



**INVITATION TO BID
No. BT157077B**

Instrumentation Buoy for Scaled Mobile Ocean Test Berth

BID DUE DATE AND TIME:
November 11, 2011 (3:00 PM, PST)

OSU Procurement and Contract Services Offices are open from 8:00 am – 12:00 noon and 1:00 pm – 5:00 pm.
Offices are closed during the 12:00 noon – 1:00 pm lunch hour.

SUBMITTAL LOCATION:

Oregon State University
Procurement and Contract Services
644 SW 13th Avenue
Corvallis, Oregon 97333

1.0 GENERAL

1.01 SCHEDULE OF EVENTS:

- Invitation to Bid Issue Date..... November 2, 2011
- Deadline for Request for Clarification or Change..... November 7, 2011 (2:00 pm, PST)
- Bid Due Date and Time..... November 11, 2011 (3:00 pm, PST)

This Schedule of Events is subject to change. Any changes will be made through the issuance of Written Addenda.

1.02 PRE-BID CONFERENCE:

A Pre-Bid Conference will not be held.

1.03 ISSUING OFFICE:

The Procurement and Contract Services (PaCS) department of Oregon State University (OSU) is the issuing office and is the sole point of contact for this Invitation to Bid. Address all concerns or questions regarding this Invitation to Bid to the Administrative Contact identified below:

1.04 ADMINISTRATIVE CONTACT:

Name: Bonnie Tufts
Title: Procurement Analyst
Telephone: 541-737-7353
Fax: 541-737-5546
E-Mail: Bonnie.tufts@oregonstate.edu

1.05 DEFINITIONS:

As used in this Invitation to Bid, the terms set forth below are defined as follows:

- a. "Addenda" means an addition to, deletion from, a material change in, or general interest explanation of the Invitation to Bid.
- b. "Exhibits" means those documents which are attached to and incorporated as part of the Invitation to Bid.
- c. "Bid" means an offer, binding on the Bidder and submitted in response to an Invitation to Bid.
- d. "Bidder" means an entity that submits a Bid in response to an Invitation to Bid.
- e. "Bid Due Date and Time" means the date and time specified in the Invitation to Bid as the deadline for submitting Bids.
- f. "Invitation to Bid" (ITB) means a Solicitation Document for the solicitation of competitive, Written, signed and sealed Bids in which Specifications, price, and delivery (or project completion) are the predominant award criteria.
- g. "Responsible" means an entity that demonstrates their ability to perform satisfactorily under a Contract by meeting the applicable standards of responsibility outlined in OAR 580-061-0130.
- h. "Responsive" means a Bid that has substantially complied in all material respects with the criteria outlined in the Invitation to Bid.
- i. "Written or Writing" means letters, characters, and symbols inscribed on paper by hand, print, type, or other method of impression intended to represent or convey particular ideas or meanings.

2.0 INTRODUCTION AND BACKGROUND

2.01 INTRODUCTION

Oregon State University (OSU) Procurement and Contract Services (PaCS) is seeking Responsive Responsible Bidders to submit Bids for an instrumentation Buoy for scaled mobile ocean test berth.

2.02 BACKGROUND:

The instrumentation buoy will be used by the Northwest National Marine Renewable Energy Center (NNMREC) will be used to test scaled wave energy converters (WECs) off the coast of Newport, Oregon. NNMREC is a Department of Energy sponsored partnership between Oregon State University (OSU) and the University of Washington (UW), with UW focusing on tidal energy and OSU focusing on wave energy. The instrumentation buoy will be a surface buoy that will provide both a stand-alone electrical load and instrumentation to monitor WECs under test. The WEC under test and the instrumentation buoy will be moored approximately 100 meters apart, and will be connected together with power and communication cables.

2.03 OREGON STATE UNIVERSITY:

Founded in 1868, Oregon State University is a comprehensive, research-extensive, public university located in Corvallis. OSU is a member of the Oregon University System and one of only two American universities to hold the Land Grant, Sea Grant, Space Grant and Sun Grant designations. OSU is also the only Oregon institution to hold the Carnegie Foundation's top ranking for research universities, a recognition of the depth and quality of OSU's graduate education and research programs.

Through its centers, institutes, Extension offices and Experiment Stations, OSU has a presence in almost every one of Oregon's 36 counties, including its main campus in Corvallis, the Hatfield Marine Sciences Center in Newport and OSU-Cascades Campus in Bend. OSU offers undergraduate, masters and doctoral degrees through 12 academic colleges enrolling more than 20,000 students from every county in Oregon, every state in the country and more than 90 nations.

3.0 SPECIFICATIONS / STATEMENT OF WORK

3.01 REQUIRED SPECIFICATIONS:

In order to qualify as a Responsive Bidder, the Bid needs to meet the required specifications In Exhibit A.

3.02 TERMS AND CONDITIONS:

OSU's terms and conditions governing the purchase resulting from this ITB are included at Exhibit B.

4.0 BIDDER QUALIFICATIONS

4.01 MINIMUM QUALIFICATIONS:

In order to qualify as a Responsive Bidder, the Bidder needs to meet the minimum qualifications below.

- a. A minimum of five (5) years' experience in design, fabrication and assembly of 6 meter Navy Oceanographic Meteorological Automatic Device (NOMAD) oceanographic buoys and moorings.

5.0 REQUIRED SUBMITTALS

5.01 QUANTITY OF BID:

Submit one (1) original Bid and one (1) duplicate copy. Mark original Bid as "ORIGINAL". Original should contain original signatures on any pages where a signature is required. Bids should contain the submittals listed in this section below:

5.02 REQUIRED SUBMITTALS:

It is the Bidder's sole responsibility to submit information in fulfillment of the requirements of this Invitation to Bid. If pertinent information or required submittals are not included within the Bid, it may cause the Bid to be rejected.

Bidders should submit the following information:

- Description of the goods offered which specifically meet the required specifications described in Exhibit A.
- Detailed information about how the Bidder meets the minimum qualifications detailed in section 4.
- Complete and itemized pricing of the goods requested.
- Exhibit C, Certifications, fully completed.
- Exhibit D, References, fully completed.

6.0 EVALUATION AND AWARD

6.01 EVALUATION:

Bids will be evaluated to determine the lowest Responsive Responsible Bidder based upon the Invitation to Bid, Exhibits and Addenda. OSU may engage in any of the processes identified in the applicable Oregon Administrative Rules to determine Contract award.

6.02 INVESTIGATION OF REFERENCES:

OSU reserves the right to investigate and to consider the references and the past performance of any Bidder with respect to such things as its performance or provision of similar goods or services, compliance with specifications and contractual obligations, and its lawful payment of suppliers, subcontractors, and workers. OSU further reserves the right to consider past performance, historical information and facts, whether gained from the Bid, interviews, references, OSU or any other source. OSU may postpone the award or execution of the Contract after the announcement of the notice of intent to award in order to complete its investigation.

7.0 INSTRUCTIONS TO BIDDERS

7.01 APPLICABLE STATUTES AND RULES:

This ITB is subject to the applicable provisions and requirements of the Oregon Revised Statutes, Oregon Administrative Rules, and OSU Policies and Procedures.

7.02 MANUFACTURER'S NAMES AND APPROVED EQUIVALENTS:

Unless qualified by the provision "NO SUBSTITUTE" any manufacturers' names, trade name, brand names, information and/or catalogue numbers listed in a specification are for information and not intended to limit competition. Bidders may offer any brand for which they are an authorized representative, which meets or exceeds the specification for any item(s). If Bids are

based on equivalent products, indicate in the Bid form the manufacturers' name and number. Bidders shall submit with their Bid, sketches, and descriptive literature, and/or complete specifications. Reference to literature submitted with a previous Bid will not satisfy this provision. Bidders shall also explain in detail the reason(s) why the proposed equivalent will meet the specifications and not be considered an exception thereto. Bids, which do not comply with these requirements, are subject to rejection. Bids lacking any written indication of intent to provide an alternate brand will be received and considered in complete compliance with the specification as listed in the ITB.

7.03 REQUEST FOR CLARIFICATION OR CHANGE:

Requests for clarification or change of the Invitation to Bid must be in Writing and received by the Administrative Contact no later than the Deadline for Request for Clarification or Change as specified in the Schedule of Events. Such requests for clarification or change must include the reason for the Bidder's request. OSU will consider all timely requests and, if acceptable to OSU, amend the Invitation to Bid by issuing an Addendum. Envelopes, e-mails or faxes containing requests should be clearly marked as a Request for Clarification or Change and include the ITB Number and Title.

7.04 ADDENDA:

Only documents issued as Written Addenda by PaCS serve to change the Invitation to Bid in any way. No other direction received by the Bidder, written or verbal, serves to change the Invitation to Bid. PaCS will notify potential Bidders through publication of the Addenda on the OUS procurement website. If you have received an Invitation to Bid you should consult the OUS procurement website, prior to Bid submittal, to assure that you have not missed any Addenda. Bidders are not required to return Addenda with their Bid. However, Bidders are responsible for obtaining and incorporating any changes made by the Addendum into their Bid. Failure to do so may, in effect, make the Bid non-Responsive, which may cause the Bid to be rejected.

7.05 PREPARATION AND SIGNATURE:

All Required Submittals must be Written or prepared in ink and signed in ink by an authorized representative with authority to bind the Bidder. Signature certifies that the Bidder has read, fully understands, and agrees to be bound by the Invitation to Bid and all Exhibits and Addenda to the Invitation to Bid.

7.06 PUBLIC RECORD:

Upon completion of the Invitation to Bid process, information in your Bid will become subject records under the Oregon Public Records Law. Only those items considered a "trade secret" under ORS 192.501(2), may be exempt from disclosure. If a Bid contains what the Bidder considers a "trade secret" the Bidder must mark each sheet of information as such. Only bona fide trade secrets may be exempt and only if public interest does not require disclosure.

7.07 SUBMISSION:

Bids must be submitted in a sealed envelope and be delivered to the submittal location listed on the Invitation to Bid cover sheet no later than the Bid Due Date and Time. Bidder must specify on the outside of the envelope the Invitation to Bid number, the Invitation to Bid title and the Bid Due Date and Time. **E-MAIL OR FACSIMILE BIDS WILL NOT BE ACCEPTED.**

7.08 MODIFICATION:

Prior to submittal, Bidders should initial modifications or erasures in ink by the person signing the Bid. After submittal but prior to the Bid Due Date and Time, Bids may be modified by submitting a Written notice indicating the modifications and a statement that the modification amends and supersedes the prior Bid. After the Bid Due Date and Time, Bidders may not modify their Bid.

7.09 WITHDRAWALS:

A Bidder may withdraw their Bid by submitting a Written notice to the Administrative Contact identified in this Invitation to Bid prior to the Bid Due Date and Time. The Written notice must be on the Bidder's letterhead and signed by an authorized representative of the Bidder. The Bidder, or authorized representative of the Bidder, may also withdraw their Bid in person prior to the Bid Due Date and Time, upon presentation of appropriate identification and evidence of authority to withdraw the Bid satisfactory to OSU.

7.10 LATE SUBMITTALS:

Bids and Written notices of modification or withdrawal must be received no later than the Bid Due Date and Time. OSU may not accept or consider late Bids, modifications, or withdrawals except as permitted in OAR 580-061-0120.

7.11 BID OPENING:

Bids will be opened immediately following the Bid Due Date and Time at the Submittal Location. Bidder may attend the Bid opening. Only the names of the Bidders submitting Bids will be announced. No other information regarding the content of the Bids will be available.

7.12 BIDS ARE OFFERS:

The Bid is the Bidder's offer to enter into a Contract pursuant to the terms and conditions specified in the Invitation to Bid, its Exhibits, and Addenda. The offer is binding on the Bidder for one hundred twenty (120) days. OSU's award of the Contract constitutes acceptance of the offer and binds the Bidder. The Bid must be a complete offer and fully Responsive to the Invitation to Bid.

7.13 CONTINGENT BIDS:

Bidder shall not make its Bid contingent upon OSU's acceptance of specifications or contract terms that conflict with or are in addition to those in the Invitation to Bid, its Exhibits, or Addenda.

7.14 RIGHT TO REJECT:

OSU may reject, in whole or in part, any Bid not in compliance with the Invitation to Bid, Exhibits, or Addenda, if upon OSU's Written finding that it is in the public interest to do so. OSU may reject all Bids for good cause, if upon OSU's Written finding that it is in the public interest to do so. Notification of rejection of all Bids, along with the good cause justification and finding of public interest, will be sent to all who submitted a Bid.

7.15 AWARDS:

OSU reserves the right to make award(s) by individual item, group of items, all or none, or any combination thereof. OSU reserves the right to delete any item from the award when deemed to be in the best interest of OSU.

7.16 LEGAL SUFFICIENCY REVIEW:

Prior to execution of any Contract resulting from this Invitation to Bid, the Contract may be reviewed for legal sufficiency by a qualified attorney for OSU pursuant to the applicable Oregon Revised Statutes and Oregon Administrative Rules. Legal sufficiency review may result in changes to the terms and conditions specified in the Invitation to Bid, Exhibits, and Addenda.

7.17 BID RESULTS:

A notice of intent to award containing the Bid results will be issued to all Bidders. The Bid file will be available for Bidder's review during the protest period at the PaCS Department. Bidders must make an appointment with the Administrative Contact to view the Bid file. After the protest period, the file will be available by making a Public Records Request to OSU.

7.18 BID PREPARATION COST:

OSU is not liable for costs incurred by the Bidder during the Invitation to Bid process.

7.19 BID CANCELLATION:

If an Invitation to Bid is cancelled prior to the Bid Due Date and Time, all Bids that may have already been received will be returned to the Bidders. If an Invitation to Bid is cancelled after the Bid Due Date and Time or all Bids are rejected, the Bids received will be retained and become part of OSU's permanent Bid file.

7.20 PROTEST OF CONTRACTOR SELECTION, CONTRACT AWARD:

Any Bidder who feels adversely affected or aggrieved may submit a protest within seven (7) calendar days after OSU issues a notice of intent to award a Contract. The protest must be clearly identified as a protest, identify the type and nature of the protest, and include the Invitation to Bid number and title. The rules governing protests are at OAR 580-061-0145.

EXHIBIT A SPECIFICATIONS

1. Scope

These specifications define the requirements for an instrumentation buoy that Northwest National Marine Renewable Energy Center (NNMREC) will use to test scaled wave energy converters (WECs) off the coast of Newport, Oregon. NNMREC is a Department of Energy sponsored partnership between Oregon State University (OSU) and the University of Washington (UW), with UW focusing on tidal energy and OSU focusing on wave energy. The instrumentation buoy will be a surface buoy that will provide both a stand-alone electrical load and instrumentation to monitor WECs under test. The WEC under test and the instrumentation buoy will be moored approximately 100 meters apart, and will be connected together with power and communication cables.

