0.90	0.84	0.79	0.78	0.81	0.89	0.97	1.13
7.49	4.59	1.01	0.87	0.73	0.67	0.67	0.70	0.80	0.95	1.07
	5.09	1.06	0.98	0.83	0.79	0.79	0.81	0.89	1.06	1.13
	5.59	1.29	0.96	0.92	0.88	0.87	0.90	0.97	1.03	1.31

Table 22 Yaw motions (deg) – Option 2 – 48" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	4.98	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02
	5.48	0.02	0.02	0.01	0.01	0.00	0.01	0.01	0.02	0.02
7.49	4.59	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02
	5.09	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02
	5.59	0.02	0.02	0.01	0.01	0.00	0.01	0.01	0.02	0.02

Option 2 – Steel Float – 36-inch Piles

Table 23 +X motions (ft) – Option 2 – 36" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.15	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.15
	4.98	0.12	0.14	0.15	0.15	0.16	0.15	0.15	0.14	0.12
	5.48	0.10	0.11	0.12	0.12	0.13	0.12	0.12	0.12	0.10
7.49	4.59	0.15	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.16
	5.09	0.12	0.14	0.15	0.16	0.16	0.16	0.16	0.14	0.12
	5.59	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.12	0.11

Table 24 +Y motions (ft) – Option 2 – 36" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.18	0.13	0.10	0.07	0.06	0.07	0.09	0.12	0.11
	4.98	0.17	0.11	0.08	0.06	0.05	0.06	0.08	0.10	0.10
	5.48	0.15	0.10	0.07	0.05	0.04	0.05	0.06	0.09	0.09
7.49	4.59	0.19	0.13	0.10	0.07	0.06	0.07	0.10	0.12	0.11
	5.09	0.18	0.12	0.09	0.06	0.05	0.06	0.08	0.10	0.10
	5.59	0.16	0.11	0.08	0.05	0.04	0.05	0.07	0.09	0.10

Table 25 +Z motions (ft) – Option 2 – 36" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	1.41	1.25	1.03	0.91	0.85	0.84	0.96	1.19	1.35
	4.98	1.13	1.02	0.93	0.88	0.85	0.82	0.84	0.92	0.99
	5.48	1.03	0.87	0.78	0.76	0.75	0.71	0.69	0.76	0.88
7.49	4.59	1.46	1.31	1.12	1.00	0.93	0.93	1.03	1.24	1.36
	5.09	1.19	1.06	0.97	0.94	0.91	0.87	0.88	0.95	1.03
	5.59	1.10	0.93	0.82	0.80	0.78	0.74	0.72	0.81	0.95

Table 26 Roll motions (deg) – Option 2 – 36" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	2.45	2.50	2.16	1.69	1.31	1.14	1.17	1.45	1.82
	4.98	2.19	2.44	2.26	1.82	1.38	1.22	1.29	1.58	2.06
	5.48	2.06	2.26	2.17	1.85	1.58	1.53	1.62	1.87	2.23
7.49	4.59	2.61	2.74	2.40	1.88	1.44	1.22	1.26	1.56	1.95
	5.09	2.33	2.60	2.44	1.98	1.54	1.40	1.48	1.80	2.30
	5.59	2.23	2.42	2.34	2.02	1.76	1.72	1.83	2.07	2.48

Table 27 Pitch motions (deg) – Option 2 – 36" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.91	0.78	0.66	0.62	0.62	0.64	0.72	0.85	0.97
	4.98	0.98	0.89	0.75	0.70	0.70	0.73	0.80	0.96	1.05
	5.48	1.11	0.90	0.84	0.79	0.78	0.81	0.89	0.97	1.13
7.49	4.59	1.01	0.87	0.73	0.67	0.67	0.70	0.80	0.95	1.07
	5.09	1.06	0.98	0.83	0.79	0.79	0.81	0.89	1.06	1.13
	5.59	1.29	0.96	0.92	0.88	0.87	0.90	0.97	1.03	1.31

Table 28 Yaw motions (deg) – Option 2 – 36" Piles

Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
6.89	4.48	0.04	0.04	0.03	0.02	0.01	0.01	0.02	0.03	0.04
	4.98	0.04	0.04	0.03	0.02	0.01	0.01	0.02	0.03	0.04
	5.48	0.04	0.03	0.03	0.02	0.01	0.01	0.02	0.03	0.03
7.49	4.59	0.05	0.04	0.03	0.02	0.01	0.01	0.02	0.03	0.04
	5.09	0.04	0.04	0.03	0.02	0.01	0.01	0.02	0.03	0.04
	5.59	0.04	0.03	0.03	0.02	0.01	0.01	0.02	0.03	0.04

Appendix B Pile Loads

Tables 19 through 40 show the pile loads for the Option 1 float for each wave heading relative to project north. Tables 41 through 52 show the pile loads for the Option 2 float by heading.

Option 1 – Concrete Float – 48-inch Piles

Table 29 NW pile loads – Option 1 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	86	90	108	137	148	131	106	90	84
		4.98	103	97	108	129	138	125	107	97	101
		5.48	123	112	113	125	132	123	112	112	122
	7.49	4.59	97	99	117	147	158	141	115	99	94
		5.09	117	109	118	139	148	135	117	109	115
		5.59	138	125	124	136	142	133	124	125	137
+Y	6.89	4.48	91	71	62	57	51	55	63	71	87
		4.98	102	80	72	57	43	54	69	76	105
		5.48	122	76	77	59	36	59	78	81	129
	7.49	4.59	102	81	69	61	53	59	70	79	99
		5.09	114	87	80	62	45	59	76	84	119
		5.59	141	87	86	66	38	68	90	89	148

Table 30 SW pile loads – Option 1 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	86	90	108	137	148	131	106	90	84
		4.98	103	97	108	129	138	125	107	97	101
		5.48	123	112	113	125	132	123	112	112	122
	7.49	4.59	97	99	117	147	158	141	115	99	94
		5.09	117	109	118	139	148	135	117	109	115
		5.59	138	125	124	136	142	133	124	125	137
+Y	6.89	4.48	94	73	65	60	51	40	36	48	73
		4.98	105	74	70	59	43	40	44	59	88
		5.48	125	76	75	62	36	45	53	75	116
	7.49	4.59	104	81	72	65	53	43	41	53	82
		5.09	117	80	77	64	45	44	50	67	100
		5.59	144	87	84	69	38	52	62	87	136

