Haines, Alaska
Lutak Dock Replacement
MARINE BASIS OF DESIGN REPORT
95% Design Submittal

5/26/2023

Prepared By:

Turnagain Marine Construction
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Anchorage, Alaska 99503
INTRODUCTION
Haines is one of three communities on the road system in Southeast, Alaska. It is located 93 miles north of Alaska’s capital, Juneau, and 20 miles southwest of Skagway. With the initiation of the Alaska Marine Highway System (AMHS) and the Haines Highway, Haines is easily accessible to tourists and locals from every direction. In 2020 the population of Haines was reported at 1,905, but typically increases during summer months as the tourist season begins.

The Lutak Dock Project will provide the Haines Borough with a new bulkhead dock facility that will replace the existing dock. The existing Lutak Dock is made up of closed sheet cell walls along with closure arcs, backfilled with granular material. It has experienced irreparable corrosion deterioration in its lifetime, along with specific closure arc failures deeming an upgrade necessary to continue the use of the dock. The new bulkhead dock design will encapsulate the existing closed sheet cell walls and will be backfilled with coarse aggregate, along with additional ground improvements within the dock footprint. The new dock will gain back a portion of the existing that was previously lost during the demolition and re-design of the adjoining AMHS facility, along with removing and replacing amenities such as fenders and bollards. The new dock will provide the Borough and its residents a reliable structure that will be used to continue cargo operations and fuel transfers.

PROJECT DESCRIPTION
The Lutak Dock Replacement Project will provide an industrial bulkhead dock primarily used for cargo and fuel barges. The basic features of the Lutak Dock include:

- (1) 70 foot wide by 700 foot long bulkhead dock
- (1) 22 foot wide by 30 foot long barge loading notch
- (10) safety ladders
- (24) cone fenders, (12) fender panels
- (12) mooring bollards
- Sacrificial anode corrosion protection system

DESIGN RESPONSIBILITIES
The project is being advanced with a design build delivery method. Turnagain Marine Construction (TMC) is the Design-Builder and lead for the project. The following is a list of various parties involved in the design:

- Bulkhead Dock – TMC
- Civil Uplands – proHNS, LLC
- Upland Survey – North 57 Land Surveying
- Electrical Engineering – RSA Engineering, Inc.
- Geotechnical Engineering - Shannon & Wilson
- Corrosion Engineering – Northwest Corrosion Engineering

DESIGN STANDARDS
The design will be in compliance with the listed or most current version of the following codes and standards:

- International Building Code (IBC)
PART I: DESIGN LOADS AND CONDITIONS

Design Vessels

Handymax

Sitka Provider
Qamun Barge and Aurora Tug

<table>
<thead>
<tr>
<th>Vessel Name</th>
<th>Displacement (Long Tons)</th>
<th>Length Overall (ft)</th>
<th>Beam (ft)</th>
<th>Full Load Draft (ft)</th>
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Design Vehicles

Manitowoc 4000W
LHM 420 Mobile Harbor Crane: Crane mats required

**Dead Loads**
Material weight of permanent components

**Live Loads**
Uniform live load = 2000 PSF

**Snow Loads**
ASCE 7-16 does not provide ground snow load values for Haines, Alaska. The Structural Engineers Association of Alaska does provide ground snow load estimates for Haines:
ASCE 7-16 Risk Category IV
Ground Snow Load = 370 PSF

**Design Seismic Loads**
Seismic design values per ASCE 7-16 and ASCE 61-14 for Haines, Alaska

ASCE 61-14 Design Classification - High
ASCE 7-16 Risk Category - IV
Site Class D
Seismic Design Category D

Mapped Acceleration Parameters for Haines, Alaska for the design event (DE), contingency level event (CLE) and operating level event (OLE) are in Appendix A: Shannon and Wilson Geotechnical Design Memorandum located in Appendix A.
Shannon & Wilson has performed a generalized limit equilibrium (GLE) to determine seismic loading acting on the new bulkhead wall under OLE, CLE and DE hazard level events. These seismic loads are used in the structural analysis of the new bulkhead dock to ensure that the following ASCE 61-14 performance levels are met:

- **Design Earthquake Performance Level = Life Safety Protection**
  - Plastic hinging of the in-ground portion of the pipe-pile combi wall is allowed.
    - Maximum Allowable Strains = 0.050
  - Tie-Back System is designed to remain elastic.
- **Contingency Level Earthquake = Repairable Damage**
  - Plastic hinging of the in-ground portion of the pipe-pile combi wall is allowed.
    - Maximum Allowable Strains = 0.035
  - Tie-Back System is designed to remain elastic.
- **Operating Level Earthquake = Minimal Damage**
  - All structural elements designed to remain elastic.

The Shannon & Wilson geotechnical investigation and report have confirmed that soils within and outside of the bulkhead wall are susceptible to liquefaction during DE and CLE hazard levels. Ground improvement will be performed within the bulkhead to mitigate liquefaction potential during both DE and CLE hazard levels. No ground improvement will be performed outside of the bulkhead, and the dock will be designed so that the full depth of marine sediments can liquefy to bedrock, providing no passive earth pressure support to the pipe-pile combi wall. Because of the magnitude of the design earthquake, with ground acceleration durations of 30 seconds, ground accelerations will not occur at the same time as soil liquefaction. Therefore, the wall will be designed for (2) seismic design scenarios:

- **1. Active Earth Pressure, Passive Earth Pressure (no liquefaction), a portion of Live Load Surcharge, and Ground Acceleration**
- **2. Active Earth Pressure, No Passive Earth Pressure (full liquefaction of soils outside of the bulkhead), a portion of Live Load Surcharge, No Ground Acceleration.**

**Ground Improvement**
Ground improvement specifications are currently under development.

**Wind Speeds on Fixed Structures**
ASCE 7-16 Risk Category – IV
Exposure Category = C
3-Second Gust Wind Speed = 137 mph

**Current Data**
Based on Tidal Current Data from NOAA Station SEA0826 at Battery Point, Chilkoot Inlet, tidal current speeds are generally less than 1 knot.

