TECHNICAL MEMORANDUM

Date:	7 February 2018	**Project No.:**	1773866-003-TM-Rev0
To:	Paul Opgrande, Doug Pendergraft, Bryan Adams	**Company:**	WBTS HOA Phase 1-2
From:	Greg Curtiss, PE and Phil Osborne, PhD, PGeo Claire Murray		
cc:	Dustin Day, Ethan Spoo	**Email:**	gcurtiss@golder.com

WESTPORT BY THE SEA CONDOS PHASE 1-2 HOA EMERGENCY DUNE RESTORATION ENGINEERED DRAWINGS

1.0 INTRODUCTION

Golder Associates Inc. (Golder) was retained by Westport by the Sea (WBTS) Condominium Homeowners Association (HOA) Phase 1-2 on 5 December 2017 to provide engineering and permitting support services related to the preliminary design of a temporary (emergency) beach and dune restoration using cobble, sand, large woody debris, and coir matting at the WBTS property. The WBTS HOA requested that the design address the temporary repair of the beach and dune along approximately 315 feet of their property (parcels #1057 and #1058). It is assumed that the work will be completed either under an amendment to WBTS' current emergency dune repair permit or under a new emergency exemption permit. The scope of work included the following:

- Task 1 – Topographic survey
- Task 2 – Engineering drawings and specification for beach and dune emergency repair
- Task 3 – Expedited Hydraulic Project Approval

This technical memorandum provides a summary of the work completed, including the draft design basis for the temporary (emergency) beach and dune restoration.

This technical memorandum should be read in conjunction with "Important Information and Limitations of this Report" which is presented at the end of this report.

2.0 PROJECT BACKGROUND

WBTS is a condominium development on the Pacific Ocean coast, south of the entrance to Grays Harbor, Washington. Pacific International Engineering documented beach and dune erosion in 2007. The erosion results from an energetic ocean wave climate and coincident high water levels and a limited sediment supply at the development. Long-term erosion trends continue to threaten the beach and foredune of the Grayland Plains littoral cell in which the development is located (George Kaminsky, Washington State Department of Ecology, personal communication, 2017); the loss of the foredune is a condition that could result in flooding and damage to the development from overwash at high water levels during a storm.

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In June 2017, WBTS HOA Phase 3 contracted Golder on behalf of HOA Phase 1-2 and HOA Phase 3 to assess the erosion at the WBTS site, develop conceptual erosion mitigation alternatives for the site, and provide a permitting assessment for the mitigation options (Golder 2017a). Golder teamed with BergerABAM to provide input related to the permitting assessment. In Golder's review of site conditions conducted March 10, 2017, existing installations of coir mat and dune placement (sand fill) were inspected. The coir mat reinforcement in place at the time appeared to have provided an additional level of protection to the sand fill as evidenced by the general maintenance of the beach scarp position through winter of 2017 in comparison with the scarp position in 2016. Golder noted that further detailed monitoring data and analysis of the magnitude and frequency of storm waves and water level during the interval since construction would be needed to substantiate this observation and to assess the general level of protection offered by the approach to emergency repair. The coir matting is a relatively soft form of protection when exposed to high water levels and breaking storm waves characteristic of this environment. Golder's report included development and assessment of the following options:

- dynamic cobble berm and dune restoration
- riprap revetment and dune restoration
- geotextile revetment and dune restoration

Subsequently a meeting and site visit was held on 27 November 2017 at the request of WBTS HOA Phase 1-2 (Golder 2017b) to assess the applicability and potential synergies from the design, permitting, and construction process which has been implemented in the development of a dynamic revetment (cobble berm) at North Cove/Washaway Beach to Westport by the Sea.

3.0 TOPOGRAPHIC SURVEY

A topographic survey of the shoreline was completed by Washington State Department of Ecology on 30 November 2017. The survey included the collection of 15 cross-shore profiles, in addition to the seasonal WORM profile, and alongshore lines to define the beach scarp crest and toe. This survey data was used as the basis for the design of the emergency dune restoration works at Phase 1-2. The raw survey data and metadata are provided as Attachment A to this memorandum (note that the raw data is provided in meters). The November topographic survey noted the following key features:

- Toe of dune scarp: 16.4 feet NAVD88
- Top of dune scarp: 22 feet NAVD88

4.0 DESIGN BASIS

4.1 Design Criteria

The design is intended to provide temporary (emergency) protection completed under an amendment to WBTS' current emergency dune repair permit or under a new emergency exemption permit. The design under the emergency permit allows for soft shoreline stabilization measures (i.e. dune restoration) using sand, coir mat, vegetation and large woody debris (LWD). The design must minimize adverse effects on adjacent properties caused by end effect erosion.

4.2 Design Life

The proposed works are intended to provide temporary protection. For the purposes of determining suitable coastal design parameters, it is assumed that the works would be in place for approximately 2 years. Accepted coastal engineering practice in North America is to use extreme coastal conditions with a probability of occurrence during the design life of approximately 40%. Under the assumption that the works will be in place for 2 years, a design event with a return period of 5 years has been assumed.

4.3 Codes and standards

The shore protection is designed in accordance with the following guidelines and standards:

- Coastal Engineering Manual (CEM) (USACE 2006)
- The Rock Manual (CIRIA; CUR; CETMEF, 2007)
- Beach Management Manual (CIRIA; CUR; CETMEF 2010)
- European Overtopping Manual (EurOtop Manual) (EA (UK) et al. 2007)
- Marine Shoreline Design Guidelines (Johannessen et al. 2014)
- Relevant cobble berm designs implemented on the WA and OR coast (Allan and Komar 2004; Komar and Allan 2010)
- Applicable Washington Administrative Codes (WAC)

4.4 Vertical Datum and Coordinate System

All dimensions and distances are in feet. All horizontal coordinate systems refer to North American Datum of 1983 (NAD83) in Washington State Plane South Zone coordinates. All elevations are in feet relative to NAVD88 (North American Vertical Datum of 1988), unless otherwise noted.