Table 31 NE pile loads – Option 1 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	75	76	90	113	121	105	83	68	62
		4.98	86	82	90	107	112	100	82	73	78
		5.48	99	91	93	103	106	97	87	87	96
	7.49	4.59	84	84	98	121	130	113	90	74	70
		5.09	96	92	99	115	120	107	90	82	89
		5.59	111	101	102	111	115	105	96	98	108
+Y	6.89	4.48	59	47	40	37	33	36	42	47	57
		4.98	67	53	47	37	28	36	45	50	69
		5.48	80	50	51	39	24	39	51	53	85
	7.49	4.59	67	53	45	40	35	39	46	52	65
		5.09	75	57	52	41	29	39	50	55	78
		5.59	93	57	56	43	25	44	59	59	97

Table 32 SE pile loads – Option 1 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	75	76	90	113	121	105	83	68	62
		4.98	86	82	90	107	112	100	82	73	78
		5.48	99	91	93	103	106	97	87	87	96
	7.49	4.59	84	84	98	121	130	113	90	74	70
		5.09	96	92	99	115	120	107	90	82	89
		5.59	111	101	102	111	115	105	96	98	108
+Y	6.89	4.48	61	48	43	40	34	26	23	31	48
		4.98	69	49	46	39	28	26	29	33	58
		5.48	82	46	49	40	24	29	35	40	76
	7.49	4.59	68	53	47	42	35	28	27	35	54
		5.09	77	52	50	42	29	29	33	35	66
		5.59	95	53	55	45	25	34	41	46	89

Table 33 North Middle pile loads – Option 1 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	57	60	72	92	100	89	73	63	59
		4.98	69	65	72	87	94	86	74	69	71
		5.48	84	76	76	85	89	84	78	77	84
	7.49	4.59	47	64	65	79	99	107	96	80	69
		5.09	40	79	73	79	94	100	93	82	76
		5.59	35	94	85	84	92	96	91	86	86
+Y	6.89	4.48	19	13	12	8	2	8	11	12	18
		4.98	27	15	15	11	2	10	14	14	26
		5.48	36	22	20	15	2	15	19	21	35
	7.49	4.59	22	22	13	14	10	2	9	12	12
		5.09	19	31	17	17	13	2	12	16	17
		5.59	16	42	26	23	18	2	17	23	26

Table 34 South Middle pile loads – Option 1 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	49	51	62	79	86	77	63	54	51
		4.98	59	56	62	75	80	74	64	59	61
		5.48	72	65	65	73	77	72	67	66	72
	7.49	4.59	55	56	67	85	92	82	69	60	57
		5.09	68	62	68	81	86	80	70	66	69
		5.59	81	73	72	79	83	79	73	74	81
+Y	6.89	4.48	16	11	10	7	2	8	11	12	17
		4.98	24	13	13	10	2	10	14	14	24
		5.48	32	19	18	13	1	14	18	20	32
	7.49	4.59	19	12	12	8	2	9	13	13	20
		5.09	28	16	15	11	2	12	16	16	28
		5.59	37	23	21	16	1	16	22	23	38

Option 1 – Concrete Float – 42-inch Piles

Table 35 NW pile loads – Option 1 – 42" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	95	115	147	174	183	168	138	110	92
		4.98	107	114	136	157	165	153	129	109	105
		5.48	120	120	131	145	150	141	126	117	119
	7.49	4.59	105	124	157	185	195	179	148	118	102
		5.09	120	125	146	167	175	163	139	120	118
		5.59	133	132	142	155	161	152	137	129	132
+Y	6.89	4.48	97	85	77	73	68	74	80	85	96
		4.98	102	92	82	68	57	65	77	87	104
		5.48	117	97	83	65	49	59	77	94	126
	7.49	4.59	107	95	85	77	71	78	87	93	106
		5.09	114	100	90	73	60	69	83	95	116
		5.59	133	108	90	71	51	64	85	107	145

Table 36 SW pile loads – Option 1 – 42" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	95	115	147	174	183	168	138	110	92
		4.98	107	114	136	157	165	153	129	109	105
		5.48	120	120	131	145	150	141	126	117	119
	7.49	4.59	105	124	157	185	195	179	148	118	102
		5.09	120	125	146	167	175	163	139	120	118
		5.59	133	132	142	155	161	152	137	129	132
+Y	6.89	4.48	106	94	87	81	68	54	54	68	81
		4.98	105	93	85	73	57	49	59	81	101
		5.48	117	97	82	66	49	49	64	94	126
	7.49	4.59	115	103	94	86	71	57	60	77	93
		5.09	114	100	91	77	60	53	66	90	115
		5.59	133	108	90	71	51	55	71	107	145

Table 37 NE pile loads – Option 1 – 42" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	82	98	123	144	150	136	110	85	68
		4.98	90	97	114	130	135	122	101	83	81
		5.48	97	99	108	119	122	112	98	91	94
	7.49	4.59	91	106	131	152	159	144	118	91	76
		5.09	99	105	122	138	143	130	109	92	92
		5.59	107	108	117	127	130	121	107	101	105
+Y	6.89	4.48	63	55	50	47	44	48	52	55	62
		4.98	70	60	53	44	37	42	50	56	69
		5.48	80	67	54	42	32	39	50	65	86
	7.49	4.59	70	62	55	50	46	51	56	60	69
		5.09	78	65	59	48	39	45	54	62	79
		5.59	91	74	59	46	33	42	55	73	99

Table 38 SE pile loads – Option 1 – 42" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	82	98	123	144	150	136	110	85	68
		4.98	90	97	114	130	135	122	101	83	81
		5.48	97	99	108	119	122	112	98	91	94
	7.49	4.59	91	106	131	152	159	144	118	91	76
		5.09	99	105	122	138	143	130	109	92	92
		5.59	107	108	117	127	130	121	107	101	105
+Y	6.89	4.48	69	61	57	52	44	35	31	36	48
		4.98	70	60	55	47	37	32	34	40	55
		5.48	81	60	53	43	32	32	39	46	67
	7.49	4.59	75	67	61	56	46	37	34	40	52
		5.09	78	65	59	50	39	34	38	45	62
		5.59	93	67	58	46	33	35	45	53	78