**Tides and Water Levels**
Elevation datum is mean lower low water (MLLW) = 0.0.
Predicted tides for Haines are from Skagway, Taiya Inlet, NOAA Station 9452400 tidal epoch 2012-2016
<table>
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<th>Elevation (ft)</th>
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<tr>
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<tr>
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<td>0.0</td>
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<tr>
<td>LAT</td>
<td>-5.03</td>
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</table>

Note that no EHW or ELW data is available on the NOAA Tides and Currents database.

**Sea Level Rise Projections**
The closest active NOAA Sea Level Rise monitoring station is based in Skagway, Alaska. Based on this site, and NOAA’s Global and Regional Sea Level Rise Scenarios adopted in 2022, the facility design will consider the NOAA Intermediate High projection for sea level rise.
PART II: MOORING AND BERTHING LOADS

Berthing Loads
The bulkhead dock will be designed for the berthing of design vessels using the following parameters:
UFC 4-152-01 Figure 5-4
Moderate Berthing Conditions

Mooring Loads
The bulkhead dock will be designed for the mooring of design vessels using the following parameters:
UFC 4-159-03 Table 3-4
Type I: Mild Weather Mooring
Sustained Wind Speed = 35 Knots / 40 MPH

The mooring forces on the bulkhead facility are resisted by the following structures:
- Bollards
- Fender Panels

Design mooring loads are based on a mooring analysis completed for the design vessel that produces line forces at bollards and maximum reactions at fender panels.

Bollards

Bollards will be a Double Bitt style with 100 metric ton capacity as produced by Marine Structures. The rated capacity will apply 0 to 60 degrees relative to the horizon and 0 to 180 degrees relative to the face of the dock.

Fenders

Fenders will be a double cone fender system and fender panel produced by TekMarine. The cone fenders will be model TJCO 800, with each cone fender having an energy absorption of 175 ft*kip and a reaction of 119 kip.
PART III: STRUCTURE ELEVATIONS
Structure elevations are based on the following design criteria:
- Highest astronomical tide (HAT) = +21.03 feet MLLW
- Mean Higher High Water (MHHW) = +16.73 feet MLLW
- Lowest astronomical tide (LAT) = -5.03 feet MLLW

To accommodate the future facility tying into the existing uplands grade, an overall elevation of +25’ will be set at the face of the dock. Fender panel length will be decided based on the various design vessels listed for the facility, along with the tidal datums HAT, MHHW, and LAT. Safety ladders will have an overall length of 32 feet to accommodate LAT from the top of the concrete curb.

**Bulkhead Dock:** Top of Deck Elevation = +25 feet to match existing
Concrete Curb Elevation = +26 feet
Barge Notch Elevation = +10 feet

**Berth Depth:**
Existing mudline in front of the dock is -30 feet.
PART IV: COATINGS AND CORROSION PROTECTION

A 50-year design life for the facility can be achieved with the following steel coatings and sacrificial anode installation:

- Sacrificial anodes installed on every plumb pile.
- Monitor consumption rates and replace depleted sacrificial anodes after anodes have been in service for 15 to 25 years.
- All steel elements installed with coatings as shown below:

**Pipe-Pile Combi Wall Coatings**
The bulkhead facility plumb piles will include a typical one coat inorganic zinc primer and two coats of coal tar epoxy (16 mils total), or an equivalent corrosion protection system. Within the upper tidal zone, one coat of organic zinc primer and five coats of coal tar epoxy (40 mils total) is recommended, or an equivalent corrosion protection system. 216-pound sacrificial anodes will be installed 15 feet above mudline during construction, and will have a design life of 20 years minimum. Routine maintenance is required to fix minor coating damage over the life of the structure, by application of carboline splash zone A-788 or similar.

**Reinforced Concrete**
Marine concrete requirements and epoxy coated or galvanized reinforcing.

**Batter Pile**
Same coating requirements as Pipe-Pile Combi Wall.

**Batter Pile Caps**
Same coating requirements as Pipe-Pile Combi Wall.

**Bollards**
Marine grade epoxy coating.

**Fender Panels**
Marine grade epoxy coating.

**Safety Ladders**
Hot dip galvanized.
LUTAK DOCK REPLACEMENT

95% DRAWINGS
MAY 18, 2023

HAINES, ALASKA
**LUTAK DOCK REPLACEMENT GENERAL NOTES**

This project is funded by federal funds and must follow the requirements to use iron, steel, manufactured products, and construction materials produced in the United States, per the build America, buy America ( Baba) act of May 2022.

**Design life**: 50 years

**Loading requirements**:

- Uniform live load: 2,000 psf
- Design vehicle (unrestricted) = MANITOWOC 4000
- Design vehicle (restricted) = LHM 420 mobile harbor crane
- Use of crane mats required for mobile harbor crane

**Design vessel**

- Design classification: high
- Design life: 50 years
- Uniform live load: 2,000 psf
- Loadings requirements:
  - Design vessel: SITKA PROVIDER = 14,819 ton max displacement
  - Design vessel: Fuel barge = 14,600 long ton max displacement
  - Design vessel: Cargo barge = 60,000 ton max displacement
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**General design codes continued**


American concrete institute code 318-19: Building code requirements for structural concrete

**NOAA tide benchmarks at #9452400 Skagway, Taiya inlet, Alaska**

- Elevation datum for the project is 0.0 ft mean lower low water (MLLW)
  - High tide line (HTL) = 21.03 ft
  - Mean higher high water (MHHW) = 16.73 ft
  - Mean high water (MHW) = 15.73 ft
  - Mean sea level (MSL) = 8.83 ft
  - Mean tide level (MTL) = 8.68 ft
  - Mean diurnal tide level (DTL) = 8.42 ft
  - Mean low water (MLW) = 1.62 ft
  - Mean lower low water (MLLW) = 0.00 ft
  - Lowest astronomical tide (LAT) = -5.03 ft

**Liquefaction mitigation**

Current bulkhead soils analysis shows that liquefaction of soils within the bulkhead will not occur during the operating level earthquake.

Stone column ground improvement shall be provided based on geotechnical design requirements in the stone column installation plan to mitigate liquefaction potential within the bulkhead during contingency and design level earthquakes.

Soils outside of the new bulkhead wall will remain susceptible to liquefaction for de and cle hazard levels. Based on the duration of ground shaking (30 seconds) for these magnitude earthquakes, soil liquefaction will not be concurrent with ground accelerations.