4.5 Water levels

A data review and analysis of water levels at the site was presented in Golder (2017a). A short summary is presented herein, with details provided in the latter report. Water levels at the site reflect the combined contributions from astronomical tides, storm surge and long-term changes in mean sea level. Astronomic tides at the site are largely predictable and the characteristic tidal elevations for the site are based on the tidal epoch at the National Oceanic and Atmospheric Administration (NOAA) National Ocean Service (NOS) Westport, WA station (#9441102), located approximately 2 miles northeast of the WBTS site. Table 1 presents a summary of characteristic tidal elevations at WBTS. The survey datum (NAVD88) is approximately 0.97 feet above the Mean Lower Low Water (MLLW) tidal datum plane at Westport based on the NOAA vertical datum transformation calculator VDATUM (NOAA 2017). Mean Higher High Water (MHHW) is 9.15 feet above MLLW or 8.18 feet above NAVD88.

Table 1: Summary of Observed Water Elevations at Westport by the Sea (based on Westport, Station ID: 9441102 and VDatum), 46° 54.2' N and 124° 6.3' W, Tidal Epoch 1983 to 2001

Characteristic Tidal Reference	Elevation (feet, NAVD88)	Elevation (feet, MLLW)
Mean Higher High Water (MHHW)	8.18	9.15
Mean High Water (MHW)	7.44	8.41
Mean Tide Level (MTL)	3.91	4.88
Mean Low Water (MLW)	0.42	1.39
Mean Lower Low Water (MLLW)	-0.97	0

The water levels described in this section are relative to present mean water level and do not include any allowances for future sea level rise. Due to the temporary nature of the proposed works, allowances for sea level rise have not been included. Golder (2017b) also conducted a preliminary analysis of extreme water levels at the WBTS site. Extreme water levels at range from 11.6 to 12.5 feet for return intervals of 5 to 100 years.

Ordinary High Water Mark (OHWM) is defined in high-energy tidal environments by the lack of persistent vegetation waterward of the bank or bluff where the beach is inundated regularly (Anderson et al. 2016) and the location varies within the seasonal storm berm. At WBTS, the toe of the scarp has eroded several feet per year over the last twenty years and is currently located at 16.4 feet NAVD88. Golder's extreme water level analysis indicates the scarp is not regularly inundated and given the significant rates of erosion at site, a more reasonable OHWM is interpreted to be just above MHHW at 8.5 feet NAVD88.

4.6 Waves

Waves and wave-induced currents are the primary mechanism for erosion of the beach and foredune at the site. The wave climate at the site along the Pacific Coast is characterized as energetic, with seasonal fluctuations in energy between summer and winter. The wave climate also varies on a longer time scale as a result of oscillations of the Pacific Decadal Oscillation-El Nino Southern Oscillation (PDO-ENSO) cycle which occurs approximately every 11 years. The extreme wave conditions based on long term buoy records and the Wave Information System (WIS) hindcast at Grays Harbor are summarized in Table 2.

Extreme significant wave heights (for return periods of 2 to 50 years) in water depths less than 164 feet range from 23 feet to almost 36 feet. The WIS study uses more recent data and the values are higher than the USACE study results. Therefore, the WIS results are recommended because they are more conservative and also more up-to-date.

Table 2: Extreme Significant Wave Height Offshore Westport

Return Period (years)	Grays Harbor NOAA NDBC #46211 / CDIP 36 (USACE 2003), H_s (feet)	USACE WIS Station #83011 (USACE 2017), H_s (feet)
2	23.0	27.2
5	27.6	29.5
10	30.2	31.5
25	32.8	33.8
50	34.8	35.8

Notes: NOAA NDBC station #46211 is located at a water depth of 130 feet;
USACE WIS station #83011 is located at a depth of 160 feet

5.0 OVERVIEW OF PROPOSED DESIGN

The proposed design was developed based on a balance of the following factors and considerations:

- Providing shoreline protection to slow the recession of the beach scarp until longer term protection works may be designed and implemented.
- Placement of realistic material quantities, given the temporary nature of the works.
- Incorporation of habitat enhancement features.

The key features of the design include a dune cap constructed along the crest of the existing beach scarp and a cobble beach berm constructed in front of the scarp. Design drawings are included as Attachment B to this technical memorandum. The design incorporates additional elements to help reduce erosion and create habitat opportunities. In the cobble beach berm, root wad bundles are proposed along the shoreline and are discussed further in section 5.1. For the dune cap, additional elements include coir mat placement, large woody debris (LWD) and dune grass plantings. Each of these elements is discussed in more detail in section 5.2.

The proposed dune and cobble beach berm span approximately 315 feet across the center of the project site. The ends of the cobble berm placement will be tapered gradually (longshore 3:1 crosshore) to meet existing dune scarp locations within approximately 30 feet of the ends of the property. Coir mat will be placed along the existing dune scarp in these transition zones.

A summary of key design parameters used in the design is provided in Table 3 and are described in more detail in the following sections.

Table 3: Summary of Key Design Parameters

Parameter / Criterion	Description
Dune Cap	
Dune crest elevation	25.0 feet NAVD88
Dune crest width	8.0 feet
Dune front slope	3H:1V
Dune back slope:	2H:1V
Dune fill materials (sand)	Medium sand, placed in 1 foot lifts and compacted with tracked excavator
Coir matting	Placed every foot across dune fill and across dune scarp
Vegetation	Dune grass planting on the dune cap crest, front slope and backslope
Large woody debris (LWD)	Randomly placed on dune cap. LWD with or without intact root wads, 1-2 foot trunk diameter.
Beach Berm	
Beach crest elevation (cobble)	20 feet NAVD88
Beach crest width	10 feet
Beach foreshore slope (cobble)	3H:1V
Beach fill materials	Cobble (angular medium pit run)
Root Wad Bundles	Bundles of four interlocked root wads placed at approximately 50 feet spacing along shoreline. Root wad dimensions; 20 foot minimum length, 1-2 foot trunk diameter, 6-9 foot root diameter.