Table 39 North Middle pile loads – Option 1 – 42" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	53	65	84	99	105	97	81	65	56
		4.98	61	64	78	90	95	89	76	65	63
		5.48	70	69	75	83	87	82	74	69	70
	7.49	4.59	59	70	90	106	112	103	87	70	62
		5.09	69	71	83	96	101	95	82	72	70
		5.59	78	76	81	89	93	88	80	76	79
+Y	6.89	4.48	24	19	13	8	3	7	12	17	22
		4.98	34	23	15	9	2	8	13	22	33
		5.48	48	31	17	11	2	10	16	30	47
	7.49	4.59	27	21	15	9	3	8	13	20	26
		5.09	40	26	16	10	2	9	15	25	39
		5.59	57	37	20	12	2	12	19	36	56

Table 40 South Middle pile loads – Option 1 – 42" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	62	76	98	116	123	113	94	76	65
		4.98	71	75	90	105	111	103	89	76	73
		5.48	81	80	87	97	101	96	86	80	82
	7.49	4.59	68	82	104	123	130	120	101	82	72
		5.09	80	82	97	111	118	110	95	84	82
		5.59	90	89	95	104	108	103	94	89	91
+Y	6.89	4.48	26	21	15	9	3	10	16	22	27
		4.98	39	26	17	9	3	10	18	27	39
		5.48	55	36	21	12	2	12	21	37	56
	7.49	4.59	31	24	17	10	3	11	18	25	32
		5.09	46	31	19	11	3	11	20	31	46
		5.59	65	43	24	14	3	14	24	43	66

Option 2 – Steel Float – 48-inch Piles

Table 41 NW pile loads – Option 2 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	45	59	61	59	58	58	60	59	48
		4.98	38	46	51	53	54	53	51	47	39
		5.48	37	41	42	43	44	43	42	41	39
	7.49	4.59	47	61	65	64	63	63	64	61	49
		5.09	41	48	53	55	56	55	53	49	42
		5.59	40	44	44	45	46	45	45	45	42
+Y	6.89	4.48	82	81	73	59	45	40	49	71	81
		4.98	69	76	75	61	47	44	55	72	82
		5.48	61	66	68	60	51	52	63	78	90
	7.49	4.59	86	89	81	65	49	44	55	77	86
		5.09	72	81	80	66	51	50	62	79	91
		5.59	66	70	73	65	57	59	70	87	99

Table 42 SW pile loads – Option 2 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	45	59	61	59	58	58	60	59	48
		4.98	38	46	51	53	54	53	51	47	39
		5.48	37	41	42	43	44	43	42	41	39
	7.49	4.59	47	61	65	64	63	63	64	61	49
		5.09	41	48	53	55	56	55	53	49	42
		5.59	40	44	44	45	46	45	45	45	42
+Y	6.89	4.48	99	101	82	60	43	39	47	60	69
		4.98	83	98	90	70	48	37	43	53	63
		5.48	70	86	85	71	53	42	45	57	74
	7.49	4.59	104	111	93	69	48	42	50	64	71
		5.09	86	103	97	77	53	41	46	57	70
		5.59	74	90	91	77	59	48	51	64	84

Table 43 NE pile loads – Option 2 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	34	45	47	45	44	43	45	44	36
		4.98	29	35	39	41	41	40	38	35	29
		5.48	28	31	32	33	33	32	31	31	29
	7.49	4.59	35	47	50	49	48	47	48	46	37
		5.09	31	37	41	42	43	41	39	36	31
		5.59	30	33	34	34	35	34	33	33	31
+Y	6.89	4.48	57	57	51	41	31	28	34	49	56
		4.98	48	53	52	43	32	31	39	50	57
		5.48	42	46	48	42	35	36	44	55	63
	7.49	4.59	60	62	57	46	34	31	38	54	60
		5.09	50	56	56	46	36	35	43	55	63
		5.59	46	49	51	45	39	41	49	61	69

Table 44 SE pile loads – Option 2 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	34	45	47	45	44	43	45	44	36
		4.98	29	35	39	41	41	40	38	35	29
		5.48	28	31	32	33	33	32	31	31	29
	7.49	4.59	35	47	50	49	48	47	48	46	37
		5.09	31	37	41	42	43	41	39	36	31
		5.59	30	33	34	34	35	34	33	33	31
+Y	6.89	4.48	69	70	57	42	30	27	33	42	48
		4.98	58	68	63	49	33	26	30	37	44
		5.48	49	60	59	49	37	30	32	39	52
	7.49	4.59	73	77	65	48	34	29	35	44	50
		5.09	60	72	68	53	37	29	32	40	49
		5.59	52	63	63	54	41	34	36	45	59

Table 45 North Middle pile loads – Option 2 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	35	46	47	46	45	46	47	46	38
		4.98	30	36	40	41	42	41	40	37	31
		5.48	29	32	32	33	34	34	33	33	31
	7.49	4.59	37	47	50	49	49	49	50	48	39
		5.09	33	38	41	43	44	43	41	38	33
		5.59	32	34	34	35	36	35	35	35	33
+Y	6.89	4.48	49	50	43	33	24	22	26	35	39
		4.98	40	48	46	36	26	22	26	32	37
		5.48	34	41	43	37	29	26	29	35	44
	7.49	4.59	51	55	48	37	27	24	28	37	41
		5.09	42	51	49	40	29	25	28	35	42
		5.59	37	44	45	40	32	29	32	40	49

Table 46 South Middle pile loads – Option 2 – 48" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	31	40	41	40	39	40	41	40	33
		4.98	26	31	34	36	36	36	35	32	27
		5.48	26	28	28	29	30	29	29	29	27
	7.49	4.59	32	41	44	43	43	43	44	42	34
		5.09	28	33	36	37	38	37	36	33	29
		5.59	28	30	30	30	31	31	31	31	29
+Y	6.89	4.48	42	43	37	29	22	19	23	31	35
		4.98	34	41	40	32	23	20	24	30	34
		5.48	30	35	37	32	25	23	26	33	40
	7.49	4.59	44	48	42	32	24	21	25	34	37
		5.09	36	43	43	35	25	22	26	33	38
		5.59	32	38	39	34	28	26	30	37	44

