



COASTAL EFFECTS EVALUATION

Developed on 03-09-2023

Project Name: Bifrost Submarine Fiber Optic Cable Project

Federal Project Number: NWP-2022-534

Directions: Please provide a description of all reasonably foreseeable coastal effects (15 CFR §930.11(g)) associated with the proposed project. This should include both direct and indirect effects to the environment, recreational/economic uses (e.g., impacting other users or industries), and other coastal resources. If coastal effects are already described in the federal permit/license application or submitted supplemental information you may note it in the description below to avoid duplication of effort.

Project Name: Bifrost Submarine Fiber Optic Cable System

Federal Project Number: NWP-2022-534

Applicant: AMCS LLC (AMCS)

Applicant Address: 410 Terry Avenue North, Seattle, WA 98109

Applicant Email: David Selby / subsea-interest@amazon.com; infrastructure-contract-notices@amazon.com

Authorized Agent: Cameron Fisher / cfisher@48northsolutions.com

Applicant Phone Number: (206) 577-6681 / Authorized Agent: (206) 714-5474

Brief Description:

Recognizing the urgency for greater digitalization, organizations are developing multi-cloud models that can effectively and rapidly support the evolving changing business needs. To meet the demand of global internet services and cloud development, AMCS LLC (AMCS), an affiliate of Amazon Web Services (AWS), proposes to install the Bifrost Submarine Fiber Optic Cable System (or "Bifrost"), an ultra-high speed fiber optic telecommunication cable system. Bifrost would provide large capacity direct link crossing the Pacific Ocean between the continental U.S. (Oregon and California) and Asia (Singapore), via Guam. This cable installation is in response to the increasing demand for broadband and cloud infrastructure.

For the Oregon landing, the cable would be buried in the seafloor (where possible) and land at the Wi-Ne-Ma Christian Camp in Winema/Cloverdale, Oregon. The cable would come ashore via a new steel bore pipe and upland beach manhole (BMH). From there, a new 235 foot- (71.6-m- [meter]) long terrestrial conduit system would be constructed to connect to a newly constructed terrestrial underground conduit that services multiple users along Wi Ne Ma Rd.

To avoid impacts to the beach, the pipe would be installed using horizontal directional drilling (HDD). From the BMH, which would be located on a private vacant lot on the Wi-Ne-Ma Christian Camp (Lot 6200), the bore pipe, would extend to a point beyond the active surf zone approximately 4,100 feet (1,250 m) offshore, exiting at a water depth of approximately 50 feet (15 m). Westerly from the bore exit hole, the cable would be buried beneath the seafloor via a sea plow along its predetermined offshore alignment along the continental shelf.

The Project is committed to working with the appropriate regulatory agencies to ensure all applicable permits are obtained prior to construction. In addition, AMCS has undergone an extensive stakeholder engagement effort, working closely with the local community to understand their concerns. This included AMCS staff meeting with Representatives Weber and Gomberg and hosting two community open houses in Pacific City, Oregon on 06/27/22 to introduce the project to the public and understand any questions they may have had. Letters were also mailed to landowners within 0.5 miles (0.8 kilometers [km]) of the project site prior to the community open houses.

Additional project details are found in submitted permit applications, attached. A list of all Federal, State, and Local Permits and authorizations required for the project and their current status are provided in **Table 1**. Supporting documentation including maps, figures, copies of permit applications or issued permits are attached.

Table 1. Permits, Consultations, and Approvals for Bifrost

| Responsible Agency | Permit or Approval | Progress | Contact |
|--------------------|---|--|--|
| USACE | NWP #57 (Utility Line Activities) | JPA submitted 11/25/22, revisions submitted 02/14/2023 (NWP-2022-534) | Kinsey Friesen Regulatory Project Manager Portland District, Regulatory Branch Kinsey.M.Friesen@usace.army.mil Phone: (503) 577-8298 |
| NOAA Fisheries | ESA Consultation / EFH Assessment | JPA submitted 11/25/22, revisions submitted 02/14/2023 (NWP-2022-534) Project is assumed consistent with the SLOPES STU Programmatic Biological Opinion. | Kathleen Wells Branch Chief West Coast Regional Office Willamette Branch kathleen.wells@noaa.gov Phone: (503) 230-5437 |
| USFWS | ESA Consultation | JPA submitted 11/25/22, revisions submitted 02/14/2023 (NWP-2022-534) | N/A |
| SHPO | Section 106 of National Historic Preservation Act (NHPA) Consultation | JPA submitted 11/25/22, revisions submitted 02/14/2023 (NWP-2022-534) A cultural resource report confirmed no cultural resources are located in the APE. (Applied Archaeological Research Inc. Report No. 2576, 06/29/2022) | Jamie French Assistant State Archaeologist State Historic Preservation Office jamie.french@opr.d.oregon.gov Phone: (503) 979-7580 |
| DSL | Oregon Right-of-Entry Authorization (Easement) | Easement Application deemed complete on 02/03/2023 (64189-EA) | Dario Frisone Proprietary Coordinator 775 Summer St., Salem, OR 97301 Dario.FRISONE@dsl.oregon.gov Phone: (503) 302-6094 |
| | Removal-Fill Permit | Removal-Fill Permit Application deemed complete on 02/21/2023 (64186-RF) | Dan Cary Senior Aquatic Resource Coordinator Aquatic Resource Management Program 775 Summer Street NE, Suite 100 Salem OR 97301-1279 Dan.CARY@dsl.oregon.gov Phone: (503) 986-5302 |
| DEQ | Section 401 of CWA – Water Quality Certification (WQC) | JPA submitted 11/25/22, revisions submitted 02/14/2023 (NWP-2022-534) | Jeff Brittain 401 Program Coordinator 700 NE Multnomah St. Ste 600 Portland, OR 97232 Jeffrey.Brittain@deq.oregon.gov Phone: (503) 229-5395 |
| OPRD | Ocean Shore Permit | Revised Ocean Shore Permit submitted 03/02/2023 (#3036-22) | Kevin Herkamp Ocean Shores Coordinator kevin.a.herkamp@opr.d.oregon.gov Phone: (971) 376-1509 |
| ODFW | Consultation | ODFW reviewed project route on 04/11/2022; ongoing consultation | Scott Marion Marine Habitat Project Leader Marine Resources Program 2040 SE Marine Science Dr. Newport, OR 97365 scott.r.marion@odfw.oregon.gov Phone: (541) 857-256 |
| Tillamook County | Conditional Use Permit | Conditional Use Permit approved on 01/31/2023 (#851-22-000388-PLNG) | Sarah Absher CBO, CFM, Director Community Development 1510-B Third Street Tillamook, OR 97141 sabsher@co.tillamook.or.us |

| | | | |
|------|--------------------|--|--|
| | | | Phone: (503) 842-3408 x3412 |
| | Development Permit | Floodplain Development Permit approved on 01/31/2023 (#851-22-000373-PLNG) | Sarah Absher CBO, CFM, Director Community Development 1510-B Third Street Tillamook, OR 97141 sabsher@co.tillamook.or.us Phone: (503) 842-3408 x3412 |
| OFCC | Coordination | OFCC issued a letter of support for the project on 08/03/2022 | Scott McMullen OFCC Chairman 2021 Marine Drive, Suite #102 Astoria, OR 97103 smcmullen@ofcc.com phone: (503) 325-2285 |

ENFORCEABLE POLICY REPORT

About this Report

This draft report lists the enforceable policies associated with the location of your proposed project. It is intended to provide guidance to federal permit and license applicants and federal action agencies proposing small to medium projects and does not replace the detailed analysis that is necessary to identify project-specific enforceable policies and coastal effects. Enforceable policies identified by this tool are not an exhaustive project-specific policy analysis. **Applicants and federal action agencies are wholly responsible for identifying all the applicable enforceable policies for the project.**

Directions

Review the policies listed in the table below and complete the “Coastal Effects” and “How Project Complies” columns. If any of the identified policies are not applicable to the project, include “N/A” in the associated column boxes.

- **“Coastal Effects” Column:** Include the coastal effects of the project associated with the identified policy. For example, the coastal effects associated with the removal or fill of material (ORS 196.682) may be “Dredge and fill of wetland, temporary impacts to water quality”.
- **“How Project Complies” Column:** Include how the project complies with the identified policies. One way to do this is to indicate the project elements that may mitigate or address the potential coastal effects.
 - Any policies that do require a local or state permit/authorization should be listed with the status and submission date of the associated permit/authorization. As these permits/authorizations are issued, they should be forwarded to Coast.PERMITS@dlcd.oregon.gov.
 - Any policies that do not require a permit or authorization should be listed and include project elements that show consistency with the policy, as well as the contact information for the staff at the associated jurisdiction who have been consulted on the project.

Additional Tips

- **Adding Rows for Applicable Enforceable Policies:** To add additional rows for applicable enforceable policies, right click and choose “Insert” then “Insert Rows Below”.
- If an identified policy states “Check marked document” in the “Enforceable Policy” column, click on the link to open the policy document. Highlighted or commented policies within the document are identified as enforceable policies that may apply to your proposed project.
- Policies identified in the “Local Government Plan / Land Use Regulations (Statewide Planning Goals 1-18)” table may be addressed through the completion of a Land Use Compatibility Statement.

Questions?

Contact Coast.PERMITS@dlcd.oregon.gov for assistance.



OCMP

Oregon Coastal
Management Program

ENFORCEABLE POLICY REPORT

Generated on 03/09/2023

Project Name: Bifrost Submarine Fiber Optic
Cable Project

Project Number: NWP-2022-534

Total Enforceable Policies: 37

Local Comprehensive Plan / Land Use Regulations (Statewide Planning Goals 1-18)

| Authority & Enforceable Policies | Coastal Effects | How Project Complies |
|---|-----------------|---|
| Tillamook County Comprehensive Plan | No effects. | The use is consistent with the applicable goals and policies of the Comprehensive Plan. The Project received a Conditional Use Permit (#851-22-000388-PLNG) and Floodplain Development Permit (#851-22-000373-PLNG) from Tillamook County. |
| Tillamook County Land Development Ordinance - Zoning | No effects. | The subject property is zoned Recreation Management and is also within the Flood Hazard Overlay zone, Shoreland Overlay zone, Tsunami Hazard Overlay zone, and Beach and Dune Overlay zone. As per TCLUO 3.040 (2), the development request contains the following use that is PERMITTED OUTRIGHT: <ul style="list-style-type: none"> TCLUO Section 3.040(2)(d): Utility lines, excluding power transmission lines. Project received a Conditional Use Permit (#851-22-000388-PLNG) and Floodplain Development Permit (#851-22-000373-PLNG) from Tillamook County. |

Statewide Planning Goals (Goal 19 Only)

| Authority & Enforceable Policies | Coastal Effects | How Project Complies |
|----------------------------------|-----------------|----------------------|
|----------------------------------|-----------------|----------------------|

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| <p>TSP 2: Making Resource Use Decisions</p> | <p>No effects.</p> | <p>The applicant is pursuing a Nationwide Permit (NWP) from U.S. Army Corps of Engineers (USACE) through the Joint Permit Application (JPA) process, triggering federal consistency review. Project review and permits/approvals are being applied from:</p> <ul style="list-style-type: none"> • Department of State Lands (DSL) <ul style="list-style-type: none"> ○ Easement (64189-EA) ○ Removal-Fill Permit (64186-RF) • OR Parks and Recreation Department (OPRD) <ul style="list-style-type: none"> ○ Ocean Shore Permit (#3036-22) • Oregon Department of Fish and Wildlife (ODFW) <ul style="list-style-type: none"> ○ Project review • Oregon Department of Environmental Quality (ODEQ) <ul style="list-style-type: none"> ○ WQC/NPDES Review • The Services (NOAA Fisheries/USFWS) <ul style="list-style-type: none"> ○ Project review, assumed consistent with the SLOPES STU Programmatic Biological Opinion • State Historic Preservation Office (SHPO) and Tribes <ul style="list-style-type: none"> ○ Project review ○ Cultural Resource Report completed for project • Tillamook County <ul style="list-style-type: none"> ○ Conditional Use Permit(#851-22-000388-PLNG) ○ Floodplain Development Permit (#851-22-000373-PLNG) |
| <p>GLD: State of Oregon Geographic Location Description for Marine Renewable Energy</p> | <p>N/A</p> | <p>The proposed work is not a marine renewable energy project.</p> |
| <p>TSP 4: Uses of the Seafloor</p> | <p>Cable would be buried (where possible) on the continental shelf.</p> | <p>In accordance with the Telecommunication Cables, Pipelines, and Other Utilities section of the TSP, the applicant regularly engages with the Oregon Fishermen’s Cable Committee (OFCC) to avoid conflicts and impacts. The cable is sited to mitigate impacts to marine habitats and avoid damage to or conflict with other ocean uses.</p> |

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| TSP 5: Uses of the Territorial Sea for the Development of Renewable Energy Facilities or Other Related Structures, Equipment or Facilities | N/A | The proposed work is not a marine renewable energy project. |
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| State Agency Authorities | | |
|---------------------------------|--|--|
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| Authority & Enforceable Policies | Coastal Effects | How Project Complies |
|---|------------------------|-----------------------------|
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| ORS 468A: Air Quality | No effects. | The project would likely have limited short-term and temporary effects on ambient air quality. Ambient air quality effects would be in the form of mobile emissions from the cable-laying vessel, as well as vehicle and machinery (e.g., HDD drill rig) emissions and dust from the terrestrial portion of the project. These emissions are likely to be indistinguishable from other local sources of airborne particulates, including other marine traffic, motor vehicle emissions, and dust from motor vehicle traffic. This would represent a minor increase in the number of vehicles traversing the area daily and would not result in the project area coming out of attainment. As a result, the project would meet all applicable air quality standards. |
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| ORS 468: Environmental Quality Generally | No effects. | All applicable permits are being acquired, and no unlawful air pollution, water pollution, crimes of environmental endangerment, or any other violation would occur. |
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| ORS 465: Hazardous Waste and Materials | N/A | No hazardous waste would be generated or introduced into the environment. |
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| ORS 454: Sewage Treatment and Disposal Systems | N/A | No septic tanks, gray water discharge, etc. are proposed. |
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| ORS 468b: Water Quality | <p>The installation of the cable could temporarily increase turbidity levels at the site of the HDD exit bore. Seafloor sediment may also be disturbed by the sea plow equipment during burial operations while on the continental shelf.</p> <p>Temporary increases in turbidity are expected to be minor, as sediments would rapidly disperse and/or settle back to the seabed. Once installed, the cable would not result in</p> | Project-related increases in turbidity would be minor, localized, and quickly dissipate with the currents in the water column. The project is expected to be authorized under NWP 57 and qualify for the Nationwide Section 401 Water Quality Certification (WQC). |
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| | any subsequent alterations in suspended sediments or turbidity levels. No other changes to water quality are proposed. | |
| OAR 340-041: Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon | <p>Temporary and minor increases in turbidity may occur from cable laying activities on the seabed.</p> <p>An inadvertent return is possible during any project-related HDD operations, which is planned in the nearshore, beach, and upland areas. For most inadvertent returns, the amount of fluid released is relatively minor and can be easily and/or quickly recovered/maintained.</p> <p>No wetlands or streams would be impacted by this project.</p> | <p>Project-related turbidity is expected to dissipate rapidly due to the dynamic conditions in the marine environment (e.g., currents, waves). This temporary increase in turbidity would not adversely affect water quality nor require additional mitigation measures. The project is expected to be authorized under NWP 57 and qualify for the Nationwide Section 401 WQC.</p> <p>To inform the proposed HDD installations, an in-depth site-specific geophysical and geotechnical investigation, consisting of a combination of marine and terrestrial based surveys, was conducted in May and July 2022. This investigation found conditions are favorable for cable installation. Best management practices would be implemented to increase robustness around HDD construction planning and to minimize the risk of an inadvertent return occurring.</p> <p>In the event of an unavoidable inadvertent return, operations would shut down immediately and all appropriate agencies would be notified within 24 hours. An Inadvertent Return Contingency Plan was developed for the Project and vetted by agencies.</p> |
| OAR 660-015: Land Conservation and Development Commission | N/A | N/A |
| OAR 660-035: Land Conservation and Development Commission | The project's cable would occur in Federal and State waters. Some vessel activity and minor turbidity is expected from the cable installation activities in State waters. | The applicant is pursuing a NWP#57 from USACE, triggering federal consistency review. |
| OAR 660-036: Land Conservation and Development Commission | No effects. | In accordance with the telecommunication cables policy, the applicant engages in ongoing coordination with the OFCC to avoid conflicts and impacts. The cable was sited to avoid impacting sensitive marine habitats. |

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| ORS 196: Ocean Resources | Approximately 4,661 cy of instantaneous and temporary removal and fill of seafloor sediments would occur within the territorial sea (~3,100 feet offshore at the HDD exit hole to 3 NM). | The project has applied for a Removal-Fill permit from DSL (64186-RF). By utilizing HDD, the project would avoid disturbing the beach and nearshore environment. |
| ORS 520: Conservation of Gas and Oil | N/A | No oil or gas would be impacted by the project. |
| ORS 517: Mining and Mining Claims | N/A | No mining is proposed, and no mining claims would be impacted by the project. |
| ORS 273: State Lands Generally | N/A | N/A |
| ORS 196: Regulation of Wetlands | No effects. | A wetland delineation was conducted on June 6, 2022, which found there were no terrestrial wetlands or streams within the project area. Therefore, no terrestrial wetlands or streams would be impacted by the project activities. |
| ORS 273: State Lands Generally | N/A | N/A |
| ORS 527: Forest Practices | N/A | N/A |
| ORS 509: Additional Fishery Requirements | N/A | No take of fish is expected to occur during project activities. |
| ORS 506: Commercial Fishing and Fisheries | N/A | No fishing activities or take of fish is proposed. The applicant has coordinated closely with the OFCC and ODFW to target a favorable cable route for both the environment and fishing community. |
| OAR 635-415: Fish and Wildlife Habitat Mitigation Policy | <p>The cable would then be buried approximately 5 feet below the seafloor while on the continental shelf using a sea plow towed from a cable laying vessel. End of burial would be approximately 53 nautical miles offshore. The proposed route would pass through EFH and HAPC but seek to minimize impacts to habitats.</p> <p>During the marine cable route survey, adjustments to the proposed cable's offshore footprint were made based on the observed seabed conditions, and in particular, avoidance of large rock outcrops. The intent of the proposed route is to reduce the impact to these habitats to the greatest extent</p> | <p>Impacts to fish and wildlife habitat have been mitigated through route design and no additional mitigation would be required. The applicant identified a favorable cable route through terrestrial and marine surveys, as well as consulting with local, state (including ODFW), and federal agencies; fishing community; and stakeholders.</p> <p>Sediment temporarily displaced due to cable installation would either slough back into the plow furrow or remain next to the furrow, smoothed over time by undersea currents. The ongoing presence of project components will not result in adverse effects to habitat or</p> |

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| | possible by selecting a narrow point through these offshore areas. | degradation of habitat quality. No long-term impacts are expected. |
| OAR 635-412: Fish Passage | No effects. | The project infrastructure and deployed activities do not preclude fish species from moving throughout their habitat. |
| ORS 498: Hunting, Angling, and Wildlife | N/A | No hunting or angling is proposed, and no wildlife impacts are expected. |
| OAR 635-425: In-Water Blasting Permits | N/A | No in-water blasting is proposed. |
| ORS 564: Threatened or Endangered Plants | No effects. | There are no known threatened or endangered plants in the project area. |
| ORS 496: Wildlife | N/A | No take of wildlife is proposed. |
| ORS 358: Archaeological Objects and Sites | No effects. | <p>The cable was sited to avoid all known shipwreck locations compiled from public and private sources. No shipwrecks were identified during the marine route survey conducted along the proposed cable route in 2021. Should a wreck be discovered during cable installation, it will be immediately reported to SHPO and the cable would be rerouted accordingly.</p> <p>Upon review of SHPO Historic Sites Database, no sites were identified within 0.5 miles of project activities. A cultural resource survey of the BMH parcel confirmed no cultural resources are located within project boundaries.</p> |
| OAR 736-051: Archaeological Permits | N/A | No archaeological permit is required for the proposed project activities. |
| ORS 390: Archaeological Resource Protection Policies | N/A | No removal of archaeological resources is proposed. |
| ORS 390: Oregon Parks and Recreation Department | No effects. The only project feature in OPRD's jurisdiction (between extreme low tide and the statutory vegetation line) is the 7-inch steel bore pipe, which would be installed under the beach and serve as the landing conduit into which the submarine cable would be installed. To avoid impacts to the beach, the pipe would be installed using HDD methods. | An Ocean Shore Permit (#3036-22) has been applied for from OPRD. |

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| ORS 97: Rights and Duties Relating to Cemeteries, Human Bodies and Anatomical Gifts | N/A | N/A |
| ORS 537: Appropriation of Water | N/A | N/A |
| ORS 536: Water Resources Administration | N/A | N/A |

Joint Permit Application

This is a joint application, and must be sent to all agencies (Corps, DSL, and DEQ). Alternative forms of permit applications may be acceptable; contact the Corps and DSL for more information.

Date Stamp

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|  | U.S. Army Corps of Engineers Portland District |  | Oregon Department of State Lands |  | Oregon Department of Environmental Quality |
| Action ID Number | | Number | | | |

(1) TYPE OF PERMIT(S) IF KNOWN (check all that apply)

Corps: Individual Nationwide No.: 57 Regional General Permit _____ Other (specify): _____

DSL: Individual GP Trans GP Min Wet GP Maint Dredge GP Ocean Energy No Permit Waiver

(2) APPLICANT AND LANDOWNER CONTACT INFORMATION

| | Applicant | Property Owner (if different) | Authorized Agent (if applicable) <input checked="" type="checkbox"/> Consultant <input type="checkbox"/> Contractor |
|-------------------|--|---|--|
| Name (Required) | David Selby | Matt Updenkelder / Ken Smith | Cameron Fisher |
| Business Name | AMCS LLC (AMCS) | Astound / Winema Church Camp | 48 North Solutions, Inc. |
| Mailing Address 1 | 410 Terry Avenue North | 151 E. Olive Street / 5195 Winema Rd (Appendix 1) | 1275 12 th Ave NW |
| Mailing Address 2 | | | Suite 8 |
| City, State, Zip | Seattle, WA 98109 | Newport, OR 97365 / Cloverdale, OR 97112 | Issaquah, WA 98027 |
| Business Phone | (206) 577-6684 | | |
| Cell Phone | | (541) 760-9822 / (503) 393-33362 | (206) 714-5474 |
| Fax | | | |
| Email | subsea-interest@amazon.com; infrastructure-contract-notices@amazon.com | matthew.updenkelder@astound.com / winema@winema.org | cfisher@48northsolutions.com |

(3) PROJECT INFORMATION

A. Provide the project location.

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| Project Name Bifrost Submarine Fiber Optic Cable System | <u>Latitude & Longitude*</u> 45.1468°, -123.973667° |
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| Project Address / Location The proposed horizontal directional drilling (HDD) entry point and beach manhole (BMH) is located at 5611 Wi Ne Ma Rd. | City (nearest) Cloverdale | County Tillamook |
|--|------------------------------|---------------------|

| Township | Range | Section | Quarter / Quarter | Tax Lot |
|----------|-------|---------|-------------------|-----------------------------|
| 5S | 11W | 12 | | 6200 (BMH) |
| 5S | 11W | 12 | | 1600 (Conduit in Winema Rd) |
| | | | | |

Brief Directions to the Site:

The proposed cable landing site is located at a large vacant lot along Wi Ne Ma Road on the Wi-Ne-Ma Christian Camp property in Cloverdale, Oregon. From I-5 South, follow I-405 S/US-30 W to US-26 W. Then, take a slight left onto OR-6 W and take it to US-101 S in Tillamook County. Follow 101-S to Wi Ne Ma Road.

B. What types of waterbodies or wetlands are present in your project area? (Check all that apply.)

- River / Stream Non-Tidal Wetland Lake / Reservoir / Pond
 Estuary or Tidal Wetland Other Pacific Ocean

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|-----------------------------|------------|--|--|
| Waterbody or Wetland Name** | River Mile | <u>6th Field HUC Name</u> SPRING CREEK/SAND LAKE/NESKOWIN FRONTAL | <u>6th Field HUC (12 digits)</u> 171002031101 |
| Pacific Ocean | N/A | | |

* In decimal format (e.g., 44.9399, -123.0283)

** If there is no official name for the wetland or waterbody, create a unique name (such as "Wetland 1" or "Tributary A").

C. Indicate the project category. (Check all that apply.)

| | | |
|---|---|--|
| <input checked="" type="checkbox"/> Commercial Development | <input type="checkbox"/> Industrial Development | <input type="checkbox"/> Residential Development |
| <input type="checkbox"/> Institutional Development | <input type="checkbox"/> Agricultural | <input type="checkbox"/> Recreational |
| <input type="checkbox"/> Transportation | <input type="checkbox"/> Restoration | <input type="checkbox"/> Bridge |
| <input type="checkbox"/> Dredging | <input checked="" type="checkbox"/> Utility lines | <input type="checkbox"/> Survey or Sampling |
| <input checked="" type="checkbox"/> In- or Over-Water Structure | <input type="checkbox"/> Maintenance | <input checked="" type="checkbox"/> Other: |

(4) PROJECT DESCRIPTION

A. Summarize the overall project including work in areas both in and outside of waters or wetlands.

Recognizing the urgency for greater digitalization, organizations are developing multi-cloud models that can effectively and rapidly support the evolving changing business needs. To meet the demand of global internet services, AMCS LLC (AMCS), an affiliate of Amazon Web Services (AWS), proposes to install the Bifrost Submarine Telecommunications Fiber Optic Cable System (or "Bifrost"), an ultra-high speed fiber optic telecommunication cable system. Bifrost would provide a large capacity direct link between the continental U.S. (Oregon) and Asia (Singapore), crossing the Pacific Ocean via Guam.

For the Oregon landing, the cable would be buried in the seafloor (where possible) on the continental shelf and land at the Wi-Ne-Ma Christian Camp (Figure 1) via bore pipe (Appendix 2). Upon landing in Cloverdale, the cable would be fed through a new upland BMH transitioning to a new 235-foot (71.6-meter [m]) terrestrial conduit build. This new conduit will attach to Astound's existing terrestrial cable conduit along Wi Ne Ma Rd constructed within the county Right-of-Way [ROW] that provides internet services to the Wi-Ne-Ma Christian Camp and surrounding neighbors (Figure 2). The project would avoid impacting any terrestrial wetlands and avoid crossing any streams in the area.

From Wi Ne Ma Rd, the cable will then continue along Astound's existing conduit – the "Salmon Route" – to Hillsboro. Supporting the Salmon Route, Astound is currently developing a new system that would provide high-speed internet access to rural residents and promote economic development both within the Tillamook region, as well as many remote areas between Tillamook and Hillsboro. This new system would utilize the Highway 6 ROW. Once constructed, the Bifrost cable would then utilize this new Highway 6 route, as well as the Salmon Route. The new route would provide route diversity and lower latency between the BMH and Hillsboro compared to the existing Salmon Route.

Prior to this application submittal, AMCS engaged in pre-application meetings with Tillamook County, Oregon Parks and Recreation Department (OPRD), Department of State Lands (DSL), and Oregon Department of Fish and Wildlife (ODFW). Furthermore, the Authorized Agent met with the U.S. Army Corps of Engineers (USACE), Oregon Department of Land Conservation and Development (DLCD), and Oregon Department of Environmental Quality (DEQ) to discuss permitting requirements for this project.

AMCS has also closely coordinated with the Oregon Fishermen's Cable Committee (OFCC) and ODFW to target a favorable cable route for both the environment and fishing community. An OFCC representative was on the cable route survey vessel to provide additional input and guidance on route selection. AMCS representatives also met with other members of the fishing community, including the Pacific City Dorymen's Association (PCDA).

In addition, AMCS has undergone an extensive stakeholder engagement effort, working closely with the local community to understand their concerns. This included AMCS staff meeting with State Representatives Weber and Gomberg and hosting two community open houses in Pacific City, Oregon on 06/27/22 to introduce the project to the public and understand any questions they may have had. Letters were also mailed to landowners within 0.5 miles (0.8 km) of the project site prior to the community open houses.

B. Describe work within waters and wetlands.

Seaward from the proposed BMH, the submarine fiber optic cable would extend out to the Pacific Ocean via a 4,100 feet (1,250 meters) bore pipe to be installed by horizontal directional drilling (HDD) methods. From the exit point approximately 3,100 feet offshore from the extreme low water mark, the proposed cable would extend in a general southwest direction across the Pacific Ocean (Figure 3), linking (outside the 200 nautical mile [NM] boundary) with the trunk cable from Grover Beach, California, to land in Singapore.

The HDD work would begin at a newly installed BMH located on the landward side of the beach on Lot 6200 (Figure 4). One (1) HDD bore pipe, approximately 7-inches (18-cm) in diameter and 4,100 feet (1,250 meters) in length, would extend beyond the active surf zone, approximately 3,100 feet (945 meters) offshore at a water depth of approximately 52.5 feet (16 m) (Sheet 3 of 7 in Appendix 3). This bore pipe would house the Bifrost cable. Using this HDD method would provide the terrestrial-to-marine interface while minimizing the disturbances to the beach area and nearshore environment. The bore pipe would be installed at least 30 feet (9 m) below beach grade, in accordance with Oregon State requirements, while also providing maximum protection to the cable in the surf zone. The bore is designed based on finding of a site-specific geotechnical report (Appendix 4). Four to six ocean ground beds (OGBs) would be installed adjacent to the BMH on Lot 6200 (Appendix 1 and Sheet 5 of 7 in Appendix 3).

BMH installation and HDD activities would take approximately 6 weeks to complete; however, deviations from standard operation pace, such as equipment breakdowns or delays in shipment, could add to this timeline. Upon completion of the HDD operations, areas surrounding the BMH would be restored to match existing conditions.

During HDD activities, the seabed would be disturbed at the location of the HDD exit point exclusively. Between 1-2 cubic yards (0.8-1.5 cubic meters) of seafloor sand/silt material would likely be disturbed at the exit point during drilling operations. From the HDD exit hole, the cable would then be buried while on the continental shelf using a sea plow towed by a cable laying vessel (Sheet 4 of 7 in Appendix 3). The sea plow used for cable burial would create a furrow approximately 1.5 feet (0.5 m) wide and approximately 5 feet (1.5 m) deep in which the cable would be laid. Sediment would then either slough back into the furrow immediately after the cable is laid, be pushed to the sides to refill the furrow from current action over time, or temporarily suspend in the water column, eventually settling out at varying distances from the furrow.

According to the USFWS' National Wetland Inventory (NWI), the cable would cross Estuarine and Marine Deepwater Habitat (M1UBL) and Estuarine and Marine Wetland Habitat (M2USN, M2USP) on the approach to the BMH. No terrestrial wetland habitat is located in the project area (including the BMH site and 235-foot terrestrial conduit link). A site visit confirmed these findings (Appendix 5). Therefore, the project would not impact any terrestrial wetlands or streams.

C. Construction Methods. Describe how the removal and/or fill activities will be accomplished to minimize impacts to waters and wetlands.

By utilizing HDD, the project would avoid disturbing the beach and nearshore environment. HDD operations would start from the newly proposed BMH and extend approximately 4,100 feet (1,250 m) in length to a point beyond the active surf zone, approximately 3,100 feet (945 m) offshore, exiting at a water depth of approximately 52.5 feet (16 m). The BMH would be an underground concrete vault measuring 12-feet (length) by 6-feet (width) by 7-feet (depth) (3.7x1.8x2.1 m) or of similar build (Sheet 7 of 7 in Appendix 3), which would be placed in the ground on the upland private parcel (Lot 6200).

From the HDD exit hole, the cable installer would use a sea plow to bury the fiber optic cable to approximately 5 feet (1.5 m) below seafloor surface. Sediment would either slough back into the plow furrow immediately after the cable is laid, be pushed to the sides to refill the furrow from ocean current action over time, or be temporarily suspended in the water column, eventually settling out at varying distances from the furrow. Both the HDD and cable laying activities would be temporary in nature and no discharge of construction materials would occur once the cable is installed.

HDD is generally considered the most environmentally-friendly and preferred method of construction, and has been extensively utilized for decades with high levels of success. The drilling mud used during HDD operations consists predominantly of water (92-94% which must adhere to safe drinking standards) and bentonite clay (6-7%), a naturally occurring, nontoxic clay. There may be up to 1% of other nontoxic biodegradable additives in the mud. During typical operations, this bentonite mud would be contained; it would only be released in the event of an unpreventable inadvertent return.

The HDD bore site, staging area, and terrestrial cabling would be restricted to the Wi-Ne-Ma Christian Camp's private property and existing paved ROW, eliminating any potential impacts to critical areas. An approximate 0.5-acre area at the BMH site is proposed for upland vegetation clearing for staging HDD and construction equipment. Upon completion of construction and HDD operations, these areas would be restored to their pre-existing conditions. There would be no notable or long-term impacts to sensitive terrestrial biological resources as a result of the project.

An in-depth geophysical and geotechnical site investigation, consisting of a combination of marine and terrestrial based surveys, was conducted in May and July 2022 (OPRD Scientific Research Permit #311 for the beach investigation) to improve understanding of the geology within the drill profile. Specifically, the surveys provided data identifying unfavorable sediment layers (e.g., rock, boulders, interchanging soils), allowing engineers to account for or avoid these sediment layers and amend/augment drill plan (as necessary) to minimize the risk of inadvertent returns and sinkholes. The complete results of this investigation are included in Appendix 4. Plans for an inadvertent return and drill break along the entire length of the HDD bore, or sinks holes appearing on the beach, have been developed for this project (Appendix 6)

(4) PROJECT DESCRIPTION (continued)

D. Describe source of fill material and disposal locations if known.

The cable installation would involve either plowing the seafloor or using a remote operational vehicle to bury the cable. Seafloor material would either slough back into the plow furrow or form small mounds adjacent the furrow. The cable installer would not remove this material from its existing location, although the installation may cause temporary and benign increases in turbidity and may result in some natural sediment drift.

E. Construction timeline.

What is the estimated project start date?

September 1, 2023

What is the estimated project completion date?

April 30, 2024

**Is any of the work underway or already complete?
If yes, please describe.**

Yes **No**

Marine surveys identifying a viable cable route were completed Nov-Dec 2021. Geotechnical surveys of the BMH, beach, and nearshore occurred from May-July 2022. An archaeological survey of the proposed BMH/terrestrial conduit area occurred in June 2022 (Appendix 7).

F. Removal Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

| Wetland / Waterbody Name * | Removal Dimensions | | | | | Time Removal is to remain** | Material*** |
|---|--------------------|-------------|-------------|----------------------|---------------|-----------------------------|--------------------|
| | Length (ft.) | Width (ft.) | Depth (ft.) | Area (sq.ft. or ac.) | Volume (c.y.) | | |
| Pacific Ocean - Territorial sea (~3,100 offshore at the HDD exit hole to 3 miles) | 21,629 | 0.13 | 4 | 2.9 ac | 4,661 | Instantaneous and temporary | Seafloor sediments |
| Pacific Ocean (3-200 miles) | 318,077 | 0.13 | 4 | 39.3 ac | 80,273 | Instantaneous and temporary | Seafloor sediments |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

G. Total Removal Volumes and Dimensions

| Total Removal to Wetlands and Other Waters | Length (ft.) | Area (sq. ft or ac.) | Volume (c.y.) |
|---|--------------|----------------------|---------------|
| Total Removal to Wetlands | 0 | 0 | 0 |
| Total Removal Below Ordinary High Water | 0 | 0 | 0 |
| Total Removal Below Highest Measured Tide | 0 | 0 | 0 |
| Total Removal Below High Tide Line | 0 | 0 | 0 |
| Total Removal Below Mean High Water Tidal Elevation | 1,636,319 | 38.5 ac | 84,934 |

H. Fill Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

| Wetland / Waterbody Name* | Fill Dimensions | | | | | Time Fill is to remain** | Material*** |
|---|-----------------|-------------|-------------|-----------------------|---------------|-----------------------------|-------------------------------|
| | Length (ft.) | Width (ft.) | Depth (ft.) | Area (sq. ft. or ac.) | Volume (c.y.) | | |
| Pacific Ocean - Territorial sea (~3,100 offshore at the HDD exit hole to 3 miles) | 21,629 | 0.13 | 4 | 2.9 ac | 4,661 | Instantaneous and temporary | Seafloor sediments (backfill) |
| Pacific Ocean (3-200 miles) | 318,077 | 0.13 | 4 | 30.3 ac | 80,273 | Instantaneous and temporary | Seafloor sediments (backfill) |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

(4) PROJECT DESCRIPTION (CONTINUED)

I. Total Fill Volumes and Dimensions

| Total Fill to Wetlands and Other Waters | Length (ft.) | Area (sq. ft or ac.) | Volume (c.y.) |
|---|--------------|----------------------|---------------|
| Total Fill to Wetlands | 0 | 0 | 0 |
| Total Fill Below Ordinary High Water | 0 | 0 | 0 |
| Total Fill Below <u>Highest Measured Tide</u> | 0 | 0 | 0 |
| Total Fill Below <u>High Tide Line</u> | 0 | 0 | 0 |
| Total Fill Below <u>Mean High Water Tidal Elevation</u> | 1,636,319 | 38.5 ac | 84,934 |

*If there is no official name for the wetland or waterbody, create a unique name (such as "Wetland 1" or "Tributary A").
 **Indicate whether the proposed area of removal or fill is permanent or, if you are proposing temporary impacts, specify the days, months or years the fill or removal is to remain.
 *** Example: soil, gravel, wood, concrete, pilings, rock etc.

(5) PROJECT PURPOSE AND NEED

Provide a statement of the purpose and need for the overall project.

Purpose: Recognizing the urgency for greater digitalization, organizations are developing multi-cloud models that can effectively and rapidly support the evolving changing business needs. To meet the demand of global internet services, AMCS, an affiliate of AWS, proposes to install the Bifrost Submarine Fiber Optic Cable System (or "Bifrost"), an ultra-high speed fiber optic telecommunication cable system. Bifrost would provide large capacity direct link between the continental U.S. (Oregon and California) and Asia (Singapore), crossing the Pacific Ocean via Guam to connect to AWS' U.S. West Coast region to its Asia Pacific region. This would support and accelerate the connectivity needs of both regions by providing seamless direct connectivity.

Need: With the increased demand of internet services worldwide, this cable would utilize the very latest fiber optic cable technologies to assure extremely high reliability, low latency, network diversity, and long system life. Upon landing in Winema, Bifrost would connect to an underground conduit system along Wi Ne Ma Road (within the county road ROW) being constructed by Astound as part of a separate effort to service the Wi-Ne-Ma Christian Camp. Onward connectivity from Wi Ne Ma Road to the Hillsboro area would be via Astound's existing terrestrial fiber optic cable route. In the future, Astound intends to construct a terrestrial route using a mix of new and existing conduits within an established ODOT ROW, which would enable route enhancement for Bifrost between the landing and Hillsboro. There would be multiple potential customers to this new route, and it would also facilitate high-speed internet access to rural residents and promote economic development both within the Tillamook region, as well as many remote areas between Tillamook and Hillsboro, that are not currently connected.

(6) DESCRIPTION OF RESOURCES IN PROJECT AREA

A. Describe the existing physical, chemical, and biological characteristics of each wetland or waterbody. Reference the wetland and waters delineation report if one is available. Include the list of items provided in the instructions.

Physical Characteristics:

The submarine fiber optic cable would cross the Pacific Ocean between Singapore and the west coast of the U.S., landing at the Wi-Ne-Ma Christian Camp in Cloverdale (north of Neskowin), Oregon via a bore pipe installed by HDD methods. The narrow continental shelf off of Oregon extends approximately 53 NM seaward from the coast. Immediately offshore, benthic areas are dominated by sands. The seafloor has an uneven surface with many shallow banks mostly consisting of glacial till and depressions filled with mud. There are also some areas of rocky bottom associated with uplifted banks; these areas are mapped by Oregon fishers as potential hazards to trawl nets.

Daley Lake, also known as Winema Lake, is a freshwater pond (PUBH) located approximately 0.12 miles southeast of the proposed BMH site. On the southwest side of the lake, there is a small outlet to the Pacific Ocean (R2UBH). Additionally, there is a small riverine outlet (R4SBC) that runs along Wi Ne Ma Road (to the north) that empties into Daley Lake. It crosses Wi Ne Ma Road to the northeast and continues northeast to run along US 101. The installation of the BMH and 235-foot conduit would avoid this waterbody and outlet. As such, no wetlands or streams would be impacted by this project (Appendix 5).

Chemical Characteristics:

There are no chemical characteristics relevant to this project. Turbidity of the seafloor during the cable installation would be temporary and have negligible impact the surrounding waterbody (i.e., Pacific Ocean).

Biological Characteristics:

Seven (7) marine mammal, one (1) terrestrial mammal, seven (7) fish, four (4) sea turtle, four (4) avian species, and two (2) insects that are present off of the Oregon coast or nearby the Winema landing are federally listed as threatened or endangered under the Endangered Species Act (ESA) or are candidate species, and may potentially be present in the project area. These include:

Marine Mammals

1. Blue whale (*Balaenoptera musculus*) – Endangered
2. Fin whale (*Balaenoptera physalus*) – Endangered
3. Humpback whale (Central America Distinct Population Segment [DPS], Mexico DPS) (*Megaptera novaeangliae*) – Endangered, Threatened; Critical Habitat
4. Southern Resident Killer whale (*Orcinus orca*) – Endangered, Critical Habitat
5. North Pacific right whale (*Eubalaena japonica*) – Endangered
6. Sei whale (*Balaenoptera borealis*) – Endangered
7. Sperm whale (*Physeter macrocephalus*) – Endangered

Terrestrial Mammals

1. Pacific Marten (Coastal DPS) - Threatened

Fish

1. Green sturgeon (southern DPS) (*Acipenser medirostris*) – Threatened, Critical Habitat
2. Lower Columbia River Chinook Ecologically Significant Unit (ESU) (*Oncorhynchus tshawytscha*) – Threatened
3. Lower Columbia River Coho ESU (*O. kisutch*) – Threatened
4. Coho Salmon, Oregon Coast ESU (*O. kisutch*) – Threatened, Critical Habitat
5. Lower Columbia River Steelhead ESU (*O. mykiss*) – Threatened
6. Columbia River Chum ESU (*O. keta*) – Threatened
7. Columbia River smelt- Eulachon (*Thaleichthys pacificus*) – Threatened

Sea Turtles

1. Green (*Chelonia mydas*) - Endangered
2. Leatherback (*Dermochelys coriacea*) – Endangered, Critical Habitat
3. Loggerhead (*Caretta caretta*) – Threatened
4. Olive Ridley (*Lepidochelys olivacea*) – Endangered

Birds

1. Marbled murrelet (*Brachyramphus marmoratus*) – Threatened
2. Northern Spotted Owl (*Strix occidentalis caurina*) – Threatened
3. Western Snowy Plover (*Charadrius alexandrinus nivosus*) – Threatened
4. Short-tailed Albatross (*Phoebastria (=Diomedea) albatrus*) – Endangered

Insects

1. Monarch Butterfly (*Danaus plexippus*) - Candidate
2. Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*) - Threatened

Cultural/Archaeological Characteristics:

Upon review of Oregon State Historic Preservation Office (SHPO) Historic Sites Database, no sites were identified within 0.5 miles of project activities. The closest site is the Oretown Grange Hall (Resource ID 38178) on HWY 101, approximately 1.0 mile from the BMH site. All terrestrial activities (i.e., BMH installation and terrestrial conduit link) would occur on previously disturbed land. A cultural resource survey of the BMH parcel confirmed no cultural resources are located within project boundaries (Appendix 7).

The proposed offshore cable route has been designed to avoid all known shipwreck locations compiled from public and private sources. In addition, no shipwrecks were identified during the marine route survey conducted along the proposed cable route in 2021. Avoidance is a generally accepted protected strategy for the preservation of potentially significant cultural resources, including shipwrecks. Should a wreck be discovered during cable installation, it will be immediately reported to SHPO and the cable would be re-routed accordingly.

Offshore Route:

During the marine cable route survey, adjustments to the proposed cable's offshore footprint were made based on the observed seabed conditions (e.g., seabed topography and composition), and in particular, avoidance of large rock outcrops. The proposed route would pass through EFH and HAPC but seek to minimize impacts to habitats. The intent of the proposed route is to reduce the impact to these habitats to the greatest extent possible by selecting a narrow point through these offshore areas. Coordination with both ODFW and OFCC were maintained throughout route development.

Furthermore, the proposed offshore cable route has been selected for its potential to achieve cable burial, which minimizes, if not obviates, interaction with regional fishing activities. The cable would then be buried approximately 5 feet (1.5 meters) below the seafloor while on the continental shelf using a sea plow towed from a cable laying vessel. End of burial would be approximately 53 nautical miles (61 statute miles; 98 km) offshore.

Wetlands:

No sensitive areas (e.g., wetlands, streams) occur at the proposed landing location (i.e., BMH/HDD entry hole location, Lot 6200) or along the 235-foot terrestrial conduit to Wi Ne Ma Road (Appendix 5).

B. Describe the existing navigation, fishing and recreational use of the waterbody or wetland.

One of the main socioeconomic resources along the Oregon coast is commercial and recreational fishing. The closest major fishing port to the Cloverdale landing site is the Port of Garibaldi, approximately 25 miles (40.2 km) north of Cloverdale. Major ports are also located at the northern and southern extents of the cable route in Astoria and Newport, respectively. Pacific City supports a small fleet of commercial, sport charter, and private fishing boats, including traditional dory fishing at Cape Kiwanda. Construction activities have been scheduled to avoid peak fishing season activities. Major traffic routes used by large vessels (other than fishing or recreational vessels) also occur offshore in state waters. Compared to other locations in Oregon (e.g., Warrenton, Coos Bay), however, vessel traffic in the area is limited.

(7) PROJECT SPECIFIC CRITERIA AND ALTERNATIVES ANALYSIS

Describe project-specific criteria necessary to achieve the project purpose. Describe alternative sites and project designs that were considered to avoid or minimize impacts to the waterbody or wetland.*

With the main line landing in southern California, multiple locations in northern California, Oregon, and Washington were assessed for this cable branch. Washington State was considered, however, most of the outer coast is designated as marine protected area which should be avoided as there could be greater environmental impact. Additionally, there is a lack of terrestrial fiber infrastructure in many parts of the state, making it difficult to connect back to the existing longhaul fiber routes.

Like Washington, northern California was ruled out due to concerns with terrestrial fiber routes available in the area. The northern California locations did not offer diverse backhaul routes to connect to a backbone fiber network and given the marine sanctuary off the northern California coast, the area should be avoided as there could be greater environmental impact. Sites in southern California were not considered for landing this branch because the southern branch of the Bifrost cable is already proposed to land near Los Angeles, and a branch must be diverse from the trunk, thus requiring a different location.

Oregon has long promoted itself to the submarine cable industry as a preferred destination. For example, included is a letter of encouragement issued to the submarine cable industry in 2018 from then Oregon Governor Kate Brown at the Pacific Telecommunications Conference re-affirmed the cable owners' selection of an Oregon landing (Appendix 8). A cable landing in Oregon was preferable for this cable, as it would provide a connection to AWS' U.S. West Coast region in eastern Oregon. The northern coast of Oregon provides shorter access to backhaul terrestrial cable routes to Hillsboro, minimizing risk of system failure. Criteria used for selecting the landing site in northern Oregon included:

- Access to heavy equipment trucks
- Power substation, if available
- Suitable elevated site for the CLS out of the tsunami zone
- Ample distance from residences to limit disturbance during construction
- Preference for private land over Government land
- Land available for purchase on a long-term lease
- Diverse landing away from other existing submarine cables
- Access to site via paved roads and existing terrestrial conduit
- No erosion issues
- Previously disturbed upland area for BMH and staging to limit disturbances
- Sufficiently remote from any onshore population centers to enhance the cable security and lessen any impact on any community where the cable lands, and
- Be environmentally satisfactory for the cable, while also providing an offshore route acceptable to local stakeholders, including local fishermen

Alternative Route: The preferred route was selected based on the seafloor survey results (avoidance of sensitive environments and habitats, hard substrates and existing services) and on the feasibility of the connection between the trunk cable and the landing sites. Numerous alternative routes were considered and those with significant impacts were not taken any further. The remaining alternatives had relatively similar impacts, but the route with the least impact was selected. This preferred offshore cable route was selected to avoid rocky habitat on the seafloor, critical habitat, prime fishing areas, known areas of deepwater coral, and areas with plow limitations (e.g., 14-degree uphill slope). Both OFCC and ODFW reviewed and preliminarily agreed upon the route during the planning stages (Appendix 8 for OFCC Letter of Support).

Alternative installation method: The installation method is selected to minimize engineering constraints, health and safety risks and environmental and social impacts. Seaward of the HDD punch out point the options for cable installation are surface lay, burial by diver, plough or Remote Operated Vehicle.

The least environmental impact comes from surface laying a cable but this is not recommended in depths less than 1000m water depth due to the health and safety and social impact resulting from bottom trawling vessels and anchoring vessels becoming caught on the cable. At the HDD punch out point, at a water

* Not required by the Corps for a complete application, but is necessary for individual permits before a permit decision can be rendered.

depth of 50 feet (~16m), and seaward diver burial is not undertaken because of the health and safety risk of divers in waters over 30 feet (10m). Burial by ROV is useful for shorter lengths and near obstructions like pipelines. But the ROV requires several passes to achieve the burial depth by jetting and creates a wider trench. While the plough only requires a single pass to create a slit in the seabed and thereby produces less suspended sediment in the water column. Meaning burial (where ground conditions allow) by plough as the quicker and least environmental impact option for burial.

Alternative installation timing: The HDD, BMH, cable landing and short terrestrial length installation needs to avoid the Wi-Ne-Ma Church Camp busy time of June, July and August. The HDD punch out and cable installation should avoid the commercial crabbing season of December to March. Hence the proposed timing meets these constraints.

Alternative technology: Alternative cable types are not considered as the type of cable is determined by the capacity for information transfer required and the seabed conditions. The need to install repeaters and a system earth on the subsea cable is based on the technical requirements of the subsea cable system. This considers the length of the subsea cable, the capacity requirement, and the need for signal amplification using repeaters, which therefore requires power from shore. Where powered repeaters are used, this necessitates the installation of a system earth for the return path. The alternative to using a system earth would be to only employ unpowered cables, leading to limits on the maximum cable length and capacity.

(8) ADDITIONAL INFORMATION

Are there [state](#) or [federally](#) listed species on the project site? Yes No Unknown

Is the project site within designated or proposed critical habitat? Yes No Unknown

Is the project site within a national [Wild and Scenic River](#) ? Yes No Unknown

Is the project site within a [State Scenic Waterway](#)? Yes No Unknown

Is the project site within the [100-year floodplain](#)? Yes No Unknown

If yes to any above, explain in Block 6 and describe measures to minimize adverse effects to those resources in Block 7.

Is the project site within the [Territorial Sea Plan \(TSP\) Area](#)? Yes No Unknown

If yes, attach TSP review as a separate document for DSL.

Is the project site within a designated [Marine Reserve](#)? Yes No Unknown

If yes, certain additional DSL restrictions will apply.

Will the overall project involve ground disturbance of one acre or more? Yes No Unknown

If yes, you may need a 1200-C permit from the Oregon Department of Environmental Quality (DEQ).

Is the fill or dredged material a carrier of contaminants from on-site or off-site spills? Yes No Unknown

Has the fill or dredged material been physically and/or chemically tested? Yes No Unknown

If yes, explain in Block 6 and provide references to any physical/chemical testing report(s).

Has a cultural resource (archaeological and/or built environment) survey been performed on the project area? Yes No Unknown

Do you have any additional archaeological or built environment documentation, or correspondence from tribes or the State Historic Preservation Office? Yes No Unknown

If yes, provide a copy of the survey and/or documentation of correspondence with this application to the Corps only. Do not describe any resources in this document. Do not provide the survey or documentation to DSL.

Is the project part of a DEQ Cleanup Site? No Yes Permit number _____
DEQ contact. _____

Will the project result in new impervious surfaces or the redevelopment of existing surfaces? Yes No

If yes, the applicant must submit a post-construction stormwater management plan as part of this application to DEQ's 401 WQC program for review and approval, see <https://www.oregon.gov/deq/FilterDocs/401wqcertPostCon.pdf>

Identify any other federal agency that is funding, authorizing or implementing the project.

| Agency Name | Contact Name | Phone Number | Most Recent Date of Contact |
|-------------|--------------|--------------|-----------------------------|
| N/A | | | |

List other certificates or approvals/denials required or received from other federal, state or local agencies for work described in this application.

| Agency | Certificate / approval / denial description | Date Applied |
|--------|---|--------------|
| USACE | No permit required (NWP 2021-444) | 9-27-2021 |
| OPRD | Scientific Permit (#311) | 4-11-2022 |

Other DSL and/or Corps Actions Associated with this Site (Check all that apply.)

Work proposed on or over lands owned by or leased from the Corps (may require authorization pursuant to 33 USC 408). These could include the federal navigation channel, structures, levees, real estate, dikes, dams, and other Corps projects.

- State owned waterway DSL Waterway Lease #:
- Other Corps or DSL Permits Corps # 2021-444 DSL #
- Violation for Unauthorized Activity Corps # DSL #
- Wetland and Waters Delineation Corps # DSL #

Submit the entire delineation report to the Corps; submit only the concurrence letter (if complete) and approved maps to DSL. If not previously submitted to DSL, send under a separate cover letter

(9) IMPACTS, RESTORATION/REHABILITATION, AND COMPENSATORY MITIGATION

A. Describe unavoidable environmental impacts that are likely to result from the proposed project. Include permanent, temporary, direct, and indirect impacts.

No permanent impacts to wetlands or waters of the State/U.S. are expected to occur as a result of installation and operation of the Bifrost telecommunication cable system. Prior to project construction, a Notice to Mariners would be issued by the U.S. Coast guard to mitigate interactions with navigation, fishing, and recreational activities.

Potential impacts and mitigation measures taken by the project will include the following:
 Alteration of nearshore/beach habitat — HDD would extend from private property (Lot 6200) to approximately 3,100 feet (945 m) offshore. By utilizing HDD installation methods, the project would avoid impacting the nearshore and beach habitat. From ~3,100 feet (945 m) offshore, sediment would be temporarily removed and filled as part of the cable burial process.

Inadvertent return — An inadvertent return is an unintended transfer of drilling mud to the surface during HDD operations through fractures or fissures that occur naturally (i.e., not because of boring operations). Ground disturbance is confined to the drill entry site and the exit site, avoiding impacts to vegetation or sensitive habitats along the bore path. The bentonite mud used during HDD operations would consist of non-toxic materials, predominantly water (92-94% of the mixture, which would adhere to safe drinking standards) and bentonite (6-7%), a naturally occurring, nontoxic clay that is commonly used in farming practices. Biodegradable additives (1% or less) may also be used in the bentonite mud. During typical operations, this bentonite mud would be fully contained; it would only be released in the event of an unpreventable inadvertent return.

To inform the proposed HDD installations, a thorough geophysical and geotechnical site investigation, consisting of a combination of marine and terrestrial based surveys, was conducted in May and July 2022 (OPRD Scientific Research Permit #311) to improve understanding of the geology within the drill profile. Specifically, the surveys provided data identifying unfavorable sediment layers (e.g., rock, boulders, interchanging soils), allowing engineers to account for or avoid these sediment layers and amend/augment drill plan (as necessary) to minimize risk of an inadvertent return. This investigation found conditions are favorable for cable installation. In the event of an unavoidable inadvertent return, operations would shut down immediately and all appropriate agencies would be notified within 24 hours, with clean-up occurring immediately. An Inadvertent Return Contingency Plan (Appendix 6) would be maintained on the construction site and followed, as needed. Example of the Material Safety Data Sheets are included in Appendix 6.

In the unlikely event of a drill break or another scenario that requires project equipment to be abandoned under the seafloor, potential impacts to the surrounding environment have been considered (Appendix 6). No adverse environmental, scenic, recreational, or economic impacts would likely result from a drill break or the presence of any other remaining materials below the seafloor, nor is there a reasonably conceived scenario (e.g., earthquake, tsunami, long-term coastal erosion) that would expose the materials to the surrounding environment and result in future impacts. For this reason, the recommended environmentally preferred alternative is to leave the materials in place.

Beach voids - Although rare, sinkhole formation may occur due to ground vibrations from HDD activities. These voids are likely the result of sand collapsing into the space created by the removal of the guide casing used during the installation of the permanent bore pipe that houses the submarine telecommunications cable. Induced sinkholes are typically small, spanning only a few feet wide and deep. If a sinkhole is detected, it would be addressed promptly. Agencies would be notified within 24 hours of when the sinkhole is detected, and corrective action would be taken, as necessary (Appendix 6).

Hard bottom impacts — As part of the Bifrost cable design, the OFCC and ODFW were consulted to avoid known fish habitat to the greatest extent possible. Cooperation with the OFCC and ODFW allowed AMCS to identify a cable route that would optimize burial feasibility, avoid rocky reef areas, and protect both EFH and fish species. Cable suspensions can adversely affect reef habitat and marine life while at the same time compromise the cable's integrity. By controlling cable slack, burying the cable, and avoiding reef areas, the cable would avoid the possibility of cable suspensions. Furthermore, there has been extensive interaction with the OFCC to minimize the likelihood of the cable interacting with fishing gear.

Protected Species — Cable installation is scheduled to avoid the April 1 to June 15 migration period of the Oregon State listed endangered gray whale migration, when mothers and calves are moving north in shallow waters. The timing of the proposed cable installation would thereby minimize any potential conflict with the migrating whale populations and fishing activities. Typical operational boat speeds during sea plowing are very slow: 0.3 to 0.6 knots, and up to 1 knot depending on the stiffness of the seabed and other factors. For those areas proposed for seafloor surface laying of the cable, ship speeds range up to 5 knots. At this slow speed, the vessel would avoid interactions with other marine users and marine mammals along the proposed cable route.

B. For temporary removal or fill or disturbance of vegetation in waterbodies, wetlands or riparian (i.e., streamside) areas, discuss how the site will be restored after construction to include the timeline for restoration.

The terrestrial cable route from the BMH (Lot 6200) to the existing conduit along Wi Ne Ma Road has been investigated. To minimize potential impacts, the fiber optic cable would be installed in previously disturbed areas. The HDD bore site construction area and staging area would be located in areas with previously disturbed upland vegetation, dominated by scrub/shrub with grass and forested sections (see Photolog). All project activities would avoid all terrestrial wetlands in the area. The lot is accessible via existing paved roads.

Compensatory Mitigation

C. Proposed mitigation approach. Check all that apply:

| | | | |
|--|---|---|---|
| <input type="checkbox"/> Permittee-responsible Onsite Mitigation | <input type="checkbox"/> Permittee-responsible Offsite mitigation | <input type="checkbox"/> Mitigation Bank or In-Lieu Fee Program | <input type="checkbox"/> Payment to Provide (not approved for use with Corps permits) |
|--|---|---|---|

D. Provide a brief description of proposed mitigation approach and the rationale for choosing that approach. If you believe mitigation should not be required, explain why.

No mitigation would be required. AMCS identified a favorable cable route through terrestrial and marine surveys, as well as consulting with local, state, and federal agencies; fishing community; and stakeholders. Sediment temporarily displaced due to cable installation would either slough back into the plow furrow or remain next to the furrow, smoothed over time by undersea currents. Working with the OFCC, the proposed cable route would minimize impacts to the EFH in the region. No long-term impacts to the seafloor are expected.

Based on the proposed project and limited impact to the marine environment, we understand the placement of a submarine cable in the Pacific Ocean would be consistent with the SLOPES STU Programmatic Biological Opinion, issued to the USACE by the National Marine Fisheries Service (NMFS) on March 14, 2014.

Mitigation Bank / In-Lieu Fee Information:

Name of mitigation bank or in-lieu fee project: N/A

Type and amount of credits to be purchased: N/A

If you are proposing permittee-responsible mitigation, have you prepared a compensatory mitigation plan?

Yes. Submit the plan with this application and complete the remainder of this section.

No. A mitigation plan will need to be submitted (for DSL, this plan is required for a complete

Mitigation Location Information (Fill out only if permittee-responsible mitigation is proposed)

| | | |
|--|-------------------------|--|
| Mitigation Site Name/Legal Description | Mitigation Site Address | Tax Lot # |
| County | City | Latitude & Longitude (in DD.DDDD format) |
| Township | Range | Section |
| | | Quarter/Quarter |

(10) ADJACENT PROPERTY OWNERS FOR PROJECT AND MITIGATION SITE

| <input type="checkbox"/> Pre-printed mailing labels of adjacent property owners attached separately (if more than 30). | Project Site Adjacent Property Owners | Mitigation Site Adjacent Property Owners |
|--|--|---|
| Contact Name Address 1 Address 2 City, ST ZIP Code | See Appendix 10 for complete list of adjacent property owners. | |
| Contact Name Address 1 Address 2 City, ST ZIP Code | | |
| Contact Name Address 1 Address 2 City, ST ZIP Code | | |

**(11) CITY/COUNTY PLANNING DEPARTMENT LAND USE AFFIDAVIT
(TO BE COMPLETED BY LOCAL PLANNING OFFICIAL)**

I have reviewed the project described in this application and have determined that:

- This project is not regulated by the comprehensive plan and land use regulations
- This project is consistent with the comprehensive plan and land use regulations
- This project is consistent with the comprehensive plan and land use regulations with the following:
 - Conditional Use Approval
 - Development Permit
 - Other Permit (explain in comment section below)
- This project is not currently consistent with the comprehensive plan and land use regulations. To be consistent requires:
 - Plan Amendment
 - Zone Change
 - Other Approval or Review (explain in comment section below)

An application or variance request has has not been filed for the approvals required above.

| | | |
|---|----------|-------------------|
| Local planning official name (print) | Title | City / County |
| SARAH ABSHER, CFM | DIRECTOR | PILLAMOOK COUNTY |
| Signature | | Date |
| <i>Sarah Absher</i> | | November 23, 2022 |
| Comments: CONDITIONAL USE REQUEST # 851-22-000388-PLUG + FLOODPLAIN DEVELOPMENT PERMIT # 851-22-000373-PLUG ARE UNDER REVIEW. PUBLIC HEARINGS ARE SCHEDULED FOR DECEMBER 8, 2022 + JANUARY 12, 2023. (See attached notice of public hearing.) | | |

(12) COASTAL ZONE CERTIFICATION

If the proposed activity described in your permit application is within the Oregon Coastal Zone, the following certification is required before your application can be processed. The signed statement will be forwarded to the Oregon Department of Land Conservation and Development (DLCD) for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program and consistency reviews of federally permitted projects, contact DLCD at 635 Capitol Street NE, Suite 150, Salem, Oregon 97301 or call 503-373-0050 or click [here](#).

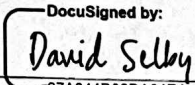
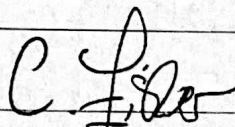
CERTIFICATION STATEMENT
I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

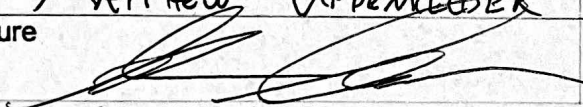
| | |
|--|----------------------------------|
| Print /Type Applicant Name | Title |
| David Selby | Authorized Signatory |
| Applicant Signature | Date |
| DocuSigned by: <i>David Selby</i> <small>27A84AC02DAB45A</small> | September 20, 2022 2:42 PM MDT |



(13) SIGNATURES

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and, to the best of my knowledge and belief, this information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities. By signing this application I consent to allow Corps or DSL staff to enter into the above-described property to inspect the project location and to determine compliance with an authorization, if granted. I hereby authorize the person identified in the authorized agent block below to act in my behalf as my agent in the processing of this application and to furnish supplemental information in support of this permit application. I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirement of obtaining the permits requested before commencing the project. I understand that payment of the required state processing fee does not guarantee permit issuance. To be considered complete, the fee must accompany the application to DSL. The fee is not required for submittal of an application to the Corps.

| | |
|---|--|
| Fee Amount Enclosed | \$ |
| Applicant Signature (required) must match the name in Block 2 | |
| Print Name David Selby | Title Authorized Signatory |
| Signature  DocuSigned by: David Selby | Date September 20, 2022 2:42 PM MDT |
| Authorized Agent Signature | |
| Print Name Cameron Fisher | Title Environmental Scientist |
| Signature  | Date September 9, 2022 |

| | |
|--|---|
| Landowner Signature(s) | |
| Landowner of the Project Site (if different from applicant) | |
| Print Name MATTHEW UPDENKLEDER | Title ASTOUND BROADBAND SR DIR CONSTRUCTION |
| Signature  | Date 9/22/22 |

| | |
|---|-------|
| Landowner of the Mitigation Site (if different from applicant) | |
| Print Name | Title |
| Signature | Date |

| | |
|---|-------|
| Department of State Lands, Property Manager (to be completed by DSL) | |
| If the project is located on state-owned submerged and submersible lands, DSL staff will obtain a signature from the Land Management Division of DSL. A signature by DSL for activities proposed on state-owned submerged/submersible lands only grants the applicant consent to apply for a removal-fill permit. A signature for activities on state-owned submerged and submersible lands grants no other authority, express or implied and a separate proprietary authorization may be required. | |
| Print Name | Title |
| Signature | Date |

* Not required by the Corps.



(14) ATTACHMENTS

- Drawings
 - Location map with roads identified
 - U.S.G.S topographic map
 - Tax lot map
 - Site plan(s)
 - Plan view and cross section drawing(s)
 - Recent aerial photo
 - Project photos
 - Erosion and Pollution Control Plan(s), if applicable
 - DSL / Corps Wetland Concurrence letter and map, if approved and applicable
- Pre-printed labels for adjacent property owners (Required if more than 30)
- Incumbency Certificate if applicant is a partnership or corporation
- Restoration plan or rehabilitation plan for temporary impacts
- Mitigation plan
- Wetland functional assessments, if applicable
 - Cover Page
 - Score Sheets
 - ORWAP OR, F, T, & S forms
 - ORWAP Reports
 - Assessment Maps
 - ORWAP Reports: Soils, Topo, Assessment area, Contributing area
- Stream Functional Assessments, if applicable
 - Cover Page
 - Score Sheets
 - SFAM PA, PAA, & EAA forms
 - SFAM Report
 - Assessment Maps
 - Aerial Photo Site Map and Topo Site Map (Both maps should document the PA, PAA, & EAA)
- Compensatory Mitigation (CM) Eligibility & Accounting [Worksheet](#)
 - Matching Quickguide sheet(s)
 - CM Eligibility & Accounting sheet
- Alternatives analysis
- Biological assessment (if requested by the Corps project manager during pre-application coordination)
- Stormwater management plan (may be required by the Corps or DEQ)
- Other
 - Please describe: Inadvertent Return Contingency Plan, Drill Break Avoidance, and Response Plan (Appendix 6)

For U.S. Army Corps of Engineers send application to:

USACE Portland District
ATTN: CENWP-ODG-P
PO Box 2946
Portland, OR 97208-2946
Phone: 503-808-4373
portlandpermits@usace.army.mil

Counties:
Baker, Benton, Clackamas, Clatsop, Columbia, Gilliam,
Grant, Hood River, Jefferson, Lincoln, Linn, Malheur,
Marion, Morrow, Multnomah, Polk, Sherman, Tillamook,
Umatilla, Union, Wallowa, Wasco, Washington, Wheeler,
Yamhill

U.S. Army Corps of Engineers
ATTN: CENWP-ODG-E
211 E. 7th AVE, Suite 105
Eugene, OR 97401-2722
Phone: 541-465-6868
portlandpermits@usace.army.mil

Counties:
Coos, Crook, Curry, Deschutes, Douglas, Jackson,
Josephine, Harney, Klamath, Lake, Lane

For Department of State Lands send application to:

West of the Cascades:
Department of State Lands
775 Summer Street NE, Ste 100
Salem, OR 97301-1279
Phone: 503-986-5200
https://www.oregon.gov/dsl/WW/Documents/uploadinstructions_removalfill.pdf

East of the Cascades:
Department of State Lands
951 SW Simpson Ave, Ste 104
Bend, OR 97702
Phone: 541-388-6112
https://www.oregon.gov/dsl/WW/Documents/uploadinstructions_removalfill.pdf

For Department of Environmental Quality:

Submit all application materials electronically through [Your DEQ Online](#).