Notes: NAVD88 = North American Vertical Datum of 1988; H:V= Horizontal to Vertical

5.1 Beach

5.1.1 Beach Profile

The Coastal Engineering Manual (USACE 2006) recommends the use of local, natural analogs (i.e. established stable beaches subjected to similar wave climate) as the basis for setting design beach crest elevations. The manual also states:

> *"In cases where no dry beach exists at the project site, or where the existing beach has a deficit of sand due to substantial reduction or elimination of a critical sediment source, such as in front of a seawall or downdrift of a shore-perpendicular structure, the natural berm elevation should be estimated using profile data from adjacent beaches which are healthier in terms of sand availability but are exposed to similar waves and water levels. Priority should be given to identifying a natural berm elevation using beach measurements from the project site or a similar site. As a last resort, when no suitable beach profile data are available to determine a natural berm height, the limit of wave runup under average (nonstorm) wave and tide conditions at the site can be estimated to establish a design berm height."*

Available information from WADOE beach monitoring and based on site visits to North Cove, comparison with other projects in the region (Komar and Allan 2010) and Golder's experience on previous projects is used in conjunction with wave run-up calculations (Stockdon et al. 2006) to establish the design cobble beach crest elevation. The crest elevation and width of the beach crest are designed to limit mean wave overtopping discharge into backbeach areas, to provide an acceptable level of buffering against short term seasonal adjustments in the beach profile and to limit accumulation of overwash of debris into backbeach areas to a degree commensurate with a short-term emergency repair. The proposed cobble berm crest elevation is designed to 20 feet NAVD88 which is approximately equivalent to MHHW + 2 feet of storm surge + runup for the 5-year storm.

The proposed design is a beach crest width of 10 feet, which is approximately equivalent to the annual rate of scarp retreat over the past 20 years. It is expected that angular cobble will provide a greater degree of resistance to erosion relative to medium beach and dune sand.

The proposed design specifies a foreshore slope of 3H:1V. The initial slope placement of 3H:1V is considered practical for a cobble berm with the expectation that the slope will adjust fairly rapidly due to cross-shore reshaping and alongshore redistribution. It is expected that the beach will flatten to approximately 7 or 8 H to 1V.

5.1.2 Beach fill materials

The proposed beach fill material is a medium angular random pit run sourced from a local quarry and consisting of a gradation of predominately cobble sized material where more than 60 % of material is between 2.5 inch and 10 inch diameter with smaller percentages of gravel and boulder sized material. The beach fill was selected considering requirements for beach stability, availability, native material compatibility, and to promote long term consistency with requirements for fish habitat preservation.

Placements of dynamic cobble material (including medium angular random pit run) have been chosen as the preferred option for a number of locations on the Pacific Ocean coast of Washington and Oregon (Golder 2017a,b) as they are considered softer and more compatible approach than riprap, and providing potential ecological benefits.

The main drivers for the cobble berm design and initial placement volume at WBTS are the use of a relatively broad gradation of locally available material (e.g. basaltic pit run is compatible with local bedrock outcrops in the Columbia River Littoral Cell and Olympic Peninsula and is available from sources within 20 miles of the site), placement restricted to areas above MHHW elevation and placement of a berm volume such that the berm crest width is equal to or greater than the typical rate of historical net scarp retreat (~10 feet per year) to account for cross-shore reshaping and alongshore redistribution.

5.1.3 Beach Planform

The beach and foreshore at WBTS is effectively straight and parallel over scales of several hundred feet alongshore with large scale rip features and shore parallel nearshore bars offshore introducing a degree of morphological variability and complexity. The planform placement of cobble berm is therefore a simple shore and scarp parallel placement to be consistent with the prevailing morphology.

The ends of the cobble berm placement will be tapered gradually (longshore 3:1 crosshore) to meet existing dune scarp locations within approximately 30 feet of the ends of the property anticipating that alongshore redistribution will spread material towards the ends of the site and may induce end effects; alongshore spreading of cobble with be mitigated to a limited extent by the placement of large woody debris (LWD) bundles at quasi regular intervals and on either end of the cobble berm. Anchoring the LWD bundles with cables attached to large boulders or sand anchors will increase the likelihood of the LWD remaining in place during storms and high-water conditions. These design features are based on the observation that large woody debris placements have been effective at creating roughness elements and enhanced deposition of cobble at North Cove (Golder 2017b; and personal communication, David Cottrell, 2017). The root wad bundles will also provide additional roughness in profile to provide some dissipation of wave energy during uprush events. Voids in the root wad bundles are expected to partially fill over time with cobble and sand mobilized by wind and wave action, to create habitat nodes.

5.2 Dune and Back Beach

5.2.1 Dune Cap Profile

The dune cap slopes up from the existing grade at 3H:1V from the crest of the existing beach scarp to an elevation of 25.0 feet NAVD88. The proposed crest width is 8 feet, before sloping down to meet the existing grade at 2H:1V. The dimensions and slopes of the dune cap have been selected to provide a level of protection consistent with a temporary measure, while considering constructability and minimizing the footprint of the material. A gentler slope has been selected on the water side to reduce the magnitude of uprush and overtopping of the dune cap during storm events at high water levels.

The dune cap will be placed on a layer of coir matting placed on existing grade on the beach scarp and backshore. It will be constructed in layers of compacted medium sand material and coir mat, placed in horizontal layers at one foot intervals. The sand material has been selected to be consistent with the existing material at the shoreline. Coir matting will be placed over the entire surface of the final grade of the dune cap. The coir matting is intended to reduce the erosion of the placed sand material.