OSU will coordinate the NNMREC selection of an experienced designer and manufacturer of 6-meter NOMAD (Navy Oceanographic Meteorological Automatic Device) oceanographic buoys and moorings to design, fabricate, and assemble portions of the system that are not specific to testing WECs. NNMREC will specify and procure the portions of the system that are specific to WEC testing. The NNMREC supplied equipment will be shipped to the Supplier, and the Supplier will install this equipment on board the buoy at their facilities. The supplier will design and install any interfaces necessary to install the NNMREC supplied equipment on board the buoy. The Supplier will provide delivery of the complete system to Newport, Oregon (delivery target of: 5/1/2012).

2. Program and Documentation Requirements

The following requirements apply to the Supplier that NNMREC will select for the instrumentation buoy.

2.1 Review of Design

Aspects of the instrumentation buoy design that are customized for the NNMREC application shall be reviewed and approved by NNMREC, before design changes will result in significant cost impact. NNMREC may contract with outside experts as necessary for assistance with this review. Aspects of the design that are standard for other NOMAD buoy applications, as agreed upon by NNMREC and the Supplier at the beginning of the project, will not be subject to review.

2.2 United States Coast Guard and National Environmental Protection Act Review

The instrumentation buoy design will be reviewed by the United States Coast Guard (USCG) in order to be permitted as a Private Aid to Navigation (PATON), and will also be subject to National Environmental Protection Act (NEPA) review. NNMREC will coordinate these review processes. The Supplier shall provide requested documentation as necessary.

2.3 Commissioning and Acceptance Testing

The Supplier shall commission all equipment that it provides, and perform a set of tests to verify proper operation at their own facilities. The Supplier shall submit a test plan, to be reviewed and approved by NNMREC, before these tests are performed. The commissioning of NNMREC supplied equipment will be the responsibility of NNMREC. Supplier will assist NNMREC to commission this equipment and interfaces with supplier provided equipment, either at Supplier or NNMREC facilities, as requested by NNMREC.

2.4 Deployment and Removal Plan

The Supplier will work cooperatively with NNMREC to develop a deployment and removal plan for the instrumentation buoy system. NNMREC prefers to use a vessel equivalent to the 54 foot R/V Elakha, described at <http://www.shipops.oregonstate.edu/ops/elakha/>, or alternately the 84 foot R/V Pacific Storm, described at <http://mmi.oregonstate.edu/research-vessels>, for deployment. In some cases, NNMREC may want to use vessels from the local commercial fishing fleet for deployment as well. The deployment and removal plan should include methods to remove the instrumentation buoy from its moorings for short periods during the course of a test so that the buoy can be towed from the test site to Yaquina Bay for servicing. The plan should describe the sea conditions required at the test site as

well as at the bar at the entrance to Yaquina Bay for the procedures to be carried out using different size vessels. The plan shall also describe the equipment and methods to lift the buoy in and out of the water in harbor.

2.5 WEC Cable Connection to Instrumentation Buoy Procedures

The Supplier will work cooperatively with NNMREC to develop a document that includes procedures for placing the umbilical cable (power and communications) in the water with all needed floats/weights and making the connections to the Instrumentation buoy and WEC. The connection between the instrumentation buoy and WEC will potentially be made somewhere between the two, with each system containing a pigtail with a length of cable. Note that this must include the requirement for verification that the cable is de-energized prior to connection/disconnection.

2.6 Documentation and Operating Manuals

The supplier shall provide a design documentation package to NNMREC that includes a complete set of as-built electrical drawings. Operating manuals shall be provided for all supplier provided equipment installed on board the instrumentation buoy.

3. Description of the Instrumentation Buoy

The instrumentation buoy system is shown in Figure 3-1. The instrumentation buoy will facilitate open ocean, stand-alone testing of scaled WECs with power outputs of up to approximately 100 kW average. It will normally be deployed at a NNMREC test site that is approximately 2.5 nautical miles offshore from Yaquina Head, north of Newport, Oregon. See Appendix A for a map showing the test site location.

WECs under test will be moored approximately 100 meters from the instrumentation buoy, and an umbilical cable will connect the two. Power generated by the WEC will be dissipated in a load bank on board the instrumentation buoy. Switch gear and power conversion equipment located on-board the instrumentation buoy will provide control of the load bank. Data may be transmitted from the WEC under test to the instrumentation buoy via a fiber optic connection through the umbilical. Wave data recorded by a wave measuring instrument will also be transmitted to the instrumentation buoy, via wireless telemetry.

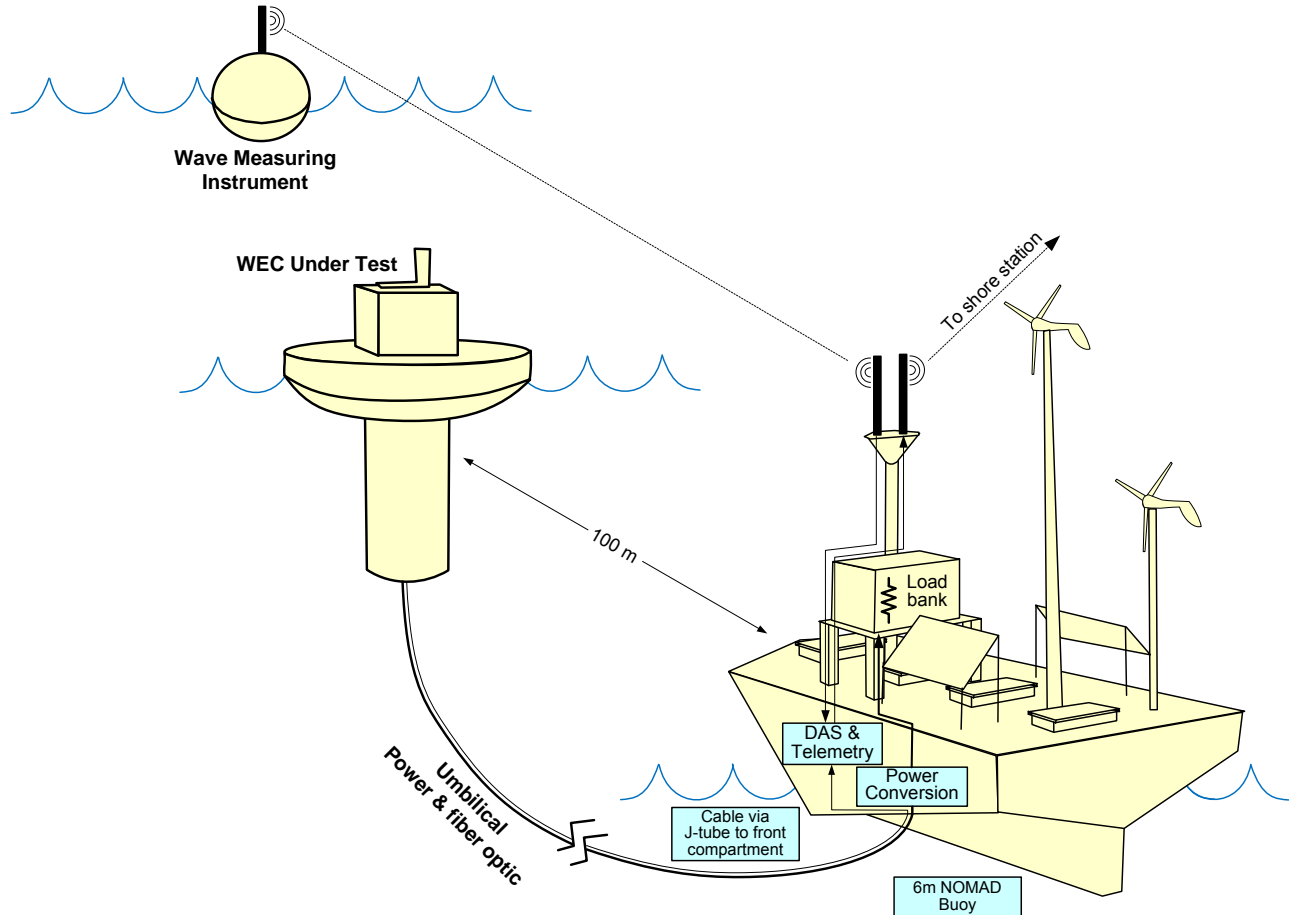


Figure 3-1 WEC Testing with Instrumentation Buoy

The primary functions of the instrumentation buoy are as follows:

1. Provide stand-alone electrical loading and power conversion for the WEC under test.
2. Measure and record WEC power output.
3. Collect and store data transmitted from both the WEC under test and a wave measuring instrument moored close by.
4. Transmit collected data to a shore station via a wireless telemetry system.

3.1 Test Site Climatology

The wave, wind, and current climatology information for the NNMREC scaled test site is provided in Appendix B. Included in Appendix B is an earlier mooring climatology analysis that was performed to

analyze a 12 month deployment at this test site. Note, upon review of that mooring climatology analysis, OSU researchers responded that the correct shoaling coefficient between NDBC and MOTB would be 1.01. Hence, the waves would be expected to increase slightly between those two points (neglecting wind effects, bottom friction and refraction). Thus it is estimated that the analysis underestimated the design wave by 7% (e.g., should be 16.2 m not 15.2 m). Regarding the currents, OSU researchers believe that wind driven currents near the surface can hit 1 knot easily during a normal winter storm (40 knot wind). Extreme events can drive even stronger currents, thus the 0.6 knot current for the 50-year storm is a low estimate.

The instrumentation buoy primary deployment window is for periods between May 1 and October 31, however, the moorings will be left in place all year. The water depth at the test site is approximately 50 meters, and the maximum significant wave height for May-October is approximately 10 meters.

3.2 Hull (Supplier responsibility)

The hull design and fabrication will be carried out by the supplier. The instrumentation buoy shall have a 6-meter NOMAD hull with four compartments, similar to NOMAD buoys used by the National Data Buoy Center (NDBC). NNMREC supplied WEC electrical loading and data acquisition equipment will be installed in the forward compartment.

The buoy shall include railings to prevent pinniped haulout. See the Advanced H2O Power website for information about pinniped haulout and marine renewable energy:

http://www.advancedh2opower.com/framework/Site%20Pages/Haulout%20and%20Roosting_DRAFT.PDF. The hull shall include lifting and towing points consistent with the deployment plan described in Section 2.4, and bumpers to prevent damage to and from service vessels. The hull shall be painted yellow above waterline and include markings per USCG requirements, as determined during the USCG review process described in Section 2.2.

3.3 Mooring System (Supplier responsibility)

The mooring system shall be designed by the supplier, subject to NNMREC review, and provided by the supplier. The mooring system shall be designed for the conditions described in Section 3.1 and Appendix B. The mooring system shall be designed to moor the instrumentation buoy for WEC testing between May 1 and October 31 at the NNMREC test site, and to be left in place and attached to a marker buoy when the instrumentation buoy is not deployed. The marker buoy shall have USCG approved lighting and marking, and shall be supplied as part of the mooring system. The mooring system shall be designed to facilitate frequent connection and disconnection of the instrumentation buoy, so that the instrumentation buoy can be towed to a protected harbor for servicing during the course of a test.

Either a two-point or three-point mooring system is proposed. The mooring system shall maintain a small watch circle and control buoy yaw, in order to control cable twist and cable loads during extreme conditions. The mooring system shall be designed together with the instrumentation buoy and umbilical cable, so that immediate repair will not be required to avoid further damage after a single mooring line failure has occurred. NNMREC expects that it may take up to 48 hours before a mooring repair will be possible.

During preliminary mooring design, the Supplier shall also perform a brief assessment of extending the deployment window for WEC testing, using the two or three point mooring system, beyond May through October. Even if normal instrumentation buoy operation is not possible during winter months, information on the survival capability with some damage to on-board equipment is desirable, in case the buoy is not removed from station before early winter storms.

The Supplier is also asked to assess the feasibility of year-around deployment of the instrument buoy on a single point mooring, at a similar location, for offshore wind resource assessment and environmental monitoring. See Section 3.11 for further details.

3.4 Power System (Supplier responsibility)

The supplier shall provide a power system to supply power to all equipment installed on board the instrumentation buoy and to also export instrumentation power to the WEC under test. NNMREC has the following minimum requirements for this system:

1. The system shall be capable of continuously providing at least 400 W of instrumentation power at 24 Vdc and 12 Vdc. An estimated power budget is shown in Table 3-1.

Table 3-1 Preliminary Power Budget

Equipment	Power Budget (W)
Export to WEC under test	150
WEC power converter	125*
NNMREC DAS	20*
Telemetry/communications	75*
On-board instrumentation	TBD (supplier provided per Sections 3.5 and 3.6)
Other	
Total	370 + TBD

*Rough estimates

The supplier shall provide all switchgear and wiring for connection of the power system to the umbilical cable and NNMREC provided equipment to be installed in the forward compartment.

2. Power may be generated by any or all of the following means: 1) solar panels, 2) wind generation, and 3) methanol fuel cell. A diesel generator may be used in place of the methanol fuel cell if it meets USCG and NEPA approval per Section 2.2.
3. NNMREC requests that solar and wind generation be adequate for normal operation under typical summer conditions, with sufficient battery storage for typical periods when this generation is not adequate (based on Newport, Oregon characteristics).
4. NNMREC requests that the methanol fuel cell (or diesel generator) not be relied upon frequently, and be appropriately sized such that it can last the duration of a 5-month deployment. The system shall be designed for emergency refueling at sea from a service vessel. NNMREC may require Supplier assistance to develop refueling procedures.
5. A method to remotely monitor power system status, including battery charge and fuel level, shall be provided.

In addition, the power system should be designed for expansion in the future so that NNMREC can install a grid emulator or other power conversion equipment on board the buoy. It is anticipated that a grid emulator will periodically require several hundred watts of additional power at 700 Vdc. This expansion may be powered through added methanol fuel cell or diesel generator capability. It may also be possible to use WEC output power, when available, as a supplemental power source to reduce fuel cell or generator usage.

Lead acid batteries, if used, shall be of the glass mat type, completely sealed to prevent hydrogen buildup.

3.5 On-Board Instrumentation (Supplier responsibility)

The following instrumentation shall be provided by the Supplier and installed on board the instrumentation buoy:

1. Anemometer: Vector Instruments model number A100R/K or equivalent.
2. Wind direction sensor: Vector Instruments model number W200P-01/WR or equivalent.
3. Acoustic Doppler Current Profiler (ADCP): Nortek 600KHz Aquadopp Profiler or equivalent.
4. Video cameras: Remotely monitored, low frame rate video cameras shall be included that view the deck and water immediately surrounding the instrumentation buoy.

Wind and ocean current data from this instrumentation will be recorded by the NNMREC DAS system described in Section 7 for integration with WEC power and wave data. NNMREC will require supplier assistance for this interface; alternate instrumentation may be selected to simplify this interface.