For questions related to *Your DEQ Online*, please visit the [Your DEQ Online help page](#), email YourDEQOnline@deq.state.or.us, or call 503-229-6184

Figures

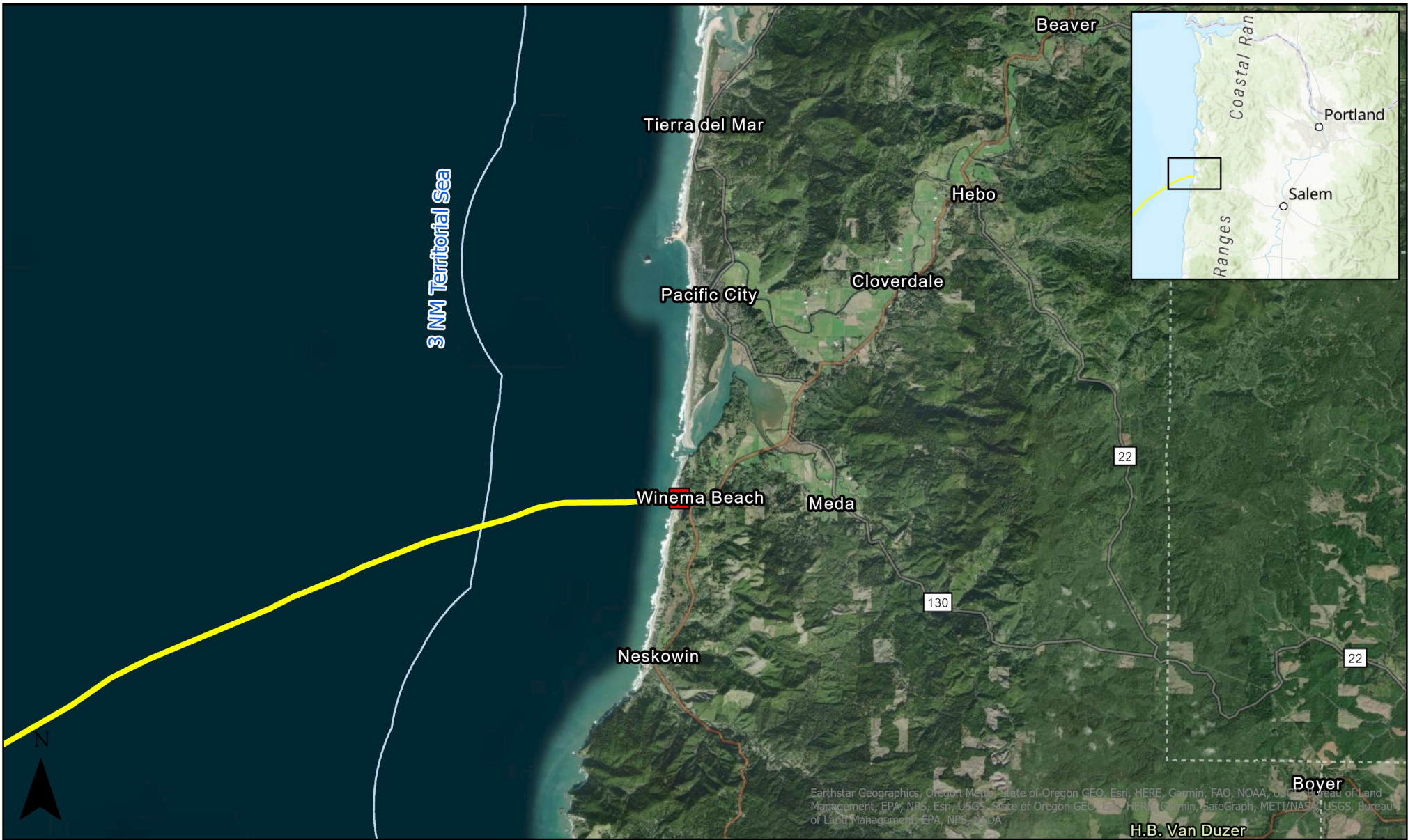


Fig. No. 1
Vicinity Map

Cloverdale, Oregon
Bifrost Submarine Cable

Prepared by: **48north**
solutions

Legend

- Beach Manhole
- Proposed Submarine Route

Scale: 1:160,000
Source: ASN, 48 NORTH
Date: 5/30/2022 11:59 AM
Spatial Reference:
PCS: NAD 1983 UTM Zone 10N

DISCLAIMER
The accuracy of source information cannot be verified; therefore, all linework, labeling, and markings appearing on this figure may be subject to errors or omissions in positions, classifications, and interpretations. This figure should only be used as a visual guide for general overview purposes.

0 2 4 8
Miles



Fig. No. 2
Proposed New and Existing
Build

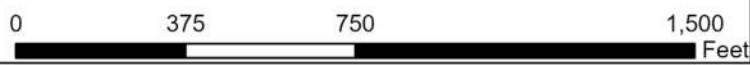
Cloverdale, Oregon
Bifrost Submarine Cable

Prepared by: **48north**
solutions

Legend

- Proposed Beach Manhole
- Proposed New HDD Landing Pipe
- Proposed New Terrestrial Conduit
- Existing Astound Conduit System

Scale: 1:4,500
Source: ASN, 48 NORTH
Date: 2/14/2023 4:11 PM
Spatial Reference:
PCS: NAD 1983 UTM Zone 10N



DISCLAIMER
The accuracy of source information cannot be verified; therefore, all linework, labeling, and markings appearing on this figure may be subject to errors or omissions in positions, classifications, and interpretations. This figure should only be used as a visual guide for general overview purposes.



Fig. No. 3
 Offshore Extent of
 Horizontal Directional Drill
 Cloverdale, Oregon
 Bifrost Submarine Cable

Legend

- Beach Manhole
- HDD Extent
- Proposed Submarine Route



Notes:
 The accuracy of source information cannot be verified, therefore all linework, labeling, and markings appearing on this map may be subject to errors or omissions in position, classifications, and interpretations. This map should only be used as a visual guide for general overview purposes.

Scale: 1:50,000
 Source: ASN, 48 NORTH
 Date: 2/14/2023 4:23 PM
 Spatial Reference:
 PCS: NAD 1983 UTM Zone 10N

DISCLAIMER
 The accuracy of source information cannot be verified; therefore, all linework, labeling, and markings appearing on this figure may be subject to errors or omissions in positions, classifications, and interpretations. This figure should only be used as a visual guide for general overview purposes.

Prepared by: **48north**
 solutions

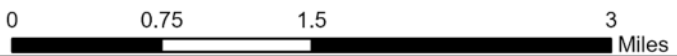




Fig. No. 4
 Tax Parcel Map of Proposed Beach Manhole Location
 Bifrost Submarine Cable Network

- Beach Manhole
- Building



Photolog

PHOTOGRAPHIC LOG: 1

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
West

Description:
General site conditions
of BMH location.



PHOTOGRAPHIC LOG: 2

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
West

Description:
Staging/OGBs site



PHOTOGRAPHIC LOG: 3

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
Southeast

Description:
Entrance to BMH site,
facing Wi Ne Ma Road.



PHOTOGRAPHIC LOG: 4

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
Northeast

Description:
Cliffs adjacent the BMH
site. (Note: building in
picture is the BMH
property owners)



PHOTOGRAPHIC LOG: 5

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
Southeast

Description:
Residences to the southeast of the proposed BMH location



PHOTOGRAPHIC LOG: 6

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
North

Description:
Beach adjacent the BMH location



PHOTOGRAPHIC LOG: 7

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
West

Description:
Beach adjacent the
BMH location



PHOTOGRAPHIC LOG: 8

Client name:
RTI Solutions

Site Location:
Winema, Oregon

Project No.:
2108-RTI-01

Date: June 27, 2022

Direction of Photo:
South

Description:
Beach adjacent the BMH
location



Appendix 1
Landownership Authorization

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DEED-EUTLA

\$55.00 \$11.00 \$61.00 \$10.00 - Total = \$137.00



00228900202200051860110111

I hereby certify that the within instrument was received for record and recorded in the County of Tillamook, State of Oregon.

Tassi O'Neil, Tillamook County Clerk

Return Address:

ATTN: Bree Urban
Wave Business Solutions, LLC
3700 Monte Villa Parkway
Bothell, WA 98021

| |
|--|
| Document Title(s) (or transactions contained therein): Utility Easement |
| Reference Number(s) of Documents assigned or released: N/A |
| Grantor(s) (Last name first, then first name and initials): Wi-Ne-Ma Christian Camp, Incorporated, an Oregon non-profit corporation |
| Grantee(s) (Last name first, then first name and initials): Wave Business Solutions, LLC, a Washington limited liability company |
| Legal description (abbreviated: i.e. lot, block, plat or section, township, range) Ptn. Lot 30 and Lot 31, Sect. 12, Twp. 5S, Rge. 11W, W.M. <input checked="" type="checkbox"/> Full legal description is on page 6 of document. |
| Assessor's Property Tax Parcel/Account Number APN# 308642 |

Appendix 2

Project Components

DESCRIPTION OF PROJECT COMPONENTS

Introduction

The proposed Bifrost Subsea Cable Project (Project) includes the installation of a submarine fiber optic cable with state waters in the Pacific Ocean, making landfall and connecting to a Cable Landing Station (CLS) in Winema, Oregon. The Project is described herein and includes both terrestrial and marine components. This project implementation will include both marine and terrestrial works as described herein.

Terrestrial Project Components

The following terrestrial Project components will be needed on land above the ordinary high-water mark:

- Cable Landing Site. The fiber optic cable coming from the ocean would land in a vacant area lot on the Wi-Ne-Ma Christian Camp (Lot 6200). Approximately 0.5-acre of space will be needed to stage the various activities necessary to complete the terrestrial portions of the work.
- Landing Pipe (LP). One landing pipe, approximately 7 inches in diameter and 4,100 feet in length, will be installed from the beach manhole (BMH) to offshore using the horizontal directional drilling (HDD) construction method. Using HDD methods allows the LP to be installed below the beach and surf zone and out into the ocean without surface disturbance along the alignment. The HDD process utilizes a large bore machine to drill a bore hole, starting at the ground surface, down to a depth of at least 20 feet by the time it reaches the sand dunes and 80 feet at the extreme low water mark, then leveling off until it needs to be guided back up to the ocean floor.
- Beach Landing Manhole. A buried BMH, also known as a landing manhole, will be installed at the landward end of the LP once it is installed. The BMH will serve as the access point to the LP and contain the splice between the marine fiber optic cable system and the terrestrial system. It will also provide access to the landing pipe for maintenance-related activities. An excavator will be used to excavate the hole into which the BMH will be placed. Once installed the BMH will be completely buried with only an access lid visible at ground level.
- Ocean Ground Bed (OGB). Since the fiber optic cable will be energized, it will need to be grounded. The OGB will be installed near the BMH on Lot 6200. The OGB system will consist of four to six ground anodes placed in a row and be connected by a ground cable to the CLS. Using an auger bit attached to an excavator, a hole approximately 12-inch in diameter, will be drilled into the ground to a depth of approximately 30 feet below surface. A grounding anode will be installed into the hole and connected back to the BMH. This would be repeated for each anode.

- **Underground Conduit System.** An underground conduit approximately 235 feet in length, will connect the BMH to a telecommunications conduit system along Winema Road. This underground conduit system will be a conduit bundle (approximately 8 to 10 inches in diameter) buried at least 3 feet deep using standard utility trenching methods. It will connect to an existing conduit along Winema Road that provides internet service the Church Camp and residential neighbors.
- **Power Feed Hut (PFE).** A PFE is needed to support powering the conduit system along Winema Road and surrounding area. This equipment will be utilized to power the submarine fiber optic cable. The PFE is located approximately one-half mile from the BMH, near the intersection of Winema Road and Highway 101. The facility houses power generation, telecommunications and ancillary equipment needed to operate Astound's residential infrastructure, as well as the marine cable. From here, the telecommunications traffic will be connected into Astound's existing telecommunications network to Hillsboro.

Marine Project Components

The marine components include the LP and the submarine fiber optic cable.

- **Landing Pipe (LP).** The LP begins on land and ends in the ocean. It is addressed under the terrestrial section above.
- **Marine Fiber Optic Cable.** The marine fiber optic cable will be buried beneath the seafloor to a depth of approximately 3 to 5 feet while on the Continental Shelf. Beyond the shelf, the cable is laid directly on the ocean floor. The cable on the shelf will measure approximately 1- to 1.5-inches in diameter and consist of the fiber optic cores, a copper conductor, stainless steel strength members, and waterproofing. The cable will be installed using either a plow or remote operated vehicle (ROV):
 - **Cable Plowing:** Most of the cable will be installed using a plow. The plow is supported by four skids that rest on the ocean floor. As the plow is towed by the cable ship, a plow shank on the back of the plow slices a furrow into the ocean floor to a depth of approximately three to five feet. The fiber optic cable is installed immediately behind the plow shank and into the plow furrow.
 - **Remote Operated Vehicle:** For areas where the plow cannot operate, the cable is buried using an ROV. The ROV is tethered to the cable ship and is placed on the ocean floor directly over the cable. The ROV tracks along the cable under its own power and uses water jets to bury the cable.

Appendix 3

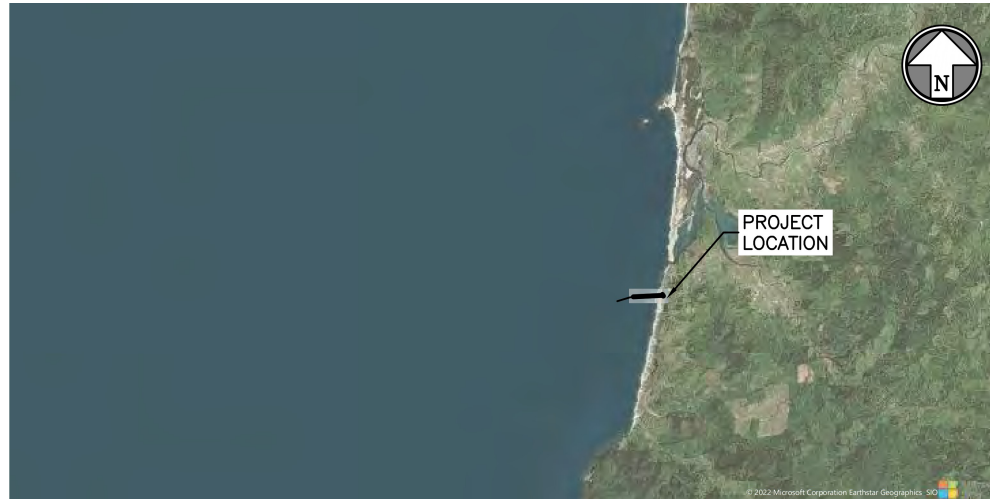
Engineering Plans

BIFROST SUBSEA CABLES PROJECT

LANDING PIPE, BHM, AND OGB DRAWINGS

SHEET INDEX

| | |
|---|--------------------------------|
| 1 | COVER SHEET |
| 2 | GENERAL NOTES AND SYMNOLOGY |
| 3 | HDD AND LANDING SITE |
| 4 | SHORE TO 3NM |
| 5 | OGB AND HDD END |
| 6 | AIR HOSE PIPE AND CABLE ANCHOR |
| 7 | BEACH MANHOLE DETAIL |



WINEMA, OREGON

RTI-1

PERMIT ISSUE
JANUARY 19 2022



CIVIL ENGINEERING / SURVEYING / UTILITIES

7101 College Boulevard, Suite 400
Overland Park, Kansas 66210
913-663-1900

BHC is a trademark of Brungardt Honomichl & Company, P.A.

PROJECT CONTACTS

OWNER'S REPRESENTATIVE
WAVE NETWORKS
MATT UPDENKELDER, PMP
PHONE: (541)-760-9822

TAX LOT:
05S11W12DC-6200

SYMBOLOLOGY

- UGE — BURIED ELECTRICAL LINE
- T — BURIED TELECOM LINE
- W — BURIED WATER LINE
- . - . - PROPERTY LINE
- — — EASEMENT
- — — TEMPORARY STAGING AREA

CONTRACTOR IS RESPONSIBLE FOR CALLING OREGON 811 AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION AND FOR LOCATING ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT EXISTING UTILITIES AND ANY DAMAGE TO THE UTILITIES SHALL BE IMMEDIATELY REPAIRED AT THE CONTRACTORS EXPENSE.

RIGHT OF WAY INFORMATION SHOWN IS APPROXIMATE.

ALL EXCAVATIONS AND WORK IN CONFINED SPACES SHALL BE PERFORMED IN ACCORDANCE WITH CURRENT OSHA REQUIREMENTS AND REGULATIONS.

THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF THE VARIOUS PERMITS OBTAINED FOR THE PROJECT. MAINTAIN 36" MINIMUM CLEARANCE OVER OR UNDER WATER, STORM & SANITARY SEWERS.

THE CONTRACTOR SHALL BE RESPONSIBLE AT ALL TIMES FOR THE MAINTENANCE OF STREETS AND OTHER UTILITIES AFFECTED BY CONSTRUCTION OPERATIONS, DEBRIS AND RUBBISH SHALL NOT BE PERMITTED TO ACCUMULATE, AND ALL PREMISES SHALL BE MAINTAINED IN A NEAT AND WORKMANLIKE CONDITION.

THERE SHALL BE ADEQUATE VEHICLE AND PEDESTRIAN ACCESS FOR INGRESS AND EGRESS FROM THE PROPERTIES ADJACENT TO THE PROJECT AT ALL TIMES.

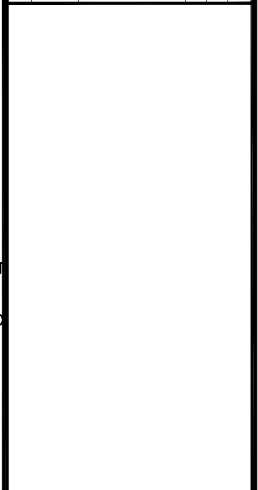
DURING NON-WORKING HOURS, THE CONTRACTOR SHALL KEEP THE EXISTING TRAFFIC LANES CLEAR FOR TRAFFIC WITHOUT INTERFERENCE FROM HIS OPERATIONS INCLUDING ALL APPROACHES AND INTERSECTIONS.

THE REQUIREMENTS OF THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) APPLY TO ALL EXCAVATION, TRENCHING, AND DITCHING OPERATIONS ON THIS PROJECT. ALL TRENCHES FOUR (4) FEET IN DEPTH SHALL BE SHORED IN COMPLIANCE WITH APPLICABLE FEDERAL AND/OR STATE REGULATIONS AS A GENERAL RULE, SHORING SHALL BE REQUIRED IN ALL STREET AREA EXCAVATIONS, AND SLOPING TO THE ANGLE OF REPOSE WILL BE PERMITTED ONLY IN NON-CRITICAL, OFF-STREET AREAS.

NO TRENCH OR EXCAVATION IN PUBLIC RIGHT OF WAY SHALL BE LEFT OPEN OVERNIGHT OR UNATTENDED.

ANY STREETS OR SIDEWALKS DISTURBED BY CONSTRUCTION SHALL BE REPAIRED OR REPLACED AND THE SURROUNDING AREA SEEDED AT THE DIRECTION OF THE LOCAL AUTHORITY SPECIFICATIONS

| Rev. | Date | Description | By | Chd | App |
|------|------------|-------------|-----|-----|-----|
| 0 | 01-05-2022 | xxx | xxx | xxx | xxx |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |



Project:
 BIFROST
 SUBSEA CABLES
 WINEMA OREGON

Site Address:
 45.146800° N
 -123.973667° W

Sheet Title:
 GENERAL NOTES AND SYMNOLOGY

Project No.:

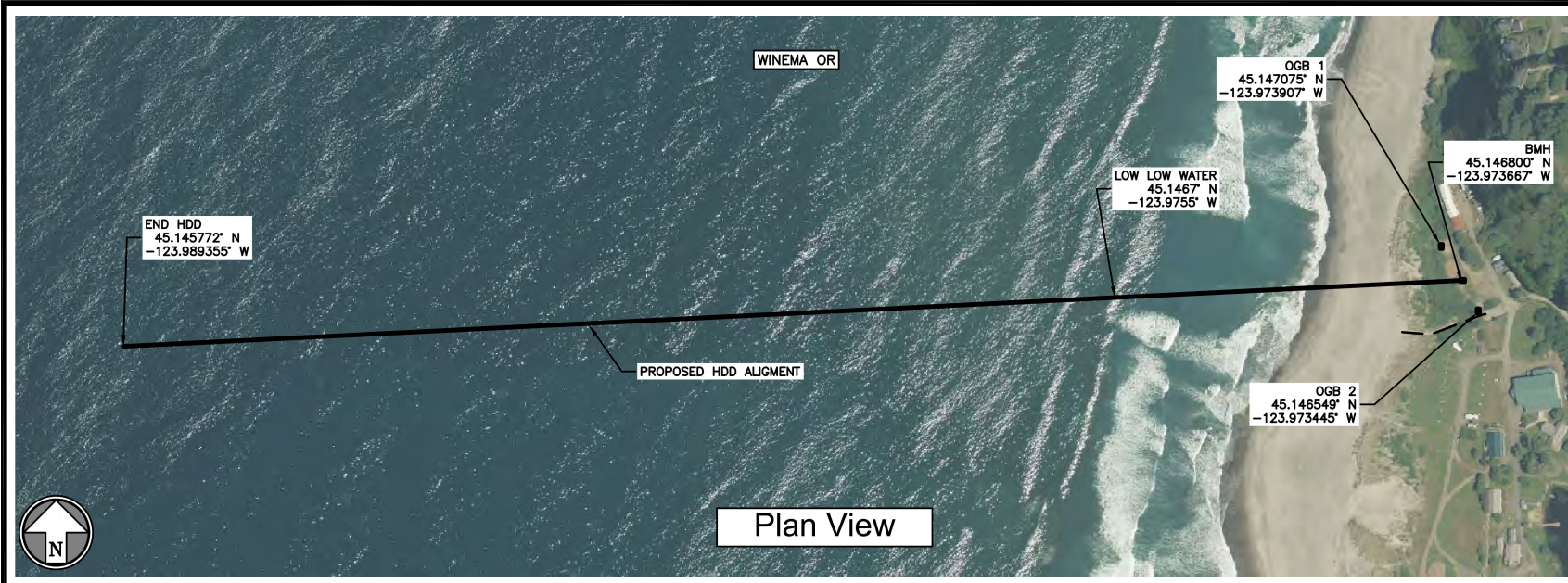
Date Drawn:

Drawn:
 Checked:
 Approved:
 Scale:

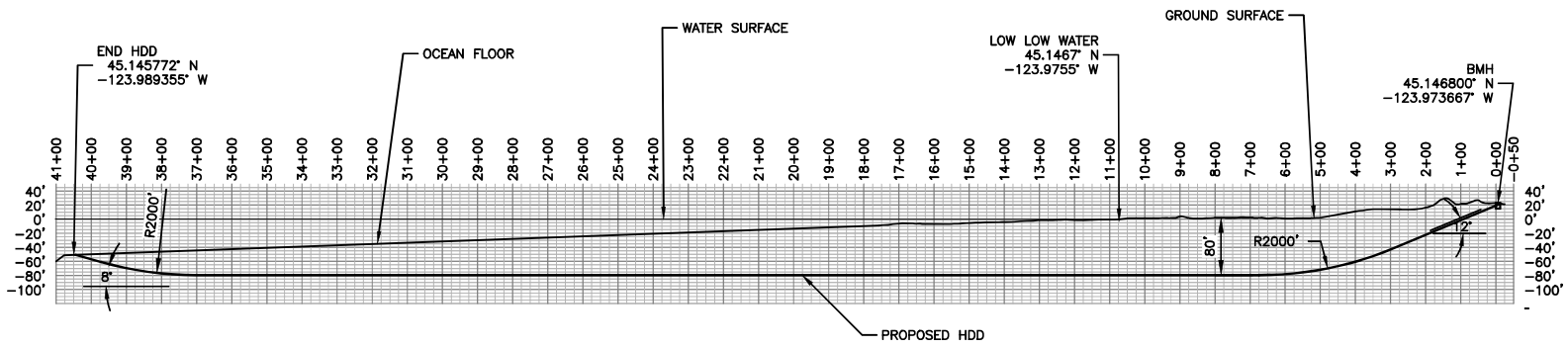
Sheet:
2
 2 of 7

Jun 16, 2022 - 10:27am Plotted By: lucas.mohr@rti-1.com P:\027630\01-01-Driver Reson Cable Landing [UNC]\Eng\Sheet\Winema\Winema_Tax_Permit.dwg Legend: GENERAL NOTES

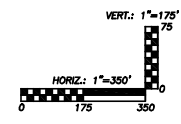
Jan 19, 2023 - 8:50am - Notes By: Robert Vaccaro - F:\027030\01\01 - Cover Beach Cable Landing\0101\01\Sheet\Winema 2023_1_19_Prelim_For_Permitting - Layout: HDD AND LANDING SITE



Plan View



Profile View



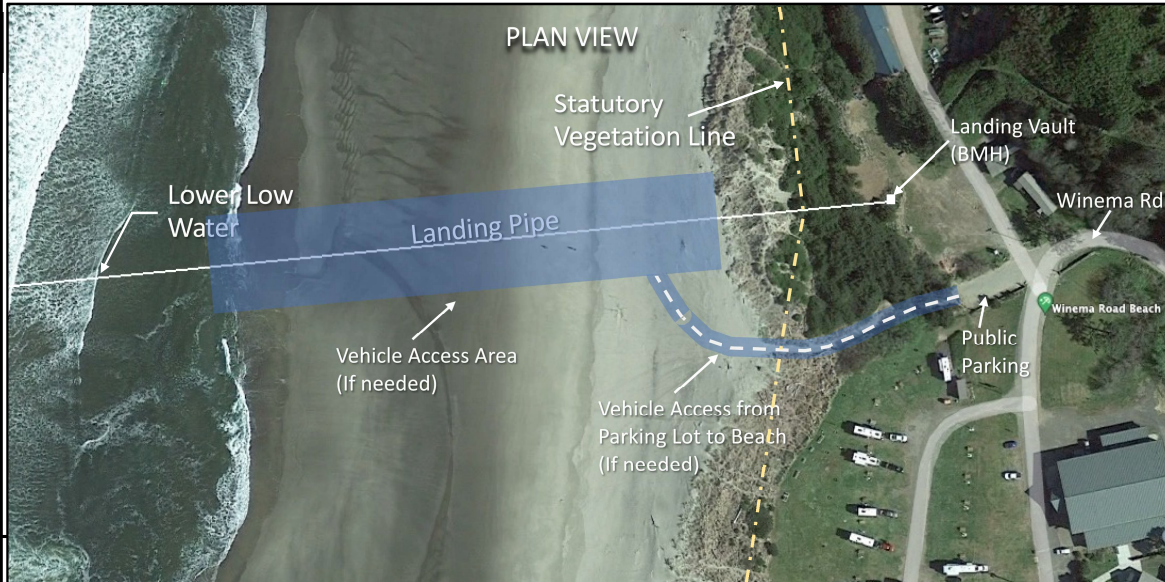
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RTI-1

BHC
CIVIL ENGINEERING / SURVEYING / UTILITIES

| | | |
|---------------|--|---|
| Project: | | BIFROST SUBSEA CABLES WINEMA OREGON |
| Site Address: | | 45.146800° N -123.973667° W |
| Sheet Title: | | HDD AND LANDING SITE |
| Project No.: | | |
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| | | 3 of 7 |

OPDR JURISDICTION & BEACH ACCESS

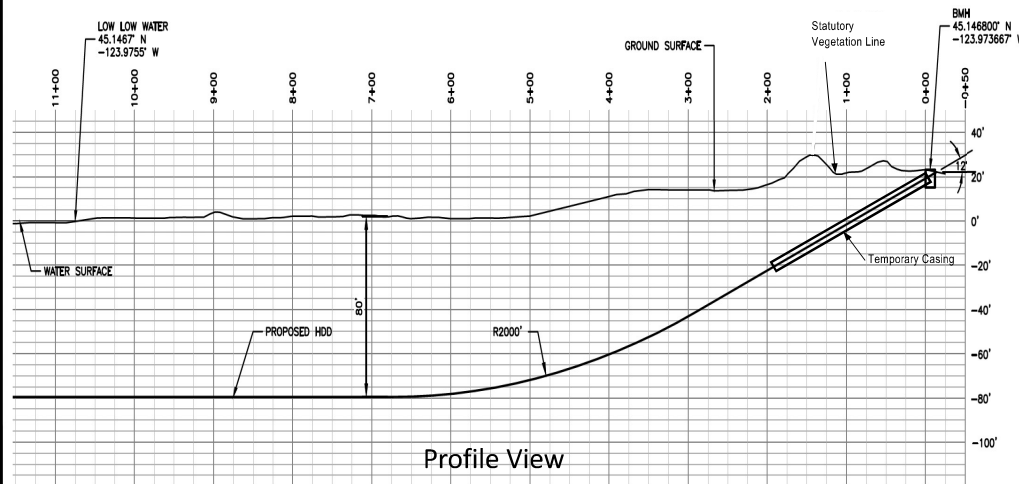


Vehicle Access from Parking Lot to Beach (If needed)



Not to Scale

Note: Edge of Tree Line to Lower Lower Water = ~1,100 feet (335m)



| Rev | Date | Description | By | Ckd | App |
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RTI-1

BHC
CIVIL ENGINEERING / SURVEYING / UTILITIES

Project:
BIFROST
SUBSEA CABLES
WINEMA OREGON

Site Address:
45.146800° N
-123.973667° W

Sheet Title:
HDD AND LANDING SITE

Project No.:

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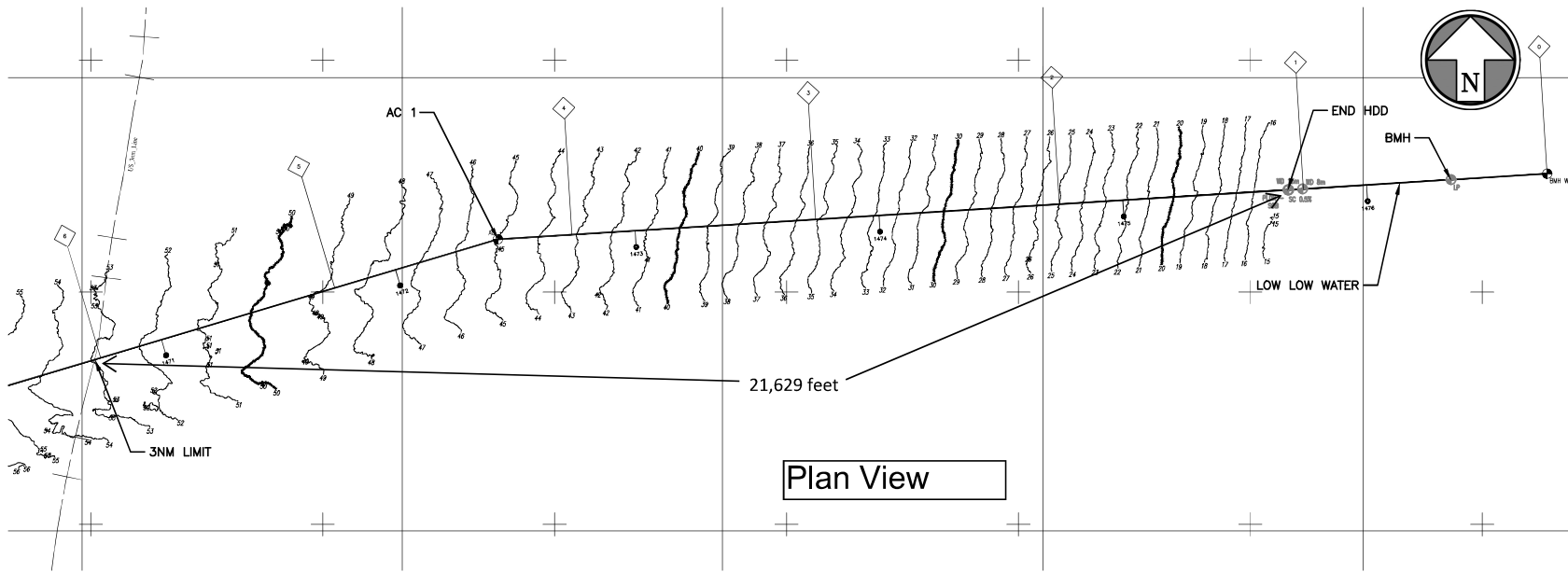
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3 of 7

Aug 19, 2022 - 10:50am Plotted By: Robert Vaccaro T:\027030\01-01-Cover-Bench-Cable-Landing\DWG\Eng\Sheet\Winema\Perim_Fur_Permit.dwg Layout: 2HM

WINEMA OR

| SEGMENT | START LATITUDE | START LONGITUDE | END LATITUDE | END LONGITUDE |
|--------------------------|----------------|-----------------|--------------|---------------|
| LOW LOW WATER TO END HDD | 45.1467° N | -123.9755° W | 45.1458° N | -123.9894° W |
| END HDD TO AC 1 | 45.1458° N | -123.9894° W | 45.1420° N | -124.0321° W |
| AC 1 TO 3NM | 45.1420° N | -124.0321° W | 45.1386° N | -124.0513° W |



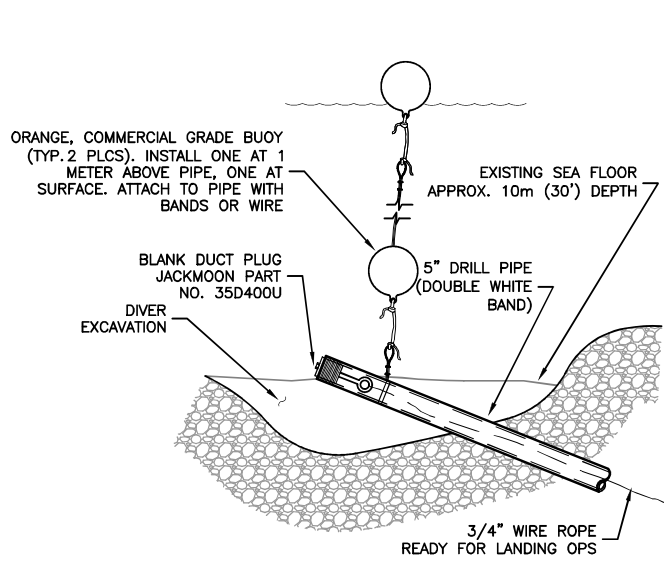
Plan View

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| 1 | 8/19/2022 | 3NM_LIMT | RW | CS | |

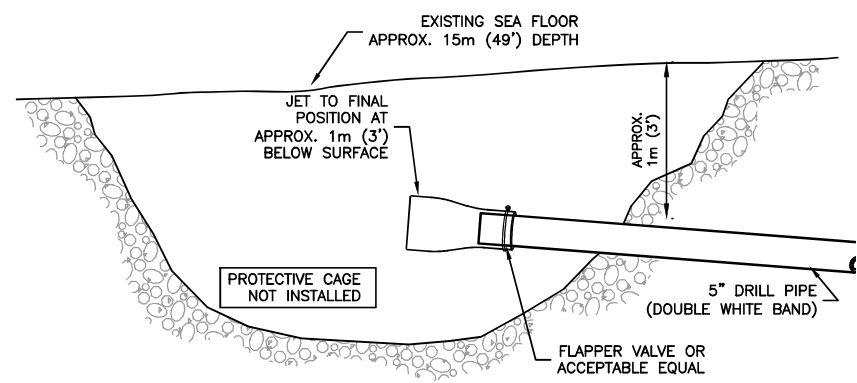


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| Sheet Title: | | SHORE TO 3NM |
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Jun 16, 2022 - 10:28am - Modified By: lucas.mohr@rti-1.com
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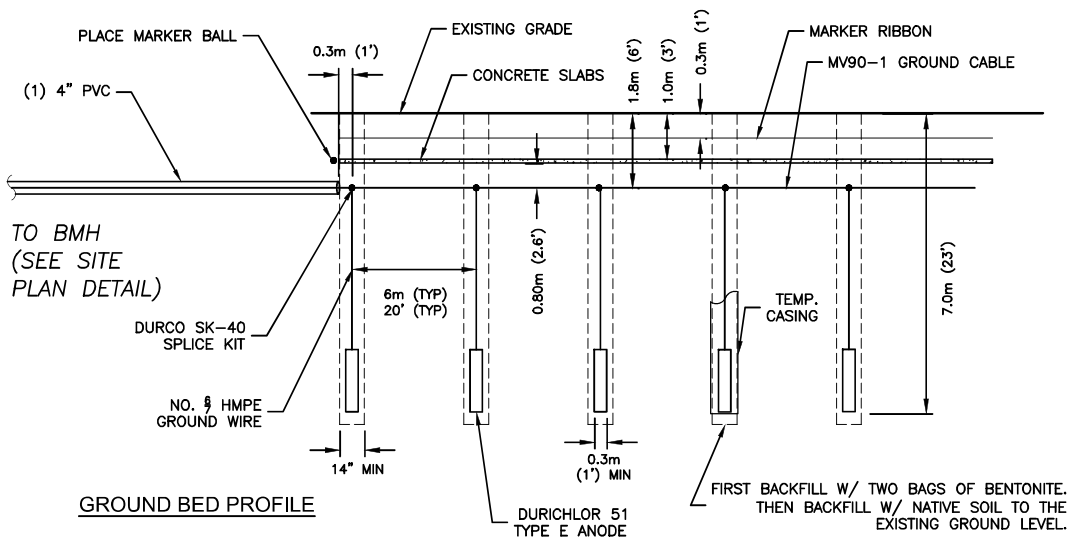


**END OF BORE PIPE - NO 1.
PREPARED FOR LANDING
CONDITION**



**END OF BORE PIPE
WITH CHECK VALVE ASSEMBLY**

- NOTES: 1. NO PULL ROPE EXISTS INSIDE BORE PIPE
 2. CONTRACTOR TO FORCE COMPRESSED AIR THROUGH BORE PIPE. EXISTING 200 PSI AIR HOSE INSIDE USING BMH-CONNECTED TO BORE PIPE WITH FLANGE ND NIPPLE CONNECTION



GROUND BED PROFILE

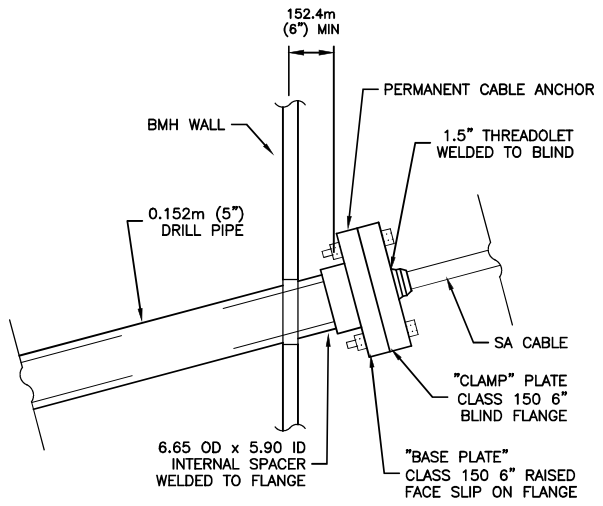
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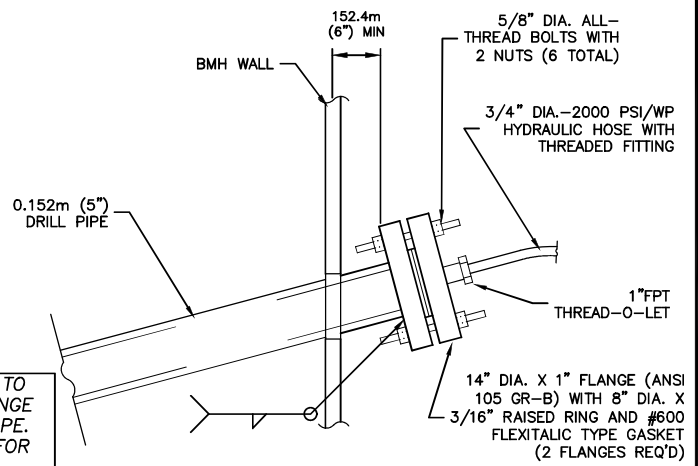
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BHC
 CIVIL ENGINEERING / SURVEYING / UTILITIES

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| Sheet Title: | | OGB AND HDD END |
| Project No.: | | |
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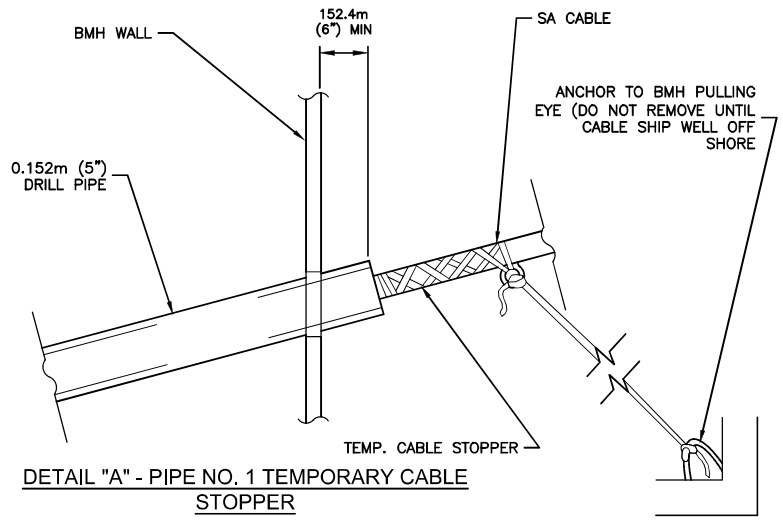
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DETAIL "B" - PIPE NO. 1 PERMANENT CABLE ANCHOR



DETAIL "C" - PIPE NO. 2 AIR HOSE CONNECTION



DETAIL "A" - PIPE NO. 1 TEMPORARY CABLE STOPPER

| Rev. | Date | Description | By | Chk | App |
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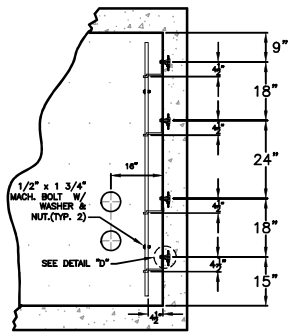
Project: BIFROST
 SUBSEA CABLES
 WINEMA OREGON
 Site Address:
 45.146800° N
 -123.973667° W
 Sheet Title:
AIR HOSE PIPE AND CABLE ANCHOR
 Project No.:
 Date Drawn:
 Drawn:
 Checked:
 Approved:
 Scale:



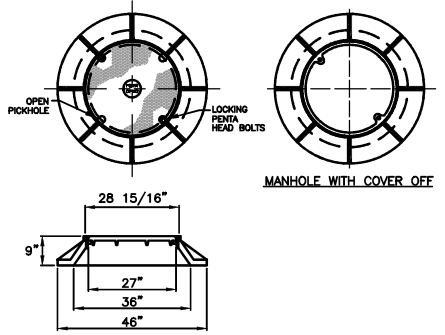
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 6 of 7

Jun 16, 2022 - 10:58am - Modified By: lucas.mohrney F:\02\2022\01-01 - Drawn Beach Cable Landing (LMS) (Sheet) (Winema)\winema_for_permitt.dwg Layout: BEACH MANHOLE

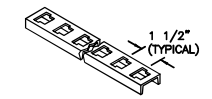
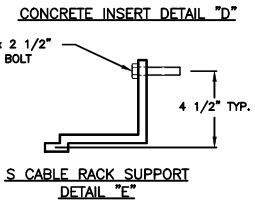
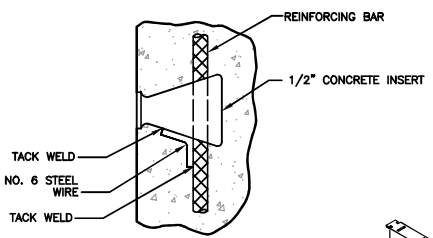
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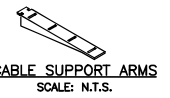
CABLE RACK MOUNTING DETAIL "C"
NOTE: TYP. ALL CABLE RACKS



MANHOLE COVER DETAIL "A"



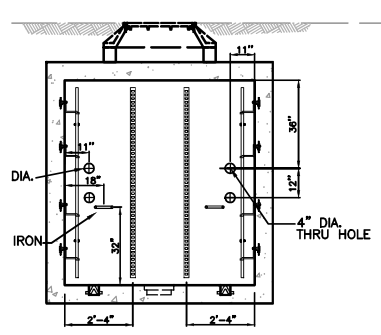
GALVANIZED CUT RACKING
SCALE: N.T.S.
MANHOLE:
46 HOLE - 1,981.20mm (6'-6")



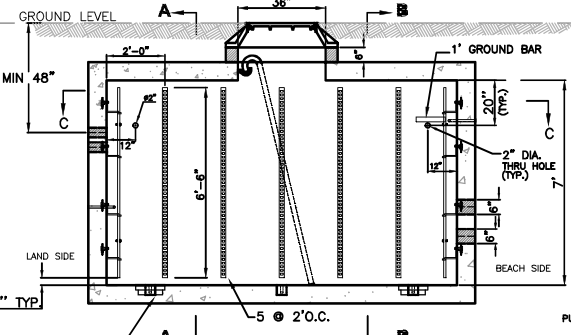
CABLE SUPPORT ARMS
SCALE: N.T.S.
FORMED FROM 4.762mm (3/16") GALVANIZED STEEL
LENGTHS:
101.6mm (4")
BEACH MANHOLE (6)
190.5mm (7 1/2")
BEACH MANHOLE (4)
328.0 mm (12")
BEACH MANHOLE (6)



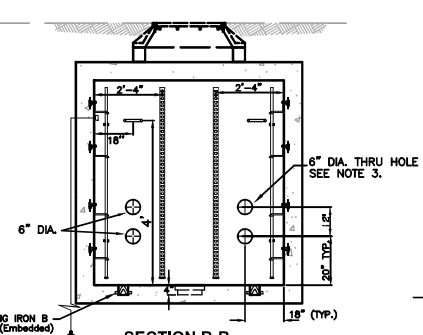
GALVANIZED SPRING NUT AND SCREW
SCALE: N.T.S.
12.7mm (1/2") NUT
19.05mm (3/4") x 31.75mm (1 1/4") PLATED CAP SCREW
(AS NECESSARY TO ACCOMMODATE RACKING)



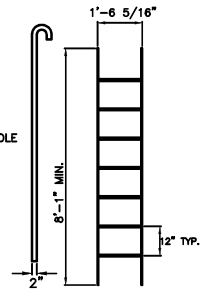
SECTION A-A
FACING LAND



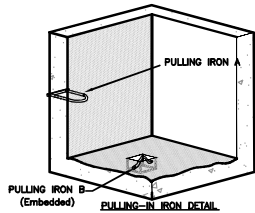
ELEVATION



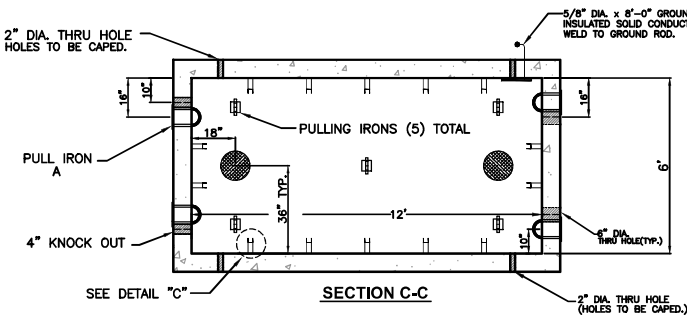
SECTION B-B
FACING SEA



LADDER DETAIL



PULLING-IRON DETAIL
Note: This detail applies to Wall and Floor of MH. Use local design. N.T.S.



SECTION C-C

- NOTE:**
1. MINIMUM PULL IRONS SHOWN. ADD ADDITIONAL PULL IRONS AS DEEMED NECESSARY.
 2. THIS DRAWING IS NOT A CONSTRUCTION DRAWING. IT IS INTENDED TO SHOW INTERNAL MINIMUM DIMENSIONS, RACKING, AND OTHER TYPICAL FEATURES.
 3. SIX INCH HOLES ARE REQUIRED FOR BEACH DUCTS OF 6" DIAMETER AND LONG LENGTH. IF THE DUCT TO THE BEACH IS LESS THAN 50 FEET AND IS 4" OR NO CONDUIT EXISTS THEN DUCT CAN BE 4".

RTI-1
PHC
CIVIL ENGINEERING / SURVEYING / UTILITIES

Project:
**BIFROST
SUBSEA CABLES
WINEMA OREGON**

Site Address:
45.146800° N
-123.973667° W

Sheet Title:
BEACH MANHOLE

Project No.:
Date Drawn:
Drawn:
Checked:
Approved:
Scale:

Sheet:
7
7 of 7

Appendix 4
Site Specific Geotechnical Report



**GEOTECHNICAL INVESTIGATION REPORT
OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, OREGON**

August 10, 2022

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ONLY THE CLIENT OR ITS DESIGNATED REPRESENTATIVES MAY USE THIS DOCUMENT AND ONLY FOR THE SPECIFIC PROJECT FOR WHICH THIS REPORT WAS PREPARED.



August 10, 2022
Project No. 20230058.001A

Mr. Chris Brungardt
RTI Solutions, Inc.
7 Turtleback Lane
Westport, CT 06880

**Subject: Geotechnical Investigation Report
Offshore Cable Landing
Horizontal Directional Drill Installations at Winema Beach
Cloverdale, Oregon**

Dear Mr. Brungardt:

Kleinfelder is pleased to present the results of a geotechnical investigation for the proposed cable duct installations that are part of the offshore cable landing project at Winema Beach near Cloverdale, Oregon. The new cable ducts are planned to be installed using horizontal directional drill (HDD) techniques.

The purpose of this study was to evaluate the subsurface conditions near the proposed trenchless installation alignments to characterize the subsurface materials likely to be encountered during HDD drilling. At this time, a pipeline alignment has not been finalized. Therefore, Kleinfelder has prepared a conceptual bore profile for HDD and completed appropriate analyses to evaluate a constructable bore path for this cable landing. Based on our evaluation of the data discussed in this report, it is our professional opinion that the proposed cable landing installation should be feasible provided the geotechnical recommendations presented are incorporated into design and construction. The primary geotechnical design and construction issue associated with the project is the presence of clean sands, gravels, cobbles and boulders above the bedrock surface that may cause instability in the borehole and difficult drilling conditions. The designer(s) and contractor(s) should be aware this issue and all other subsurface conditions as they will affect design and construction, as described herein.

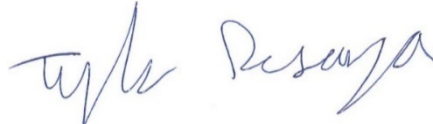
Kleinfelder appreciates the opportunity to provide services for this project. If you have questions regarding this report, please contact the undersigned.

Respectfully submitted,

KLEINFELDER, INC.



Pedro Rivas
Staff Engineer II



Tyler S. DeSouza
Project Engineer / Project Manager



Kenneth G. Sorensen
Sr. Principal Geotechnical Engineer



Samuel R. Christie, PE, GE
Principal Geotechnical Engineer



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APPENDIX E –GEOPHYSICAL INVESTIGATION RESULTS

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1 INTRODUCTION

1.1 GENERAL

This report presents the results of a geotechnical investigation conducted for the proposed cable duct installations for the offshore cable landing project at Winema Beach near Cloverdale, Oregon. The purpose of this investigation was to evaluate the subsurface conditions near the project alignment and to characterize the subsurface materials likely to be encountered during trenchless construction activities. The approximate location of the cable landing alignment is shown on Figure 1, Site Vicinity Map.

This report includes our recommendations related to the geotechnical aspects of project planning, design, and construction of the proposed trenchless cable landing installation. Conclusions and recommendations presented in this report are based on the subsurface conditions encountered at the locations of the explorations at the project site and geophysical surveys performed along the alignment. Recommendations presented herein should not be extrapolated to other areas or used for other projects without our prior review.

1.2 PROJECT DESCRIPTION

Kleinfelder understands that the proposed project includes the installation of a cable landing at Winema Beach, Oregon. It is proposed to install 2 or more cable ducts from the shore housing (Manhole) to about 4,000 feet out to sea using HDD techniques. In this case, the hollow steel drill rods used for HDD will be left in place for use as conduits, so there is no reaming or hole opening once the pilot hole is drilled. The HDD bottom hole assemblies (BHAs) will be removed once the bores exit. This does not require pulling in of conduit after the bore is drilled. After removal of the BHAs, the cables will be pulled into the open drill rod conduits.

1.3 SCOPE OF SERVICES

As authorized by RTI Solutions Inc., our scope of services included providing a report with the following items:

- A description of the proposed project, including a site vicinity map and a site plan showing the location of the subsurface explorations and proposed entry and exit points for the HDD alignments.

- A description of the site geologic setting and potentially adverse geologic hazards that could impact the project such as soil liquefaction, ground shaking and ground rupture due to earthquake activity.
- A site geology map along the proposed HDD crossing alignment depicting the anticipated geologic conditions as revealed by the boring and geophysical investigations.
- A description of the site surface and subsurface conditions encountered during the field investigation, including boring logs
- A summary of the field exploration and laboratory testing programs
- Analysis of the potential for hydraulic fracturing and inadvertent fluid releases from the HDD bore
- Recommendations related to the geotechnical aspects of HDD including:
 - Anticipated drilling conditions
 - Soil characteristics, bit, and tool selection
 - Drilling fluid considerations including effects of saline water
 - Solids and fluid volume
 - Equipment support
 - Recommendations for control of inadvertent fluid releases and related contingency planning
- Recommendations for Contractor selection and pre-bid services
- Appendices with logs of borings and laboratory test results
- Appendix including finding of geophysical work.

2 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 SITE DESCRIPTION

The proposed cable landing alignment is located adjacent to Winema Beach, west of Highway 101 in Cloverdale, Oregon. The proposed entry point for the HDD and manhole is located in a private lot north of Winema Road, east of the beach foredune. The alignment will run in a southwesterly direction from the manhole area and extend offshore underneath the Pacific Ocean for about 4,000 feet before reaching the pipe exit point. The topography is generally flat to gently rolling near the foredune located between the beach and manhole location. This area has the highest ground surface elevation along the alignment. From the foredune, the ground slopes away to the west. The project location is shown on Figure 1.

2.2 FIELD EXPLORATION PROGRAM

The field exploration program included both terrestrial and over-water explorations, as discussed below. The terrestrial field exploration program was conducted between May and June, 2022. The exploration program included drilling one (1) geotechnical boring at the proposed manhole location and conducting a geophysical survey, including MASW, ERT, and downhole seismic surveys. These exploration locations are shown on Figure 2, Exploration Location Map. Daily field report logs and available exploration equipment specification and/or calibration sheets are shown in Appendices A & B, respectively.

2.2.1 Exploratory Boring

The subsurface conditions at the site were explored on May 16th through 19th, 2022 by drilling one (1) boring utilizing a CME-75 truck-mounted drill rig equipped for mud rotary drilling and rock coring techniques. The boring was drilled near the proposed cable landing manhole location to a depth of approximately 151½ feet below the ground surface. Further, upon completion of the boring, downhole seismic testing was completed within the boring. This survey method is discussed in further detail in Section 2.2.3 below.

The boring was located in the field with a GPS unit, as well as visual sighting and/or pacing from existing site features. Therefore, the location of the boring shown on Figure 2 should be considered approximate and may vary slightly from those indicated.

A Kleinfelder professional maintained a log of the boring, visually classified the soils encountered according to the Unified Soil Classification System (American Society for Testing and Materials International [ASTM] D2488 visual-manual procedure) and obtained samples of the subsurface materials. Kleinfelder field personnel also completed logs of the bedrock by visually classifying the types of rock encountered according to the Rock Classification Systems for Engineering Purposes (American Society for Testing and Materials International [ASTM] STP984-EB visual-manual procedure) and obtained relatively undisturbed rock core samples. A Soil Description Key is provided on Figure C-2. A Rock Description Key is provided on Figure C-3. The boring log is presented on Figure C-4.

2.2.2 Sampling Procedures

Relatively undisturbed samples were obtained from the borings at selected depths by driving a 2.5-inch inside diameter (I.D.), split-barrel, California sampler containing stainless steel and brass liners into undisturbed soil with a 140-pound automatic hammer free-falling a distance of 30 inches. The California sampler was in general conformance with ASTM D3550. Soil sampled using this method may have experienced some minor disturbance due to hammer impact, retrieval, and handling. Disturbed samples were also obtained at selected depths by driving a 1.4-inch I.D. Standard Penetration Test (SPT) sampler into undisturbed soil with a 140-pound automatic hammer free-falling a distance of 30 inches. The SPT sampler was in general conformance with ASTM D1586. The rock core samples were obtained from the boring using a NQ core bit with a borehole diameter of 3.0 inches.

Blow counts were recorded at 6-inch depth intervals for each driven sample attempt and are reported on the logs. Blow counts shown on the boring logs have not been corrected for the effects of overburden pressure, rod length, sampler size, or hammer efficiency. Sampler size correction factors were applied to estimate the sample apparent density noted on the boring logs. The consistency terminology used in soil descriptions for cohesive soils is based on field observations (see Figure B-2). Disturbed soil samples and relatively undisturbed rock samples obtained from the boring were packaged and sealed in the field to reduce moisture loss and disturbance and returned to our laboratory for further testing. After the boring was completed, it was backfilled with neat cement grout.

The boring location was intentionally offset from the proposed HDD alignment in order to reduce the risk of creating a preferential conduit for inadvertent return of drilling fluid to the ground surface during HDD drilling operations. Upon completion, the boring was abandoned by placing a cement and bentonite grout mix from the bottom of the hole to the ground surface using tremie methods.

Following grouting, the boring was covered with native soil. The HDD contractor should monitor the exploration borehole location for fluid returns during HDD drilling.

Photographs of the samples recovered were taken in the field during the drilling program. A compilation of the sample photos taken in the field are provided in Figures C-5 to C-19.

2.2.3 Onshore Geophysical Survey

A geophysical survey was performed onshore between May 16th and 18th, 2022 and June 11th by Global Geophysics of Redmond, Washington. Geophysical survey methods, including Multichannel Analysis of Surface Waves (MASW), Electrical Resistivity Tomography (ERT) and Downhole Seismic Survey, were utilized along the terrestrial portion of the HDD alignment to evaluate the depth to bedrock and to characterize soil and rock stiffness and excavation characteristics. The MASW method determines variations in surface wave velocities with increasing distances and wavelengths. The data from these measurements are used to model the shear waves velocities of the subsurface. This information can then be used to infer rock/soil types, stratigraphy and soil conditions. The ERT maps differences in the electrical properties of geologic materials. These differences can result from variations in lithology, water content, pore-water chemistry, or voids. The seismic downhole method provides a designer with information pertinent to the seismic wave velocities of the materials in question. The S-wave velocities are directly related to important geotechnical properties such as of Poisson's ratio, shear modulus, bulk modulus, and Young's modulus.

The results of the ERT and the shear wave velocity measurements were used along with soil boring and geologic data to characterize the site for geotechnical design. Results of the geophysical survey are provided in Appendix E of this report.

2.2.4 Offshore Geophysical Survey

An offshore geophysical survey was performed between July 7th and 9th by Global Geophysics. The geophysical survey methods for the offshore section of the alignment included ERT and overwater profiling. These methods were used to evaluate the depth to bedrock and characterize soil and rock characteristics. The offshore ERT is performed in a similar manner as the terrestrial survey, however the measured values are much lower in sea water due to large current output. Overwater Profiling provides a continuous subsurface image of the seabed, the underlying stratigraphy and major structure features in the bedrock.

In general, higher resistivity readings indicate finer-grained and/or clayey material in soil or rock.

The results of the offshore ERT and overwater profiling are provided in Appendix E of this report.

2.3 LABORATORY TESTING

Laboratory tests are currently being performed on selected samples recovered from the boring to evaluate physical and engineering properties. The geotechnical laboratory testing program includes the following tests:

- Unit Weight (ASTM D2937)
- Moisture Content (ASTM D2216)
- Percent Finer Than No.200 Sieve (ASTM D1140)
- Sieve Analysis (ASTM D6913)
- Atterberg Limits (ASTM D4318)
- Uniaxial Compressive Strength of Intact Rock (ASTM D7012 Method C)

Unit weight, moisture content, percent passing the No. 200 sieve, and Atterberg limits results are summarized on the boring logs presented in Appendix C. The results of all laboratory tests are included in Appendix D.

3 SITE CONDITIONS

3.1 REGIONAL GEOLOGY

The site is located within the Coast Range geologic province of Central Oregon. Along the west margin of Oregon, the oceanic Juan de Fuca Plate is undergoing subduction by the continental North American plate along the Cascadia Subduction Zone, located offshore approximately 70 miles to the west of the site. The Cascadia Subduction Zone extends south from Queen Charlotte Sound in British Columbia, through Washington and Oregon, terminating at the Mendocino Triple Junction in Northern California. The basement rock in the central portion of this province consists dominantly of the Siletz Terrane (Siletz River Volcanics), an accreted island arc composed dominantly of early Eocene age (approximately 50 to 56 million years old) pillow basalt, volcanic breccia with interbedded sedimentary units. Subsequent to accretion of the Siletz Terrane, the Cascadia Subduction Zone shifted westward, generating a volcanic arc across the eastern two thirds of the state. Volcanism continued throughout the Oligocene and Miocene epochs (approximately 34 to 5 million years ago), depositing abundant volcanic flows along with interlayered lake and river deposits throughout the area. Concurrent with, and following conclusion of the volcanism, the forearc basin west of the shoreline infilled with oceanic sedimentary deposits. The Cascadia Subduction Zone has created a compressional tectonic regime, resulting in regional uplift east of the subduction zone. This regional uplift in concert with eustatic sea level change has exposed the forearc oceanic sediments throughout much of the Coast Range province. In the vicinity of the site, the deposits are overlain by and/or juxtaposed with mid to late Tertiary age (approximately 40 to 2.6 million years old) volcanic and non-marine deposits, and by younger Quaternary (approximately 2.6 million years old to present day) landslide, colluvial, alluvial, dune and beach deposits.

3.2 SITE GEOLOGY

Geologic mapping compiled by the USGS (Snively et al, 1996) presents the surficial site geology as Holocene and Pleistocene aged beach and dune sands. The underlying bedrock at the crossing location is mapped as basaltic sandstone of the Alsea Formation. The native soils and bedrock encountered at the site during our field investigation are consistent with published geologic mapping. The Geology Map can be seen in Figure 3 and detailed description of the soils and bedrock encountered in our boring is contained on the boring log in Appendix C of this report.

3.3 SEISMICITY AND FAULTING

Hazard mapping completed by the Oregon Department of Geology and Mineral Industries indicates that the proposed crossing location is in an area of earthquake hazards, specifically ground shaking. The Cascadia fold and fault belt is located approximately 2¼ miles west of the project site. The site is expected to experience very strong to severe ground shaking during a seismic event. Discussion of associated liquefaction and lateral spreading potential at the site is discussed in Section 4 below.

3.4 SUBSURFACE CONDITIONS

The following descriptions provide a general summary of the subsurface conditions encountered during the field exploration program, as well as detailed descriptions of the conditions at the crossing location. For more detailed descriptions of the actual conditions encountered at specific boring locations, refer to the boring logs presented in Appendix C.

Based on information gathered from the boring, geophysical survey, and geologic review, the site subsurface conditions are generally consistent with the mapped surficial geology referenced in the site geology section of this report. At Boring B-1, located just north of the proposed cable landing manhole, surficial soils consist of medium dense sands in the upper 20 feet, which were then underlain by dense poorly-graded gravels to a depth of about 38 feet. Very dense sands were then encountered to a depth of 60 feet before transitioning to sandstone bedrock to the boring termination depth of about 151½ feet.

The MASW survey performed onshore indicates approximately 50 to 70 feet of overburden material underlain rock with a shear wave velocity of approximately 1,400 to 2,100 feet per second (fps). Based on the geophysical results of the survey line, the overburden and bedrock transitional zone is generally more gradual, occurring over a vertical distance of approximately 20 to 40 feet. The onshore ERT results suggest a similar thickness of overburden, approximately 55 to 70 feet.

The results of the offshore geophysical survey indicate approximately 35 to 50 feet of overburden material along the alignment underlain by the basal sandstone layer. Additionally, the ERT results show variation in resistivity of the basal layer which could indicate changes in lithology such as density or composition of the rock along the alignment.

It should be noted that interbedded lenses of cobbles and boulders up to 18 inches across were encountered within the gravel layer found between approximately 20 feet to 38 feet below the ground surface within Boring B-1. Caving and/or fluid loss conditions were not noted during drilling

within this layer but are common occurrences during HDD construction in such conditions. It is not known if this layer persists along the entire alignment. Further discussion on the impact of these conditions with regard to HDD design and construction is provided in Section 4.

3.5 GROUNDWATER CONDITIONS

Groundwater levels at the site were about 11 feet below the ground surface during the drilling of Boring B-1. It is possible that groundwater conditions at the site could change due to variations in sea tides, or other factors not apparent at the time the explorations were performed.

4 DISCUSSIONS, CONCLUSIONS AND DESIGN CONSIDERATIONS

4.1 GENERAL CONCLUSIONS

Based on our geotechnical investigation and evaluation of the data discussed in this report, it is our professional opinion that the proposed trenchless crossing should be feasible provided the geotechnical recommendations presented in this report are incorporated into design and construction. Conclusions and recommendations for trenchless design and construction are provided below.

4.2 LIQUEFACTION AND LATERAL SPREADING POTENTIAL

4.2.1 Liquefaction

Liquefaction describes a condition in which saturated soil loses shear strength and deforms as a result of increased pore water pressure induced by strong ground shaking during an earthquake. Dissipation of the excess pore water pressures will produce volume changes within the liquefied soil layer, which causes settlement. Factors known to influence liquefaction potential include soil type, structure, grain size, relative density, confining pressure, depth to groundwater and the intensity and duration of ground shaking. Soils most susceptible to liquefaction are saturated, loose sandy soils, and low plasticity clays and silts. If liquefaction occurs, structures above the liquefiable layers may undergo settlement.

For layers that meet the compositional criteria, liquefaction triggering (factor of safety) analyses were performed using methodologies proposed by Youd et al. (2001), Cetin et al. (2004), and Idriss & Boulanger (2006, 2008). The analyses utilized sample blow count data from the rotary-wash borings drilled for this study. In order to perform liquefaction analysis, estimates of earthquake magnitude and peak ground acceleration (PGA_M) are needed. Using the U.S. Geological Survey (USGS) interactive deaggregation website, the modal earthquake magnitude $M_w = 9.1$ was estimated. It should be noted that the simplified liquefaction triggering analysis is valid for earthquake magnitudes of $M_w = 8.5$ or less and therefore a Magnitude of $M_w = 8.5$ was used in the simplified analysis. The peak ground acceleration (PGA_M) value for our analyses was calculated based on Equation 11.8-1 in Section 11.8.3 of ASCE 7-16 for the Risk-Targeted Maximum Considered Earthquake (MCE_R). The PGA_M value was calculated using the US Seismic Design Maps application assuming a Site Class C. The calculated PGA_M value is 0.88g for the MCE_R .

The results of the liquefaction analysis and shear wave velocity measurements indicate the potential for liquefaction at the site is low.

4.2.2 Lateral Spreading

Lateral spreading is a term describing the permanent deformation of sloping ground that occurs during earthquake shaking as a result of soil liquefaction. This typically occurs on sloping ground and adjacent to free faces such as river or canal banks. Based on the conditions encountered in the boring, the risk of lateral spreading deformation affecting the conduit due to a design-level earthquake is characterized as low due to the absence of liquefiable soils and the relatively level ground surface.

4.3 HDD CONSIDERATIONS

4.3.1 General Discussion

The proposed HDD alignment is currently planned to be approximately 4,000 feet long. Kleinfelder created a conceptual profile (shown on Figure 4a), which considers the HDD profile to cross primarily through the sandstone. This preliminary profile utilizes the stationing and approximate topographic and bathymetric survey data provided by Global Geophysics in the geophysical survey report in Appendix E. Based on our review of the pipeline alignment, subsurface conditions, and our preliminary inadvertent returns analysis, the HDD bore path appears technically feasible. However, there are several design and constructability issues that should be addressed. Discussion of these issues can be found in the sections below.

4.3.2 Anticipated Drilling Conditions

As stated previously, presence of coarse gravel to cobble-sized material with probable boulders increases the risk of loss of circulation and difficulty advancing the drill string during drilling in these materials. The installation of conductor casings extending through these large granular near-surficial soils could help to mitigate these issues. The Contractor should ultimately determine means and methods of construction. When driving external casings, the contractor should be prepared with appropriate contingency plans, including remedial actions (e.g., having multiple casing sizes on hand, lead sections with reinforcement or cutting edges, concentric auger assemblies, etc.), to install the casing through the coarse gravel to probable boulder sized materials encountered in the boring.

Mud motors will be needed in the very dense sands and gravels, and within the sandstone rock unit. The soil and rock conditions encountered in the exploratory boring is shown on the boring log in Appendix C. The Contractor should carefully evaluate the ground conditions identified in this report and should use means and methods including drilling fluid additives and drill bits that are appropriate for these ground conditions.