Therefore, the new bulkhead wall will be designed to accommodate full liquefaction of soils to bedrock elevations after ground accelerations have subsided.

**Material specifications**:

- Structural steel:
  - ASTM A36 / A572
  - FY = 50 ksi
- HSS square / rect:
  - ASTM A500 GR B
  - FY = 42 ksi
- HSS round:
  - ASTM A500 GR B
  - FY = 46 ksi
- Bolts:
  - ASTM A325
- Welding electrodes: E70XX

- Structural concrete:
  - Minimum concrete compressive strength at 28 days:
    - P’c = 5,000 psi
    - Water-cement ratio non-air-entrained = 0.48
    - Water-cement ratio air-entrained = 0.40
  - Reinforcing steel = ASTM A615 or A706, Grade 60

- Fill material:
  - Select material, type c, see civil drawings

- Surface course:
  - D-1 material, see civil drawings

- Ground improvement stone columns:
  - ASHTO #57 coarse aggregate stone

- Fill material against new bulkhead wall:
  - ASHTO #57 coarse aggregate stone

- Rip rap:
  - Class I and class IV, see civil drawings

- Filter material:
  - Selected material type c

**Seismic performance requirements**

- ASCE 7-16 Risk category = IV (essential facility)
- ASCE 61-14 Design classification = high
- Maximum considered earthquake (MCE) is an earthquake with a return period of 50 years (2% probability of exceedance in 50 years).

- Design earthquake (OE)
  - Performance level = life safety protection
  - 2/3 the acceleration associated with the MCE
  - Peak ground acceleration = 0.45g

- Contingency level earthquake (CLE)
  - Performance level = repairable damage
  - 475 year return period
  - Peak ground acceleration = 0.17g

- Operating level earthquake (OLE)
  - Performance level = minimal damage
  - 72 year return period
  - Peak ground acceleration = 0.054g

- Design vessel: fuel barge = 14,600 long ton max displacement
- Design vessel: Cargo barge = 60,000 ton max displacement
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- General design codes continued

- American concrete institute code 318-19: Building code requirements for structural concrete
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OVERALL EXISTING SITE PLAN

MOORING DOLPHINS, TYP OF 4
AML DOLPHIN
AML BARGE RAMP
Boat Launch Ramp
Haines Ferry Terminal
Ferry Terminal Ramp
Ferry Terminal Building
Fuel Depot
Lutak Dock
Lutak Road
EXISTING SHEET PILE CELLS AND CLOSURE ARCS

EXISTING FACE BEAM

NOTE: TOTAL LENGTH OF EXISTING FACE BEAM = 650FT

EXISTING CONCRETE FACE BEAM

DEMO FACE BEAM CURB ALONG ENTIRE LENGTH

DEMO FULL DEPTH OF FACE BEAM AT TIEBACK PILE LOCATIONS

DEMO FULL DEPTH OF FACE BEAM AT BARGE NOTCH (APPROXIMATELY 72 CY)

EXISTING BULKHEAD FACE BEAM

EXISTING CLOSED CELL

DEMO APPROXIMATELY 200 CY OF EXISTING FACE BEAM AT TIEBACK LOCATIONS

DEMO APPROXIMATELY 245 CY OF EXISTING CURB AND FACE BEAM AT APRON

NEW CONCRETE APRON AND COLLECTOR

NEW PILE CAP

NEW PILE CAP

EXISTING CONCRETE APRON

EXISTING FACE BEAM

EXISTING CLOSED CELL

EXISTING BULKHEAD FACE BEAM

EXISTING FACE BEAM DEMO AT TIEBACK CAP

3/16" = 1'-0"

EXISTING FACE BEAM DEMO AT APRON

3/16" = 1'-0"

NOTE: TOTAL LENGTH OF EXISTING FACE BEAM = 650FT

EXISTING SHEET PILE CELLS AND CLOSURE ARCS

EXISTING FACE BEAM

NOTE: TOTAL LENGTH OF EXISTING FACE BEAM = 650FT

EXISTING CONCRETE FACE BEAM

DEMO FACE BEAM CURB ALONG ENTIRE LENGTH

DEMO FULL DEPTH OF FACE BEAM AT TIEBACK PILE LOCATIONS

DEMO FULL DEPTH OF FACE BEAM AT BARGE NOTCH (APPROXIMATELY 72 CY)

EXISTING BULKHEAD FACE BEAM

EXISTING CLOSED CELL

DEMO APPROXIMATELY 200 CY OF EXISTING FACE BEAM AT TIEBACK LOCATIONS

DEMO APPROXIMATELY 245 CY OF EXISTING CURB AND FACE BEAM AT APRON

NEW CONCRETE APRON AND COLLECTOR

NEW PILE CAP

NEW PILE CAP

EXISTING CONCRETE APRON

EXISTING FACE BEAM

EXISTING CLOSED CELL

EXISTING BULKHEAD FACE BEAM

EXISTING FACE BEAM DEMO AT TIEBACK CAP

3/16" = 1'-0"

EXISTING FACE BEAM DEMO AT APRON

3/16" = 1'-0"
EXISTING AML DOLPHIN TO REMAIN
EXISTING AML BARGE RAMP TO REMAIN

NEW RIPRAP SHORE PROTECTION TIED INTO EXISTING
LIGHT POLE, VIDEO SURVEILLANCE, AND CONVENIENCE OUTLETS
EXISTING BUILDING
NEW FIRE HYDRANT
NEW FREEZE FREE WATER RISER
ELECTRICAL PANELBOARD WITH MAIN CIRCUIT BREAKER

NEW PIPE-PILE COMBI WALL DOCK
NEW SAFETY LADDER
BARGE LOADING NOTCH
NEW RIP-RAP SHORE PROTECTION TIED INTO EXISTING
NEW LIGHT POLE, VIDEO SURVEILLANCE, AND CONVENIENCE OUTLETS
NEW MOORING BOLLARDS
BOROUGH AND ALASKA MARINE HIGHWAY SYSTEM BOUNDARY LINE
ALASKA MARINE HIGHWAY SYSTEM STAGING AREA
FUEL DEPOT
LUTAK ROAD

PILE CAP EXTENTS = 705' - 0"
INSTALL FIRE HYDRANT ASSEMBLY.