5.2.2 Dune Cap Planform

In planform, the proposed dune cap follows the alignment of the existing beach scarp along the shoreline. The crest alignment includes some gentle undulations, arising from variation in the elevation of the existing ground at the crest of the beach scarp. The undulations mimic naturally formed dunes.

The length of dune cap is approximately 300 feet. At northern and southern extents, the dune cap slopes down to meet the existing grade at 3H:1V. No dune material will be placed within approximately 30' of the north and south property limits.

5.2.3 Dune Cap Vegetation

The crest, front and back slopes of the dune cap will be vegetated with a dune grass species native to the area. The vegetation will reduce the erosion of the sand material by wind and during overwash events. The dune grass species will enhance the habitat value of the dune cap.

5.2.4 Large Woody Debris (LWD)

Large woody debris will be randomly placed on the dune crest to create naturalized habitat. The LWD are expected to aid in trapping sand transported by aeolian processes and reduce the erosion of sand material in the dune cap by Aeolian processes.

5.3 Maintenance and Monitoring

The proposed works are intended as a temporary repair while longer term works may be planned and implemented. The design is dynamic in nature and is expected to adjust to the water level and wave conditions that occur while the works are in place. During storm events at high water levels, waves are expected to mobilize the placed cobble and beach materials. Monitoring of the performance of the placed material is recommended, particularly after large storm events. Golder recommends requesting Washington State Department of Ecology to incorporate the new beach profiles on the Phase 1-2 property into their regular seasonal surveys. Experience and observations gained from the performance of the temporary may provide useful insights for the design of a longer term solution at the site.

As with any beach or dynamic coastal structure, maintenance or nourishment may be required over the design life of the project.

5.4 Material volume estimates

Preliminary material quantity estimates were calculated using the typical section in AutoCAD and are provided in Table 4:

Table 4: Schedule of Estimated Quantities

Description	Unit	Estimated Quantity
Sand	Cubic yards	900
Medium pit run (cobble)	Cubic yards	1,100
Coir Matting	Square feet	47,000
Root wads	units	30
Dune Grass Planting	Square feet	9,100
Large Wood Debris (LWD)	units	30

6.0 CLOSURE

We trust that the information contained in this memorandum is sufficient for your present needs. Should you have questions or comments, please contact Phil Osborne at posborne@golder.com or Greg Curtiss at gcurtiss@golder.com.

GOLDER ASSOCIATES INC.

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Principal, Coastal Practice Lead

Claire Murray, MEng
Coastal Engineer
Non-signing contributing author

GC/PO/lih

List of Tables (in text)

Attachments

7.0 REFERENCES

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8.0 IMPORTANT LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Inc. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project (WBTS in Westport, Washington) as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety, and equipment capabilities.

ATTACHMENT A

Raw topographic survey data

ATTACHMENT B

Drawing sheet set

WESTPORT BY THE SEA HOA PHASE 1-2
EMERGENCY DUNE RESTORATION
WESTPORT, WA

LOCATION: 1600 W OCEAN AVE
LAT/LON: 46.89°N, 124.12°W
SEC: 12 T:16N R:12W
IN: PACIFIC OCEAN
NEAR: WESTPORT
COUNTY: GRAYS HARBOR
STATE: WASHINGTON

VICINITY MAP

0 1500 3000
1" = 1500' SCALE FEET

DRAWING INDEX				
SHEET NUMBER	SHEET TITLE	REVISION	ISSUED	DATE
1773866-600-2-001	KEY PLAN & VICINITY MAP	1	ISSUED FOR CONSTRUCTION	07/02/2018
1773866-600-2-002	SITE PLAN	1	ISSUED FOR CONSTRUCTION	07/02/2018
1773866-600-2-003	CROSS-SECTION A	1	ISSUED FOR CONSTRUCTION	07/02/2018
1773866-600-2-004	SITE NOTES AND SPECIFICATIONS	1	ISSUED FOR CONSTRUCTION	07/02/2018

1

KEY PLAN

0 150 300
1" = 150' SCALE FEET

NOTE(S)
1. ALL DIMENSIONS IN FEET UNLESS NOTED OTHERWISE.
2. ALL ELEVATIONS IN FEET RELATIVE TO NAVD88

REFERENCE(S)
1. IMAGE COURTESY OF USGS IMAGE COURTESY OF LAR-IAC © 2016 MICROSOFT CORPORATION BING
2. PARCEL LINES DOWNLOADED FROM GRAYS HARBOR GIS WEBSITE (HTTP://WWW.CO.GRAYS-HARBOR.WA.US/DEPARTMENTS/CENTRAL_SERVICES/GIS.PHP) ON DECEMBER 11 2017

ISSUED FOR CONSTRUCTION

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
1	2018-02-07	ISSUED FOR CONSTRUCTION	CM	KM	GC	PO
0	2018-01-05	ISSUED FOR CLIENT REVIEW	CM	KM	GC	PO
A	2017-12-22	ISSUED FOR REVIEW	CM	KM	GC	---