Option 2 – Steel Float – 36-inch Piles

Table 47 NW pile loads – Option 2 – 36" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	28	35	37	37	37	37	37	35	29
		4.98	23	27	29	30	32	31	30	27	23
		5.48	21	24	24	25	26	25	25	24	22
	7.49	4.59	29	38	40	39	40	39	40	38	31
		5.09	25	30	33	35	35	34	33	30	25
		5.59	24	26	27	28	29	28	27	27	25
+Y	6.89	4.48	43	43	38	31	24	21	26	37	42
		4.98	36	40	39	32	24	23	29	38	43
		5.48	34	35	36	31	27	27	33	41	47
	7.49	4.59	47	46	43	35	26	24	31	44	48
		5.09	39	42	41	35	27	27	34	44	50
		5.59	37	36	38	34	30	32	39	48	54

Table 48 SW pile loads – Option 2 – 36" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	28	35	37	37	37	37	37	35	29
		4.98	23	27	29	30	32	31	30	27	23
		5.48	21	24	24	25	26	25	25	24	22
	7.49	4.59	29	38	40	39	40	39	40	38	31
		5.09	25	30	33	35	35	34	33	30	25
		5.59	24	26	27	28	29	28	27	27	25
+Y	6.89	4.48	52	53	43	32	23	21	25	32	36
		4.98	43	51	47	36	25	19	22	28	33
		5.48	37	45	44	37	28	22	24	30	39
	7.49	4.59	58	61	51	37	26	22	27	35	39
		5.09	48	57	53	42	28	21	25	31	38
		5.59	41	50	50	42	31	25	27	34	45

Table 49 NE pile loads – Option 2 – 36" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	22	28	29	29	29	28	28	27	22
		4.98	18	21	23	24	25	24	23	21	18
		5.48	17	19	19	20	20	19	19	18	17
	7.49	4.59	22	29	31	31	31	30	30	28	23
		5.09	19	22	25	26	26	25	24	22	19
		5.59	18	20	21	21	21	20	20	20	18
+Y	6.89	4.48	29	29	26	21	16	14	17	25	28
		4.98	24	27	26	22	16	16	19	25	29
		5.48	22	23	24	21	18	18	22	28	32
	7.49	4.59	31	31	29	23	18	16	21	29	32
		5.09	26	28	28	23	18	18	23	30	34
		5.59	24	25	25	23	20	21	26	32	36

Table 50 SE pile loads – Option 2 – 36" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	22	28	29	29	29	28	28	27	22
		4.98	18	21	23	24	25	24	23	21	18
		5.48	17	19	19	20	20	19	19	18	17
	7.49	4.59	22	29	31	31	31	30	30	28	23
		5.09	19	22	25	26	26	25	24	22	19
		5.59	18	20	21	21	21	20	20	20	18
+Y	6.89	4.48	35	36	29	21	15	14	17	21	24
		4.98	29	34	32	25	17	13	15	19	22
		5.48	25	30	30	25	19	15	16	20	26
	7.49	4.59	39	41	34	25	17	15	18	24	26
		5.09	32	38	36	28	19	14	17	21	25
		5.59	28	33	33	28	21	17	18	23	30

Table 51 North Middle pile loads – Option 2 – 36" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	17	21	22	21	22	22	22	22	18
		4.98	14	17	19	19	20	19	19	17	15
		5.48	14	15	15	16	16	16	16	15	15
	7.49	4.59	20	26	28	27	27	27	28	27	22
		5.09	18	21	23	24	24	24	23	21	18
		5.59	17	18	19	19	20	20	19	19	17
+Y	6.89	4.48	24	24	21	16	12	11	12	17	19
		4.98	19	23	22	18	13	11	13	16	18
		5.48	17	20	21	18	14	12	14	17	21
	7.49	4.59	25	27	24	18	13	12	14	19	20
		5.09	21	25	24	20	14	12	14	18	20
		5.59	18	21	22	19	16	14	16	20	24

Table 52 South Middle pile loads – Option 2 – 36" Piles

	Hs (ft)	Tp (s)	-40	-30	-20	-10	0	10	20	30	40
+X	6.89	4.48	19	25	26	25	25	25	26	25	21
		4.98	17	20	22	22	23	23	22	20	17
		5.48	16	17	18	18	19	18	18	18	17
	7.49	4.59	23	31	32	31	31	31	32	31	25
		5.09	20	24	27	28	28	28	27	24	21
		5.59	19	21	22	22	23	23	22	22	20
+Y	6.89	4.48	26	27	23	18	14	12	14	20	22
		4.98	22	26	25	20	14	13	15	19	21
		5.48	19	22	23	20	16	15	17	20	25
	7.49	4.59	28	30	27	21	15	13	17	22	24
		5.09	23	27	27	22	16	14	17	21	24
		5.59	20	24	25	22	18	17	19	24	28

Appendix F – Electrical Design Narrative

TECHNICAL MEMORANDUM

To: Ed DeBroeck

Date: 17 June 2022

From: Ben Haight

SUBJECT: Skagway Dock – Narrative of 30% Electrical Design

Scope of Loads:

- Move existing Aerial 2.4 KV Power Lines to Underground.
- Power to the existing Ore Terminal Facility and Temsco.
- Power to new Floating Cruise Dock.
- Power to new Marine Service Platform and Fuel Header.
- Power for new RO/RO Ramp.
- Future Medium-voltage Cruise Ship Shore Power.
- Power to future Bathroom/Passenger Waiting Building.

There are two aerial lines supported by single structures along the shoreline between the ore terminal facility and the existing docks. The upper line is powered at 35 KV for transmission of energy between Skagway and Haines. This line transitions to a submarine cable at the southern shore. The lower line is powered at 2.4 KV and provides energy to the existing cruise ship dock and the ore terminal & ore loader via pad-mounted transformers near to those facilities.

The submarine cable to Haines will be replaced with a new cable routed from a new shoreside facility located near the Dyea Road in a separate project. It appears the new cable will be placed into operation in the next two to three years. We are not including new underground conduits for this circuit.

A new 2.4 KV underground feeder will be routed from the northern end of the project site (at an H structure next to State Street) to the southern end. It will be terminated at junctions strategically located to serve the RO/RO Ramp, the Marine Service Platform, and the Floating Cruise Dock, as well as the existing Ore Terminal Facility, Temsco, and a future Bathroom/Waiting Building. The cables and junctions may be rated to allow a future voltage increase to 12.5 KV. Two 4-inch conduits will be provided for this feeder.