LOCATION: 500' N E 100' E 219 MAIN STREET #13
HAINES, AK 99827
PHONE: (907) 780-4004
CERTIFICATE OF AUTHORIZATION NUMBER: 100662

PROJECT NUMBER: 22-010
SHEET TITLE: WATER SYSTEM ADDITION PLAN
C100

DATE: MAY 18, 2023
CERTIFICATE OF AUTHORIZATION
NUMBER: 100662
ISSUE DATE: MAY 18, 2023

LUTAK DOCK
REPLACEMENT
22-010
C300
HAINES, ALASKA
95% DESIGN

UNDERGROUND MARKING

SHEET TITLE:
CIVIL TECHNICAL SPECIFICATIONS

PROJECT NUMBER:
HNS LLC

REV# DESCRIPTION
MAY 18, 2023

DATE

C300

WATER PAPER: SHALL BE RED BOND PAPER, MEET ANSI/AWS D1.1-2000 SPECIFICATIONS FOR RESEARCH PAPER, WHICH IS MANUFACTURED WITH 100% RECYCLED PAPER BASED ON PAPER MADE FROM RECYCLED MATERIALS.

WATER PAPER: SHALL BE RED BOND PAPER, MEET ANSI/AWS D1.1-2000 SPECIFICATIONS FOR RESEARCH PAPER, WHICH IS MANUFACTURED WITH 100% RECYCLED PAPER BASED ON PAPER MADE FROM RECYCLED MATERIALS.

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### LUTAK DOCK REPLACEMENT

#### HAINES, ALASKA

### 95% DESIGN

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### TECHNICAL SPECIFICATIONS

- proHNS LLC
- HAINES BOROUGH
- LUTAK DOCK REPLACEMENT
- HAINES, ALASKA
NEW LUTAK BULKHEAD DOCK

FUEL BARGE PLAN

1" = 50'-0"
EXISTING AML DOLPHIN TO REMAIN, UNMODIFIED

AML CARGO BARGE RAMP TO REMAIN, ROTATED 2.5°

NEW AML BARGE BERTH LINE

NEW LUTAK BULKHEAD DOCK

NOTE: TURNAGAIN TO COORDINATE WITH ALASKA MARINE LINES ON UPDATES TO THE AML RAMP.
**BATTER PILE INSTALLATION NOTE:** Excavate between cells at batter pile locations prior to setting tieback cap to verify batter angle.

**CONSTRUCTION SEQUENCING NOTES:**
1. Install pipe-PILE COMBI WALL
2. Install tieback cap and batter pile
3. Install precast concrete cap
4. Install cast-in-place concrete collector
5. Backfill between existing cells and new combi wall
6. Perform ground improvement and foundation prep for apron
7. Install cast-in-place concrete apron
8. Surface course and grading

---

**PIPE-PILE COMBI WALL AND TIEBACK PILE PLAN**

1" = 30'-0"
PRECAST PILE CAP AND COLLECTOR PLAN

1" = 30'-0"

1. INSTALL PIPE-PILE COMBI WALL
2. INSTALL TIEBACK CAP AND BATTER PILE
3. INSTALL PRECAST CONCRETE CAP
4. INSTALL CAST-IN-PLACE CONCRETE COLLECTOR
5. BACKFILL BETWEEN EXISTING CELLS AND NEW COMBI WALL
6. PERFORM GROUND IMPROVEMENT AND FOUNDATION PREP FOR APRON
7. INSTALL CAST-IN-PLACE CONCRETE APRON
8. SURFACE COURSE AND GRADING

PRECAST CONCRETE CAP, TYPICAL
CAST IN PLACE CONCRETE COLLECTOR, TYPICAL
TYPICAL

42" X 3/4" BATTER PILE, TYP

MATCHLINE

34'-1 1/2"

3' - 0"

34'-1 1/2"

34'-3"

45'-5"

34'-1 1/2"

3'-0"

3'-0"

3'-0"

42'-7 1/2"

24" WIDE SCUPPER

STEEL WALER CAP

NZ-38 SHEET PILES AT BARGE LANDING NOTCH

CONSTRUCTION SEQUENCING NOTES:
1. INSTALL PIPE-PILE COMBI WALL
2. INSTALL TIEBACK CAP AND BATTER PILE
3. INSTALL PRECAST CONCRETE CAP
4. INSTALL CAST-IN-PLACE CONCRETE COLLECTOR
5. BACKFILL BETWEEN EXISTING CELLS AND NEW COMBI WALL
6. PERFORM GROUND IMPROVEMENT AND FOUNDATION PREP FOR APRON
7. INSTALL CAST-IN-PLACE CONCRETE APRON
8. SURFACE COURSE AND GRADING

CONSTRUCTION SEQUENCING NOTES:
MEAN SEA LEVEL 8'-10''

0.0 MLLW 0'-0''

TOP OF DOCK 25'-0''

HIGH TIDE LINE 21'-0''

MEAN SEA LEVEL 8'-10''

0.0 MLLW 0'-0''

NEW PRECAST CONCRETE CAP, SEE: 3 S207

TOP OF DOCK 25'-0''

NEW FENDER PANEL, SEE: 1 S202

AASHTO #57 COARSE AGGREGATE STONE

EXISTING CLOSED CELL SHEET PILES TO REMAIN IN PLACE

SELECTED MATERIAL, TYPE C

GRAVEL SURFACE COURSE

SEE GRADING PLAN 1.33%

CONCRETE APRON, SEE: 1.33%

NEW 42" X 3/4" STEEL PIPE-PILE COMBI WALL

ESTIMATED MUDLINE ELEVATION = -30'.

ESTIMATED BEDROCK ELEVATION = -45' TO -65'. IF BEDROCK ELEVATION EXCEEDS -65', NOTIFY ENGINEER BEFORE PROCEEDING.