3.6 Other Equipment (Supplier responsibility)

The following equipment shall also be provided by the Supplier:

1. Navigation light: Tideland Signal Corporation model ML-140 or equivalent. Must meet USCG approval during the review process described in Section 2.2 and have an amber flashing pattern to be determined during USCG review.
2. AIS transponder: as proposed by Supplier.
3. Radar reflector: include if buoy structure does not provide sufficient radar visibility.
4. GPS: the need for GPS tracking of the buoy is to be determined.
5. Bilge pumps: as proposed by Supplier; should include redundancy and high water level alarms.
6. Lifting bridle or fixtures: as determined necessary for lifting buoy from water during development of deployment plan described in Section 2.4.
7. Trailer, dolly, or cradle: as determined necessary for shore storage and movement during development of deployment plan described in Section 2.4.

3.7 Data Acquisition

NNMREC will provide the data acquisition system (DAS) shown in Figure 3-2. This DAS will record the following:

1. The power output of the WEC under test (measured on board the instrumentation buoy).
2. Wind speed, wind direction, and ocean current data measured on board the instrumentation buoy.
3. Data received from the DAS installed on board the WEC under test.
4. Wave data from the wave measuring instrument shown in Figure 3-1.

NNMREC will require Supplier assistance to install the DAS on board the instrumentation buoy and interface to supplier provided on-board instruments. National Instruments CompactRIO will be used for the NNMREC DAS, for compatibility with standardized CompactRIO DAS modules that will be provided by the National Renewable Energy Laboratory (NREL) for installation on board the WEC under test. The CompactRIO controllers on board the instrumentation buoy and WEC under test will be interconnected via Ethernet to a NNMREC server at the Hatfield Marine Science Center (HMSC) on shore. In addition, an Ethernet connection will be provided between developer DAS and control systems on board the WEC, and a developer host system at HMSC. The WEC and instrumentation buoy CompactRIO controllers will have capability to store data locally, with redundancy, as well as to transfer data to the instrumentation buoy controllers or shore PC.

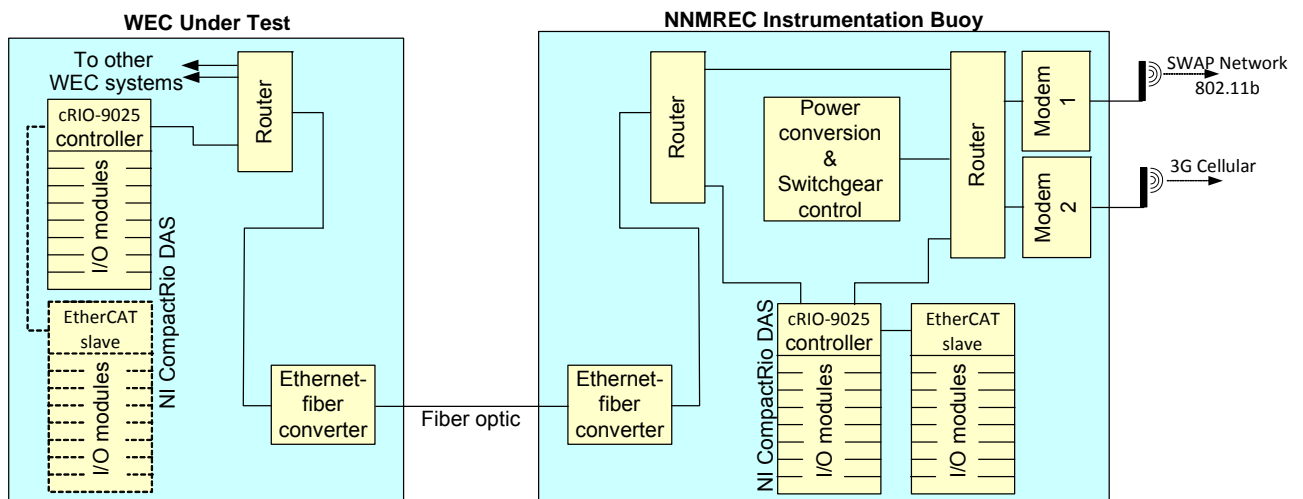


Figure 3-2 NNMREC DAS, Telemetry, and Networking

The interface between the NNMREC DAS and the wave measuring instrument is not shown in Figure 3-2. NNMREC will assess the viability of implementing this interface early in the project. It is preferable to collect wave data and other WEC data with a common DAS to minimize data post-

processing. If this interface proves difficult, however, wave data will be transmitted directly to shore and will be integrated with other data by post processing.

Additional data acquisition and control will be necessary to monitor and control the instrumentation buoy power systems and other equipment. These functions may either be provided by separate equipment or integrated with the NNMREC DAS. The Supplier and NNMREC will assess these requirements and determine the best approach early in the project.

3.8 Telemetry and Networking

NNMREC will work cooperatively with the Supplier to specify the telemetry and networking components. The Supplier will procure and install this equipment.

The telemetry and network system and interface to NNMREC DAS is shown in Figure 3-2. Ethernet connectivity between the WEC under test and instrumentation buoy via fiber optic cables in the umbilical is preferred. Alternatively, radio telemetry may be used if fiber optic proves difficult. Connectivity between the instrumentation buoy and shore station will be provided by wireless telemetry. NNMREC proposes to use a redundant telemetry system that makes use of both an 802.11b Ship to Shore Wireless Access Protocol (SWAP) network and 3G cellular. The SWAP network is run by the College of Oceanic and Atmospheric Sciences (COAS) at OSU and includes an antenna approximately 3 miles from the NNMREC test site. COAS staff will assist NNMREC with the SWAP network connection.

A short range wireless Ethernet connection to the instrumentation buoy may also be necessary to directly access the system from a laptop computer on board a service vessel in the vicinity of the buoy. It may be feasible for the SWAP network to provide this function.

Not shown in Figure 3-3 is a possible wireless link between a wave measuring instrument, most likely a Datawell Waverider buoy, and the instrumentation buoy. Depending on the difficulty of recording this data with the DAS, this data may be directly transmitted to shore, as described in Section 3.7. The low speed, 25.5 - 35.5 MHz wireless transmission from the Waverider buoy will have sufficient range for transmission to HMSC.

3.9 WEC Electrical Loading and Power Conversion

WEC electrical loading equipment will be procured by NNMREC and shipped to the Supplier for installation on board the instrumentation buoy. The supplier will be required to design, fabricate, and install the mounting supports and cable conduits required to install this equipment. See Figure 3-3 for a diagram of this equipment. The variable speed, variable frequency electrical generator on board the WEC will connect to a power converter that will be located in the forward compartment of the instrument buoy, via the umbilical cable described in Section 3.10. The power converter will connect to a load bank mounted above the deck of the instrumentation buoy. The power converter will control the amount of WEC power dissipated in the load bank.

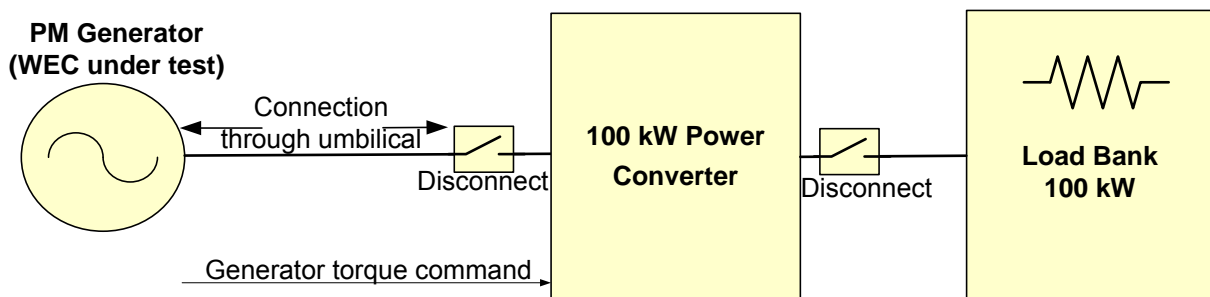


Figure 3-3 Instrumentation Buoy Electrical Load System

NNMREC will use either a standard, off-the-shelf power converter or a custom design. The dimensions of the power converter have not yet been determined, and will be dependent on space available in the forward compartment of the instrumentation buoy. The Supplier will provide NNMREC

with the maximum dimension enclosure that will fit inside the forward compartment of the instrumentation buoy before the project begins. NNMREC will select or design a converter based on those dimensions. The forward instrumentation buoy hatch may need to be oversized if the converter will not fit through a standard dimension NOMAD buoy hatch. The power converter will dissipate up to 5 kW of power inside the forward compartment of the buoy. NNMREC will require the Supplier's assistance to determine the best method to cool the power converter.

The 100 kW load bank will be approximately 760 mm x 910 mm x 1370 mm (30" x 36" x 54") and have a mass of 250 kg (550 lbs); two or more smaller load banks that total 100 kW can also be used. It is possible to use multiple, smaller load banks in place of a single large load bank. It will be important for the load bank to be elevated above deck level enough to keep significant seawater spray from penetrating the load bank enclosure. The load bank will use a ventilated enclosure similar to that shown for a smaller load bank in Figure 3-4. The bottom of the enclosure will be open, the sides louvered, and the top elevated from the sides to allow cooling air to flow out from under the cover. The surface of the enclosure may be as hot as 100 °C on the sides, and hotter on the top; this will need to be taken into account in the mounting design. While small amounts of seawater spray penetrating the enclosure will not cause damage, submersion of the heating elements inside may short the electrical terminals of one of the heating elements and cause damage. The load bank will be connected to the power converter in the forward compartment with two or three conductors of electrical cable, which should be protected by conduit where above deck. This cable may be as large as 1/0, with each conductor having an insulated



mm (0.7").

Figure 3-4 Example Enclosure for Smaller Load Bank

3.10 Umbilical Cable

NNMREC will contract with third parties to design and supply the umbilical cable that connects the WEC under test to the instrumentation buoy. The Supplier will be responsible for designing the entry of the umbilical cable on to the instrumentation buoy, in cooperation with NNMREC and the third parties.

The umbilical cable will have the following capacity:

1. Three-phase, four wire cable with sufficient capacity for 100 kW power transfer @ 480 V.
2. Two 14-16 AWG or larger conductors for 24 Vdc instrumentation power.
3. Two pair of fiber optic cable minimum; four or more pair preferred.

The diameter of the power cable is expected to be about 40-50 mm (1.5"-2"). The fiber optic and 18 AWG conductors may be separated into a second umbilical. It is also possible that NNMREC will decide to use wireless telemetry in place of the fiber optic conductors.

Two concepts considered for cable entry on board a vessel during an earlier design study done for NNMREC, side or center entry, are shown in Figure 3-5 for reference. It will be important to coordinate the cable entry design with the mooring system design.

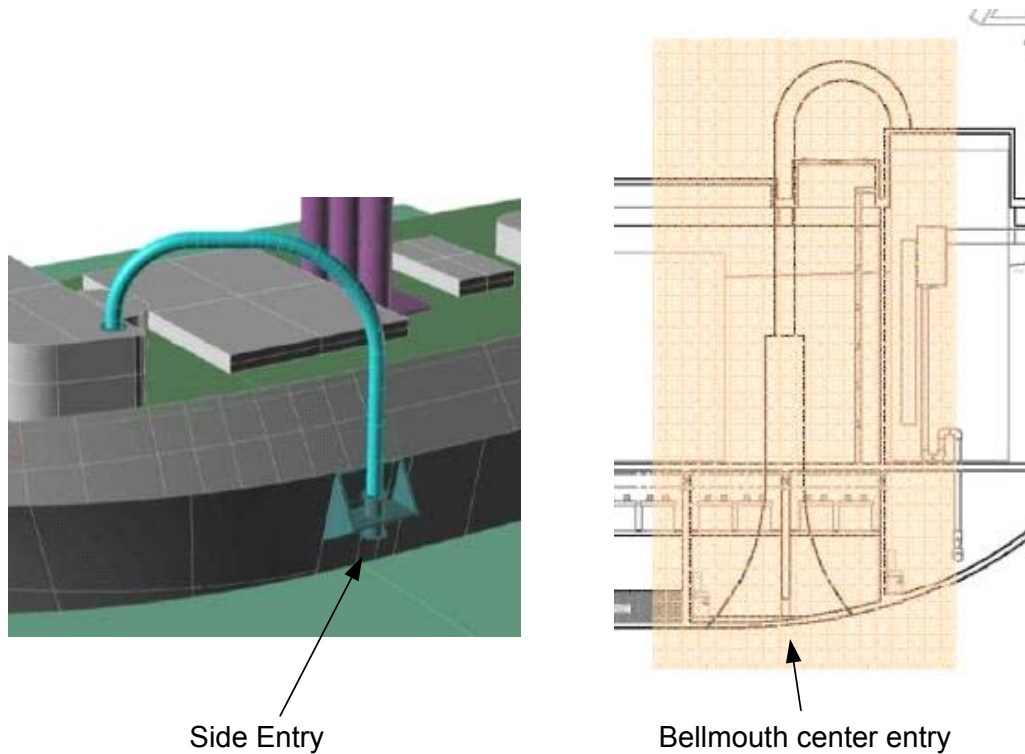


Figure 3-5 Concepts for Side and Center Umbilical Entry on to Buoy

The umbilical cable will either be suspended beneath the surface by floats or submerged to the sea floor between the instrumentation buoy and WEC under test. If suspended beneath the surface, surface marking floats that meet USCG approval will be required. The cable design must include strain reliefs and connection systems that will avoid damage in the event of a WEC mooring failure. The design also needs to facilitate frequent connection and disconnection of either the WEC or instrumentation buoy, so that either can be towed to a protected harbor for servicing during the course of a test. The design must be consistent with the WEC Cable Connection to Instrumentation Buoy Procedures, described in Section 2.5 and listed at the bottom of Table 4-1, that will be developed by the supplier and NNMREC.

3.11 Adaptability for other uses

NNMREC may have the need in the future to retrofit the instrumentation buoy for use in offshore wind resource assessments and environmental monitoring when not in normal use. The supplier is asked to provide a brief assessment to determine the design impacts of providing an instrumentation buoy that is easily convertible for this purpose. This includes the flexibility to use a single point mooring rather than the normal multi-point mooring and to leave the buoy deployed year-around.

4. Summary of Requirements

The requirements for the instrumentation buoy are summarized in Table 4-1.