CLIENT
WESTPORT BY THE SEA HOA PHASE 1-2

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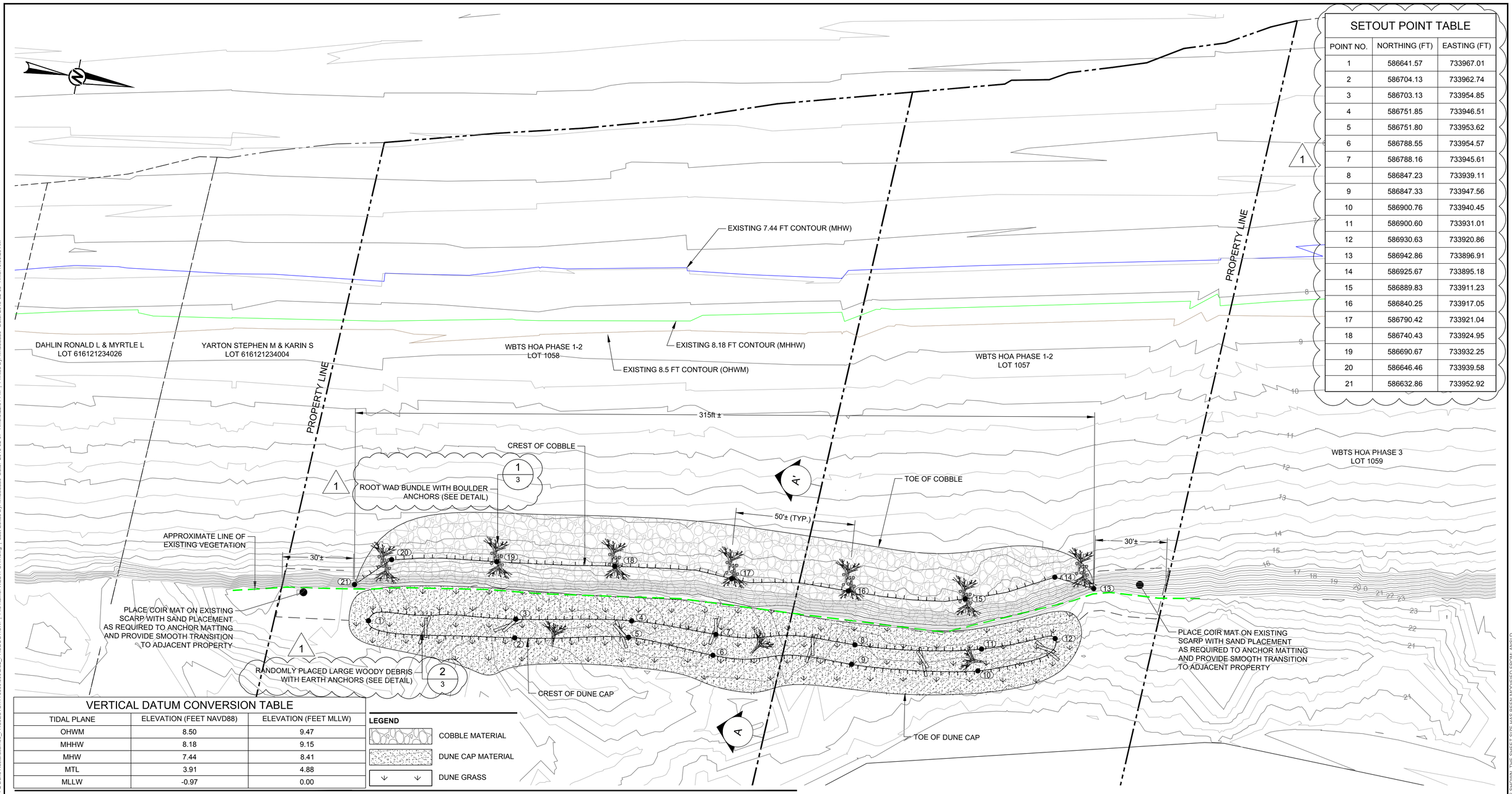
PROJECT
EMERGENCY DUNE RESTORATION
WESTPORT, WA

TITLE
KEY PLAN & VICINITY MAP

PROJECT NO.	PHASE	REV.	SHEET
1773866	600	1	1 of 4 — 1

Path: \\golder.gds\gal\burnaby\CAD-GIS\Client\Westport by the Sea HOA\Phase 1-2 Dune Restoration\99_PROJECTS\1773866\600\202_PRODUCTION | File Name: 1773866-600-2_Vacinity Map.dwg | Last Edited By: kmacsasac Date: 2018-02-07 Time:2:12:15 PM | Printed By: kmacsasac Date: 2018-02-07 Time:3:08:49 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D



SETOUT POINT TABLE

POINT NO.	NORTHING (FT)	EASTING (FT)
1	586641.57	733967.01
2	586704.13	733962.74
3	586703.13	733954.85
4	586751.85	733946.51
5	586751.80	733953.62
6	586788.55	733954.57
7	586788.16	733945.61
8	586847.23	733939.11
9	586847.33	733947.56
10	586900.76	733940.45
11	586900.60	733931.01
12	586930.63	733920.86
13	586942.86	733896.91
14	586925.67	733895.18
15	586889.83	733911.23
16	586840.25	733917.05
17	586790.42	733921.04
18	586740.43	733924.95
19	586690.67	733932.25
20	586646.46	733939.58
21	586632.86	733952.92

VERTICAL DATUM CONVERSION TABLE

TIDAL PLANE	ELEVATION (FEET NAVD88)	ELEVATION (FEET MLLW)
OHWM	8.50	9.47
MHHW	8.18	9.15
MHW	7.44	8.41
MTL	3.91	4.88
MLLW	-0.97	0.00

LEGEND

- COBBLE MATERIAL
- DUNE CAP MATERIAL
- DUNE GRASS

NOTE(S)

1. ALL DIMENSIONS IN FEET UNLESS NOTED OTHERWISE.
2. ALL ELEVATIONS IN FEET RELATIVE TO NAVD88

REFERENCE(S)

1. EXISTING CONTOURS BASED ON TOPOGRAPHIC DATA COLLECTED BY DEPARTMENT OF ECOLOGY, STATE OF WASHINGTON, NOV 30, 2017.
2. TIDAL ELEVATIONS FROM N0AA TIDE STATION AT WESTPORT (#9441102) TIDAL EPOCH.
3. PARCEL LINES DOWNLOADED FROM GRAYS HARBOR GIS WEBSITE (HTTP://WWW.CO.GRAYS-HARBOR.WA.US/DEPARTMENTS/CENTRAL_SERVICES/GIS.PHP) ON DECEMBER 11 2017
3. COORDINATES ARE IN SYSTEM NAD 1983 STATE PLANE WASHINGTON SOUTH (ft.)