FILL BOTTOM OF PLUMB PIPE PILES WITH CONCRETE

SOCKET PILES INTO BEDROCK 10' MINIMUM

TOP OF CONCRETE FILL ELEVATION = -40'

ANODE 1 S402

NEW 42" X 3/4" STEEL PIPE-PILE COMBI WALL

2 S400

PRECAST CONCRETE CAP, SEE: 3 S207

GRAVEL SURFACE COURSE

SEE GRADING PLAN 1.33%

CONCRETE APRON, SEE: 1.33%

NEW PRECAST CONCRETE CAP, SEE: 3 S207

TOP OF DOCK 25'-0''

NEW FENDER PANEL, SEE: 1 S202

AASHTO #57 COARSE AGGREGATE STONE

EXISTING CLOSED CELL SHEET PILES TO REMAIN IN PLACE

SELECTED MATERIAL, TYPE C

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PRECAST CONCRETE CAP, SEE: 3 S207

GRAVEL SURFACE COURSE

SEE GRADING PLAN 1.33%

CONCRETE APRON, SEE: 1.33%

NEW PRECAST CONCRETE CAP, SEE: 3 S207

TOP OF DOCK 25'-0''

NEW FENDER PANEL, SEE: 1 S202

AASHTO #57 COARSE AGGREGATE STONE

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2 S400

PRECAST CONCRETE CAP, SEE: 3 S207

GRAVEL SURFACE COURSE

SEE GRADING PLAN 1.33%

CONCRETE APRON, SEE: 1.33%

NEW PRECAST CONCRETE CAP, SEE: 3 S207

TOP OF DOCK 25'-0''

NEW FENDER PANEL, SEE: 1 S202

AASHTO #57 COARSE AGGREGATE STONE

EXISTING CLOSED CELL SHEET PILES TO REMAIN IN PLACE

SELECTED MATERIAL, TYPE C

GRAVEL SURFACE COURSE

SEE GRADING PLAN 1.33%

CONCRETE APRON, SEE: 1.33%

NEW 42" X 3/4" STEEL PIPE-PILE COMBI WALL

ESTIMATED MUDLINE ELEVATION = -30'.
PIPE-PILE COMBI WALL PLAN VIEW

3/4" = 1'-0"
1. TIEBACK SLED FABRICATION DETAILS

3/8" = 1'-0"

2. TIEBACK CAP ISOMETRIC

3. TIEBACK SLED CONNECTION DETAILS

3/8" = 1'-0"

4. SLED TOP FLANGE

3/8" = 1'-0"

5. SLED BOTTOM FLANGE

3/8" = 1'-0"
Collected Details

1. Collector Connection and Pile Cap Connection
   - 1/4" = 1'-0"
   - Concrete Collector
   - Apron Slab
   - #6 at 6" on center, top and bottom
   - #4 Ties at 6" OC, Stagger with #6 Hooked Dowels
   - (15)#9 reinforcing, top and bottom
   - (2)#9 at Midheight
   - #4 ties at 6" OC, Stagger with #6 Hooked Dowels
   - (15)#9 reinforcing, top and bottom
   - Roughen to 1/4" amplitude and apply bonding agent
   - (2)#6 at 6" on center with 180° Hooks

2. Enlarged Collector Plan
   - 3/16" = 1'-0"
   - (2)#4 continuous, post install 6" into precast pile cap with Hilti Hit HY-200 Epoxy Adhesive.
   - #4 with standard 180° Hook at 12" on center, post install with Hilti Hit HY-200 Epoxy Adhesive.
   - Cast in place collector, reinforcing not shown for clarity

3. Collector and Apron Details
   - 1/2" = 1'-0"
   - Concrete Collector
   - Apron Slab
   - #6 at 6" on center, top and bottom
   - #4 Ties at 6" OC, Stagger with #6 Hooked Dowels
   - (15)#9 reinforcing, top and bottom
   - (2)#9 at Midheight
   - #4 ties at 6" OC, Stagger with #6 Hooked Dowels
   - (15)#9 reinforcing, top and bottom

4. Curb Connection at Collector
   - 3/4" = 1'-0"
   - Cast in place collector, reinforcing not shown for clarity

Turnagain
Marine Construction
5003 Cordova Street
Anchorage, AK 99503
PHONE: (907) 261-8960
CORPORATE AUTHORIZATION NUMBER: 161179
ISSUE DATE: MAY 18, 2023
SHEET NUMBER: S205

Lutak Dock Replacement
Haines, Alaska
95% Drawings

Sheet Description Date
Issue Date: May 18, 2023
Sheet Title: Collector Details
BOLLARD DETAILED

3/4" = 1'-0"

1. BOLLARD DETAIL
2. BOLLARD ISOMETRIC
3. BOLLARD ANCHOR REINFORCING

3/4" = 1'-0"

INTEGRAL HOUSEKEEPING PAD AND CURB

PLACE (2) TIES WITHIN FIRST 5" THEN REMAINING TIES AT 5" ON CENTER

(10) 1 1/2" DIAMETER ANCHOR BOLTS

1/2"x4"x4" PLATE WASHER

#5 BARS WITH 90° HOOKS AT TOP, EXTEND BARS TO BOTTOM MAT OF PILECAP REINFORCING

CONCRETE PILE CAP, REINFORCING NOT SHOWN FOR CLARITY

PLUMB PILE

100 TON BOLLARD

1' - 3" 2' - 11" 1' - 3"

#5 TIES, TYPICAL

(10) ANCHOR RODS

(30) #5 ANCHOR TENSION REINFORCING

CONCRETE CURB

2" CLR

PLACE (2) TIES WITHIN FIRST 5" THEN REMAINING TIES AT 5" ON CENTER

#5 BARS WITH 90° HOOKS AT TOP, EXTEND BARS TO BOTTOM MAT OF PILECAP REINFORCING

CONCRETE PILE CAP, REINFORCING NOT SHOWN FOR CLARITY

PLUMB PILE
1. **PILE CAP TO APRON CONNECTION**
   3/8" = 1'-0"

2. **PIPE PILE TO PILE CAP CONNECTION**
   3/8" = 1'-0"

3. **REINFORCED CONCRETE APRON SECTION**
   3/8" = 1'-0"
**TIEBACK CONCRETE PILE SHAFT ELEVATION**

**CONCRETE PILE SHAFT DETAIL**

**CONCRETE PILE SHAFT PLAN**

- **CONCRETE**
- **#4 TIES @ 20" O.C.**
- **TIEBACK PILE**
- **CAGE REBAR**
- **SHEAR RINGS 2' ON CENTER (8 TOTAL)**
- **BEDROCK**
- **STAPLE**
- **REBAR**
- **HOOPS**
- **SHEAR RINGS**
- **STEEL PILE**
- **3/4" = 1'-0"**
- **1" = 1'-0"**