4.3.3 Drill Bit Selection

Drill bits should be selected based on anticipated subsurface conditions and previous experience. The drilling contractor should be prepared with a variety of bits that have worked well in similar soil and rock conditions. The use of mud motors should be considered in soils with Standard Penetration Test blow counts exceeding 50 blows per foot. The radius of the pilot hole curves should be no less than 1,000 feet to accommodate the use of a mud motor unless the characteristics of the mud motor that will be used during construction allow for a tighter turning radius.

4.3.4 Steering

The density and consistency of soils encountered at the proposed crossing site were variable and would be expected to cause difficult steering conditions for HDD drilling. The use of conductor casings advanced through the upper soils will help to reduce risk associated with steering or maintaining tangent through the large granular materials encountered.

The sandstone bedrock at the proposed crossing includes an upper, decomposed zone encountered in Boring B-1. In general, degree of weathering, and strength (including potential anisotropic rock strength, or differing strength in vertical vs horizontal direction) will be variable along the bore path as geometry transitions between tangents, vertical and horizontal curves. Localized, "mixed face" or transition conditions may result at the drill head and cause difficulty in steering or maintaining a tangent.

4.3.5 Borehole Instability

The surficial poorly graded sands and underlying poorly-graded gravels may be prone to instability in the HDD borehole. As recommended previously in Section 4.3.2, the use of conductor casing installed through these soils will mitigate these concerns. The materials appear to become denser at a depth of about 20 feet. We suggest that be considered when evaluating casing needs. The contractor should carefully evaluate the subsurface conditions identified in this report and should use means and methods including drilling fluids appropriate for these ground conditions.

4.3.6 Loss of Circulation

Loss of circulation and/or fluid loss typically occurs when the drill bit encounters large interstitial pore spaces in coarse soil materials (i.e., gravels, cobbles and boulders). Loss of returns is recognized by a decrease of drilling fluid returns, or a drop in drilling fluid pressure. If interstitial pore spaces are small or discontinuous, they may fill with solids contained in the drilling fluid returns as drilling progresses beyond them. Once the pore spaces are filled, fluid will return up the bore hole again and fluid pressure will increase until another gravel layer is encountered. If open-graded layers are continuous to the surface, drilling fluid may inadvertently return to the surface.

As shown on the boring log in Appendix C, surficial layers of loose poorly graded sand and underlying poorly graded gravels with varying amounts of sand, cobbles and boulders were encountered near the proposed HDD entry point in the upper 40 feet. The use of conductor casing installed through these soil layers will help to mitigate the risk of loss of circulation in these materials.

The consolidated rock units that were encountered consist primarily of sandstone. During our exploration program, the rock was cored to a depth of approximately 151 feet. The rock was generally slightly fractured with some joints and bedding planes. RQD values were variable (31% to 100%) due to the variable rock strength, weathering, and mechanical disturbance along the horizontal bedding planes due to the drilling process.

The drilling contractor should be prepared with drilling fluid additives to address the potential for loss of circulation in the consolidated rock. Some small lenses of granular material or fractures within the rock may be encountered, resulting in temporary loss of circulation or fluid loss. Larger gravel layers or bedrock fractures may present greater difficulty in maintaining circulation. Product data sheets and Material Safety Data Sheets for loss of circulation materials should be submitted to the owner for approval by jurisdictional regulators prior to mobilization.

4.3.7 Drilling Fluid Construction Considerations

An appropriate drilling fluid mix is necessary to maintain a clean borehole and reduce the potential for borehole instability issues which can result in poor drilling returns and partial or complete plugging of the borehole. This results in higher fluid pressures within the bore and can lead to hydraulic fracturing and inadvertent fluid returns to the ground surface. Furthermore, hydraulic fracturing is likely to occur near the bore exit point as the drill bit approaches the ground surface. This is a common risk of HDD and countermeasures should be in place to mitigate this condition.

A proper drilling fluid pressure should be maintained throughout the entire length of the bore and should be reduced as much as practical near the exit point. A pressure sensing sub several feet behind the drill bit can be used to monitor drilling fluid pressures in the bore hole and compare them to the maximum predicted allowable pressures. This can be used to help avoid inadvertent fluid releases. The pressure sub provides real-time monitoring of fluid pressures within the borehole and is useful in detecting a spike in drilling pressure that may result from a borehole that is not well cleaned and/or becomes blocked with the drilling solids. Furthermore, the pressure data allows the driller to understand when modifications to the drilling method may be needed to avoid a fluid release.

4.3.8 Inadvertent Returns of Drilling Fluid

Hydraulic fracturing occurs when borehole pressure causes plastic deformation of the soil surrounding the borehole, initiating and propagating fractures in the soil mass. The resistance to plastic deformation and fracturing is a function of soil strength, overburden pressure, and pore water pressure. Hydraulic fracturing can result in drilling fluid inadvertently returning to the ground surface or running horizontally away from the borehole. Allowable borehole pressure was evaluated using the Delft Geotechnics equation and the methods presented in the NASTT Good Practices Guidelines, 4th edition. The estimated allowable borehole pressure was compared to predicted borehole pressure in our analyses.

A preliminary hydraulic fracturing analysis was performed for the proposed alignment, as shown on Figure 4. A pilot-hole diameter of 12¼ inches, a drill rod diameter of 5-7/8 inches, and a mud pump output of up to 400 gallons per minute was used. Target up-hole fluid velocities in the analyses range from about 85 to 95 feet per minute in our analysis. The drilling fluid density was estimated to be about 10 to 12 pounds per gallon. Changes in the drilling fluid properties and drilling equipment affect the analysis results.

Once layout of the alignment is complete and the contractor's equipment has been selected, finalized inadvertent returns and pipe stress analyses to confirm the adequacy of the selected bore path should be performed.

Borehole instability issues and/or the contractor not maintaining a clean borehole can result in poor drilling returns and partial or complete plugging of the borehole. This will result in higher fluid pressures within the bore and can lead to hydraulic fracturing and inadvertent fluid returns to the ground surface.

Based on our preliminary inadvertent returns analysis (see Appendix C), the HDD profiles are technically feasible. However, hydraulic fracturing could occur and would be expected to occur near the bore exit point as the drill bit approaches the ground surface. This is a common risk of HDD and countermeasures should be in place to mitigate this condition. Measures such as drilling without fluid for the last few rod joints, using air as a drilling fluid, or not exiting the bore hole and digging down to it from the sea floor are several ways to approach this issue. The contractor should select the appropriate methods to use based on their equipment and project constraints.

4.4 DRILLING FLUID PROGRAM

4.4.1 General

The drilling contractor should develop a Drilling Fluid Program (DFP) as part of the HDD Bore Plan. A properly designed drilling fluid program can substantially reduce losses due to hydraulic fracturing, stuck product pipe, or loss of tooling. The drilling fluid program should account for anticipated soil conditions, fluid selection, drill bit and reamer selection, and volume calculations. For this project we recommend a drilling fluid engineer be on site during drilling to make needed adjustments in drilling fluid properties based on the encountered conditions.

4.4.2 Borehole Slurry Density

The density of the slurry in the borehole directly affects the buoyancy force and therefore the normal force between the pipe and the wall of the borehole. The density of drilling returns is a function of ground conditions, penetration rate, mud flow rate, drilling fluid composition, and efficiency of the mud cleaning system. In general, drilling return density with about 20% solids varies between 9 and 11 pounds per gallon in soil and up to about 12 pounds per gallon in rock. In coarse gravel and cobbles, drilling fluid densities can approach 13 pounds per gallon.

For this project we anticipate drilling fluid return density will be on the order of 10 to 12 pounds per gallon where good returns are achieved, and drilling is performed in accordance with the NASTT's HDD Good Practices Guidelines (2017).

4.4.3 Soil Conditions for Drilling Fluid Design

For the purpose of drilling fluid design, earth materials are divided into two categories: Inert, including sand and gravel; and reactive, including clay. Information regarding subsurface conditions likely to be encountered at the site is provided in the Subsurface Conditions section of this report as well as in the boring log for the exploration performed for this study in Appendix C.

4.4.4 Drilling Fluid Selection

Drilling fluid program base fluid should be designed for site-specific soil conditions. The base fluid may consist of either a bentonite or polymer and water, with additives to achieve specific fluid properties.

The drilling contractor should submit a base fluid design with a list of additives, loss of circulation materials, and grouting materials that may be used on the project and SDS sheets for approval at least two (2) weeks prior to mobilization. Assistance with drilling fluid selection can be obtained from reputable drilling fluid suppliers.

4.4.5 Soil and Fluid Volume

The volume of soil to be removed can be estimated as follows:

$$\frac{(\text{Hole Diameter in Inches})^2}{25} = \text{Volume in Gallons per Foot}$$

Sufficient fluid should be pumped during drilling and reaming operations to maintain flow. Drilling rates and drilling fluid flow rates may be adjusted in the field to match varying site conditions. However, an estimate of drilling fluid demand is useful when sizing drilling equipment, mud pumps, and solids removal systems, and can be particularly helpful in determining realistic drilling rates. Drilling fluid demand can be estimated based on the bore hole volume and the following ratios:

| <u>Fluid Volume: Soil Volume</u> | <u>Ratio</u> |
|----------------------------------|--------------|
| Sand, Gravel, Cobble, Rock | 1:1 |
| Above, mixed with Clay | 2:1 |
| Clay or reactive Shale | 3-5:1 |

Drilling rates can be estimated based on the drilling fluid demand and the pump output at the design base fluid viscosity.

4.5 SOLIDS SEPARATION PLANT

Fine-grained silts and clays are generally the most difficult to remove from drilling fluids. Silts and clays are present on this site and use of desilters/centrifuges may be needed to remove the fine soils from the drilling fluids.

4.6 DRILL PAD SUPPORT

Surface conditions in the vicinity of the HDD entry points likely consists of medium dense sands and are not likely to provide adequate support for HDD drilling equipment. The contractor should conduct a pre-bid site visit to determine the suitability of site conditions for their equipment. Use of a gravel surface course underlain by a geotextile is recommended where heavy truck and equipment traffic is planned. This may also be needed for a storm water pollution prevention plan (SWPPP). We recommend the contractor evaluate the site access for their equipment and select an appropriate base course for the access road and rig area.

4.7 UTILITIES AND WELL CLEARANCE

The location of existing utilities and water wells was beyond the scope of this report. There should be an attempt to locate all underground utilities near the alignment during the design phase and certainly prior to construction. These utilities should be protected by the Contractor so as not to be impacted by the trenchless crossings. The bore profiles should be designed to allow sufficient clearance from all underground utilities to avoid entering an existing utility trench or pipe zone materials or causing excessive settlement of the utilities above the bore. If existing utilities are within about 25 feet of the bore entry and exit pits, conductor casings should be used to help contain HDD drilling fluids and keep them out of adjacent utility areas.

Nearby water wells may exist and must be located and protected to prevent being impacted by HDD construction. The HDD bore profile should be designed to allow sufficient clearance from nearby wells to avoid drilling fluid releases contaminating them. In general, we recommend wells be located at least 100 feet from the HDD bore path for this type of HDD installation. If a well becomes impacted with drilling fluid, the well may need to be re-developed or replaced.

4.8 CONTRACTOR SELECTION

The success of the project will be substantially dependent on the experience and performance of the specialty contractor retained to perform the work. We recommend the use of a specialty contractor with a minimum of three (3) years construction experience in the field of horizontal directional drilling in similar drilling conditions on projects of similar scope (i.e. diameter, length, and depth). The HDD contractor should be familiar with the use of drilling mud and additives and conductor casings and should provide examples of projects they have successfully completed installing similar utilities in similar conditions.

5 ADDITIONAL SERVICES

5.1 PLANS AND SPECIFICATIONS

It is recommended that Kleinfelder conduct a general review of final plans and specifications to evaluate that our recommendations have been properly interpreted and implemented during design. In the event Kleinfelder is not retained to perform this recommended review, no responsibility will be assumed for misinterpretation of the given recommendations.

5.2 PROJECT BID DOCUMENTS

Kleinfelder's experience is that contractors bidding on the project often contact us to discuss the geotechnical aspects of the project. Informal contacts between Kleinfelder and an individual contractor could result in misleading or incomplete information being provided to the contractor. Therefore, it is recommended that a pre-bid meeting be held to answer any questions about the report prior to submittal of bids. If this is not possible, questions or clarifications regarding this report should be directed to the project owner or his/her designated representative. After consultation with Kleinfelder, the project owner (or his/her representative) should provide clarifications or additional information to all contractors bidding the job.

5.3 EXECUTION PLAN AND PERMIT ASSISTANCE

In order to facilitate best management practices and obtaining the required permits for the trenchless crossings, a project execution plan should be developed prior to construction. The plan should include layout of equipment, MSDS sheets for all proposed drilling fluids and additives, development of a drilling fluid containment and contingency plan in case of inadvertent fluid returns, and discussion of any other site-specific constraints relative to the project.

5.4 CONSTRUCTION OBSERVATION AND TESTING

It is recommended that all trenchless construction be monitored by a representative from Kleinfelder. The purpose of these services is to observe the soil and drill mud conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes to the owner in design or construction procedures if conditions differ from those described herein.

6 LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report. The work performed was based on project information provided by Client. If Client does not retain Kleinfelder to review any plans and specifications, including any revisions or modifications to the plans and specifications, Kleinfelder assumes no responsibility for the suitability of our recommendations. In addition, if there are any changes in the field to the plans and specifications, Client must obtain written approval from Kleinfelder's engineer that such changes do not affect our recommendations. Failure to do so will vitiate Kleinfelder's recommendations.

Kleinfelder offers various levels of investigative and engineering services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. Since detailed study and analysis involves greater expense, our clients participate in determining levels of service, which provide information for their purposes at acceptable levels of risk. The client and key members of the design team should discuss the issues covered in this report with Kleinfelder, so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk and expectations for future performance and maintenance.

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that soil and/or groundwater conditions could vary between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, Kleinfelder should be notified immediately so that we may re-evaluate the recommendations of this report as appropriate. If the scope of the proposed construction, including the estimated building loads, and the design depths or locations of the foundations changes from that described in this report, the conclusions and recommendations contained in

this report are not considered valid unless the changes are reviewed, and the conclusions of this report are modified or approved in writing, by Kleinfelder.

As the geotechnical engineering firm that performed the geotechnical evaluation for this project, Kleinfelder should be retained to confirm that the recommendations of this report are properly incorporated in the design of this project, and properly implemented during construction. This may avoid misinterpretation of the information by other parties and will allow us to review and modify our recommendations if variations in the soil conditions are encountered.

7 REFERENCES

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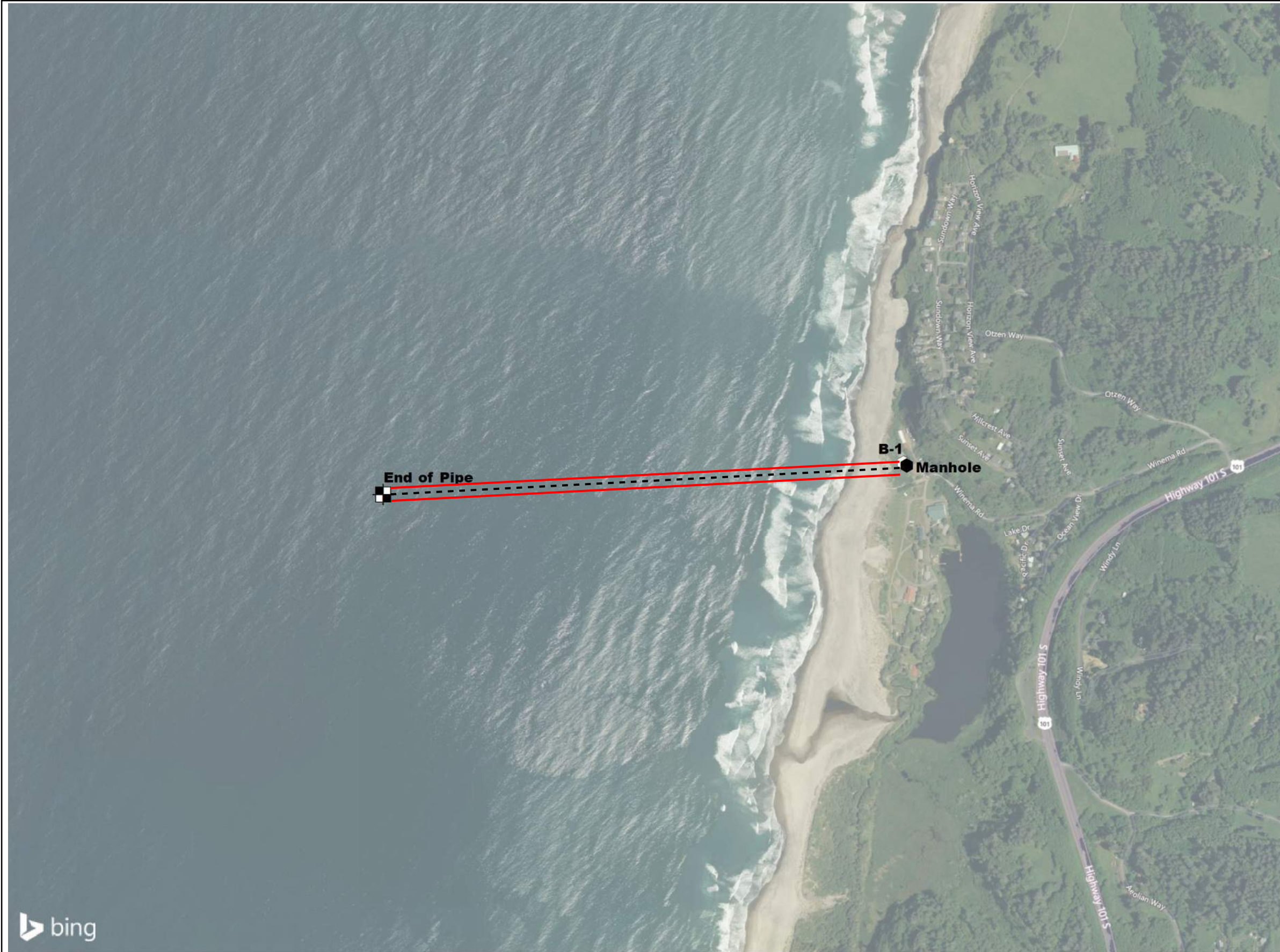
FIGURES

LIST OF ATTACHMENTS

The following figures are attached and complete this appendix.

| | |
|----------|--------------------------|
| Figure 1 | Site Vicinity Map |
| Figure 2 | Exploration Location Map |
| Figure 3 | Geologic Map |

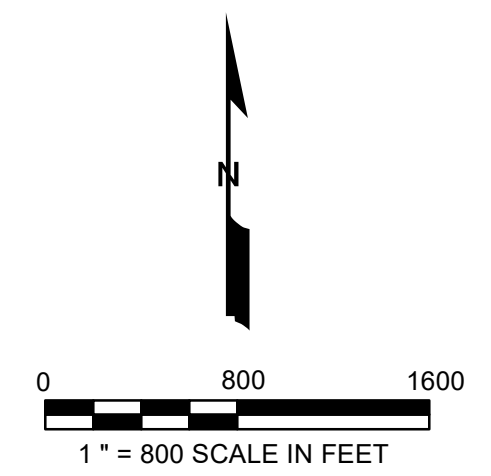
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VICINITY MAP
 NOT TO SCALE

NOTE:
 BASE MAPPING AND VICINITY MAP CREATED FROM LAYERS
 COMPILED BY ESRI PRODUCTS AND 2022 MICROSOFT
 CORPORATION.
 COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE
 OREGON NORTH FIPS 3601

| LEGEND | |
|--------|-----------------------------|
| | MANHOLE LOCATION |
| | EXPLORATORY BORING |
| | END OF PIPE |
| | CABLE LANDING HDD ALIGNMENT |



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PROJECT NO.
20230058.001A

 DRAWN BY: tdesouza
 CHECKED BY: T. DeSouza
 DATE: 06-06-2022

SITE VICINITY MAP

 OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

1

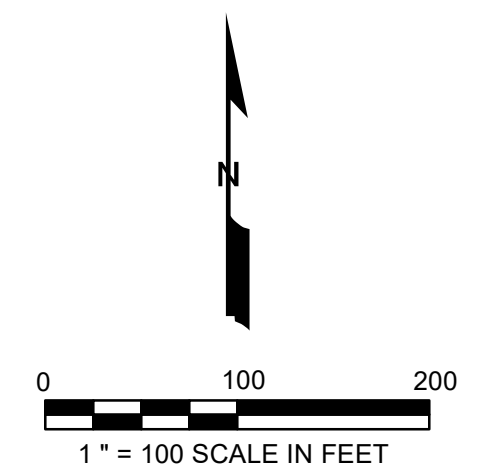
GIS FILE PATH: \\nazrgisstor01\working_clients\Automated_Exploration_Plans\20230058.001A_OFFSHORECABLELANDING_20220606_tdesouza\MXD
 GIS FILE NAME: 20230058.001A_ELP_11x17_2021_20220606_2117_td
 PLOTTED: 6/6/2022 9:18:34 PM BY: TDESOUZA



VICINITY MAP NOT TO SCALE

NOTE:
 BASE MAPPING AND VICINITY MAP CREATED FROM LAYERS
 COMPILED BY ESRI PRODUCTS AND 2022 MICROSOFT
 CORPORATION.
 COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE
 OREGON NORTH FIPS 3601

| LEGEND | |
|--------|-------------------------------------|
| | MANHOLE LOCATION |
| | EXPLORATORY BORING |
| | TERRESTRIAL GEOPHYSICAL SURVEY AREA |
| | CABLE LANDING HDD ALIGNMENT |



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PROJECT NO.
20230058.001A

 DRAWN BY: tdesouza
 CHECKED BY: T. DeSouza
 DATE: 06-06-2022

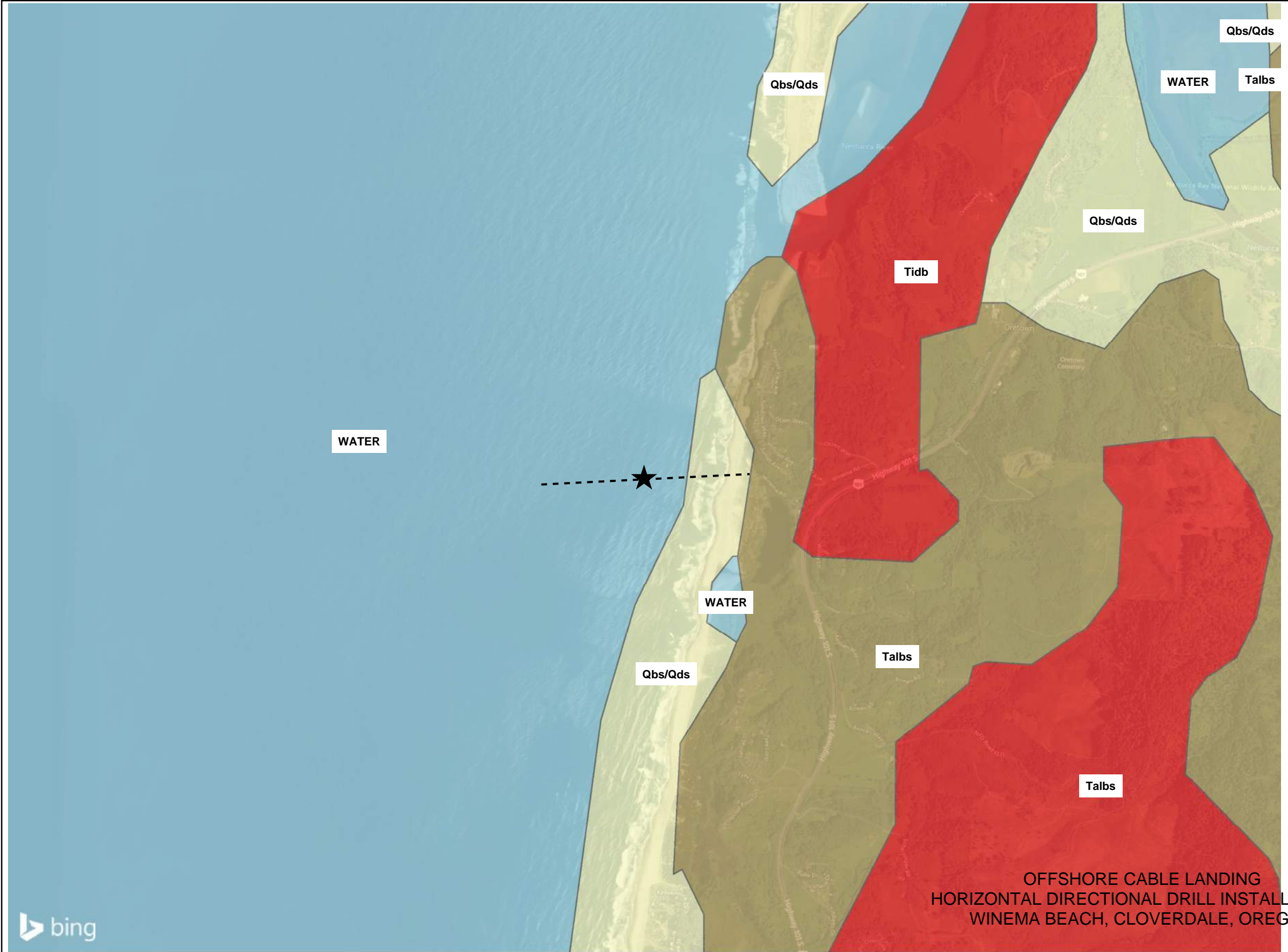
EXPLORATION LOCATION MAP

 OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

2

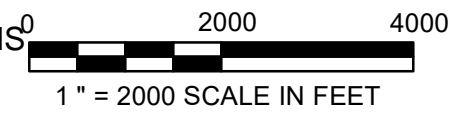
GIS FILE PATH: \\nazrgis\proj\01\working_clients\Automated_Exploration_Plans\20230058.001A_OFFSHORECABLELANDING_20220606_tdesouza\MXD
 GIS FILE NAME: 20230058.001A_ELP_SG_11x17_2021_20220606_2057_td
 PLOTTED: 6/6/2022 8:58:18 PM BY: TDESOUZA



LEGEND

- Cable Landing HDD Alignment
- Depoe Bay Basalt
- Basaltic Sandstone (Aalsea Formation)
- Alluvial Beach and Dune Sands
- Water

NOTE:
 BASE MAPPING AND VICINITY MAP CREATED FROM LAYERS COMPILED BY ESRI PRODUCTS AND 2022 MICROSOFT CORPORATION.
 COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE OREGON NORTH FIPS 3601
 THE STATE GEOLOGIC MAP COMPILATION OF THE CONTERMINOUS UNITED STATES WAS DEVELOPED BY THE U.S. GEOLOGICAL SURVEY MINERAL RESOURCES PROGRAM (MRP).



**OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
 WINEMA BEACH, CLOVERDALE, OREGON**

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PROJECT NO.
20230058.001A

 DRAWN BY: tdesouza
 CHECKED BY: T. DeSouza
 DATE: 06-06-2022

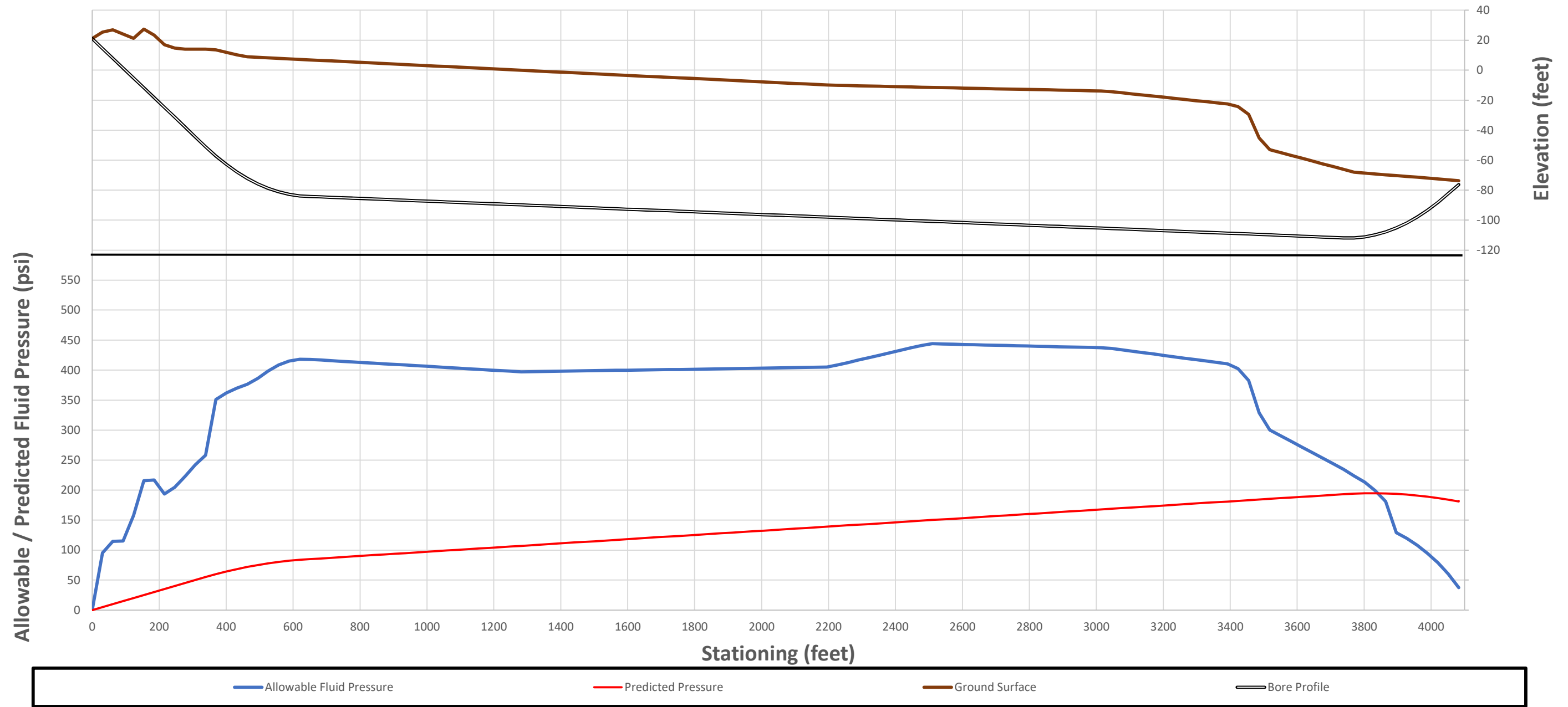
GEOLOGY MAP

OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

3

Hydrofracture Risk Analysis for the Pilot Bore with Alignment Profile




ASSUMPTIONS

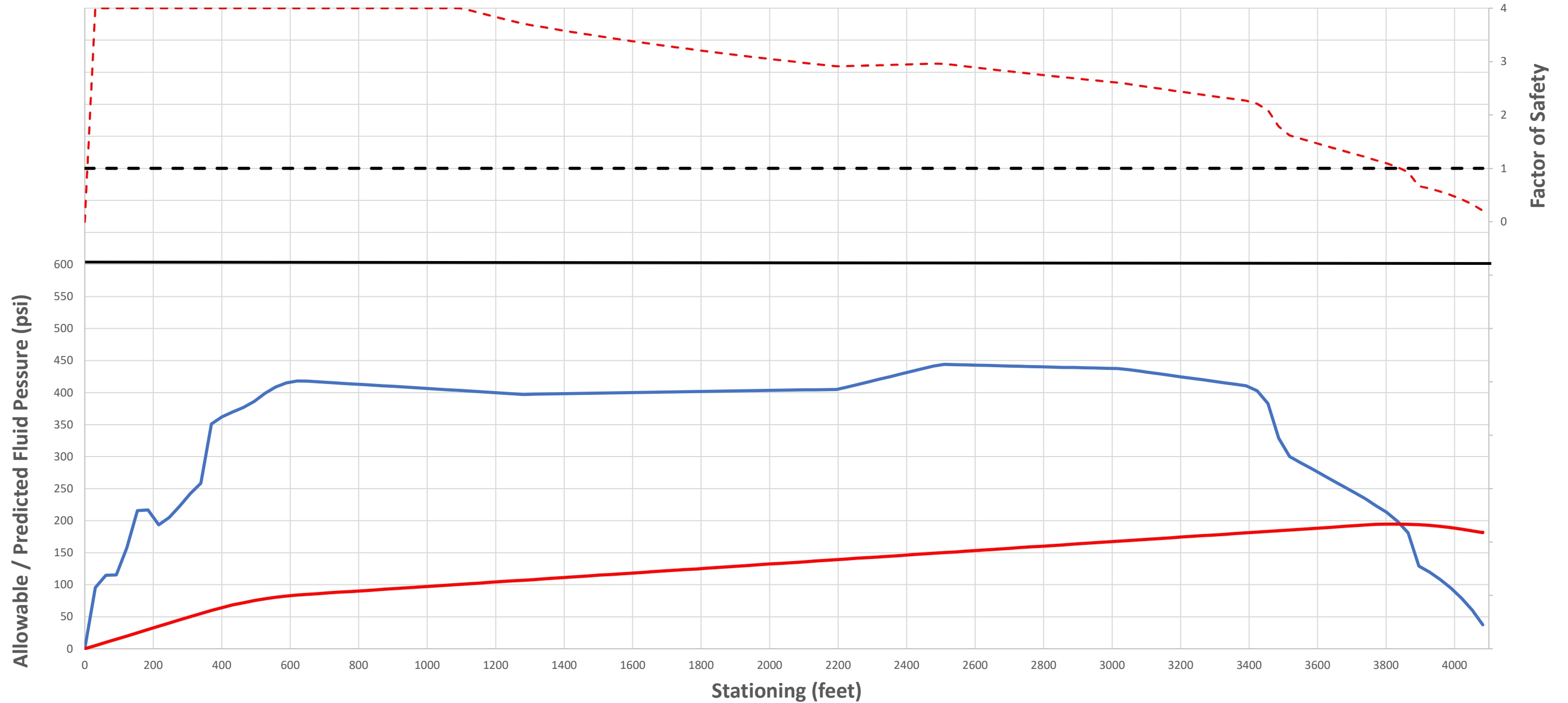
ANALYSIS WAS BASED ON:

- A. ENTRY ANGLE OF 12 DEGREES.
- B. EXIT ANGLE OF 11 DEGREES.
- C. A PILOT HOLE DIAMETER OF 12.25 INCHES.
- D. A DRILL ROD DIAMETER OF 5.875 INCHES.
- E. A MUD PUP OUTPUT OF UP TO 400 GALLONS PER MINUTE.
- F. A MUD UNIT WEIGHT OF 12 POUNDS PER GALLON.
- G. TARGET UP-HOLE FLUID VELOCITIES IN THIS ANALYSIS ARE APPROXIMATELY 85 FEET PER MINUTE.
- H. CHANGES IN THE DRILLING FLUID PROPERTIES AND DRILLING EQUIPMENT WILL AFFECT THE ANALYSIS RESULTS.
- I. A FACTOR OF 5 WAS APPLIED TO CALCULATE THE RADIUS OF THE PLASTIC ZONE USING THE DELFT EQUATION.

Calculation performed with HDD CALC Version v.3.0.0.

| | | | |
|---|-------------------------|--|-------------------------|
|  | Proj. No. 20230058.001A | HYDROFRACTURE RISK ANALYSIS OF THE PILOT BORE | FIGURE 4a |
| | Drawn By PR | | |
| Check By KS | Date 7/29/2022 | | |

Hydrofracture Risk Analysis for the Pilot Bore with Factor of Safety Plot



ASSUMPTIONS

ANALYSIS WAS BASED ON:

- A. ENTRY ANGLE OF 12 DEGREES.
- B. EXIT ANGLE OF 11 DEGREES.
- C. A PILOT HOLE DIAMETER OF 12.25 INCHES.
- D. A DRILL ROD DIAMETER OF 5.875 INCHES.
- E. A MUD PUP OUTPUT OF UP TO 400 GALLONS PER MINUTE.
- F. A MUD UNIT WEIGHT OF 12 POUNDS PER GALLON.
- G. TARGET UP-HOLE FLUID VELOCITIES IN THIS ANALYSIS ARE APPROXIMATELY 85 FEET PER MINUTE.
- H. CHANGES IN THE DRILLING FLUID PROPERTIES AND DRILLING EQUIPMENT WILL AFFECT THE ANALYSIS RESULTS.
- I. A FACTOR OF 5 WAS APPLIED TO CALCULATE THE RADIUS OF THE PLASTIC ZONE USING THE DELFT EQUATION.

Calculation performed with HDD CALC Version v.3.0.0.

| | | | |
|--|--|--|-------------------------|
| <p>KLEINFELDER <i>Bright People. Right Solutions.</i></p> | Proj. No. 20230058.001A | HYDROFRACTURE RISK ANALYSIS OF THE PILOT BORE | FIGURE 4b |
| | Drawn By PR Check By KS Date 7/29/2022 | | |



APPENDIX A
FIELD INVESTIGATION DAILY FIELD REPORTS



Daily Field Report

| | | | |
|--------------------|--|------------------|------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>5/16/2022</u> |
| Project No. | <u>20230058.001A</u> | Bldg. Permit No. | <u></u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0820</u> |
| Client | <u>RTI</u> | Time Departed | <u>1700</u> |
| Contractor | <u>Western States, Global Geophysics</u> | Travel Time | <u>1 hr</u> |
| Equipment Observed | <u>CME 75 Truck Rig</u> | Mileage | <u></u> |
| Reviewed By | <u>T. DeSouza</u> | Date Reviewed | <u>5/17/2022</u> |
| | | Weather | <u>Sunny</u> |

Observations/Remarks:

0820: Arrive on site.
0840: Western States crew arrives on site. Western States crew comprised of Adonis Pablo and Collin.
0845: Evangeline Johnston with Global Geophysics arrives on site.
0900: Meet with Nathan Stoller of Winema Church Camp to discuss plan for the week and access to site
0905: Safety kickoff with entire crew. Frank Cuccio with DRG and Matt Updenkeld with Wave present onsite.
0920: Begin setting up drill rig. Global Geophysics begins clearing a path through vegetation to beach for ERT line.
1010: Begin drilling using mud rotary techniques.
1300: Global begins setting up ERT line.
1400: Discussion with Frank, Matt and Evangeline. Decided to move geophysics line closer to proposed manhole which will require making a new access path through vegetation. Begin clearing new path.
1600: Finish drilling for the day at a depth of 70 ft. Will resume tomorrow using rock coring techniques. Drillers offsite.
1700: New path cleared for geophysics lines, ready to set up in the morning. Offsite.

Daily Field Report

| | | | |
|--------------------|--|------------------|------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>5/17/22</u> |
| Project No. | <u>20230058.001A</u> | Bldg. Permit No. | <u></u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0630</u> |
| Client | <u>RTI</u> | Time Departed | <u>1700</u> |
| Contractor | <u>Western States, Global Geophysics</u> | Travel Time | <u>1 hr</u> |
| Equipment Observed | <u>CME 75 Truck Rig</u> | Mileage | <u></u> |
| Reviewed By | <u>T. DeSouza</u> | Date Reviewed | <u>5/18/2022</u> |
| | | Weather | <u>Sunny</u> |

Observations/Remarks:

0630: Arrive on site. Evangeline with Global Geophysics already on site setting up ERT line from proposed manhole to the beach.

0720: Western states crew arrives on site. Begin setting up outer casing to 65' prepare for coring.

0840: Outer casing set. Begin coring.

1300: Finished ERT, clean up and set up MASW line from manhole to the beach.

1430: Global geophysics on standby waiting for drill rig to finish since the vibrations from the rig provide too much noise on data to continue work.

1515: Drill crew runs out of water for drill rig. End drilling for the day at a depth of 120 ft. to go and refill water tank. Resume geophysics work.

1530: Drillers offsite.

1645: Finish MASW, clean up.

1700: Everyone offsite.

Daily Field Report

| | | | |
|--------------------|--|------------------|------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>5/18/22</u> |
| Project No. | <u>20230058.001A</u> | Bldg. Permit No. | <u></u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0700</u> |
| Client | <u>RTI</u> | Time Departed | <u>1900</u> |
| Contractor | <u>Western States, Global Geophysics</u> | Travel Time | <u>1 hr</u> |
| Equipment Observed | <u>CME 75 Truck Rig</u> | Mileage | <u></u> |
| Reviewed By | <u>T. DeSouza</u> | Date Reviewed | <u>5/19/2022</u> |
| | | Weather | <u>Rain</u> |

Observations/Remarks:

0700: Arrive on site.

0710: Global geophysics arrives on site and sets up MASW on the beach during low tide. Informed that ERT work performed yesterday did not successfully obtain data due to equipment issues. Will perform ERT during second mobilization for offshore work.

0715: Western States arrives on site and prepares to resume drilling.

0740: Resume coring.

1000: Terminate boring at a depth of 151.5'. Begin removing inner drill rods.

1100: Drill crew on standby waiting for Global geophysics to perform downhole MASW test in boring.

1200: Begin downhole test.

1530: Finish downhole MASW. Global Geophysics cleans up. Western States sets up to grout boring.

1630: Finished grouting boring with a bentonite grout mix pumped via tremie pipe for entire depth of boring. Begin cleaning up. Global Geophysics offsite

1830: Boring topped off with native soil and site restored to original condition. Met with Nathan Stoller with the church camp and received his approval of the site conditions prior to leaving.

1900: Offsite.



Daily Progress Report

| | | | |
|--------------------|---------------------------------|---------------|-----------------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>6/11/22</u> |
| Project No. | <u>20230058.001A</u> | DPR No. | <u>001</u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u> </u> |
| Client | <u>RTI</u> | Time Departed | <u> </u> |
| Contractor | <u>Global Geophysics</u> | Travel Time | <u> </u> |
| Equipment Observed | <u>N/A</u> | Mileage | <u> </u> |
| ASN Representative | <u>Dave Edgington</u> | Date Reviewed | <u>6/11/22</u> |
| | | Weather | <u> </u> |

Observations/Remarks:

Summary:

Last 24 hours: N/A
Progress to Date: N/A
Next 24 hours: Perform ERT test on the beach

Notes:

No work carried out. DPR started to maintain consistency with ASN's DPR numbers. On hire from 6/12/22

ASN Representative

Pedro Rivas

Kleinfelder Representative



Daily Progress Report

| | | | |
|--------------------|---------------------------------|---------------|-------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>6/12/22</u> |
| Project No. | <u>20230058.001A</u> | DPR No. | <u>002</u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0530</u> |
| Client | <u>RTI</u> | Time Departed | <u>0930</u> |
| Contractor | <u>Global Geophysics</u> | Travel Time | <u>1 hr</u> |
| Equipment Observed | <u>N/A</u> | Mileage | <u></u> |
| ASN Representative | <u>Dave Edgington</u> | Date Reviewed | <u>6/12/22</u> |
| | | Weather | <u>Light Rain</u> |

Observations/Remarks:

Summary:

Last 24 hours: Mobilize to project site
Progress to Date: Perform ERT test on the beach
Next 24 hours: Demobilize

Personnel Onsite:

| Name | Association | Phone | Hours Worked |
|---------------------|-------------------|--------------|--------------|
| Pedro Rivas | Kleinfelder | 559.360.0247 | 4 |
| John Liu | Global Geophysics | 425.890.4321 | 4 |
| Matthew Updenkelder | Wave | 541.760.9822 | 4 |
| Total Hours Worked | | | 12 |

Events Log:

0530: Tailboard meeting
0540: Begin set up of onshore ERT test
0720: Finish set up and begin test
0830: Finish test, clean up
0930: Offsite

Notes:

Offshore geophysics was delayed per boat captain noting conditions not being suitable for work. Date for remobilization to be determined

ASN Representative

Pedro Rivas

Kleinfelder Representative

Weather Forecast

| | TODAY | | | | TOMORROW | | | | | | | | TUE, JUN 14 | | | | | | | | |
|-----------------------|-------|-----|-----|-----|----------|-----|-----|-----|-----|-----|-----|-----|-------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Time | 14 | 17 | 20 | 23 | 02 | 05 | 08 | 11 | 14 | 17 | 20 | 23 | 02 | 05 | 08 | 11 | 14 | 17 | 20 | 23 | |
| Wind direction | ↘ | ↘ | ↘ | ↘ | ↘ | ↘ | ↘ | ↘ | → | → | → | → | → | → | ↘ | ↘ | ↘ | ↘ | ↘ | ↘ | ↘ |
| Wind speed (knots) | 13 | 12 | 11 | 13 | 14 | 10 | 9.7 | 7.8 | 9.3 | 8.5 | 8.1 | 8.1 | 8.9 | 8.3 | 11 | 10 | 8.7 | 8.0 | 4.8 | 2.9 | |
| Wind gusts (knots) | 14 | 14 | 15 | 17 | 17 | 15 | 13 | 11 | 12 | 11 | 12 | 12 | 13 | 13 | 15 | 12 | 9.5 | 8.5 | 6.0 | 3.7 | |
| Temperature (°C) | 13 | 13 | 12 | 11 | 11 | 10 | 11 | 11 | 13 | 13 | 12 | 11 | 11 | 11 | 11 | 12 | 13 | 13 | 12 | 9.7 | |
| Cloud coverage | | | | | | | | | | | | | | | | | | | | | |
| Precipitation (mm/3h) | 0.3 | 0.2 | 0.3 | 0.8 | 2.4 | 1.8 | 0.7 | 0.9 | 1.2 | 0.8 | 0.4 | 0.6 | 0.8 | 0.7 | 0.8 | 0.9 | 0.4 | 0.2 | - | - | |
| Waves direction | | | | | | | | | | | | | | | | | | | | | |
| Waves height (m) | 1.4 | 1.4 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 |
| Waves period (s) | 7s | 7s | 8s | 8s | 6s | 6s | 6s | 5s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s |

ERT test set up on the beach





Daily Progress Report

| | | | |
|--------------------|--------------------------|---------------|---------------|
| Project Name | Winema HDD Cable Landing | Date | 7/7/22 |
| Project No. | 20230058.001A | DPR No. | 003 |
| Location | Winema Beach, Oregon | Time Arrived | 0545 |
| Client | RTI | Time Departed | 1400 |
| Contractor | Global Geophysics | Travel Time | 2 hr |
| Equipment Observed | N/A | Mileage | |
| ASN Representative | N/A | Date Reviewed | |
| | | Weather | Overcast/Cool |

Observations/Remarks:

Summary:

Last 24 hours: Mobilize to project site
Progress to Date: Attempted ERT test offshore
Next 24 hours: Continue ERT test offshore

Personnel Onsite:

| Name | Association | Phone | Hours Worked |
|---------------------|--------------------|--------------|--------------|
| Pedro Rivas | Kleinfelder | 559.360.0247 | 8 |
| John Liu | Global Geophysics | 425.890.4321 | 8 |
| Evangeline Johnston | Global Geophysics | - | 8 |
| Demar Hagger | Big Bites Charters | 503.333.4634 | 8 |
| David Tindall | Big Bites Charters | - | 8 |
| Aaron McCann | Big Bites Charters | - | 8 |
| Total Hours Worked | | | 48 |

Events Log:

0545: Onsite, charter boat being offloaded at the marina
0600: Tailboard meeting with Global Geophysics and Big Bites Charters crews.
0610: Geophysics equipment is loaded onto boats
0630: Boats depart marina
0930: Crew arrives at project site. Had difficulty traversing high waves. Scopes out and verifies alignment.
1000: Begin setting up to perform ERT
1140: Crew mentions having trouble anchoring.
1200: Due to anchoring problem, ERT cable head is pulled into the water and possibly damaged. Unable to continue for the day. Head back to marina
1330: Arrive at marina, offload equipment
1400: Offsite

Notes:

ERT cable was pulled into ocean due to the boat not being anchored properly. Sensitive sensors at the cable head were submerged underwater and deemed unusable until fixed. Work is planning to continue with backup cables. Charter boat plans to acquire heavier anchors by tomorrow to keep the boat stable and continue work.

ASN Representative

Pedro Rivas

Kleinfelder Representative

Weather Forecast

| | TODAY | | | TOMORROW | | | | | | | | SAT, JUL 9 | | | | | | | |
|-----------------------|-------|-----|-----|----------|-----|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|-----|-----|
| Time | 17 | 20 | 23 | 02 | 05 | 08 | 11 | 14 | 17 | 20 | 23 | 02 | 05 | 08 | 11 | 14 | 17 | 20 | 23 |
| Wind direction | ↗ | → | ↖ | ↖ | ↖ | ↖ | → | ↘ | ↘ | ↓ | ↓ | ↙ | ↙ | ← | ↘ | ↘ | ↘ | ↘ | ↓ |
| Wind speed (knots) | 6.2 | 1.9 | 2.9 | 3.9 | 3.5 | 2.5 | 4.3 | 6.6 | 7.0 | 4.8 | 3.9 | 2.7 | 3.1 | 2.1 | 5.6 | 7.2 | 8.1 | 5.8 | 2.7 |
| Wind gusts (knots) | 6.4 | 2.5 | 2.7 | 3.7 | 3.5 | 2.5 | 3.5 | 6.6 | 8.1 | 7.0 | 4.5 | 3.1 | 3.1 | 2.7 | 6.4 | 7.8 | 10 | 8.5 | 3.3 |
| Temperature (°C) | 17 | 16 | 14 | 14 | 13 | 15 | 17 | 18 | 18 | 17 | 15 | 14 | 13 | 15 | 17 | 18 | 17 | 16 | 14 |
| Cloud coverage | | | | | | | | | | | | | | | | | | | |
| Precipitation (mm/3h) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Waves direction | → | → | → | → | → | → | → | → | → | → | → | → | → | → | → | → | → | → | → |
| Waves height (m) | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| Waves period (s) | 7s | 7s | 7s | 7s | 7s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s |



Daily Progress Report

| | | | |
|--------------------|---------------------------------|---------------|----------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>7/7/22</u> |
| Project No. | <u>20230058.001A</u> | DPR No. | <u>003</u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0545</u> |
| Client | <u>RTI</u> | Time Departed | <u>1400</u> |
| Contractor | <u>Global Geophysics</u> | Travel Time | <u>2 hr</u> |
| Equipment Observed | <u>Charter Boats</u> | Mileage | <u></u> |
| ASN Representative | <u>N/A</u> | Date Reviewed | <u></u> |
| | | Weather | <u>Overcast/Cool</u> |

Observations/Remarks:

Summary:

Last 24 hours: Mobilize to project site
 Progress to Date: Attempted ERT test offshore
 Next 24 hours: Continue ERT test offshore

Personnel Onsite:

| Name | Association | Phone | Hours Worked |
|---------------------|--------------------|--------------|---------------------|
| Pedro Rivas | Kleinfelder | 559.360.0247 | 8 |
| John Liu | Global Geophysics | 425.890.4321 | 8 |
| Evangeline Johnston | Global Geophysics | - | 8 |
| Demar Hagger | Big Bites Charters | 503.333.4634 | 8 |
| David Tindall | Big Bites Charters | - | 8 |
| Aaron McCann | Big Bites Charters | - | 8 |
| Total Hours Worked | | | 48 |

Events Log:

0545: Onsite, charter boat being offloaded at the marina
 0600: Tailboard meeting with Global Geophysics and Big Bites Charters crews.
 0610: Geophysics equipment is loaded onto boats
 0630: Boats depart marina
 0930: Crew arrives at project site. Slow travel due to difficulty traversing high waves. Scopes out and verifies alignment.
 1000: Begin setting up to perform ERT
 1140: Crew mentions having trouble anchoring.
 1200: Due to anchoring problem, ERT cable head is pulled into the water and possibly damaged. Unable to continue for the day. Head back to marina
 1330: Arrive at marina, offload equipment
 1400: Offsite

Notes:

ERT cable was pulled into ocean due to the boat not being anchored properly. Sensitive sensors at the cable head were submerged underwater and deemed unusable until fixed. Work is planning to continue with backup cables. Charter boat plans to acquire heavier anchors by tomorrow to keep the boat stable and continue work.

ASN Representative
Pedro Rivas
Kleinfelder Representative

Weather Forecast

| | TODAY | | | TOMORROW | | | | | | | | SAT, JUL 9 | | | | | | | | |
|-----------------------|-------|-----|-----|----------|-----|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Time | 17 | 20 | 23 | 02 | 05 | 08 | 11 | 14 | 17 | 20 | 23 | 02 | 05 | 08 | 11 | 14 | 17 | 20 | 23 | |
| Wind direction | ↗ | → | ↖ | ↖ | ↖ | ↖ | → | ↘ | ↘ | ↘ | ↓ | ↙ | ↙ | ← | ↘ | ↘ | ↘ | ↘ | ↓ | |
| Wind speed (knots) | 6.2 | 1.9 | 2.9 | 3.9 | 3.5 | 2.5 | 4.3 | 6.6 | 7.0 | 4.8 | 3.9 | 2.7 | 3.1 | 2.1 | 5.6 | 7.2 | 8.1 | 5.8 | 2.7 | |
| Wind gusts (knots) | 6.4 | 2.5 | 2.7 | 3.7 | 3.5 | 2.5 | 3.5 | 6.6 | 8.1 | 7.0 | 4.5 | 3.1 | 3.1 | 2.7 | 6.4 | 7.8 | 10 | 8.5 | 3.3 | |
| Temperature (°C) | 17 | 16 | 14 | 14 | 13 | 15 | 17 | 18 | 18 | 17 | 15 | 14 | 13 | 15 | 17 | 18 | 17 | 16 | 14 | |
| Cloud coverage | | | | | | | | | | | | | | | | | | | | |
| Precipitation (mm/3h) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Waves direction | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | ← | |
| Waves height (m) | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.7 | 0.7 |
| Waves period (s) | 7s | 7s | 7s | 7s | 7s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s | 6s |



Daily Progress Report

| | | | |
|--------------------|---------------------------------|---------------|--------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>7/8/22</u> |
| Project No. | <u>20230058.001A</u> | DPR No. | <u>004</u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0600</u> |
| Client | <u>RTI</u> | Time Departed | <u>1400</u> |
| Contractor | <u>Global Geophysics</u> | Travel Time | <u>2 hr</u> |
| Equipment Observed | <u>Charter Boats</u> | Mileage | <u></u> |
| ASN Representative | <u>N/A</u> | Date Reviewed | <u></u> |
| | | Weather | <u>Clear/Sunny</u> |

Observations/Remarks:

Summary:

Last 24 hours: Attempted ERT test offshore
Progress to Date: Completed ERT test offshore
Next 24 hours: Perform offshore seismic profiling

Personnel Onsite:

| Name | Association | Phone | Hours Worked |
|---------------------|--------------------|--------------|--------------|
| Pedro Rivas | Kleinfelder | 559.360.0247 | 9.5 |
| John Liu | Global Geophysics | 425.890.4321 | 9.5 |
| Evangeline Johnston | Global Geophysics | - | 9.5 |
| Demar Hagger | Big Bites Charters | 503.333.4634 | 9.5 |
| David Tindall | Big Bites Charters | - | 9.5 |
| Aaron McCann | Big Bites Charters | - | 9.5 |
| Total Hours Worked | | | 57 |

Events Log:

0600: Tailboard meeting with Global Geophysics and Big Bites Charters crews and equipment is loaded onto boats.
0610: Boats depart marina
0730: Crew arrives at project site. Begin setting up to perform ERT test
1345: Finish ERT tests. Head back to marina
1500: Arrive at marina, offload equipment
1530: Offsite

Notes:

ASN Representative Pedro Rivas
Kleinfelder Representative

Weather Forecast

| | TODAY | | | | TOMORROW | | | | | | | |
|-----------------------|-------|-----|-----|-----|----------|-----|-----|-----|-----|-----|-----|-----|
| | 14 | 17 | 20 | 23 | 02 | 05 | 08 | 11 | 14 | 17 | 20 | 23 |
| Time | | | | | | | | | | | | |
| Wind direction | ↘ | ↘ | ↓ | ↓ | ↙ | ↖ | ↙ | ↘ | ↘ | ↘ | ↘ | ↙ |
| Wind speed (knots) | 8.1 | 8.5 | 8.3 | 6.8 | 4.7 | 3.9 | 2.7 | 6.2 | 6.4 | 7.2 | 4.8 | 1.9 |
| Wind gusts (knots) | 7.6 | 11 | 12 | 9.5 | 6.8 | 4.3 | 4.3 | 7.8 | 7.0 | 8.5 | 7.2 | 2.1 |
| Temperature (°C) | 18 | 17 | 16 | 14 | 14 | 13 | 14 | 17 | 17 | 17 | 16 | 15 |
| Cloud coverage | | | | | | | | | | | | |
| Precipitation (mm/3h) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Waves direction | → | → | → | → | → | → | → | → | → | → | → | → |
| Waves height (m) | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 |
| Waves period (s) | 7s | 7s | 7s | 7s | 7s | 7s | 7s | 7s | 6s | 6s | 6s | 6s |

ERT Testing performed along proposed alignment





Daily Progress Report

| | | | |
|--------------------|---------------------------------|---------------|--------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>7/9/22</u> |
| Project No. | <u>20230058.001A</u> | DPR No. | <u>005</u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0600</u> |
| Client | <u>RTI</u> | Time Departed | <u>1330</u> |
| Contractor | <u>Global Geophysics</u> | Travel Time | <u>2 hr</u> |
| Equipment Observed | <u>Charter Boat</u> | Mileage | <u></u> |
| ASN Representative | <u>N/A</u> | Date Reviewed | <u></u> |
| | | Weather | <u>Clear/Sunny</u> |

Observations/Remarks:

Summary:

Last 24 hours: Completed ERT test offshore
Progress to Date: Completed offshore seismic profiling
Next 24 hours: N/A

Personnel Onsite:

| Name | Association | Phone | Hours Worked |
|---------------------|--------------------|--------------|--------------|
| Pedro Rivas | Kleinfelder | 559.360.0247 | 8 |
| John Liu | Global Geophysics | 425.890.4321 | 8 |
| Evangeline Johnston | Global Geophysics | - | 8 |
| Demar Hagger | Big Bites Charters | 503.333.4634 | 8 |
| Total Hours Worked | | | 32 |

Events Log:

0600: Tailboard meeting with Global Geophysics and Big Bites Charters crews and equipment is loaded onto boat.
0645: Charter boat departs marina
0800: Crew arrives at project site. Begin setting up to perform seismic profiling
1215: Finish test. Head back to marina
1330: Arrive at marina, offload equipment
1400: Offsite

Notes:

ASN Representative Pedro Rivas
Kleinfelder Representative

Seismic profiling performed offshore along proposed alignment





Daily Progress Report

| | | | |
|--------------------|---------------------------------|---------------|--------------------|
| Project Name | <u>Winema HDD Cable Landing</u> | Date | <u>7/9/22</u> |
| Project No. | <u>20230058.001A</u> | DPR No. | <u>005</u> |
| Location | <u>Winema Beach, Oregon</u> | Time Arrived | <u>0600</u> |
| Client | <u>RTI</u> | Time Departed | <u>1400</u> |
| Contractor | <u>Global Geophysics</u> | Travel Time | <u>2 hr</u> |
| Equipment Observed | <u>Charter Boat</u> | Mileage | <u></u> |
| ASN Representative | <u>N/A</u> | Date Reviewed | <u></u> |
| | | Weather | <u>Clear/Sunny</u> |

Observations/Remarks:

Summary:

Last 24 hours: Completed ERT test offshore
Progress to Date: Completed offshore seismic profiling
Next 24 hours: N/A

Personnel Onsite:

| Name | Association | Phone | Hours Worked |
|---------------------|--------------------|--------------|--------------|
| Pedro Rivas | Kleinfelder | 559.360.0247 | 8 |
| John Liu | Global Geophysics | 425.890.4321 | 8 |
| Evangeline Johnston | Global Geophysics | - | 8 |
| Demar Hagger | Big Bites Charters | 503.333.4634 | 8 |
| Total Hours Worked | | | 32 |

Events Log:

0600: Tailboard meeting with Global Geophysics and Big Bites Charters crews and equipment is loaded onto boat.
0645: Charter boat departs marina
0800: Crew arrives at project site. Begin setting up to perform seismic profiling
1215: Finish test. Head back to marina
1330: Arrive at marina, offload equipment
1400: Offsite

Notes:

ASN Representative

Pedro Rivas

Kleinfelder Representative

Seismic profiling performed offshore along proposed alignment





APPENDIX B

AVAILABLE FIELD EXPLORATION EQUIPMENT DOCUMENTATION

LIST OF ATTACHMENTS

The following sheets are attached and complete this appendix.

| | |
|--------------|---|
| Appendix B-1 | Drill Rig Specifications |
| Appendix B-2 | Drill Rig Hammer Efficiency Calibration |
| Appendix B-3 | Geophysical Survey Equipment Specifications |

APPENDIX B-1

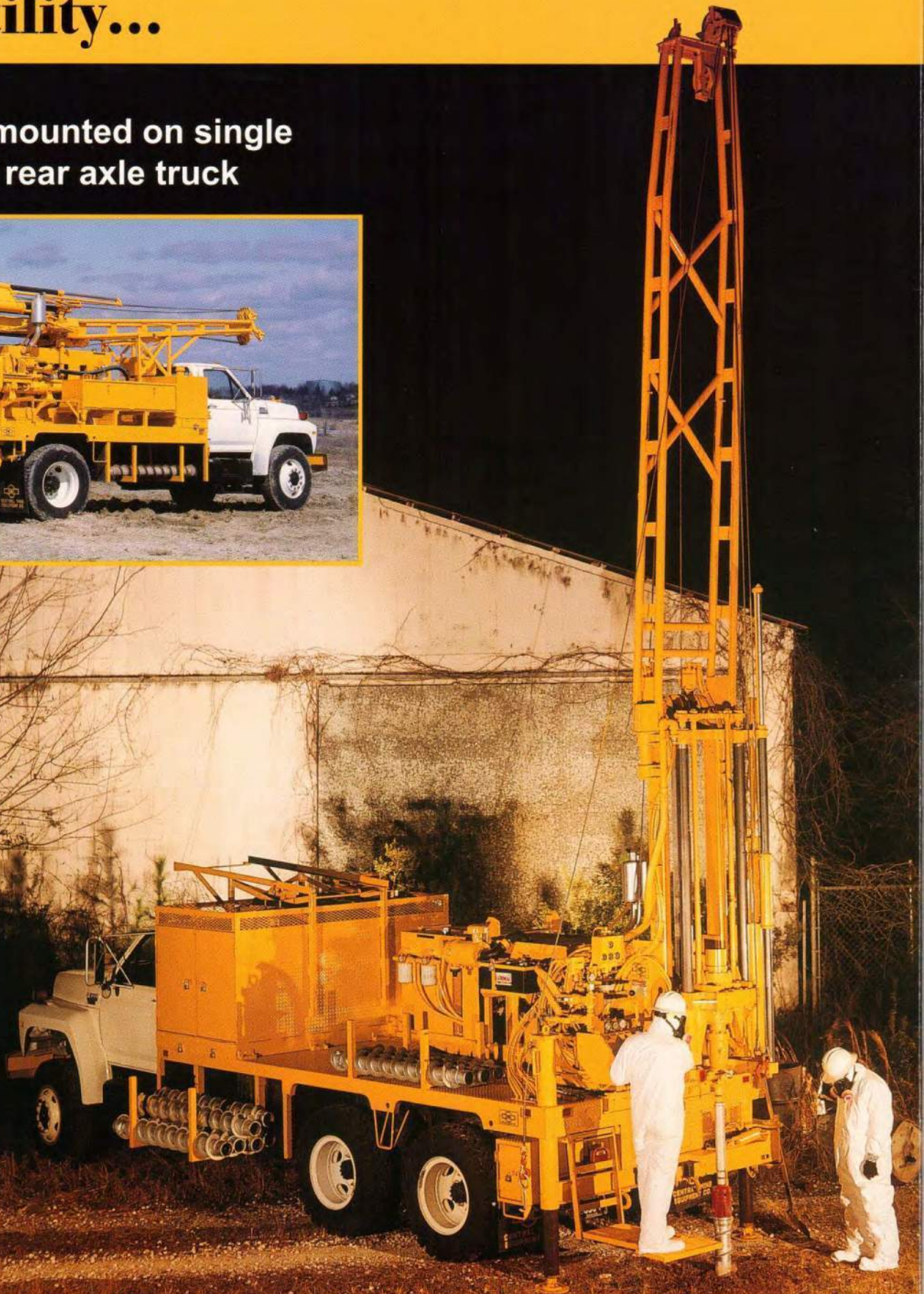
Drill Rig Specifications

CME-75



Versatility...

Available mounted on single
or tandem rear axle truck



Performance and Dependability, the CME-75 delivers

Ever wonder why you see so many CME-75 drills out there in the field? It's really quite simple. With over 45 years of field experience, the CME-75 has earned a reputation second to none for outstanding performance and dependability.

Hydraulic feed and retract system provides 30,000 pounds of retract force and 20,000 pounds of down pressure.

The twin 72 inch stroke feed cylinders of the hydraulic vertical drive system are in line with the drill spindle providing precise control of force on the drilling tools.

The split, two piece, feed slide bushings are easily



replaced after normal wear intervals. And the standard upright gives you clearance to drill with 12 1/4 inch I.D. hollow augers.

For exceptional drilling efficiency the feed system has two separate controls. One gives you manual control of

feed and retract and features both normal and fast retract positions. Retract rates of up to 95 feet per minute let you add or remove drilling tools quickly.

The other is used exclusively for feed and has a detent engaged position. Pressure controls let you dial in specific feed rate and feed pressure. This system is extremely advantageous in core drilling and other operations that require precise control of feed.

And since the two controls are isolated, you can use the manual control for rapid retract without changing pressure settings for the detent feed control.

Control logic - the key to operator productivity

Drilling and set-up controls are logically arranged on a control panel located at the driller's station. The most frequently used controls, such as the feed, hydraulic hoists and sliding base levers, are staggered for easier identification and operation. A lock-out position for the clutch lever helps prevent accidental engagement.

Rugged mechanical rotary drive provides over 10,400 foot pounds of torque, plus high rotation speed when you need it

You get the torque you need for auger drilling, as well as rotation speeds over 745 rpm for rotary or core drilling applications. Other optional rotation speed and torque combinations are also available, including a high-torque rotary drive that gives you 13,200 foot pounds of torque.

With five forward gears and one reverse, there's a rotation speed and torque combination available for just about any situation. The transmission is connected to the drill engine through a heavy duty 13 inch clutch.



Patented spindle brake stops rotation in an instant

Our emergency spindle brake can stop rotation in less than a revolution. This system is activated by two conveniently located push button switches as well as by strategically located, multi-directional wobble switches.

Safety...
it's a habit you can live with.

Optional Equipment

for even more productivity

Automatic SPT hammer*

Our 140-pound (63.5 kg) automatic hammer gives you extremely consistent and accurate Standard Penetration Test results, meeting all ASTM-D-1586-99 requirements. There are no ropes or cables to impede the free-fall of the weight. A viewing slot allows you to verify the 30 inch (76 cm) fall height.

The hammer swings on a hydraulic cylinder, from the stored position to on-hole position. And the six foot vertical travel also allows you to use the hammer to drive casing or probes. Since raising and lowering is done hydraulically, set-up is quick and almost effortless.

To improve safety, all moving parts are enclosed, including the impact area between weight and anvil.

Other hammers with internationally accepted weight and fall height configurations are available, including a combination 340/140 pound (154/63.5 kg) model.



Hydraulic rod holder and breakout wrench*

The hydraulic rod holder makes your job quicker and safer. It not only pivots from on-hole to off-hole positions, but also hydraulically telescopes in and out. It is especially compatible with the optional in-out and sideways slide bases.



Slide bases make the job easier and quicker

Slide base options are available for both in-out and sideways movement of the drill on the platform.

An 18 inch in-out movement allows you to quickly move the drill off the borehole and align the sheaves for lifting tools with the cathead or any of the hoists.

An 16 inch sideways movement gives you even more versatility. Aligning augers or rods when making connections is easy. Or, if the bit drifts off at an angle when you start a hole, you can quickly straighten it to a vertical position.

If you've ever tried to line up your rig on an existing borehole, you've probably already recognized another benefit of the slide bases.

Quick mast disconnect

This feature allows you to quickly disconnect the optional mast when working inside buildings, underneath bridges or in other low overhead drilling locations. Since the mast is completely separated from the uprights, it doesn't interfere with other drill functions such as the optional slide bases.



With the mast in a horizontal position, you simply clamp it to its storage rack and extend the drill's in-out slide base. This pulls the sockets on the upright drill frame away from the large tapered pins on the mast.

Angle drilling system for special applications*

This unique system is especially effective for drilling underneath ponds, storage tanks or other structures. When used with our patented Continuous Sample Tube System, you can even take soil samples while drilling angle holes.