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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0	2018-01-05	ISSUED FOR CLIENT REVIEW	CM	KM	GC	PO
A	2017-12-22	ISSUED FOR REVIEW	CM	KM	GC	---

LOCATION: 1600 W OCEAN AVE
LAT/LON: 46.89°N, 124.12°W
SEC: 12 T:16N R:12W
IN: PACIFIC OCEAN

NEAR: WESTPORT
COUNTY: GRAYS HARBOR
STATE: WASHINGTON

ISSUED FOR CONSTRUCTION

0 20 40
1" = 20' FEET

CLIENT
WESTPORT BY THE SEA HOA PHASE 1-2

PROJECT
EMERGENCY DUNE RESTORATION
WESTPORT, WA

CONSULTANT

Golder Associates
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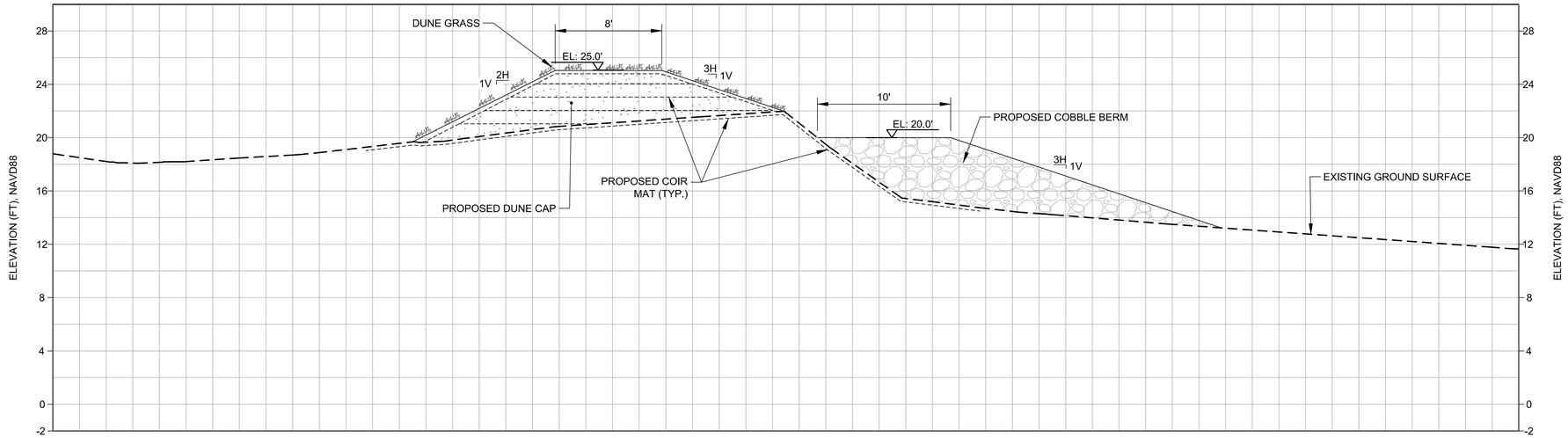
TITLE
SITE PLAN

PROJECT NO.	PHASE	REV.	SHEET
1773866	600	1	2 of 4 2

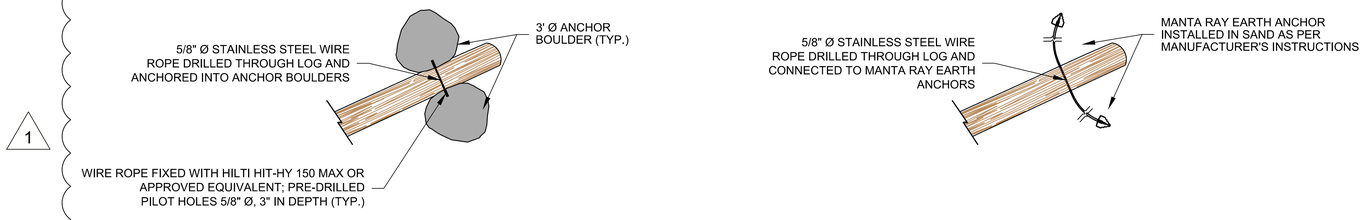
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

Path: \\golder.gds\galtburnaby\CAD-GIS\Client\Westport by the Sea HOA\Phase 1-2 Dune Restoration\99_PROJECTS\1773866\600\202_PRODUCTION\ | File Name: WESTPORT.dwg | Last Edited By: kmacisaac Date: 2018-02-07 Time:3:22:51 PM | Printed By: kmacisaac Date: 2018-02-08 Time:10:35:29 AM



SCALE 1" = 5'
VERT. SCALE 1" = 5'

A CROSS - SECTION A - A'



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NTS 1 BOULDER ANCHOR ATTACHMENT DETAIL

NTS 2 EARTH ANCHOR ATTACHMENT DETAIL

VERTICAL DATUM CONVERSION TABLE		
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LEGEND

COBBLE MATERIAL

DUNE GRASS

DUNE CAP MATERIAL

NOTE(S)

1. ALL DIMENSIONS IN FEET UNLESS NOTED OTHERWISE.
2. ALL ELEVATIONS IN FEET RELATIVE TO NAVD88

REFERENCE(S)

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2. TIDAL ELEVATIONS FROM N0AA TIDE STATION AT WESTPORT (#9441102) TIDAL EPOCH.