**DIMENSIONS:**

- **2'-6 1/2"**
- **50' - 10"**
- **30'-0"**

**MATERIALS:**

- **#4 TIES**
- **(36) #11 BARS**

**NOTES:**

- **BEDROCK**
- **SHAP**
- **SHEAR RING**
- **1/4"**
- **2' - 6 1/2"**
- **1/2"**
- **3/8"**
- **4"**
- **5"**
- **95% DRAWINGS**

---

**LUTAK DOCK**

**REPLACE**

**HAINES, ALASKA**

**95% DRAWINGS**

**SHEET TITLE:** TIEBACK CONCRETE PILE SHAFT DETAILS

**PROJECT NUMBER:** 22-010

**ISSUE DATE:** MAY 18, 2023

**CORPORATE AUTHORIZATION NUMBER:** 161179

**PHONE:** (907) 261-8960

**ADDRESS:** 5050 CORDOVA STREET, ANCHORAGE, AK 99503

**COMPANY:** Turnagain Marine Construction
FENDER PANEL FACE, PER MANUFACTURER

CHAIN AND RESTRAINT BRACKETS, PER MANUFACTURER

TJCO 800 T10 CONE FENDER

24" DIA X 1/2" CONNECTION PILE CENTERED ON COMBI WALL PILE

30" DIA X 2" CONNECTION PLATE

(6) 1 1/2" DIAMETER BOLTS

CENTERED ON COMBI WALL PILE

8 3/4" X 12" X 1" ROLLED PLATE

UHMW FENDER PANEL

CONE FENDER

26' - 0"

6' - 0" 10' - 0" 10' - 0"

7' - 4"

PIPE-PILE COMBI WALL FACE

CL PILE CAP

BOBALLARD

PILE CAP

TOP OF FENDER

3/8" = 1'-0"

1/4" = 1'-0"

1/4" = 1'-0"

1" = 1'-0"

1' - 0"

1 1/2"

11"

4 1/2"

5/16"

5/16"

3/4"

3/8"

3/8"

3/8"
NOTE: SAFETY LADDER COATING SHALL MATCH COATING SYSTEM FOR STEEL PILE.
1. **ANODE ARRANGEMENT**

   1/2" = 1'-0"

2. **ANODE / PILE INSTALLATION**

   3/4" = 1'-0"

- **WELD CONNECTION, TYP BOTH ENDS**
- **ALUMINUM ANODE INGOT (216LB), ONE PER TWO PILES, CIRCUMFERENTIAL LOCATION TO BE FIELD DETERMINED BY CONTRACTOR**
- **15 FT, TYP**
- **ANODE MOUNTING CORE, TYP EACH END**
- **PIPE PILE SURFACE**
- **2-IN SCH. 80 PIPE CORE**
- **WELD ALL AROUND, TYP TOP AND BOTTOM CORE**
- **6"**
- **6' - 0"**
- **2-IN SCH. 80 PIPE CORE**
- **ANODE**
- **ALUMINUM ANODE (216LB)**

LUTAK DOCK REPLACEMENT HAINES, ALASKA

ANODE DETAILS
1. BARGE LOADING NOTCH PLAN

1/8" = 1'-0"

2. BARGE LOADING NOTCH NZ PILE PLAN

1/8" = 1'-0"

Pile Cap and Tieback Batter Piles Hidden in View for Clarity.
EACH FLANGE, EACH PILE

1/2" GAP BETWEEN PILE AND WALER FLANGE. FILL GAP WITH 2" LONG SHIM PLATES ONCE WALER IS ON CAP

(2) 3/4" DIAMETER x 6" LONG HEADED STUDS AT 24" ON CENTER

PLATE GIRDER WALER

1/4" AT 24" ON CENTER WITH STANDARD 90° HOOKS

(3) #4 CONTINUOUS BARS

2 1/2" CONTINUOUS WEB PLATE (50 KSI)

1 1/4" SHEAR PLATE (50 KSI)

(2) ROWS OF (11) 1 1/4" DIAMETER A490 BOLTS WITH SHORT SLOTTED HORIZONTAL HOLES

(3) #4 CONTINUOUS BARS

PLUMB PILE AT TIEBACK

CIP SHEAR PLATE TO DOUBLER

PLUMB PILE BELOW

3/4"x1'-0" DOUBLER PLATE

1 1/4" SHEAR PLATE (50 KSI)

CJP SHEAR PLATE TO DOUBLER

CJP AT BOTH FLANGES

2 1/4"x24" CONTINUOUS FLANGE PLATE (50 KSI), TYPICAL EACH FLANGE

1" CONTINUOUS WEB PLATE (50 KSI)

PISTON PILE

PLUMB PILE AT TIEBACK

1" GAP BETWEEN PILE AND WALER FLANGE. FILL GAP WITH 2" LONG SHIM PLATES ONCE WALER IS ON CAP

(2) 3/4" DIAMETER x 6" LONG HEADED STUDS AT 24" ON CENTER

PLATE GIRDER WALER

WALER AT NOTCH

3/4" = 1'-0"

WALER TO TIEBACK PLUMB PILE

3/4" = 1'-0"

PLUMB PILE AT TIEBACK

4'-0 1/2"

CIP SHEAR PLATE TO DOUBLER

3/4"x1'-0" DOUBLER PLATE

1 1/4" SHEAR PLATE (50 KSI)

CJP SHEAR PLATE TO DOUBLER

CJP AT BOTH FLANGES

2 1/4"x24" CONTINUOUS FLANGE PLATE (50 KSI), TYPICAL EACH FLANGE

1" CONTINUOUS WEB PLATE (50 KSI)

PISTON PILE

PLUMB PILE AT TIEBACK

1" GAP BETWEEN PILE AND WALER FLANGE. FILL GAP WITH 2" LONG SHIM PLATES ONCE WALER IS ON CAP

(2) 3/4" DIAMETER x 6" LONG HEADED STUDS AT 24" ON CENTER

PLATE GIRDER WALER

WALER AT NOTCH

3/4" = 1'-0"