Table 4-1 Requirements for Instrumentation Buoy System

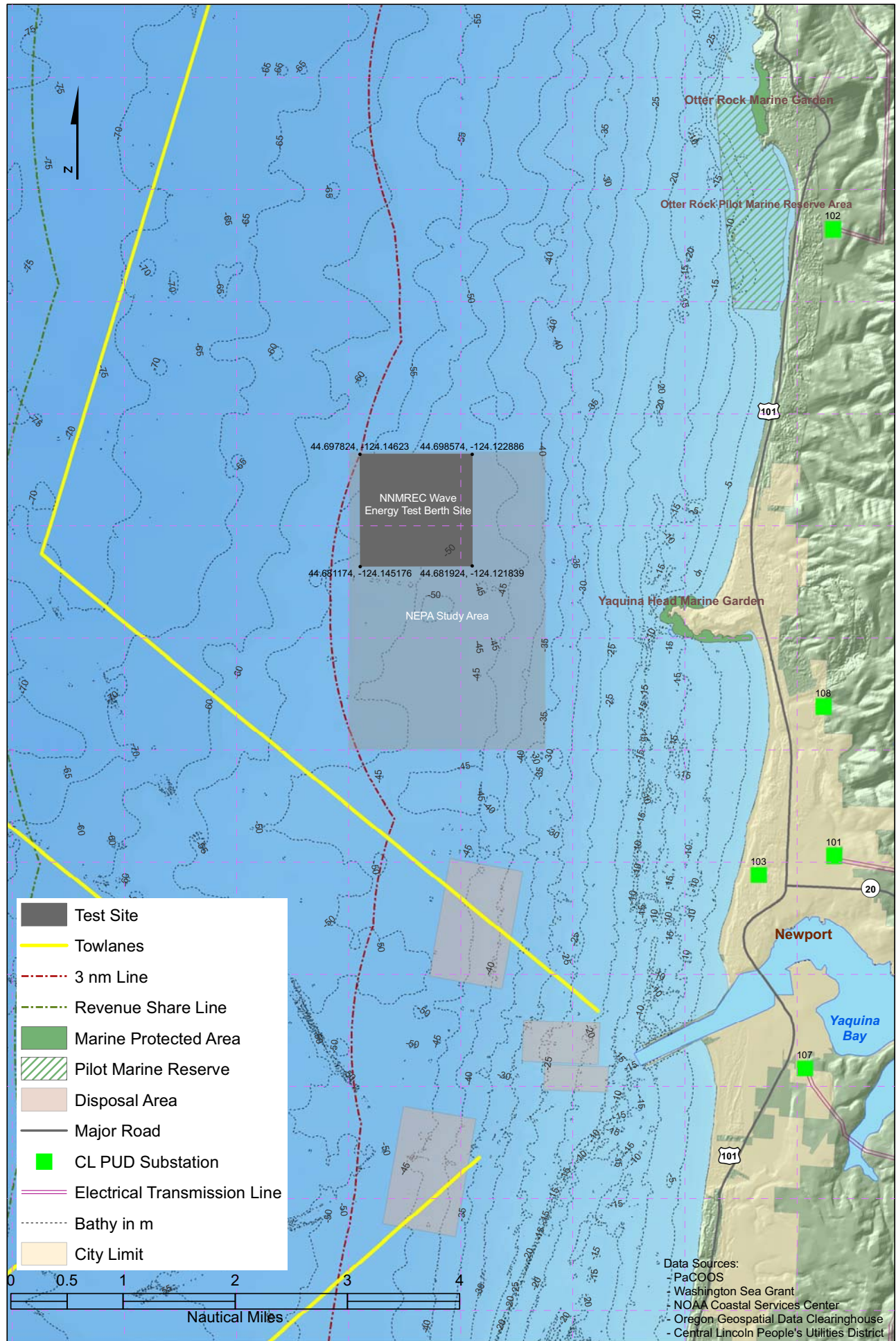
Requirement	Specification
Hull (Section 3.2)	Supplier is responsible for hull design and fabrication.
Test site & climatology	See Appendix A for test site location and Appendix B for climatology; design for deployment May-Oct.
Lift and towing points	Design to be consistent with deployment plan.
Bumper	Design to prevent damage from contact with service vessels.
Paintings/markings	Yellow above waterline and markings per USCG requirements.
Pinniped haulout	Include railings or features to prevent haulout.
Mooring System (Section 3.3)	Supplier is responsible for mooring system design, procurement, and assembly.
Test site & climatology	See Appendix A for test site location and Appendix B for climatology; design for deployment May-Oct.
Type	Two or three point system proposed.
Marker buoy	To hold moorings when instrumentation buoy not deployed. Supplier provided; shall meet USCG approval.
Single line failure	Design to prevent buoy/umbilical damage after single mooring line failure.
Extended deployment window	Wider deployment window than May-Oct desirable; Supplier to perform assessment during preliminary mooring design.
Power system (Section 3.4)	Supplier is responsible for power system design and installation.
Power capacity	400 W total, or greater, at 24 and 12 Vdc.
Renewable generation	Solar, and wind shall be relied upon during typical summer conditions, with sufficient battery storage for periods when these sources are not adequate
Fuel cells or diesel generator	Methanol fuel cells or a diesel generator shall not be relied upon frequently, and shall not require refueling during 5 month deployment. Emergency refueling at sea shall be possible.
Diesel generator	May be used if it meets USCG and NEPA approval.
Fuel monitoring	Remote monitoring of status including battery charge and fuel level shall be provided.
Lead acid batteries	Lead acid batteries, if used, shall be glass mat type, completely sealed to prevent hydrogen buildup.
On-Board Instrumentation (Section 3.5)	Supplier is responsible for this instrumentation.
Anemometer	Vector Instruments A100R/K or equivalent

Requirement	Specification
Wind direction	Vector Instruments W200P-01/WR or equivalent
ADCP	Nortek 600 kHz Aquadopp Profiler or equivalent
Video cameras	Remotely monitored, low frame rate video cameras that view deck and water immediately surrounding buoy
DAS interface	Supplier will assist NNMREC with interface of wind and ADCP instrumentation with NNMREC DAS.
Other Equipment (Section 3.6)	Supplier is responsible for this equipment.
Navigation light	Tideland Signal Corporation model ML-140 or equivalent. Subject to USCG approval; flashing pattern per USCG.
IAS transponder	As proposed by Supplier
Radar reflector	Include if buoy structure does not provide sufficient radar visibility.
GPS	Need to be assessed early in project.
Bilge pumps	As proposed by Supplier
Lifting bridle or fixtures	As determined by deployment plan (to be written per Section 2.4).
Trailer, dolly, or cradle	As determined by deployment plan (to be written per Section 2.4).
Data Acquisition (Section 3.7)	NNMREC provided equipment; Supplier to assist with installation and interface to equipment it provides.
Data recorded	<ol style="list-style-type: none"> 1. WEC power output 2. Wind speed, wind direction, and ocean current 3. Data received the DAS installed on board WEC under test 4. Wave data from the wave measuring instrument (TBD)
Other supervision and control	Can either be integrated with NNMREC DAS or provided by separate equipment; Supplier and NNMREC to determine best approach early in project.
Telemetry & Networking (Section 3.8)	Equipment to be specified cooperatively by NNMREC and Supplier, and procured/installed by Supplier.
Shore telemetry	Redundant system proposed using: <ol style="list-style-type: none"> 1. COAS 802.11b SWAP network 2. 3G cellular
WEC telemetry	Fiber optic preferred; wireless will be used if fiber optic difficult
Wave measuring instrument telemetry	25.5-25.5 MHz wireless; direct transmission to shore possible if DAS interface difficult
Service wireless	Local wireless access from service vessels needed; SWAP network may provide this function.
WEC Electrical Loading and Power Conversion (Section 3.9)	Equipment to be specified and procured by NNMREC, and installed by the Supplier
Power	100 kW
Power converter	<ul style="list-style-type: none"> • Supplier to provide NNMREC with maximum dimension enclosure that will fit in forward compartment before beginning of project. • Oversized forward enclosure hatch may be required.

Requirement	Specification
	<ul style="list-style-type: none"> Power converter will dissipate up to 5 kW power.
Load bank	<ul style="list-style-type: none"> Mount above deck. Approximate dimensions 760 mm x 910 mm x 1370 mm (30" x 36" x 54"); two or more smaller load banks that total 100 kW can also be used. Approximate mass 250 kg (550 lbs). Surface temperature as high as 100°C on sides (top hotter). Bottom of enclosure open; must elevate to avoid submersion of heating elements installed inside.
Converter – load bank wiring	Two or three, 1/0 conductors required; 18 mm (0.7") OD each with insulation.
Umbilical Cable (Section 3.10)	NNMREC will contract with third parties to design and supply the umbilical cable. Supplier will provide entry on to instrumentation buoy; design of entry will be by Supplier with assistance from third parties and NNMREC.
General	Cable may run along sea floor or be suspended under surface by floats.
Cable markers	Marker floats required per USCG if cable not on sea floor; specific requirements TBD during USCG review. Lighting TBD.
Power conductors	Four conductors, 100 kW @ 480 V
Fiber optic	Two pair of conductors minimum; four or more preferred.
Instrumentation power	Two 14-16 AWG conductors (or larger)
Adaptability for other uses (Section 3.11)	Supplier to provide brief assessment of design impacts of providing an instrumentation buoy that is easily convertible for alternate use in offshore wind assessments.
Required Documents (Section 2)	
Test Berth Deployment and Removal Plan	To be written by Supplier cooperatively with NNMREC; see Section 2.4.
WEC Cable Connection to Instrumentation Buoy	To be written by Supplier cooperatively with NNMREC; see Section 2.5.
Documentation and Operating Manuals	To be provided by Supplier; see Section 2.6.

Appendix A
Test Berth Site Map

NNMREC Wave Energy Test Berth Site Map



- Test Site
- Towlanes
- 3 nm Line
- Revenue Share Line
- Marine Protected Area
- Pilot Marine Reserve
- Disposal Area
- Major Road
- CL PUD Substation
- Electrical Transmission Line
- Bathymetry in m
- City Limit



- Data Sources:
- PaCOOS
 - Washington Sea Grant
 - NOAA Coastal Services Center
 - Oregon Geospatial Data Clearinghouse
 - Central Lincoln People's Utilities District

Appendix B

Test Site Climatology Information

The data below shows May-Oct maximum SWH for buoy 46050, 17.5 nautical miles from test site.

Table A-1 Monthly maximum SWH at Buoy 46050 (from Table 2 in Glostén report, see following pages)

Month	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
January	7.5	6.8		6.0	7.8	5.4	7.5	9.0	12.1	6.1	2.9	8.7	6.4		7.8	6.8		7.3
February	6.1	4.7		6.2	7.6			10.1	7.0	7.4	5.9	4.4	6.7		12.4	7.8		6.7
March	3.9	6.4	7.5	7.9	6.1			14.1	6.6	6.9	8.0	9.8	6.5		7.9	6.9	6.9	6.3
April	4.4	6.0	5.6	4.7	7.9		2.5	7.9	5.4	5.1	5.5	5.2	6.3	3.4	5.9	4.8	5.4	5.9
May	3.1	5.2	4.1	3.8	4.0		4.6	3.8	5.6	5.8	4.3	3.2	3.2	7.6	4.6	4.1	3.6	5.1
June	3.1	3.2	5.8	4.1	2.7		4.2	4.0	4.5	4.6	3.8	4.2	4.0	5.8	3.4	3.9	4.9	3.9
July	2.5	3.3	3.3	2.7	3.6		3.1	4.0	2.6	2.8	2.9	2.9	3.2	3.3	2.9	3.6	3.4	3.0
August	2.7	3.7	2.7	3.5	2.4	1.9	2.7	2.4	2.9	5.1	3.2	3.2	3.5	2.9	2.9	2.5	4.0	3.3
September	4.2	3.0	3.1	4.7		7.4	4.0	5.0	3.9	4.9	3.4	3.2	4.1	4.1	3.8	4.0	3.9	4.6
October	5.6	4.7		5.0		7.7	5.0	8.7	8.5	9.2	3.6	9.2	5.4	6.2	7.0	9.4	5.5	5.2
November	7.0	6.4		7.2		10.5	10.8	7.2	6.3	10.7	8.5	8.1	6.1	6.4	10.8	9.9	6.1	9.4
December	8.0	7.7	7.8	9.2		7.9	8.0	7.0	8.6		11.1	7.9	5.5	8.4	10.7	12.1	9.0	6.7
Annual Max	8.0	7.7	7.8	9.2	7.9	10.5	10.8	14.1	12.1	10.7	11.1	9.8	6.7	8.4	12.4	12.1	9.0	9.4
May-Oct Max	5.6	5.2	5.8	5.0	4.0	7.7	5.0	8.7	8.5	9.2	4.3	9.2	5.4	7.6	7.0	9.4	5.5	5.2

OSU MOBILE OCEAN TEST BERTH

Climatology for MOTB Mooring Analysis

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DOC: 0906-40-004	REV: B	FILE: 10009.01	DATE: 8 June 2010

Revision History

Rev	Description	Date	Approved
B	Changed document number at client's request.	06/08/2010	CJN
A	Rev. — was stamped and signed by David L. Gray PE, Washington Registration No. 24362, on 12 May 2010. Added water depth information. Revised annual maximum SWH extrapolation for Buoys 46050 and 46005. Corrected error in number of years with winters having fewer than 40% of possible data entries. Added discussion of retention of data sets for years where any month has fewer than 40% of possible entries. Added shoaling calculation. Added annual maximum wind speed extrapolation. Added Figures 6 and 7. Replaced Figures 1, 2, and 4, and 1-1, 1-2, and 1-3.	06/01/2010	DLG

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http://www.ndbc.noaa.gov/station_page.php?station=46050.
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7. Microsoft Excel 2007, version (12.0.6524.5003) SP 2.

Summary

Eighteen years of significant wave height (SWH) measurements at NDBC Station 46050 have been analyzed with the objective of determining the 50-year return period (50-YRP) SWH and most probable wave period at the site of the Mobile Ocean Test Berth (MOTB). The 50-year return period wave height and period will be used for the design and analysis of the MOTB mooring system. Buoy 46050 was chosen because of its close proximity to the proposed MOTB location. The buoy is approximately 17.5 n.m. from the MOTB site. The water depth at the buoy is 123 m. The MOTB site is located in approximately 46 meters of water.

The annual maximum extrapolation of the 50-YRP extreme SWH using EV-I (Gumbel) method predicts a SWH for the 50-YRP of 16.1 m. A peak-over-threshold (POT) extrapolated extreme value was also computed; the extrapolated value using the POT method predicts a SWH for the 50-YRP of 15.2 m. The annual increase found in the measured data has not been incorporated into the extrapolated extreme values.

The 50-YRP SWH at the MOTB site is determined by adjusting the 50-YRP SWH predicted at the NDBC buoy location using the *shoaling coefficient* from Reference 5. The resulting 50-YRP SWH at the MOTB site is 15.2 m.

The mooring design is being developed for a 50-YRP SWH of 15.2 m and a modal wave period of 18 s.

An extrapolation to the 50-YRP wind speed was also calculated. The 50-YRP 8-minute average wind speed for Buoy 46050 is predicted to be 27.0 m/s using the annual maximum method. The wind speed used in mooring calculations is adjusted to the 1-hour average at 10 m elevation. The adjusted value used in the mooring design analysis is 28.1 m/s (63 mph).

Methodology

The determination of annual maximum and the calculations of the histograms and joint probability tables were done using Microsoft Excel (Reference 7). The Excel database functions DMAX and DCOUNT are extensively used.