Future medium-voltage shore power for the cruise ship dock will require the construction of a small substation somewhere close to the dock. It will occupy an area of approximately 60 ft x 80 ft. The substation will not be included in this project, but is expected to be located at the northern end of the project site. Power from the substation to the cruise ship dock will require four 6-inch conduits. They will terminate at a vault onshore near the approach to the dock to allow for pulling in the cables.

We plan to include conduit for communications for future needs. A 2-inch conduit terminating at pedestals located near the approach to the dock and at the southern end of the project site will be included in the duct bank.

The RO/RO Ramp will have a service including a pad-mounted transformer and 480V distribution panel to power lights on the ramp and associated catwalk and dolphin, any equipment related to the operation of the ramp, a powered capstan on the associated dolphin, and cathodic protection for the fuel lines which pass underground under the new ramp.

The Marine Service Platform will have a service including a pad-mounted transformer and 480V distribution panel to power lights on the platform and associated catwalk and dolphins, any equipment related to the operation of the fuel header, a powered capstan on the associated dolphin, and provision for future electrically-powered mobile equipment. Provision for medium-voltage power for a mobile harbor crane is not included.

The existing Ore Terminal Facility (three-phase 240V) and Temsco (one-phase 240V) will be served by new pad-mounted transformers at the location of the existing pole-mounted Temsco transformer. This work will be coordinated with the respective owners and the utility, and temporary power will be provided to the existing utility customers during construction.

The Floating Cruise Dock will have a service including a pad-mounted transformer and 480V distribution panel to power lights on the dock and associated catwalk and dolphins, powered capstans (to be installed on the existing dolphins), and 120V maintenance power. The future Bathroom Building will also be served by this transformer. As an option, the dock could also be provided with 480V shore power; this would increase the flexibility of the dock, but would entail a much larger transformer and one or more power mounds installed on the dock.

Appendix G – Float Bid Drawings

FLOAT SYSTEM PERFORMANCE REQUIREMENTS

PROVIDE FLOAT UNITS AND CONNECTIONS CAPABLE OF WITHSTANDING DESIGN LOADING CRITERIA INDICATED BELOW:

1. FLOAT UNITS SHALL BE CAPABLE OF SUPPORTING ALL DESIGN LOAD COMBINATIONS THROUGHOUT ENTIRE TIDAL RANGE.

2. FREEBOARD:

   A. DEAD LOAD FREEBOARD: 4'–8"

   B. THE FREEBOARD UNDER ALL DEAD LOADS SHALL NOT BE MORE THAN 2 INCH BELOW OR MORE THAN 1 INCH ABOVE THE SPECIFIED FREEBOARD AFTER ONE YEAR OF OPERATION. DEAD LOADS SHALL CONSIST OF THE FLOAT SYSTEM, RUBSTRIPS, BULLRAIL, PILE RESTRAINT GUIDES, TRANSITION PLATES, AND ALL OTHER ATTACHED APPURTENANCES.

3. UNIFORM LIVE LOAD:

   A. 90 PSF UNIFORM LIVE LOAD LL(U) (FOR DESIGN OF STRUCTURES)

   B. FOR FLOATATION THE FLOAT SHALL CONSIDER 40PSF LIVE LOAD OVER THE ENTIRE FLOAT OR 1/4 OF THE FLOAT WITH 90PSF IN ANY LOCATION.

4. LIVE LOAD:

   A. 18 KIP AXLE FORKLIFT LOAD

   B. EMERGENCY AMBULANCE TYPE III VEHICLE 16,000 LB AXLE LOAD

   C. 4000 LB POINT LOAD

   D. VEHICLE LOAD = AASHTO H10 TRUCK

   E. FREEBOARD UNDER DL + POINT LL TO BE 6 FEET MINIMUM.

   F. CROSS SLOPE SHALL NOT EXCEED 2%.

5. SNOW LOAD:

   60 PSF

6. WIND LOAD:

   40 KNOT 30 SECOND DURATION WIND SPEED (WITH CRUISE SHIP DOCKED)

   140 MPH 3 SECOND GUST WITH NO CRUISE SHIP AND NO LIVE LOAD ON FLOAT

7. CURRENT LOAD:

   1.5 FT/SEC CURRENT SPEED

8. SITE WAVE CONDITIONS

	50 YRP	100 YRP
ONE–HOUR AVERAGE WIND SPEED (KTS)	59.61	63.76
ACES SIGNIFICANT WAVE HEIGHT (FT)	6.89	7.49
ACES WAVE MODAL PERIOD (SEC)	4.98	5.09

9. BERTHING LOAD:

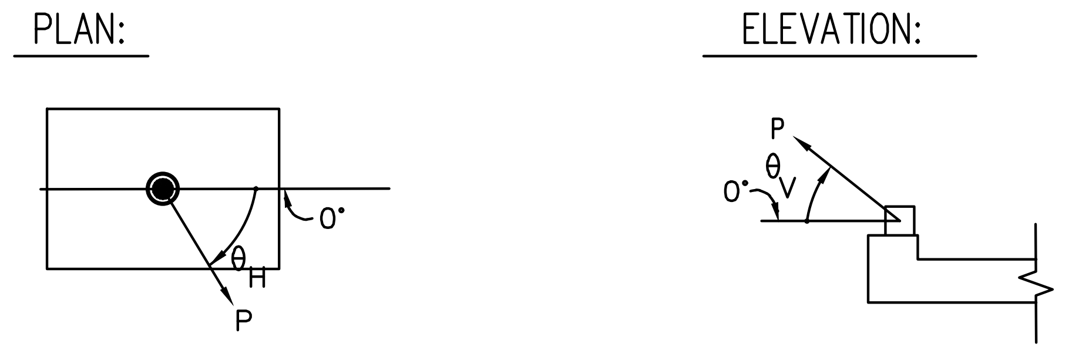
   FENDER PANELS AND FLOAT STRUCTURE SHALL ACCOMMODATE A FENDER REACTION UP TO 450 KIPS

10. UTILITY LOADS:

    A. WORK WITH THE SITE DESIGNER TO ESTABLISH UTILITY LOADING AS DESIGN PROGRESSES ON THE OVERALL PROJECT.

11. THE FLOAT MANUFACTURER SHALL PROVIDE FOUR LIFE PRESERVERS AND FOUR FIRE EXTINGUISHERS WITH THE FLOAT SYSTEM. THESE ITEMS SHALL BE LOCATED AND MOUNTED TO THE FLOATS IN SUCH MANNER THAT THEY DO NOT INTRUDE UPON THE FUNCTIONALITY OF THE FLOATING DOCK.