WALER TO TIEBACK PLUMB PILE

3/4" = 1'-0"
EXTENTS OF STONE COLUMN GROUND IMPROVEMENT = 70' BEHIND FACE OF DOCK

GROUND IMPROVEMENT NOTES:
- CONSTRUCT STONE COLUMNS FROM BEDROCK ELEVATION TO 2 FEET BELOW FINISHED GRADE.
- STONE COLUMNS TO BE CONSTRUCTED USING A VIBROFLAT CAPABLE OF A BOTTOM FEED METHOD.
- STONE COLUMN MATERIAL SHALL MEET THE GRADATION AND DURABILITY REQUIREMENTS OF AASHTO NUMBER 57 STONE.
- PERFORM GROUND IMPROVEMENT TO ACHIEVE A SOIL REPLACEMENT RATIO OF 17 PERCENT.
- CONSTRUCT STONE COLUMNS WITH A DIAMETER OF 3 FEET.
- ON AVERAGE, OVER THE GROUND IMPROVED AREA, A 7 FOOT TRIANGULAR GRID WILL ACHIEVE THIS REPLACEMENT RATIO.
- MAINTAIN A SPACING OF 5 FEET FROM THE EDGE OF TIEBACK BATTER PILES TO CENTER OF STONE COLUMNS.
### Panel 'B'

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**Total VAr:**
- L1G: 2245
- L2G: 6815
- L3G: 16415
- Total: 55773 VA

**Panel Notes:**
- No scale

**Panel Options:**
- Main only

---

**Panel 'C':**

- Meter Base
- Equipment
- 1.5" C, 48L, HP (4)

**Panel 'E':**

- Meter Base
- Equipment
- 2" C, 48L, HP (4)

---

**Notes:**
- No scale

---

**Engineering, Inc.**

**LUTKA MARINE CONSTRUCTION**

**ANCHORAGE, ALASKA 99503**
MEMORANDUM

TO: Josh Zellmer
FROM: Thomas Keatts
DATE: April 7, 2023
PROJECT: Lutak Dock Replacement
PROJ. #: 110150-001
SUBJECT: Lutak Dock Draft Design Memo

This memo presents preliminary geotechnical information for design of the proposed Lutak Dock Replacement, including seismic design parameters, loading due to earth pressures, global stability analysis, and ground improvement requirements. The information below is based on subsurface explorations by S&W and others which will be included in the final geotechnical report. The information below is preliminary and is not for final design.

1 SEISMIC PARAMETERS

The tables below present the seismic coefficients for use in preliminary design of the Lutak dock replacement. Tables below correspond to the Design Event (DE) 2,475 year return period event, the Contingency Level Event (CLE) 475 year return period event, and the Operating Level Event (OLE) 72 years return period event. The tables below assume the fundamental period of the structure is less than 0.5 seconds and that ASCE 7-16 Section 11.4.8 Exception 2 applies and is followed by the structural engineer.

<table>
<thead>
<tr>
<th>Seismic Coefficients (Site Class D, DE)</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration Coefficient, (PGA)</td>
<td>0.45 (g)</td>
<td>ASCE 7-16 Figure 22-10</td>
</tr>
<tr>
<td>Spectral Acceleration Coefficient at Period of 0.2s, (Ss)</td>
<td>1.011 (g)</td>
<td>ASCE 7-16 Figure 22-3</td>
</tr>
<tr>
<td>Spectral Acceleration Coefficient at Period of 1.0s, (S1)</td>
<td>0.492 (g)</td>
<td>ASCE 7-16 Figure 22-4</td>
</tr>
<tr>
<td>Site Factor at Zero Period, (Fpga)</td>
<td>1.15</td>
<td>ASCE 7-16 Table 11.8-1</td>
</tr>
<tr>
<td>Site Factor for Short Period, (Fsa)</td>
<td>1.1</td>
<td>ASCE 7-16 Table 11.4-1</td>
</tr>
<tr>
<td>Site Factor for Long Period, (Fv)</td>
<td>1.81</td>
<td>ASCE 7-16 Table 11.4-2</td>
</tr>
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</table>
2 STABILITY ANALYSIS

Generalized limit equilibrium (GLE) analysis was used to determine the resultant forces acting on the face of the proposed wall and was confirmed using coulomb earth pressure theory and the Mononabe-Okabe (MO) method. Note the MO method assumes unsaturated backfill and no liquefiable soil. Therefore, the MO method is not strictly appropriate for this analysis. The GLE method has no such limitations. GLE analysis determines the resultant force necessary to achieve a factor of safety of unity (1) against failure. Analysis was conducted for static, pseudo static (DE, CLE, and OLE events), and post seismic analysis for several soil and structure configurations. Analysis included:

- improved ground conditions including stone columns with a composite friction angle of 38 degrees ignoring potential benefit from existing closed cell sheet piles, for all static and pseudo static analysis;
- improved ground conditions including stone columns with a composite friction angle of 38 degrees ignoring potential benefit from existing closed cell sheet piles and a uniform surcharge load of 2,000 psf for static analysis;
- post seismic analysis assuming liquefaction of the retained soil with a residual composite friction angle of 20 degrees.
In GLE analysis no specific wall type is included in the modeling, the wall type is selected based on the required resistance and global stability requirements. The results of the GLE analysis are attached and are summarized in the table below.

<table>
<thead>
<tr>
<th>Design Analysis</th>
<th>Resultant Force (lb/ft), Angle Above Horizontal (degrees)</th>
<th>Resultant Location (MLLW)</th>
<th>Ka</th>
<th>Uniformly Distributed Seismic Increment (psf per ft of wall height)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static</td>
<td>38,200, 18°</td>
<td>Elevation -13 feet</td>
<td>0.22</td>
<td>0</td>
</tr>
<tr>
<td>Static with 2,000 psf surcharge</td>
<td>41,400, 18°</td>
<td>Elevation -9 feet</td>
<td>0.22</td>
<td>0</td>
</tr>
<tr>
<td>Pseudo Static DE</td>
<td>170000, 18°</td>
<td>Elevation -25.5 feet</td>
<td>0.22</td>
<td>11.3</td>
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<tr>
<td>Pseudo Static CLE</td>
<td>115,000, 18°</td>
<td>Elevation -28.5 feet</td>
<td>0.22</td>
<td>4.6</td>
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<tr>
<td>Pseudo Static OLE</td>
<td>41,400, 18°</td>
<td>Elevation -13.5 feet</td>
<td>0.22</td>
<td>0.9</td>
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<tr>
<td>Post Seismic Design Event</td>
<td>160,000, 10°</td>
<td>Elevation -32.5 feet</td>
<td>0.45</td>
<td>0</td>
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</table>

Global stability analysis was performed assuming a failure surface that extends a minimum of 10 feet into bedrock (minimum 10-foot rock socket length). This resulted in a global factor of safety of at least 2.5 for all design cases.