Annual maximum significant wave heights and wind speeds were identified in the measured data for each of the years from 1992 through 2009, those years where fewer than 40% of the possible winter SWH entries have been omitted from the trend and extrapolation analysis. The alternative of eliminating the years where any of the winter months contained fewer than 40% of the

possible monthly entries was also considered. However, too many of the available annual maxima were eliminated, which resulted in a very poor regression and extrapolation. The loss of the buoy for so many winter months reduces the validity of the extrapolated value; however, the quality of the regression to the remaining annual maxima increases confidence in the return period prediction. Winter months (Oct, Nov, Dec, Jan, Feb, Mar, and Apr) were chosen to match those of Ref. 4.

Data Completeness

Table 1 on the following page shows the percent completeness of the data entries for significant wave height (WVHT) for the years 1992 through 2009 for NDBC Buoy 46050. The winter months are highlighted in blue.

Histograms of METOCEAN Parameters

Histograms of the data from Buoy 46050 have been calculated for wind speed (WSPD), wind direction (WD), significant wave height (WVHT), mean wave direction (MWD), average wave period (APD), dominant wave period (DPD), wind-wave direction and swell wave direction. A modal wave period is computed for each hourly observation (for which an APD is available) from a trimmed average of the ratios of the dominant wave period to the average wave period. A histogram of the synthesized modal wave period is also calculated.

The data used are those recorded in the archived hourly record. Those years where there are a significant number of records missing are also included in the histograms. This inclusion may distort the histograms, since the winter months are often the months when the hourly records are missing.

The histograms are shown in Appendix 2.

Joint Probability Diagrams of METOCEAN Parameters

Diagrams have been prepared showing the joint probabilities of significant wave height and the computed modal wave period, significant wave height and wind speed, significant wave height and mean wave direction, wind direction and mean wave direction, and wind speed and wind direction. The SWH vs. Modal Period diagram was used to identify the wave period used in the mooring design analysis.

The mean wave direction vs. wind direction shows that the winds are predominately from the N to NW and from SW to S. The waves are generally from the W to NW directions. The wave direction is reasonably correlated with the wind direction.

The joint probability diagrams are shown in Appendix 1.

Table 1: Percent completeness of the WVHT data entries for Buoy 46050 (1992 – 2009)

Month	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
January	97%	94%	0%	99%	100%	46%	51%	100%	99%	100%	4%	100%	100%	0%	100%	100%	0%	99%
February	93%	94%	0%	99%	100%	0%	0%	98%	100%	100%	100%	100%	100%	0%	100%	100%	0%	99%
March	99%	94%	73%	99%	100%	0%	0%	97%	100%	100%	100%	100%	100%	0%	100%	99%	83%	100%
April	99%	94%	100%	95%	100%	0%	6%	100%	99%	100%	98%	100%	100%	53%	99%	99%	99%	100%
May	99%	95%	99%	100%	99%	0%	97%	100%	99%	100%	100%	100%	100%	100%	100%	99%	99%	100%
June	97%	84%	98%	99%	100%	0%	97%	88%	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%
July	99%	93%	93%	100%	100%	0%	100%	98%	100%	100%	100%	100%	99%	100%	100%	99%	100%	99%
August	99%	88%	99%	99%	74%	1%	106%	97%	100%	99%	100%	100%	100%	100%	78%	100%	100%	98%
September	97%	86%	62%	99%	0%	76%	96%	84%	100%	100%	100%	99%	100%	100%	73%	100%	100%	100%
October	96%	95%	0%	99%	0%	99%	100%	71%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
November	96%	91%	0%	99%	0%	98%	100%	98%	100%	100%	100%	100%	98%	100%	100%	99%	100%	98%
December	95%	22%	64%	99%	0%	100%	99%	100%	100%	0%	100%	100%	22%	100%	100%	7%	97%	99%

Table 2: Monthly and annual maximum SWH at Buoy 46050 (1992 – 2009)

Month	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
January	7.5	6.8	0.0	6.0	7.8	5.4	7.5	9.0	12.1	6.1	2.9	8.7	6.4	0.0	7.8	6.8	0.0	7.3
February	6.1	4.7	0.0	6.2	7.6	0.0	0.0	10.1	7.0	7.4	5.9	4.4	6.7	0.0	12.4	7.8	0.0	6.7
March	3.9	6.4	7.5	7.9	6.1	0.0	0.0	14.1	6.6	6.9	8.0	9.8	6.5	0.0	7.9	6.9	6.9	6.3
April	4.4	6.0	5.6	4.7	7.9	0.0	2.5	7.9	5.4	5.1	5.5	5.2	6.3	3.4	5.9	4.8	5.4	5.9
May	3.1	5.2	4.1	3.8	4.0	0.0	4.6	3.8	5.6	5.8	4.3	3.2	3.2	7.6	4.6	4.1	3.6	5.1
June	3.1	3.2	5.8	4.1	2.7	0.0	4.2	4.0	4.5	4.6	3.8	4.2	4.0	5.8	3.4	3.9	4.9	3.9
July	2.5	3.3	3.3	2.7	3.6	0.0	3.1	4.0	2.6	2.8	2.9	2.9	3.2	3.3	2.9	3.6	3.4	3.0
August	2.7	3.7	2.7	3.5	2.4	1.9	2.7	2.4	2.9	5.1	3.2	3.2	3.5	2.9	2.9	2.5	4.0	3.3
September	4.2	3.0	3.1	4.7	0.0	7.4	4.0	5.0	3.9	4.9	3.4	3.2	4.1	4.1	3.8	4.0	3.9	4.6
October	5.6	4.7	0.0	5.0	0.0	7.7	5.0	8.7	8.5	9.2	3.6	9.2	5.4	6.2	7.0	8.4	5.5	5.2
November	7.0	6.4	0.0	7.2	0.0	10.5	10.8	7.2	6.3	10.7	8.5	8.1	6.1	6.4	10.8	9.9	6.1	9.4
December	8.0	7.7	7.8	9.2	0.0	7.9	8.0	7.0	8.6	0.0	11.1	7.9	5.5	8.4	10.7	12.1	9.0	6.7
Annual Max	8.0	7.7	7.8	9.2	7.9	10.5	10.8	14.1	12.1	10.7	11.1	9.8	6.7	8.4	12.4	12.1	9.0	9.4

Annual Maxima

Monthly and annual maximum SWHs in meters are given in Table 2 on the preceding page. The winter months are highlighted in blue. Months where there are no SWH data are entered as 0.0 in light grey text. The annual maxima for each year are highlighted in red and listed in the bottom row.

The trend in the annual maxima is shown in Figure 1. Years where more than 40% of the winter observations are recorded are shown as filled circles. These points are used in the trend line analysis. The other data years are shown as open circles. These points are not used in the trend line analysis. It is noted that the annual extreme for 1996 is included in the trend analysis and the extreme value analysis, even though data for October, November, and December are missing. This is because there was nearly 100% coverage in January, February, March, and April of that year.

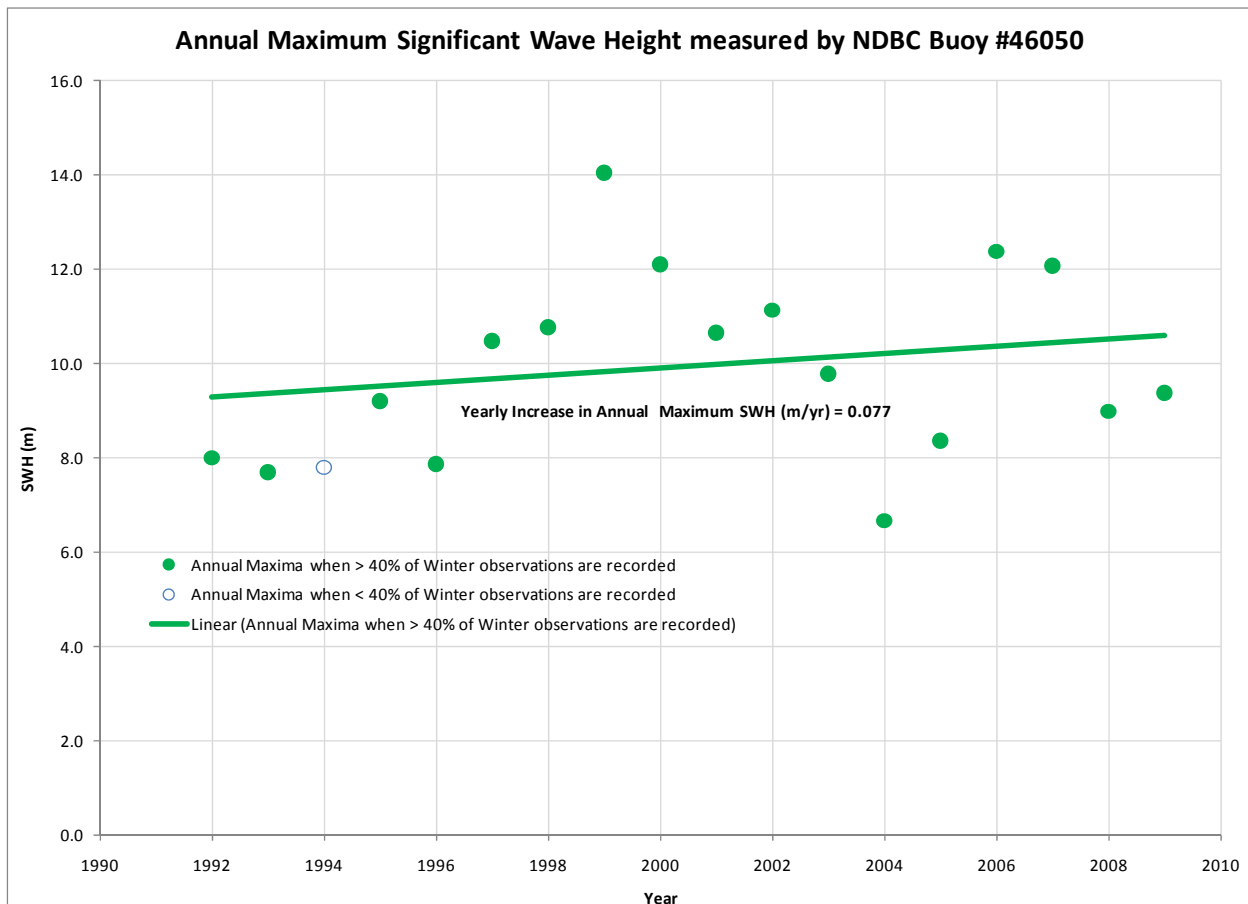


Figure 1: Trend in annual maximum SWH at NDBC Buoy 46050

The annual increase in the annual extremes for the years 1992 through 2009 is found to be 0.077 m/yr. Thus in 50 years, the annual maximum significant wave height could be expected to increase by 3.9 meters. This does not imply that the 50-YRP SWH, which may occur any time in the next 50 years, will be 3.9 meters higher than the generalized extreme value (GEV) prediction.

Return Period Extrapolations - SWH

Diagrams of the extreme value extrapolations are shown in Figures 2 and 3. Figure 2 uses the annual extreme values for the extrapolation, not including those years for which there are fewer than 40% entries for the winter months. The most probable 50-YRP SWH is projected to be 16.1 m, with a 90% prediction interval from a low of 14.6 m to a high of 17.5 m.

The range of modal (peak) wave periods for a 16.1 m SWH is estimated from the limiting conditions for waves of extreme steepness, e.g., waves with periods where $H_s/(gT^2) > 0.00776$, giving a limiting lower period of approximately 14.6 seconds, and a fully developed sea with a modal wave period of 25.6 seconds. A modal wave period of 18 seconds was chosen for this analysis by visually projecting the low period edge of the joint probability scatter diagram of significant wave height and peak wave periods (shown in Appendix 2).

Figure 3 uses all events with a significant wave height above the 99.5 percentile SWH of all entries. The threshold is 7.01 m. These peak-over-threshold events (POT) are sorted so that only independent events are included. The independence period is assumed to be 72 hours, after Ruggiero *et al* (Ref. 4). There are 87 events in this 18-year record. The 50-YRP SWH is projected to be 15.2 m. The higher SWH from the AMM extrapolation was chosen for the design analysis.

Figures 4 and 5 show the extreme value extrapolation for NDBC Buoy 46005 for comparison with Ruggiero *et al* (Ref. 4). The AMM method is shown in Figure 4. The POT method is shown in Figure 5. The 99.5 percentile SWH used in the POT method was found to be 8.12 m, essentially the same value used in Ref. 4.

The annual increase and the 50-YRP found in this analysis for Buoy 46050 compare reasonably well with the values found by Ruggiero *et al* (Ref. 4) for Buoy 40005. Buoy 46005 is approximately 300 n.m. further offshore than Buoy 46050. Their SWH annual rate of increase is 0.095 m/yr based on the annual maxima. Their 50-YRP SWH, also based on the annual maxima, is 13.6 m. They also estimated the 50-YRP using r-largest ($r=5$) and peak-over-threshold (at 99.5 percentile level), to be 13.6 m and 13.9 m, respectively.

The estimate of the 50-YRP SWH for Buoy 46005 was also calculated by Glostén in order to compare and verify the methodology. Glostén's predictions for the 50-YRP SWH from data at Buoy 46005 are 14.8 m using the annual maximum method (AMM); and 15.3 m using the POT method. The r-largest extreme value extrapolation has not been calculated for this project.

The Glostén extrapolations contain only the data years 1987 to 2008 (2005 is missing). Ruggiero *et al* used data from 1976 to 2007. Glostén's predictions of the 50-YRP SWH are more conservative with respect to the MOTB mooring design, but not unreasonably large.