12. MOORING BOLLARDS SHALL BE RATED FOR 150 TONS SAFE WORKING LOAD. MOORING BOLLARDS SHALL BE DESIGNED WITH A LOAD FACTOR OF 1.6 PER UFC 4–152–01 DESIGN PIERS AND WHARVES 2017.



LOCATION	RATED CAPACITY P	RANGE OF HORIZONTAL ANGLE θ_H	RANGE OF VERTICAL ANGLE θ_V
BOLLARDS ON FLOAT	150 TONS	0° TO 180°	0° TO +60°

13. STABILITY REQUIREMENTS:

    A. FLOAT METACENTRIC HEIGHT SHALL BE 2'–0" MIN. UNDER ALL LOADING CONDITIONS

14. PILE HOOPS AND PILES:

    A. PILE HOOPS SHALL BE EXTERNAL TO THE FLOATS.

    B. PILE HOOPS SHALL HAVE A REMOVABLE BOLTED PORTION SUCH THAT THE FLOATS MAY BE DETACHED FROM THE SYSTEM AND MOVED.

    C. THE PILES SHALL BE LOCATED TO ONE SIDE OF THE FLOATS TO MAXIMIZE THE UNOBSTRUCTED TRAVEL PATH. COORDINATE WITH ENGINEER ON FINAL PILE LOCATION.

    D. PILE HOOPS SHALL HAVE ADJUSTABLY TO ACCOMMODATE UP TO 6" OF PILE TOLERANCE IN ANY DIRECTION. MAXIMUM SPACE BETWEEN PILES AND BEARINGS SHALL BE 1.5" AFTER SHIMS ARE PLACED.

    E. PILE HOOPS SHALL HAVE UHMW PADS TO CONTACT THE PILES. THE PADS SHALL BE REMOVABLE IN A MANNER THAT DOES NOT REQUIRE HANDLING OR TOOLS WORK TO OCCUR BETWEEN THE PILE AND THE PAD. THE UHMW PADS SHALL HAVE A MINIMUM OF 1.5" OF WEAR THICKNESS AVAILABLE.

    F. THE MOS'S NAVAL ARCHITECT, GLOSTEN ASSOCIATES, WILL MODEL THE FLOAT AND DETERMINE FLOAT MOVEMENTS DURING STORM CONDITIONS THE FLOAT MANUFACTURE WILL WORK WITH THE MOS TO FINALIZE PILE HOOP DESIGN TO ACCOMMODATE THEM MOVEMENTS. IT MAY BE THAT FENDERS INSIDE THE PILE HOOPS IS NEEDED.

15. FLOAT UTILITIES

    A. UTILITY ROUTING ON FLOATS ARE SCHEMATIC AND SHALL BE FINALIZED DURING DESIGN PROCESS

16. TRANSFER SPAN CONNECTION

    THE TRANSFER SPAN CONNECTION SHALL ACCOMMODATE THE DEAD, LIVE AND WIND LOADS OF THE TRANSFER SPAN.

DEAD LOAD	165 KIPS (ACCOUNTS FOR HALF OF THE TRANSFER SPAN WEIGHT)
LIVE LOAD	112 KIPS

(THESE LOADS ARE APPROXIMATE AND WILL BE FINALIZED DURING DESIGN)

17. FLOAT COATINGS AND CORROSION PROTECTION

    THE EXTERNAL SURFACE OF THE STEEL PONTOON FLOAT SHALL HAVE A MULTI LAYER CORROSION PROTECTION SYSTEM. THE COATINGS SHALL INCLUDE SPRAY METALIZING, A ZINC PRIMER AND A MARINE EPOXY PAINT THE COATINGS SYSTEM SHALL BE SUBMITTED TO MOS REVIEW.

Plotted: Jul 05, 2022 – 2:19pm achun Layout: F1.1
M:\2021\2100135 Skagway Ore Peninsula Multi–use Dock\Drawings\Current\Bid Set\2100135_F1.1 Float Design Criteria.dwg

kpff
1601 5th Avenue, Suite 1300
Seattle, Washington 98101
(206) 382-0600 Fax (206) 382-0500

NO.	DATE	BY	REVISION

CRUISE TERMINAL FLOAT
SKAGWAY, ALASKA

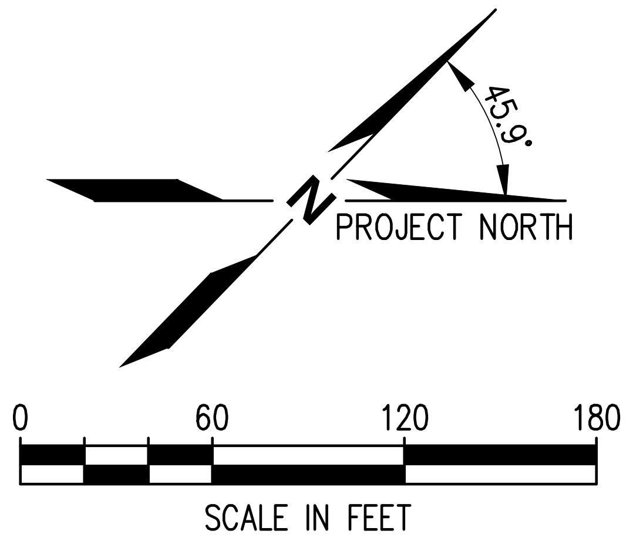
FLOAT DESIGN CRITERIA

DRAWN: DYU
DESIGN: ED
CHECKED: RR
PROJECT NO.: 2100135
SCALE: AS SHOWN
DATE: 06/15/2022
DRAWING NO. F1.1
SHEET NO. 01 OF 03

BID SET

OVERALL SITE PLAN

SCALE: 1" = 60'



NOTE:

THESE DRAWINGS ARE DIAGRAMMATIC AND DO NOT NOR ARE INTENDED TO REPRESENT A COMPLETE AND DETAILED DESIGN. ALL LAYOUT ITEMS ARE APPROXIMATE. BASED ON THESE DRAWINGS AND THE ACCOMPANYING SPECIFICATIONS, THE CONTRACTOR SHALL DEVELOP DETAILED PLANS AND SHOP DRAWINGS THAT PROVIDE A FULLY FUNCTIONAL ARRANGEMENT SUITABLE TO MEET THE PROJECT REQUIREMENTS.