And, since the kelly drive is directly connected to the right angle drive box, you can raise or lower the mast with the drive-train already connected and ready to go.



Fluted kelly and chuck assembly

If your drilling operations include a substantial amount of core or rotary drilling, the CME fluted kelly and chuck assembly can save you a lot of time. The 5 foot stroke of the kelly, combined with the 6 foot stroke of the feed system, gives you a total stroke of 11 feet. You can use 10 foot drill rods, which means fewer rod connections and less rod handling.

The kelly has two vertical slots and two horizontal slots which are engaged by the chuck to provide rotary torque and thrust. The CME fluted kelly can even be rotated without engaging the thrust plungers. This gives you the option of using the weight of the drill string to provide down pressure on the bit.

The 2 5/8 inch fluted kelly and chuck assembly is available in either manual or hydraulically actuated configurations. Or, for larger diameter holes, a 3 1/2 inch O.D. fluted kelly and hydraulic chuck assembly is available.



Plenty of auger storage available

Above deck auger storage areas are provided with the optional drill platform. The CME-75 is also available with several under body

auger rack configurations, including hydraulically operated racks that slide in and out for easy access to augers.



Water tank / tool box combinations

You can choose a 250 gallon or a 500 gallon water tank. Numerous water tank/tool box configurations are available, including models with rod storage capacity underneath and an expanded metal rack on top.



Additional optional equipment

- Drill platform
- Continuous Sample Tube System
- High torque or high speed rotary drive
- CPT controls
- Mast, 22 ft. or 26 ft.
(from base of frame to sheaves)
- Underside sheave
- Low clearance sheave
- Cathead, 8 in. diameter
- 8,500 lb. hydraulic hoist
max line speed...72 ft./min. up - 310 ft./min. dwn
- 7,000 lb. hydraulic hoist
max line speed...85 ft./min. up - 340 ft./min. dwn
- 3,200 lb. hydraulic hoist
max line speed...100 ft./min.
- 1,800 lb. hydraulic hoist
max line speed...200 ft./min.
- Hydraulic wireline hoist (1800 lb. pull)
max line speed...200 ft./min.
- Auger and rod guides for angle drilling
- Probe hammer
- Spindle Adapter
- Water pumps:
 - Moyno 3L6.....36 gpm/225 psi
 - Moyno 3L8.....84 gpm/225 psi
 - Bean.....25 gpm/500 psi
 - Bean.....35 gpm/500 psi
 - Gardner Denver 4 1/2x5....1.48 gpm/197 psi
 - Gardner Denver 5x6.....200 gpm/310 psi
 - (Other pumps available)

*patented by CME

Specifications

Power

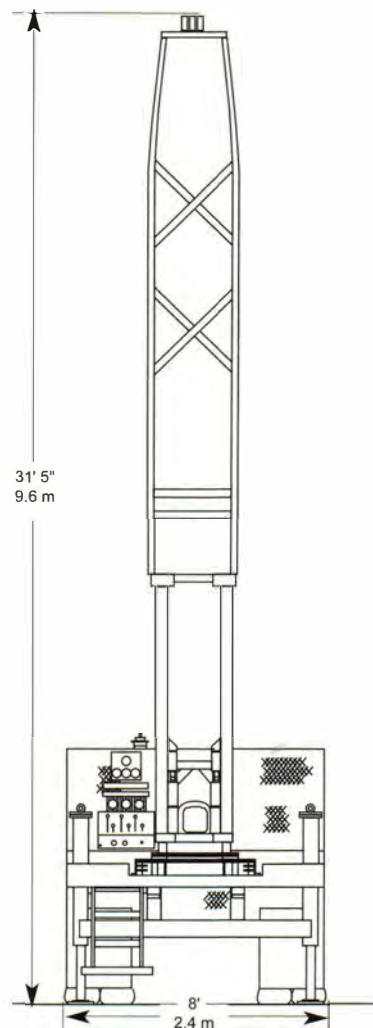
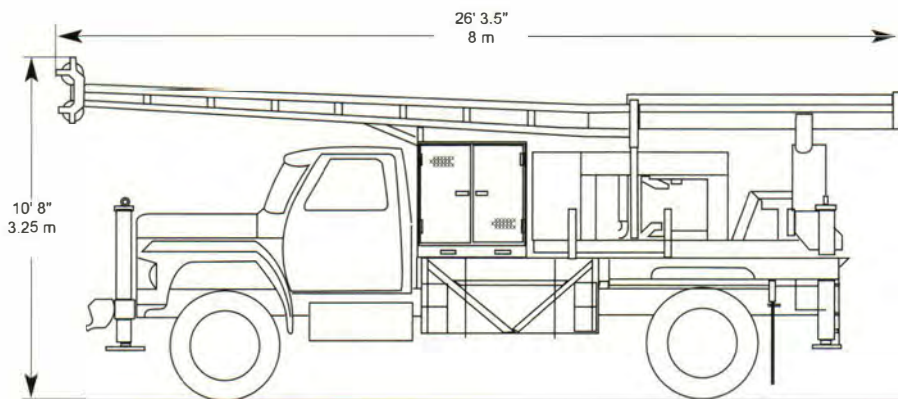
Cummins QSB 4.5L turbo charged Tier-4f diesel engine

Rotary Drive

Clutch, heavy duty.....13 in. (33 cm)
Transmission5 speed fwd., 1 speed rev.
Rotary torque10,445 ft. lbs. (14,160 Nm)
Rotary torque (optional).....13,225 ft. lbs. (17,930 Nm)
Rotary speed745 rpm max
Rotary speed (optional).....930 rpm max
Hollow spindle I.D.....2 3/4 in. (7 cm) {3 3/4 in.(9.5 cm) avail.}

Hydraulic Feed System

Retract force30,000 lbs. (13,608 Kg)
Pulldown force20,000 lbs. (9,072 Kg)
Retract rate (max)......95 ft./min. (29 m/min)
Feed rate (max)......52 ft./min. (16 m/min)
Stroke.....72 in. (1.8 m)



Typical single rear axle truck configuration with 26' mast and optional deck platform.

Dimensions will vary, depending on truck wheel base and all-wheel drive or tandem rear axle applications.

Central Mine Equipment Company manufactures a complete line of drilling equipment for the environmental, geotechnical and water well drilling industries of the world. We have been a leader in drilling product quality, innovation and service for over ninety years.



CENTRAL MINE EQUIPMENT COMPANY

4215 Rider Trail North, Earth City (St. Louis), Missouri, 63045 USA

Phone: 314-291-7700 • 1-800-325-8827 • FAX: 314-291-4880

E-mail: info@cmeco.com • Website: www.cmeco.com

APPENDIX B-2

Drill Rig Hammer Efficiency Calibration

Table 1. Energy Transfer Ratio and Correction Factors

| Rig No. | Energy Transfer Ratio | Correction Factor |
|---------------|-----------------------|-------------------|
| Track Rig #2 | 75.1 | 1.252 |
| Track Rig #3 | 77.2 | 1.287 |
| Truck Rig #4 | 77.5 | 1.292 |
| Truck Rig #5 | 85.5 | 1.425 |
| Track Rig #7 | 71.6 | 1.193 |
| Track Rig #8 | 74.3 | 1.238 |
| Truck Rig #9 | 77.7 | 1.295 |
| Track Rig #10 | 77.0 | 1.283 |
| Track Rig #12 | 81.4 | 1.357 |

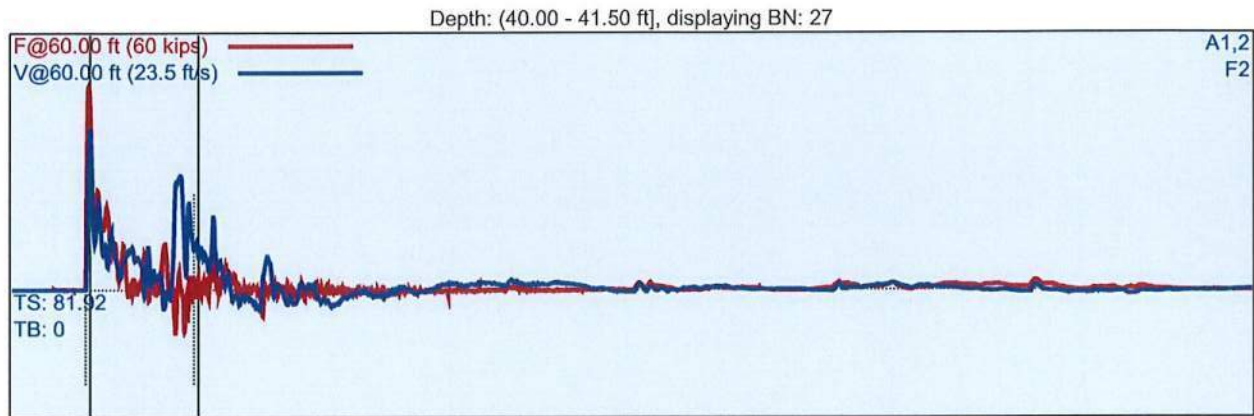
The transfer energy can vary as a result of changes to rig operating rate and lubrication, rod verticality, rig anvil dimensions, the subassembly, and other varying factors. The dynamic test data and representative wave forms for the SPT hammer systems are presented in Attachment A. ASTM D4633 recommends that the equipment used to perform the calibrations be calibrated every three years or as recommended by the manufacturer. Calibration information for the equipment is presented in Attachment B.



WSSC-8-06
GJS
WSSC
AR: 1.43 in²
LE: 60.00 ft
WS: 16807.9 ft/s

RIG #5
Interval start: 12/23/2021

SP: 0.492 k/ft³
EM: 30000 ksi



F2 : [SPT B2] 213.8 PDICAL (1) FF1

A1 (PR): [K0035] 295 mv/6.4v/5000g (1) VF1
A2 (PR): [K0232] 318 mv/6.4v/5000g (1) VF1

FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute

EFV: Maximum Energy
ETR: Energy Transfer Ratio - Rated

| BL# | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
|-----|-----------|-------------|-------------|------------|--------------|----------|
| 1 | 4 | 52 | 15.0 | 1.9 | 303 | 86.5 |
| 2 | 4 | 48 | 14.2 | 42.9 | 293 | 83.6 |
| 3 | 4 | 50 | 14.7 | 44.0 | 310 | 88.5 |
| 4 | 4 | 51 | 14.7 | 47.0 | 311 | 88.8 |
| 5 | 10 | 51 | 14.7 | 50.7 | 301 | 86.0 |
| 6 | 10 | 49 | 14.7 | 51.9 | 302 | 86.3 |
| 7 | 10 | 53 | 15.0 | 51.7 | 314 | 89.7 |
| 8 | 10 | 49 | 14.5 | 52.4 | 311 | 89.0 |
| 9 | 10 | 54 | 14.8 | 52.0 | 310 | 88.5 |
| 10 | 10 | 48 | 14.4 | 51.8 | 306 | 87.4 |
| 11 | 10 | 50 | 14.6 | 52.2 | 310 | 88.6 |
| 12 | 10 | 47 | 14.3 | 51.7 | 297 | 84.9 |
| 13 | 10 | 49 | 14.4 | 52.3 | 309 | 88.4 |
| 14 | 10 | 50 | 14.6 | 51.9 | 314 | 89.7 |
| 15 | 15 | 50 | 14.5 | 51.7 | 312 | 89.1 |
| 16 | 15 | 49 | 14.4 | 52.4 | 311 | 88.8 |
| 17 | 15 | 47 | 14.2 | 51.9 | 293 | 83.8 |
| 18 | 15 | 50 | 14.8 | 52.2 | 315 | 89.9 |
| 19 | 15 | 48 | 14.6 | 52.3 | 307 | 87.6 |
| 20 | 15 | 51 | 14.8 | 51.5 | 315 | 90.1 |
| 21 | 15 | 50 | 15.0 | 52.5 | 311 | 88.7 |
| 22 | 15 | 48 | 14.7 | 52.1 | 303 | 86.5 |
| 23 | 15 | 50 | 14.8 | 51.6 | 313 | 89.3 |
| 24 | 15 | 54 | 15.2 | 52.0 | 314 | 89.6 |
| 25 | 15 | 52 | 14.9 | 52.0 | 314 | 89.7 |
| 26 | 15 | 54 | 15.0 | 52.0 | 316 | 90.4 |
| 27 | 15 | 48 | 14.7 | 52.2 | 303 | 86.5 |
| 28 | 15 | 48 | 14.8 | 51.9 | 308 | 88.0 |

| | | | | | | |
|----|---------|-------------|------|------|-----|------|
| 29 | 15 | 48 | 14.2 | 52.1 | 299 | 85.4 |
| | Average | 50 | 14.7 | 52.0 | 308 | 88.1 |
| | Std Dev | 2 | 0.2 | 0.4 | 6 | 1.7 |
| | Maximum | 54 | 15.2 | 52.5 | 316 | 90.4 |
| | Minimum | 47 | 14.2 | 50.7 | 293 | 83.8 |
| | | N-value: 25 | | | | |

Sample Interval Time: 32.87 seconds.

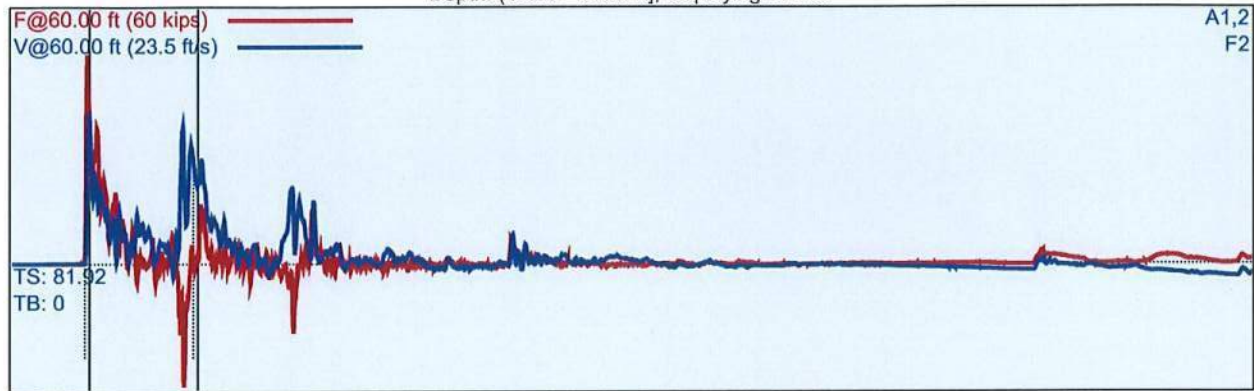
WSSC-8-06
GJS
WSSC

RIG #5
Interval start: 12/23/2021

AR: 1.43 in²
LE: 60.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft³
EM: 30000 ksi

Depth: (42.50 - 44.00 ft), displaying BN: 57



F2 : [SPT B2] 213.8 PDICAL (1) FF1

A1 (PR): [K0035] 295 mv/6.4v/5000g (1) VF1
A2 (PR): [K0232] 318 mv/6.4v/5000g (1) VF1

| BL# | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
|-----|-----------|-------------|-------------|------------|--------------|----------|
| 30 | 8 | 47 | 14.3 | 1.9 | 302 | 86.2 |
| 31 | 8 | 50 | 14.7 | 51.2 | 305 | 87.1 |
| 32 | 8 | 52 | 14.8 | 52.0 | 304 | 86.8 |
| 33 | 8 | 49 | 14.6 | 51.9 | 309 | 88.4 |
| 34 | 8 | 49 | 14.3 | 51.7 | 309 | 88.3 |
| 35 | 8 | 48 | 14.1 | 51.9 | 305 | 87.0 |
| 36 | 8 | 47 | 14.3 | 52.0 | 306 | 87.5 |
| 37 | 8 | 51 | 14.3 | 51.6 | 307 | 87.8 |
| 38 | 10 | 50 | 14.1 | 52.1 | 300 | 85.8 |
| 39 | 10 | 49 | 14.2 | 52.0 | 301 | 85.9 |
| 40 | 10 | 49 | 14.2 | 51.5 | 302 | 86.2 |
| 41 | 10 | 50 | 14.0 | 51.8 | 305 | 87.2 |
| 42 | 10 | 51 | 14.1 | 52.1 | 300 | 85.8 |
| 43 | 10 | 51 | 13.8 | 52.0 | 298 | 85.0 |
| 44 | 10 | 47 | 14.1 | 51.8 | 299 | 85.5 |
| 45 | 10 | 47 | 14.0 | 52.0 | 298 | 85.2 |
| 46 | 10 | 51 | 13.8 | 51.7 | 298 | 85.0 |
| 47 | 10 | 50 | 13.7 | 52.4 | 296 | 84.5 |
| 48 | 12 | 48 | 14.0 | 51.4 | 300 | 85.6 |
| 49 | 12 | 49 | 13.8 | 52.2 | 299 | 85.4 |
| 50 | 12 | 50 | 14.0 | 51.9 | 298 | 85.2 |
| 51 | 12 | 48 | 13.9 | 52.1 | 299 | 85.3 |
| 52 | 12 | 48 | 13.8 | 51.3 | 304 | 86.9 |
| 53 | 12 | 51 | 13.6 | 52.5 | 291 | 83.3 |
| 54 | 12 | 48 | 13.8 | 51.8 | 297 | 84.8 |
| 55 | 12 | 45 | 14.0 | 51.5 | 296 | 84.6 |
| 56 | 12 | 48 | 14.0 | 52.2 | 302 | 86.3 |
| 57 | 12 | 49 | 13.7 | 52.0 | 299 | 85.4 |
| 58 | 12 | 50 | 13.5 | 52.2 | 292 | 83.3 |
| 59 | 12 | 49 | 13.9 | 51.8 | 301 | 85.9 |

| | | | | | |
|---------|----|------|------|-----|------|
| Average | 49 | 13.9 | 51.9 | 299 | 85.4 |
| Std Dev | 1 | 0.2 | 0.3 | 3 | 0.9 |
| Maximum | 51 | 14.2 | 52.5 | 305 | 87.2 |
| Minimum | 45 | 13.5 | 51.3 | 291 | 83.3 |

N-value: 22

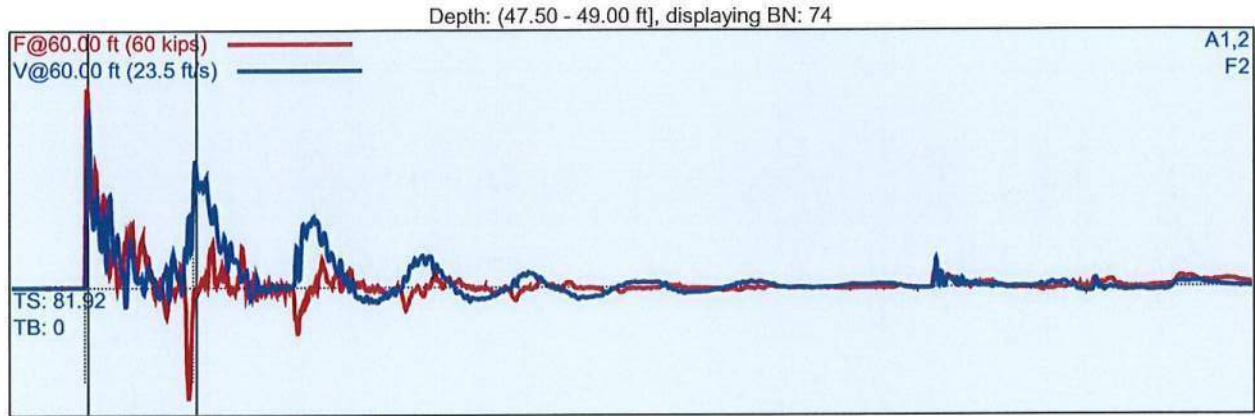
Sample Interval Time: 33.48 seconds.

WSSC-8-06
GJS
WSSC

RIG #5
Interval start: 12/23/2021

AR: 1.43 in²
LE: 60.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft³
EM: 30000 ksi



F2 : [SPT B2] 213.8 PDICAL (1) FF1

A1 (PR): [K0035] 295 mv/6.4v/5000g (1) VF1
A2 (PR): [K0232] 318 mv/6.4v/5000g (1) VF1

| BL# | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
|-------------|-----------|-------------|-------------|------------|--------------|----------|
| 60 | 2 | 46 | 14.6 | 1.9 | 312 | 89.2 |
| 61 | 2 | 46 | 14.4 | 51.2 | 306 | 87.3 |
| 62 | 6 | 45 | 14.8 | 51.9 | 301 | 86.1 |
| 63 | 6 | 49 | 15.2 | 51.7 | 306 | 87.5 |
| 64 | 6 | 45 | 14.8 | 51.9 | 296 | 84.5 |
| 65 | 6 | 46 | 15.1 | 51.8 | 302 | 86.4 |
| 66 | 6 | 46 | 15.3 | 51.7 | 312 | 89.0 |
| 67 | 6 | 46 | 15.4 | 51.9 | 310 | 88.6 |
| 68 | 9 | 46 | 15.5 | 51.9 | 310 | 88.5 |
| 69 | 9 | 45 | 15.2 | 51.8 | 299 | 85.3 |
| 70 | 9 | 45 | 15.2 | 51.8 | 301 | 86.0 |
| 71 | 9 | 45 | 15.1 | 51.8 | 299 | 85.4 |
| 72 | 9 | 45 | 15.2 | 51.6 | 301 | 86.0 |
| 73 | 9 | 44 | 15.3 | 52.1 | 300 | 85.6 |
| 74 | 9 | 47 | 15.7 | 51.7 | 315 | 90.0 |
| 75 | 9 | 46 | 15.4 | 52.0 | 306 | 87.5 |
| 76 | 9 | 45 | 15.3 | 51.8 | 301 | 85.9 |
| Average | | 46 | 15.2 | 51.8 | 304 | 86.8 |
| Std Dev | | 1 | 0.2 | 0.1 | 5 | 1.6 |
| Maximum | | 49 | 15.7 | 52.1 | 315 | 90.0 |
| Minimum | | 44 | 14.8 | 51.6 | 296 | 84.5 |
| N-value: 15 | | | | | | |

Sample Interval Time: 18.50 seconds.

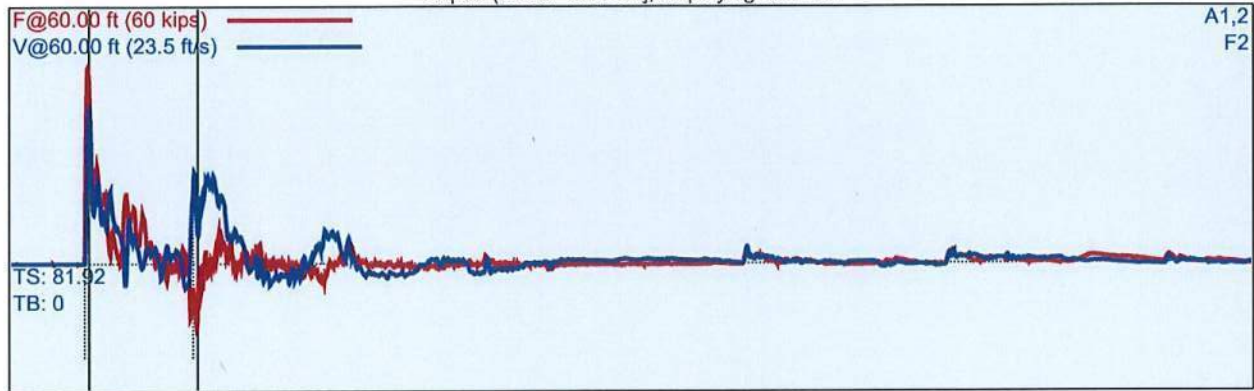
WSSC-8-06
GJS
WSSC

RIG #5
Interval start: 12/23/2021

AR: 1.43 in²
LE: 60.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft³
EM: 30000 ksi

Depth: (50.00 - 51.50 ft), displaying BN: 102



F2 : [SPT B2] 213.8 PDICAL (1) FF1

A1 (PR): [K0035] 295 mv/6.4v/5000g (1) VF1
A2 (PR): [K0232] 318 mv/6.4v/5000g (1) VF1

| BL# | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
|-----|-----------|-------------|-------------|------------|--------------|----------|
| 77 | 6 | 0 | 2.1 | 1.9 | 0 | 0.0 |
| 78 | 6 | 49 | 15.5 | 59.7 | 296 | 84.5 |
| 79 | 6 | 49 | 15.0 | 51.2 | 311 | 88.9 |
| 80 | 6 | 46 | 15.0 | 51.6 | 312 | 89.2 |
| 81 | 6 | 50 | 15.3 | 52.0 | 306 | 87.5 |
| 82 | 6 | 52 | 15.5 | 51.7 | 307 | 87.7 |
| 83 | 9 | 50 | 14.9 | 51.8 | 307 | 87.8 |
| 84 | 9 | 48 | 14.8 | 51.7 | 309 | 88.2 |
| 85 | 9 | 50 | 15.1 | 51.5 | 301 | 86.1 |
| 86 | 9 | 50 | 15.0 | 52.0 | 298 | 85.2 |
| 87 | 9 | 49 | 14.9 | 52.0 | 300 | 85.8 |
| 88 | 9 | 52 | 15.4 | 51.4 | 302 | 86.4 |
| 89 | 9 | 50 | 14.7 | 51.9 | 311 | 89.0 |
| 90 | 9 | 49 | 14.4 | 52.0 | 307 | 87.9 |
| 91 | 9 | 49 | 14.4 | 51.9 | 300 | 85.7 |
| 92 | 13 | 50 | 14.5 | 51.3 | 302 | 86.4 |
| 93 | 13 | 47 | 14.2 | 52.4 | 293 | 83.6 |
| 94 | 13 | 0 | 1.0 | 70.0 | 2 | 0.6 |
| 95 | 13 | 49 | 14.4 | 41.0 | 290 | 82.8 |
| 96 | 13 | 47 | 14.2 | 52.2 | 300 | 85.6 |
| 97 | 13 | 47 | 14.2 | 51.5 | 291 | 83.1 |
| 98 | 13 | 46 | 14.2 | 51.8 | 300 | 85.8 |
| 99 | 13 | 46 | 14.2 | 51.7 | 304 | 86.8 |
| 100 | 13 | 47 | 14.2 | 52.2 | 301 | 85.9 |
| 101 | 13 | 47 | 14.4 | 51.8 | 289 | 82.5 |
| 102 | 13 | 46 | 14.2 | 51.8 | 287 | 82.0 |
| 103 | 13 | 49 | 14.4 | 51.9 | 303 | 86.5 |
| 104 | 13 | 46 | 14.3 | 51.9 | 291 | 83.2 |

| | | | | | |
|---------|----|------|------|-----|------|
| Average | 46 | 13.9 | 52.2 | 286 | 81.7 |
| Std Dev | 10 | 2.8 | 4.5 | 62 | 17.8 |
| Maximum | 52 | 15.4 | 70.0 | 311 | 89.0 |
| Minimum | 0 | 1.0 | 41.0 | 2 | 0.6 |

N-value: 22

Sample Interval Time: 30.97 seconds.

Summary of SPT Test Results

Project: WSSC-8-06, Test Date: 12/23/2021

| Instr. Length ft | Blows Applied /6" | N Value | N60 Value | Average FMX kips | Average VMX ft/s | Average BPM bpm | Average EFV ft-lb | Average ETR % |
|--------------------------------|-------------------------|------------|--------------|------------------------|------------------------|-----------------------|-------------------------|---------------------|
| 60.00 | 4-10-15 | 25 | 35 | 50 | 14.7 | 52.0 | 308 | 88.1 |
| 60.00 | 8-10-12 | 22 | 31 | 49 | 13.9 | 51.9 | 299 | 85.4 |
| 60.00 | 2-6-9 | 15 | 21 | 46 | 15.2 | 51.8 | 304 | 86.8 |
| 60.00 | 6-9-13 | 22 | 31 | 46 | 13.9 | 52.2 | 286 | 81.7 |
| Overall Average Values: | | | | 48 | 14.4 | 52.0 | 299 | 85.5 |
| Standard Deviation: | | | | 6 | 1.6 | 2.3 | 33 | 9.5 |
| Overall Maximum Value: | | | | 54 | 15.7 | 70.0 | 316 | 90.4 |
| Overall Minimum Value: | | | | 0 | 1.0 | 41.0 | 2 | 0.6 |

EFV: Maximum Energy
ETR: Energy Transfer Ratio - Rated

APPENDIX B-3

Geophysical Survey Equipment Specifications

- **3-component tri-axial sensors**
- **Motor-driven clamp mechanism**
- **Fits in 2-inch (51-mm) boreholes**
- **Automatic orientation of horizontal geophones to any azimuth (Model BHG-3)**
- **Cable disconnects for convenient surface handling and extending depth**
- **Works in wet or dry holes**

Geostuff's BHG series, 3-component borehole geophones are designed for shallow seismic velocity measurements. Both units include a motor-driven clamp to hold the sensor in position in the borehole.

These geophones are applicable to a wide variety of shallow surveys, including shothole logging, downhole shear wave measurements, static corrections for petroleum shear-wave reflection surveys, cross-hole, tomographic, seam wave, and shallow VSP surveys for coal, minerals, and rock mechanics.

Model BHG-3 includes a fluxgate compass and servo mechanism which automatically orients the horizontal geophones to any magnetic azimuth selected by the operator. Thus, the longitudinal sensor can be aligned with the polarization of the shear wave source.

While downhole shear wave surveys have traditionally been done with random orientation, being able to precisely align one of the horizontal geophones with the plank or energy source provides significant advantages. Anisotropy appears to be much more common than originally thought, and the velocities of horizontally polarized shear waves vary with azimuth. With an orientable geophone, these velocity variations may be measured or simply avoided. By maintaining orientation of the source-receiver combination all the way down the borehole, the user can maintain better control and recognition of shear wave arrivals.

The clamping mechanism is a steel leaf spring, compressed by a motor-driven piston. When compressed, the spring expands, forcing the geophone



against the borehole wall.

The tool may be used in soft-wall, uncased holes as well as cased holes. In the unlikely event of a failure to release, the tool may be dragged up the hole against the spring friction. The motor-driven spring is faster, more reliable, and less cumbersome than the common alternative using an inflated bladder.

Download a free copy of our tutorial paper "**Borehole Shear-Wave Surveys for Engineering Site Investigations**" at <http://www.geostuff.com>



Control Electronics:

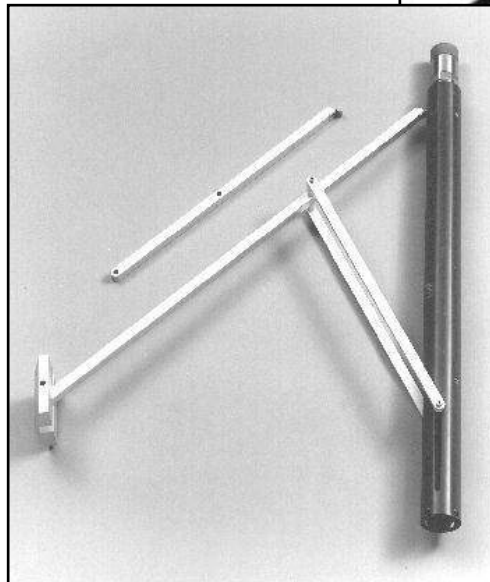
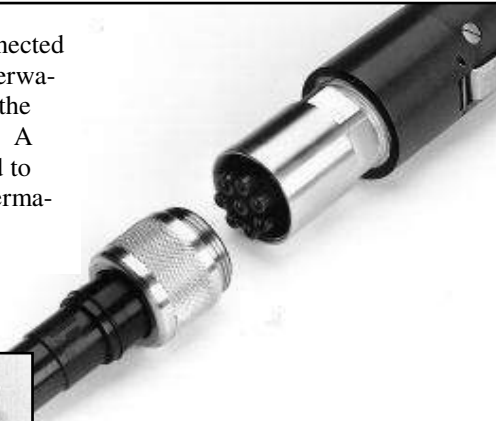
The BHGC-1b controller directs the voltages to control the clamping mechanism and servo mechanism. A meter monitors motor current to indicate the clamping action and force. This unit is usable with either model.

A rechargeable, internal, 24-volt battery is supplied, along with a 110/220 volt charger.

A Model BHGC-4 which can control up to four borehole geophones is also available.



Removable connector: The cable is connected to the geophone by a high-pressure, underwater connector. The ability to disconnect the sensor makes it easier to handle and use. A male-female extension cable can be used to temporarily extend the length without permanently



Big Hole Adaptor: An optional mechanical arm and pressure foot (shown here on the BHG-2) can be substituted for the spring to clamp the tool in large diameter boreholes. Conversion is easily done by the user in minutes. Multiple arms provide for various diameter holes. Largest arm extends diameter up to 480 mm (19 inches). When retracted, will fit inside a 75-mm (3-inch) diameter borehole.

Common Specifications

Number of geophones: 1 vertical and 2 horizontal in an X-Y-Z configuration

Natural Frequency: 15-Hz high-output omnidirectional is standard; 10, 28 and 40 Hz optional

Pressure rating: 300 meters (1000 ft) water depth, consult factory for deeper options

Clamp mechanism: DC motor. Requires 24 volts DC on surface (or more, depending on cable length). Requires 1/2 amp when moving spring (1 amp peak at clamping)

Expanded diameter: 18 cm (7 in) total diameter including probe body.

BHG-2 Borehole Geophone

Diameter: 48 mm (1.9 in)

Length: 700 mm (27.5 in)

Weight: 2 kg (4 lb)

BHG-3 Borehole Geophone

Diameter: 48 mm (1.9 in)

Length: 1.1 m (44 in)

Weight: 3.4 kg (7 lb)

Compass: fluxgate sensor, powered from same DC voltage as clamp mechanism.

Maximum inclination: +/- 90 degrees from vertical with standard 15-Hz sensors, much less with optional sensors.

Orientation Accuracy: better than 5 degrees

The flux gate compass will not function in steel-cased boreholes.

Cable

7-conductor, with two copper and 5 copperweld conductors, Kevlar-reinforced, polyurethane-jacket cable, with Reed Products SU-8 female connector molded on wet end.

Specifications are subject to change without notice for product improvement or other considerations. For more information, contact:

GEOSTUFF

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 Lincoln, CA 95648
 phone 916-258-1090
 info@geostuff.com
 www.geostuff.com

Geode

Exploration Seismograph



It is no wonder that over 2,700 Geodes have been sold. It is the most versatile and flexible seismograph available. Small and lightweight enough to pack in your suitcase, it expands easily for full-scale 2D and 3D surveys at a cost your bottom line will love. When you are not using the Geode for reflection, refraction, MASW/MAM, or tomography surveys, use it for monitoring earthquakes and other passive sources. The Geode will even do marine profiling or continuous recording. It is the most popular engineering seismograph in the world, and is widely used throughout the academic and research community.

For light-duty applications, you can use your laptop to view, record and even process your data. In harsh conditions, control your Geodes with Geometrics' StrataVisor NZ/C series computers and seismographs. You can connect Geodes together to build systems of over 1,000 channels. Geodes are shock-proof, dust-proof, submersible and able to withstand extreme temperatures.

Fifteen years on, we can say with confidence that the Geode is the most reliable seismograph we have ever produced. Because of this, we can offer a 3-year warranty backed by Geometrics, now in our 48th year of providing prompt, knowledgeable customer support.

FEATURES & BENEFITS

- **Bulletproof** - Not really, but almost. Survives 1.5m drop onto concrete in 14 orientations. The Geode comes standard with a 3-year warranty.
- **Distributed architecture** - Use standard 24-pair geophone cables, no matter how many channels.
- **Ultra-wide bandwidth** - Useful for everything from crosshole surveys to earthquake monitoring.
- **Geophone and line testing** - No need for time-consuming "tap test".
- **Versatile** - Configure systems ranging from 8 to 1000 channels.*
- **Waterproof and dustproof** - No need to pick up the system in a sudden rain or dust storm.
- **High temperature range** - Use in the Sahara, Amazon or at the North Pole.
- **GPS synchronization** - Sub-sample timing accuracy so you know exactly when an event occurs.

* Systems can be expanded temporarily via Geometrics' rental pool or existing loaner networks.

Configurations: 8, 12, 16, or 24 channels in weatherproof field-deployable Geode module. Geode is operated from either Windows XP/7/10-based laptop or by Geometrics' ruggedized StrataVisor NZ field computer/seismograph. Basic operating software controls one Geode. It can also be optionally expanded to control multiple Geodes, as well as do marine surveying, continuous recording, GPS synchronization, and seismic surveillance.

A/D Conversion: 24-bit result using Crystal Semiconductor sigma-delta converters and Geometrics proprietary oversampling.

Dynamic Range: 144 dB (system), 110 dB (instantaneous, measured) at 2 ms, 24 dB.

Distortion: 0.0005% @ 2 ms, 1.75 to 208 Hz.

Bandwidth: 1.75 Hz to 20 kHz. 0.6 and DC low frequency option available.

Common Mode Rejection: > 100 dB at <= 100 Hz, 36 dB.

Crosstalk: -125 dB at 23.5 Hz, 24 dB, 2 ms.

Noise Floor: 0.20 μ V, RFI at 2 ms, 36 dB, 1.75 to 208 Hz.

Stacking Trigger Accuracy: 1/32 of sample interval.

Maximum Input Signal: 2.8 V PP, 0 dB.

Input Impedance: 20 kOhm, 0.02 μ f.

Preamplifier Gains: Standard factory configuration is 24 and 36 dB. Optional configurations include 12 and 24 dB or 0 dB.

Anti-alias Filters: -3 dB at 83% of Nyquist frequency.

Acquisition and Display Filters:

- **Low Cut:** OUT, 10, 15, 25, 35, 50, 70, 100, 140, 200, 280, 400 Hz, 24 or 48 dB/octave, Butterworth.
- **Notch:** 50, 60, 150, 180 Hz and OUT, with the 50 dB rejection bandwidth 2% of center frequency.
- **High Cut:** OUT, 32, 64, 125, 250, 500 or 1000 Hz, 24 or 48 dB/octave.

Sample Interval: 0.02, 0.03125, 0.0625, 0.125, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0 ms.

Correlation: Optional (with SGOS, standard with MGOS) high-speed hardware correlator available in each Geode for fast cycle time with vibrators and pseudo-random sources. Correlates 16K record, unlimited channels, in under 1 second.

Record Length: 16,384 samples standard, 65,536 samples optional.

Pre-trigger Data: Up to full record length.

Delay: Full record length to +100 sec.

Data Transmission: Uses Ethernet transmission standard over CAT-5 copper or multimode fiber-optic cable. Distance between boxes: CAT 5 cable up to 0.25 km; fiber-optic cable up to 1.5 km.

Event Trigger: Based on seismic event; criteria set by user.

Continuous Recording (optional): Record GPS-synchronized, gapless data in SEG-2 format.

Auxiliary Channels: All Geode channels can be programmed as either AUX or DATA.

Roll-along: Built-in, no external roll box required.

Geophone Testing: Pulse test measures resistance, sensitivity, natural frequency, and damping.

Instrument Tests: Optional analog testing available. Measure noise, crosstalk, CMR, dynamic range, gain similarity and trigger accuracy. Additional built-in oscillator required.

Data Formats: SEG-2 standard. SEG-D and SEG-Y available as options.

System Software: Basic operating software includes full compliment of acquisition, display, plotting, filtering and storage features. Numerous optional features available; see SCS data sheet.

Bundled Applications Software: SeisImager/2D Lite refraction analysis software from OYO.

Data Storage: Stores data locally in SEG-2 on laptop/PC media. Drivers available for tape/disk storage in SEG-2/D/Y.

Plotters: Drives any Windows-compatible plotter or printer.

Triggering: Positive/negative TTL or contact closure, software adjustable threshold. STA/LTA-like algorithm for triggering on seismic waveform.

Power: Requires 12V external battery. Uses 0.5 W/channel during acquisition (0.25 ms sample rate). A single 12 Amp-hour battery is sufficient for a typical day of data acquisition; standby mode reduces power consumption by 70%.

Environmental: Operates from -50°C to +70°C (-58°F to +158°F). Waterproof and submersible. Withstands a 1m drop onto concrete on 6 sides and 8 corners. Passes MIL810E/F vibration.

Physical: L: 25.4 cm; W: 30.5 cm; H: 17.75 cm; Weight: 3.6 kg (10x12x7 in; 8 lb). Uses waterproof Bendix 61-pin connector for geophone input.

Operating System: Windows XP/7/10.

Warranty: Three years standard, extended warranty available.

Optional Built-In Test Functions

Instrument:

- Noise
- DC Offset
- Gain Accuracy
- Gain and Phase Similarity
- Distortion
- Crossfeed
- CMR
- Bandwidth
- Timing Accuracy

Geophone:

- Natural Frequency
- Resistance
- Damping
- Sensitivity

Specifications subject to change without notice. GeodeDS_v1 (0518)



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APPENDIX C

BORING LOGS

LIST OF ATTACHMENTS

The following figures are attached and complete this appendix.

| | |
|--------------------|----------------------|
| Figure C-1 | Graphics Key |
| Figure C-2 | Soil Description Key |
| Figure C-3 | Rock Description Key |
| Figure C-4 | Boring Log B-1 |
| Figure C-5 to C-19 | Sample Photos |

SAMPLE/SAMPLER TYPE GRAPHICS

| | |
|--|---|
| | CALIFORNIA SAMPLER (3 in. (76.2 mm.) outer diameter) |
| | CORE SAMPLER |
| | STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter) |

ROCK LITHOLOGY GRAPHICS

| | |
|--|-----------|
| | SANDSTONE |
|--|-----------|

GROUND WATER GRAPHICS

| | |
|--|---|
| | WATER LEVEL (level where first observed) |
| | WATER LEVEL (level after exploration completion) |
| | WATER LEVEL (additional levels after exploration) |
| | OBSERVED SEEPAGE |

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, i.e., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

| | | | | | | |
|--|--|---|--|--|---|---|
| GRAVELS (More than half of coarse fraction is larger than the #200 sieve) | CLEAN GRAVEL WITH <5% FINES | Cu ≥ 4 and 1 ≤ Cc ≤ 3 | | GW | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES | |
| | | Cu < 4 and/or 1 > Cc > 3 | | GP | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES | |
| | GRAVELS WITH 5% TO 12% FINES | Cu ≥ 4 and 1 ≤ Cc ≤ 3 | | GW-GM | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES | |
| | | | | GW-GC | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES | |
| | | Cu < 4 and/or 1 > Cc > 3 | | GP-GM | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES | |
| | | | | GP-GC | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES | |
| | GRAVELS WITH > 12% FINES | | | GM | SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES | |
| | | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES | |
| | | | | GC-GM | CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES | |
| | SANDS (Half or more of coarse fraction is smaller than the #4 sieve) | CLEAN SANDS WITH <5% FINES | Cu ≥ 6 and 1 ≤ Cc ≤ 3 | | SW | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES |
| | | | Cu < 6 and/or 1 > Cc > 3 | | SP | POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES |
| | | SANDS WITH 5% TO 12% FINES | Cu ≥ 6 and 1 ≤ Cc ≤ 3 | | SW-SM | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES |
| | | | | SW-SC | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES | |
| Cu < 6 and/or 1 > Cc > 3 | | | | SP-SM | POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES | |
| | | | | SP-SC | POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES | |
| SANDS WITH > 12% FINES | | | | SM | SILTY SANDS, SAND-GRAVEL-SILT MIXTURES | |
| | | | | SC | CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES | |
| | | | | SC-SM | CLAYEY SANDS, SAND-SILT-CLAY MIXTURES | |
| FINE GRAINED SOILS (Half or more of material is smaller than the #200 sieve) | | SILTS AND CLAYS (Liquid Limit less than 50) | | ML | INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY | |
| | | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS | |
| | | | | CL-ML | INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS | |
| | SILTS AND CLAYS (Liquid Limit 50 or greater) | | OL | ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY | | |
| | | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT | | |
| | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS | | |
| | | OH | ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY | | | |

NOTE: USE MATERIAL DESCRIPTION ON THE LOG TO DEFINE A GRAPHIC THAT MAY NOT BE PROVIDED ON THIS LEGEND.



PROJECT NO.:
20230058.001A

DRAWN BY:

CHECKED BY:

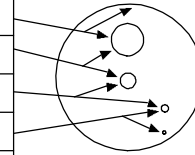
DATE:

GRAPHICS KEY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

GRAIN SIZE

| DESCRIPTION | SIEVE SIZE | GRAIN SIZE | APPROXIMATE SIZE |
|-------------|---------------------------------------|--------------------------------------|--------------------------------|
| Boulders | >12 in. (304.8 mm.) | >12 in. (304.8 mm.) | Larger than basketball-sized |
| Cobbles | 3 - 12 in. (76.2 - 304.8 mm.) | 3 - 12 in. (76.2 - 304.8 mm.) | Fist-sized to basketball-sized |
| Gravel | coarse 3/4 - 3 in. (19 - 76.2 mm.) | 3/4 - 3 in. (19 - 76.2 mm.) | Thumb-sized to fist-sized |
| | fine #4 - 3/4 in. (#4 - 19 mm.) | 0.19 - 0.75 in. (4.8 - 19 mm.) | Pea-sized to thumb-sized |
| Sand | coarse #10 - #4 | 0.079 - 0.19 in. (2 - 4.9 mm.) | Rock salt-sized to pea-sized |
| | medium #40 - #10 | 0.017 - 0.079 in. (0.43 - 2 mm.) | Sugar-sized to rock salt-sized |
| | fine #200 - #40 | 0.0029 - 0.017 in. (0.07 - 0.43 mm.) | Flour-sized to sugar-sized |
| Fines | Passing #200 | <0.0029 in. (<0.07 mm.) | Flour-sized and smaller |



SECONDARY CONSTITUENT

| Term of Use | AMOUNT | |
|-------------|---------------------------------------|---|
| | Secondary Constituent is Fine Grained | Secondary Constituent is Coarse Grained |
| Trace | <5% | <15% |
| With | ≥5 to <15% | ≥15 to <30% |
| Modifier | ≥15% | ≥30% |

MOISTURE CONTENT

| DESCRIPTION | FIELD TEST |
|-------------|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible free water, usually soil is below water table |

CEMENTATION

| DESCRIPTION | FIELD TEST |
|-------------|--|
| Weakly | Crumbles or breaks with handling or slight finger pressure |
| Moderately | Crumbles or breaks with considerable finger pressure |
| Strongly | Will not crumble or break with finger pressure |

CONSISTENCY - FINE-GRAINED SOIL

| CONSISTENCY | SPT - N ₆₀ (# blows / ft) | Pocket Pen (tsf) | UNCONFINED COMPRESSIVE STRENGTH (Q _u)(psf) | VISUAL / MANUAL CRITERIA |
|--------------|--------------------------------------|------------------|--|--|
| Very Soft | <2 | PP < 0.25 | <500 | Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed. |
| Soft | 2 - 4 | 0.25 ≤ PP <0.5 | 500 - 1000 | Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure. |
| Medium Stiff | 4 - 8 | 0.5 ≤ PP <1 | 1000 - 2000 | Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure. |
| Stiff | 8 - 15 | 1 ≤ PP <2 | 2000 - 4000 | Can be imprinted with considerable pressure from thumb. |
| Very Stiff | 15 - 30 | 2 ≤ PP <4 | 4000 - 8000 | Thumb will not indent soil but readily indented with thumbnail. |
| Hard | >30 | 4 ≤ PP | >8000 | Thumbnail will not indent soil. |

REACTION WITH HYDROCHLORIC ACID

| DESCRIPTION | FIELD TEST |
|-------------|--|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming immediately |

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

| APPARENT DENSITY | SPT-N ₆₀ (# blows/ft) | MODIFIED CA SAMPLER (# blows/ft) | CALIFORNIA SAMPLER (# blows/ft) | RELATIVE DENSITY (%) |
|------------------|----------------------------------|----------------------------------|---------------------------------|----------------------|
| Very Loose | <4 | <4 | <5 | 0 - 15 |
| Loose | 4 - 10 | 5 - 12 | 5 - 15 | 15 - 35 |
| Medium Dense | 10 - 30 | 12 - 35 | 15 - 40 | 35 - 65 |
| Dense | 30 - 50 | 35 - 60 | 40 - 70 | 65 - 85 |
| Very Dense | >50 | >60 | >70 | 85 - 100 |

FROM TERZAGHI AND PECK, 1948

PLASTICITY

| DESCRIPTION | LL | PI |
|-------------|---------|---------|
| Non-Plastic | NP | NP |
| Low | < 30 | < 15 |
| Medium | 30 - 50 | 15 - 25 |
| High | > 50 | > 25 |

LL is from Casagrande, 1948. PI is from Holtz, 1959.

STRUCTURE

| DESCRIPTION | CRITERIA |
|--------------|---|
| Stratified | Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness. |
| Laminated | Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness. |
| Fissured | Breaks along definite planes of fracture with little resistance to fracturing. |
| Slickensided | Fracture planes appear polished or glossy, sometimes striated. |
| Blocky | Cohesive soil that can be broken down into small angular lumps which resist further breakdown. |
| Lensed | Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness. |

ANGULARITY

| DESCRIPTION | CRITERIA |
|-------------|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces. |
| Subangular | Particles are similar to angular description but have rounded edges. |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges. |
| Rounded | Particles have smoothly curved sides and no edges. |



PROJECT NO.: 20230058.001A
 DRAWN BY:
 CHECKED BY:
 DATE:

SOIL DESCRIPTION KEY

OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
 WINEMA BEACH, CLOVERDALE, OREGON

C-2

INFILLING TYPE

| NAME | ABBR | NAME | ABBR |
|------------|------|-----------|------|
| Albite | Al | Muscovite | Mus |
| Apatite | Ap | None | No |
| Biotite | Bi | Pyrite | Py |
| Clay | Cl | Quartz | Qz |
| Calcite | Ca | Sand | Sd |
| Chlorite | Ch | Sericite | Ser |
| Epidote | Ep | Silt | Si |
| Iron Oxide | Fe | Talc | Ta |
| Manganese | Mn | Unknown | Uk |

BEDDING CHARACTERISTICS

| TERM | Thickness (in.) | Thickness (mm.) |
|-------------------|-----------------|-----------------|
| Very Thick Bedded | > 36 | > 915 |
| Thick Bedded | 12 - 36 | 305 - 915 |
| Moderately Bedded | 4 - 12 | 102 - 305 |
| Thin Bedded | 1 - 4 | 25 - 102 |
| Very Thin Bedded | 0.4 - 1 | 10 - 25 |
| Laminated | 0.1 - 0.4 | 2.5 - 10 |
| Thinly Laminated | < 0.1 | < 2.5 |

Bedding Planes Planes dividing the individual layers, beds, or stratigraphy of rocks.
 Joint Fracture in rock, generally more or less vertical or traverse to bedding.
 Seam Applies to bedding plane with unspecified degree of weather.

DENSITY/SPACING OF DISCONTINUITIES

| DESCRIPTION | SPACING CRITERIA |
|----------------------|------------------------------------|
| Unfractured | > 6 ft. (> 1.83 meters) |
| Slightly Fractured | 2 - 6 ft. (.061 - 1.83 meters) |
| Moderately Fractured | 8 in - 2 ft. (203.20 - 609.60 mm.) |
| Highly Fractured | 2 - 8 in. (50.80 - 203.30 mm.) |
| Intensely Fractured | < 2 in. (< 50.80 mm.) |

APERTURE

| DESCRIPTION | CRITERIA [in.(mm.)] |
|-------------|---------------------|
| Tight | < 0.04 (< 1) |
| Open | 0.04 - 0.20 (1 - 5) |
| Wide | > 0.20 (> 5) |

ADDITIONAL TEXTURAL ADJECTIVES

| DESCRIPTION | RECOGNITION |
|---------------------|---|
| Pit (Pitted) | Pinhole to 0.03 ft. (3/8 in.) (>1 to 10 mm.) openings |
| Vug (Vuggy) | Small openings (usually lined with crystals) ranging in diameter from 0.03 ft. (3/8 in.) to 0.33 ft. (4 in.) (10 to 100 mm.) |
| Cavity | An opening larger than 0.33 ft. (4 in.) (100 mm.), size descriptions are required, and adjectives such as small, large, etc., may be used |
| Honeycombed | If numerous enough that only thin walls separate individual pits or vugs, this term further describes the preceding nomenclature to indicate cell-like form |
| Vesicle (Vesicular) | Small openings in volcanic rocks of variable shape and size formed by entrapped gas bubbles during solidification |

DISCONTINUITY TYPE

| DESCRIPTION |
|-------------|
| Fault |
| Joint |
| Shear |
| Foliation |
| Vein |
| Bedding |

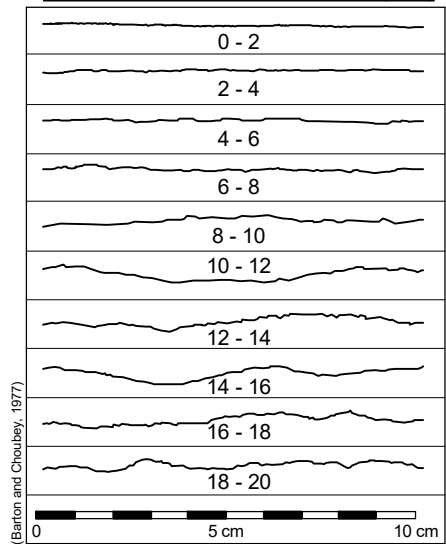
INFILLING AMOUNT

| DESCRIPTION |
|------------------|
| Surface Stain |
| Spotty |
| Partially Filled |
| Filled |
| None |

ROCK QUALITY DESIGNATION (RQD)

| DESCRIPTION | RQD (%) |
|-------------|----------|
| Very Poor | 0 - 25 |
| Poor | 25 - 50 |
| Fair | 50 - 75 |
| Good | 75 - 90 |
| Excellent | 90 - 100 |

JOINT ROUGHNESS COEFFICIENT (JRC)



RQD Rock-quality designation (RQD) Rough measure of the degree of jointing or fracture in a rock mass, measured as a percentage of the drill core in lengths of 10 cm. or more.

DEGREES OF WEATHERING

| DESCRIPTION | CRITERIA |
|----------------------|---|
| Unweathered | No evidence of chemical/mechanical alternation; rings with hammer blow. |
| Slightly Weathered | Slight discoloration on surface; slight alteration along discontinuities; <10% rock volume altered. |
| Moderately Weathered | Discoloring evident; surface pitted and alteration penetration well below surface; Weathering "halos" evident; 10-50% rock altered. |
| Highly Weathered | Entire mass discolored; Alteration pervading most rock, some slight weathering pockets; some minerals may be leached out. |
| Decomposed | Rock reduced to soil with relic rock texture/structure; Generally molded and crumbled by hand. |

RELATIVE HARDNESS / STRENGTH DESCRIPTIONS - FOR WEAKER SEDIMENTARY ROCKS IN COLORADO

| SPT N ₆₀ | HARDNESS |
|---------------------|------------------------|
| < 20 | Very Weak to Weathered |
| 20 - 39 | Weak |
| 40 - 49 | Moderately Strong |
| 50 - 50/6" | Strong |
| > 50/6" | Very Strong |

This table was developed by Kleinfelder based on project experience in Colorado for shale, claystone, siltstone, poorly cemented sandstone, and other weaker sedimentary rocks.



PROJECT NO.:
20230058.001A

 DRAWN BY:

 CHECKED BY:

 DATE:

ROCK DESCRIPTION KEY

OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
 WINEMA BEACH, CLOVERDALE, OREGON

C-3

INFILLING TYPE³

| NAME | ABBR | NAME | ABBR |
|------------|------|-----------|------|
| Albite | Al | Muscovite | Mus |
| Apatite | Ap | None | No |
| Biotite | Bi | Pyrite | Py |
| Clay | Cl | Quartz | Qz |
| Calcite | Ca | Sand | Sd |
| Chlorite | Ch | Sericite | Ser |
| Epidote | Ep | Silt | Si |
| Gypsum | Gy | Talc | Ta |
| Iron Oxide | Fe | Unknown | Uk |
| Manganese | Mn | | |

DENSITY/SPACING OF DISCONTINUITIES⁵

| DESCRIPTION | SPACING CRITERIA |
|----------------------|-----------------------------------|
| Unfractured | >6 ft. (>1.83 meters) |
| Slightly Fractured | 2 - 6 ft. (0.061 - 1.83 meters) |
| Moderately Fractured | 8 in - 2 ft. (203.20 - 609.60 mm) |
| Highly Fractured | 2 - 8 in (50.80 - 203.30 mm) |
| Intensely Fractured | <2 in (<50.80 mm) |

ADDITIONAL TEXTURAL ADJECTIVES⁵

| DESCRIPTION | RECOGNITION |
|---------------------|--|
| Pit (Pitted) | Pinhole to 0.03 ft. (3/8 in.) (>1 to 10 mm.) openings |
| Vug (Vuggy) | Small openings (usually lined with crystals) ranging in diameter from 0.03 ft. (3/8 in.) to 0.33 ft. (4 in.) (10 to 100 mm.) |
| Cavity | An opening larger than 0.33 ft. (4 in.) (100 mm.), size descriptions are required, and adjectives such as small, large, etc., may be used |
| Honeycombed | If numerous enough that only thin walls separate individual pits or vugs, this term further describes the preceding nomenclature to indicate cell-like form. |
| Vesicle (Vesicular) | Small openings in volcanic rocks of variable shape and size formed by entrapped gas bubbles during solidification. |

WEATHERING⁵

| DESCRIPTION | CRITERIA |
|----------------------|---|
| Unweathered | No evidence of chemical / mechanical alteration; rings with hammer blow. |
| Slightly Weathered | Slight discoloration on surface; slight alteration along discontinuities; <10% rock volume altered. |
| Moderately Weathered | Discoloring evident; surface pitted and alteration penetration well below surface; Weathering "halos" evident; 10-50% rock altered. |
| Highly Weathered | Entire mass discolored; Alteration pervading most rock, some slight weathering pockets; some minerals may be leached out. |
| Decomposed | Rock reduced to soil with relic rock texture/structure; Generally molded and crumbled by hand. |

RELATIVE HARDNESS / STRENGTH DESCRIPTIONS⁴

| GRADE | UCS | FIELD TEST | |
|-------|------------------|------------|--|
| R0 | Extremely Weak | 0.25 - 1.0 | Indented by thumbnail |
| R1 | Very Weak | 1.0 - 5.0 | Crumbles under firm blows of geological hammer, can be peeled by a pocket knife. |
| R2 | Weak | 5.0 - 25 | Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer. |
| R3 | Medium Strong | 25 - 50 | Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of a geological hammer. |
| R4 | Strong | 50 - 100 | Specimen requires more than one blow of geological hammer to fracture it. |
| R5 | Very Strong | 100 - 250 | Specimen requires many blows of geological hammer to fracture it. |
| R6 | Extremely Strong | > 250 | Specimen can only be chipped with a geological hammer. |

ROCK QUALITY DESIGNATION (RQD)²

| DESCRIPTION | RQD (%) |
|-------------|----------|
| Very Poor | 0 - 25 |
| Poor | 25 - 50 |
| Fair | 50 - 75 |
| Good | 75 - 90 |
| Excellent | 90 - 100 |

APERTURE¹

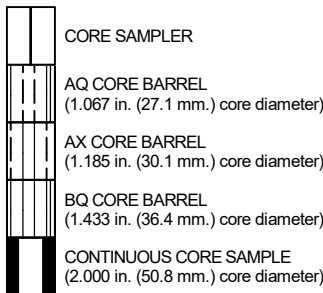
| DESCRIPTION | CRITERIA [in (mm)] |
|-------------|---------------------|
| Tight | <0.04 (<1) |
| Open | 0.04 - 0.20 (1 - 5) |
| Wide | >0.20 (>5) |

BEDDING CHARACTERISTICS⁶

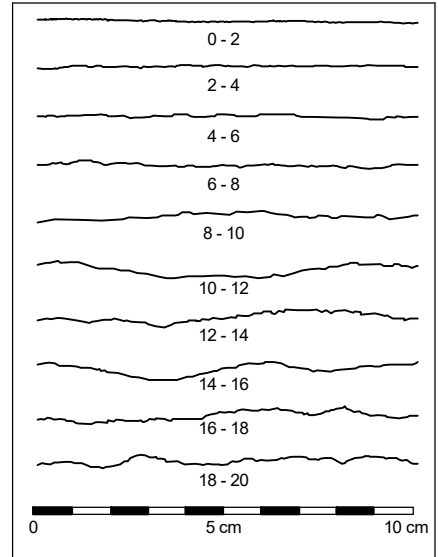
| DESCRIPTION | Thickness [in (mm)] |
|-------------------|----------------------|
| Very Thick Bedded | >36 (>915) |
| Thick Bedded | 12 - 36 (305 - 915) |
| Moderately Bedded | 4 - 12 (102 - 305) |
| Thin Bedded | 1 - 4 (25 - 102) |
| Very Thin Bedded | 0.4 - 1 (10 - 25) |
| Laminated | 0.1 - 0.4 (2.5 - 10) |
| Thinly Laminated | <0.1 (<2.5) |

- Bedding Planes Planes dividing the individual layers, beds, or stratigraphy of rocks.
- Joint Fracture in rock, generally more or less vertical or traverse to bedding.
- Seam Applies to bedding plane with unspecified degree of weather.

CORE SAMPLER TYPE GRAPHICS



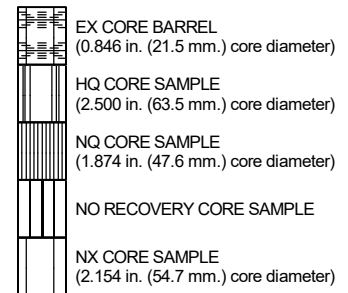
JOINT ROUGHNESS COEFFICIENT (JRC)⁴



RQD Rock-quality designation (RQD) Rough measure of the degree of jointing or fracture in a rock mass, measured as a percentage of the drill core in lengths of 4 in. (10 cm.) or more.

REFERENCES

1. Bieniawski, Z.T., 1989, Engineering Rock Mass Classifications. John Wiley & Sons, New York. (Mod. by Kleinfelder).
2. Deere, D.U., and Deere, D.W., 1989, Rock Quality Designation (RQD) After Twenty Years, USACE Contract Report GL-89-1.
3. Federal Highway Administration (FHWA), 2002, Subsurface Investigations, FHWA-NHI-01-031. (Mod. by Kleinfelder).
4. International Society for Rock Mechanics (ISRM), 1978, "Suggested Methods for the Quantitative Description of Discontinuities in Rock Masses," International Joint Rock Mechanics and Mining Sciences & Geomechanics Abstracts, Vol. 15.
5. United States Army Corps of Engineers (USACE), 1994, Rock Foundations, EM 1110-1-2908, November 30, 1994.
6. United States Department of the Interior Bureau of Reclamation (USBR), 1998, Engineering Geology Field Manual, Volume 1.