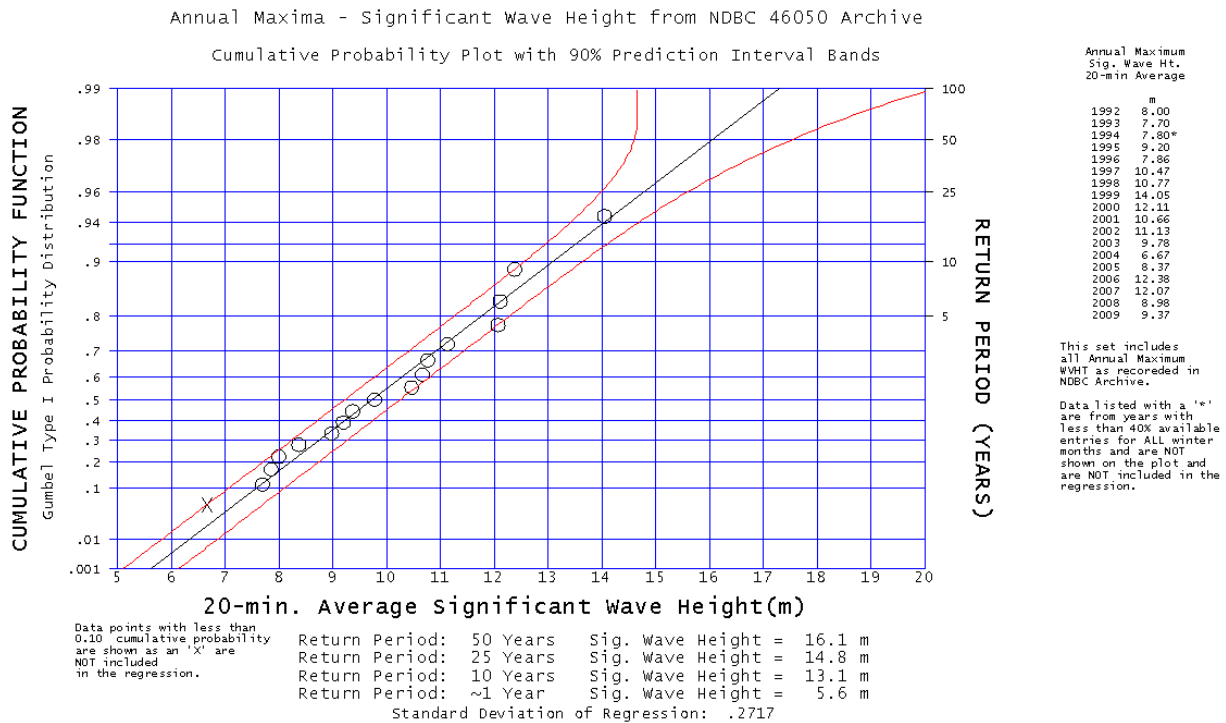


Figure 2: Extreme value extrapolation of annual maximum SWHs at NDBC Buoy 46050

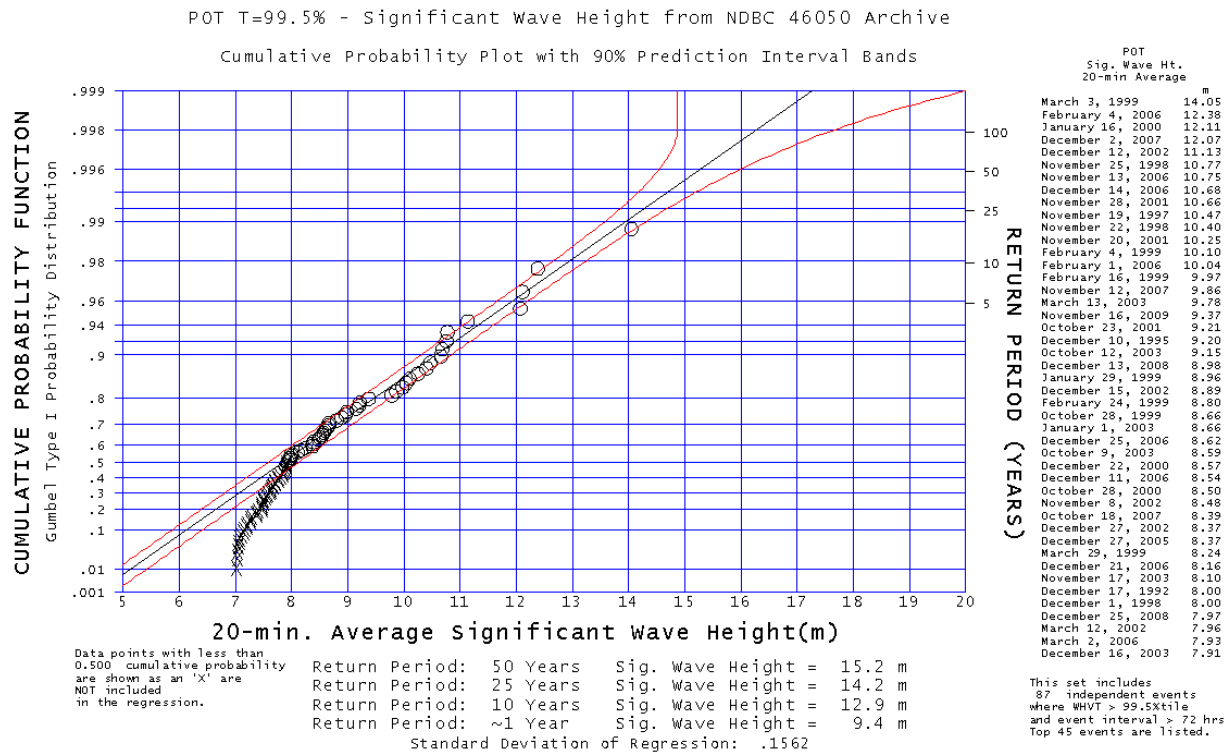


Figure 3: Extreme value extrapolation of POT SWHs at NDBC Buoy 46050

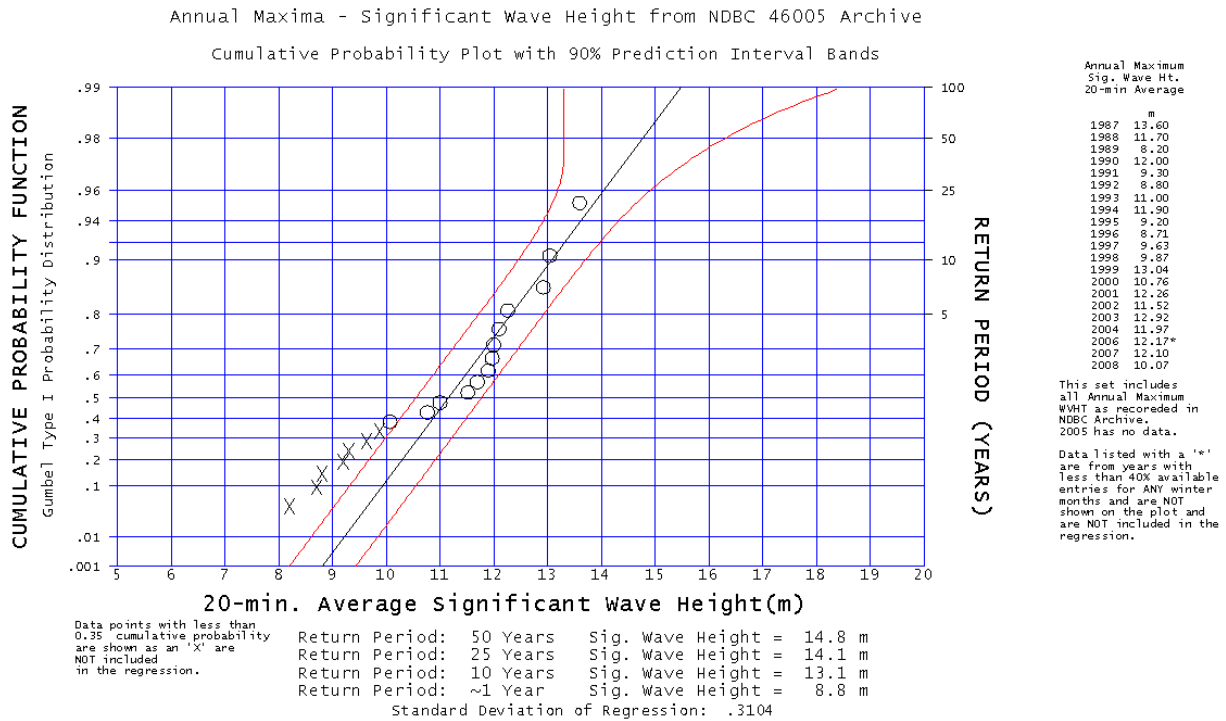


Figure 4: Extreme value extrapolation of annual maximum SWHs at NDBC Buoy 46005

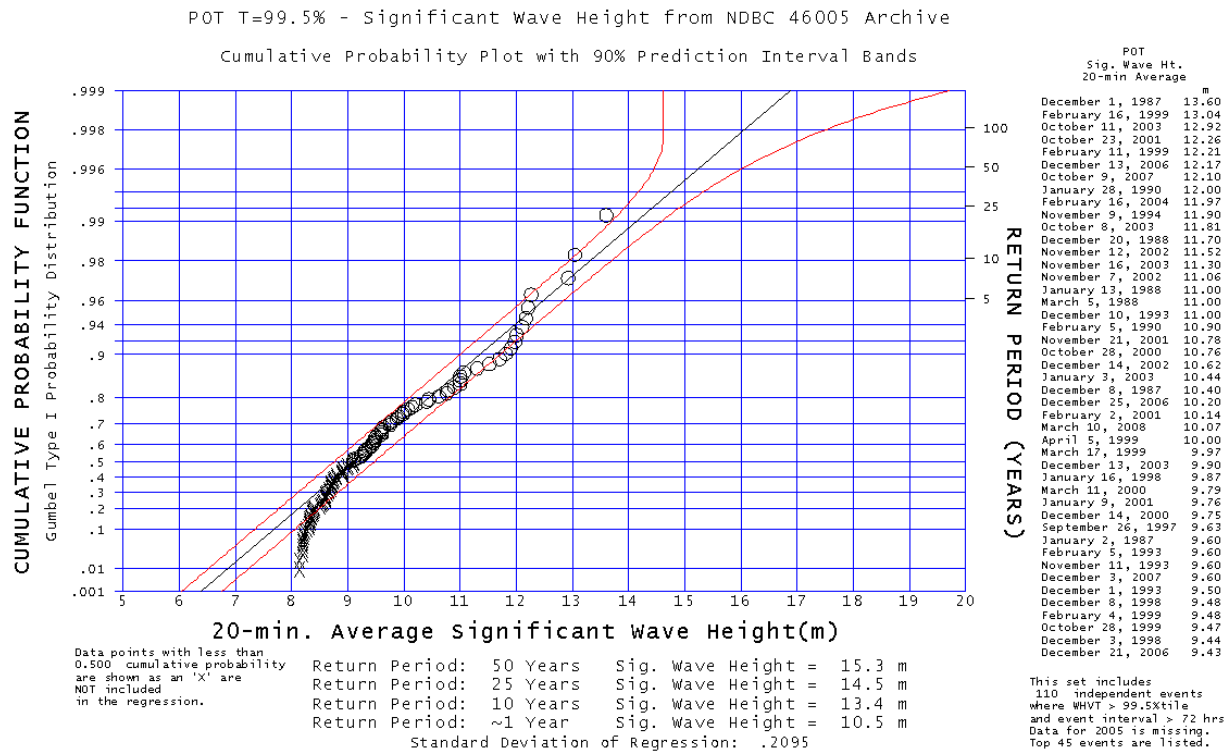


Figure 5: Extreme value extrapolation of POT SWHs at NDBC Buoy 46005

Shoaling

The 50-YRP SWH at the MOTB site is determined by adjusting the AMM 50-YRP SWH predicted at the NDBC buoy location using the *shoaling coefficient* from Reference 5. The shoaling coefficient is calculated to be 0.942. The resulting 50-YRP SWH at the MOTB site is 15.2 m. The shoaling calculation was also checked using a constant slope bathymetry SWAN model (Reference 6). The SWAN model also predicts a SWH at the MOTB site of 15.2 m.

Return Period Extrapolations – Wind Speed

An extrapolation to the 50-YRP wind speed was also calculated. The extrapolations are shown in Figures 6 and 7.

The 50-YRP 8-minute average wind speed for Buoy 46050 is predicted to be 27.0 m/s using the annual maximum method. The 50-YRP wind speed using the POT method predicts an 8-minute average wind speed of 26.9 m/s. The anemometer on the buoy is at 5 m elevation. The wind speed used in mooring calculations is adjusted to the 1-hour average at 10 m elevation. The adjusted value that is used in the mooring design analysis is 28.1 m/s (63 mph).

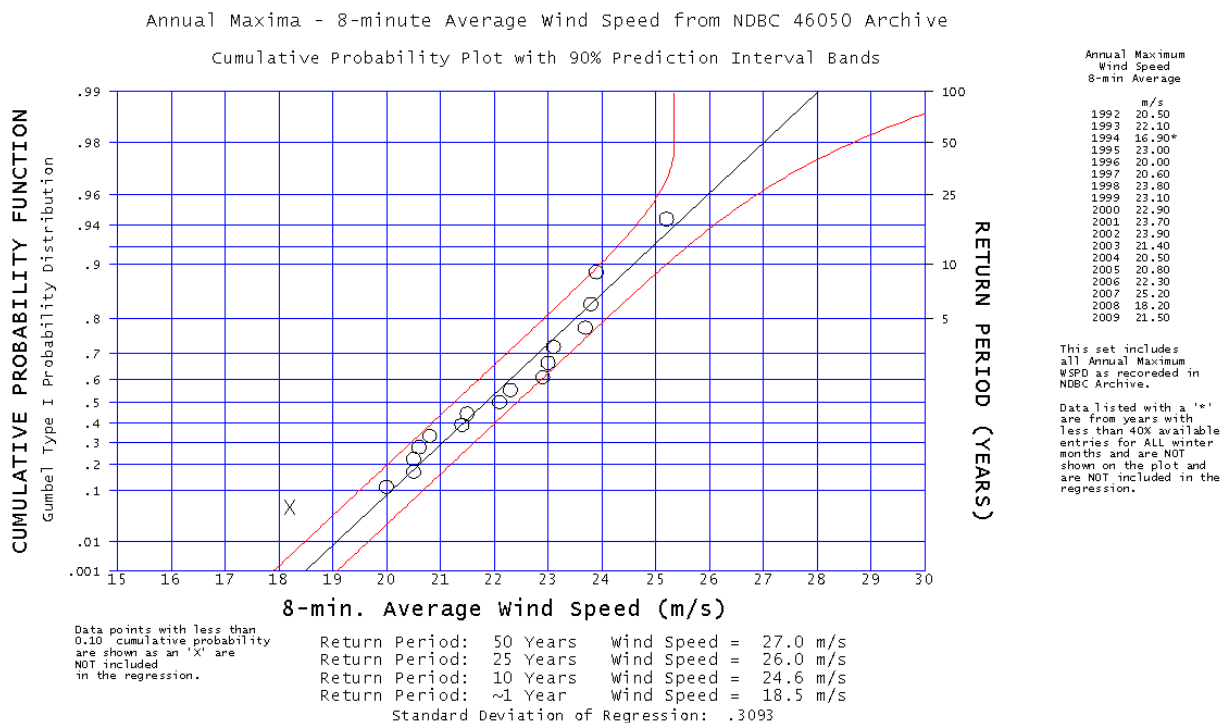


Figure 6: Extreme value extrapolation of annual maximum 8-minute average wind speed at NDBC Buoy 46005