3 ROCK SOCKET DESIGN

Socketing of both vertical and battered piles into rock by developing drilled shafts below the pile tips will be needed for additional axial and lateral support of foundation elements. If socketing is needed, it should be accomplished by advancing the pile tip to bedrock using driving techniques. Once refusal on rock is encountered with driving techniques, the pile should be drilled out beyond the pile tip into rock (to create a socket) to the required depth. The contractor should be prepared to employ measures to confirm that the driven pile is resting on competent bedrock during construction and some penetration of the pile into rock may be necessary to account for poor or weathered rock conditions.

Prior to backfilling the drilled shaft with rebar and concrete, the shafts should be flushed and cleaned so that the walls are clean of loose debris, rock, and mud. After insertion of the rebar cage, concrete should be placed in the socket boring using tremie methods to reduce the risk of voids in the socket backfill. The contractor should record the quantity of the concrete used to backfill the socket for comparison to the socket boring drilled volume. Strength of the socket concrete should be verified through regular materials testing.
structural engineer licensed in Alaska should assess the socket to evaluate the required socket strength and to determine the required steel reinforcement in the socket.

Assuming the rock socket is developed as described above, we recommend an allowable bond strength of 100 pounds per square inch. We recommend a minimum socket length of 10 feet for all sockets.

4 GROUND IMPROVEMENT

Ground improvement is needed behind the proposed new bulkhead to provide reinforcement to the existing fill and native soils. The recommendations below are based on achieving a composite friction angle of 38 degrees within the improvement zone.

We recommend ground improvement be completed using a vibroflot capable of the bottom feed method to construct stone columns. Aggregate used in ground improvement should meet the gradation and durability requirements of AASHTO Number 57 stone. To achieve a composite friction angle of 38 degrees, a replacement ratio of 17 percent should be attained. We recommend achieving the desired ratio using 7 foot spacing on a triangular grid and constructing the stone columns to a diameter of 3 feet. The columns should extend to bedrock and should be placed from the new dock face to a distance 70 feet behind (landward) of the dock face. A proposed ground improvement layout plan is attached.

Note the ground improvement design is based on the requirements to achieve the desired final stability of the dock. No consideration has been made related to the existing bulkhead structure. Damage to the existing structure during ground improvement is possible and should be evaluated by others.

KLBTMK/tmk

Enc.

Figures:
GLE Analysis (6 sheets)
Ground Improvement Layout

c: Josh Zellmer, Turnagain Marine Construction
**Lutak Dock Replacement**

**Scenario**
- Master Scenario

**Company**
- Shannon & Wilson

**Date**
- 12/16/2022, 9:08:40 AM

**File Name**
- Dock Model Final.sldm
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<th>Material Name</th>
<th>Color</th>
<th>Dv (inch)</th>
<th>cohesion (psf)</th>
<th>Phi (deg)</th>
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<td>Custom Water</td>
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<td>0</td>
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<td>Bedrock</td>
<td>Green</td>
<td>1.00</td>
<td>0</td>
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<td>Mohr - Coulomb</td>
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**Method Name**: Spencer
**Min FS**: 0.9
**GLE / Morgenstern-Price**: 1.0

**Project**: Lutak Dock Replacement

**Scenario**: Master Scenario

**Company**: Shannon & Wilson

**Date**: 12/16/2022, 9:08:40 AM

**File Name**: Dock Model Final.smdl
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<th>Friction Angle</th>
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<th>GSI</th>
<th>Dmi</th>
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<tr>
<td>Fill</td>
<td>1.00</td>
<td>Mohr-Coulomb</td>
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<td>Soil Strength</td>
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<td>No Strength</td>
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- **Method Name:** Spencer 1.0
- **Min FS:**
- **GLE/Morgenstern Price:** 1.1

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**Lutak Dock Replacement**

- **Scenario:** Master Scenario
- **Company:** Shannon & Wilson
- **Date:** 12/16/2022, 9:08:40 AM
- **File Name:** Dock Model Final.slmd
### Material Information

| Material Name | Color | Material Type | Strength Type | Cohesion (psf) | Friction Angle (deg) | UCS (psf) | Weight (lbs/ft³) | Color | Material Name
|---------------|------|---------------|---------------|----------------|----------------------|----------|-----------------|------|---------------
| Bedrock       | White| Native        | Mohr-Coulomb  | 0              | 0                    | 125      | 1.5e+06         | Native| Native        |
| Native and Fill | White| Native        | Mohr-Coulomb  | 0              | 0                    | 25       | 1.5e+06         | Native| Native and Fill |
| Generalized Hoek-Brown | Green| Generalized Hoek-Brown | Mohr-Coulomb  | 0              | 0                    | 50       | 1.5e+06         | Generalized Hoek-Brown | Generalized Hoek-Brown |
| Granular Residual (Liquefied) | Purple| Granular Residual (Liquefied) | Mohr-Coulomb  | 0              | 0                    | 25       | 1.5e+06         | Granular Residual (Liquefied) | Granular Residual (Liquefied) |
| Ground Improvement Residual | Pink| Ground Improvement Residual | Mohr-Coulomb  | 0              | 0                    | 30       | 1.5e+06         | Ground Improvement Residual | Ground Improvement Residual |

### Project Information

**Project:** Lutak Dock Replacement

**Scenario:** Master Scenario

**Company:** Shannon & Wilson

**File Name:** Dock Model Final.smd

**Date:** 12/16/2022, 9:08:40 AM
NOTES
1. Base drawing provided by Turnagain Marine Construction 3/29/23
2. See Lutak Dock Replacement Draft Geotechnical Design Memo for additional details.

LEGEND
- Proposed location of stone column.

GROUND IMPROVEMENT LAYOUT

Lutak Dock Replacement
Halvorsen, Alaska

April 2023 110150-001
SHANNON & WILSON, INC.
Engineering Firm and Recordkeeper

FIG. 1