THIS PAGE PROVIDED FOR INFORMATION ONLY, SITE LAYOUT IS PRELIMINARY.

Plotted: Jun 15, 2022 – 3:04pm dyu Layout: F1.2
M:\2021\2100135 Skagway Ore Peninsula Multi-use Dock\Drawings\Current\Bid Set\2100135_F1.2 Preliminary Overall Site Plan.dwg

kpff
1601 5th Avenue, Suite 1300
Seattle, Washington 98101
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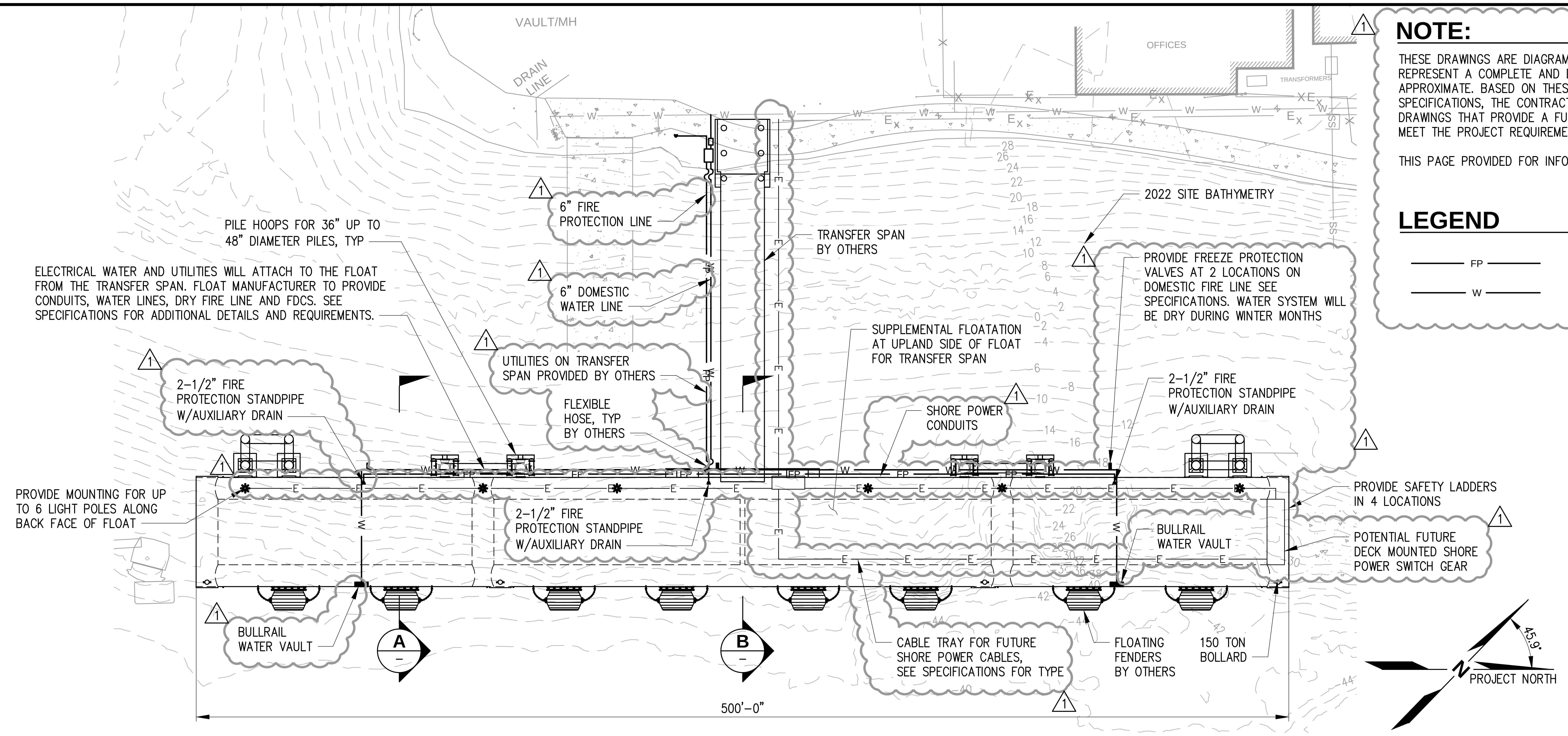
NO.	DATE	BY	REVISION

CRUISE TERMINAL FLOAT
SKAGWAY, ALASKA

PRELIMINARY OVERALL SITE PLAN

DRAWN: DYU
DESIGN: ED
CHECKED: RR
DRAWING NO. F1.2
SHEET NO. 02 OF 03
PROJECT NO.: 2100135
SCALE: AS SHOWN
DATE: 06/15/2022

BID SET



FLOAT - PLAN VIEW

SCALE: 3/8" = 1'-0"