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NEAR: WESTPORT
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STATE: WASHINGTON

0 5 10
1" = 5' FEET

ISSUED FOR CONSTRUCTION

CLIENT
WESTPORT BY THE SEA HOA PHASE 1-2

PROJECT
EMERGENCY DUNE RESTORATION
WESTPORT, WA

CONSULTANT
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TITLE
CROSS-SECTION A-A'

PROJECT NO.	PHASE	REV.	SHEET
1773866	600	1	3 of 4 3

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Path: \\golder.gds\galtburnaby\CAD-GIS\Client\Westport by the Sea HOA\Phase 1-2 Dune Restoration\99_PROJECTS\1773866\600\202_PRODUCTION\ | File Name: 1773866-600-2-03_Cross Section.dwg | Last Edited By: kmacisaac Date: 2018-02-07 Time:3:23:07 PM | Printed By: kmacisaac Date: 2018-02-08 Time:10:33:55 AM

PROJECT DESCRIPTION:

THE WORK INVOLVES THE EMERGENCY RESTORATION OF THE DUNE SCARP ON THE UPPER FORESHORE AS SHOWN IN THESE DRAWINGS AND IN ACCORDANCE WITH THESE SPECIFICATIONS

SURVEY CONTROL:

SURVEY INFORMATION SHOWN ON DRAWINGS REPRESENT THE SITE CONDITIONS AS SURVEYED ON NOVEMBER 30, 2017.

BASIS OF BEARING:

WASHINGTON STATE PLANE COORDINATE SYSTEM

NORTH AMERICAN DATUM OF 1983 (NAD83)

BASIS OF ELEVATION:

NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

TIDAL DATUMS ARE BASED ON WESTPORT, WA TIDE GAUGE, NOAA NOS STATION: 9441102:

CONVERSIONS

OHWM=8.50 FEET NAVD88

MHHW=8.18 FEET NAVD88

MLLW=-0.97 FEET NAVD88

DEFINITIONS AND NOTES:

ALL DIMENSIONS AND DISTANCES ARE IN FEET.

OHWM= ORDINARY HIGH WATER MARK

MHHW = MEAN HIGHER HIGH WATER

MLLW = MEAN LOWER LOW WATER

GENERAL NOTES:

1. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN DUE TO ONGOING EROSION AT THE SITE
2. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ADHERENCE TO ALL OWNER'S HEALTH AND SAFETY PROCEDURES AND REQUIREMENTS AS WELL AS ANY STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS.
3. CONSTRUCTION MATERIALS, SUBCONTRACTORS, AND STOCKPILE LOCATIONS SHALL BE SUBJECT TO APPROVAL BY THE OWNER.
4. TEMPORARY ROADS FOR SITE ACCESS AND STOCKPILE ACCESS SHALL BE APPROVED BY THE OWNER.
5. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS PRIOR TO STARTING WORK AND SHALL NOTIFY THE OWNER AND ENGINEER IF CONFLICTS EXIST ON THE DRAWINGS
6. THE CONTRACTOR IS RESPONSIBLE FOR SURVEY CONTROL, CONSTRUCTION STAKING AND FOR NOTIFYING OWNER'S SURVEYOR AS REQUIRED TO DEVELOP PAY QUANTITIES AND AS-BUILT DRAWINGS.
7. THE CONTRACTOR SHALL PERFORM HOUSEKEEPING DUTIES ON A DAILY BASIS TO KEEP WORK AREAS CLEAN. HOUSEKEEPING SHALL BE PERFORMED AT THE COMPLETION OF THE WORK TO THE SATISFACTION OF THE OWNER.
8. THE CONTRACTOR SHALL BE RESPONSIBLE TO SUPPLY AND INSTALL ALL MATERIALS REQUIRED TO FULLY CONSTRUCT THE DESIGNS IN THESE DRAWINGS.
9. WORKERS SHALL BE AWARE OF ACTIVE EQUIPMENT IN THE VICINITY OF THE WORK AREA AND SHALL TAKE PRECAUTIONS NOT TO DISTURB OPERATING EQUIPMENT.
10. WHEN DISCREPANCIES BETWEEN DRAWINGS AND SPECIFICATIONS ARISE, SPECIFICATIONS WILL SUPERSEDE THE DRAWINGS.
11. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY SAFETY EQUIPMENT AND PROVIDE ACCESS FOR THE OWNER'S REPRESENTATIVE TO INSPECT THE WORK. INSPECTION ACCESS IS REQUIRED THROUGHOUT THE DURATION OF THE PROJECT.
12. THE CONTRACTOR SHALL NOT PARK ANY VEHICLES OR EQUIPMENT IN OR DISTURB ANY AREA OUTSIDE THE LIMITS AS SHOW ON THE DRAWINGS, OR AS APPROVED BY OWNER'S REPRESENTATIVE. VEHICLES OR EQUIPMENT SHALL NOT BE LOCATED OR TRANSIT BELOW OHWM.
13. CONTRACTOR TO PROVIDE ACCESS ALONG EXISTING TRAFFIC PATTERNS DURING ALL CONSTRUCTION ACTIVITIES.
14. THE CONTRACTOR SHALL PROTECT EXISTING FENCES, UTILITIES, MONITORING WELLS, AND OTHER SITE FEATURES FROM DAMAGE DURING CONSTRUCTION. ANY DAMAGE SHALL BE REPAIRED TO OWNER'S STANDARDS AT CONTRACTORS EXPENSE.
15. PRIOR TO STARTING CONSTRUCTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND COORDINATE UNDERGROUND UTILITIES.
16. A COPY OF THE APPROVED DRAWINGS AND APPLICABLE SPECIFICATIONS SHALL BE ON SITE DURING CONSTRUCTION.