PROJECT NO.:
20230058.001A

DRAWN BY:
CHECKED BY:
DATE:

ROCK DESCRIPTION KEY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL
WINEMA BEACH, CLOVERDALE, OREGON

C-3



PLOTTED: 08/01/2022 01:47 AM BY: PRIVAS

| | | |
|---|--|---|
| Date Begin - End: <u>5/16/2022 - 5/18/2022</u> | Drilling Company: <u>Western States</u> | ROCK CORING LOG B-1 |
| Logged By: <u>P. Rivas</u> | Drill Crew: <u>Adonis, Collin</u> | |
| Hor.-Vert. Datum: <u>WGS 1984</u> | Drilling Equipment: <u>CME-75</u> | Hammer Type - Drop: <u>140 lb. Auto - 30 in.</u> |
| Plunge: <u>-90 degrees</u> | Drilling Method: <u>Mud Rotary</u> | Hammer Efficiency: <u>85.5%</u> |
| Weather: <u>Cloudy</u> | Exploration Diameter: <u>4 in. O.D.</u> | Hammer Cal. Date: <u>12/23/2021</u> |

| Approximate Elevation (feet) | Depth (feet) | Graphical Log | FIELD EXPLORATION | | | | LABORATORY RESULTS | | | | | | | Additional Tests/Remarks | |
|------------------------------|--------------|---------------|--|-------------------|---|------------------------------|--------------------|----------------------|--------------------|----------------|------------------|--------------|-------------------------------------|--------------------------|--|
| | | | Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf ROD=% | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | | |
| | | | Latitude: 45.14690° N Longitude: -123.97376° E Approximate Ground Surface Elevation (ft.): 21.00 Surface Condition: Bare Earth | | | | | | | | | | | | |
| | 20 | | Alluvial Beach and Dune Deposits Silty SAND with Gravel (SM): fine to coarse sand, brown, moist | | | | | | | | | | | | |
| | 5 | | Poorly Graded SAND (SP): fine sand, gray, moist, medium dense | BC=9 12 16 | | | | 11.1 | 111.0 | | 0.9 | | | | |
| | 10 | | Clayey SAND (SC): fine sand, low plasticity, dark brown, organic odor, wet, very loose | BC=2 1 1 | | | | | | | | | | | |
| | 15 | | Poorly Graded SAND (SP): fine sand, gray, wet, dense | BC=13 23 29 | | | | 20.3 | 107.4 | | 4.0 | | | | |
| | 20 | | Poorly Graded GRAVEL with Silt and Sand (GP-GM): fine to coarse gravel, gray, wet, very dense, fine to coarse sand, cobbles and boulders up to 18 in. | BC=15 27 22 | | GP-GM | | | | 47 | 8.6 | | | | |
| | 25 | | dense | BC=27 18 22 | | GP-GM | | | | 33 | 5.9 | | | | |
| | 30 | | no boulders | BC=31 50/6" | | | | | | | | | | | |

PROJECT NUMBER: 20230058.001A
OFFICE FILTER: FRESNO
GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2023.GLB [KLF_BORING/TEST PIT SOIL LOG]



PROJECT NO.:
20230058.001A

DRAWN BY: PR

CHECKED BY: TD

DATE: 5/24/2022

ROCK CORING LOG B-1

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

C-3

PAGE: 1 of 5

PLOTTED: 08/01/2022 01:47 AM BY: PRIVAS

| | | |
|--|---|--|
| Date Begin - End: 5/16/2022 - 5/18/2022 | Drilling Company: Western States | ROCK CORING LOG B-1 |
| Logged By: P. Rivas | Drill Crew: Adonis, Collin | |
| Hor.-Vert. Datum: WGS 1984 | Drilling Equipment: CME-75 | Hammer Type - Drop: 140 lb. Auto - 30 in. |
| Plunge: -90 degrees | Drilling Method: Mud Rotary | Hammer Efficiency: 85.5% |
| Weather: Cloudy | Exploration Diameter: 4 in. O.D. | Hammer Cal. Date: 12/23/2021 |

| Approximate Elevation (feet) | Depth (feet) | Graphical Log | FIELD EXPLORATION | | | | LABORATORY RESULTS | | | | | | | Additional Tests/Remarks | |
|------------------------------|--------------|---------------|---|--|----------------------|---|------------------------------|----------------|----------------------|--------------------|----------------|------------------|--------------|--------------------------|-------------------------------------|
| | | | Latitude: 45.14690° N Longitude: -123.97376° E Approximate Ground Surface Elevation (ft.): 21.00 Surface Condition: Bare Earth | | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf ROD=% | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | | Plasticity Index (NP=NonPlastic) |
| | | | Lithologic Description | | | | | | | | | | | | |
| -15 | | | Poorly Graded SAND with Silt (SP): fine to coarse sand, brown, wet, very dense, fine to coarse gravel, seashells present Clayey SAND (SC): fine sand, medium plasticity, dark gray, wet, medium dense, trace fine gravel | | BC=32 26 20 | | | | | | | | | | |
| -20 | | | | | BC=3 3 4 | | SC | | | | 17 | 53 | 26 | | |
| -25 | | | Poorly Graded SAND (SP): fine to medium sand, dark brown, wet, very dense, trace fine gravel yellowish brown, no gravel | | BC=25 50/4" | | | 15.2 | 122.9 | | 3.6 | | | | |
| -30 | | | | | BC=30 39 41 | | | | | | 5.4 | | | | |
| -35 | | | | | BC=24 35 38 | | | | | | | | | | |
| -40 | | | ALSEA FORMATION SANDSTONE: brown, fine-grained sand, highly weathered, R0, intensely fractured Brown to dark brown | | BC=41 41 50/6" | | | | | | | | | | |
| -45 | | | | | BC=50/6" | | | | | | | | | | |

GINT FILE: KLF_gint_master_2023
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2023.GLB [KLF_BORING/TEST PIT SOIL LOG]
 PROJECT NUMBER: 20230058.001A
 OFFICE FILTER: FRESNO



PROJECT NO.: 20230058.001A
 DRAWN BY: PR
 CHECKED BY: TD
 DATE: 5/24/2022

ROCK CORING LOG B-1

 OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

C-3

 PAGE: 2 of 5

PLOTTED: 08/01/2022 01:53 AM BY: PRIVAS

ROCK CORING LOG B-1

Date Begin - End: 5/16/2022 - 5/18/2022 **Drilling Company:** Western States
Logged By: P. Rivas **Drill Crew:** Adonis/Collin
Hor.-Vert. Datum: WGS 1984 **Drilling Equipment:** CME-75
Plunge: -90 degrees **Coring Method:** Coring
Weather: Cloudy **Core Bit Type:** NQ Core

ROCK CORING INFORMATION

| Approximate Elevation (feet) | Depth (feet) | Graphical Log | ROCK CORING INFORMATION | | | | | | | Discontinuity Description | |
|--|--------------|--|-------------------------|------------|-------------|---------------------------|---------------------|---------|---|--|---|
| | | | Box Number | Run Number | Sample Type | Recovery (NR=No Recovery) | Drill Rate (min/ft) | RQD (%) | Relative Strength | | |
| Latitude: 45.14690° N Longitude: -123.97376° E Approximate Ground Surface Elevation (ft.): 21.00 | | | | | | | | | | | |
| Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing | | | | | | | | | | | |
| -50 | | <p>SANDSTONE: dark gray, fine-grained sand, moderately weathered, moderately bedded, intensely fractured, contains small shell fragments, silt matrix prevalent</p> <p>Slightly weathered, moderately fractured</p> <p>4 in. layer of intensely fractured to brecciated</p> <p>5 in. layer of intensely fractured and rehealed</p> <p>Thickly bedded</p> <p>Highly fractured</p> <p>Moderately fractured</p> <p>Convolute siltstone rip-up clasts, bed remnants</p> <p>UCS = 5610 psi</p> <p>Moderately fractured</p> <p>Gray to dark gray, moderately fractured</p> <p>Localized calcareous mineralization within joints</p> <p>UCS = 5050 psi</p> <p>Localized mass highly fractured and partially rehealed</p> | 1 | 1 | | 12" | N/A | 0 | R2 | Fracture#: (Depth), Type, Relative Dip, Density or Spacing, Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC | |
| | | | 1 | 2 | | 56" | N/A | 75 | | | (71.6'), joint, 55°, moderately fractured, none, No, tight, JRC=16-18 |
| 75 | | | | | | | | | | | (73.2'), joint, 3°, highly fractured, none, No, slightly open, JRC=10-12 |
| -55 | | | | | | | | | | | (73.4'), joint, 0°, moderately fractured, none, No, slightly open, JRC=10-12 |
| | | | | | | | | | | | (76.5'), joint, 50°, none, No, slightly open, JRC=8-10 |
| | | | | | | | | | | | (76.9'), joint, 40°, none, No, slightly open, JRC=6-8 |
| 80 | | | | | | | | | | | (77.7'), joint, 55°, none, No, tight, JRC=4-6 |
| -60 | | | | | | | | | | | (78.7'), joint, 55°, none, No, slightly open, JRC=10-12 |
| | | | | | | | | | | | (79'), joint, 40°, highly fractured, none, No, slightly open, JRC=8-10 |
| | | | | | | | | | | | (79.3'), joint, 65°, moderately fractured, none, No, slightly open, JRC=12-14 |
| | | | | | | | | | (80'), joint, 45°, none, No, slightly open, JRC=8-10 | | |
| 85 | | | | | | | | | (84.4'), joint, 45°, slightly fractured, none, No, slightly open, JRC=4-6 | | |
| -65 | | | | | | | | | (85.1'), joint, 60°, moderately fractured, none, No, slightly open, JRC=4-6 | | |
| | | | | | | | | | (85.8'), joint, 30°, none, No, slightly open, JRC=2-4 | | |
| | | | | | | | | | (86.1'), joint, 70°, highly fractured, none, No, slightly open, JRC=10-12 | | |
| 90 | | | | | | | | | (88'), joint, 30°, none, No, slightly open, JRC=2-4 | | |
| -70 | | | | | | | | | (88.2'), joint, 50°, none, No, slightly open, JRC=10-12 | | |
| | | | | | | | | | (88.8'), joint, 50°, none, No, slightly open, JRC=4-6 | | |
| | | | | | | | | | (89.3'), joint, 65°, moderately fractured, none, No, slightly open, JRC=14-16 | | |
| 95 | | | | | | | | | (90.5'), joint, 25°, slightly fractured, none, No, slightly open, JRC=2-4 | | |
| -75 | | | | | | | | | (93'), joint, 30°, moderately fractured, none, No, slightly open, JRC=4-6 | | |
| | | | | | | | | | (93.5'), joint, 80°, none, No, slightly open, JRC=14-16 | | |
| | | | | | | | | | (94'), joint, 30°, highly fractured, none, No, slightly open, JRC=4-6 | | |
| 100 | | | | | | | | | (94.2'), joint, 60°, none, No, slightly open, JRC=8-10 | | |
| -80 | | | | | | | | | (94.5'), joint, 60°, none, No, slightly open, JRC=8-10 | | |
| | | | | | | | | | (95.1'), joint, 50°, moderately fractured, none, No, slightly open, JRC=14-16 | | |
| | | | | | | | | | (98'), slightly fractured | | |
| | | | | | | | | | (100.6'), joint, 45°, none, No, slightly open, JRC=8-10 | | |

OFFICE FILTER: FRESNO

PROJECT NUMBER: 20230058.001A
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2023.GLB [KLF_ROCK CORING LOG]

GINT FILE: KLF_gint_master_2023



PROJECT NO.: 20230058.001A
 DRAWN BY: PR
 CHECKED BY: TD
 DATE: 5/24/2022

ROCK CORING LOG B-1
 OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE
C-3
 PAGE: 3 of 5

PLOTTED: 08/01/2022 01:53 AM BY: PRIVAS

ROCK CORING LOG B-1

Date Begin - End: 5/16/2022 - 5/18/2022 **Drilling Company:** Western States
Logged By: P. Rivas **Drill Crew:** Adonis/Collin
Hor.-Vert. Datum: WGS 1984 **Drilling Equipment:** CME-75
Plunge: -90 degrees **Coring Method:** Coring
Weather: Cloudy **Core Bit Type:** NQ Core

| Approximate Elevation (feet) | Depth (feet) | Graphical Log | ROCK CORING INFORMATION | | | | | | Relative Strength | Discontinuity Description | | |
|------------------------------|--------------|---|---|------------|-------------|---------------------------|---------------------|---------|-------------------|--|------------|---|
| | | | Box Number | Run Number | Sample Type | Recovery (NR=No Recovery) | Drill Rate (min/ft) | RQD (%) | | | | |
| | | | Latitude: 45.14690° N Longitude: -123.97376° E Approximate Ground Surface Elevation (ft.): 21.00 | | | | | | | Fracture#: (Depth), Type, Relative Dip, Density or Spacing, Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC | | |
| | | | Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing | | | | | | | | | |
| -85 | | [Graphical Log: Dotted pattern] | SANDSTONE: gray to dark gray, fine-grained sand, slightly weathered, moderately bedded, moderately fractured, contains fine calcareous shell fragments, silt matrix prevalent Decrease in shell fragments present | | | 4 | 8 | | 60" (cont.) | N/A | 86 (cont.) | R2 (100.9'), joint, 70°, spotty, Ca, slightly open, JRC=4-6 (104.1'), joint, 35°, none, No, slightly open, JRC=12-14 (105.1'), joint, 80°, spotty, Ca, slightly open, JRC=10-12 (106.1'), joint, 25°, highly fractured, none, No, slightly open, JRC=8-10 (106.5'), joint, 15°, none, No, slightly open, JRC=6-8 (107.5'), joint, 85°, moderately fractured, none, No, slightly open, JRC=0-2 (107.9'), joint, 20°, none, No, slightly open, JRC=2-4 (109.1'), joint, 30°, none, No, slightly open, JRC=2-4 (109.8'), joint, 10°, none, No, slightly open, JRC=2-4 (110.5'), joint, 20°, moderately fractured, spotty, Ca, slightly open, JRC=4-6 (111.7'), joint, 55°, highly fractured, none, No, slightly open, JRC=4-6 (112.2'), joint, 70°, slightly fractured, none, No, slightly open, JRC=4-6 (115.2'), joint, 40°, highly fractured, none, No, slightly open, JRC=2-4 (115.4'), joint, 40°, moderately fractured, none, No, slightly open, JRC=2-4 (116.5'), joint, 60°, slightly fractured, none, No, slightly open, JRC=6-8 (120.5'), bedding, 5°, moderately fractured, none, No, tight, JRC=2-4 (121.5'), bedding, 5°, slightly fractured, none, No, tight, JRC=0-2 (123.3'), bedding, 5°, none, No, tight, JRC=2-4 (127'), joint, 40°, moderately fractured, spotty, Ca, slightly open, JRC=6-8 (127.8'), joint, 10°, none, No, slightly open, JRC=2-4 (129.5'), joint, 20°, none, No, slightly open, JRC=6-8 (131.1'), joint, 15°, highly fractured, partially filled, Cl, slightly open, JRC=4-6 (131.5'), joint, 15°, none, No, slightly open, JRC=6-8 (131.8'), bedding, 5°, slightly fractured, none, No, slightly open, JRC=6-8 (136.5'), joint, 80°, none, No, slightly open, JRC=14-16 (136.8'), joint, 45°, partially filled, Ca, slightly open, JRC=2-4 |
| | | | 5 | 9 | | 60" | N/A | 75 | | | | |
| | | | 5 | 10 | | 60" | N/A | 100 | | | | |
| | | | 6 | 11 | | 60" | N/A | 93 | | | | |
| | | | 6 | 12 | | 58" | N/A | 96 | | | | |
| | | | 7 | 13 | | 60" | N/A | 100 | | | | |
| | | | 7/8 | 14 | | 60" | N/A | 98 | | | | |
| | | | 8 | 15 | | 60" | N/A | 31 | | | | |
| | | | UCS = 4210 psi | | | | | | | | | |
| | | | Slightly fractured, abundant fine calcareous shell fragments | | | | | | | | | |
| | | Shell fragments to 0.75 in. present UCS = 4990 psi | | | | | | | | | | |
| | | Intensely fractured zone with sand and clay fracture infill | | | | | | | | | | |

OFFICE FILTER: FRESNO

PROJECT NUMBER: 20230058.001A
GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2023.GLB [KLF_ROCK CORING LOG]

GINT FILE: KLF_gint_master_2023



PROJECT NO.:
20230058.001A

DRAWN BY: PR
CHECKED BY: TD
DATE: 5/24/2022

ROCK CORING LOG B-1

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

C-3

PAGE: 4 of 5

Date Begin - End: 5/16/2022 - 5/18/2022 **Drilling Company:** Western States
Logged By: P. Rivas **Drill Crew:** Adonis/Collin
Hor.-Vert. Datum: WGS 1984 **Drilling Equipment:** CME-75
Plunge: -90 degrees **Coring Method:** Coring
Weather: Cloudy **Core Bit Type:** NQ Core

| Approximate Elevation (feet) | Depth (feet) | Graphical Log | ROCK CORING INFORMATION | | | | | | | Discontinuity Description |
|------------------------------|--------------|--|--|------------|-------------|---------------------------|---------------------|------------|--|--|
| | | | Box Number | Run Number | Sample Type | Recovery (NR=No Recovery) | Drill Rate (min/ft) | RQD (%) | Relative Strength | |
| | | | Latitude: 45.14690° N Longitude: -123.97376° E Approximate Ground Surface Elevation (ft.): 21.00 | | | | | | | Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC |
| | | | Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing | | | | | | | |
| -120 | | Intensely fractured and partially revealed layer | 8 | 15 | | 60" (cont.) | N/A | 31 (cont.) | R2 (136.9'), joint, 20°, highly fractured, partially filled, Ca, slightly open, JRC=2-4 (137.6'), joint, 80°, intensely fractured, partially filled, Cl, slightly open, JRC=10-12 (139.8'), joint, 70°, moderately fractured, partially filled, Cl, slightly open, JRC=2-4 (142.2'), joint, 50°, slightly fractured, none, No, slightly open, JRC=8-10 (145.6'), joint, 60°, moderately fractured, none, No, slightly open, JRC=16-18 (146.5'), joint, 55°, none, No, slightly open, JRC=6-8 (148.3'), joint, 60°, highly fractured, partially filled, Ca, slightly open, JRC=6-8 (148.6'), joint, 60°, slightly fractured, none, No, slightly open, JRC=4-6 (151.3'), joint, 80°, none, No, slightly open, JRC=10-12 | |
| | | | 8 | 16 | | 59" | N/A | 71 | | |
| -125 | | | 9 | 17 | | 59" | N/A | 71 | | |
| -130 | | | | | | | | | | |
| -135 | | | | | | | | | | |
| -140 | | | | | | | | | | |
| -145 | | | | | | | | | | |
| -150 | | | | | | | | | | |



PROJECT NO.:
20230058.001A

 DRAWN BY: PR
 CHECKED BY: TD
 DATE: 5/24/2022

ROCK CORING LOG B-1

 OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

C-3

 PAGE: 5 of 5



PHOTO 1: BORING B-1, 5 FT SAMPLE



PHOTO 2: BORING B-1, 10 FT SAMPLE



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

| |
|--|
| PHOTO SUMMARY |
| OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS WINEMA BEACH, CLOVERDALE, OREGON |

FIGURE:

C-5



PHOTO 3: BORING B-1, 15 FT SAMPLE



PHOTO 4: BORING B-1, 20 FT SAMPLE



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-6



PHOTO 5: BORING B-1, 25 FT SAMPLE

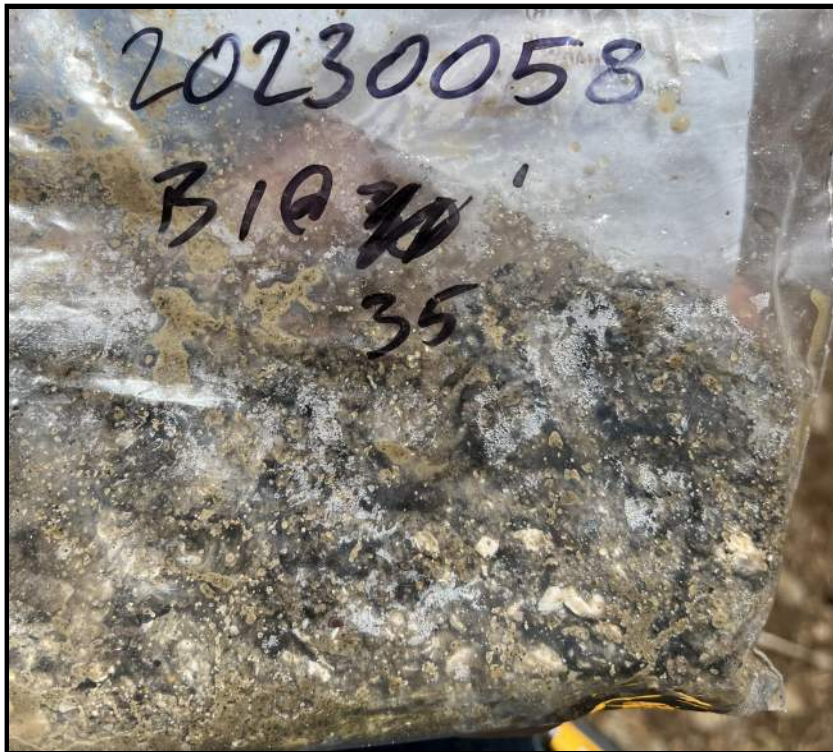


PHOTO 6: BORING B-1, 35 FT SAMPLE



| | |
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| DRAWN: | 06/2022 |
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| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-7



PHOTO 7: BORING B-1, 40 FT SAMPLE



PHOTO 8: BORING B-1, 45 FT SAMPLE



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-8

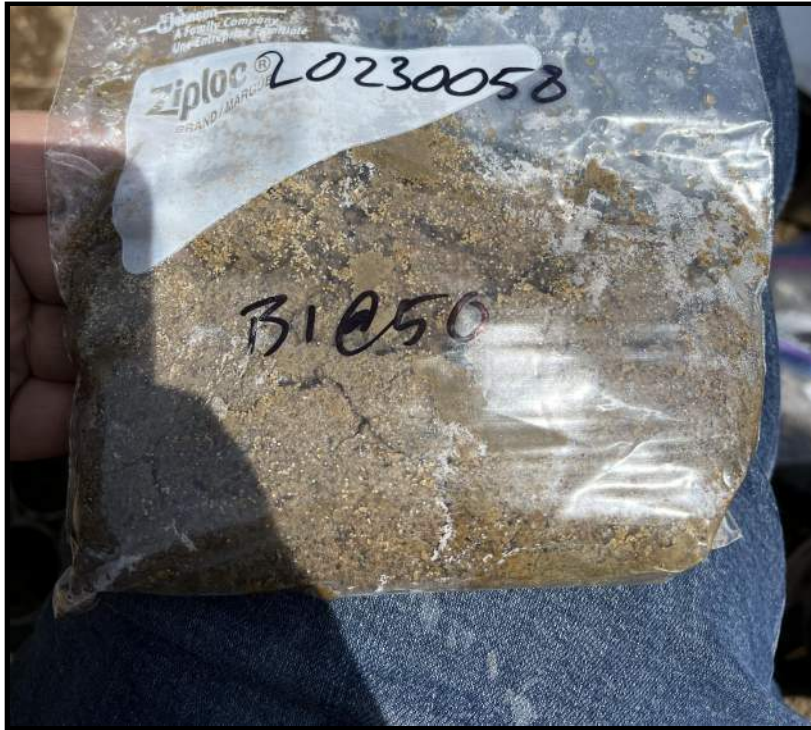


PHOTO 9: BORING B-1, 50 FT SAMPLE

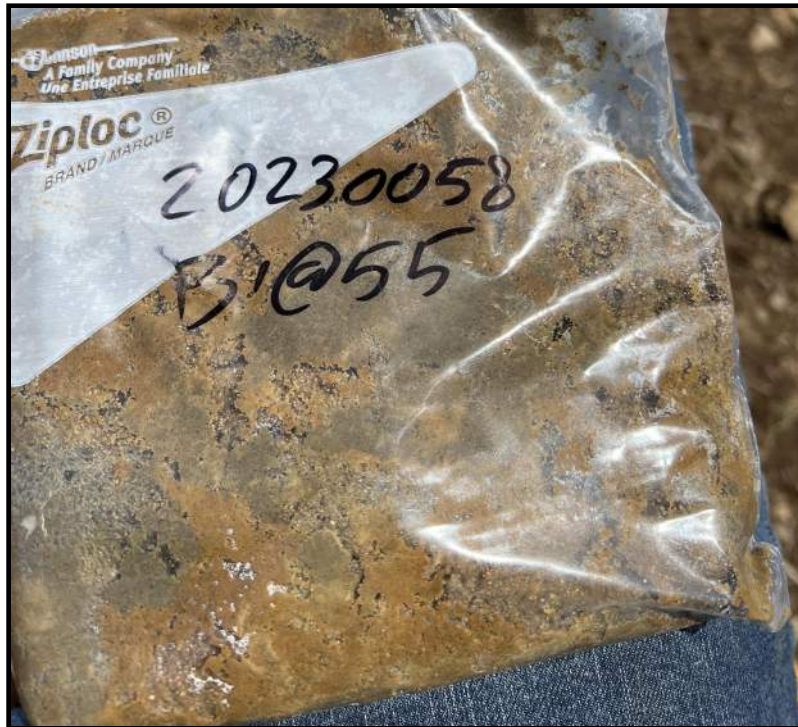


PHOTO 10: BORING B-1, 55 FT SAMPLE


| | | | |
|---|-----------------------------|--|--------------------|
|  | PROJECT NO. 20230058.001A | PHOTO SUMMARY | FIGURE: C-9 |
| | DRAWN: 06/2022 | | |
| | DRAWN BY: TD | OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS WINEMA BEACH, CLOVERDALE, OREGON | |
| | CHECKED BY: KS/SC | | |
| | FILE NAME: PHOTO SUMMARY | | |



PHOTO 11: BORING B-1, 60 FT SAMPLE



PHOTO 12: BORING B-1, 65FT SAMPLE



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

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| PHOTO SUMMARY |
| OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS WINEMA BEACH, CLOVERDALE, OREGON |

FIGURE:

C-10



PHOTO 13: BORING B-1, CORE RUNE 1: 70 FT -71.5 FT



PHOTO 14: BORING B-1, CORE RUN 2: 71.5 FT - 76.5 FT



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-11



PHOTO 15: BORING B-1, CORE RUN 3: 76.5 FT -81.5 FT



PHOTO 16: BORING B-1, CORE RUN 4: 81.5 FT - 86.5 FT



PROJECT NO. 20230058.001A
 DRAWN: 06/2022
 DRAWN BY: TD
 CHECKED BY: KS/SC
 FILE NAME:
 PHOTO SUMMARY

PHOTO SUMMARY

OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-12



PHOTO 17: BORING B-1, CORE RUN 5: 86.5 FT -91.5 FT



PHOTO 18: BORING B-1, CORE RUN 6: 91.5 FT - 96.5 FT


| | | | |
|---|-----------------------------|--|---------------------|
|  | PROJECT NO. 20230058.001A | PHOTO SUMMARY | FIGURE: C-13 |
| | DRAWN: 06/2022 | | |
| | DRAWN BY: TD | | |
| | CHECKED BY: KS/SC | | |
| | FILE NAME: PHOTO SUMMARY | OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS WINEMA BEACH, CLOVERDALE, OREGON | |



PHOTO 19: BORING B-1, CORE RUN 7: 96.5 FT - 101.5 FT



PHOTO 20: BORING B-1, CORE RUN 8: 101.5 FT - 106.5 FT



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-14



PHOTO 21: BORING B-1, CORE RUNE 9: 106.5 FT - 111.5 FT



PHOTO 22: BORING B-1, CORE RUN 10: 111.5 FT - 116.5 FT



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

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| PHOTO SUMMARY |
| OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS WINEMA BEACH, CLOVERDALE, OREGON |

FIGURE:

C-15



PHOTO 23: BORING B-1, CORE RUNE 11: 116.5 FT -121.5 FT



PHOTO 24: BORING B-1, CORE RUN 12: 121.5 FT - 126.5 FT



| | |
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| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-16



PHOTO 25: BORING B-1, CORE RUNE 13: 126.5 FT -131.5 FT



PHOTO 26: BORING B-1, CORE RUN 14: 131.5 FT - 136.5 FT



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-17



PHOTO 27: BORING B-1, CORE RUNE 15: 136.5 FT -141.5 FT



PHOTO 28: BORING B-1, CORE RUN 16: 141.5 FT - 146.5 FT



| | |
|-------------|---------------|
| PROJECT NO. | 20230058.001A |
| DRAWN: | 06/2022 |
| DRAWN BY: | TD |
| CHECKED BY: | KS/SC |
| FILE NAME: | PHOTO SUMMARY |

PHOTO SUMMARY


OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE:

C-18



PHOTO 29: BORING B-1, CORE RUNE 17: 146.5 FT -151.5 FT

| | | | |
|---|-----------------------------|--|---------------------|
|  | PROJECT NO. 20230058.001A | PHOTO SUMMARY | FIGURE: C-19 |
| | DRAWN: 06/2022 | | |
| | DRAWN BY: TD | | |
| | CHECKED BY: KS/SC | | |
| | FILE NAME: PHOTO SUMMARY | OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL INSTALLATIONS WINEMA BEACH, CLOVERDALE, OREGON | |



APPENDIX D

LABORATORY TEST RESULTS

LIST OF ATTACHMENTS

The following figures are attached and complete this appendix.

Figure D-1 – Laboratory Test Result Summary

Figure D-2 – Rock Laboratory Test Result Summary

Figure D-3 – Atterberg Limits Test Results

Figure D-4 – Sieve Analysis Test Results

Figures D-5 to D-8 – Uniaxial Compressive Strength Results

| Exploration ID | Depth (ft.) | Sample Description | Water Content (%) | Dry Unit Wt. (pcf) | Sieve Analysis (%) | | | Atterberg Limits | | | Additional Tests |
|----------------|-------------|---|-------------------|--------------------|--------------------|------------|--------------|------------------|---------------|------------------|------------------|
| | | | | | Passing 3/4" | Passing #4 | Passing #200 | Liquid Limit | Plastic Limit | Plasticity Index | |
| B-1 | 5.0 | POORLY GRADED SAND (SP) | 11.1 | 111.0 | | | 0.9 | | | | |
| B-1 | 15.0 | POORLY GRADED SAND (SP) | 20.3 | 107.4 | | | 4.0 | | | | |
| B-1 | 20.0 | POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM) | | | 91 | 47 | 8.6 | | | | |
| B-1 | 25.0 | POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM) | | | 73 | 33 | 5.9 | | | | |
| B-1 | 40.0 | CLAYEY SAND (SC) | | | | | 17 | 53 | 27 | 26 | |
| B-1 | 45.0 | POORLY GRADED SAND (SP) | 15.2 | 122.9 | | | 3.6 | | | | |
| B-1 | 50.0 | POORLY GRADED SAND (SP) | | | | | 5.4 | | | | |

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic



PROJECT NO.:
20230058.001A

DRAWN BY:

CHECKED BY:

DATE:

**LABORATORY TEST
RESULT SUMMARY**

OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

D-1

| Exploration ID | Depth (ft.) | Sample Description | Unconfined Compressive Strength (psi) | UCS with Young's Modulus (tsf) | Triaxial Compressive Strength (tsf) | Triaxial with Young's Modulus (tsf) | Triaxial with Poisson's Ratio | Point Load Index (MPa) | Direct Shear Strength on Saw-Cut Surface (tsf) | Direct Shear Strength on Fracture Surface (tsf) | Direct Shear Strength Apparent Friction | Brazilian Splitting Tensile Strength (MPa) | Dry Unit Weight (pcf) | Specific Gravity | Moh's Hardness | Slake Durability | Cerhar Abrasivity Index |
|----------------|-------------|--------------------|---------------------------------------|--------------------------------|-------------------------------------|-------------------------------------|-------------------------------|------------------------|--|---|---|--|-----------------------|------------------|----------------|------------------|-------------------------|
| B-1 | 82.0 | SANDSTONE | 5610 | | | | | | | | | | 146.0 | | | | |
| B-1 | 91.5 | SANDSTONE | 5050 | | | | | | | | | | 157.0 | | | | |
| B-1 | 112.4 | SANDSTONE | 4210 | | | | | | | | | | 153.0 | | | | |
| B-1 | 132.5 | SANDSTONE | 4990 | | | | | | | | | | 152.0 | | | | |



PROJECT NO.:
20230058.001A

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CHECKED BY:

DATE:

**ROCK LABORATORY TEST
RESULT SUMMARY**

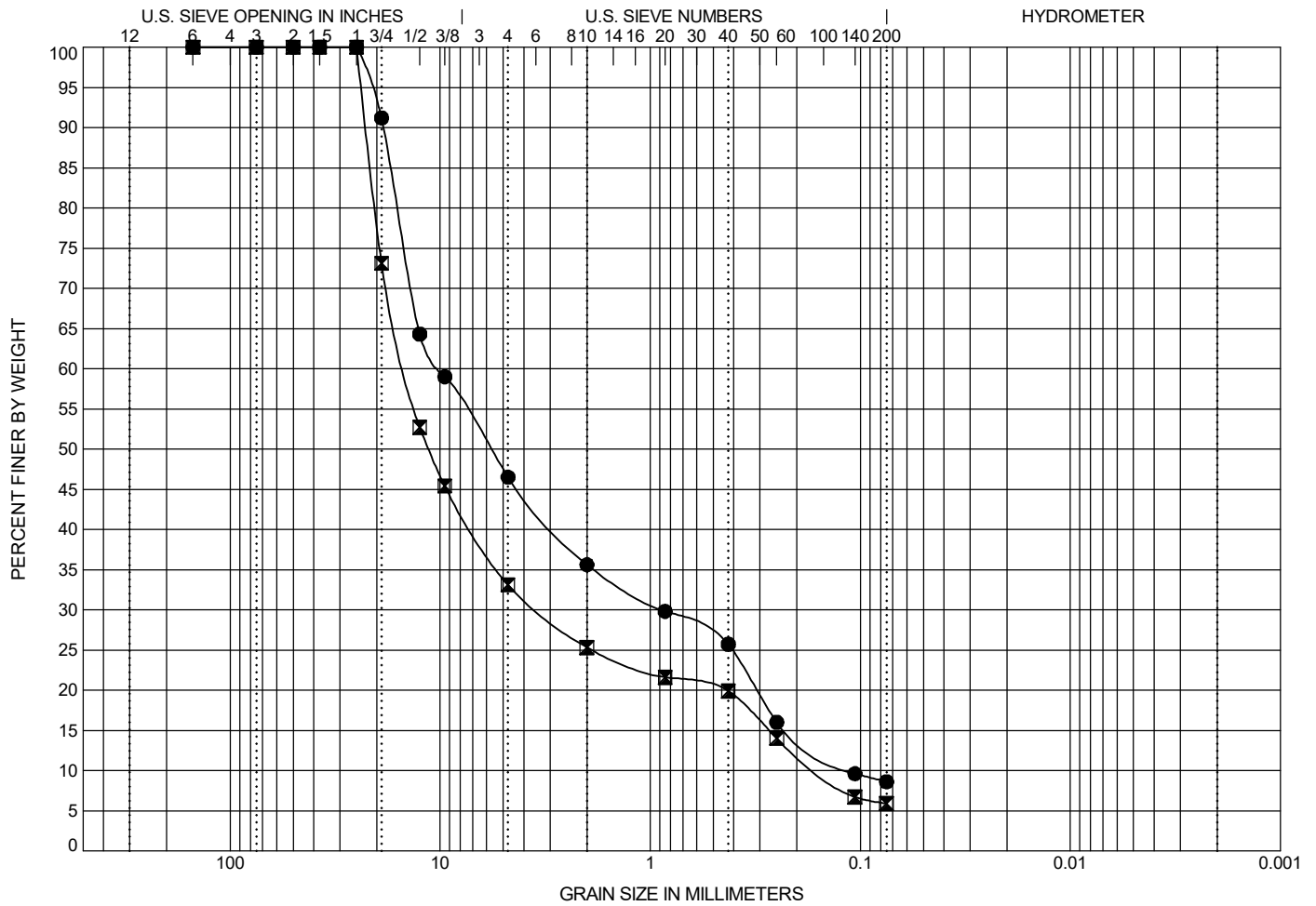
OFFSHORE CABLE LANDING
HORIZONTAL DIRECTIONAL DRILL
WINEMA BEACH, CLOVERDALE, OREGON

FIGURE

D-2

Refer to the Geotechnical Investigation Report or the supplemental plates for the method used for the testing performed above.
NA = Not Available


| BOULDER | COBBLE | GRAVEL | | SAND | | | SILT | CLAY |
|---------|--------|--------|------|--------|--------|------|------|------|
| | | coarse | fine | coarse | medium | fine | | |





| | | | |
|--|-------------------------------------|----------------|-------------|
| Specimen Preparation in accordance with ASTM D4543 Remarks: | Diameter, in | D ₀ | 2.39 |
| | Height, in | H ₀ | 5.42 |
| | Moisture Condition | | As Received |
| | Unit Weight, pcf | ρ _d | 146 |
| | Uniaxial Compressive Strength (psi) | σ _u | 5,610 |
| | Time to Failure, mm:ss | | 2:18 |
| | | | |

| | | |
|-----------------------------|--------|-----------------------------------|
| Description of Specimen: -- | | Test Method: ASTM D7012, Method C |
| Boring: | B-1 | |
| Run: | 4 | |
| Depth, ft: | 82 | |
| Test Date: | 6/9/22 | |

| | | | |
|--|---|--|---------------------------------|
|  <p>9969 Horn Rd., Sacramento, CA 95827</p> | PROJECT NO.: 20230058 ENTRY BY: S. Winn CHECKED BY: C. Pollack DATE: 6/14/2022 | UNIAXIAL COMPRESSION TEST OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL WINEMA BEACH, CLOVERDALE, OREGON | FIGURE D-5 |
| | | | PAGE: 1 of 1 |



| | | | |
|--|-------------------------------------|----------------|-------------|
| Specimen Preparation in accordance with ASTM D4543 Remarks: | Diameter, in | D ₀ | 2.39 |
| | Height, in | H ₀ | 5.04 |
| | Moisture Condition | | As Received |
| | Unit Weight, pcf | ρ _d | 157 |
| | Uniaxial Compressive Strength (psi) | σ _u | 5,050 |
| | Time to Failure, mm:ss | | 3:12 |
| | | | |

Description of Specimen: -- Test Method: ASTM D7012, Method C

| | |
|------------|----------|
| Boring: | B-1 |
| Run: | 6 |
| Depth, ft: | 91.5 |
| Test Date: | 6/9/2022 |



9969 Horn Rd., Sacramento, CA 95827

PROJECT NO.: 20230058
 ENTRY BY: A. Auvinen
 CHECKED BY: C. Pollack
 DATE: 6/14/2022


UNIAXIAL COMPRESSION TEST
 OFFSHORE CABLE LANDING
 HORIZONTAL DIRECTIONAL DRILL
 WINEMA BEACH, CLOVERDALE, OREGON

FIGURE
 D-6



| | | | |
|--|-------------------------------------|----------------|-------------|
| Specimen Preparation in accordance with ASTM D4543 Remarks: | Diameter, in | D ₀ | 2.39 |
| | Height, in | H ₀ | 5.17 |
| | Moisture Condition | | As Received |
| | Unit Weight, pcf | ρ _d | 153 |
| | Uniaxial Compressive Strength (psi) | σ _u | 4,210 |
| | Time to Failure, mm:ss | | 2:16 |
| | | | |

| | | |
|-----------------------------|----------|-----------------------------------|
| Description of Specimen: -- | | Test Method: ASTM D7012, Method C |
| Boring: | B-1 | |
| Run: | 10 | |
| Depth, ft: | 112.4 | |
| Test Date: | 6/9/2022 | |


| | | | |
|--|---|--|---------------------------------|
|  <p>9969 Horn Rd., Sacramento, CA 95827</p> | PROJECT NO.: 20230058 ENTRY BY: S. Winn CHECKED BY: C. Pollack DATE: 6/14/2022 | UNIAXIAL COMPRESSION TEST OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL WINEMA BEACH, CLOVERDALE, OREGON | FIGURE D-7 |
| | PAGE: 1 of 1 | | |



| | | | |
|--|-------------------------------------|----------------|-------------|
| Specimen Preparation in accordance with ASTM D4543 Remarks: | Diameter, in | D _o | 2.40 |
| | Height, in | H _o | 5.03 |
| | Moisture Condition | | As Received |
| | Unit Weight, pcf | ρ _d | 152 |
| | Uniaxial Compressive Strength (psi) | σ _u | 4,990 |
| | Time to Failure, mm:ss | | 5:49 |
| | | | |

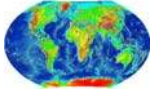
Description of Specimen: -- Test Method: ASTM D7012, Method C

| | |
|------------|-------------|
| Boring: | B-1 |
| Run: | 14 |
| Depth, ft: | 132.5-133.8 |
| Test Date: | 6/9/2022 |

| | | | |
|--|---|--|---------------------------------|
|  <p>9969 Horn Rd., Sacramento, CA 95827</p> | PROJECT NO.: 20230058 ENTRY BY: S. Winn CHECKED BY: C. Pollack DATE: 6/14/2022 | UNIAXIAL COMPRESSION TEST OFFSHORE CABLE LANDING HORIZONTAL DIRECTIONAL DRILL WINEMA BEACH, CLOVERDALE, OREGON | FIGURE D-8 |
| | | | PAGE: 1 of 1 |



APPENDIX E
GEOPHYSICAL INVESTIGATION RESULTS



July 14, 2022

Our ref: 112-0228.000

Kleinfelder
3731 W. Ashcroft Ave,
Fresno, CA 93722

Attention: Mr. Pedro Rivas

**RE: REPORT FOR THE GEOPHYSICAL SURVEYS FOR WINEMA HDD,
OREGON**

Dear Mr. Rivas:

Global Geophysics LLC. conducted downhole seismic, multi-channel analysis of surface wave (MASW), electrical resistivity tomography (ERT), and overwater seismic profiling surveys near Winema, OR in May, June and July, 2022. The objective of the studies is to the stratigraphy along the proposed HDD alignment.

**1. GEOPHYSICAL METHODS, INSTRUMENTATION AND FIELD
PROCEDRUES**

The following paragraphs describe the methods and procedures.

1.1. Downhole Seismic Survey

The seismic downhole method provides a designer with information pertinent to the seismic wave velocities of the materials in question. The P-wave and S-wave velocities are directly related to the important geotechnical elastic constants of Poisson's ratio, shear modulus, bulk modulus, and Young's modulus. Accurate in-situ P-wave and S-wave velocity profiles are essential in geotechnical foundation designs. These parameters are used in both analyses of soil behavior under both static and dynamic loads where the elastic constants are input variables into the models defining the different states of deformations such as elastic, elasto-plastic, and failure. Another important use of estimated shear wave velocities in geotechnical design is in the liquefaction assessment of soils.

The downhole seismic survey was carried out using a Geometrics 32-bit Geode, a 24-channel seismograph. The receiver package employed was a Geostuff BHG-2 tri-axial package containing one vertical geophone for recording compressional wave (P-wave) and the two horizontal geophones for recording shear waves (S-wave). A lumber secured under vehicle

front wheels was used for S-wave source. The lumber was impacted by a 20 lb sledge hammer horizontally on both sides of the lumber to generate S-wave with opposite polarities. The receiver was lowered in the borehole at 3-foot interval, and data was collected and stored for further interpretation.

1.2. Multichannel Analysis of Surface Wave (MASW)

The MASW method determines variations in surface wave velocities with increasing distances and wavelengths. The data from these measurements are used to model the shear wave velocities of the subsurface. This information can then be used to infer rock/soil types, stratigraphy and soil conditions.

The MASW survey requires a seismic source, to generate surface-waves, and at least 24 geophones, to measure the ground response at increasing distances from the source. Surface waves are a special type of seismic wave whose propagation is confined to the near surface medium. The depth of subsurface penetration of a surface-wave is directly proportional to its wavelength. In a non-homogeneous medium, surface-waves are dispersive, i.e. each wavelength has a characteristic velocity stemming from subsurface heterogeneities. The relationship between surface-wave velocity and wavelength is used to calculate the shear-wave velocity of the medium with increasing depth.

The seismic source will be an excavator. Examples of passive sources are drill rigs, road traffic, micro-tremors, and water-wave action (in near-shore environments). Geophone measures the arrival time of the various components of the surface wave-train traveling from the seismic source.

The surface-wave velocity with respect to frequency (called the ‘dispersion curve’) is determined by measuring the delay time in wave propagation between the geophones. The dispersion curve is then matched to a theoretical dispersion curve using an iterative forward-modeling procedure. The result is a profile of shear-wave velocity versus depth. This shear wave profile can be with used other parameters such as density, to estimate the dynamic shear modulus of the medium as a function of depth.

The MASW survey was conducted using 24 geophone spaced at 10 ft.

1.3. Electrical Resistivity Tomography

The electrical resistivity tomography (ERT) technique maps differences in the electrical properties of geologic materials. These differences can result from variations in lithology, water content, pore-water chemistry, or voids. The method involves transmitting an electric current into the ground between two electrodes and measuring the voltage between two other electrodes. The direct measurement is the apparent resistivity of the area beneath the electrodes. The measurements include deeper layers as the electrode spacing is increased. Recent advances in technology permit rapid collection of multiple soundings, using up to 56 electrodes for each spread. The data are modeled to create a 2-D geo-electric cross-section that is useful for mapping both vertical and horizontal variations of the subsurface strata.

The data was acquired with an AGI SuperSting R8 system using up to 56 electrodes spaced at a 10-20 feet interval on the ground surface/sea floor along the proposed HDD alignment. Once the electrode array was installed in the ground, multiple soundings were automatically carried out by the control unit. The data was downloaded on site into a computer and processed using specialized inversion software to determine if all of the objectives had been met.

1.4. Overwater Profiling

Overwater profiling provides a continuous subsurface image of the seabed, the underlying stratigraphy and major structural features in the bedrock. The subsurface acoustic image are produced in real-time on a computer screen which displays the data as a profile or cross-section view along the transect. Subsurface reflection data is acquired every 1 to 2 meters and the location of each data point is determined with the global position satellite system. Preliminary interpretation of the data can be done in the field without the need for additional processing.

The reflection survey used a low frequency seismic reflection system, with a frequency band-pass of 450 to 1500 Hz to obtain maximum subsurface penetration in fine-grained to coarse-grained sediment. The acoustic energy source was mounted on the side of the vessel and a 20 ft long hydrophone is towed approximately 10 ft astern of the acoustic transducer.

A DGPS system will be used to navigate along proposed HDD alignment. The reflection data is processed and stored on a digital acquisition system.

2. RESULTS

The line locations are shown in Figure 1. The s-wave profile MASW 1 (on land) is presented in Figure 2 together with resistivity profile ERT 2 (on land). The borehole B1 is approximately 65 north of the transect. The interpreted top of the sandstone is shown in dashed magenta line. MASW and ERT measure different soil properties with different electrode/geophone/shot spacings, their contour lines may not match.

In addition, the measured soil resistivity values are in very different ranges when collected on land and in sea water. The resistivity range is much lower in sea water due to large current output. The ERT 1 profile is shown in Figure 3. The interpreted overburden and basal layer (assuming sandstone) is highlighted with the dashed magenta line. The overburden thickness varies between 35 ft to 50 ft. However, there is a big data gap between ERT1 and ERT2, and different materials have similar resistivity ranges, the interpreted geological units can be different from ground truthing.

The overwater seismic profiling data were collected back and forth between (45°8.750'N, -123°59.366') and (45°8.783', -123°58.816') as close to the shore as possible (approximately 15 ft water depth). The track lines and profiles are shown in Figure 4. The interpreted basal layer based on the resistivity profile is shown in dashed purple line.

The shear velocities measured at borehole B1 is listed in the table below:

Table 1: Calculated shear wave velocity at B1

| Depth (ft) | Arrival (ms) | S-wave Velocity (ft/s) |
|------------|--------------|------------------------|
| 3 | 21.72 | |
| 6 | 24.96 | 610 |
| 9 | 28.21 | 766 |
| 12 | 31.45 | 834 |
| 15 | 34.70 | 867 |
| 18 | 37.94 | 885 |
| 21 | 41.18 | 896 |
| 24 | 44.43 | 903 |
| 27 | 47.67 | 908 |
| 30 | 49.81 | 1378 |
| 33 | 51.96 | 1382 |
| 36 | 54.10 | 1385 |
| 39 | 56.25 | 1387 |
| 42 | 58.39 | 1389 |
| 45 | 60.54 | 1390 |
| 48 | 62.68 | 1391 |
| 51 | 64.82 | 1392 |
| 54 | 66.97 | 1393 |
| 57 | 69.11 | 1393 |
| 60 | 71.26 | 1394 |
| 63 | 73.40 | 1395 |
| 66 | 74.94 | 1942 |
| 69 | 76.48 | 1943 |
| 72 | 78.02 | 1943 |
| 75 | 79.56 | 1944 |
| 78 | 81.10 | 1944 |
| 81 | 82.64 | 1944 |
| 84 | 83.85 | 2466 |
| 87 | 85.07 | 2466 |
| 90 | 86.28 | 2466 |
| 93 | 87.50 | 2466 |
| 96 | 88.71 | 2467 |
| 99 | 89.93 | 2467 |
| 102 | 91.14 | 2467 |
| 105 | 92.36 | 2467 |
| 108 | 93.57 | 2467 |

| | | |
|-----|--------|------|
| 111 | 94.79 | 2467 |
| 114 | 96.00 | 2468 |
| 117 | 97.18 | 2536 |
| 120 | 98.36 | 2536 |
| 123 | 99.55 | 2536 |
| 126 | 100.73 | 2536 |
| 129 | 101.91 | 2537 |
| 132 | 103.09 | 2537 |
| 135 | 104.27 | 2537 |
| 138 | 105.45 | 2537 |
| 141 | 106.64 | 2537 |
| 144 | 107.82 | 2537 |
| 147 | 109.00 | 2537 |

S-wave source to borehole distance =

5 ft

LIMITATION OF GEOPHYSICAL METHODS

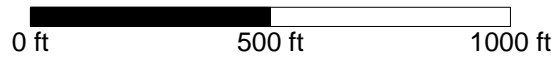
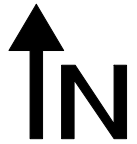
Global geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. MASW, ERT, seismic profiling are remote sensing geophysical methods that may not detect all subsurface conditions due to the limitations of the methods, soil conditions, size of the features and their depths. Different soil/rock types have wide overlapping velocity and resistivity ranges, the interpreted geological units may be proven to be different by ground truthing.

Sincerely,

Global Geophysics

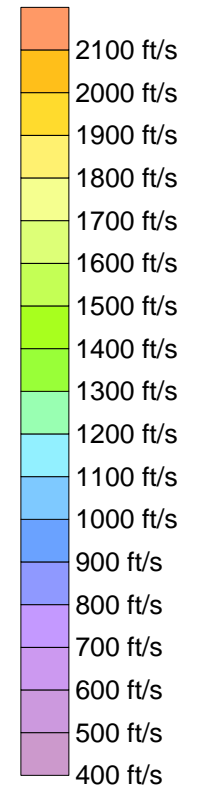
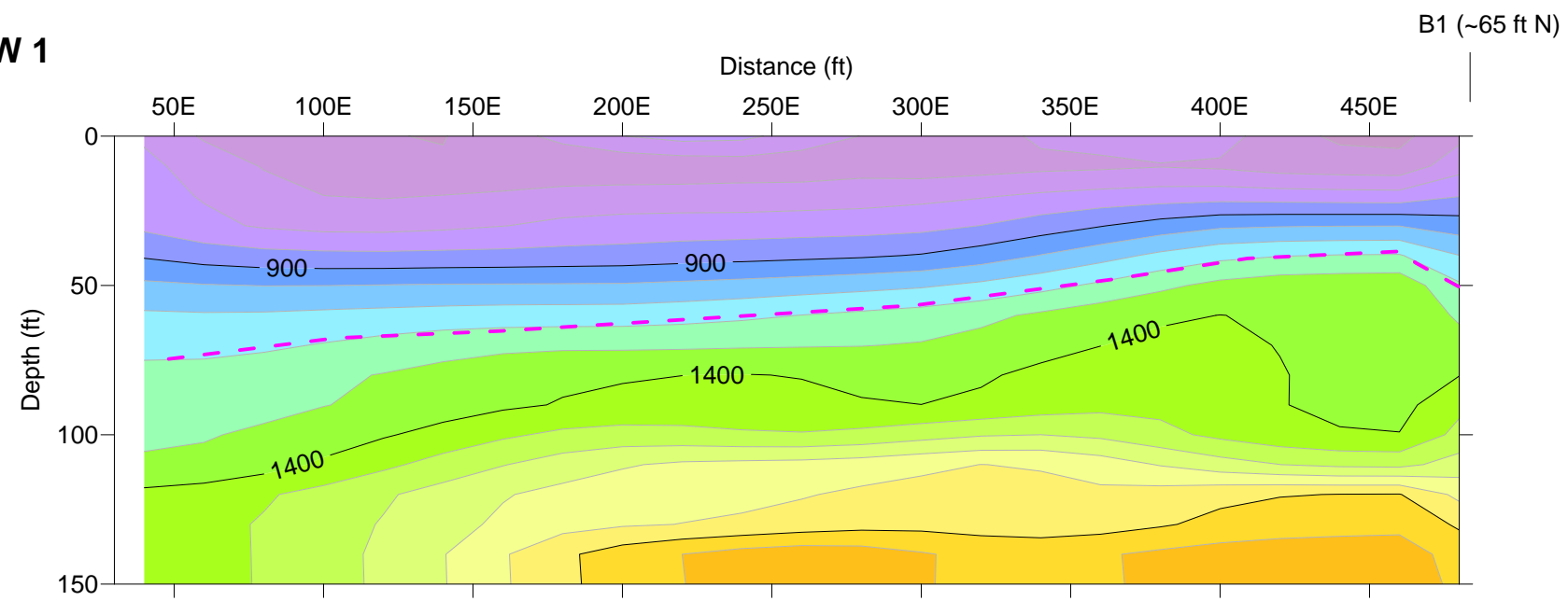


John Liu, Ph.D., R.G.
Principal Geophysicist

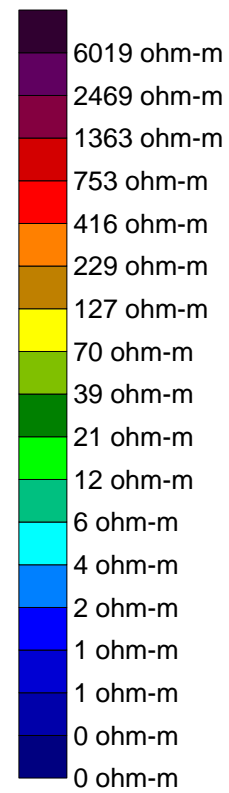
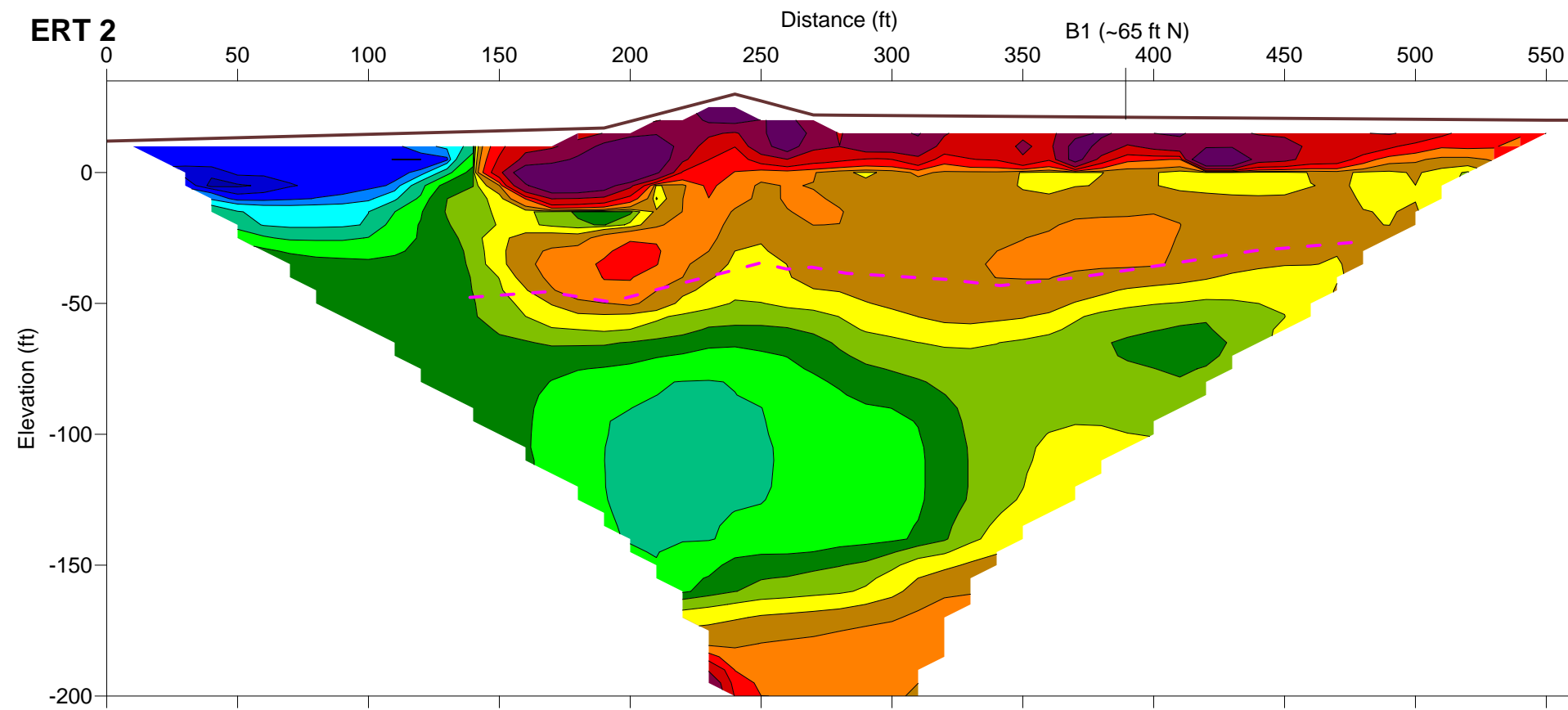


| | | | |
|------------------------|-------------------------|---|-----------------|
| PROJECT | | Geophysical Survey Along Winema HDD Winema, OR | |
| TITLE | | Site Map | |
| Global Geophysics | Project #: 112-0228.000 | FILE No. | |
| P.O. Box 2229 | DESIGN -- | SCALE AS SHOWN | REV. |
| Redmond, WA 98073-2229 | CADD EJ | | |
| Tel: 425-890-4321 | CHECK JL | | |
| | REVIEW -- | | |
| | | | FIGURE 1 |

MASW 1

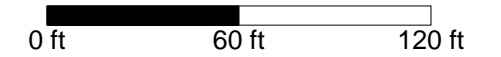


ERT 2

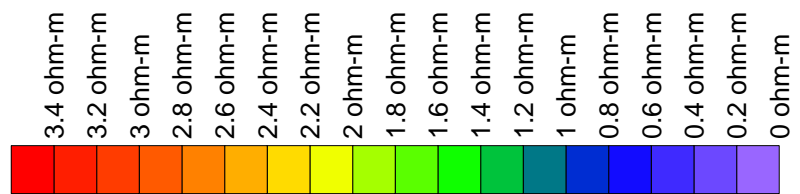
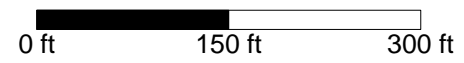
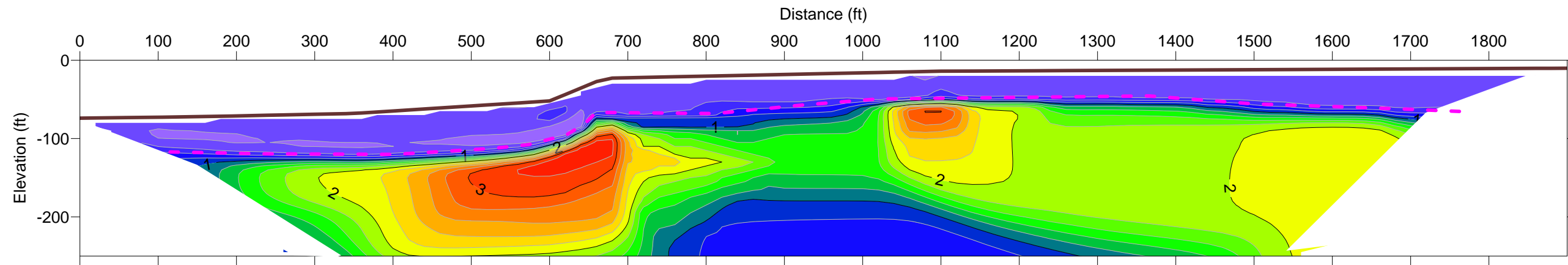


Legend:

--- Interpreted top of the sandstone



| | | |
|---|-------------------------|-----------------|
| PROJECT | | |
| Geophysical Survey Along Winema HDD Winema, OR | | |
| TITLE | | |
| S-wave Velocity and Resistivity Profiles | | |
| Global Geophysics | Project #: 112-0228.000 | FILE No. |
| P.O. Box 2229 | DESIGN -- | SCALE AS SHOWN |
| Redmond, WA 98073-2229 | CADD EJ | REV. |
| Tel: 425-890-4321 | CHECK JL | FIGURE 2 |
| | REVIEW -- | |

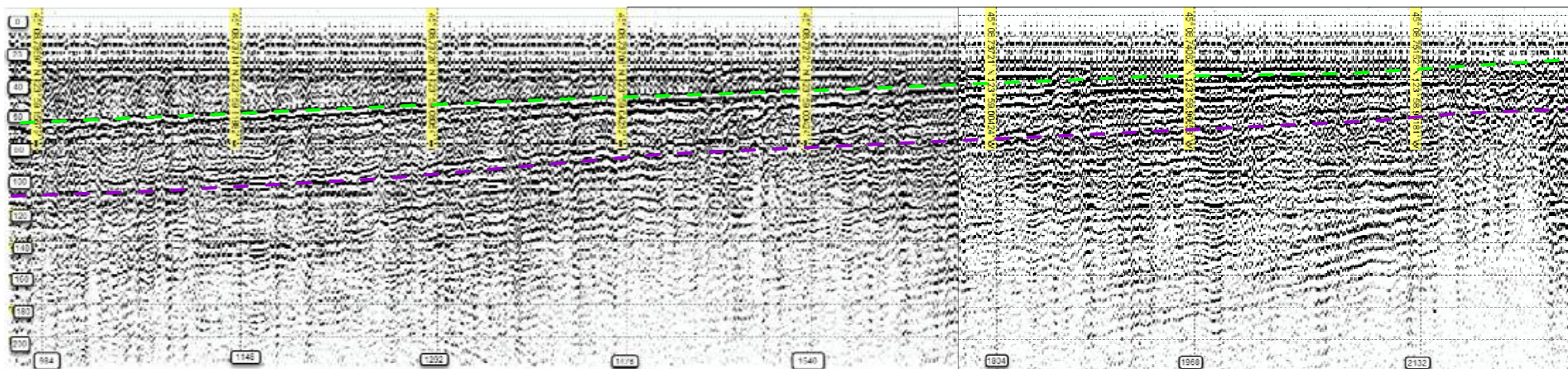
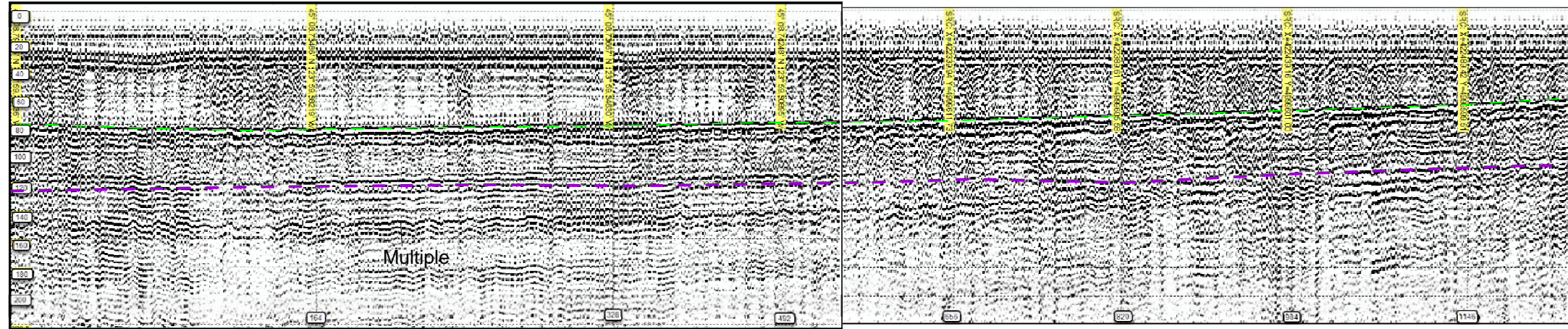
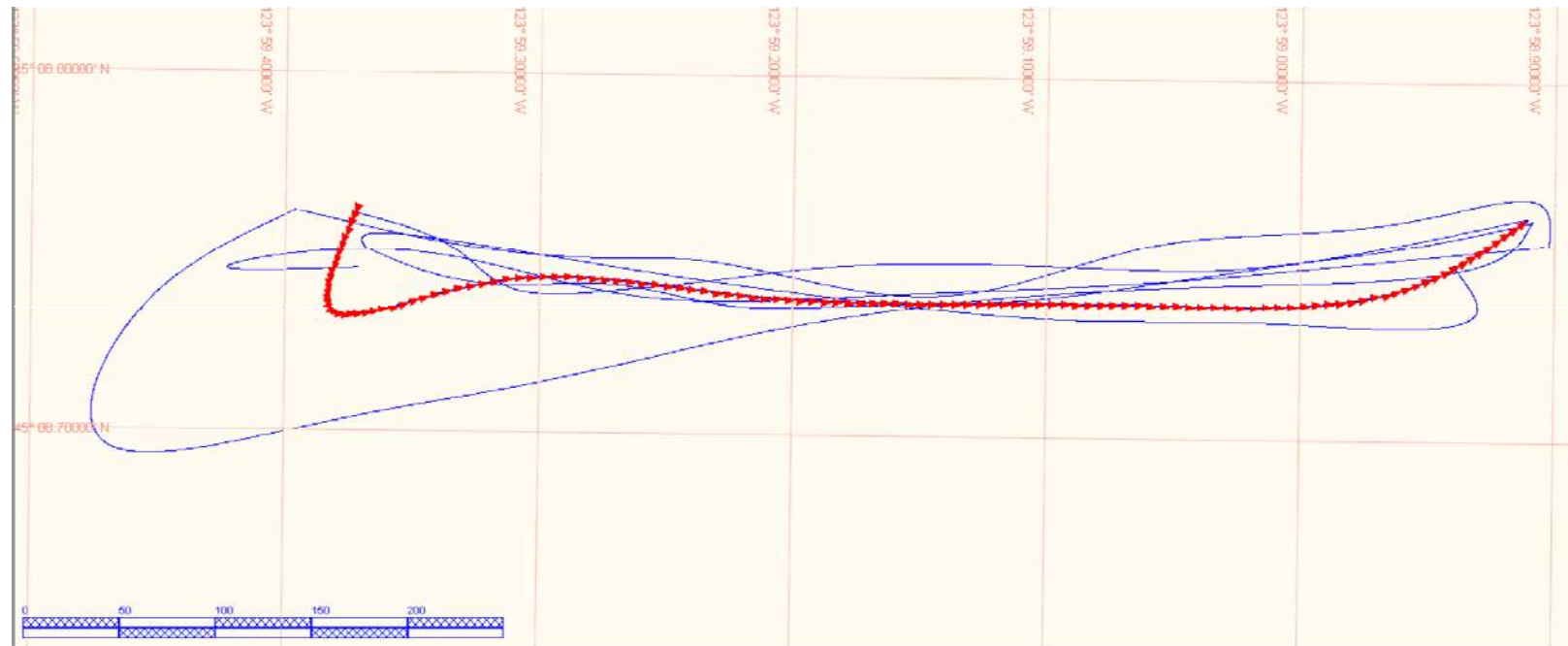


Legend:

--- Interpreted top of the sandstone

| | | |
|--|-------------------------|-----------------------|
| PROJECT | | |
| Geophysical Survey Along Winema HDD Winema, OR | | |
| TITLE | | |
| ERT 1 Resistivity Profile | | |
| Global Geophysics P.O. Box 2229 Redmond, WA 98073-2229 Tel: 425-890-4321 | Project #: 112-0228.000 | FILE No. |
| | DESIGN -- | SCALE AS SHOWN REV. |
| | CADD EJ | |
| | CHECK JL | |
| | REVIEW -- | |
| | | FIGURE 3 |

Track Lines



Seismic record images are not scaled

Legend:

- - - Sea floor
- - - Interpreted basal layer

| | | |
|---|-------------------------|-----------------------|
| PROJECT | | |
| Geophysical Survey Along Winema HDD Winema, OR | | |
| TITLE | | |
| Seismic Profile | | |
| Global Geophysics P.O. Box 2229 Redmond, WA 98073-2229 Tel: 425-890-4321 | Project #: 112-0228.000 | FILE No. |
| | DESIGN -- | SCALE AS SHOWN REV. |
| | CADD EJ | |
| | CHECK JL | |
| | REVIEW -- | FIGURE 4 |



APPENDIX F
GBA INFORMATION SHEET

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer

will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site’s subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report’s Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals’ misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals’ plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note*

conspicuously that you’ve included the material for information purposes only. To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled “limitations,” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer’s recommendations will not of itself be sufficient to prevent moisture infiltration.* **Confront the risk of moisture infiltration** by including building-envelope or mold specialists on the design team. **Geotechnical engineers are not building-envelope or mold specialists.**



Telephone: 301/565-2733

e-mail: info@geoprofessional.org www.geoprofessional.org

Appendix 5
Wetland Delineation Report

WETLAND DELINEATION / DETERMINATION REPORT COVER FORM

A complete report and signed report cover form, along with applicable review fee, are required before a report review timeline can be initiated by the Department of State Lands. All applicants will receive an emailed confirmation that includes the report's unique file number and other information.

Ways to submit report:

- ❖ **Under 50MB** - A single unlocked PDF can be emailed to: wetland.delineation@dsl.oregon.gov.
- ❖ **50MB or larger** - A single unlocked PDF can be uploaded to DSL's Box.com website. After upload notify DSL by email at: wetland.delineation@dsl.oregon.gov.
- ❖ **OR** a hard copy of the unbound report and signed cover form can be mailed to: Oregon Department of State Lands, 775 Summer Street NE, Suite 100, Salem, OR 97301-1279.

Ways to pay review fee:

- ❖ By credit card on DSL's epayment portal after receiving the unique file number from DSL's emailed confirmation.
- ❖ By check payable to the Oregon Department of State Lands attached to the unbound mailed hardcopy **OR** attached to the complete signed cover form if report submitted electronically.

Contact and Authorization Information

| | |
|--|--|
| <input checked="" type="checkbox"/> Applicant <input type="checkbox"/> Owner Name, Firm and Address: Wave Astound 3700 Monte Villa PKWY Bothell, WA 98021 <i>MATTHEW UPDENKELDER, SR DIRECTOR CONSTRUCTION</i> | Business phone # (541) 760-9822 Mobile phone # (optional) E-mail: matthew.upendenkelder@astound.com |
|--|--|

| | |
|--|--|
| <input type="checkbox"/> Authorized Legal Agent, Name and Address (if different): | Business phone # Mobile phone # (optional) E-mail: |
|--|--|

I either own the property described below or I have legal authority to allow access to the property. I authorize the Department to access the property for the purpose of confirming the information in the report, after prior notification to the primary contact.

Typed/Printed Name: MATTHEW UPDENKELDER **Signature:**
Date: 2/10/23 **Special instructions regarding site access:** _____

Project and Site Information

| | |
|---|--|
| Project Name: Winema Beach Landing Site | Latitude: 45 08 48N Longitude: 123 58 24W decimal degree - centroid of site or start & end points of linear project |
| Proposed Use: Cable landing site with buried conduit | Tax Map # Tillamook County map 55 |
| | Tax Lot(s) 30 |
| Project Street Address (or other descriptive location): 5195 Winema Road | Tax Map # |
| | Tax Lot(s) |
| City: Cloverdale County: Tillamook | Township 05 Range 11W Section 12 QQ Use separate sheet for additional tax and location information |
| | Waterway: River Mile: |

Wetland Delineation Information

| | |
|---|--|
| Wetland Consultant Name, Firm and Address: Northwest Watershed Solutions LLC 820 Borsberry Ln SE Salem, OR 97306 <small>Digitally signed by Tom Rumreich DN: cn=Tom Rumreich, o=Northwest watershed solutions, ou, email=jandtrumreich@gmail.com, c=US Date: 2023.02.08 07:52:44 -08'00'</small> | Phone # (541) 217-0051 Mobile phone # (if applicable) E-mail: jandtrumreich@gmail.com |
|---|--|

The information and conclusions on this form and in the attached report are true and correct to the best of my knowledge.
Consultant Signature: _____ **Date:** _____

Primary Contact for report review and site access is Consultant Applicant/Owner Authorized Agent

Wetland/Waters Present? Yes No Study Area size: _____ Total Wetland Acreage: _____

Check Applicable Boxes Below

| | |
|--|---|
| <input type="checkbox"/> R-F permit application submitted <input type="checkbox"/> Mitigation bank site <input type="checkbox"/> EFSC/ODOE Proj. Mgr: _____ <input type="checkbox"/> Wetland restoration/enhancement project (not mitigation) <input type="checkbox"/> Previous delineation/application on parcel If known, previous DSL # _____ | <input type="checkbox"/> Fee payment submitted \$ _____ <input type="checkbox"/> Resubmittal of rejected report (\$100) <input type="checkbox"/> Request for Reissuance. See eligibility criteria. (no fee) DSL # _____ Expiration date _____ <input type="checkbox"/> LWI shows wetlands or waters on parcel Wetland ID code _____ |
|--|---|

For Office Use Only

| | | |
|---|-------------------------------|-----------------|
| DSL Reviewer: _____ | Fee Paid Date: ____/____/____ | DSL WD # _____ |
| Date Delineation Received: ____/____/____ | | DSL App.# _____ |

WETLAND DELINEATION / DETERMINATION REPORT COVER FORM

A complete report and signed report cover form, along with [applicable review fee](#), are required before a report review timeline can be initiated by the Department of State Lands. All applicants will receive an emailed confirmation that includes the report's unique file number and other information.