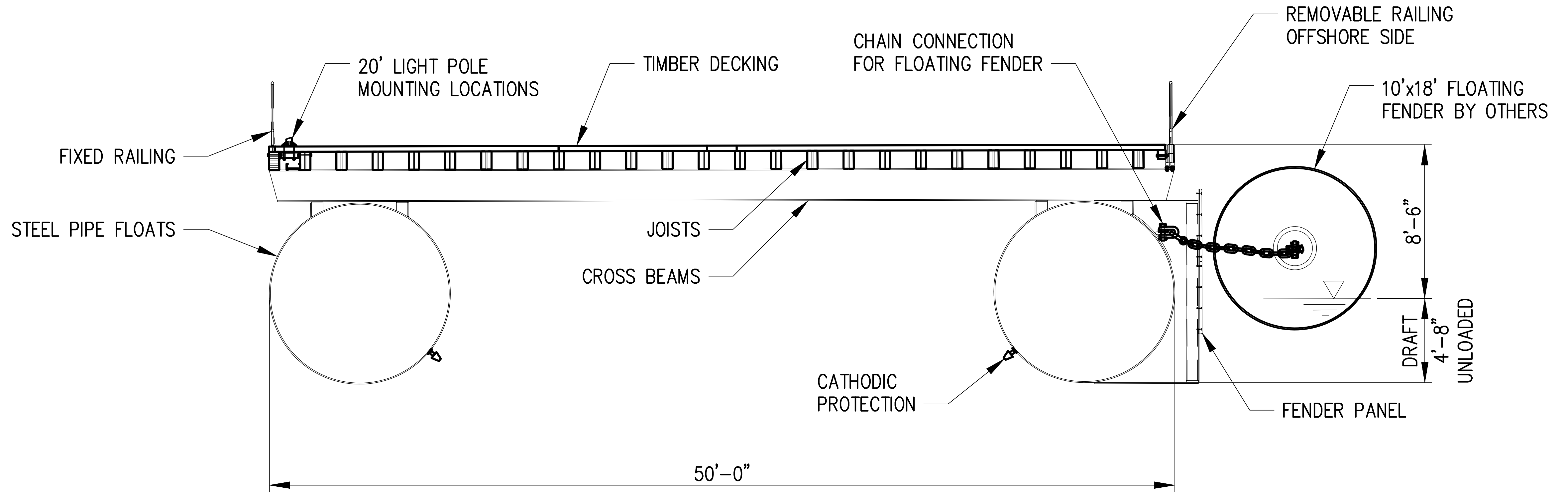
⚠1 **NOTE:**

THESE DRAWINGS ARE DIAGRAMMATIC AND DO NOT NOR ARE INTENDED TO REPRESENT A COMPLETE AND DETAILED DESIGN. ALL LAYOUT ITEMS ARE APPROXIMATE. BASED ON THESE DRAWINGS AND THE ACCOMPANYING SPECIFICATIONS, THE CONTRACTOR SHALL DEVELOP DETAILED PLANS AND SHOP DRAWINGS THAT PROVIDE A FULLY FUNCTIONAL ARRANGEMENT SUITABLE TO MEET THE PROJECT REQUIREMENTS.

THIS PAGE PROVIDED FOR INFORMATION ONLY, SITE LAYOUT IS PRELIMINARY.

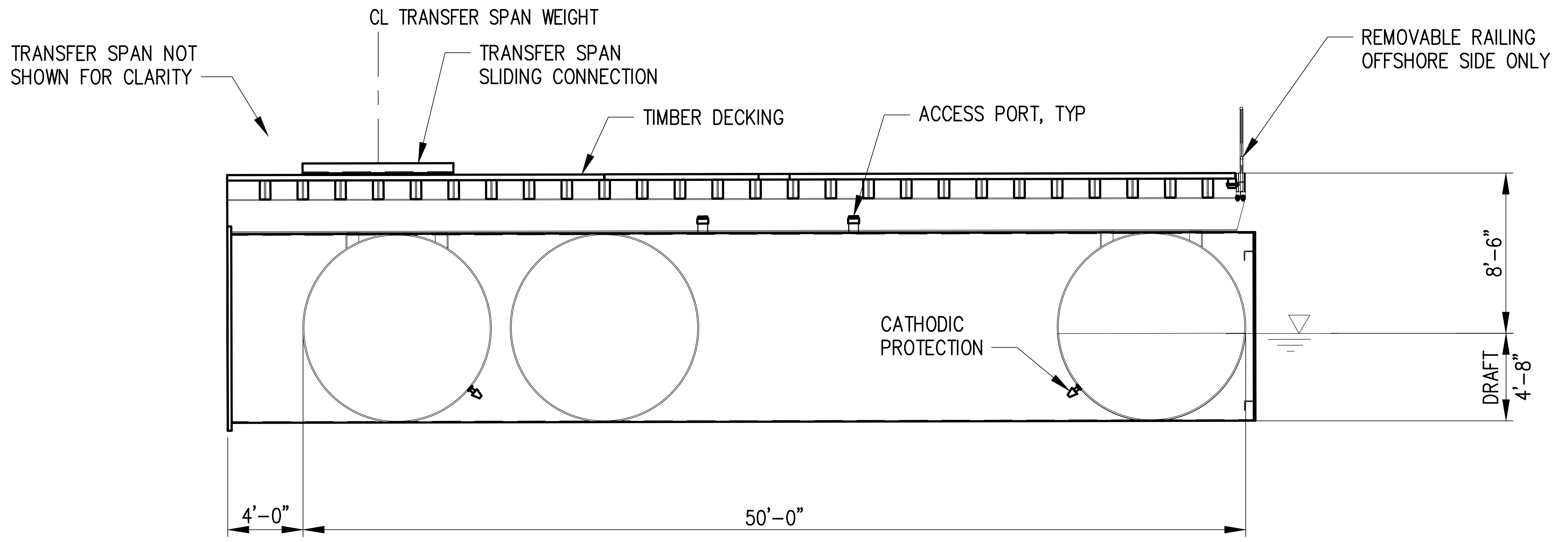
LEGEND

——— FP ———	6" FIRE PROTECTION LINE
——— W ———	6" DOMESTIC WATER LINE



A TYPICAL FLOAT SECTION

SCALE: 2" = 1'-0"



B FLOAT SECTION AT TRANSFER SPAN

SCALE: 2" = 1'-0"

Plotted: Jun 15, 2022 - 5:03pm dyu Layout: F2.1
M:\2021\2100135 Skagway Ore Peninsula Multi-use Dock\Drawings\Current\Bid Set\2100135_F2.1 Float Plan.dwg

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NO.	DATE	BY	REVISION
⚠1	06/15/2022	EJD	BID ADDENDUM #1

MUNICIPALITY OF SKAGWAY ALASKA
GATEWAY TO THE KLONDIKE

CRUISE TERMINAL FLOAT
SKAGWAY, ALASKA

FLOAT PLAN

DRAWN: DYU	PROJECT NO.: 2100135
DESIGN: ED	SCALE: AS SHOWN
CHECKED: RR	DATE: 06/15/2022
DRAWING NO.	**F2.1**
SHEET NO.	**03** OF **03**

BID SET