SPECIFCATIONS:

1. MATERIALS
- a. DUNE FILL MATERIALS SHALL CONSIST OF MEDIUM SAND.
- b. BEACH FILL MATERIALS SHALL CONSIST OF ANGULAR MEDIUM PIT RUN: PREDOMINATELY COBBLE SIZED MATERIAL WHERE MORE THAN 60% OF MATERIAL IS BETWEEN 2.5 INCH AND 10 INCH DIAMETER WITH SMALLER PERCENTAGES OF GRAVEL AND BOULDER SIZED MATERIAL.
- c. COIR MATTING TO BE OPEN WEAVE STYLE EROSION CONTROL MAT WITH MAXIMUM OPENING OF 0.5" X 0.5".
- d. LARGE WOODY DEBRIS (LWD) WITH INTACT ROOT WADS. 1 TO 2 FOOT TRUNK DIAMETER.
- e. ROOT WAD BUNDLES: BUNDLES OF FOUR INTERLOCKED ROOD WADS. 20 FOOT MINIMUM LENGTH, 1 TO 2 FOOT TRUNK DIAMTER, 6 TO 9 FOOT ROOT DIAMETER.

2. PLACEMENT
- a. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING, LOADING, HAULING, HANDLING AND PLACING OF MATERIALS.
- b. PRIOR TO PLACEMENT OF FILL MATERIALS, THE CONTRACTOR SHALL REMOVE FROM THE WORK SITE ALL DEBRIS LYING WITHIN THE LIMITS OF THE FILL SECTION.
- c. DUNE FILL MATERIAL TO BE PLACED IN 1 FOOT LIFTS AND COMPACTED WITH TRACKED EXCAVATOR. COIR MATS TO BE PLACED BETWEEN LIFTS AND ACROSS DUNE SCARP.
- d. BEACH FILL MATERIAL (COBBLE) TO BE PLACED LOOSELY WITHOUT COMPACTION.
- e. FOLLOWING PLACEMENT, THE FILL MATERIAL SHALL BE GRADED TO SLOPES IN ACCORDANCE WITH THE LINES AND GRADES SET OUT ON THE DRAWINGS PROVIDED.
- f. COIR MATTING SHALL BE PLACED LOOSELY ALONG THE SURFACE OF THE GROUND TO ENSURE CLOSE CONTACT THE GROUND SURFACE. MATS ON THE DUNE SCARP FACE TOP OF DUNE CAP SHALL BE SECURED USING STAPLES OR WOOD STAKES
- g. LARGE WOODY DEBRIS (LWD) RANDOMLY PLACED ON DUNE CAP AND ANCHORED WITH EARTH ANCHORS AS PER MANUFACTURER'S INSTRUCTIONS.
- h. ROOT WAD BUNDLES SHALL BE PLACED AT APPROXIMATELY 50 FOOT INTERVALS ALONG SHORELINE AND ANCHORED WITH BOULDERS AS SHOWN IN DETAIL 1.
- i. DUNE GRASS VEGETATION TO BE PLANTED ON DUNE CAP CREST, FRONT SLOPE, AND BACKSLOPE.

3. CONSTRUCTION TOLERANCES
- a. FILL MATERIALS SHALL BE PLACED TO THE LINES AND GRADES SET OUT ON THE DRAWING AND WITHIN THE FOLLOWING TOLERANCES:
  - i. ELEVATIONS WITHIN 0.5 FEET OF THE SPECIFIED ELEVATION
  - ii. HORIZONTAL TOLERANCES WITHIN 1 FEET

4. ACCESS TO SITE
- a. CONTRACTOR SHALL MAKE ARRANGEMENTS WITH THE PROPERTY OWNERS AND ADJACENT PROPERTY OWNERS FOR ACCESS TO THE SITE. NO SEPARATE PAYMENT WILL BE MADE FOR THE PROVISION OF ANY ACCESS ROADS OR INCIDENTAL WORKS IN CONNECTION THEREWITH.

5. SURVEYING AND MEASUREMENT
- a. THE CONTRACTOR SHALL UNDERTAKE SURVEY BY A LICENSED SURVEY OF THE WORKS FOLLOWING CONSTRUCTION TO CONFIRM GEOMETRIC COMPLIANCE WITH THE DRAWINGS AND CONTRACT DOCUMENTS AND TO CONFIRM QUANTITIES
- b. THE SURVEY SHALL BE COMPLETED WITH THE FOLLOWING ACCURACIES:
  - i. VERTICAL ACCURACY: +0.1 FEET, -0.1 FEET
  - ii. HORIZONTAL ACCURACY: +0.2 FEET, -0.2 FEET
- c. THE SURVEY SHALL BE RECORDED IN THE FOLLOWING DATUMS:
  - i. VERTICAL: NORTH AMERICAN VERTICAL DATUM OF 1988
  - ii. HORIZONTAL: WASHINGTON STATE PLANE SOUTH ZONE COORDINATE SYSTEM, NAD83
- d. THE SURVEY SHALL COVER ALL WORK AREAS AND SHALL BE CONDUCTED TO OBTAIN CROSS-SHORE TRANSECTS (PROFILES) AT 50 FOOT INTERVALS EXTENDING 15 FEET LANDWARD AND WATERWARD OF THE CONSTRUCTION WORKS. THE SURVEY SHALL BE DESIGNED TO CAPTURE ALL SIGNIFICANT BREAKS IN SLOPE AND TOPOGRAPHICAL FEATURES. ALONGSHORE SURVEY LINES SHALL ALSO BE OBTAINED FOR THE FOLLOWING:
  - i. THE BEACH FILL (COBBLE) TOE AND CREST
  - ii. DUNE FRONT SLOPE TOE AND CREST
  - iii. DUNE BACK SLOPE TOE AND CREST

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PROJECT
EMERGENCY DUNE RESTORATION
WESTPORT, WA

TITLE
SITE NOTES AND SPECIFICATIONS

PROJECT NO.	PHASE	REV.	SHEET
1773866	600	1	4 of 4

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