Ways to submit report:

- ❖ **Under 50MB** - A single unlocked PDF can be emailed to: wetland.delineation@dsl.oregon.gov.
- ❖ **50MB or larger** - A single unlocked PDF can be uploaded to [DSL's Box.com](#) website. After upload notify DSL by email at: wetland.delineation@dsl.oregon.gov.
- ❖ **OR** a hard copy of the unbound report and signed cover form can be mailed to: Oregon Department of State Lands, 775 Summer Street NE, Suite 100, Salem, OR 97301-1279.

Ways to pay review fee:

- ❖ By credit card on [DSL's epayment portal](#) after receiving the unique file number from DSL's emailed confirmation.
- ❖ By check payable to the Oregon Department of State Lands attached to the unbound mailed hardcopy **OR** attached to the complete signed cover form if report submitted electronically.

| Contact and Authorization Information | |
|--|---|
| <input type="checkbox"/> Applicant <input type="checkbox"/> Owner Name, Firm and Address: | Business phone # Mobile phone # (optional) E-mail: |
| <input type="checkbox"/> Authorized Legal Agent, Name and Address (if different): | Business phone # Mobile phone # (optional) E-mail: |
| I either own the property described below or I have legal authority to allow access to the property. I authorize the Department to access the property for the purpose of confirming the information in the report, after prior notification to the primary contact. | |
| Typed/Printed Name: _____ Signature: _____ Date: _____ Special instructions regarding site access: _____ | |
| Project and Site Information | |
| Project Name: | Latitude: _____ Longitude: _____ decimal degree - centroid of site or start & end points of linear project |
| Proposed Use: | Tax Map # _____ Tax Lot(s) _____ ----- Tax Map # _____ Tax Lot(s) _____ |
| Project Street Address (or other descriptive location): | Township _____ Range _____ Section _____ QQ _____ Use separate sheet for additional tax and location information |
| City: _____ County: _____ | Waterway: _____ River Mile: _____ |
| Wetland Delineation Information | |
| Wetland Consultant Name, Firm and Address: | Phone # _____ Mobile phone # (if applicable) _____ E-mail: _____ |
| The information and conclusions on this form and in the attached report are true and correct to the best of my knowledge. | |
| Consultant Signature: _____ | Date: _____ |
| Primary Contact for report review and site access is <input type="checkbox"/> Consultant <input type="checkbox"/> Applicant/Owner <input type="checkbox"/> Authorized Agent | |
| Wetland/Waters Present? <input type="checkbox"/> Yes <input type="checkbox"/> No | Study Area size: _____ Total Wetland Acreage: _____ |
| Check Applicable Boxes Below | |
| <input type="checkbox"/> R-F permit application submitted | <input type="checkbox"/> Fee payment submitted \$ _____ |
| <input type="checkbox"/> Mitigation bank site | <input type="checkbox"/> Resubmittal of rejected report (\$100) |
| <input type="checkbox"/> EFSC/ODOE Proj. Mgr: | <input type="checkbox"/> Request for Reissuance. See eligibility criteria. (no fee) |
| <input type="checkbox"/> Wetland restoration/enhancement project (not mitigation) | DSL # _____ Expiration date _____ |
| <input type="checkbox"/> Previous delineation/application on parcel If known, previous DSL # _____ | <input type="checkbox"/> LWI shows wetlands or waters on parcel Wetland ID code _____ |
| For Office Use Only | |
| DSL Reviewer: _____ | Fee Paid Date: _____ / _____ / _____ |
| Date Delineation Received: ____ / ____ / ____ | DSL WD # _____ |
| | DSL App.# _____ |

Wetland Determination for the Winema Beach Cable Landing in Cloverdale Oregon

Prepared for: Wave Astound

Prepared By: Northwest Watershed Solutions LLC

Date: February 4, 2023

Project summary

The Wave Astound Company from Bothell Washington is proposing to construct an ocean cable landing facility at Winema Beach near Cloverdale, Oregon. This wetland determination report examines the site of proposed cable landing project near the fore dune close to the Pacific Ocean. This project is a handheld vault with ground rods. The area of potential impact at this site is 183.7 feet by 62.3 feet. The conduit package will be installed by boring. This purpose of this report is to determine if wetlands are present at the site.

Description of Study Area and Landscape Setting

The proposed cable beach landing site is located just east of the fore dune of the Pacific Ocean. To the west of the site are buildings and a gravel roadway. North of the site are some small dunes covered with various grasses and small trees. To the south of the project area is a small berm and the beach access road. The land east of the study site is a series of hills that slope to the study site. The church buildings and the roadway are at the toe of the hillslope and are buffers to the study area. The study area is nearly level except for the southern boundary that has a very slight slope to the beach access road berm.

Current and Past Land Use

The study site appears to be currently used by the adjacent church camp as an overflow parking area and a recreational area. The site is routinely mowed. The site might have been periodically used by campers.

Site Alterations

This particular site appears to have been leveled many years ago and some crushed road rock has been placed to provide a better surface for parking in a small portion of the study area.

Methods for the Wetland Determination

Wetland determination of the project area was conducted on June 6, 2022. The entire area was traversed on foot and a visual assessment of hydrophytic vegetation, unusual topographic features, and wetland hydrology indicators was conducted by Northwest Watershed Solutions LLC professionals. Sample plots were dug to a depth of at least 18 inches. Absolute aerial cover was reported for tree, shrub, and herb layers utilizing 30, 15, and 5 foot radius plots respectively. This was a three-step system to delineate wetland areas in accordance with federal, state and local guidance and regulations. This three-step approach is detailed in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (USACE, 2010). In this process, data is collected using USACE methodology on hydrology, vegetation and soils of upland and wetland plots. This data is recorded for both wetland and upland plots and recorded

on U.S. Army Corps of Engineers Wetland Determination Data Forms. Data forms, photographs and maps are provided for reference in the appendix.

Two field investigators review every observation and concur on the documentation of plants, hydrology, and soil characteristics.

Deviations from LWI or NWI

Potential wetlands and water resources were identified prior to the field determination by reviewing the following resources:

- 1). US Fish and Wildlife Service (USFWS), National Wetland Inventory (NWI) data (USFWS2016; figures 1a – 1f, Appendix A)
- 2). Local Wetlands inventory (LWI) for Tillamook County
- 3). Natural resource Conservation Service GIS Soils Data (NCRS 2016)
- 4) This determination report was completed in accordance with implementation regulation for Section 404 of the Federal Clean Water Act and the Oregon Removal-Fill Law.

The above resources indicated that there were no wetlands documented in the study area. Wetlands were identified in the area around the southern border of Winema Lake. The wetlands that were identified on the southern boundary of the lake are “Freshwater Forest/ Shrub Wetland.” Soil maps indicated that there were no documented hydric soils in the study area as well.

Field Determination

Northwest Watershed Solutions LLC wetland professionals performed the field determination on June 7, 2022. The methodology used for determining the presence of wetlands was strictly adhered to using the *Corps of Engineer Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coastal Region Version 2.0* (Regional Supplement) (USACE 2010). The National Wetland Plant list 2014 (Lichvar et al. 2016) was used to assign wetland indicator statuses for plants, and the NCRS *Guide for Identifying and Delineating Hydric Soils Version 7.0* (Vasilas et al. 2010) Appendix was used to verify hydric soil indicators in the field. All soil colors referenced Appendix C are based on the Munsell color system (Munsell 2019)

After an extensive examination of the study site, no primary or secondary indicators of hydrology were observed. Several test pits were dug to determine if subsurface hydrology indicators were present in the form of a high water table or saturation. Geomorphic position was considered and determined not to be an indicator.

After an extensive survey of the study area, the only suspected wetland area was near the southern boundary of the study area. Hooker’s willow (*Salix hookeriana*) was documented at this location. Since this species is identified as being FACW, this area was suspected as a wetland. Sample point 4

was selected near the willows. The vegetation analysis documented that this area did not contain hydrophytic vegetation. Vegetation at this site failed the Fact Neutral Test, Dominance Test, and Prevalence test. Subsequently, the area was determined not to have hydrophytic vegetation.

At sample plot 4, the soil sample pit revealed that the soils were not hydric and there were no indicators of hydrology. The soils exhibited no redox, depleted matrix, or gleyed matrix. A second sample point (sample point 5) for this study area was selected approximately 10 feet south of sample point 4. This sample point was in close proximity to a sand berm that was adjacent to the beach access road and may have been the lowest elevation of the study area. The soil sampling at this location did not document hydric soils or hydrology. No hydric soil indicators were observed in any soil pits dug at this study site.

Photo points C and E depict the study area. Photo point C was taken from the southern boundary of the API looking north. Photo point E was taken from the northern API looking south. Photo point D was not used.

Our conclusion for the Winema Beach cable landing site is that this area does not contain wetlands. Most of the area at this study site was routinely mowed, however it is our opinion that this activity did not confound our abilities to identify hydrophytic vegetation at this site.

Results and Conclusion

On June 6, 2022 an extensive field survey was conducted on the entire study area at the Winema Beach Cable Landing Site. Strict adherence to the standard sampling protocols was used based on the methodology outlined in the Corps of Engineers Wetland Delineation Manual. The three criteria for ascertaining whether wetlands are present at the site were based on hydrology, vegetation, and soil studies. After our investigation of the area proposed to be impacted by the cable landing and associated structures, no wetlands were identified.

Disclaimer OAR 141 -090-0035(12)(J)(I)

This report documents the investigation, best professional judgement, and conclusions of the investigators. It is correct and complete to the best of Northwest Watershed Solutions LLC knowledge. It should be considered a preliminary jurisdictional determination of wetlands and other waters and used at the readers own risk until it has been reviewed and approved in writing by DSL in accordance with OARs 141-090-0005 through 141-090-0055 and by the USACE, Portland District.

Jurisdictional determinations, including the applicability of exemptions, are made on a case-by case basis by the DSL and USACE . Those agencies are the authority in these determinations.

APPENDIX A

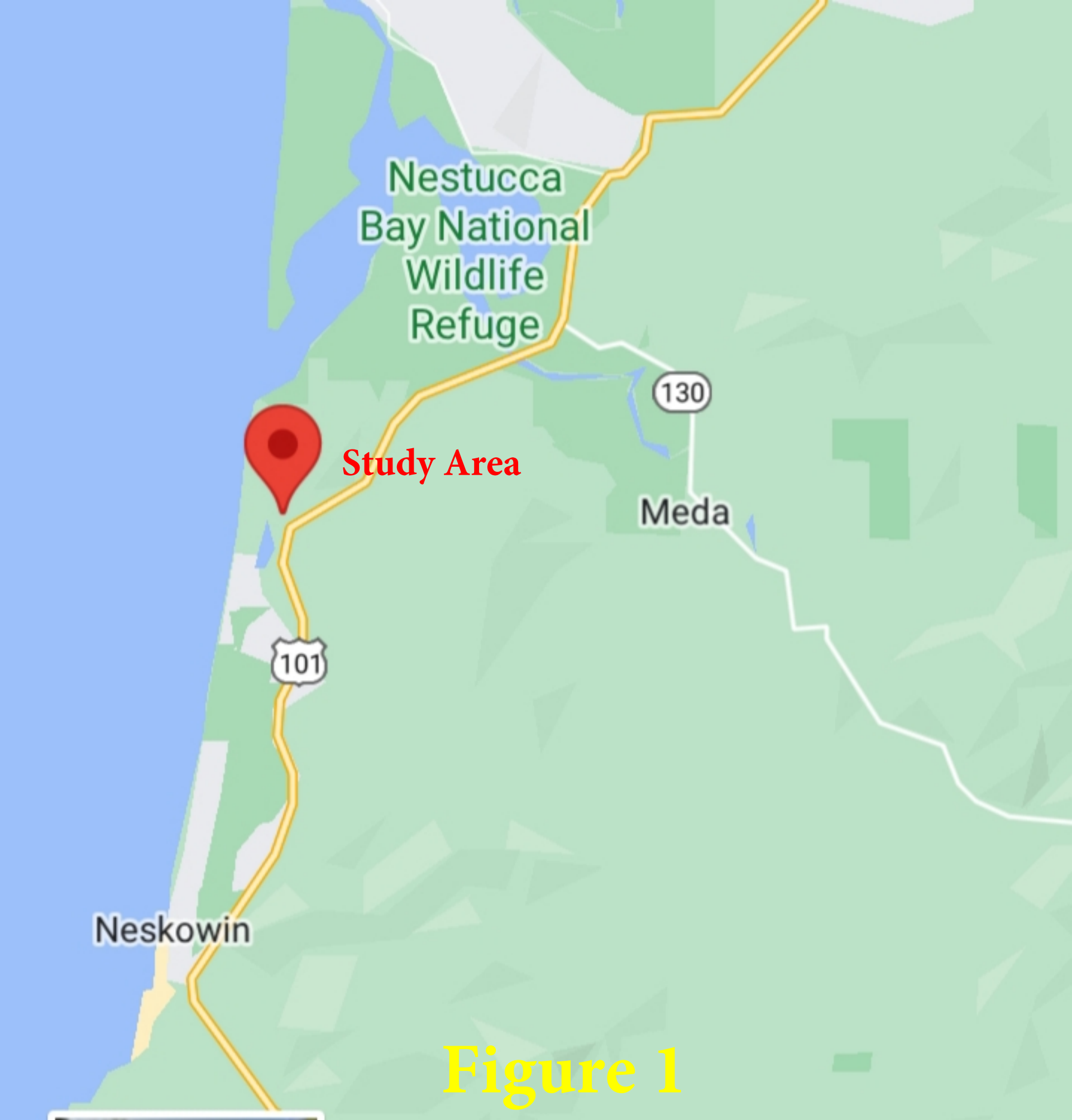
Figure 1 - Location Map

Figure 2 - Tax Lot Map

Figure 3 – Recent aerial photo

Figure 4 - Wetland determination map

Figure 5 – Ground level photos



Nestucca
Bay National
Wildlife
Refuge

Study Area

130

Meda

101

Neskowin

Figure 1

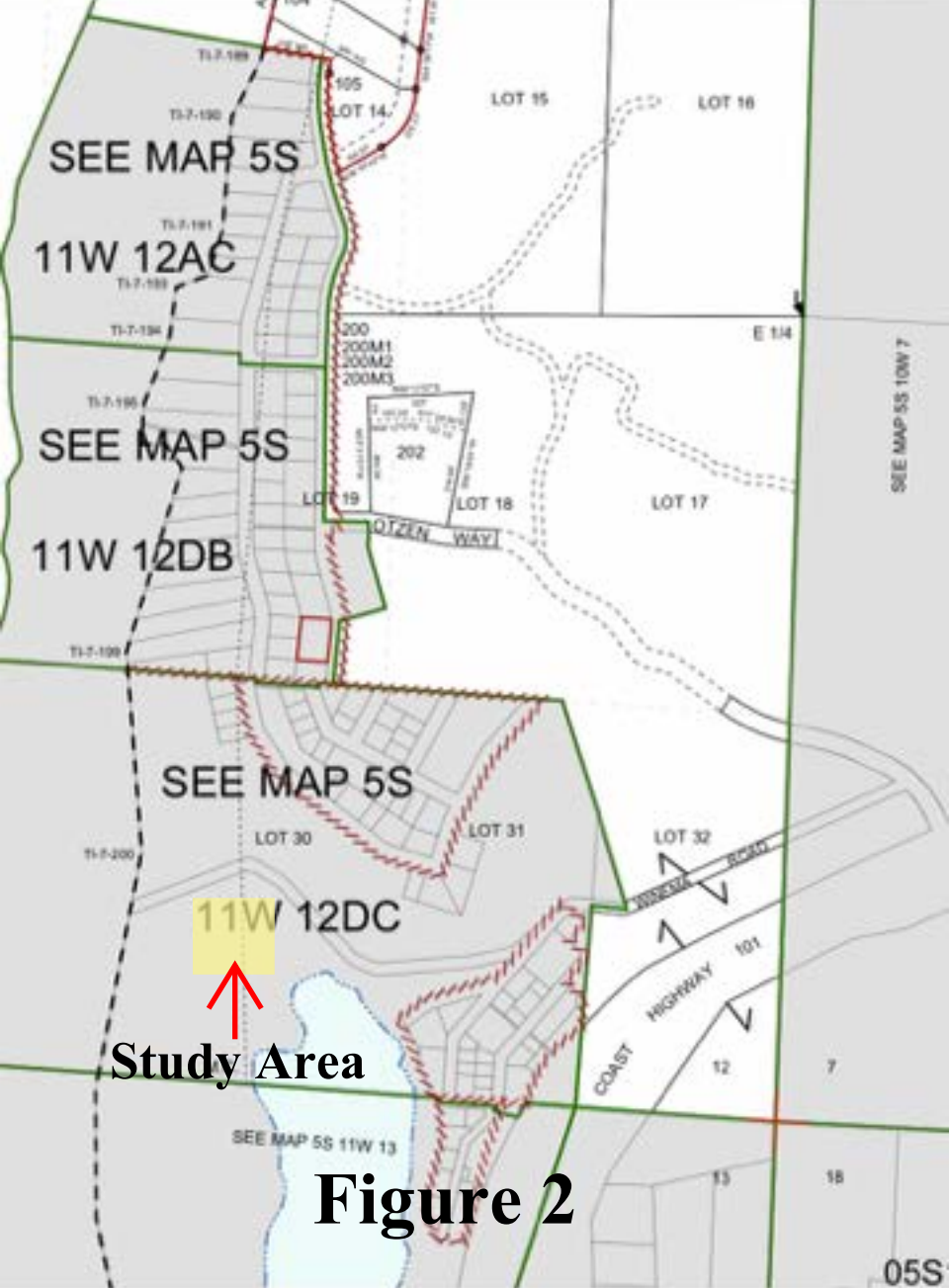


Figure 2



Photo Point D

Sample Point 4

Sample Point 5

Photo Point C

WINEMA R

Figure 3 & 4



Figure # 5 c - Photo Point C (Facing North)



Figure #5 d - Photo Point E (Facing South)

APPENDIX B: Citations

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Web Soil Survey (2019, July 31) *USDA. Natural Resources Conservation Service*. Retrieved March 9, 2021. <https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

Vepraskas, M. J., Craft, C.B. (2016). *Wetland Soils 2nd Edition*. Boca Raton, FL: Taylor & Francis Group.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Winema Landing City/County: Tillamook Sampling Date: 6/07/22
 Applicant/Owner: Wave State: OR Sampling Point: 4
 Investigator(s): Northwest Watershed Solutions LLC Section, Township, Range: Sect 7 T5S R 10 W
 Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Flat Slope (%): 0
 Subregion (LRR): A2 Lat: 45deg 08' 48"N Long: -123deg 58' 23"W Datum: N/A
 Soil Map Unit Name: Waldport fine sand, thin surface 3-12 percent slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | |
|---|--|
| Hydrophytic Vegetation Present? Yes _____ No <u>X</u> Hydric Soil Present? Yes _____ No <u>X</u> Wetland Hydrology Present? Yes _____ No <u>X</u> | Is the Sampled Area within a Wetland? Yes _____ No <u>X</u> |
| Remarks: <p align="center">Above average rainfall</p> | |

VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: <u>30</u>) | Absolute % Cover | Dominant Species? | Indicator Status | |
|---|------------------|-------------------|------------------|--|
| 1. <u>Salix hookeriana</u> | <u>30</u> | <u>X</u> | <u>FACW</u> | Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B) |
| 2. _____ | _____ | _____ | _____ | |
| 3. _____ | _____ | _____ | _____ | |
| 4. _____ | _____ | _____ | _____ | |
| <u>30</u> = Total Cover | | | | |
| Sapling/Shrub Stratum (Plot size: <u>15</u>) | | | | Prevalence Index worksheet: Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species <u>1</u> x 2 = <u>2</u> FAC species _____ x 3 = _____ FACU species <u>3</u> x 4 = <u>12</u> UPL species _____ x 5 = _____ Column Totals: <u>4</u> (A) <u>14</u> (B) Prevalence Index = B/A = <u>3.5</u> |
| 1. _____ | _____ | _____ | _____ | |
| 2. _____ | _____ | _____ | _____ | |
| 3. _____ | _____ | _____ | _____ | |
| 4. _____ | _____ | _____ | _____ | |
| _____ = Total Cover | | | | |
| Herb Stratum (Plot size: <u>5</u>) | | | | Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ 5 - Wetland Non-Vascular Plants ¹ ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic. |
| 1. <u>Gaultheria shallon</u> | <u>20</u> | <u>X</u> | <u>FACU</u> | |
| 2. <u>Fragaria chiloensis</u> | <u>5</u> | _____ | <u>FACU</u> | |
| 3. _____ | _____ | _____ | _____ | |
| 4. _____ | _____ | _____ | _____ | |
| 5. _____ | _____ | _____ | _____ | |
| 6. _____ | _____ | _____ | _____ | |
| 7. _____ | _____ | _____ | _____ | |
| 8. _____ | _____ | _____ | _____ | |
| 9. _____ | _____ | _____ | _____ | |
| 10. _____ | _____ | _____ | _____ | |
| <u>25</u> = Total Cover | | | | |
| Woody Vine Stratum (Plot size: <u>5</u>) | | | | Hydrophytic Vegetation Present? Yes _____ No <u>X</u> |
| 1. <u>Rubus ursinus</u> | <u>5</u> | _____ | <u>FACU</u> | |
| 2. _____ | _____ | _____ | _____ | |
| <u>60</u> = Total Cover | | | | |
| % Bare Ground in Herb Stratum <u>10</u> | | | | |
| Remarks: <p align="center">Unknown grass in herb stratum</p> | | | | |

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Winema Landing City/County: Tillamook Sampling Date: 6/07/22
 Applicant/Owner: Wave State: OR Sampling Point: 5
 Investigator(s): Northwest Watershed Solutions LLC Section, Township, Range: Sect 7 T5S R 10 W
 Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Flat Slope (%): 0
 Subregion (LRR): A2 Lat: 45deg 08' 48"N Long: -123deg 58' 24"W Datum: N/A
 Soil Map Unit Name: Waldport fine sand, thin surface 3-12 percent slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | |
|---|--|
| Hydrophytic Vegetation Present? Yes _____ No <u>X</u> Hydric Soil Present? Yes _____ No <u>X</u> Wetland Hydrology Present? Yes _____ No <u>X</u> | Is the Sampled Area within a Wetland? Yes _____ No <u>X</u> |
| Remarks: <u>Above average rainfall</u> | |

VEGETATION – Use scientific names of plants.

| <u>Tree Stratum</u> (Plot size: <u>30</u>) | Absolute % Cover | Dominant Species? | Indicator Status | Dominance Test worksheet: |
|--|------------------|-------------------|------------------|---|
| 1. <u>Salix hookeriana</u> | <u>60</u> | <u>X</u> | <u>FACW</u> | Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) |
| 2. _____ | | | | Total Number of Dominant Species Across All Strata: <u>2</u> (B) |
| 3. _____ | | | | Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B) |
| 4. _____ | | | | |
| | <u>60</u> | = Total Cover | | |
| <u>Sapling/Shrub Stratum</u> (Plot size: <u>15</u>) | | | | Prevalence Index worksheet: |
| 1. _____ | | | | Total % Cover of: _____ Multiply by: _____ |
| 2. _____ | | | | OBL species _____ x 1 = _____ |
| 3. _____ | | | | FACW species <u>1</u> x 2 = <u>2</u> |
| 4. _____ | | | | FAC species _____ x 3 = _____ |
| 5. _____ | | | | FACU species <u>2</u> x 4 = <u>8</u> |
| | | | | UPL species <u>3</u> x 5 = <u>10</u> |
| | | | | Column Totals: _____ (A) _____ (B) |
| | | | | Prevalence Index = B/A = <u>3.3</u> |
| <u>Herb Stratum</u> (Plot size: <u>5</u>) | | | | Hydrophytic Vegetation Indicators: |
| 1. <u>Gaultheria shallon</u> | <u>20</u> | <u>X</u> | <u>FACU</u> | <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation |
| 2. <u>Fragaria chiloensis</u> | <u>5</u> | | <u>FACU</u> | <input type="checkbox"/> 2 - Dominance Test is >50% |
| 3. _____ | | | | <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ |
| 4. _____ | | | | <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) |
| 5. _____ | | | | <input type="checkbox"/> 5 - Wetland Non-Vascular Plants ¹ |
| 6. _____ | | | | <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) |
| 7. _____ | | | | ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic. |
| 8. _____ | | | | |
| 9. _____ | | | | |
| 10. _____ | | | | |
| 11. _____ | | | | |
| | <u>25</u> | = Total Cover | | |
| <u>Woody Vine Stratum</u> (Plot size: _____) | | | | |
| 1. _____ | | | | |
| 2. _____ | | | | |
| | <u>85</u> | = Total Cover | | |
| % Bare Ground in Herb Stratum <u>10</u> | | | | |
| Remarks: <u>Some unknown grass in the plot</u> | | | | Hydrophytic Vegetation Present? Yes _____ No <u>X</u> |

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

| Depth (inches) | Matrix | | Redox Features | | | | Texture | Remarks |
|-------------------|---------------|-----|----------------|---|-------------------|------------------|---------|---------|
| | Color (moist) | % | Color (moist) | % | Type ¹ | Loc ² | | |
| 0-5 | 10YR 3/2 | 100 | | | | | SL | |
| 5-10 | 10YR 5/2 | 100 | | | | | SL | |
| 10-20 | 7.5 YR 4/2 | 100 | | | | | SL | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____
Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

No Hydric soil indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____
 Water Table Present? Yes _____ No X Depth (inches): _____
 Saturation Present? Yes _____ No X Depth (inches): _____
 (includes capillary fringe)

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators presents

Appendix 6
Inadvertent Return Contingency Plan
Drill Break Avoidance and Response Plan
Beach Void Monitoring and Response Plan

BIFROST CABLE

Inadvertent Return Contingency Plan For Horizontal Directional Drilling

Prepared for
Bifrost Subsea Fiber Optic Cable Project
Winema, Oregon Operations

February 10, 2023

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1. Introduction

This Inadvertent Return Contingency Plan has been developed for the Bifrost Subsea Fiber Optic Cable Project (Project) in Winema, Oregon. The primary construction component of the project is the installation of a single steel landing pipe (LP) that will extend from on shore to a specified point in the ocean. This LP will be installed by use of horizontal directional drill (HDD) construction methods. Further detailed descriptions on this process and the LP are included below.

RTI Solutions, Inc. (RTI-S) has adapted and modified this plan based on the plan previously developed by AMCS LLC That plan was previously submitted and approved for use in a previous similar project. This plan is submitted in compliance with applicable environmental regulations, rules, and policies for federal and state authorities, including but not limited to the U.S. Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), Oregon Parks and Recreation Department (OPRD), and the Oregon Department of State Lands (DSL).

Pursuant to the OPRD Beach Construction/Alteration Standards (Chapter 736, Division 20), Rules 736-020-0005 (Factors Evaluated), 736-020-0010 (General Standards), 736-020-0015 (Scenic Standards), 736-020-0020 (Recreational Use Standards), 736-020-0025 (Safety Standards), and 736-020-0030 (Natural and Cultural Resource Standards), the inadvertent return contingency plan, beach void monitoring and response plan, and drill break avoidance and response plan are collectively intended to meet OPRD's standards for avoiding and minimizing potential impacts to the following public and natural resources: Physical Environment; Aesthetics; Public Access; Public Recreation; Public Safety; and Water Quality. Based on field surveys and publicly available literature, implementation of the Project would result in no impacts to the following additional resources under the purview of OPRD, pursuant to 736-020-0015 (Scenic Standards) and 736-020-0030 (Natural and Cultural Resource Standards): Key Natural Features; Shoreline Vegetation; Fish and Wildlife Resources; Historic, Cultural, and Archeological Sites; Navigation; and Areas of Geologic Interest.

Horizontal Directional Drill (HDD) operations, also known as directional bores, have the potential to release drilling fluids, a mixture of fine clay and water described later, to the ground surface or onto the ocean floor. The release is known as an inadvertent return (IR). An IR can occur where the drill bit is particularly close to the ground surface or where the drilling mud migrates to the surface through a fracture or fisher in the ground. Because drilling muds consist largely of a bentonite clay-water mixture (approximately 92% water 7% bentonite clay and 1% nontoxic additives), they are not classified as toxic or hazardous substances. However, if it is released into low flow aquatic environments in large quantities, the mud has the potential to settle onto the bottom and, acting as a silt, adversely impact fish and invertebrate species.

While drilling mud seepage associated with an IR is most likely to occur near the bore entry and exit points where the drill head is shallow, IRs can occur in any location along a directional bore path. This Inadvertent Return Contingency Plan (IRCP) establishes operational procedures and responsibilities for the prevention, containment, and clean-up of IRs associated with the proposed directional drilling utility project. All onsite personnel, including subcontractors, responsible for the work must adhere to this plan during the directional drilling process.

The specific objectives of this IRCP are to:

1. Minimize the potential for an IR associated with directional drilling activities.
2. Provide for the timely detection of IRs.
3. Protect the environmentally sensitive habitats that may occur in the vicinity of the work.
4. Provide for an organized, timely, and "minimum-impact" response in the event of an IR.
5. Provide for all appropriate notifications are made immediately to the management and safety personnel, as well as the applicable regulatory agencies.

2. Site Conditions

The possibility of having an IR is heavily influenced by the specific characteristics of each site. For this Project, there are a number of site characteristics that are advantageous to the drilling process and will help reduce the probability of an IR, lessen the potential severity of an IR and increase the ability to respond to an IR. Some of these site characteristics include:

1. There are no sensitive habitats, such as streams or wetlands in proximity to the site. Therefore, there is no potential for an IR to reach a stream, wetland or other sensitive aquatic habitat.
2. The Site elevation of twenty feet (20') is close to sea level. This is important in that it will reduce the residual head pressure in the bore pipe once the HDD pump is shut down. Should an IR be identified, shutting down the drill operation is the first step. A bore site that is substantially above sea level would have a higher volume of drilling mud in the pipe remaining above sea level. Gravity could allow this mud to flow down the pipe thereby increasing the volume of the IR. With a bore site elevation of twenty feet, potential for additional mud to escape once the pumps are shut down is minimal.
3. The bore site is located a sufficient distance from the ocean (~500 feet) and set back quite a distance from the beach (~200 feet). This will allow the bore pipe to achieve a depth of approximately thirty-five feet (35') as it begins to pass under the beach and approximately eighty feet (80') as it reaches the ocean edge. The deeper the bore the less likely an IR is.
4. The initial stages of the bore will be under the dune area. The presence of the dunes increases the overburden over the drill head thereby reducing the possibility of an IR.
5. The bore site is surrounded by higher ground.

3. Responsibilities

The Site Supervisor has overall responsibility for implementing this IRCP. The Site Supervisor will ensure that all employees are trained prior to the commencement of the HDD installation. The Site Supervisor shall be notified immediately when an IR is detected. The Site Supervisor will be responsible for ensuring that the safety department is aware of the IR, coordinating personnel, response, cleanup, regulatory agency notification and coordination to ensure proper clean-up, disposal of recovered material, and timely reporting of the incident. The Site Supervisor shall also ensure all waste materials are properly containerized, labeled, and removed from the site to an approved disposal facility by personnel experienced in the removal, transport, and disposal of drilling mud.

The Site Supervisor shall be familiar with all aspects of the drilling activity, the contents of this IRCP and the conditions of approval under which the activity is permitted to take place. The Site Supervisor shall have the authority to stop work and commit the resources (personnel and equipment) necessary to implement this plan. The Site Supervisor shall assure that a copy of this plan is available (onsite) and accessible to all construction personnel during all HDD construction. The Site Supervisor shall ensure that all workers are properly trained and familiar with the necessary procedures for response to an IR, prior to commencement of drilling operations.

The Site Supervisor shall ensure that:

- All equipment and vehicles are be checked and maintained daily to prevent leaks of hazardous materials.
- Spill kits and spill containment materials are always available on-site and that the equipment is in good working order.
- Equipment required to contain and clean up an IR will either be available at the work site or readily available at an offsite location within 15 minutes of the bore site.
- If equipment is required to be operated near an identified sensitive aquatic habitat, absorbent pads, and plastic sheeting for placement beneath motorized equipment shall be used to protect the riverbed from engine fluids.

Prior to the start of construction, the Site Supervisor shall ensure that the crew members receive training in the following:

- The provisions of the IRCP, equipment maintenance, and site-specific permit and monitoring requirements.
- Inspection procedures for release prevention and containment equipment and materials.
- Contractor/crew obligation to immediately stop the drilling operation upon first evidence of the occurrence of an IR and to immediately report any releases.
- Contractor/crew member responsibilities in the event of a release.
- Operation of release prevention and control equipment and the location of release control materials, as necessary and appropriate.
- Protocols for communication with agency representatives who might be on-site during the clean-up effort.
- As part of the Site Supervisors daily safety meeting, they will ensure the workers understand the appropriate procedures to be followed in case of an IR

4. HDD Design and Operations

4.1 HDD Design Elements

The Project has been designed to minimize the potential of an IR. Figure 1 below shows the general site design.

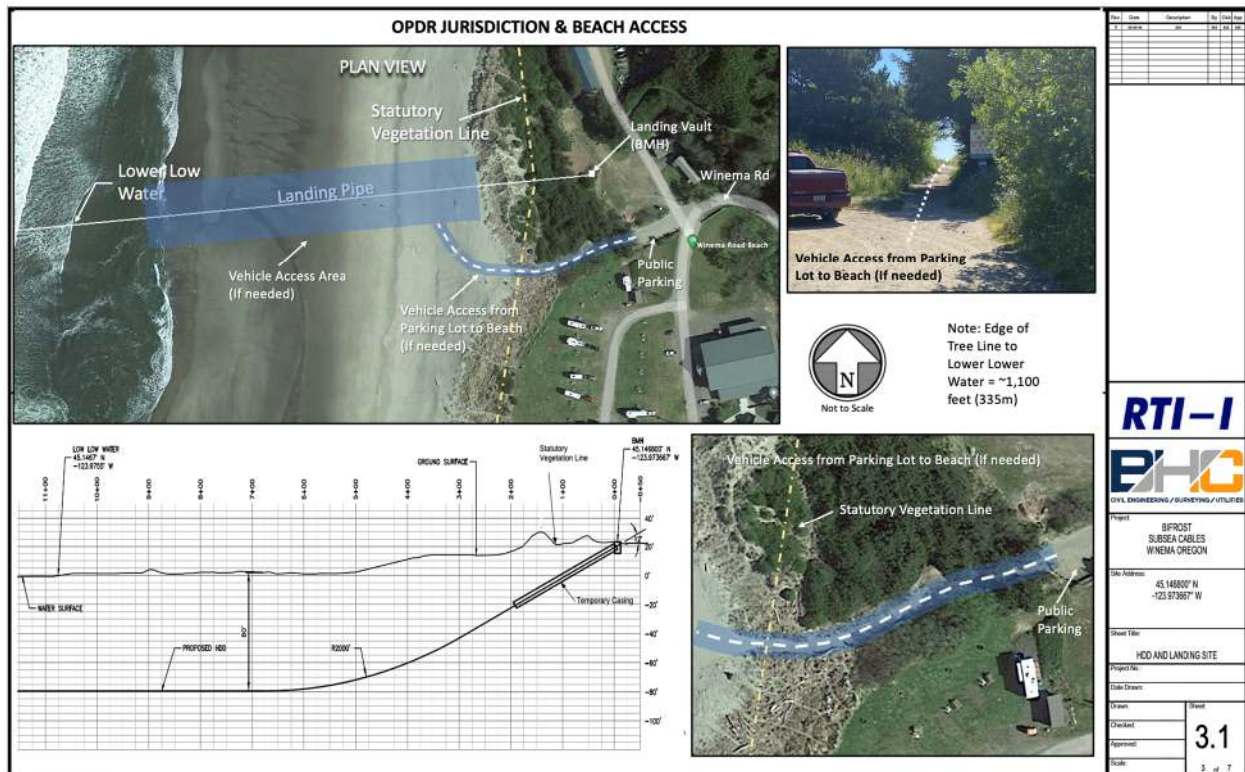


Figure 1: General Site Design

Some of the design elements that have been incorporated include:

- Geotechnical Analysis and Guidance. The Geotechnical Report prepared for the project identifies the subsurface soil characteristics to be expected along the drill path and makes recommendations to help inform the HDD contractor relative to mud mixture and formation penetration rates.
- Temporary Surface Casing. A temporary casing approximately 17 to 20-inches in diameter will be installed for approximately the first 200 linear feet of the HDD at which point the casing will be approximately 20 feet deep. It will enter cross the Statutory Vegetation Line approximately 110 feet westerly of the entry point and

will be at a depth of approximately 20 feet. The temporary casing will terminate just westerly of the dunes at which point it will be 35 feet deep. The purpose of this casing is to ensure the integrity of the bore hole as the remainder of the bore operation is completed. The casing will ensure the bore hole does not collapse during the drilling process. Further it protects from scour that would increase the diameter of the bore hole. As the drill head reaches deeper depths (beyond about 20' deep) the subsurface materials are denser and well packed and there is limited risk of collapse.

- HDD Entry Angle. The entry angle of the bore pipe will be approximately 12 degrees from horizontal. This angle is steep enough to allow the bore head to gain depth quickly, thereby reducing the potential of an IR, and horizontal enough to allow for a larger bend radius on the bore pipe.
- Large Bend Radius. The bend radius used for the bore pipe is 2,000 feet. This very large radius will allow for minimum pressure to be exerted on the bore pipe when leveling it off at the desired elevation and as it is guided to its design end point.

4.2 The HDD Bore Machine

The HDD bore machine, also known as the HDD rig, will be placed in position and prepared for bore pipe installation. The individual segments of bore pipe will be placed on the HDD rig by either a small crane, forklift or excavator stationed next to the drill rig.



Figure 2: Example of an HDD Rig, Bore Pipes and Forklift

4.3 Fluid Mixing & Recycling Unit

A mixing & recycling unit will be used to mix the drilling mud, remove the drill cuttings for disposal and recycle the drilling mud for reuse in the drilling process. The drilling mud is made up of a natural clay called bentonite and water which are mixed in the large tank for use in the drilling process. The mud is mixed at a ratio of approximately 95% water and 7% bentonite clay and up to 1% of non-toxic additives. The drilling mud is pumped down the drill pipe to turn the cutting head as it penetrates the formation. The drilling mud exits the cutting head, which is larger than the bore pipe, and returns to the bore site in the annular space between the sides of the bore hole and the bore pipe. In the process the drilling mud suspends and carries the cuttings from the drilling process (sand, rock, soil, clay) back to

the bore site for disposal. In the process, the drilling mud coats the bore hole helping keep it from collapsing, seals it and serves to lubricate the hole allowing the bore pipe to slide along the hole more easily. As the drilling mud and cuttings are returned to the bore site they are pumped back to the mixing/recycling unit where the cuttings are separated from the drilling fluid. The cuttings are stockpiled for removal to an approved landfill and the drilling fluid reused as the bore process continues. This recycling process will minimize the use of freshwater for the mixing and reduce the risk of drilling fluid leak in the surrounding area.

The recycling unit chosen for these operations typically has a 280 m³ / hour clean mud recycling capacity and utilizes three stages of recycling: a preliminary shaker, a de-sander, and a de-silter. The de-silter employs two sets of meshes and hydro cyclones to clean the fluid from solids up to 20 µm. An example of this unit is illustrated in 3.



Figure 3: Example of a Drilling Fluid Mixing & Recycling Unit

4.4 On-site Response Equipment

Certain equipment will be on site and available for immediate deployment to contain and remove an IR should one occur. Some of this equipment is included in standard HDD operations and some are specific to particular response. On-site or staged within a 10-minute drive from the site will be:

- Pumps and hoses to pump drilling mud back to the bore site from a near-by IR.
- Sandbags or straw bales and coir waddles to use to surround and contain an IR.
- Vacuum trailer or truck to respond to IR's that lie beyond the length of available hoses
- Spill Kit for potential machinery leaks or spills. Though not part of an IR, it is worth noting that a standard hazardous materials spill kit will be on site to respond to potential spills from hydraulic leaks, fuels or other materials used in the equipment.

4.5 Drilling Mud

4.5.1 Drilling Mud Mixing and Preparation

The mud to be used typically consists of approximately 92% water, 7% bentonite clay and less than 1% other non-toxic additives. The drilling mud is prepared by mixing the water, bentonite clay and additives in the mixing unit. The dust that would be produced when pouring the bentonite in the mixing unit poses an inhalation hazard for the worker that does the mixing. Appropriate Personal Protection Equipment, including dust masks and eye protection, will be worn by personnel near the mixing process.

There are various components that may be added to the drilling mud that enhance borehole stabilization, fluid carrying capacity, and water characteristics. A polymer additive would be available on-site to be employed in the drilling fluid in negligible concentration (0.5 kg per m³ of drilling fluid) as (and only if) required to enhance the bore hole stability by strengthening the filter-cake being formed on the bore walls during the drilling operation. Filter-cake refers to the layers (caking) of the drilling mud that form on the bore hole walls as the drilling mud penetrates the formation as is circulated throughout the bore hole. This caking affect serves to help hold the hole open and provide a more lubricated surface for the bore pipe and the returning drilling mud and cuttings.

All components are biodegradable and non-toxic/environmentally friendly. MSDS of the drilling fluid powder and the polymer additive are included in Appendices A-C of this plan.

The drilling mud to be used for each day's work will be prepared in the beginning of the day with adequate time provided for thorough mixing and adjustment of the mud's properties according to the previous day's findings and the manufacturer's specification. Typically, approximately 30 minutes is needed for proper hydration of the mud components and homogenization of the mix.

4.5.2 Rheological Adjustments

Assigned personnel will monitor the return fluids from the borehole to determine percentage of hole cleaning and drilling mud carrying capacities. Modifications in the drilling mud composition or rheological characteristics may be required as the drill passes through different substrates to ensure proper borehole stabilization and filter-cake formation and returns.

4.5.3 Cuttings Removal

As the drilling mud and cuttings return to the bore entry pit, they are pumped directly to the mixer for recycling. Solids can be optically assessed with accuracy after the fluid turbidity clears and the volume of fluids can be calculated so that comparisons can take place between the calculated volume accruing from the borehole length / drilled cross-sectional area, and the actual recycled quantity. The cuttings that cannot be recycled further are spoils and will be transported off-site by a vacuum truck and disposed of at an approved facility.

4.5.4 Drilling Mud Containment

The drilling mud does not constitute harmful substance to the environment and the surrounding area as bentonite is a naturally occurred substance whilst all the additives employed for saltwater tolerance are biodegradable. However, the employment of the recycling unit will ensure that the drilling mud be of a minimum amount and, therefore, the risk of non-containment is minimized.

Additionally, the last 30 to 40 meters of the pilot bore will be bored using fresh water being fed in the bore, flushing out the drilling fluid so that there will be minimal mud escaping the bore at the punch out position. The exact length of flushing shall be decided on site, depending on the drilling findings and the actual drilled material at the end of the pilot bore. Having assessed the above, a calculation of the drilling rate combined with the drilling fluid volume in the pipeline will be made to start pumping water in the system to displace the entire amount of mud from the drill-string by the time that punch out occurs.

5. Inadvertent Return Contingency Plan

5.1 Bore Status Monitoring and Site Preparation

Prevention of IRs begins at the bore site and with the bore machinery and site preparation. During the bore process, the drilling operator will closely monitor the drilling fluid volumes and pressures, the bore thrust force, the volume of fluids returning to the site (returns) and other variables. The drill operator will balance these variables to achieve the most efficient formation penetration rate. Pressure levels will be set at a minimum level necessary to advance the bore while reducing the probability of IRs most efficiently. During the bore process, the drilling operator will work to

keep the annular space between the bore pipe and the drill hole open to allow for the drilling fluids to return to the bore site for reuse. However, this is not always possible given the bore conditions and lengths of the bore.

A pit at the bore entry point is excavated to collect the drilling mud and cuttings as they return to the drill site. A pump is placed in the bore entry pit to pump the returns to the recycling unit. Typically, sandbags are used around the top edge of the pit to provide additional containment. The vacuum trailer and portable suction pumps will be on-site during all drilling operations. Containment materials (e.g., straw, silt fencing, sandbags, spill kits) will be staged on-site, readily available, and easily mobilized for immediate use in the event of an accidental release of drilling mud.

Water containing mud, silt, bentonite, or other pollutants from equipment washing or other activities will not be allowed to enter the water (sea). The bentonite used in the drilling process will be either disposed of at an approved disposal facility or recycled in an appropriate manner. Other construction materials and wastes shall be recycled or disposed of, as appropriate.

5.2 Inadvertent Return Detection

An IR appears as a visible pooling of drilling mud on the ground surface or discoloration of the water in the ocean. Drilling indicators that can act as an early warning that an IR may be imminent are, sudden decrease in mud volume returns during drilling operations, or loss in drilling mud pump pressure. While these indicators are not uncommon and usually don't lead to an IR, they are indicators that the Site Supervisor and on-site representatives need to remain vigilant in their visual inspections along the drill path on land and in the ocean. Drilling personnel will observe the volume of drilling fluid return and immediately report reductions to the Site Supervisor. The mud system operator will monitor actual drilling fluid volumes from the pumps and the return flow from the borehole. The operator will alert the on-site personnel if there is a significant variance. In the event of partial circulation loss, pumping of drilling fluid may be reduced to lessen pressure applied to native formation materials.

Visual inspections will occur along the bore path at regular intervals while during drilling of the pilot hole. The Site Supervisor will ensure the bore path is inspected every one to two hours. These will be increased as necessary should the drilling conditions described above warrant more frequent inspections.

Should an IR be identified, its location will be recorded, notes made concerning the extent of the drilling mud on the surface and the Corrective Actions described in the following section will be implemented.

5.3 Corrective Actions

The response of the field crew to an IR will be immediate and in accordance with procedures outlined in this IRCP. It is important for the reader to understand certain site conditions specific to the Project that will influence the measures that may or may be necessary. Those site characteristics are described in Section 2 above.

The actions to be taken will vary greatly depending on the location of the IR, for example on land or in the ocean, and the size of the IR and perhaps most importantly, the ability to contain and control the IR. To better focus the response measures, IRs on land will be addressed separately in this plan for those in the ocean.

5.4 Inadvertent Returns on Land (Terrestrial)

Should an IR be identified on land, whether wet or dry but not within the ocean water the following actions will be taken:

1. Direction boring and mud circulation will cease immediately.
2. The bore stem will be pulled back to relieve pressure on the IR.
3. The Site Supervisor will notify the project team of the response actions to be taken and notifications to agencies will be made (see Section 5).
4. Containment measures will be immediately implemented upon discovery of the IR. These measures may differ depending on the severity of the IR as described below.

- If the IR is small, that is it can easily be contained and controlled using the equipment on site and is not threatening sensitive resources the following actions will be taken:
 - All drilling and mud circulation will stop until it the IR can be contained and controlled.
 - Containment measures will be implemented and may include placing a physical barrier such as sandbags, silt fence, straw bales, coir waddles or an earth berm around the release point of the IR. It may also be beneficial to dig a small pit to accommodate a pump or to implement other reasonable containment measures. Once contained, the drilling mud will be removed, either by hand tools, a pump or vacuum and returned to the back to the bore site for recycling.
 - In some cases, the IR is so small, and the drilling mud is so thick that it simply piles up and can be removed by shovels without the need to install containment devices. In these cases, it will be treated like any other stockpiled materials until it can be removed from the site.
 - In some cases, the IR is so small and temporary that containment measures are not warranted. In such cases it is likely that removal of the drilling mud may cause damage to the area. In these cases, the mud will be allowed to dry naturally.
 - If the IR is large, that is it cannot be it cannot be controlled or removed using the on-site pumps and vacuum trailer and/or it threatens sensitive resources the following actions will be taken:
 - All drilling and mud circulation will stop until it the IR can be contained and controlled.
 - Containment measures will be implemented by the Site Supervisor. Containment will require the deployment of the larger vacuum truck, additional mechanical equipment and additional sandbags and other containment materials described above. The vacuum truck will be positioned as close to the IR location as possible and will remove the drilling mud from the area and return it to the drill site for recycling.
5. **Drilling of the landing pipe can only continue if the IR is controlled.** Once the IR is contained and controlled, it is likely that the best course of action will be to advance the bore pipe past the fracture point, until the drilling mud ceases to come to the surface. Leak stopping materials, such as pelletized bentonite or nut shells, may be added to the drilling mud to help seal off the fracture. As long as the drilling mud coming to the surface can be contained and controlled, the bore operation may continue. In some cases, it may be necessary to pull the bore head back and redirect to a different bore path or depth.
- For small IRs, the Site Supervisor will have the authority to continue drilling, as long as the IR is fully contained and controlled.
 - For large IRs, the bore process will remain shut down until after consultation with the regulatory agencies.
6. Reporting requirements will be different for a small IR versus a large IR.
- Small IRs, by definition, did not impact sensitive resources. The incidents will be noted in the Site Supervisor's daily logs and discussed in the daily safety meetings. The daily log will include pictures of the site before and after cleanup.
 - Large IRs will require the preparation of a specific incident report documenting the event including pictures before and after containment/clean-up and details such as location, activity in progress, drilling fluid and pumping parameters, personnel involved, and mitigating actions to be taken shall be prepared.

5.5 Inadvertent Returns in the Ocean

While the drill head is under the ocean, workers will perform visually inspections a minimum of 4 times per day of the ocean from the shore to for possible IRs in the ocean. If detected, the following measures will be taken to allow for the drilling fluid to dissipate.

1. Direction boring and mud circulation would cease immediately as practical.
2. The bore stem will be pulled back to relieve pressure on the IR.
3. The Site Supervisor will notify the project team of the response actions to be taken and notifications to agencies will be made.
4. The Site Supervisor, drill rig operator, will determine if adding leak stopping materials, such as pelletized bentonite or pecan shells is likely to reduce or eliminate the IR.
5. Allow for sediment dissipation and dilution. There is no feasible way to contain an inadvertent release in the ocean. The proper course of action will be to control the release volume and time allowing for the drilling mud to dissipate as the bore head is advanced beyond the fracture point and the IR ceases. It is important to understand that the bore will be passing under the surf zone. The drilling mud will quickly dissipate in this high energy zone of the ocean. The following steps will be implemented once the bore is allowed to continue.
 - Drilling activities will cease until the inadvertent release has dissipated as determined by visual inspection.
 - Once the IR has dissipated, drilling activities will continue for a period no longer than 10 minutes after the inadvertent release is once again observed at which point drilling activities will cease until the IR dissipates.
 - The drilling process will continue in this manner until the IR ceases, or the bore is completed.

5.6 Final Clean-up of Releases

The clean-up will commence after the release is contained as described above. The final clean-up will include removal of all visible drilling mud located in accessible areas. Removal methods will vary based on the volume of the release and the site-specific conditions. Removal equipment may include vacuum trucks, loader and track hoe buckets, small pumps, shovels and buckets. After removal of the drilling mud, all containment measures (e.g., fiber rolls, straw bale) will be removed (unless otherwise specified by the Site Supervisor) and the release area will be returned as close to the original condition as possible. If the removal of the drilling mud leaves a depression, clean sand from the immediate surrounding area will be used to restore the grade. If clean sand is not available from the immediate surrounding area, clean sand from a commercial source will be brought in.

5.7 Beach Access

Vehicles that may be necessary to drive onto the beach include a pickup truck, utility work truck and trailer, vacuum truck and/or front-end loader. Access to the beach would be from the existing public parking lot located at the end of Winema Road as shown in Figure 1 above and along the previously improved access route. It may be necessary to prune some of the overhanging branches from the trees along the access route to allow for access of larger vehicles should they be needed. The sand is expected to be compact enough for Project contractors to operate on the beach safely, however, if the beach sand is super loose and not compacted, they may have to mat a pathway to the site with standard 6-foot by 12-foot timber or plastic mats to allow for equipment access.

6. Documentation

The Site Supervisor will record the IR event in their daily log. The log would include the following:

- Details on the release event, including:

- an estimate of the amount of drilling fluid released,
- the location and date/time of release,
- the size of the area impacted, and
- the success of the clean-up action.
- Name and telephone number of person reporting.
- How the release occurred.
- The type of activity that was occurring around the area of the IR.
- Description of any sensitive areas, and their location in relation to the IR.
- Description of the methods used to clean up or secure the site.
- A listing of the current permits obtained for the project.

7. Communication with Regulatory Agencies

All employees and subcontractors will adhere to the following protocols when permitting Regulatory Agency Personnel to arrive on site. Regulatory Agency Personnel will be required to comply with appropriate safety rules. Only the Site Supervisor will coordinate communication with Regulatory Agency Personnel.

Small IRs, which, by definition, are immediately controlled and not in a sensitive environment, will be reported to the regulatory agencies no later than the day following the IR event.

For large IRs as described in Section 5.4, notification to the regulatory agencies listed below will be immediate according to the location of the IR:

- Within the ocean: US Army Corps of Engineers and Oregon Department of State Lands
- On the Beach (between Statutory Vegetation Line and Low Lower Water Line: Oregon Department of Parks and Recreation, Tillamook County

Easterly of the Beach: Tillamook County.

Table 1. List of Agency Contacts

| Agency | Point of Contact | Contact Information |
|---------------------------------------|--|---|
| US Army Corps of Engineers | Kinsey Friesen | Kinsey.M.Friesen@usace.army.mil Cell: 503-577-8298 |
| Oregon Dept. of State Lands | Dario Frisone | Dario.Frisone@dsl.oregon.gov Cell: (503) 302-6094 |
| Oregon Parks and Recreation Dept. | Kevin Herkamp and Tyler Blanchette | Kevin.A.Herkamp@oprd.oregon.gov Cell: (971) 376-1509 and Tyler.blanchette@oprd.oregon.gov Cell: (503) 510-6741 |
| Oregon Dept. of Environmental Quality | Haley Teach | Haley.teach@deq.state.or.us Cell: (503) 702-9753 |
| Tillamook County | Sarah Absher | sabsher@co.tillamook.or.us Office: (503) 842-3408 x3317 |

Appendix A. Example of Drilling Fluids

Geology

SAND, CLAY, SILT and MARL

Drilling Fluid System

MAX GEL

MAX GEL viscosifier is a premium Wyoming bentonite blended with special extenders, producing a product that will yield more than twice as much viscosity as API Wyoming bentonite. MAX GEL is an easily mixed bentonite for freshwater and extended bentonite systems. It is used to rapidly build mud viscosity and provide superior hole cleaning, as well as to help control lost circulation, formation sloughing and promote hole stability in unconsolidated formations. It is typically used between 15 and 35 lbs./gal as required.

Yields much faster than API-standard bentonite

Non-toxic and proven suitable for use in all drilling applications

Transportation and storage costs are reduced due to lower treatment

requirements as compared to API bentonite

SODA ASH

SODA ASH is used to condition and soften make-up water and raise pH, allowing drilling fluid additives to mix more efficiently. SODA ASH treats out hardness due to calcium in make-up water and raises pH.



HYDRO FORCE

HYDRO FORCE liquid is designed for use as a permanent clay/shale stabilizer. The product provides excellent shale and clay control and greatly reduces bit balling and mud rings. HYDRO FORCE is compatible with all drilling fluids and bentonite, synthetic polymers, and biopolymers. Concentration will vary depending on the reactivity of the clay or shale encountered.

Excellent shale and clay inhibition when used as directed

Soluble in all water-based mud systems

Mixes easily and immediately controls clay/shale swelling

LUBE FORCE

LUBE FORCE is an ecologically friendly drilling fluid lubricant and shale control additive for water-based mud systems. It is based on oleo chemicals, which are derived from natural oils and fats, and is 100% biodegradable. LUBE FORCE Improves lubricity resulting in torque and drag reduction allowing faster, deeper, and highly deviated drilling.

Improves Lubricity

Easily disperses in WBM

Does not affect mud rheology

Improves API filtration properties

Compatible in arctic drilling conditions and is thermally stable to +300 F



SAND FORCE

SAND FORCE is a biopolymer used for increasing viscosity in water-base systems. Small additions provide viscosity and weight-material suspension for all water-base mud systems.

SAND FORCE has the unique ability to produce a fluid that is highly shear-thinning (LSRV).

SAND FORCE effectively increases viscosity for cuttings transport and suspension in all water-base fluids, from highly weighted to low-solids systems, and including freshwater, seawater, salt and heavy-brine systems.

Highly effective low shear rate viscosifier for improved hydraulics and power at the bit for maximum penetration rates

TROL FORCE

TROL FORCE is an anionic fluid loss control agent aimed at HDD. TROL FORCE produces a thin, resilient filter cake which minimizes differential sticking potential. TROL FORCE also provides excellent carrying capacity for cuttings and hole cleaning.

NSF/ANSI 60 approved

Reduces differential sticking

More economical alternative to PAC or CMC

Excellent fluid loss control agent



Lost Circulation

HDD Defense

HDD Defense is a blend of environmentally safe sealants and swellable materials designed to remediate inadvertent return events in HDD applications. Designed to be applied at the onset of inadvertent returns, HDD Defense should be spotted as a pill on bottom (in the inadvertent return zone), with typical concentrations varying from 1 – 1.5 lbs./gallon.

Effectively bridges across loss zones

Can be pumped through mud motors

Environmentally safe and non-toxic

APPLICATION

At the onset of inadvertent returns, pumping should be stopped while mixing the HDD Defense pill. Isolate a mixing tank suitable of holding the desired finished volume, and fill with fresh mud. Add the required HDD Defense through the mixing hopper. Once the pill is mixed, the entire pill should be picked up and pumped down the drill pipe. Chase the pill with active mud until the tail of the pill is outside of the bit. Stop pumping and pull pipe out of the hole to position the bit behind the tail of the pill. Begin circulating at a slow rate while monitoring returns. Stage the pumps up slowly and circulate behind the pill for 1-2 hours to allow the material to create a seal. Wash and ream to bottom pumping sweeps with Drill-Seal as needed to prevent further inadvertent returns.



DRILL-SEAL

DRILL-SEAL is a blend of natural plant fibers. These deformable and compressible particles conform to the shape of pores and fractures to provide a bridge and a primary seal against loss of drilling mud. DRILL-SEAL can be used as a standalone product or in conjunction with HDD Defense lost circulation materials to combat lost circulation / inadvertent returns.

Sealing various types of unconsolidated and fragile soil

Stopping major losses of mud and fluids in fractured formation

Deformable and compressible particles conform to the shape of pores and fractures

APPLICATION

Pills may be used in sweep fashion or spotted downhole to create a lasting seal. Typical concentrations range from 1 – 2 sacks per 50 gallons.

SEAL FORCE

SEAL FORCE is a swelling copolymer for lost circulation that expands over 200 times its volume in freshwater. SEAL FORCE is a lost circulation material used to seal fractures. It can also be spotted in caving zones to consolidate loose formations. After placing SEAL FORCE pills, pull up above the problem zone to prevent stuck pipe. Hydration occurs in 20 to 30 minutes. Circulate with mud and LCM to fill the voids between the spotted pill.

Can be hydrated prior to spotting

Will accumulate in a variety of fracture sizes due to its swelling capacity and particle size distribution



Loss of Circulation Materials (LCM)

LCM pills and sweeps incorporate fibrous and granular products to effectively block the paths of the seepage or whole loss. Magma Fiber will mesh across loss zones and provide a foundation for the blockage where sawdust will further incorporate itself into the structure. High viscosity base bentonite/Drill Plex fluid will further slow the migration of drilling fluid into loss zones and form extremely high gel strengths around the loss zone. SEAL FORCE/POLY SWELL, an insoluble and flexible LCM, can swell up to 200 times its volume in fresh water. SEAL FORCE/POLY SWELL can be added at connections, dry or pre-hydrated for seepage losses, or incorporated in the LCM pill at various points of mixing to improve the blocking potential.

Recommended properties and maintenance

As mud engineering is not confirmed for this project, drilling fluids monitoring and maintenance will depend on the experience of the drilling foreman, driller and tank hands, as well as available testing equipment on location. Wherever possible, API RP 13B-1 should be followed when monitoring drilling fluid parameters. An application guide is provided for field personnel with additions for each section of the bore. All drilling fluid additive concentrations must be maintained for fresh water added, including make-up volume for disposed fluids.

Viscosity

The funnel viscosity of the drilling fluid will depend on the diameter of the section of hole being drilled or reamed and the nature of the drilled cuttings being removed. It is a simple measurement that indicates how much thicker the fluid is in relation to water (26 seconds/quart). Crews can monitor the funnel viscosity of the fluid to maintain recommended mud properties and determine if the formation being drilled is contributing to an increase in viscosity. As a result, clay control additives can be adjusted to further improve clay and shale stability.



Similarly, in unconsolidated formations like sand, silt and gravel, viscosity increases will improve cuttings transport and suspension. Continuous monitoring of the funnel viscosity in these formations will ensure the drilling fluid maintains optimum performance.

Sand Content

Sand content is normally maintained below 1 %. Excessive sand in the drilling fluid can cause premature wear on circulating pumps, piping and mud motors. Periodic sand content tests by crews can effectively determine formation (geology) changes as well as deficiencies in the cleaning system. Holes in shaker screens and plugged hydrocyclones can cause rapid increases in the sand content and should be repaired immediately.

Density (mud weight)

The mud density should be maintained as low as possible. Continuous mud density monitoring by tank hands can expose deficiencies in the circulating system such as holes in shaker screens, plugged hydrocyclones and poor centrifuge performance. Excess density will increase hydrostatic pressure and could cause inadvertent losses into weak formations. Excess solids due to higher mud weight can also affect the rate of penetration.

Fluid Loss (API Filtrate)

High yield bentonite on its own does provide some fluid loss control but often additives are required for unconsolidated formations or reactive clay formations demonstrating a higher dispersion potential. TROL FORCE/PAC L FORCE/PLATINUM PAC provides fluid loss control and crews can monitor fluid loss if there is a filter press on location. Maintaining acceptable parameters for fluid loss can prevent hole collapse and clay/shale hydration.

pH, Hardness & Chlorides

Testing the make-up water before mixing drilling fluid products will determine compatibility and



potential contamination. Recommended drilling fluid additives are designed to mix efficiently in any make-up water but there are exceptions. Very high hardness levels can restrict bentonite and additive hydration and salt content over 5000 ppm can reduce the hydration potential of bentonite products. Soda ash or sodium bicarbonate is normally to treat contaminated hard water sources. Higher salt content may require the use of specialty additives if the source water cannot be replaced. Resulting pH and hardness following mixing can also be determined by the filtrate from the fluid loss test (API filtrate).

Rheology

Crews are often trained on the use of electric and hand crank viscometers and additional fluid properties can be checked during the shift. Increases in plastic viscosity are often an indication of increases in mud weight due to excess solids and low gravity solids dissolution. Maintaining the mud weight as low as possible will result in a lower plastic viscosity. Slight changes in additive concentrations may better consolidate cuttings and reduce sloughing and swelling in HDD bores.

Yield point and low-end rheology (6/3 RPM) properties determine the ability of the fluid to efficiently clean cuttings from the borehole by maintaining the appropriate flow regime for HDD bore path lengths and angles. Elevated properties may provide solutions to reduce torque, drag, annular pressures, and seepage losses.

Gel strengths (10 sec/10 min) indicate the ability of the drilling fluid to “stiffen” and provide a matrix for effective cuttings suspension. Gel strengths should be higher and flatter in HDD fluids to provide immediate suspension and reduce the tendency of cuttings to form beds. These cuttings beds may accumulate as annular blockages that can affect fluid flow and annular pressures.

These tests are normally performed by mud engineers. We recommend mud engineering on all crossings.



Right Turn Supply, LLC.

P.O. Box 132016
Spring, TX 77393

P.O. Box 840
Pella, IA 50219

Crossing Specifications and Mud Volumes

| | |
|------------------------|--------------------------------------|
| Length: | 6100 ft |
| Pilot: | 12-1/4 inches |
| Casing: | NA |
| Product: | 36" STEEL |
| Reaming Stages: | 30-inch, 40-inch, 48-inch, Swab Pass |
| Formation: | CLAY – SAND – SILT – MARL |
| Mud Motor: | JET |
| Rig: | 440 K + |
| Tank Volume: | 8000 gal. |
| Total Fluid: | 668,816 gal. |



Mud Volume Calculations for Each Pass

12-1/4" Pilot Bore

| | |
|---|-----------------|
| Hole Volume per Foot: | 6 gallons/foot |
| Recommended Pump Rate: (ROP = 10 - 15 mins/joint) | 125 GPM |
| Hole Volume: | 37,363 gallons |
| Mud to Pump: | 363,095 gallons |
| Mud Lost (2%): | 7,262 gallons |
| Total Mud to Pump (losses, tanks, hole vol.): | 370,357 gallons |

Ream Pass 1: 30" Diameter

| | |
|--|-------------------|
| Hole Volume per Foot: | 37 gallons/foot |
| Recommended Pump Rate: (ROP = 20 - 25 mins/joint) | 400 GPM |
| Hole Volume: | 224,082 gallons |
| Mud to Pump: | 1,549,206 gallons |
| Mud Lost (1%): | 15,492 gallons |
| Total Mud to Pump (losses + increases in hole vol.): | 1,564,698 gallons |

Ream Pass 2: 40" Diameter

| | |
|--|-------------------|
| Hole Volume per Foot: | 65 gallons/foot |
| Recommended Pump Rate: (ROP = 15 - 20 mins/joint) | 500 GPM |
| Hole Volume: | 398,367 gallons |
| Mud to Pump: | 1,936,508 gallons |
| Mud Lost (1%): | 19,365 gallons |
| Total Mud to Pump (losses + increases in hole vol.): | 1,955,873 gallons |



Ream Pass 3: 48" Diameter

| | |
|---|-------------------|
| Hole Volume per Foot: | 94 gallons/foot |
| Recommended Pump Rate: (ROP = 15 - 20 mins/joint) | 600 GPM |
| Hole Volume: | 573,649 gallons |
| Mud to Pump: | 1,742,857 gallons |
| Mud Lost (1%): | 17,429 gallons |
| Total Mud to Pump (losses + increases in hole vol.): | 1,760,286 gallons |

Swab Pass: 48" Diameter

| | |
|---|-------------------|
| Hole Volume per Foot: | 94 gallons/foot |
| Recommended Pump Rate: | 600 GPM |
| Hole Volume: | 573,649 gallons |
| Mud to Pump: | 1,161,905 gallons |
| Mud Lost (1%): | 11,619 gallons |
| Total Mud to Pump (losses + increases in hole vol.): | 1,173,524 gallons |

Additive Concentrations

Batch Mixing per 3000 Gallons

| MAX GEL | SAND FORCE | TROL FORCE | SODA ASH | HYDRO FORCE | LUBE FORCE |
|--------------|------------------------------|-------------------------------|------------------------------|-------------|------------|
| 12 – 18 BAGS | 6 – 12 lbs. (3 – 6 VIS CUPS) | 12 – 18 lbs. (6 – 9 VIS CUPS) | 8 – 15 lbs. (4 – 8 VIS CUPS) | 3 – 6 GAL. | 3 – 6 GAL. |

NOTE: Adjust water pH first with SODA ASH. pH level needs to be 8.5 – 10

NOTE: Mix MAX GEL 2nd and let hydrate for 5 minutes

NOTE: Add SAND FORCE and TROL FORCE through the hopper

NOTE: Lastly add HYDRO FORCE and LUBE FORCE directly into the clean tank



Properties

| Stage | Stage Funnel Viscosity (sec/qt) | Mud Weight (lb/gal) | Sand Content (%) | Plastic Viscosity (CP) | Yield Point (lb/100 ft ²) | Fluid Loss (mL) | Hardness (ppm) | pH |
|-----------|---------------------------------|---------------------|------------------|------------------------|---------------------------------------|-----------------|----------------|----------|
| Pilot | 60 - 80 | 8.8 - 10 | <1 % | 9 - 15 | 18 -32 | <15 | < 100 | 8.5 - 10 |
| Ream | 80 - 100 | 8.8 - 10 | <1 % | 9 - 15 | 35+ | <15 | < 100 | 8.5 - 10 |
| Swab Pass | 80 - 100 | 8.8 - 10 | <1 % | 9 - 15 | 35+ | <15 | < 100 | 8.5 - 10 |

Additive Concentrations

| Product Name | Quantity | Units | Pallets |
|--------------|------------------------|--------------------|---------------------|
| MAX GEL | 133,763 – 200,645 LBS. | 2,675 – 4,013 bags | 39 – 58 (70/PALLET) |
| SODA ASH | 1672 – 3344 LBS. | 67 – 134 buckets | 2 – 4 (32/PALLET) |
| SAND FORCE | 1338 - 2675 LBS. | 54 – 107 buckets | 2 – 4 (32/PALLET) |
| TROL FORCE | 2675 - 4013 LBS. | 107 – 161 buckets | 4 – 5 (32/PALLET) |
| HYDRO FORCE | 669 - 1338 GAL. | 134 – 268 buckets | 4 - 9 (32 PALLET) |
| LUBE FORCE | 669 - 1338 GAL. | 134 – 268 buckets | 4 - 9 (32 PALLET) |



Safety data sheet number PID1046
Version 4
Revision date 28/Oct/2016
Supercedes date 14/Feb/2016



Safety Data Sheet MAX GEL*

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name MAX GEL*
Product code PID1046

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Viscosifier.
Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I Drilling Fluids UK Limited
C/O Schlumberger
Enterprise Drive
Westhill Industrial Estate
Westhill, AB32 6TQ
Scotland UK
+47 51577424

MISDS@slb.com

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600

| | |
|--------|--|
| Norway | Poison information centre: +47 22 59 13 00 |
|--------|--|

2. Hazards identification

2.1 Classification of the substance or mixture

Regulation (EC) No. 1272/2008

Health hazards Not classified
Environmental hazards Not classified
Physical Hazards Not classified

2.2 Label elements

Signal word

None

Hazard statements

This product is not classified as hazardous therefore no (H) hazard statements assigned.