POT T=99.5% - 8-minute Average Wind Speed from NDBC 46050 Archive

Cumulative Probability Plot with 90% Prediction Interval Bands

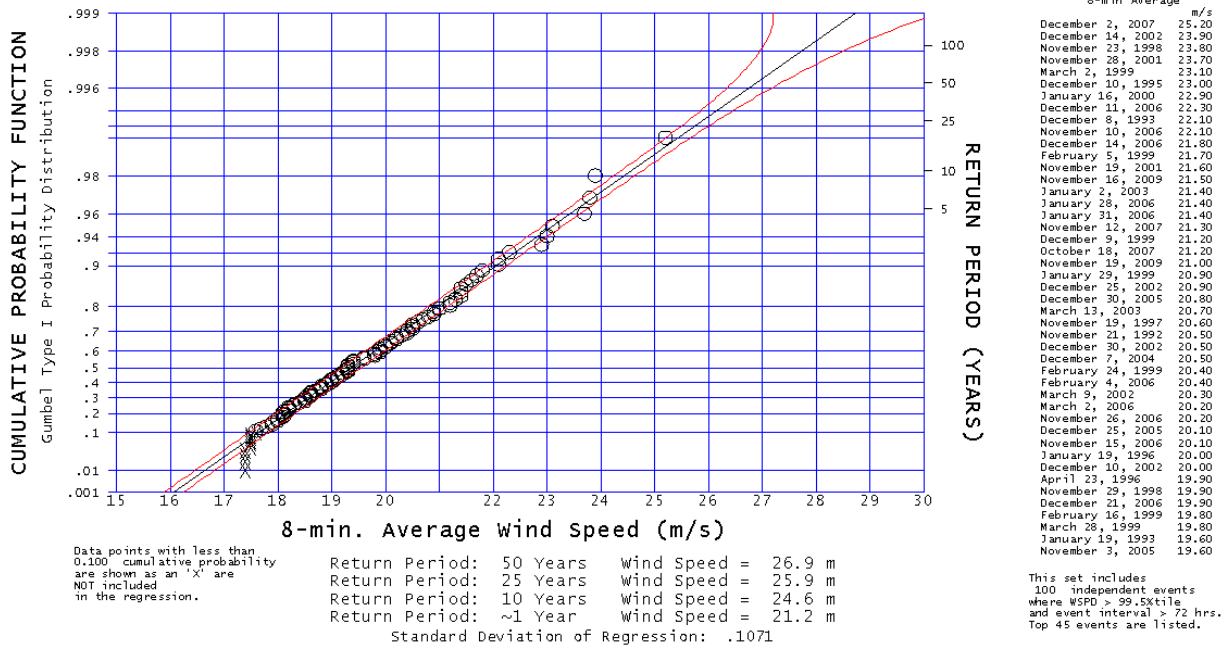


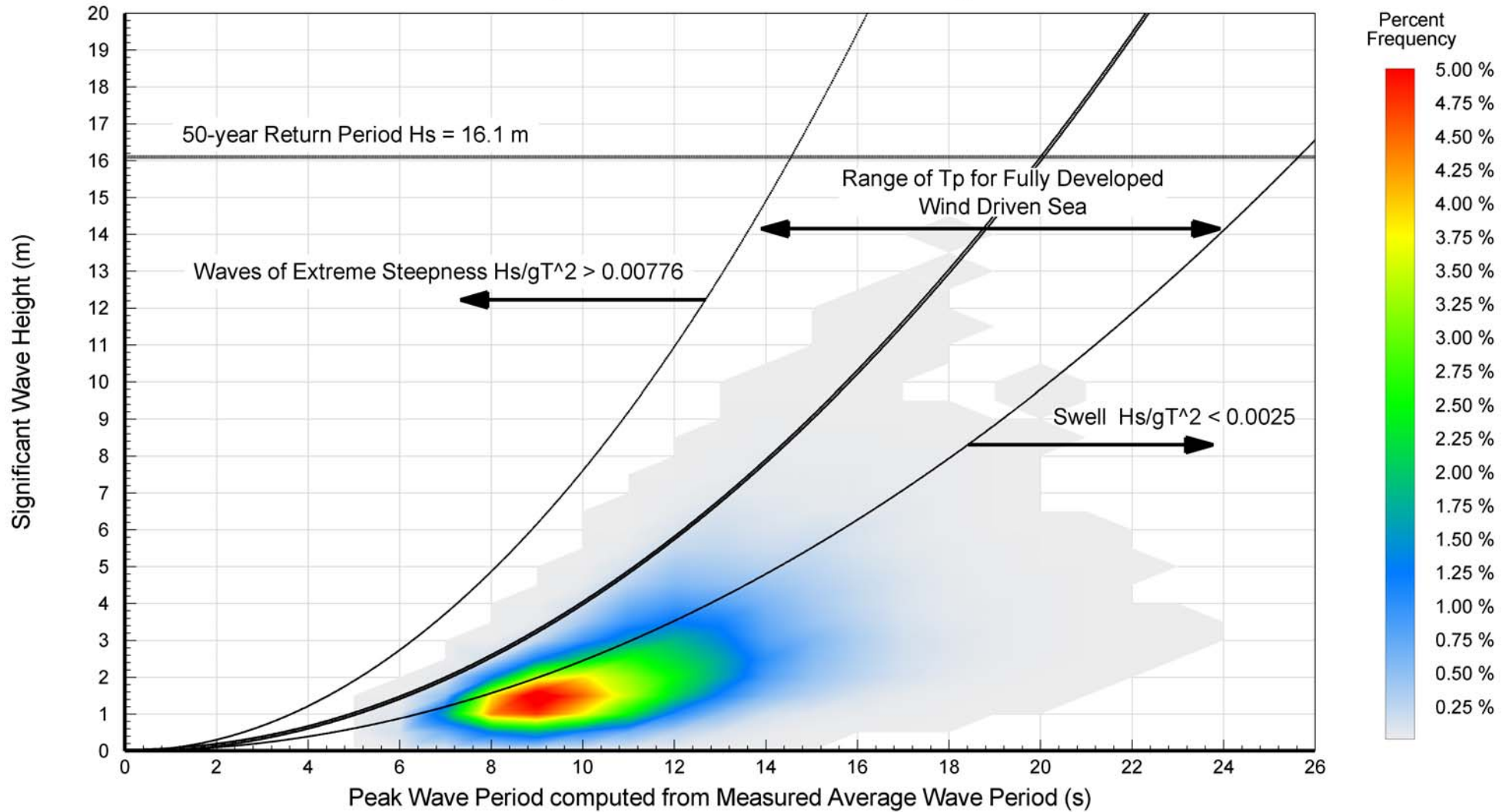
Figure 7: Extreme value extrapolation of POT 8-minute average wind speeds at NDBC Buoy 46005

Appendices

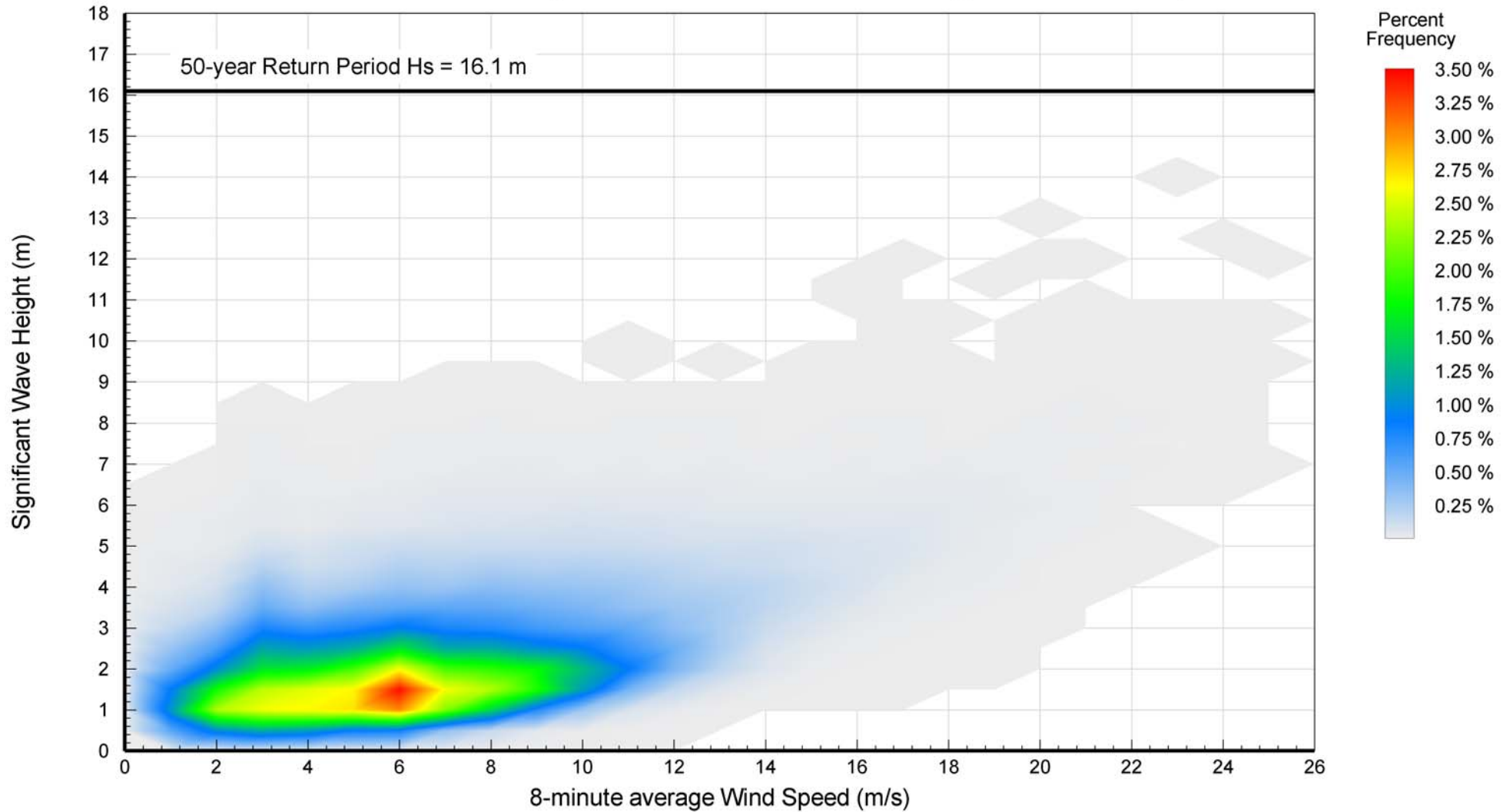
- Appendix 1 Joint Probability Diagrams of METOCEAN Data from NDBC Buoy 46050
- Appendix 2 Histograms of METOCEAN Data from NDBC Buoy 46050

**Appendix 1 Joint Probability Diagrams of METOCEAN Data from
NDBC Buoy 46050**

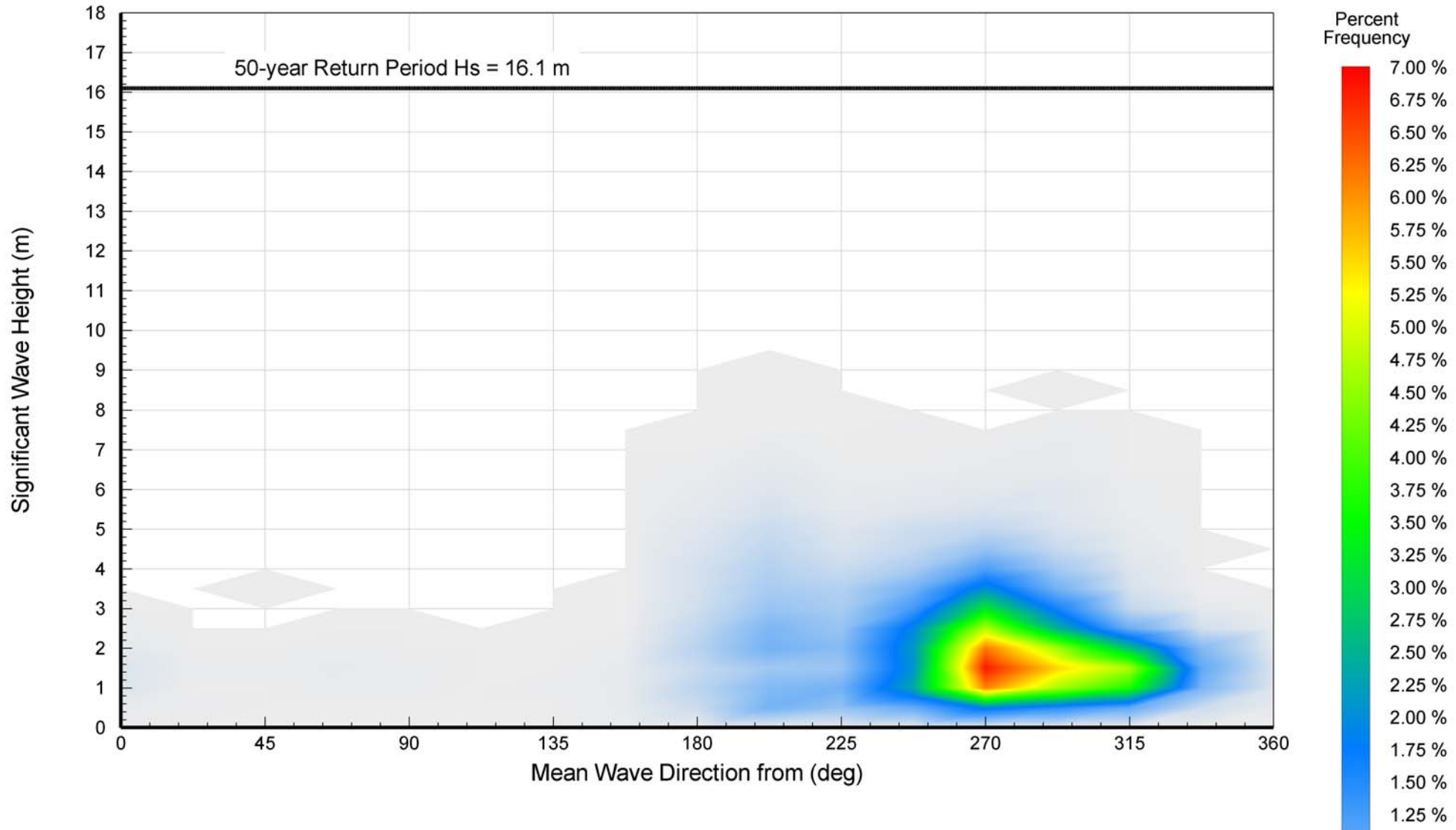
Station 46050 (LLNR 641) - STONEWALL BANKS - 20NM West of Newport, OR Annual - Joint Probability Distribution - Wave Height vs Wave Period