Precautionary Statements - EU (§28, 1272/2008)

This product is not classified as hazardous therefore has no (P) precautionary statements assigned.

-
 -

Contains

Crystalline silica (impurity)

Silica - crystalline, tridymite

2.3 Other data

Not classified as PBT/vPvB by current EU criteria

Australian statement of hazardous/dangerous nature

Classified as Non-Hazardous according to the criteria of NOHSC.
 NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS.

3. Composition/information on ingredients

3.1 Substances

| Component | EC-No. | CAS-No | Weight % - range | Classification (67/548) | Classification (Reg. 1272/2008) | REACH registration number |
|---------------------------------|-----------|------------|------------------|-------------------------|---------------------------------|---------------------------|
| Crystalline silica (impurity) | 238-878-4 | 14808-60-7 | 1-5 | Xn; R48/20 | STOT Rep. 2 - H373 | Exempt |
| Silica - crystalline, tridymite | 239-487-1 | 15468-32-3 | 0-1 | Xn; R48/20 | STOT RE 2 (H373) | No data available |

3.2 Mixtures

Not Applicable

Comments

Naturally occurring mineral.

The product contains other ingredients which do not contribute to the overall classification.

This product contains a small quantity of quartz, crystalline silica. Prolonged and repeated exposure to concentrations of crystalline silica exceeding the workplace exposure limit (WEL) may lead to chronic lung disease such as silicosis. IARC Monographs, Vol. 68, 1997, concludes that there is sufficient evidence that inhaled crystalline silica in the form of quartz or cristobalite from occupational sources causes cancer in humans. IARC Classification Group I.

4. First aid measures

4.1 First Aid

| | |
|---------------------|---|
| Inhalation | If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult. |
| Ingestion | Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur. |
| Skin contact | Wash skin thoroughly with soap and water. Get medical attention if irritation persists. |
| Eye contact | Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Get medical attention if any discomfort continues. |

4.2 Most important symptoms and effects, both acute and delayed

General advice The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

| | |
|---------------------|---|
| Inhalation | Please see Section 11. Toxicological Information for further information. |
| Ingestion | Please see Section 11. Toxicological Information for further information. |
| Skin contact | Please see Section 11. Toxicological Information for further information. |
| Eye contact | Please see Section 11. Toxicological Information for further information. |

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media

Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons

None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards

None known.

Hazardous combustion products

Thermal decomposition can lead to release of irritating gases and vapours

5.3 Advice for firefighters

Special protective equipment for fire-fighters

As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures

Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8.

6.2 Environmental precautions

Disposal should be in accordance with applicable regional, national and local laws and regulations. Large spills released to the environment may disturb the natural chemical balance of soil/fresh water.

Environmental exposure controls

Avoid release to the environment. Local authorities should be advised if significant spillages cannot be contained.

6.3 Methods and materials for containment and cleaning up

Methods for containment

Prevent further leakage or spillage if safe to do so. Cover powder spill with plastic sheet or tarp to minimise spreading.

Methods for cleaning up

Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling

Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures

Use good work and personal hygiene practices to avoid exposure. When using do not smoke, eat or drink. Wash hands and face before breaks and immediately after handling the product. Remove contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

| | |
|---------------------------------------|---|
| Technical measures/precautions | Ensure adequate ventilation. Keep airborne concentrations below exposure limits. |
| Storage precautions | Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from moisture. |
| Storage class | Chemical storage. |
| Packaging material | Use specially constructed containers only. |

7.3 Specific end uses

See Section 1.2.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure Limits No biological limit allocated

| Component | EU OEL - Third List | Austria | Australia | Denmark |
|---------------------------------|--|---|--|---|
| Crystalline silica (impurity) | Not determined | 0.15 mg/m ³ TWA alveolar dust, respirable fraction | 0.1 mg/m ³ TWA respirable dust | 0.1 mg/m ³ |
| Silica - crystalline, tridymite | Not determined | 0.15 mg/m ³ TWA alveolar dust, respirable fraction | 0.1 mg/m ³ TWA respirable dust | 0.15 mg/m ³ TWA 0.05 mg/m ³ TWA K |
| Component | Malaysia | France | Germany | Hungary |
| Crystalline silica (impurity) | 0.1 mg/m ³ TWA | 0.1 mg/m ³ TWA | Not determined | 0.15 mg/m ³ TWA |
| Silica - crystalline, tridymite | 0.05 mg/m ³ TWA | 0.05 mg/m ³ TWA | Not determined | 0.15 mg/m ³ TWA |
| Component | New Zealand | Italy | Netherlands | Norway |
| Crystalline silica (impurity) | 0.2 mg/m ³ TWA Known or presumed human carcinogen | Not determined | 0.075 mg/m ³ | 0.3 mg/m ³ TWA total dust 0.1 mg/m ³ TWA respirable dust 0.3 mg/m ³ STEL total dust 0.1 mg/m ³ STEL respirable dust Carcinogen |
| Silica - crystalline, tridymite | 0.1 mg/m ³ TWA Known or presumed human carcinogen | Not determined | 0.075 mg/m ³ | 0.15 mg/m ³ TWA total dust 0.05 mg/m ³ TWA respirable dust 0.45 mg/m ³ STEL total dust 0.15 mg/m ³ STEL respirable dust Carcinogen |
| Component | Poland | Portugal | Romania | Russia |
| Crystalline silica (impurity) | 2 mg/m ³ TWA NDS >50% free crystalline silica 0.3 mg/m ³ TWA NDS >50% free crystalline silica 4.0 mg/m ³ TWA NDS 2% to 50% free crystalline silica 1.0 mg/m ³ TWA NDS 2% to 50% free crystalline silica | 0.025 mg/m ³ TWA respirable fraction | 0.1 mg/m ³ TWA respirable fraction, dust | 3 mg/m ³ STEL 1123 disintegration aerosol, total mass of aerosols 3 mg/m ³ STEL 1124 total mass of aerosols 1 mg/m ³ TWA 1123 1 mg/m ³ TWA 1124 Fibrogenic substance glass; regulated under Quartz 1123, 1124 |
| Silica - crystalline, tridymite | 2 mg/m ³ TWA NDS >50% free crystalline silica 0.3 mg/m ³ TWA NDS >50% free crystalline silica 4.0 mg/m ³ TWA NDS 2% to 50% free crystalline silica 1.0 mg/m ³ TWA NDS 2% to 50% free crystalline silica | Not determined | 0.05 mg/m ³ TWA respirable fraction, dust | 3 mg/m ³ STEL 1124 total mass of aerosols 1 mg/m ³ TWA 1124 Fibrogenic substance 1124 |
| Component | Spain | Switzerland | Turkey | UK |

| | | | | |
|---------------------------------|-----------------------------------|--------------------------------|----------------|----------------|
| Crystalline silica (impurity) | 0.05 mg/m ³ TWA VLA-ED | 0.15 mg/m ³ TWA MAK | Not determined | Not determined |
| Silica - crystalline, tridymite | Not determined | 0.15 mg/m ³ TWA MAK | Not determined | Not determined |

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure

Ensure adequate ventilation. Mechanical ventilation or local exhaust ventilation is required.

Personal protective equipment

Eye protection

Safety glasses with side-shields. Tightly fitting safety goggles.

Hand protection

Repeated or prolonged contact: Use protective gloves made of: Neoprene, Nitrile, Frequent change is advisable.

Respiratory protection

No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment, Suitable mask with particle filter P3 (European Norm 143), At work in confined or poorly ventilated spaces, respiratory protection with air supply must be used.

Skin and body protection

Wear suitable protective clothing, Eye wash and emergency shower must be available at the work place.

Hygiene measures

Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.



9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

| | |
|-----------------|----------------|
| Physical state | Solid |
| Appearance | Powder |
| Odour | Odourless |
| Colour | Tan - Grey |
| Odour threshold | Not applicable |

| Property | Values | Remarks |
|------------------------|--------------------------|---------|
| pH | No information available | |
| pH @ dilution | No information available | |
| Melting/freezing point | No information available | |
| Boiling point/range | No information available | |
| Flash point | No information available | |
| Evaporation rate | No information available | |

| | | |
|-------------------------------------|--------------------------|----------------|
| Flammability (solid, gas) | Not Applicable | |
| Flammability Limits in Air | | Not applicable |
| Upper flammability limit | Not applicable | |
| Lower flammability limit | Not applicable | |
| Vapour pressure | No information available | |
| Vapour density | No information available | |
| Specific gravity | No information available | |
| Bulk density | No information available | |
| Relative density | 2.3 - 2.5 sg | @ 20 °C. |
| Water solubility | Insoluble in water | |
| Solubility in other solvents | No information available | |
| Autoignition temperature | No information available | |
| Decomposition temperature | No information available | |
| Kinematic viscosity | No information available | |
| Dynamic viscosity | No information available | |
| Log Pow | No information available | |
| Explosive properties | Not Applicable | |
| Oxidising properties | None known | |
| 9.2 Other information | | |
| Pour point | No information available | |
| Molecular weight | No information available | |
| VOC content(%) | None | |
| Density | No information available | |

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerisation

Hazardous polymerisation does not occur.

10.4 Conditions to avoid

Avoid dust formation. Protect from moisture.

10.5 Incompatible materials

No materials to be especially mentioned.

10.6 Hazardous decomposition products

See Section 5.

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Product information This product contains a small quantity of quartz, crystalline silica. Prolonged and repeated exposure to concentrations of crystalline silica exceeding the workplace exposure limit (WEL) may lead to chronic lung disease such as silicosis.

Inhalation Inhalation of dust in high concentration may cause irritation of respiratory system.

Eye contact Dust may cause mechanical irritation.

Skin contact Prolonged contact may cause redness and irritation.

Ingestion Ingestion may cause stomach discomfort.

Unknown acute toxicity Not Applicable.

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|---------------------------------|---------------------|-------------------|-------------------|
| Crystalline silica (impurity) | = 500 mg/kg (Rat) | No data available | No data available |
| Silica - crystalline, tridymite | No data available | No data available | No data available |

Sensitisation This product does not contain any components suspected to be sensitizing.

Mutagenic effects This product does not contain any known or suspected mutagens.

Carcinogenicity Crystalline silica dust is listed by IARC in Group 1 as known to cause lung cancer in humans, if inhaled.

Reproductive toxicity This product does not contain any known or suspected reproductive hazards.

Routes of exposure Inhalation.

Routes of entry Inhalation.

Specific target organ toxicity (single exposure) Not classified

Specific target organ toxicity (repeated exposure) Not classified.

Aspiration hazard Not Applicable.

12. Ecological information

12.1 Toxicity

The product component(s) are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment. Listed on PLONOR list of OSPAR

Toxicity to algae

This product is not considered toxic to algae.

Toxicity to fish

This product is not considered toxic to fish.

Toxicity to daphnia and other aquatic invertebrates

This product is not considered toxic to invertebrates.

| Component | Toxicity to fish | Toxicity to algae | Toxicity to daphnia and other aquatic invertebrates |
|---------------------------------|--------------------------|--------------------------|---|
| Crystalline silica (impurity) | No information available | No information available | No information available |
| Silica - crystalline, tridymite | No information available | No information available | No information available |

12.2 Persistence and degradability

Not Applicable - Inorganic chemical.

12.3 Bioaccumulative potential

Not Applicable - Inorganic chemical.

12.4 Mobility in soil

Mobility

Insoluble in water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT/vPvB by current EU criteria.

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

| | |
|--|---|
| Waste from residues / unused products | Dispose of in accordance with local regulations. |
| Contaminated packaging | Empty containers should be transported/delivered using a registered waste carrier for local recycling or waste disposal. |
| EWC waste disposal No. | According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. The following Waste Codes are only suggestions: EWC waste disposal No: 01 05 99 - wastes not otherwise specified |

14. Transport information

14.1 UN number

Not regulated

14.2 Proper shipping name

The product is not covered by international regulation on the transport of dangerous goods

14.3. Hazard class(es)

| | |
|-------------------------------------|---------------|
| ADR/RID/ADN/ADG Hazard class | Not regulated |
| IMDG Hazard class | Not regulated |
| ICAO Hazard class/division | Not regulated |

14.4 Packing group

| | |
|--------------------------------------|---------------|
| ADR/RID/ADN/ADG Packing Group | Not regulated |
| IMDG Packing group | Not regulated |
| ICAO Packing group | Not regulated |

14.5 Environmental hazard

No

14.6 Special precautions

Not Applicable

14.7 Transport in bulk according to Annex I/II of MARPOL 73/78 and the IBC Code

Please contact MISDS@slb.com for info regarding transport in Bulk.

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

| | |
|---|-----------------------------|
| Germany, Water Endangering Classes (VwVwS) | Water endangering class = 1 |
|---|-----------------------------|

Australian Standard for the Uniform Scheduling of Drugs and Poisons

No Poisons Schedule number allocated

New Zealand hazard classification Not classified.

HSNO approval no. Not required.

Group number Not required.

Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments.

This safety data sheet complies with the requirements of Regulation (EC) No. 1272/2008.

National Code of Practice for the Preparation of Material Safety Data Sheets 2nd Edition [NOHSC: 2011 (2003)].

National Occupational Health and Safety Commission's Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004) 3rd Edition].

National Occupational Health and Safety Commission's Exposure Standards for Atmospheric Contaminants in the occupational Environment [NOHSC:1003 (1995)].

Safe Work Australia.

Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.

International inventories

| | |
|--|-----------|
| USA, Toxic Substances Control Act inventory (TSCA) | Complies |
| European Union - EINECS and ELINCS | Complies |
| Canada (DSL) | Complies. |
| Philippines (PICCS) | Complies |
| Inventory - Japan - Existing and New Chemicals list | Complies |
| China (IECSC) | Complies |
| Australia (AICS) | Complies |
| Korea (KECL) | Complies |
| Inventory - New Zealand - Inventory of Chemicals (NZIoC) | Complies |

Contact REACH@miswaco.slb.com for REACH information.

15.2 Chemical Safety Report

No information available

16. Other information

Prepared by Global Regulatory Compliance - Chemicals (GRC - Chemicals) , Anne Karin (Anka) Fosse
Supersedes date 14/Feb/2016
Revision date 28/Oct/2016
Version 4
The following sections have been revised: 3,, 5,, 6,, 7,, 9,, 10,, 11,, 16, No changes with regard to classification have been made.

Text of R phrases mentioned in Section 3

R48/20 - Harmful: danger of serious damage to health by prolonged exposure through inhalation

Full text of H-Statements referred to under sections 2 and 3

This product is not classified as hazardous therefore no (H) hazard statements assigned.

H373 - May cause damage to organs through prolonged or repeated exposure if inhaled

*A mark of M-I L.L.C., a Schlumberger Company

Disclaimer

The information contained herein is considered in good faith as reliable of the date issued and is based upon on measurements, tests or data derived from supplier's own study or furnished by others. In providing this SDS information, Supplier makes no express or implied warranties as to the information or product; merchantability or fitness of purpose; any express or implied warranty; or non-infringement of intellectual property rights; and supplier assumes no responsibility for any direct, special or consequential damages, results obtained, or the activities of others. To the maximum extent permitted by law, supplier's warranty obligations and buyer's sole remedies are as stated in separate agreement between the parties.



Safety Data Sheet Sodium Carbonate, Anhydrous

Date Reviewed: January 2021

Supersedes: February 2015

This document has been prepared to meet the requirements of the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200; the Canada's Workplace Hazards Materials Information System (WHMIS) and, the EC Directive, 2001/58/EC.

SECTION 1: Product and Company Identification

| | |
|--|--|
| Product Name | Sodium Carbonate, Anhydrous |
| Alternate Product Name(s) | Soda Ash, Disodium Carbonate Also: Dense Soda Ash, Soda Ash Light, Synthetic Light Soda Ash, Soda Ash Liquid, Natural Light Soda Ash, Natural Light HA Soda Ash |
| Chemical Formula | Na ₂ CO ₃ |
| Product Use | Oil well drilling fluid additive. Calcium precipitation. |
| This chemical is certified to ANSI/NSF Standard 60, Drinking Water Chemicals – Health Effects (as packaged in the original, unopened container). Concentration not to exceed 100 ppm when used for corrosion control or scale control pH adjustment. | |
| Supplier | Drillchem Drilling Solutions PO Box 132107 Spring, TX 77393 |
| Telephone No. | Ph: (281) 713-8941 |
| Emergency No. | (24 Hours) 800-424-9300 CHEMTREC |

SECTION 2: Hazards Identification


Emergency Overview:

White, odorless, granular solid. Product is non-combustible. Reacts with acids to release carbon dioxide gas and heat. May irritate skin and eyes. Dusts may irritate respiratory tract. Not expected to be toxic to the environment, nor to aquatic organisms. Avoid simultaneous exposure to soda ash and lime dust. In the presence of moisture (i.e. perspiration) the two materials combine to form caustic soda (NaOH), which may cause burns.

Hazard Classification:

| Class | Category | Hazard Statement |
|--------------|------------|------------------------------------|
| Eye Irritant | Category 2 | H319 Causes serious eye irritation |

EC Labelling:

| | |
|---|--|
| Name of Substance to appear on label | Sodium Carbonate |
| Symbol(s) | Xi- irritating  |
| Label Phrases | R36: Irritating to eyes. S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S2: Keep out of reach of children S22: Do not breath dust |

Potential Health Effects:

| | |
|------------------------|--|
| Skin | Prolonged contact may cause skin irritation (red, dry, cracked skin). |
| Eyes | Irritating to the eyes. |
| Ingestions | Although low in toxicity, ingestion may cause nausea, vomiting, stomach ache, and diarrhea. |
| Inhalation | Prolonged inhalation of product dusts may irritate nose, throat, and lungs. |
| Chronic Effects | Excessive, long term contact may produce "soda ulcers" on hands and perforation of the nasal septum. Sensitivity reactions may occur from prolonged and repeated exposure. This product does not contain any ingredient designated by IARC, NTP, ACGIH or OSHA as probable or suspected human carcinogens. |

SECTION 3: Composition/Information on Ingredients

| Chemical Name | CAS # | Wt% | EC No. | EC Class |
|------------------|----------|------|-----------|----------|
| Sodium Carbonate | 497-19-8 | 99.8 | 207-838-8 | Xi, R36 |

SECTION 4: First Aid Measures

| | |
|----------------------------|---|
| Skin | Wash with plenty of soap and water. Get medical attention if irritation occurs and persists. Remove and wash contaminated clothing before re-use. |
| Eyes | Immediately flush with water for at least 15 minutes lifting the upper and lower eyelids intermittently. See a medical doctor or ophthalmologist as necessary. |
| Ingestions | Rinse mouth with water. Dilute by giving 1 or 2 glasses of water. Do not induce vomiting. Never give anything by mouth to an unconscious person. If symptoms persist, contact a doctor or poison control center |
| Inhalation | Remove to fresh air. If breathing difficulty or discomfort occurs and persists, obtain medical attention. |
| Advice to Physician | While internal toxicity is low, irritant effects of high concentrations may produce corneal opacities, and vesicular skin reactions in humans with abraded skin only. Treatment is symptomatic and supportive. |

SECTION 5: Firefighting measures

| | |
|--|--|
| Extinguishing Media | Not combustible, use extinguishing method suitable for surrounding fire. |
| Fire/Explosion Hazards | Not applicable. |
| Fire Fighting Procedures | Wear full protective clothing and self-contained breathing apparatus |
| Flammable Limits | Not applicable |
| Auto-Ignition Temperature | Not applicable |
| Hazardous Combustion Products | Carbon dioxide. |
| Sensitivity to Impact | None |
| Sensitivity to Static Discharge | None |

SECTION 6: Accidental Release Measures

| | |
|----------------------------------|--|
| Personal Precautions | Refer to Section 8 "Exposure Controls / Personal Protection" |
| Containment | Prevent large quantities of this product from contacting vegetation or waterways; large spills could kill vegetation and fish. |
| Clean Up | This product, if spilled, can be recovered and re-used if contamination does not present a problem. Vacuum or sweep up the material and collect in a suitable container for disposal. If the spilled product is unusable due to contamination, consult state or federal environmental agencies for acceptable disposal procedures and locations. See Section 13 "Disposal Considerations". |
| Notification Requirements | Federal regulations do not require notification for spills of this product. State and local regulations may contain different requirements; consult local authorities. |

SECTION 7: Handling and Storage

| | |
|-----------------|---|
| Handling | <p>Use air conveying / mechanical systems for bulk transfer to storage. For manual handling of bulk transfer use mechanical ventilation to remove airborne dust from railcar, ship or truck. Use approved respiratory protection when ventilation systems are not available. Selection of respirators is based on the dust cloud generation. Keep material out of lakes, streams, ponds and sewer drains.</p> <p>Avoid eye contact or prolonged skin contact. Avoid breathing dusts. When dissolving, add to water cautiously and with stirring; solutions can get hot. Use good personal hygiene and housekeeping.</p> |
| Storage | <p>Store in a cool dry area, away from incompatible products (acids). Prolonged storage may cause product to cake from atmospheric moisture.</p> |

SECTION 8: Exposure Controls/ Personal Protection

| | |
|-----------------------------|--|
| Engineering Controls | <p>Where possible, provide general mechanical and/or local exhaust ventilation to prevent release of airborne dust into the work environment. Eye wash facility should be provided in storage and general work area.</p> |
|-----------------------------|--|

Personal Protective Equipment:

| | |
|------------------------------|--|
| Eyes and Face | <p>For dusty or misty conditions, or when handling solutions where there is reasonable probability of eye contact, wear chemical safety goggles and hardhat. Under these conditions do not wear contact lenses. Otherwise, appropriate eye and face protection equipment (ANSI Z87 approved) should be selected for the particular use intended for this material. Safety glasses with side shields are recommended.</p> |
| Respiratory | <p>Whenever dust in the worker's breathing zone cannot be controlled with ventilation or other engineering means, workers should wear respirators or dust masks approved by NIOSH/MSHA, EU CEN or comparable certification organization to protect them against airborne dust.</p> |
| Hands, Body, and Arms | <p>Wear long-sleeve shirt and trousers, and impervious gloves for routine product use. Cotton gloves are sufficient for dry product; wear impervious (e.g., rubber, neoprene, etc.) gloves when handling solutions. Protective shoes or boots.</p> |

Exposure Guidelines:

Federal guidelines treat the ingredient(s) in this product as a nuisance dust, as no product-specific guidelines have been issued for exposure. As with all nuisance dusts, worker breathing zone concentrations should be measured by validated sampling and analytical methods. The following limits (OSHA and MSHA) apply to this material:

Particulates Not Otherwise Regulated:

OSHA (PEL / TWA): 15 mg/m³ (total dust); 5 mg/m³ (rasp fraction)
MSHA (PEL / TWA): 10 mg/m³ (total dust)

SECTION 9: Physical and Chemical Properties

| | |
|--|---|
| Appearance | White, granular solid |
| Odor | Odorless |
| Odor Threshold | Not applicable |
| Formula | Na ₂ CO ₃ |
| Molecular Weight | 105.99 |
| pH | 11.3 |
| Melting point/freezing point | 854°C (1569°F) |
| Initial boiling point/boiling range | Decomposes |
| Flash point | None |
| Evaporation rate | Not Applicable |
| Flammability (solid, gas) | Not combustible |
| Flammability in Air | |
| Upper flammability limit | No information available |
| Lower flammability limit | No information available |
| Vapor Pressure | Not applicable |
| Vapor Density | Not applicable |
| Bulk Density (g/l) | Dense grades: 0.9 – 1.1 Natural light grade: 0.7 – 0.9 Synthetic light grade: 0.5 – 0.7 |
| Specific Gravity | 2.533 (vs. Water) |
| Water Solubility(ies) | 212.5 g/l @ 20°C |
| Partition coefficient | No information available |
| Auto-ignition temperature | No information available |
| Decomposition temperature | 400°C |
| Viscosity | |
| Viscosity, dynamic | No information available |
| Viscosity, cinematic | No information available |
| Percent Volatile | 0% |

SECTION 10: Stability and Reactivity

| | |
|--------------------------------|--|
| Stability | Stable |
| Conditions to Avoid | Contract with acids will release carbon dioxide, heat. Contract with lime dust in the presence of moisture can produce corrosive sodium hydroxide. |
| Materials to Avoid | May react with aluminum, acids, fluorine, lithium, and 2,4,6- Trinitrotoluene. |
| Polymerization | Will not occur. |
| Hazardous Decomposition | When heated to decomposition, carbon dioxide is released. |
| Other Precautions | When dissolving, add to water cautiously and with stirring; solutions can get hot. |

SECTION 11: Toxicological Information

| | |
|------------------------|--|
| Eye | Severe irritant (50 mg, rabbit). |
| Skin | Mild irritant (500 mg/24hr, rabbit). Minor irritation may occur on abraded skin. Not a sensitizer (tested at 0.25% solution). |
| Oral | LD ₅₀ , rat: 4,090 mg/kg |
| Inhalation | LC ₅₀ , rat, 2hr 2.3 mg/l 24 – hour LC ₅₀ : 800 mg/m ³ , 20 h exposure (guinea pig) (moderate toxicity) |
| Chronic | Excessive, long term contact may produce “soda ulcers” on hands and perforation of the nasal septum. Sensitivity reactions may occur from prolonged and repeated exposure. |
| Carcinogenicity | Not designated by IARC, NTP, ACGIH or OSHA as probable or suspected human carcinogens. |

SECTION 12: Ecological Information

| | |
|--------------------------------------|---|
| Acute Ecotoxicity | 96 – hour LC ₅₀ : 265 – 565 mg/l (daphnia magna) (low toxicity) 300 – 320 mg/l (blue gill sunfish) (low toxicity) 96 – hour TL _m : 1200 mg/l (mosquito-fish) 48 – hour TL _m : 840 mg/l (mosquito-fish) 48 – hour EC ₅₀ : 265 mg/l (daphnia magna) 5 Day EC ₅₀ : 242 mg/l (Nitzscheria linearis) |
| Chronic Ecotoxicity | 7 Day EC, biomass: 14 mg/l (phytoplankton) |
| Mobility | Air: Not Applicable Water: Considerable solubility and mobility. Soil / sediments: Non-significant adsorption |
| Abiotic Degradation | Water (hydrolysis): degradation's products: carbonate (pH>10) / carbonic acid / carbon dioxide (pH<6). Soil: Hydrolysis as a function of pH. |
| Biotic Degradation | Aerobic / anaerobic: Not applicable (inorganic compound) |
| Potential for Bioaccumulation | Not applicable (ionizable inorganic compound) |

Observed effects are related to alkaline properties of the product. Product is not significantly hazardous for the environment

SECTION 13: Disposal Considerations

| | |
|------------------------|---|
| Disposal Method | When this product is discarded or disposed of, as purchased, it is neither a characteristic nor a listed hazardous waste according to US Federal RCRA regulations (40 CFR 261). As a non-hazardous waste the material may be disposed of in a landfill in accordance with government regulations; check local or state regulations for applicable requirements prior to disposal. Any processing, usage, alteration, chemical additions to, or contamination of, the product may alter the disposal requirements. Under Federal Regulations, it is the generator's responsibility to determine if a waste is a hazardous waste. |
|------------------------|---|

SECTION 14: Transport Information

| | |
|---|----------------|
| Proper Shipping Name | Not regulated |
| Primary Hazard Class/Division | Not regulated |
| UN/NA Number | Not applicable |
| Label(s), Placard(s), Marking(s) | Not applicable |
| Reportable Quantity (RQ) | None |
| 49 STCC Number | Not Applicable |
| ADR (EU), TDG (Canada) | Not regulated |
| IMDG (sea), ICAO (air), IATA (air) | Not regulated |

SECTION 15: Regulatory Information

SARA Title III (Superfund Amendments and Reauthorization Act)

| | |
|---|------------------------------------|
| Section 302 Extremely Hazardous Substances: 40CFR355, Appendix A | Not listed |
| Section 311 Hazard Class 40CFR370 | Immediate (acute) |
| Section 312 Threshold Planning Quantity (TPQ) 40CFR370 | No TPQ listed for sodium carbonate |
| Section 313 Reportable Ingredients 40CFR372 | Not listed |

CERCLA (Comprehensive Environmental Response Compensation and Liability Act):
40CFR302.4 – There is no listed RQ (reportable quantity) for this product.

TSCA (Toxic Substance Control Act)

This product is listed on the TSCA Inventory of Chemical Substances. No other TSCA rules affect this product

State Regulations:


This product does not contain any components that are regulated under California Proposition 65.

Other:

Clean Water Act (CWA) – Section 301/ 311: Not listed

Clean Air Act (CAA) – Section 112: Not regulated

CANADA:

| | |
|--|--|
| WHMIS Classification | D2B Toxic Class E Corrosive Symbol:  This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations. |
| WHMIS Ingredient Disclosure List | Listed |
| DSL Status (Domestic Substances List) | Listed on DSL |

EUROPEAN UNION:

| | |
|--|---|
| EINECS Inventory | Listed: 207-838-8 |
| Annex I (Substances Directive) | Listed: 011-005-00-2 Xi, R-36 (See label details in Section 16) |
| German Water Classification | Hazard class 1, low hazard to waters |
| EU – Food Additives Directive (95/2/EC) – Annex I – Generally Permitted for Use in Food | E500 |

INTERNATIONAL:

This product is also found in the chemical inventories of Australia, China, Korea, Japan and the Philippines.

SECTION 16: Other Information

HMIS (Hazardous Material Identification System)

| | |
|---------------------------|---|
| Health | 2 |
| Flammability | 0 |
| Physical Hazard | 0 |
| Personal Protection (PPE) | B |

Protection = B (Safety glasses and gloves)

4 = Severe, 3 = Serious, 2 = Moderate, 1 = Slight, 0 = Minimal

NFPA (National Fire Protection Association System)

| | |
|--------------|------|
| Health | 2 |
| Flammability | 0 |
| Reactivity | 0 |
| Special | None |

4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Insignificant

Other Information:

Soda ash is produced in three principal grades: Dense, natural light and synthetic light soda ash. When these products are mixed in water they may be known as liquid soda ash. These grades differ only in physical characteristics such as bulk density and size and shape of particles, which influence flow characteristics and angle of repose. Other physical properties, as well as chemical as chemical properties of solutions, are common to each grade of soda ash.

Certified to ANSI / NSF 60

Concentration not to exceed 100 ppm when used for corrosion control or scale control pH adjustment.



The information given corresponds to the current state of our knowledge and experience of the product, and is not exhaustive. This applies to product, which conforms to the specification, unless otherwise stated. In this case of combinations and mixtures one must make sure that no new dangers can arise. In any case, the user is not exempt from observing all legal, administrative and regulatory procedures relating to the product, personal hygiene, and protection of human welfare and the environment.

This Safety Data Sheet is offered for your information, consideration and investigation as required by Federal Hazardous Products Act and related legislation. The information is believed to be accurate but Drillchem Drilling Solutions, LLC. provides no warranties, either expressed or implied.



SAFETY DATA SHEET

Sand Force

Section: 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Sand Force

Other means of identification : N/A

Recommended use : Viscosifier

Restrictions on use : None known

Company : Right Turn Supply LLC
P.O. Box 132016
Spring, TX 77393

Emergency telephone number : (800) 424-9300 (24 Hours) CHEMTREC

Issuing date : 08/01/2018
Reissue date : 01/01/2021

Section: 2. HAZARDS IDENTIFICATION

GHS Classification

Flammable liquids : Not classified

Skin irritation : Not classified

Eye irritation : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity - single exposure : Not classified

Aspiration hazard : Not classified

GHS Label element

Hazard pictograms :



Signal Word : Warning

Hazard Statements : May form combustible dust concentrations in air.

SAFETY DATA SHEET

Sand Force

Precautionary Statements : **Prevention:**
P201 – Obtain special instructions before use.
P264 – Wash face, hands and any exposed skin thoroughly after handling.
P280 – Wear protective gloves/protective clothing/eye protection/face protection.

Response:
P308 + P313 – If exposed or concerned: Get medical advice/attention.
P302 + P352 – IF ON SKIN: Wash with plenty of soap and water.
P332 + P313 – If skin irritation occurs: Get medical advice/attention.
P363 – Wash contaminated clothing before reuse.
P305 + P351 + P338 – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P337 + P313 – If eye irritation persists: Get medical attention/advice.

Storage:
P403 + P235: Store in a well-ventilated place. Keep cool
P404 – Store in a closed container
P405 – Store locked up.

Disposal:
P501 – Dispose of contents/container in accordance with local/regional/national regulations.

Other hazards : None Known

Section: 3. COMPOSITION/INFORMATION ON INGREDIENTS

| Substances | CAS Number | Percent | GHS Classification – US |
|-------------|-------------|-----------|----------------------------------|
| Xanthan Gum | 11138-66-22 | 60 – 100% | Expl. Dust (Combustible Dust) |

The exact percentage (concentration) of the composition has been withheld as proprietary

Section: 4. FIRST AID MEASURES

In case of eye contact : Flush eyes with water for at least 15 minutes, holding eyelids open. Remove Any contact lenses. If irritation persists, seek medical attention.

In case of skin contact : Wash with soap and water. Get medical attention if irritation persists.

If swallowed : Under normal conditions, first aid procedures are not required.

SAFETY DATA SHEET

Sand Force

- If inhaled : If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
- Protection of first-aiders : Move to fresh air. Call a physician if symptoms develop or persist.
- Notes to physician : Treat symptomatically.
- Most important symptoms and effects, both acute and delayed : No significant hazards expected.

Section: 5. FIREFIGHTING MEASURES

- Suitable extinguishing media : Water, fog, carbon dioxide, foam, dry chemical.
- Unsuitable extinguishing media : None known
- Specific hazards during firefighting : Full protective clothing and approved self-contained breathing apparatus required for firefighting personnel.
- Hazardous combustion products : Decomposition in fire may produce toxic gases. Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential
- Special protective equipment for firefighters : Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
- Specific extinguishing methods : Use standard firefighting procedures and consider the hazards of other involved materials.

Section: 6. ACCIDENTAL RELEASE MEASURES

- Personal precautions, protective equipment and emergency procedures : Avoid contact with skin, eyes and clothing. Ventilate area. Avoid creating and breathing dust. Wear appropriate personal protective equipment.
- Environmental precautions : None known.
- Methods and materials for containment and cleaning up : Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.
In the event of spill or accidental release, notify relevant authorities in accordance with all applicable regulations.
For waste disposal, see section 13 of the SDS.

SAFETY DATA SHEET

Sand Force

Section: 7. HANDLING AND STORAGE

- Advice on safe handling : Wear personal protective equipment. Avoid contact with eyes, skin or clothing. Wash hands after use. Do not eat, drink or smoke in work area. Wash contaminated clothing before reuse. Wear a NIOSH-approved, European Standard En 149, or equivalent when using this product. Material slippery when wet. Avoid creating or inhaling dust.
- Conditions for safe storage : Store in a cool dry place. Keep away from oxidizers. Protect from physical damage.

Section: 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

8(a): OCCUPATIONAL EXPOSURE LIMITS:

| Substances | CAS Number | OSHA PEL-TWA | ACGIH-TLV-TWA |
|-------------|------------|----------------------|----------------------|
| Xanthan Gum | 11138-66-2 | 15 mg/m ³ | 10 mg/m ³ |

- Engineering measures : Use in a well-ventilated area. Use approved industrial ventilation and local exhaust. As required to maintain exposures below applicable exposure limits.

Personal protective equipment

- Eye protection : Wear safety glasses with side shields or splash proof goggles.
- Hand protection : Wear normal work gloves.
- Skin protection : Wear suitable protective clothing.
- Respiratory protection : Wear NIOSH-approved, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product. Handle only in a well-ventilated area.
- Hygiene measures : Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

Section: 9. PHYSICAL AND CHEMICAL PROPERTIES

- Appearance : Powder

SAFETY DATA SHEET

Sand Force

| | | |
|---|---|------------------------------|
| Colour | : | Off white to tan |
| Odour | : | Slight |
| Flash point | : | 200.0 °F (93.3 °C) estimated |
| pH | : | 7 (1%) |
| Odour Threshold | : | no data available |
| Melting point/freezing point | : | no data available |
| Initial boiling point and boiling range | : | no data available |
| Evaporation rate | : | no data available |
| Flammability (solid, gas) | : | no data available |
| Upper explosion limit | : | no data available |
| Lower explosion limit | : | no data available |
| Vapour pressure | : | no data available |
| Relative vapour density | : | no data available |
| Relative density | : | 1.6 |
| Density | : | 42.5 lbs/ft ³ |
| Water solubility | : | Soluble in water |
| Solubility in other solvents | : | no data available |
| Partition coefficient: n-octanol/water | : | no data available |
| Auto-ignition temperature | : | no data available |
| Thermal decomposition temperature | : | no data available |
| Viscosity, dynamic | : | no data available |
| Viscosity, kinematic | : | no data available |
| Molecular weight | : | 1,000,000 |

Section: 10. STABILITY AND REACTIVITY

| | | |
|------------------------------------|---|---|
| Chemical stability | : | Material is stable under normal conditions. |
| Possibility of hazardous reactions | : | Hazardous polymerization will not occur |
| Conditions to avoid | : | Avoid creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity by grounding and bonding containers and equipment before transferring material. Prevent dust accumulation. |
| Incompatible materials | : | Strong oxidizing agents. |

SAFETY DATA SHEET

Sand Force

Hazardous decomposition products : Carbon monoxide and carbon dioxide.

Section: 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure : Eye, skin contact, inhalation

Potential Health Effects

Eyes : May cause mild irritation to the eye.

Skin : None known.

Ingestion : None known

Inhalation : May impede respiration

Acute oral toxicity : No data available

Acute inhalation toxicity : No data available

Acute dermal toxicity : No data available

Skin corrosion/irritation : No data available

Serious eye damage/eye irritation : May cause mild irritation to the eye.

Respiratory or skin sensitization : No data available

Carcinogenicity : No data available to indicate product or components present at greater than 0.1% are chronic health hazards

Section: 12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity for the component:

| Substances | CAS Number | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|-------------|------------|---------------------|-------------------|--|
| Xanthan Gum | 11138-66-2 | >45,000 mg/kg (Rat) | No data available | >21 mg/L (Rat) 1h >4.25 mg/L (Rat) 4h |

| Substances | CAS Number | Skin corrosion/irritation |
|-------------|------------|---------------------------------------|
| Xanthan Gum | 11138-66-2 | Non-irritating to the skin in rabbits |

| Substances | CAS Number | Eye damage/irritation |
|-------------|------------|--|
| Xanthan Gum | 11138-66-2 | Mechanical irritation of the eyes is possible. |

| Substances | CAS Number | Skin Sensitization |
|-------------|------------|---------------------------|
| Xanthan Gum | 11138-66-2 | No information available. |

SAFETY DATA SHEET

Sand Force

| | | |
|-------------|------------|--|
| Substances | CAS Number | Respiratory Sensitization |
| Xanthan Gum | 11138-66-2 | No sensitization responses were observed |

| | | |
|-------------|------------|--------------------------|
| Substances | CAS Number | Mutagenic Effects |
| Xanthan Gum | 11138-66-2 | No information available |

| | | |
|-------------|------------|---|
| Substances | CAS Number | Carcinogenic Effects |
| Xanthan Gum | 11138-66-2 | Did not show carcinogenic effects in animal experiments |

| | | |
|-------------|------------|--|
| Substances | CAS Number | Reproductive toxicity |
| Xanthan Gum | 11138-66-2 | Animal testing did not show any effects on fertility |

| | | |
|-------------|------------|---|
| Substances | CAS Number | STOT - single exposure |
| Xanthan Gum | 11138-66-2 | No significant toxicity observed in animal studies at concentration requiring classification. |

| | | |
|-------------|------------|---|
| Substances | CAS Number | STOT - repeated exposure |
| Xanthan Gum | 11138-66-2 | No significant toxicity observed in animal studies at concentration requiring classification. |

| | | |
|-------------|------------|-------------------|
| Substances | CAS Number | Aspiration hazard |
| Xanthan Gum | 11138-66-2 | Not applicable |

| Substances | CAS Number | Toxicity to Algae | Toxicity to Fish | Toxicity to Microorganisms | Toxicity to Invertebrates |
|-------------|------------|--------------------------|---|----------------------------|--|
| Xanthan Gum | 11138-66-2 | No information available | TLM96 320-560 ppm (Oncorhynchus mykiss) LC50 (96h) 490 mg/L (Oncorhynchus mykiss) | No information available | TLM96 >75,000 ppm (Mysidopsis bahia) LC50 (48h) 980 mg/L (Daphnia magna) |

Environmental Effects : The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability: no data available

Mobility: no data available

Bioaccumulative potential: no data available

Other information

No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

Section: 13. DISPOSAL CONSIDERATIONS

Disposal methods : Bury in a licensed landfill according to federal, state and local regulations. Follow all applicable national and local regulations.

SAFETY DATA SHEET

Sand Force

Contaminated packaging : Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

Section: 14. TRANSPORT INFORMATION

US D.O.T Non-bulk (packages less than 119 gallons):

Land transport (DOT):

Not regulated as dangerous goods.

Air transport (IATA)

Not regulated as dangerous goods

Sea transport (IMDG/IMO)

Not regulated as dangerous goods

Section: 15. REGULATORY INFORMATION

This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA list : All components listed on inventory or are exempt

EPA SARA Title III Extremely hazardous substances: Not applicable.

EPA SARA (311, 312) Hazard Class: None

EPA SARA (313) Chemicals: This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (10 CFR 372)

EPA CERCLA/Superfund Reportable Spill Quantity: Not applicable

EPA RCRA Hazardous waste classification: If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

US STATE REGULATION:

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100): All components listed do not apply to the California Proposition 65 Regulation.

US. Massachusetts RTK - Substance List: Does not apply

US. New Jersey Worker and Community Right-to-Know Act: Does not apply

US. Pennsylvania Worker and Community Right-to-Know Law: Does not apply

SAFETY DATA SHEET

Sand Force

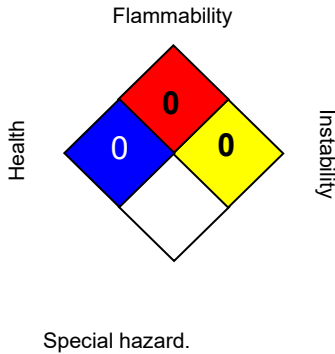
INTERNATIONAL CHEMICAL CONTROL LAWS:

United States TSCA Inventory: On TSCA Inventory

Canadian Domestic Substances List (DSL): On DSL Inventory

Section: 16. OTHER INFORMATION

NFPA:



HMIS III:

| | |
|-----------------|---|
| HEALTH | 0 |
| FLAMMABILITY | 0 |
| PHYSICAL HAZARD | 0 |

0 = not significant, 1 = Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Revision Date : 08/01/2018
Version Number : 1.0

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.



SAFETY DATA SHEET

SDS DATE: 1-1-2022



SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: TROL FORCE NSF

CAS: Proprietary

MANUFACTURER: Right Turn Supply
ADDRESS: 2265 Graceland Cemetery Road, Pella, IA 50219

EMERGENCY PHONE: 281-413-1939
E mail: Info@rightturnsupply.com

CHEMICAL FAMILY: Polysaccharides

RECOMMENDED USE: Fluid Loss Control/Rheology Modification

SECTION 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

IMMEDIATE CONCERNS: May cause eye and respiratory irritation.

POTENTIAL HEALTH EFFECTS

EYES: Contact may cause eye irritation

SKIN: This product is unlikely to cause skin irritation

INGESTION: This product is unlikely to cause harmful effects from ingestion

INHALATION: May cause irritation to the respiratory tract if inhaled. May cause coughing, sneezing or nasal irritation.

ACUTE HEALTH HAZARDS: None.

CHRONIC HEALTH HAZARDS: Excessive inhalation or eye exposure over long periods may cause harmful irritation

SLIP HAZARD: If the material becomes wet, it could produce a slip hazard.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Particulate inhalation may lead to pulmonary problems.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENTS:

| | <u>CAS NO.</u> | <u>% WT</u> |
|-------------|----------------|-------------|
| Proprietary | | |

SAFETY DATA SHEET

SECTION 4: FIRST AID MEASURES

SDS DATE: 1-1-2022

EYES: Immediately flush with large amounts of cold water, holding eye-lids open. Flush for 15 minutes if possible. Remove contact lenses if present.

SKIN: Rinse contact area with cold water. Remove contaminated clothing, and wash with soap and water. If irritation develops, seek medical attention.

INGESTION: Do not induce vomiting. Have exposed individual rinse mouth thoroughly with water. Never give anything by mouth to an unconscious person. Consult physician if symptoms persist.

INHALATION: Move exposed person to fresh air and call 911. Give artificial respiration if not breathing and administer oxygen if breathing is difficult.

NOTES TO PHYSICIANS OR FIRST AID PROVIDERS: Treat Symptomatically. Ensure that medical personnel are aware of the materials involved and take precautions to protect themselves. First aid responders are advised to wear protective equipment as found in section 8 of this SDS.

SECTION 5: FIRE-FIGHTING MEASURES

FLASH POINT: No data available

AUTOIGNITION TEMPERATURE: No data available

EXTINGUISHING MEDIA: Use alcohol foam, CO₂, water fog, or dry chemicals when fighting fires involving this material. Do not use a direct stream if dust is formed. Dust dispersed by a direct stream in the presence of an ignition source could ignite.

SPECIAL FIRE FIGHTING PROCEDURES: Move containers from fire area if you can do it without risk. Dike fire-control water for later disposal; do not scatter the material. Persons involved in fire-fighting response involving this product and its containers/packaging should refer to Section 8 of this SDS for the proper selection of exposure controls and personal protective equipment.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Dust-air mixtures may be explosive. Avoid open flames, sparks etc.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon oxides (CO_x).

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILLS: Wet material is slippery! Avoid generating and spreading of dust. Shovel into dry containers. Cover and move the containers. Wash away with water or vacuum with a high efficiency filter to recover and reuse the material. If product is contaminated, collect in suitable containers for disposal. Do not contaminate drainage or waterways. Repackage or recycle if possible.

ENVIRONMENTAL PRECAUTIONS: Prevent entry into waterways, sewers, basements or confined areas. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Avoid allowing water runoff to contact spilled material. If sweeping of a contaminated area is necessary, use a dust suppressant agent that does not react with the product. Contaminated surfaces will be extremely slippery.

SPECIAL PROTECTIVE EQUIPMENT: In case of dust generation, wear goggles and ensure adequate ventilation and/or use breathing apparatus. Dust in high concentrations may form explosive mixtures with air. Review Sections 5 and 7 of this SDS with personnel before starting any cleanup operations.

SECTION 7: HANDLING AND STORAGE

HANDLING: Avoid dust generation. Ensure adequate ventilation or breathing apparatus before handling material. Gloves should be worn.

STORAGE: Store in dry conditions, do not let product get wet, wet material could produce a slip hazard. Store in original packaging, or appropriate alternative. If repackaged, label new packaging. Store at ambient temperature and pressure.

OTHER PRECAUTIONS: Keep away from ignition source.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation. Provide readily accessible eye wash stations and emergency showers. Where explosive mixtures may be present, electrical systems safe for such locations must be used.

VENTILATION: Ensure area of use is well ventilated.

SAFETY DATA SHEET

SDS DATE: 1-1-2022

RESPIRATORY PROTECTION: Depending on airborne concentration, wear an OSHA approved N95 half-face dust respirator.

EYE PROTECTION: Employees should be provided with and required to use safety goggles where there is any possibility of product coming in contact with eyes. Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of contact lenses. Ensure that an eye wash station is operable and nearby.

SKIN PROTECTION: Depending on the conditions of use, protective gloves, apron, boots, head and face protection should be worn. Remove contaminated clothing immediately, wash skin with soap and water, and launder clothing before reuse.

WORK HYGIENIC PRACTICES: Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Promptly remove contaminated clothing and launder before reuse. Shower after work using plenty of soap and water.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

FORM: solid powder.

APPEARANCE: white to off white.

ODOR: odorless or no characteristic odor.

pH (2% solution): 8-11

BOILING POINT: No data available

MELTING POINT: No data available

FREEZING POINT: No data available

SPECIFIC GRAVITY: 1.5 typical

EVAPORATION RATE: No data available

FLAMABILITY LIMITS: No data available

AUTOIGNITION TEMPERATURE: No data available

FLASH POINT: No data available

SOLUBILITY IN WATER: 100%

SECTION 10: STABILITY AND REACTIVITY

STABILITY: Stable. Hazardous polymerization does not occur.

CONDITIONS TO AVOID: Ignition sources may cause exothermic reaction. Wet material can be a slip hazard.

MATERIALS TO AVOID: Oxidizing agents

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS: Carbon oxides (COx)

SECTION 11: TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:

ORAL LD50 (RAT); No data available

DERMAL LD50 (RABBIT): No data available

INHALATION LC50 (RAT): No data available

SAFETY DATA SHEET

SDS DATE: 1-1-2022

CARCINOGENICITY:

NTP Not listed
IARC Not listed
OSHA Not listed

SENSITIZATION: No data available

NEUROTOXICITY: No data available

GENETIC EFFECTS: No data available

REPRODUCTIVE EFFECTS: No data available

TERATOGENIC EFFECTS: No data available

MUTAGENICITY: No data available

SECTION 12: ECOLOGICAL INFORMATION

ENVIRONMENTAL DATA: MOBILITY IN SOIL POTENTIAL - No data available

ECOTOXICOLOGICAL INFORMATION: TERRESTRIAL/MICROORGANISM TOXICITY –

ACUTE: No data available
CHRONIC: No data available

BIOACCUMULATION/ACCUMULATION: No data available

AQUATIC TOXICITY: No data available

CHEMICAL FATE INFORMATION: PERSISTENCE & DEGRADABILITY – Material breaks down naturally.

GENERAL COMMENTS: Any other adverse environmental effects, such as environmental fate (exposure), ozone depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and global warming potential are indicated in this section if data exists. Otherwise, this data has not been established.

SECTION 13: DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: This product does not meet the criteria of a hazardous waste if discarded in its purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc. may render the resulting materials hazardous.

PRODUCT DISPOSAL: Recover and reclaim or recycle, if practical. Should this product become a waste, dispose of in a permitted industrial landfill. Ensure that containers are empty by RCRA criteria prior to disposal in a permitted industrial landfill.

EMPTY CONTAINER: Empty containers may retain residues. All label precautions must be observed.

COMMENTS: Dispose of material in accordance with national, state, regional, and local regulations. Never discharge directly into sewers or surface water. Consult with environmental regulatory agencies for guidance on acceptable disposal practices for the product, in any form, and its containers/packaging.

SECTION 14: TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION)

PROPER SHIPPING NAME: Not regulated as a dangerous good.

ROAD AND RAIL (ADR/RID)

SHIPPING NAME: Not regulated as a dangerous good.

AIR (ICAO/IATA)

SHIPPING NAME: Not regulated as a dangerous good.

SAFETY DATA SHEET

SDS DATE: 1-1-2022

VESSEL (IMO/IMDG)

SHIPPING NAME: Not regulated as a dangerous good.

SECTION 15: REGULATORY INFORMATION

UNITED STATES:

SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)

311/312 HAZARD CATEGORIES: None of the components are listed.

313 REPORTABLE INGREDIENTS: None of the components are listed.

CERCLA (COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT)

CERCLA REGULATORY: None of the components are listed.

TSCA (TOXIC SUBSTANCE CONTROL ACT)

TSCA REGULATORY: All components are listed and registered.

CALIFORNIA PROPOSITION 65: This product does not contain any chemicals that are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

CARCINOGEN: This product is not listed as a carcinogen under NTP, IARC, or OSHA.

CANADA

WHMIS (WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM): Not a controlled product.

SECTION 16: OTHER INFORMATION

REVISION SUMMARY: This SDS replaces the 06/16/2014 SDS.

NFPA

Health Hazard: 1

Fire Hazard: 1

Reactivity Hazard: 0

HMIS

Health Hazard: 1

Flammability: 1

Physical Hazard: 0

HMIS RATINGS NOTES: Please refer to Section 8 of this SDS for recommended personal protective equipment.

GENERAL STATEMENTS: Other information not included anywhere else in this SDS is included in this section if, in fact, such data exists.

MANUFACTURER DISCLAIMER: This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty or guarantee is made as to its accuracy, reliability or completeness. **NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION HEREIN PROVIDED.** It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. We do not accept liability for any loss or damage that may occur from the use of this information nor do we offer warranty against patent infringement.



1. IDENTIFICATION

| | |
|-----------------------------------|---|
| Product Name | Hydroforce HDD |
| Product Use | HDD/Boring/Tunneling Applications |
| Supplier | Drillchem Drilling Solutions PO Box 132107, Spring, TX 77393 |
| Contact Numbers | 281-713-8941 |
| E-mail Contact for SDS | info@drillchem.com |
| Emergency Telephone Number | CHEMTREC: 800-424-9300 (24 Hours) |

2. HAZARDS IDENTIFICATION

| | |
|--|----------------------------------|
| Hazard Classification | Precautionary Statements: |
| This material is not classified as hazardous according to 29CFR 1910.1200. | None applicable. |

3. COMPOSITION / INFORMATION ON INGREDIENTS

Description: Mixture

| Component | CAS No. | Concentration (%) |
|-------------------|---------|-------------------|
| Proprietary Blend | * | 95 |

(*) Our company is withholding the specific chemical composition under provision of the OSHA Hazard Communication Rule Trade Secrets. The specific composition will be made available to health professionals in accordance with 29 CFR 1910.1200(i)(1-4).

4. FIRST AID MEASURES

| | |
|-------------------|---|
| Inhalation | Remove to fresh air. If not breathing, if breathing is irregular, or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing that may restrict breathing. Obtain medical attention if discomfort persists. |
| Skin | Remove contaminated clothing. Immediately wash off with mild detergent for at least 20-60 minutes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Obtain medical attention if irritation persists. |
| Eye | Obtain immediate medical attention. Immediately flush eye with plenty of water for at least 20-60 minutes while holding eyelids open. |

| | |
|------------------|--|
| Ingestion | Do not induce vomiting unless directed to do so by medical personnel. Obtain medical attention if you feel unwell. |
|------------------|--|

5. FIRE FIGHTING MEASURES

| | |
|---------------------------------------|---|
| Extinguishing media | CO ₂ , Dry Chemical. Foam, Water Fog |
| Unsuitable extinguishing media | Do not use a direct stream of water. Water may cause splattering. |
| Fire fighting procedures | Do not enter any enclosed or confined fire space without proper protective equipment including self contained breathing apparatus and full bunker gear. |
| Combustion products | Oxides of carbon and hydrogen chloride. |

6. ACCIDENTAL RELEASE MEASURES

| | |
|--|---|
| Personal Precautions | Avoid contact with skin and eyes. Evacuate the area of all non-essential personnel. Shut off leaks, if possible without personal risk. |
| Personal Protection | Wear protective clothing specified for normal operations (see section 8). |
| Environmental Protection | None Known. |
| Clean up methods - small spillage | Absorb or contain liquid with sand, earth, or spill control material. Shovel up and place in labelled, sealable container for subsequent safe disposal. |
| Clean up methods - large spillage | Transfer to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Treat residues as for small spillages. |

7. HANDLING AND STORAGE

| | |
|-----------------|--|
| Handling | Avoid breathing vapors and/or mists. Avoid contact with skin, eyes and clothing. |
| Storage | Store in a cool, well ventilated area. |

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

| | |
|--|------------------------------------|
| Occupational Exposure Standards | None established. |
| Engineering Control | Use only in well-ventilated areas. |

Measures

| | |
|-------------------------------|--|
| Respiratory Protection | Use NIOSH/MSHA approved air-purifying or air-fed respirator if recommended exposure limit is exceeded. Use self contained breathing apparatus for entry into confined space, for other poorly ventilated areas and for large spill clean-up sites. |
| Hand Protection | Chemical resistant gloves: Nitrile, Neoprene or PVC. |
| Eye Protection | Chemical splash goggles (chemical monogoggles). Wear face-shield in addition when transferring material. |
| Body Protection | Use protective clothing, which is chemical resistant to this material. Safety shoes or boots should be chemical resistant. |

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Physical state: light colorless to slightly hazy, light amber liquid

Odor: none

Odor Threshold: Not applicable

pH-value: 6 - 8

Melting/Freezing Point: < 25 °C

Initial Boiling Point & Range: Not available

Flash Point: > 200 °F

Evaporation Rate: Not available

Upper/Lower Explosion Limits: Not applicable

Vapor Pressure: Not available

Flammability: Not applicable

Vapor Density: Not available

Relative density: 1.11 - 1.19 (15.6°C)

Density: 9.26 - 9.93 lbs/gallon

Solubility: Dispersible in water

Partial coefficient (n-octanol/water): Not available

Auto-ignition Temperature: Not available

Decomposition Temperature: Not available

Viscosity: 2.6 cP at 40 °C

10. STABILITY AND REACTIVITY

Stability Stable under normal conditions of use.

Conditions To Avoid Excessive heat, sparks and open flames.

| | |
|---------------------------------------|--|
| Incompatible Materials | Strong oxidizing materials. Strong Lewis or mineral acids, Strong alkalis. |
| Thermal Decomposition Products | Oxides of carbon, carbon dioxide and water vapor. |

11. TOXICOLOGICAL INFORMATION

| | |
|------------------------------------|--|
| Basis for assessment | Information given is based on the toxicology of components in the mixture. |
| Skin irritation: | Expected to cause irritation |
| Eye irritation | Expected to cause irritation |
| Acute toxicity - Dermal | ND |
| Acute toxicity - Inhalation | Expected to cause irritation |
| Acute toxicity - Oral | ND |
| Repeated dose toxicity | ND. |
| Mutagenicity | ND. |
| Developmental toxicity | ND. |

12. ECOLOGICAL INFORMATION

| | |
|--|--|
| Basis for Assessment | Ecotoxicological data have not been determined specifically for this product. The information given below is based on knowledge of the components. |
| Mobility | Soluble in water |
| Persistence/degradability | ND |
| Bioaccumulation | ND |
| Freshwater Fish Toxicity | ND |
| Freshwater Invertebrates Toxicity | ND |
| Acute toxicity - algae | ND |
| Acute toxicity - bacteria | ND |

13. DISPOSAL CONSIDERATIONS

| | |
|---------------------------|---|
| Waste disposal | Dispose to licensed disposal contractor. Responsibility for proper waste disposal rests with the generator of the waste. |
| Container disposal | Dispose to licensed disposal contractor. |
| Local Legislation | The recommendations given are considered appropriate for safe disposal. However, local regulations may be more stringent and these must be complied with. |

14. TRANSPORT INFORMATION

| | |
|---------------------------|--------------------|
| DOT Classification | Not DOT regulated. |
|---------------------------|--------------------|

15. REGULATORY INFORMATION

INTERNATIONAL REGISTRATION:

| | |
|-----------------------|------------------------------------|
| TSCA (USA) | All components listed or exempted. |
| SARA Title III | No components listed. |

16. OTHER INFORMATION

| | |
|-----------------------|---|
| Abbreviations: | ND: No data available |
| Revisions: | 1/21/2012: Original version 9/22/2015: Updated SDS format 3/31/2018: Updated Formatting |
| Prepared by: | HSE Coordinator |

The information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since the information contained herein may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modification of the information, we do not assume any responsibility for the result of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Safety Data Sheet

Lube Force

SDS Revision Date: 02/21/2020

1. Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product Identity Lube Force
Alternate Names BioDegradable Drilling Lubricant

1.2. Relevant identified uses of the substance or mixture and uses advised against

Intended use Downhole Drilling Lubricant.
Application Method See Technical Data Sheet.

1.3. Details of the supplier of the safety data sheet

Company Name Right Turn Supply
P.O. Box 840
Pella, IA 50219, USA

Emergency

CHEMTREC (USA) (800) 424-9300
24 hour Emergency Telephone No. International +1-703-527-3887
Customer Service: Right Turn Supply (641-780-1953)

2. Hazard identification of the product

2.1. Classification of the substance or mixture

No applicable GHS categories.

2.2. Label elements

Using the Toxicity Data listed in section 11 and 12 the product is labeled as follows.

No applicable GHS categories.

[Prevention]:

No GHS prevention statements

[Response]:

No GHS response statements

[Storage]:

No GHS storage statements

[Disposal]:

No GHS disposal statements

Safety Data Sheet

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3. Composition/information on ingredients

This product contains the following substances that present a hazard within the meaning of the relevant State and Federal Hazardous Substances regulations.

| Ingredient/Chemical Designations | Weight % | GHS Classification | Notes |
|--|----------|--------------------|-------|
| Fatty acid CAS Number: 0061790-12-3 | 40-60% | Not Classified | [1] |
| Proprietary-Trade Secret CAS Number: 0090622-46-1 | 30-60% | Asp. Tox. 1;H304 | [1] |

[1] Substance classified with a health or environmental hazard.

[2] Substance with a workplace exposure limit.

[3] PBT-substance or vPvB-substance.

*The full texts of the phrases are shown in Section 16.

4. First aid measures

4.1. Description of first aid measures

| | |
|-------------------|--|
| General | In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person. |
| Inhalation | Remove to fresh air, keep patient warm and at rest. If breathing is irregular or stopped, give artificial respiration. If unconscious place in the recovery position and obtain immediate medical attention. Give nothing by mouth. |
| Eyes | Irrigate copiously with clean water for at least 15 minutes, holding the eyelids apart and seek medical attention. |
| Skin | Remove contaminated clothing. Wash skin thoroughly with soap and water or use a recognized skin cleanser. |
| Ingestion | Get Medical attention immediately. If swallowed, do not induce vomiting. If person is fully conscious, give water to drink. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head lower than hips to help prevent aspiration. |

4.2. Most important symptoms and effects, both acute and delayed

| | |
|-----------------|---|
| Overview | Inhalation: Liquid, no dust is generated in normal use. Skin: May be irritating to the skin with prolonged contact. Eye: May cause irritation to the eyes and could cause prolonged impairment of vision. Ingestion: Not anticipated route of exposure. If ingested may be irritating to mouth, throat and stomach. Exposure to solvent vapor concentrations from the component solvents in excess of the stated occupational exposure limits may result in adverse health effects such as mucous membrane and respiratory system irritation and adverse effects on the kidneys, liver and central nervous system. Symptoms include headache, nausea, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness. |
|-----------------|---|

Repeated or prolonged contact with the preparation may cause removal of natural fat from the skin resulting in dryness, irritation and possible non-allergic contact dermatitis. Solvents may also be absorbed through the skin. Splashes of liquid in the eyes may cause irritation and soreness with possible reversible damage. See section 2 for further details.

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SDS Revision Date: 02/21/2020

5. Fire-fighting measures

5.1. Extinguishing media

Dry chemical, foam, carbon dioxide and water fog.

5.2. Special hazards arising from the substance or mixture

Hazardous decomposition: High temperatures and fires may produce such toxic substances as carbon monoxide and carbon dioxide.

5.3. Advice for fire-fighters

Cool closed containers exposed to fire by spraying them with water. Do not allow run off water and contaminants from fire fighting to enter drains or water ways.

ERG Guide No. ----

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

6.2. Environmental precautions

None known.

6.3. Methods and material for containment and cleaning up

Collect and place in suitable container for reuse or disposal.

7. Handling and storage

7.1. Precautions for safe handling

See section 2 for further details. - [Prevention]:

7.2. Conditions for safe storage, including any incompatibilities

Keep from freezing, store in a cool dry place.

Handle containers carefully to prevent damage and spillage or accumulation of dust.

Incompatible materials: Strong oxidizing agents and acids.

See section 2 for further details. - [Storage]:

7.3. Specific end use(s)

No data available.

8. Exposure controls and personal protection

Safety Data Sheet

Lube Force

SDS Revision Date: 02/21/2020

8.1. Control parameters

Exposure

| CAS No. | Ingredient | Source | Value |
|--------------|--------------------------|----------|----------------------|
| 0061790-12-3 | Fatty acid | OSHA | No Established Limit |
| | | ACGIH | No Established Limit |
| | | NIOSH | No Established Limit |
| | | Supplier | No Established Limit |
| 0090622-46-1 | Proprietary-Trade Secret | OSHA | No Established Limit |
| | | ACGIH | No Established Limit |
| | | NIOSH | No Established Limit |
| | | Supplier | No Established Limit |

Carcinogen Data

| CAS No. | Ingredient | Source | Value |
|--------------|--------------------------|--------|--|
| 0061790-12-3 | Fatty acid | OSHA | Select Carcinogen: No |
| | | NTP | Known: No; Suspected: No |
| | | IARC | Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No; |
| 0090622-46-1 | Proprietary-Trade Secret | OSHA | Select Carcinogen: No |
| | | NTP | Known: No; Suspected: No |
| | | IARC | Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No; |

8.2. Exposure controls

Respiratory

If workers are exposed to concentrations above the exposure limit they must use the appropriate, certified respirators.

Eyes

Wear safety glasses or goggles with side shields. Maintain eye wash station in work area.

Skin

Overalls which cover the body, arms and legs should be worn. Skin should not be exposed. All parts of the body should be washed after contact.

Engineering Controls

Provide adequate ventilation. Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good general extraction. If these are not sufficient to maintain concentrations of particulates and any vapor below occupational exposure limits suitable respiratory protection must be worn.

Other Work Practices

Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

See section 2 for further details. - [Prevention];

9. Physical and chemical properties

Appearance

Brown/Black Liquid

Odor

None

Odor threshold

Not Measured

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| | |
|--|--|
| pH | 6.7 |
| Melting point / freezing point | Not Measured |
| Initial boiling point and boiling range | > 212F |
| Flash Point | > 600F |
| Evaporation rate (Ether = 1) | Not Applicable |
| Flammability (solid, gas) | Not Applicable |
| Upper/lower flammability or explosive limits | Lower Explosive Limit: Not Measured Upper Explosive Limit: Not Measured |
| Vapor pressure (Pa) | Not Measured |
| Vapor Density | Not Applicable |
| Specific Gravity | 0.9005-0.9305 g/cm ³ |
| Solubility in Water | Appreciable |
| Partition coefficient n-octanol/water (Log Kow) | Not Measured |
| Auto-ignition temperature | Not Measured |
| Decomposition temperature | Not Measured |
| Viscosity (cSt) | Not Measured |

9.2. Other information

No other relevant information.

10. Stability and reactivity

10.1. Reactivity

Hazardous Polymerization will not occur.

10.2. Chemical stability

Stable under normal circumstances.

10.3. Possibility of hazardous reactions

No data available.

10.4. Conditions to avoid

Excessive heat and open flame.

10.5. Incompatible materials

Strong oxidizing agents and acids.

10.6. Hazardous decomposition products

High temperatures and fires may produce such toxic substances as carbon monoxide and carbon dioxide.

11. Toxicological information

Acute toxicity

Exposure to solvent vapor concentrations from the component solvents in excess of the stated occupational exposure limits may result in adverse health effects such as mucous membrane and respiratory system irritation and adverse

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effects on the kidneys, liver and central nervous system. Symptoms include headache, nausea, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness.

Repeated or prolonged contact with the preparation may cause removal of natural fat from the skin resulting in dryness, irritation and possible non-allergic contact dermatitis. Solvents may also be absorbed through the skin. Splashes of liquid in the eyes may cause irritation and soreness with possible reversible damage.

| Ingredient | Oral LD50, mg/kg | Skin LD50, mg/kg | Inhalation Vapor LD50, mg/L/4hr | Inhalation Dust/Mist LD50, mg/L/4hr | Inhalation Gas LD50, ppm |
|---------------------------------------|-----------------------------|-------------------|---------------------------------|-------------------------------------|--------------------------|
| Fatty acid - (61790-12-3) | 3,200.00, Rat - Category: 5 | No data available | No data available | No data available | No data available |
| Proprietary (90622-46-1) Trade Secret | No data available | No data available | No data available | No data available | No data available |

Note: When no route specific LD50 data is available for an acute toxin, the converted acute toxicity point estimate was used in the calculation of the product's ATE (Acute Toxicity Estimate).

| Classification | Category | Hazard Description |
|-------------------------------|----------|--------------------|
| Acute toxicity (oral) | --- | Not Applicable |
| Acute toxicity (dermal) | --- | Not Applicable |
| Acute toxicity (inhalation) | --- | Not Applicable |
| Skin corrosion/irritation | --- | Not Applicable |
| Serious eye damage/irritation | --- | Not Applicable |
| Respiratory sensitization | --- | Not Applicable |
| Skin sensitization | --- | Not Applicable |
| Germ cell mutagenicity | --- | Not Applicable |
| Carcinogenicity | --- | Not Applicable |
| Reproductive toxicity | --- | Not Applicable |
| STOT-single exposure | --- | Not Applicable |
| STOT-repeated exposure | --- | Not Applicable |
| Aspiration hazard | --- | Not Applicable |

12. Ecological information

12.1. Toxicity

No additional information provided for this product. See Section 3 for chemical specific data.

Aquatic Ecotoxicity

| Ingredient | Americamysis bahia (Mycid Shrimp) | Microtox Threshold Level | ErC50 algae, mg/l |
|---------------------------|-----------------------------------|--------------------------|-------------------|
| Fatty acid - (61790-12-3) | 894,200 ppm | .Not Available | Not Available |

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| | | | |
|---------------------------------------|---------------|---------------|---------------|
| Proprietary (90622-46-1) Trade Secret | Not Available | Not Available | Not Available |
|---------------------------------------|---------------|---------------|---------------|

12.2. Persistence and degradability

This product is readily BioDegradable. 81% in 28 days

12.3. Bioaccumulative potential

Not Measured

12.4. Mobility in soil

No data available.

12.5. Results of PBT and vPvB assessment

This product contains no PBT/vPvB chemicals.

12.6. Other adverse effects

No data available.

13. Disposal considerations

13.1. Waste treatment methods

Observe all federal, state and local regulations when disposing of this substance.

14. Transport information

| | DOT (Domestic Surface Transportation) | IMO / IMDG (Ocean Transportation) | ICAO/IATA |
|---|--|---|----------------------------------|
| 14.1. UN number | Not Applicable | Not Regulated | Not Regulated |
| 14.2. UN proper shipping name | Not Regulated | Not Regulated | Not Regulated |
| 14.3. Transport hazard class(es) | DOT Hazard Class: Not Applicable DOT Label: --- | IMDG: Not Applicable Sub Class: Not Applicable | Air Class: Not Applicable |
| 14.4. Packing group | Not Applicable | Not Applicable | Not Applicable |
| 14.5. Environmental hazards | | | |
| IMDG | Marine Pollutant: No | | |
| 14.6. Special precautions for user | No further information | | |

15. Regulatory information

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| | |
|--|---|
| Regulatory Overview | The regulatory data in Section 15 is not intended to be all-inclusive, only selected regulations are represented. |
| Toxic Substance Control Act (TSCA) | All components of this material are either listed or exempt from listing on the TSCA Inventory. |
| WHMIS Classification | Not Regulated |
| US EPA Tier II Hazards | Fire: No Sudden Release of Pressure: No Reactive: No Immediate (Acute): No Delayed (Chronic): No |

EPCRA 311/312 Chemicals and RQs:

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

EPCRA 302 Extremely Hazardous :

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

EPCRA 313 Toxic Chemicals:

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Carcinogens (>0.0%):

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Developmental Toxins (>0.0%):

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Female Repro Toxins (>0.0%):

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Male Repro Toxins (>0.0%):

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

N.J. RTK Substances (>1%) :

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Penn RTK Substances (>1%):

Edible oil

16. Other information

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders.

The full text of the phrases appearing in section 3 is:

H304 May be harmful if swallowed and enters airways.

This is the first version in the GHS SDS format. Listings of changes from previous versions in other formats are not applicable.

The information and data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation and verification. Buyer assumes all risk of use, storage and

Safety Data Sheet

Lube Force

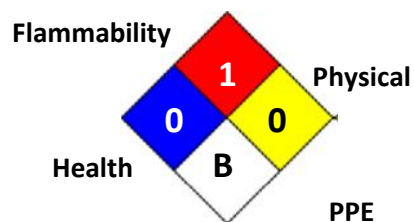
SDS Revision Date: 02/21/2020

handling of the product in compliance with applicable Federal, State and local law and regulations. Right Turn Supply makes no warranty of any kind, express or implied, concerning the accuracy or completeness of the information and data herein. The implied warranties of merchantability and fitness for a particular purpose are specifically excluded. Right Turn Supply will not be liable for claims relating to any use of this product.

Emergency Overview:

Risk Classification System:

| | |
|--------------|---|
| HEALTH | 0 |
| FLAMMABILITY | 1 |
| PHYSICAL | 0 |
| PPE | B |



End of Document

BIFROST CABLE DRILL BREAK AVOIDANCE & RESPONSE PLAN

Prepared for
Bifrost Subsea Fiber Optic Cable Project
Winema, Oregon Operations

February 10, 2023

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1. INTRODUCTION

The construction of the Bifrost Subsea Fiber Optic Cable Project (Project) includes the installation of a single steel landing pipe (LP) that will extend from on shore to a point in the ocean (**Figure 1**). This LP will be installed by use of horizontal directional drill (HDD) construction methods. Further detailed descriptions on this process and the LP are included in Ocean Shores Alteration Permit application.

While exceedingly rare, it is possible that during the HDD process, the LP can become jammed or break. This Drill Break Avoidance & Response Plan (Plan) details the measures that will be taken to help prevent the LP becoming stuck, broken, or unrecoverable. The Plan also includes those measures that will take place to attempt to recover a stuck or broken pipe as well as an abandonment plan should the pipe be unrecoverable. This Plan may be revised periodically.

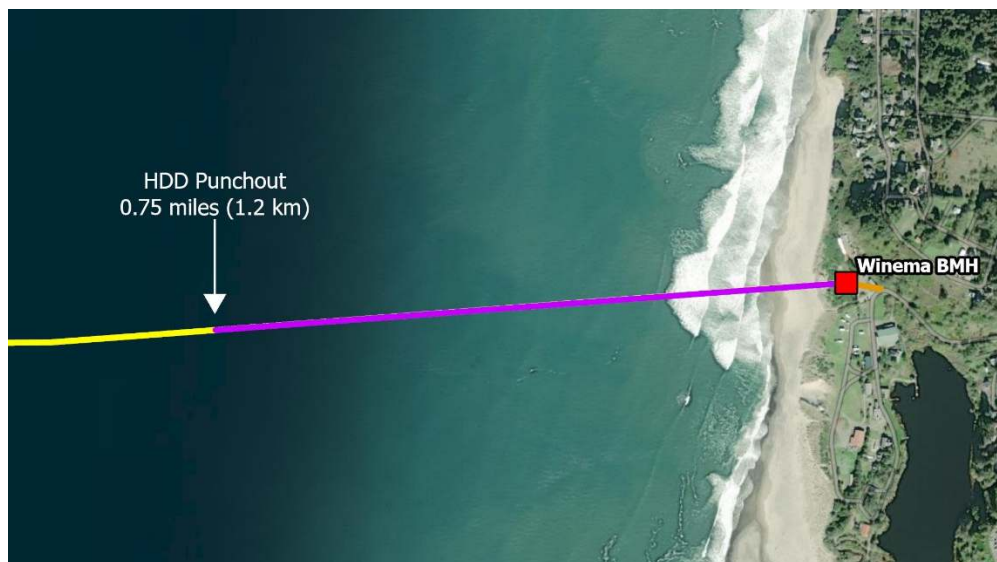


Figure 1: Bore extent from BMH to Exit Hole.

AMCS LLC (AMCS) prepared this Plan for the proposed Project in compliance with applicable environmental regulations, rules, and policies for federal and state authorities, including but not limited to the U.S. Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), Oregon Parks and Recreation Department (OPRD), and the Oregon Department of State Lands (DSL).

Pursuant to the OPRD Beach Construction/Alteration Standards (Chapter 736, Division 20), Rules 736-020-0005 (Factors Evaluated), 736-020-0010 (General Standards), 736-020-0015 (Scenic Standards), 736-020-0020 (Recreational Use Standards), 736-020-0025 (Safety Standards), and 736-020-0030 (Natural and Cultural Resource Standards), the inadvertent return contingency plan, beach void monitoring and response plan, and drill break avoidance and response plan are collectively intended to meet OPRD's standards for avoiding and minimizing potential impacts to the following public and natural resources: Physical Environment; Aesthetics; Public Access; Public Recreation; Public Safety; and Water Quality. Based on field surveys and publicly available literature, implementation of the Project would result in no impacts to the following additional resources under the purview of OPRD, pursuant to 736-020-0015 (Scenic Standards) and 736-020-0030 (Natural and Cultural Resource Standards): Key Natural Features; Shoreline Vegetation; Fish and Wildlife Resources; Historic, Cultural, and Archeological Sites; Navigation; and Areas of Geologic Interest.

2. BASELINE CONDITIONS AND DESIGN CONSIDERATIONS

To inform the engineering design and the HDD implementation, a detailed geophysical and geotechnical investigative surveys has been conducted to identify the sub-terrain along the proposed LP alignment. These surveys included both marine and terrestrial surveys:

1. Marine Surveys: The marine surveys included utilization of a seismic subbottom profiler to determine the seafloor conditions and Electronic Resistivity Tomography (ERT) to better understand the subsurface geomorphology. These data were collected in the ocean where the vessels can operate safely.
2. Terrestrial Survey: The terrestrial geotechnical surveys included the use of ERT, multichannel analysis of surface waves (MASW), sonar, and geophysical drill exploration. The ERT and MASW were conducted along the proposed LP alignment. The vertical drill was conducted near the planned entry point for the LP. The sonar was utilized down the horizontal drilled hole.

These data was compiled into a comprehensive geotechnical report that provides recommendations concerning LP specifications and HDD parameters. Based on the data collected, the following specification and design parameters have been incorporated into the project design:

- 1) Landing Pipe Specifications:
 - a) Pipe grade: E-75 or greater.
 - b) Size: Approximately 6- to 7-inch outside diameter at the joint.
 - c) Wall size (thickness): 0.3-inch or greater.
 - d) Torsional Strength: 60,000 feet below land surface or greater (35,000 or greater at the joint).
 - e) Tensile Strength: 500,000 pounds or greater.
- 2) Surface Casing.
 - a) Due to the changing nature of the geology confirmed via the geotechnical survey, it is expected that an additional temporary casing, called a “surface casing” (or “conductor casing”) will be likely be installed for the first portion of the bore. The casing will be approximately 18-20-inches in diameter and will be approximately 180 to 200-feet in length. It will enter cross the Statutory Vegetation Line approximately 110 feet westerly of the entry point and will be at a depth of approximately 20 feet. The temporary casing will terminate just westerly of the dunes at which point it will be 35 feet deep. The purpose of the casing is to provide a stable path for the LP as it is being installed beneath the softer, looser surface materials. The casing will keep the bore hole from collapsing in the softer earth materials and will keep a clear path for the drilling mud to be returned to the bore site.
 - b) Upon completion of the HDD operations and installation of the LP, the surface casing will be removed creating a void space around the LP. The void space is typically naturally filled in by the loose materials around the bore hole. Where the bore hole is relatively shallow and close to the surface and the overburden is loose, it is possible that the void space can migrate to the surface as a result of sand collapsing into the void. This potential void space will be monitored and mitigated as described in the accompanying Beach Void Monitoring and Response Plan prepared for the Project.

3. DRILL BREAK AVOIDANCE MEASURES

The results from the geophysical survey was used to inform HDD engineering to prepare for drilling through interchanging formations of soft and hard materials expected to be encountered. The geotechnical report provides information allowing the driller to:

- Adjust penetration rates according to the identified formations.
- Slow down prior to approaching hard formations.

- Stop the drill upon encountering hard formations and if necessary, switch out tooling to drill account for the harder or softer formation.
- Adjust drilling fluid properties according to the formations.
- Determine what additional rock drill bits, mud-motor or other equipment to have on-site.
- Pre-stage drill break response materials and equipment to have on site (see Section 4).

4. DRILL BREAK RESPONSE MEASURES

This section describes the measures that will be implemented in the unlikely event that the drill string or drill head is broken (i.e., “drill break”) during the HDD process. A drill break can occur in conditions where the bore head becomes stuck or wedged against the down-hole formation and the efforts to free the pipe cause the bore pipe or bore head to break.

4.1 Immediate Notification

In the event of a drill break during HDD operations, a designated Project representative (e.g., contractor or subcontractor) will notify the individuals listed in **Table 1** by phone and/or e-mail within twenty-four (24) hours of the occurrence of the break (the “Initial Notification”).

Following the Initial Notification, the designated Project representative will submit a written report regarding the incident (the “Preliminary Report”) to the same individuals within three (3) business days following the occurrence of the break. The Preliminary Report will provide the following:

- Description of the break, including the date, time, location of drill head relative to the punch in location, and other material details regarding the break.
- Description of the suspected root cause of the break.
- Description of the immediate responsive action taken on-site.
- Description of the corrective actions taken to preclude recurrence of the break and to prevent similar occurrences involving similar components or systems.
- A copy of the Daily Progress Report from the date of the incident.
- Summary of all the third parties/agencies notified and preliminary responses from those parties.

Table 1: List of Agency Contacts

| Agency | Point of Contact | Contact Information |
|---------------------------------------|--|---|
| US Army Corps of Engineers | Kinsey Friesen | Kinsey.M.Friesen@usace.army.mil Cell: 503-577-8298 |
| Oregon Dept. of State Lands | Dario Frisone | Dario.Frisone@dsl.oregon.gov Cell: (503) 302-6094 |
| Oregon Parks and Recreation Dept. | Kevin Herkamp and Tyler Blanchette | Kevin.A.Herkamp@opr.oregon.gov Cell: (971) 376-1509 and Tyler.blanchette@opr.oregon.gov Cell: (503) 510-6741 |
| Oregon Dept. of Environmental Quality | Haley Teach | Haley.teach@deq.state.or.us Cell: (503) 702-9753 |
| Tillamook County | Sarah Absher | sabsher@co.tillamook.or.us Office: (503) 842-3408 x3317 |

4.2 Corrective Actions

In the event of a drill break, the following corrective actions will be taken:

- All HDD operations will stop immediately.
- The HDD operator will recover the remaining drilling assembly attached to the HDD machine back to the drill site. The length of recovered drill pipe will be recorded.
- The drill pipe will be fitted with a tool, known as a “fishing tool” (**Figure 2**), that is designed to follow the bore hole to the down-hole break location. Fishing tools use the principle of one-way grip designed to slide over the broken drill string and latch on to the broken drill pipe.
- The HDD operator will guide the fishing tool back down the hole to the severed end of the drill pipe and attempt to attach it to the pipe.
- If the fish tool can be successfully attached to the pipe the HDD operator will attempt to recover the remainder of the drill broken drill string.
- If the broken drill string is successfully recovered, the HDD operator will determine if the existing bore hole is fully reusable, partially reusable, or not reusable.
 - Fully Reusable: This means the HDD operator will continue the HDD operation using the same bore hole in its entirety.
 - Partially Reusable: This means a portion of, or majority of, the existing bore hole can be reused but at some point, the HDD operator will divert the bore head to start cutting a new bore hole.
 - Not Reusable: This means the entire bore hole would be abandoned (See abandonment plan below) and a new bore hole will be commenced.
- If the broken drill string is not successfully recovered, the bore hole will be abandoned and a new bore hole started.
- The HDD operator will contain any released drilling mud (see Section 6).
- The HDD operator will create an incident report that documents the break and that includes photographs of the break and details regarding the break, such as location, activity in progress, drilling parameters, personnel involved, and mitigating actions to be taken. This incident report will be created and provided to agencies listed in **Table 1** within 7 days of the incident.



Figure 2: Examples of Fishing Tools

5. BORE HOLE ABANDONMENT PLAN

If the bore hole must be abandoned, the bore hole will be filled with grout in accordance with the Oregon of Water Resources Department Chapter 690, Division 210, Section 310

<https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=178819>.

The HDD operator will:

- Prepare the appropriate grout mixture in accordance with 690-210-0131 as sited above.
- Mobilize a grout pump and mixer truck to the site.
- Pump grout downhole until it is seen coming back to the surface at the bore hole entrance.
- Remove and clean up any excess grout leaving the grout line approximately 1-foot below natural grade.
- Fill the remaining 1-foot with topsoil.

6. DRILLING MUD RELEASE

Terrestrial Inadvertent Return

The drill operator will be equipped with a tracked hydraulic excavator, straw or hay bales, stakes to secure bails, silt fence, sandbags, shovels, pumps, and any other materials or equipment necessary to contain and clean up inadvertent releases of drilling mud caused by a drill break. Drill operator will position barriers to keep any inadvertent release on Lot 6200 or the beach from reaching to the ocean shore. **For additional information on inadvertent returns and responses please see the accompanying *Inadvertent Return Contingency Plan*.**

7. EQUIPMENT NEEDED & BEACH ACCESS

It is highly unlikely that vehicle access on the beach would be necessary due to the designed depth of the bore pipe as it crosses under the beach. However, it is possible that certain survey or locational equipment and vehicles may need to access the beach.

Vehicles that may be necessary to drive onto the beach include a pickup truck, utility work truck and front-end loader. Access to the beach would be from the existing public parking lot located at the end of Winema Road as shown in **Figure 3**. The sand is expected to be compact enough for Project contractors to operate on the beach safely, however, if the beach sand is super loose and not compacted, they may have to mat a pathway to the site with standard 6-foot by 12-foot timber mats to allow the equipment to access it.



Figure 3: Vehicle Access to Beach (If needed)

BIFROST CABLE BEACH VOID MONITORING & RESPONSE PLAN

Prepared for
Bifrost Subsea Fiber Optic Cable Project
Winema, Oregon Operations

February 10, 2023

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1. INTRODUCTION

The construction of the Bifrost Subsea Fiber Optic Cable Project (Project) includes the installation of a single steel landing pipe (LP) that will extend from on shore to a point in the ocean (**Figure 1**). This LP will be installed by use of horizontal directional drill (HDD) construction methods. Further detailed descriptions on this process and the LP are included in Ocean Shores Alteration Permit application.

While exceedingly rare, it is possible that beach voids (or “sinkholes”) may occur after HDD construction is conducted. Beach voids may be the result of sand collapsing into the space created by the removal of the casing that would be used during the installation of the permanent bore pipe that would house the Bifrost cable. This Beach Void Monitoring and Response Plan (Plan) details the measures that will be taken to monitor for beach voids and address them as necessary.

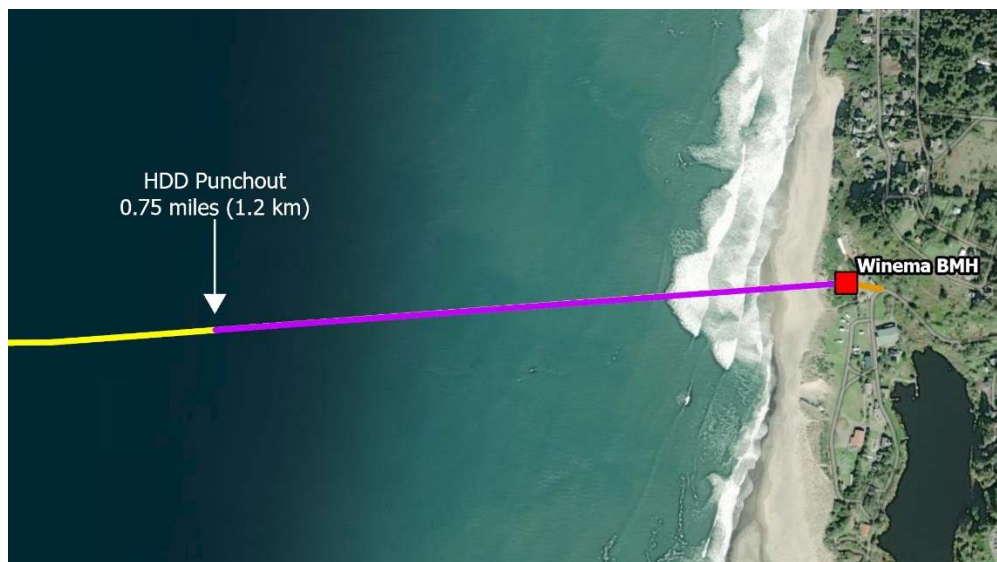


Figure 1: Bore Extent from BMH to Exit Hole.

This plan was prepared for the proposed Project in compliance with applicable environmental regulations, rules, and policies for federal and state authorities, including but not limited to the U.S. Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), OPRD, and the Oregon Department of State Lands (DSL).

Pursuant to the OPRD Beach Construction/Alteration Standards (Chapter 736, Division 20), Rules 736-020-0005 (Factors Evaluated), 736-020-0010 (General Standards), 736-020-0015 (Scenic Standards), 736-020-0020 (Recreational Use Standards), 736-020-0025 (Safety Standards), and 736-020-0030 (Natural and Cultural Resource Standards), the inadvertent return contingency plan, beach void monitoring and response plan, and drill break avoidance and response plan are collectively intended to meet OPRD’s standards for avoiding and minimizing potential impacts to the following public and natural resources: Physical Environment; Aesthetics; Public Access; Public Recreation; Public Safety; and Water Quality. Based on field surveys and publicly available literature, implementation of the Project would result in no impacts to the following additional resources under the purview of OPRD, pursuant to 736-020-0015 (Scenic Standards) and 736-020-0030 (Natural and Cultural Resource Standards): Key Natural Features; Shoreline Vegetation; Fish and Wildlife Resources; Historic, Cultural, and Archeological Sites; Navigation; and Areas of Geologic Interest.

2. CONSTRUCTION ELEMENTS – SURFACE CASING

Due to the changing nature of the geology confirmed via the geotechnical survey, it is expected that an additional temporary casing, called a “surface casing” (or “conductor casing”) will be likely be installed for the first portion of the bore. The casing will be approximately 18-20 inches in diameter and will be between 180 and 200 feet in length. It will enter cross the Statutory Vegetation Line approximately 110 feet westerly of the entry point and will be at a depth of approximately 20 feet. The temporary casing will terminate just westerly of the dunes at which point it will be 35 feet deep. The purpose of the casing is to provide a stable path for the LP as it is being installed beneath the softer, looser surface materials. The casing will keep the bore hole from collapsing in the softer earth materials and will keep a clear path for the drilling mud to be returned to the bore site.

Upon completion of the HDD operations and installation of the LP, the surface casing will be removed, as described in the Drill Break Avoidance and Response Plan, creating a void space around the LP. The void space is typically naturally filled in by the loose materials around the bore hole. The materials above the hole will naturally bridge and thus there is no visual evidence at the surface. However, where the bore hole is relatively shallow and the overburden is loose, it is possible that the void space can migrate to the surface because of sand collapsing into the void.

Further, during high tides, seawater can saturate the sand and cause the sand to flow into any spaces created during removal of the 18–20-inch guide casing. This saturation could lead to the collapse of the sand above the former casing location and potentially create surface voids. The material is sand so if a sinkhole should occur the sand may naturally settle in around the void. Project contractors would add additional sand by shovel from the adjacent beach as needed. The geophysical survey of the beach area west of Lot 6200 conducted in May-June 2022 did not detect any voids along the proposed bore pipe route.

3. MONITORING AND RESPONSE

Upon completion of the HDD operations (~September-October 2023), removal of the temporary casing, and prior to landing the Bifrost cable (~April 2024), the beach area along the LP path will be visually inspected by foot for the presence of Project-related sink holes. Inspections will occur daily for the first seven (7) days after the surface casing is removed, then weekly for a total of four (4) weeks then monthly for a total of six (6) months from then the temporary casing was removed. The monitor will record the date and time of the monitoring event and any findings.

4. NOTIFICATIONS AND RESPONSE

4.1 Notification

In the event of the identification of a sink hole, the Project representative will immediately notify the ODPR representative by email and/or phone call. A written report or email to OPRD will be provided within three (3) business days of the discovery. The report will provide at least the following information:

- Description of observed sink hole including size, diameter, and location on the beach,
- Photo(s) of the observed sinkhole,
- Immediate responsive action taken onsite, and
- Any further corrective action to be undertaken.

If additional corrective actions are necessary, a final report or email describing the actions taken will be submitted upon completion of the repair.

4.2 Repair or Corrective Actions

If a report is received detailing that voids have formed in the sand, a designated Project representative, contractor, or subcontractor will take immediate action to repair the void by backfilling with sand from the immediate area. The area will be secured with cones, signage, temporary fencing, or warning tape as necessary to protect the public from entering the area (“Safety Warning”). These actions will be communicated to OPRD (Kevin Herkamp; [971 376-1509 / Kevin.A.Herkamp@opr.oregon.gov] and Tyler Blanchette [503 510-6741; tyler.blanchette@opr.oregon.gov]).

A project team contact list including the Applicant (AMCS), HDD Contractor (the HDD Company), and the General Contractor (Alcatel Submarine Networks [ASN]) is provided in **Table 1**, below.

Table 1. Project Team Representative Contact List

| Company Name | Point of Contact | Project Role | Contact Information |
|--------------------------|------------------|------------------------|---------------------|
| AMCS (Applicant) | TBD | Representative | TBD |
| HDD Company | TBD | Project Superintendent | TBD |
| ASN (General Contractor) | TBD | On-site Representative | TBD |

After installation of the “Safety Warning” and initial notifications are made, the on-site crew will take the appropriate corrective action. The corrective action will depend on the size and nature of the observed sink hole(s).

If a void is less than three (3) feet in diameter at its widest point and less than three (3) feet deep, the void will be filled by hand/shovel upon discovery using beach sand material immediately adjacent to the void. If a void is three (3) or more feet in diameter at its widest point and more than three (3) feet deep, the Project team will immediately fill in the void by hand and then follow up with additional sand compaction in the beach area west of Lot 6200. Sand material used to fill the void space will be collected from the surrounding beach area by scraping thin layers of the surface sand so as not to leave a depression.

Following completion of any corrective action, the Project team will submit a written report (“Response Report”) to OPRD within three (3) days describing the results of the corrective action and any modification to the resumed monitoring.

5. EQUIPMENT NEEDED

It is expected that sink holes, if found will be able to be repaired using hand tools such as shovels and rakes. For sink holes larger than three (3) feet in diameter at its widest point or more than three (3) feet deep at its deepest point, a mechanical compactor will need to be used. This will be a self-powered tamper that is operated by one (1) person. It would be brought to the site by a standard pickup/work truck.

Though it is extremely unlikely, it is possible that additional clean (i.e., inert and free of pollutants) sand would need to be brought into the site to address sinkhole(s). If so, it will be necessary to use a small front-end loader (i.e., a bobcat) to deliver the sand to the sinkhole. The sand would be supplied by a small dump truck to the HDD site. From there the front-end loader would deliver the sand to the sink hole and compact it. Note, however, that on-site sources on the beach would be utilized to the greatest extent possible.

Vehicles that may be necessary to drive onto the beach include a pickup truck, utility work truck and/or front-end loader. Access to the beach would be from the existing public parking lot located at the end of Winema Road as shown in **Figure 2** below.



Figure 2: Vehicle Access to Beach (If needed)

Appendix 7
Archeological Report

State Historic Preservation Office Report Cover Page

Year:

Title:

Author(s):

Agency/Client:

District/Contractor:

Agency/Client Report#:

Project Acres:

Survey Acres:

County(ies):

Township:

Range:

Section(s):

Township:

Range:

Section(s):

Archaeological Permit Number(s):

Accession Number:

Reports submitted to:

Tribes:

UOMNCH:

LCIS:

Curation:

Report Addresses Testing:

Have tribes been contacted or consulted?

List tribes:

List any other groups contacted or consulted:

Report is associated with: PA

MOA

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**RESULTS OF A CULTURAL RESOURCES STUDY OF
AMAZON WEB SERVICES' WINEMA ROAD FIBER OPTIC
CABLE INSTALLATION PROJECT,
TILLAMOOK COUNTY, OREGON**



By

Bill R. Roulette, M.A., RPA

Prepared for
Astound Broadband
Newport, Oregon

June 29, 2022

APPLIED ARCHAEOLOGICAL RESEARCH, INC. REPORT NO. 2576



**APPLIED
ARCHAEOLOGICAL
RESEARCH, INC.**
Cultural Resource Management and Historic Preservation

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INTRODUCTION

Project Description

AMCS LLC, an affiliate of Amazon Web Services (AWS) proposes to land a submarine cable on the Oregon coast in Tillamook County (Figure 1). Once on shore, the cable will be installed underground along an approximately 0.4-mile section of Winema Road. A short length of cable would diverge from the main installation and extend to a church camp near the where the cable comes ashore. Establishing the onshore connection and extending the cable to the cable landing station (CLS) will involve excavations that have potential to impact cultural resources if they are present. A beach manhole (BMH) and two ocean ground beds (OGBs) will be installed where the cable comes ashore (Figure 2). To install the BMH will require the excavation of a small pit measuring approximately 4-x-4-feet (ft). The installation of OGBs will require excavation of narrow trenches from the BMH to the beds and where the anodes are to be buried. The trenches would be about 2 ft wide and up to 5 ft deep.

From where it comes ashore to the CLS the cable will be installed underground via directional boring. Installation will require the excavation of five pits for vaults to be placed into the public right of way on the north side of Winema Road. Vault pits typically will measure approximately 6 by 8 ft and would be about 4 ft deep. They will be 5 ft or less from the edge of pavement. A sixth vault will be installed at the CLS that is to be located on the south side of Winema Road at its intersection with Otzen Road. The CLS will contain a paved driveway/parking area, additional grounding beds, and infrastructure required to operate the system.

Project Compliance and Staffing

The landing of the cable on the Oregon coast requires a joint permit application (JPA) between the project proponent, the Oregon Department of State Lands, and the United States Army Corp of Engineers (ACOE). In addition, the construction and operation of the cable requires a license from the Federal Communications Commission. The need for federal permits makes the part of the project an undertaking of the federal government and as such subject to the requirements of Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800 (Section 106), which requires the lead federal agency, assumed to be the ACOE, to make a good faith effort to locate historic properties in the project area of potential effects (APE). Astound Broadband, the contractor for the project, contracted with Applied Archaeological Research, Inc. (AAR) to conduct a study that would assist the lead agency at such time the project comes under its jurisdiction, in fulfilling its Section 106 obligations related to the terrestrial part of the project in Oregon. This report describes the results of AAR's study. It has been prepared by Bill R. Roulette, M.A., RPA 11132. Julie Wilt, M.S., assisted with background research, and Laura De Simone, M.S., assisted with the fieldwork.

Tribal Consultation

Official consultation with affected tribes will be done by the lead federal agency. For AAR's project, an informational email was prepared that described the project and which included a request for information regarding tribal concerns related to it. A map accompanied the email that showed the APE. The email was sent on June 13, 2022, to the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw; Confederated Tribes of Grand Ronde; Confederated Tribes of Siletz; Coquille Indian Tribe; and the Cow Creek Band of the Umpqua Tribe of Indians. Kassandra Rippee, the Tribal Historic Preservation Officer of the Coquille Indian Tribe, responded and stated that she would defer to other tribes. The email was sent to an obsolete address for the Cow Creek Band of the Umpqua Tribe of Indians. Kassandra Rippee forwarded the email to the correct person at the tribe, Jennifer Bryant, Cultural Resources Program Manager. Jennifer Bryant responded that she would review the information provided by AAR. No other comments were received.

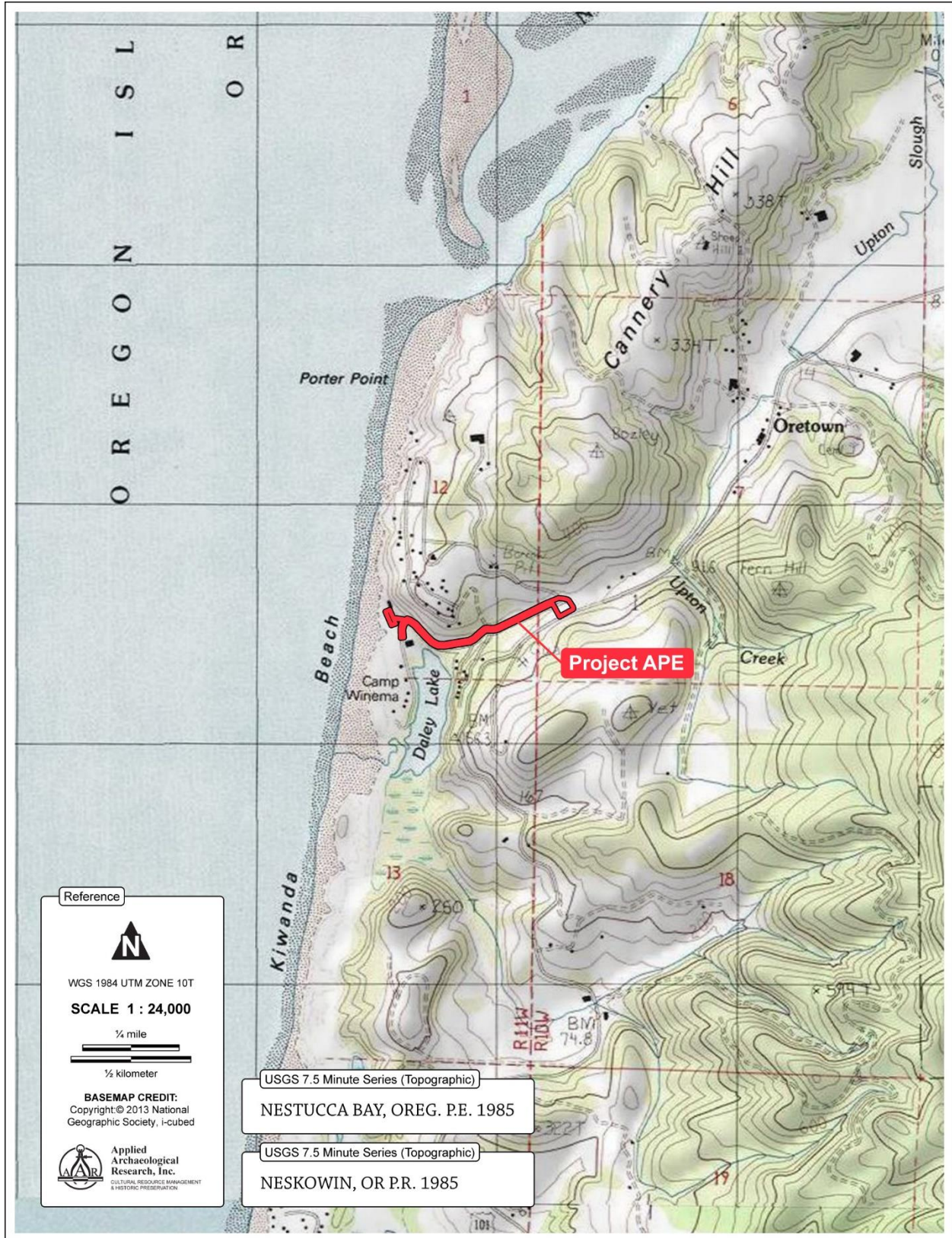


Figure 1. Topographic map showing the project APE location.

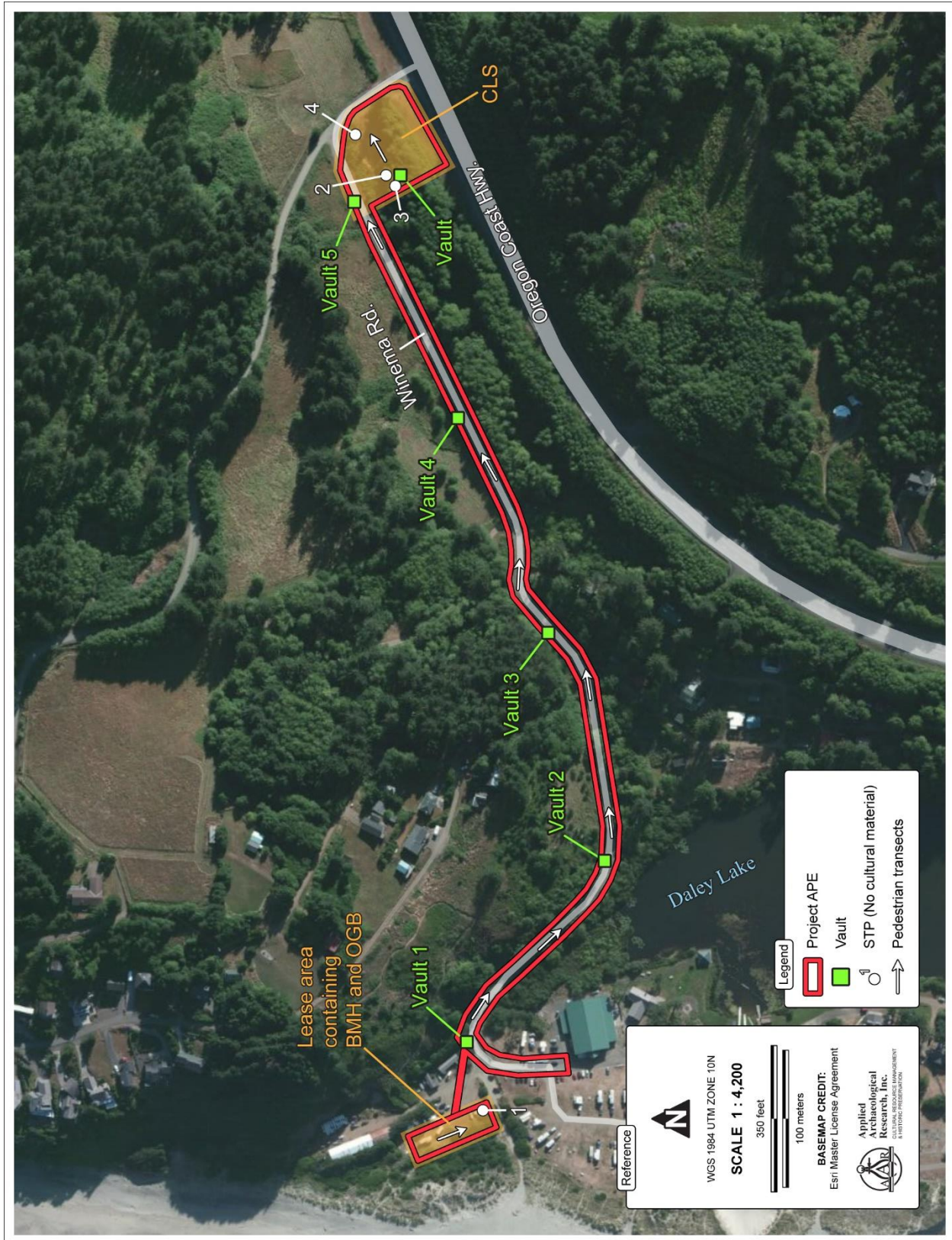


Figure 2. Aerial photomap showing the project APE, shovel test probes (STPs), and pedestrian transects.

APE Description

The APE defined for the project is in Section 12, Township 5 South, Range 11 West, Willamette Meridian (WM) and Section 7, Township 5 South, Range 10 West, WM. It begins in a privately owned rectangular lease area that measures around 200 by 60 ft and encompasses 0.27 acre. The lease area is improved to facilitate recreational vehicle camping. The BMH and the OGBs will be installed in the lease area. From there the installation route extends a short distance eastward along Winema Road and splits with one branch extending southward about 230 ft to a church camp built around Winema Lake. Another branch follows Winema Road generally eastward for approximately 0.4 mile to the CLS. Along roads, the APE is defined as the width of the roadbed plus 10 ft on either side. The CLS is privately owned. It is largely rectangular in shape that measures 154 by 292 ft and encompasses 1.03 acres. In all, the APE includes 3.73 acres. Elevations in the APE range from about 20 ft above mean sea level (amsl) at the lease area to ca. 120 ft amsl at the CLS.

Conventions

Measurements used in this report to express common distances, elevations, and areas are in United States customary units. Measurements related to archaeological techniques are in metric units. Numbers in the thousands used to express ages and distances feature commas to denote thousands. Calendar dates and dates used to express years before present (B.P.) do not use commas to denote the thousands place but do use commas to denote ages of 10,000 B.P. and greater. Modern, common names without taxonomic equivalents are used when listing plants and animals.

ENVIRONMENTAL, ARCHAEOLOGICAL, AND CULTURAL OVERVIEW

Environmental Overview

The cable would come ashore on the coastal plain just east of Winema Beach. In Oregon, the coastal plain consists of a long, narrow zone between the open ocean and the Coast Range (Franklin and Dyrness 1973). It is particularly narrow in the APE vicinity. Winema Lake, just to the south of the landing site, sits in a swale in a stable sand dune field. It is fed by an unnamed stream that flows from the west face of the Coast Range. The old dune field is backed by a steep riser that ascends to the range.

The shape and configuration of the coastal plain has been influenced to an unknown extent by tectonic activity. At least 11 earthquakes during the Holocene along the Oregon coast have resulted in differential subsidence, uplift, sedimentation, and erosion along the coast (Charland and Reckendorf 1998:5-14). The last large quake occurred approximately 300 years ago (Atwater et al. 2005).

Beyond the plain, the remainder of the installation route traverses south-facing slopes on Cannery Hill in the Coast Range. The hill is a spur that is separated from the main mass of the Coast Range by a shallow saddle that likely marks the course of a former drainage. The Coast Range is a narrow belt of moderately high mountains and coastal headlands extending from the Columbia River on the north to the Middle Fork of the Coquille River on the south. The range has been described as "simply a big slab of sea floor raised high and dry, tilted ever so gently eastward, and broken up a bit by a few faults" (Alt and Hyndman 1992:71). Uplift of the sea floor began during the Miocene, a period of prolific volcanism that produced the lava flows of eastern Oregon as the ocean retreated to the west (Orr et al. 1992:169). During the subsequent Pliocene and Pleistocene epochs erosion shaped the mountains and rivers and streams cut drainages that give the range its characteristic dissected appearance.

Overall, the installation route is within the Sitka spruce forest zone that is found on the coastal plain and areas inland to an elevation of 500 ft amsl. Intermixed into this zone are unique habitats that

include sand dune and strand communities and herb-and-shrub-dominated communities (Franklin and Dyrness 1973:291). Major tree species of the Sitka spruce forest zone include Sitka spruce, western hemlock, Douglas-fir, western redcedar, and red alder, although closer to the coast, lodgepole, or shore pine, may dominate. Understory vegetation is dense and includes a variety of shrubs, herbs, and ferns including sword fern, wood sorrel, red and evergreen huckleberry, salal, red elderberry, and western rhododendron. Sand dune and strand communities are dominated by colonizing species including a variety of herbaceous species, such as beach peavine and beach silvertop, sedges and grasses, including bighead sedge and seashore bluegrass, and trailing coast morning glory. A common species in this community is European beachgrass, which was introduced to help stabilize dunes fields in the late 1800s, but which now is a naturalized species (Franklin and Dyrness 1973:291). Shrub communities can contain tightly packed and extremely dense vegetation often dominated by salal, evergreen huckleberry, wax myrtle, rhododendron, and kinnikinnick.

Terrestrial mammals found or formerly found in the APE include deer and elk, coyote, black bear, mountain lion, bobcat, beaver, snowshoe hare, raccoon, weasels, minks, martens, and skunks. Bird species found in the area are numerous and include varieties of blue and ruffed grouse, mountain quail, and owls such as the great horned and long-eared owls (Bailey 1936).

Surficial sediments mapped at the landing site and along the section of the installation route to the church camp are described as Active Dunes (Bowlsby and Swanson 1964, sheet 33). This type of deposit consists of wind-drifted sand in the form of dunes, ridges, or hummocks. The section of the route along Winema Road to the CLS begins with a short steep slope as the road climbs the toeslope of Cannery Hill. The soil mapped in that section of the route is Neskowin silty clay loam, 40 to 60 percent slopes. It is found on moderately to very steep uplands near Oretown and Neskowin. It formed in residuum weathered from igneous rocks (Bowlsby and Swanson 1964:48). The soil mapped along the section of route on the sideslope of Cannery Hill and at the CLS is Hembre silt loam, 3 to 12 percent slopes. It also is limited to upland settings and formed in basic igneous rocks (Bowlsby and Swanson 1964:44).

Archaeological Context

For the current study it is necessary only to describe the prehistory of the Pacific Coast in general outline. Based on changes in human-to-land relations, technology, and human organization, among other factors, four main periods can be defined. They are described below.

Archaic (11,000-5500 B.P.)

People have made the Oregon coast their home for thousands of years, but the dynamic nature of the coast has hindered the discovery of older archaeological sites in the region. Isostatic rebound from glacial melting, erosion, and tectonic events have all led to the destruction or burial of many of the earliest sites (Aikens et al. 2011:218-219). Nevertheless, some older sites have been documented that date to the Terminal Pleistocene/Early Holocene, such as 35CS9, south of the APE in Coos County. The site has been dated to ca. 11,000 B.P. and excavations there suggests use of the locale for several millennia (Hall et al. 2005). A slightly younger site, the Tahkenitch Landing site (35DO130), in Douglas County, contains three cultural components one of which, Component I is dated to between 8000 and 5200 B.P. Subsequent components are dated to ca. 5200-3000 B.P., and to around 3000 B.P. Use of the site appears to have peaked during the second component and to have dwindled over time. It continued at least intermittently into the historic period when it functioned as a canoe landing (Minor and Toepel 1986).

On the northern Oregon coast, Archaic sites are assigned to the Youngs River Complex and contain shouldered and leaf shaped points. They are found on high terraces near the mouth of the

Columbia River. Human groups from this era were mobile and had a broad-spectrum foraging lifeway (Ames and Maschner 1999:67; Minor 1983, 1984).

Early Pacific (5500-3500 B.P.)

The beginning of the Early Pacific period coincides roughly with cooler and wetter environmental conditions (Ames and Maschner 1999:83) and sea level stabilization along the Oregon coast (Lyman 1991:80). Archaeological sites from this period typically contain lanceolate projectile points and scrapers. Bone tools increase in frequency and diversity of forms compared to preceding period assemblages, but this may be in part a function of preservation (Lyman 1991:80). While a diverse suite of resources was used during this period, suggesting a continuation of the broad-spectrum foraging adaptation seen in the Archaic period, resources captured or harvested in the intertidal and coastal zones, including sea mammals, increased in importance. Lyman (1991:80) calls this period the early Littoral to emphasize the apparent increase in exploitation of coastal resources concomitant with sea level stabilization. Increased biological diversity and productivity related to sea level stabilization and the development of estuaries was followed by increased sedentism by prehistoric populations and some increased logistical organization.

Middle Pacific (3500-1500 B.P.)

On the Oregon coast, the first village appears during this period and shell middens become much larger than in the preceding period indicating a greater degree of residential sedentism or site reuse (Ames and Maschner 1999). At the same time, a variety of site types are recognized, suggesting increasing logistical organization of economic activities. More use of storage technology is evident, as is intensification of salmon in some areas (Ames and Maschner 1999:108). More types of bone and antler tools appear in assemblages, including unilaterally barbed harpoons and multipart tools such as the composite toggling harpoon (Ross 1990:555).

Late Pacific (1500-200 B.P.)

Modern climatic conditions were in place by 2000 B.P. On the Northwest Coast generally, the Native American lifeways seen at the time of European and American contact were fully in place by the beginning of this period. Settlement patterns seen archaeologically suggest a developed system of logistical movements with winter villages located around estuaries and a variety of field camps where economic resources were procured and processed in bulk. Faunal remains are highly variable in Late Pacific sites and a wide array of bone and flaked stone tools is found.

Ethnographic Overview

At the time of Euroamerican contact, the APE was within the homeland of the Nestucca Indians, a Salish-speaking people. The Nestucca occupied the region between Cape Lookout and Cascade Head, primarily living around Sand Lake, Nestucca Bay, and Neskowin. The Nestucca were a subdivision of the Tillamook Indians, who occupied the river valleys along the coast from Tillamook Head south to the Siletz River.

Like other Tillamook groups, the Nestucca lived in permanent, mostly politically autonomous winter villages, dispersing in the spring, summer, and fall to more distant locations to gather and process resources for storage and later consumption (Seaburg and Miller 1990). Winter villages were usually located at the mouths or confluences of major rivers, but also along the shores of estuaries and bays (Jacobs 2003:2; Seaburg and Miller 1990:561). Houses were rectangular, made of upright cedar plank walls and gabled roofs, and included both semi-subterranean and aboveground styles (Jacobs 2003:2; Seaburg and Miller 1990:561). House interiors usually featured a central fire pit and raised sleeping

platforms along the sides (Seaburg and Miller 1990:561). Floors were covered with mats and goods were stored in baskets under the platforms or hung from the house rafters for smoking and drying. Besides houses, villages had sweat lodges, menstrual huts, and cemeteries.

Subsidiary residential sites were occupied seasonally from late spring to late autumn at fishing, hunting, and plant gathering sites. Structures were sometimes constructed at these locations but were not as substantial as winter houses (Jacobs 2003:2-3). These secondary sites were the centers of resource procurement and processing and likely featured hearths, ovens, drying racks, and associated artifacts, depending on the specific resources and range of activities. Fish weirs and traps were often constructed to trap fish in areas of shallow water where they were easier to catch (Sauter and Johnson 1974:54). However, such subsidiary sites were open to the community, as well as to outsiders (Jacobs 2003, Sauter and Johnson 1974).

The historical Nestucca villages nearest the APE were to the north. One was on the east side of the Nestucca River in Pacific City. The other was on bay side of North Spit (Sauter and Johnson 1974). Other Nestucca villages and campsites are reported to have been located around Nestucca Bay, on the western edge of Sand Lake, at Tierra del Mar, along the Nestucca River near the present town of Woods, and near Neskowin, where Hawk and Slab creeks meet (Sauter and Johnson 1974:175-177). Stella Falls, located on the Little Nestucca River, was an especially productive fishing site due to the narrowing river and height of the falls (Sauter and Johnson 1974:175).

Fish, roots, berries, terrestrial and sea mammals, and shellfish formed the basis of the Nestucca subsistence (Jacobs 2003:75, 80-81; Seaburg and Miller 1990:562). Resources were taken when available and either consumed directly or processed and stored for future use. In the spring salmonberry sprouts were gathered and camas, huckleberries, and salalberries were collected and processed for storage during the early summer. Some roots such as fern, lily, and wild carrots were collected in the winter months (Jacobs 2003:80-81). Men hunted alone year-round, and groups of men hunted together during the fall elk season. Bow and arrow, spear, traps, and pitfalls were used to capture and kill elk, deer, bear, beaver, muskrat, and other small mammals (Jacobs 2003:75). Sea mammals such as sea lion and seals were hunted, and shellfish were gathered and dried. Fresh and saltwater fish were widely used, and salmon was an important staple. Salmon were taken from August through December (Seaburg and Miller 1990:564).

Like other Tillamook peoples, Nestucca society had free and slave classes with a fluid ranking in the free class based on acquisition of spirit powers (Jacobs 2003:96). Each village had a headman, but leadership was often a looser, task-related responsibility (Seaburg and Miller 1990:565) with knowledgeable individuals taking the lead in specific tasks.

Infectious diseases against which they had no resistance spread among the Nestucca and other Tillamook groups and other Indian communities along the Oregon coast, in the lower Columbia River Valley, and in the Willamette Valley beginning in the late eighteenth century. A smallpox outbreak occurred around 1775 and probably affected the entire coastal region (Boyd 1990:137). All groups lost at least a third of their members in this epidemic, which may have spread from a Spanish expedition ship (Boyd 1990:138). A second epidemic followed in 1801, spread from the Great Plains through the Columbia Plateau. Various other epidemics of measles or smallpox or other infectious diseases occurred periodically between the 1820s and the 1860s. The cumulative effect of the epidemics was to reduce the population of the Tillamook from an estimated 4,320 in the early 1800s to 193 in 1854 (Boyd 1990:136, 146).

Treaties negotiated in 1851, but never ratified, led to the Tillamook ceding their traditional lands. However, no concerted effort was made by white settlers or the military to remove the Tillamook to either the Siletz Reservation, established in 1855 or to the Grand Ronde Reservation, established in 1858. The

United States Congress disposed of land claim cases raised by the Tillamook in 1897 and 1912 and the courts dismissed a lands claim case in 1945. The Tillamook received awards from the Indian Claims Commission in 1958 and 1962 (Seaburg and Miller 1990:561).

Regional Historical Background

The first Euroamericans on the northern Oregon coast may have been Spanish explorers (Ruby and Brown 1976:26-31). American Captain Robert Gray, aboard his ship *Columbia Rediviva*, was the first non-native person to cross the bar at the mouth of Tillamook Bay in 1788. George Vancouver arrived later that same year, exploring the Columbia River to upstream of the Willamette River (Silverstein 1990:535). In 1805, Lewis and Clark reached the mouth of the Columbia, overwintering at Fort Clatsop, and traveling as far south as Seaside, Oregon. These initial visits helped to open the region to further exploration and to trade.

Most early Euroamericans on the northern Oregon coast were engaged in the fur trade. Traders exchanged guns, powder, shot, items of Euroamerican clothing, knives, beads, and tobacco, as well as metal implements such as copper and brass kettles for furs provided by native groups (Silverstein 1990:535). The coastal fur trade focused on sea otters and resulted in the near annihilation of those animals by the early 1830s. Thereafter, the focus shifted to inland mammals such as beaver (Cole and Darling 1990:131). With production of sea otter furs declining, ship-based coastal trading moved to land-based posts at Astoria, Fort Vancouver, and in the Columbia Basin of eastern Oregon and Washington.

As more Euroamericans settled the Willamette Valley in the mid-1800s, many settlers came overland to the coast, following the Yamhill River drainage over the Coast Range into the Salmon River or Nestucca River drainages, and then north up the coast to Tillamook. The beaches were used as travel ways. Indians that lived in a village on the Nestucca River near where Pacific City is now located used their canoes to ferry travelers across the river. Eventually a trail was established on the north side of the river that led upriver to Hebo and could be used to bypass Cape Kiwanda for those heading north (Dicken 1971:35). In 1854, the Nestucca Bay area was bypassed completely when settlers cleared a trail from Tillamook to Hebo, and from Hebo over the coast range to Grand Ronde (Dicken 1971:33).

The largest community near the APE is Pacific City. It was platted as Ocean Park in 1893 by Thomas Malaney but was re-platted in 1910 as Pacific City to avoid confusion with another Ocean Park in Washington. Beginning in the 1910s, Pacific City became a popular resort destination for people from the Willamette Valley. In fact, so many people from McMinnville owned second homes in Pacific City, that a section of the hill above town was known as McMinnville Heights (Boge 1979:135). Nearby communities of Oretown and Neskowin were settled about the same time as Pacific City, or a bit earlier. Both has post offices but neither had the kind of growth as Pacific City (McArthur 1982, 539, 564).

RESULTS OF SITE-SPECIFIC BACKGROUND RESEARCH

Previous Archaeology in the Project Vicinity

A review of site record forms and site distribution maps on file at the Oregon State Historic Preservation Office (SHPO) indicates that the APE has not previously been surveyed and contains no recorded archaeological sites. Little previous archaeological research has been done in the immediate vicinity of the APE. A surface survey conducted in 1977 that included lands along Bozley Creek near Oretown. No cultural resources were identified during the project (Cole and Pettigrew 1977).

Most recorded sites in the general vicinity of the APE are to the north on the Nestucca River. They include 35TI25, 35TI26, and 35TI27, located in the town of Woods on the north bank of the

Nestucca River and which were recorded more than 60 years ago during a survey of the Oregon coast (Collins 1951a, 1951b, 1951c, 1953). Also in the Pacific City area, local artifact collectors report having found artifacts in the dunes around Cape Kiwanda and on the North Spit (Swanson 1976:6). Avocational archaeologists John Sauter and Bruce Johnson were quite active in digging into sites throughout Tillamook County and published a book to describe their findings (Sauter and Johnson 1974). In it they state: “Sand spits such as Netarts, Nestucca, Bay Ocean, and Nehalem all contain pockets of camp midden which reflect temporary encampments” (Sauter and Johnson 1974:142).

Cartographic Research

Historical maps dating from between 1872 and 1955 were examined to determine if any unrecorded historical developments, other than roadways, are within the APE. The earliest maps, prepared by the General Land Office (GLO) show no historical features in or near the APE (GLO 1872a, 1872b).

Winema and Ozten Roads are shown on a map published in 1941 by the Army Map Service (AMS 1941). The map shows a few structures at the north end of Winema Lake but no developments other than roadways in the APE. It shows a stream or other type of drainage feature coursing westward following Winema Road and to drain into the lake. No developments except roadways are depicted in the APE on a map published by the United States Geological Survey (USGS) in 1955. The map shows increased developments around the lake. It does not show the drainage feature seen on the 1941 map (USGS 1955).

A real estate atlas published in 1930 shows J.M. Card as the owner of the lands bordering the APE (Metsker 1930). When Card obtained the land is unknown, but it was least by the late 1920s. In 1927, he and his wife Effie, platted the community of Wi-ne-ma on the east side of Winema Lake between it and U.S. 101. Card did not live on the property and instead owned and operated a dairy farm in the Little Nestucca valley (Ancestry.com 2022; Coastview 2021).

A few lots sold but no community ever developed at Wi-ne-ma. By 1941, Edna Flemming owned the townsite and surrounding property. In that year, a group from the Amity Church of Christ was at the looking for a place to camp. They were directed to the Win-ne-ma townsite as a possible camping spot but were told they would need to get permission from the landowner. They were allowed to camp around Winema Lake and so enjoyed the setting that the church made an offer to purchase the property. By 1945 fund for the purchase had been raised and in December of that year, Wi-ne-ma Christian Camp, Inc. became the owner. The purchase included all remaining unsold lots in Wi-ne-ma and the lands west of Winema Lake to the ocean beach. The property has been developed for retreats and other events and recreational vehicle camping (Coastview 2021; Wi-ne-ma Christian Camp 2022).

FIELD METHODS AND RESULTS

Methods

Fieldwork for the project was conducted June 20, 2022, by Bill R. Roulette, M.A., RPA, and Laura L. De Simone, M.S. The lease area where the cable would come ashore and the CLS were surveyed using transects spaced no more than 5 meters apart. Each of the five vault locations along Winema Road were located and examined. Four shovel test probes (STPs) were excavated, one in the lease area and three in the CLS (Figure 2). They were cylindrical holes 45-60 centimeters (cm) in diameter. They were excavated to 12 and 50 cm below surface (cmbs) in levels that were 10 cm thick. Soil removed from them was processed through one-eight-inch gauge hardware mesh.

Results

During the survey of the lease area where the cable will come ashore it was observed that it was artificially flat. It consists of a platform cut into the toeslope of Cannery Hill (Figure 3). A scarp just beyond the west edge of the lease area marked the limits of the cut and fill. There was a 45 cm elevation difference between the surface of the platform and the native landsurface at the base of the scarp. The north half of the lease area has been improved for recreational vehicle camping and contains water spigots and electrical boxes. The water and electrical lines are buried.

The surface of the southern and central parts of the lease area had 50 percent or better surface visibility. However, the exposed surface was not the native ground surface. The surface in its northern part was grassy and had less than 50 percent visibility.

No artifacts were observed at the surface in the lease area. One STP was excavated in the lease area. It was placed where a OGB will be installed at its southern end. It contained 13 cm of moist, dark brown (7.5YR 3/3) clay loam with abundant rock over decaying bedrock. It did not contain artifacts.

The roadside fault locations were marked with flagging tape. Vaults are to be installed on the north side of Winema Road in areas created by cutting and filling (Figures 4 and 5). Vegetation in all their locations was thick resulting in zero percent surface visibility. No artifacts were observed. At the same, because of their locations, the spots had essentially no potential to contain archaeological resources.

The CLS was readily identifiable in the field using project design sheets. Its northern and southern parts were thickly vegetated, its center part less so. A 30- to 35-foot-wide area of vegetation will be preserved along its southern edge to serve as a sight buffer between it and U.S. 101. Excluding the buffer zone, the development footprint in the CLS encompasses roughly 0.8 acre.

Viewed in cross section the CLS has a shallow "U" profile (Figure 6). Its interior part forms a trough framed on its north and south sides by rising ground. The higher ground may be related to road construction as Winema Road borders it to the north and U.S. 101 is a short distance to its south.

Surface visibility was less than 50 percent throughout the CLS and no artifacts were found on the ground surface.

Three STPs were excavated to search for buried archaeological deposits. They were placed in an approximate east-west line toward the center of the CLS. STP 2 was placed at its western end. It contained a layer of moist, dark brown (7.5YR 3/3) to very dark brown (7.5YR 2.5/3) loamy clay. The layer extended to 45 cmbs. It capped a layer of moist, gray (7.5YR 5/1) to brown (7.5YR 5/2) clay. Excavations extended 5 cm into the clay which was determined to most likely be decayed rock (Figure 7).

Despite being located only about 30 m east of STP 2, the soil profile in STP 3 was completely different. It consisted of a 37-cm-thick layer of moist, light brown (7.5 YR 6/3) to brown (7.5YR 5/3) medium sand. The sand layer sat atop decaying bedrock in a matrix of moist dark brown (7.5YR 3/4) loamy clay (Figure 8).

STP 4 was about 30 m east of STP 3. Its soil profile was a truncated version of the one seen in STP 3 and included a 12-cm-thick layer of moist, light brown (7.5 YR 6/3) to brown (7.5YR 5/3) medium sand over decaying bedrock.

STPs excavated in the CLS did not contain artifacts.



Figure 3. Lease area where cable will come ashore with Cannery Hill visible to frame right. Note spigot to left and electrical boxes to right. Truncated scarp in background is edge of push pile. View is north.



Figure 4. Location of Vault 1 along Winema Road. Vault is to be installed to frame left a short distance beyond the “No Parking” sign. View is generally east.



Figure 5. View generally west of location of Vault 5 to be installed on north side of Winema Road (frame right) in center foreground.



Figure 6. Overview looking north of the CLS with Winema Road to frame left and U.S. 101 to frame right.



Figure 7. *Left:* Soil profile exposed in STP 2 excavated at the CLS. *Right:* Soil profile exposed in STP 3 excavated at the CLS. In the photographs, the scale is divided into 10-cm sections and the trowel points north.

SUMMARY AND RECOMMENDATIONS

No cultural resources are recorded in the APE. The lease area where the cable will come ashore has been cut so that the native soil has been removed and decaying bedrock is present just below the surface. Vault pits along Winema Road will be excavated into fill cut from the adjoining hillside. Part of the CLS has been graded to near bedrock and archaeological investigations elsewhere in it did not identify cultural resources.

It is AAR's opinion that its study represents a good faith effort to locate historic properties in the APE and would have done so if they were present. Based on the available evidence, the APE does not contain historic properties and a finding of no effect to historic properties is appropriate for the undertaking. AAR recommends that no additional archaeological investigations are warranted in the APE as described in this report.

AAR's recommendations is made based on the study described in this report. It is always possible that cultural deposits may be encountered during project implementation. If archaeological material is exposed in the APE during project implementation, all work in the vicinity of the finds shall cease immediately and the ACOE, Oregon SHPO, and the affected tribes should be promptly notified to assure compliance with the relevant state and federal laws and regulations. Project-related work in the APE shall not resume until mitigation measures have been agreed upon by all parties.

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Appendix 8
Governor Brown 2018 Letter



KATE BROWN
Governor

January 5, 2018

Delegates
Pacific Telecommunications Conference
Honolulu, Hawaii 96826

RE: Trans Pacific Undersea Cable Projects

Ladies and Gentleman:

We invite and encourage you to consider the State of Oregon as your future site to come ashore on the west coast of North America, and as an excellent location for the placement of related on-shore operations. Oregon has a long record of successful submarine cable industry projects, a highly developed telecommunications infrastructure, a workforce of skilled professionals for marine and terrestrial telecommunications cable installation, and unparalleled cooperation between its undersea cable operators, fishing industry, and state government.

As chair of the State Land Board, which approves easements for cable landings on the Oregon coast, I can assure you that we will welcome and give full and timely consideration to all landing requests. Please know that the Department of State Lands and the Oregon Business Development Department along with other involved state agencies will work in partnership with you, as an undersea cable operator, and Oregon's fishing fleet to ensure the success of your project once approved.

Please contact Chris Castelli, Oregon Department of State Lands, 775 Summer Street NE, Salem, OR 97301-1279 USA; phone: 503 986-5280; e-mail: chris.castelli@state.or.us, for more information.

We stand ready to assist you and to provide you with the information you need to come ashore in Oregon.

Sincerely,

Governor Kate Brown

KB:jkt



Appendix 9
OFCC Letter of Support



OREGON FISHERMEN'S CABLE COMMITTEE

Established as Oregon Fishermen's Undersea Cable Committee July 9, 1998

2021 Marine Drive, Suite 102

Astoria, Oregon 97103

Phone (503) 325-2285

Fax (503) 325-7012

www.ofcc.com

August 3, 2022

Mr. Dan Carey, Aquatic Resource Coordinator
Mr. Dario Frisone, Proprietary Coordinator
Aquatic Resource Management | Northwest Region
OREGON DEPT. OF STATE LANDS
775 SUMMER ST NE, STE 100
SALEM OR 97301-1279

Ms. Kinsey Friesen, Regulatory Lead
US ARMY CORPS OF ENGINEERS
Portland District, Regulatory Branch
Lincoln, Tillamook, and Yamhill County Project Manager
PO BOX 2946
PORTLAND OR 97208-2946

Messrs. Carey and Frisone and Ms. Friesen,

The Oregon Fishermen's Cable Committee, Inc. has been working with AMCS LLC, Alcatel Submarine Networks UK Ltd and their affiliates on the Bifrost Cable System since June of 2021. We were provided with the desktop study cable route across the Oregon shelf and slope which we loaded into the format of one of the navigation plotter systems used by many of our Oregon commercial fishermen. We took that file and loaded it on a Newport, Oregon trawler, whose captain has many decades of fishing experience and extensive, detailed local knowledge of the seabed around the proposed Bifrost route. The trawlerman noted several areas of hard substrate and one large ridge on the initial route. Using the fisherman's exhaustive knowledge of the sea bottom, we modified the route around all hard bottom areas and around the ridge. Cable route engineers used our OFCC modified route to create a route for the cable route survey, which was conducted by the RV GEO RESOLUTION from September 22, 2021 to November 19, 2021. The OFCC had fishermen representatives aboard the survey ship to assist and to advise if any modifications to the survey route were needed. An electronic survey using high resolution echo sounders, sub-bottom profiling and side-scan sonar was conducted along the OFCC suggested route. In addition, further ground-truthing was done using a sea-bottom probe. The survey concluded that full burial is possible along the entire alignment studied.

On July 29, 2022 AMCS LLC and the OFCC signed a cable agreement that provides for a cooperative arrangement between the parties. Subjects addressed in the agreement include:

- cable burial in the commercial fishing grounds
- a release of liability for fishermen for accidental damage to the cable
- a 24hour hotline telephone number for fishermen to call if they believe they may have snagged the Bifrost Cable System
- OFCC costs related to the installation of the Bifrost Cable System
- annual costs of OFCC membership
- participation in the OFCC Sacrificed Gear Fund and the claim resolution process
- membership in the OFCC
- OFCC activities related to this project
- debris control
- as-built Lat/Long coordinates and charts
- post lay inspection and burial following installation
- patrol and guard boats
- dispute resolution

This agreement provides a strong foundation for the collaborative approach for sharing the seabed between diverse ocean users. Amazon has been cooperative with the Oregon fishing industry in all regards. The OFCC wholly supports the permit and easement applications of AMCS LLC for the Bifrost Cable System. We encourage the State Land Board to approve their requests.

Best regards,



Scott McMullen, Chair

For the OFCC Board of Directors

Appendix 10
List of Adjacent Property Owners

Adjacent Landowners

State of Oregon

Department of State Lands: Dario Frisone / Dario.Frisone@dsl.oregon.gov

Oregon Parks and Recreation Department: Kevin Herkamp / kevin.a.herkamp@oprd.oregon.gov

Elizabeth Hayes

373 LEDGEVIEW AVE

FOND DU LAC, WI 54935

Map # 5S1112DC06100; 5S1112DC06000; 5S1112DC05900

Franklin Lamb

2740-A HALAULANI RD

KILAUEA, HI 96754

Map # 5S1112DC05800

Arlene Schaefer

6150 OTZEN WAY

CLOVERDALE, OR 97112-9788

Map # 5S1112DB00101

Alpha Development Inc

2515 SW EDGEMOOR AVE

BEAVERTON, OR 97005

Map # 5S1112DC06300

Nathan & Valerie Stoller

42900 SUNSET AVE

CLOVERDALE, OR 97112

Map # 5S1112DC06400

Wi-Ne-Ma Christian Camp

5195 WI-NE-MA RD

CLOVERDALE, OR 97112

Map # 5S1112DC06500; 5S1112DC00100

Ralph Holcomb

5407 RIDGEFIELD RD

BETHESDA, MD 20816

Map # 5S1112DC06600