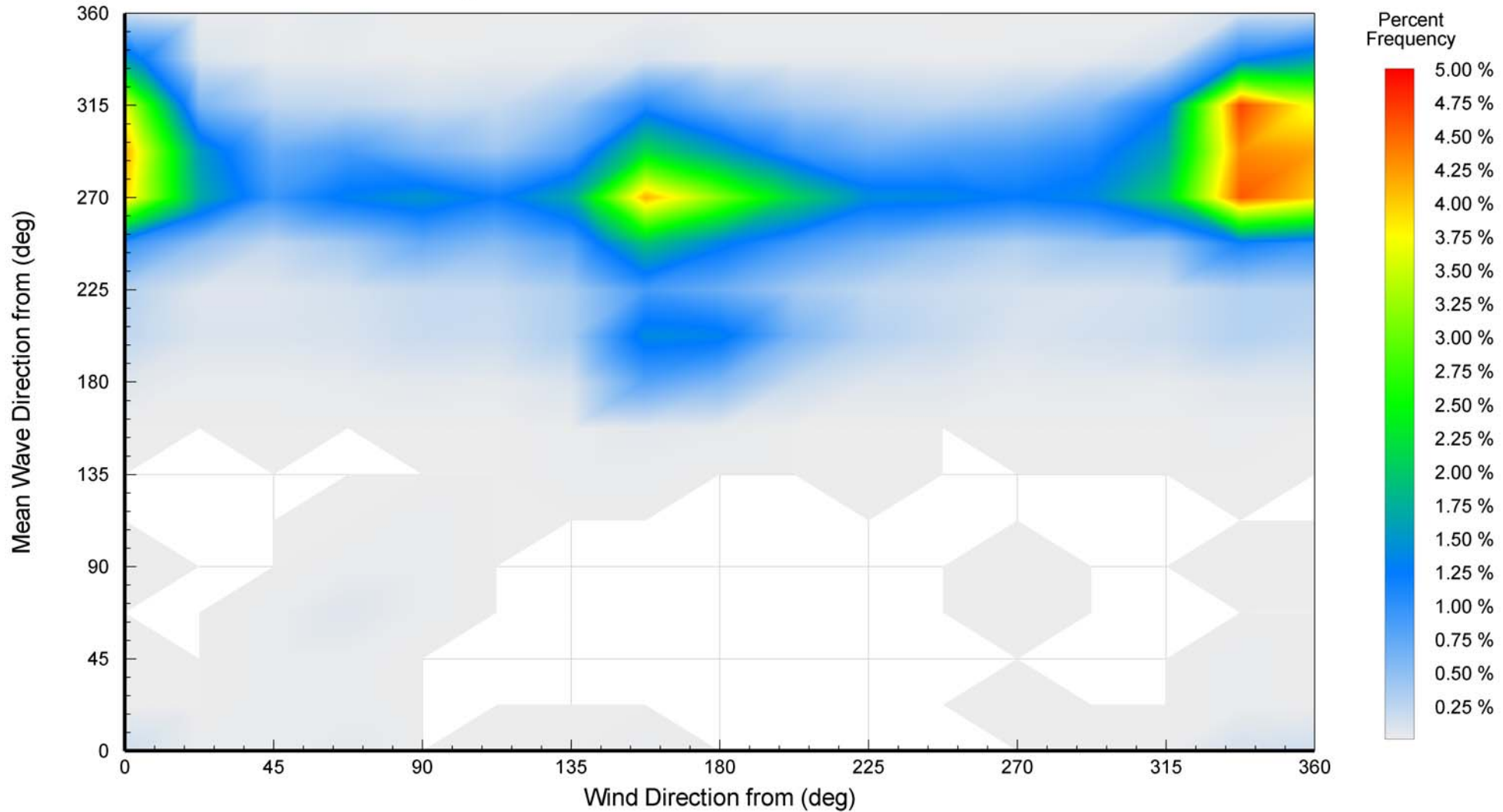
Station 46050 (LLNR 641) - STONEWALL BANKS - 20NM West of Newport, OR Annual - Joint Probability Distribution - Wave Height vs Wind Speed



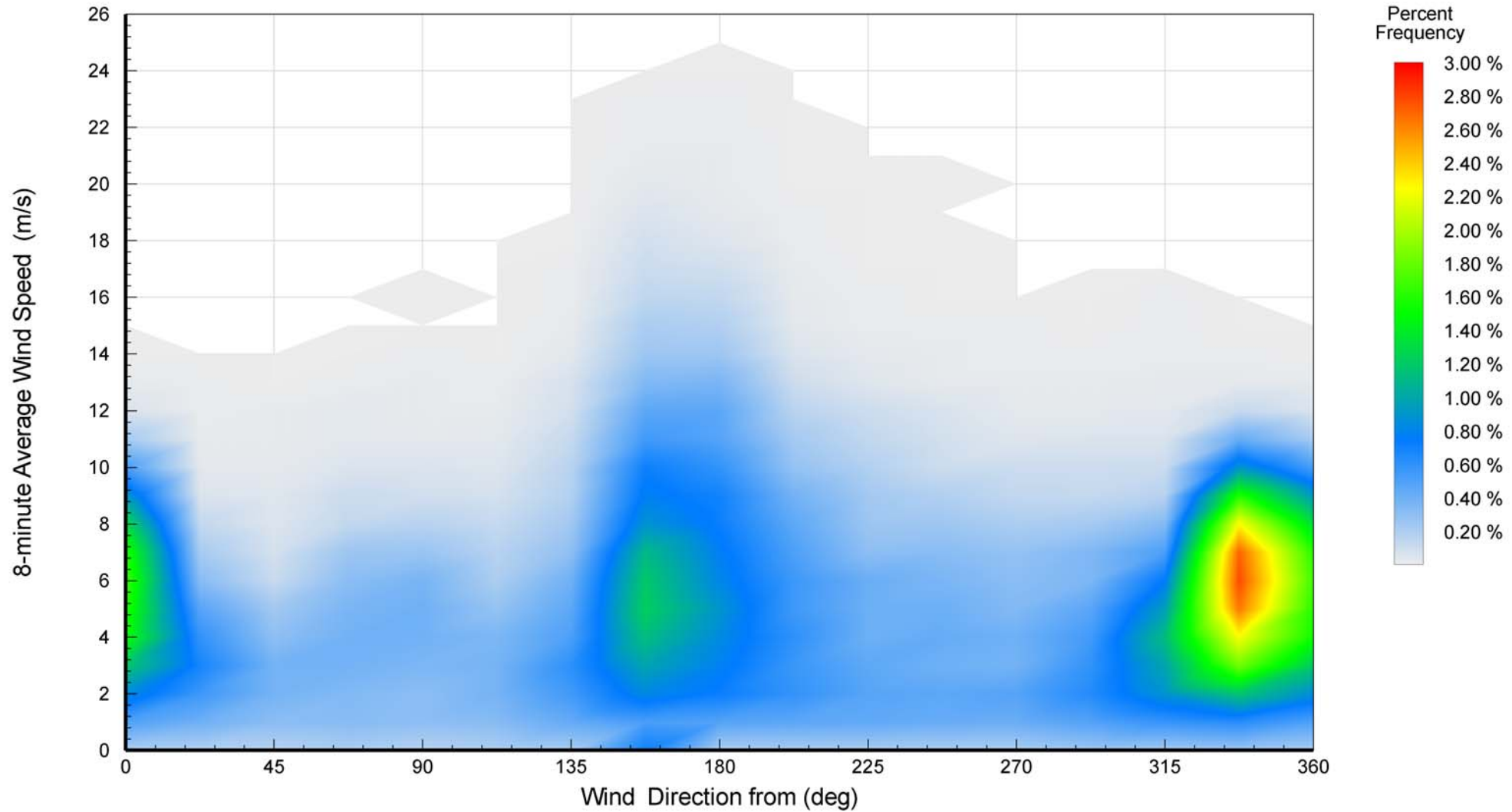
Station 46050 (LLNR 641) - STONEWALL BANKS - 20NM West of Newport, OR Annual - Joint Probability Distribution - Wave Height vs Mean Wave Direction



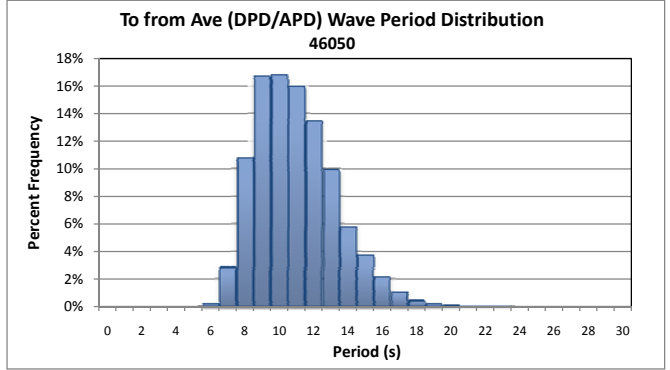
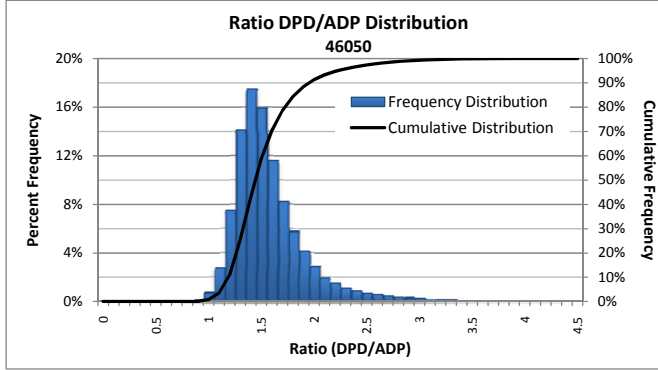
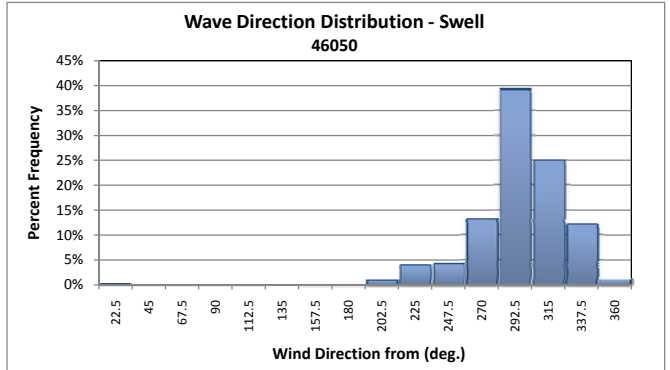
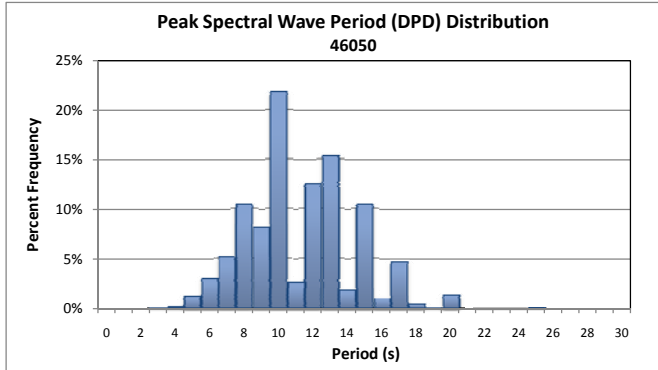
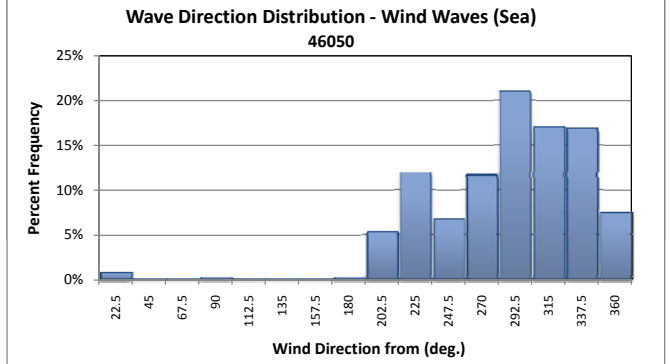
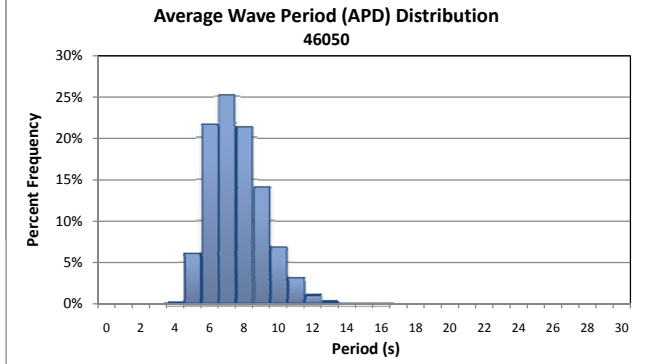
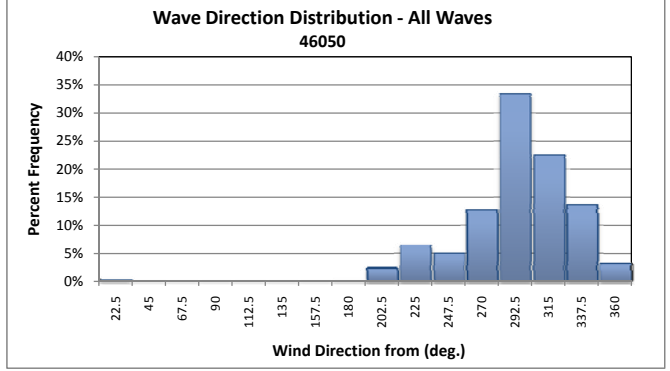
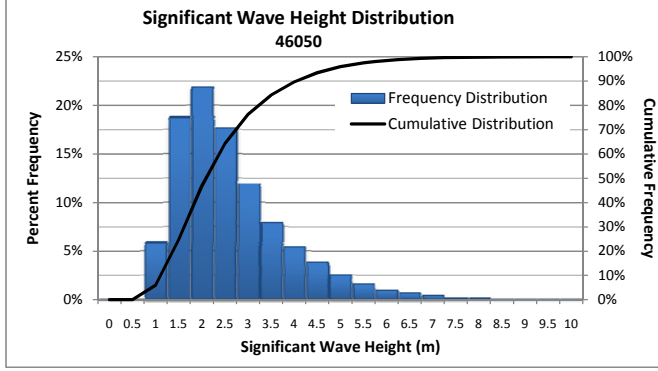
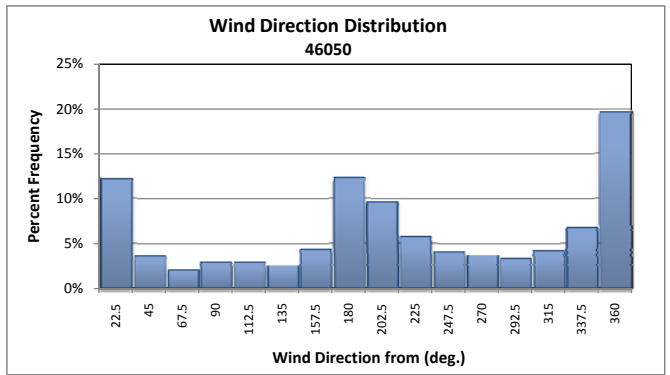
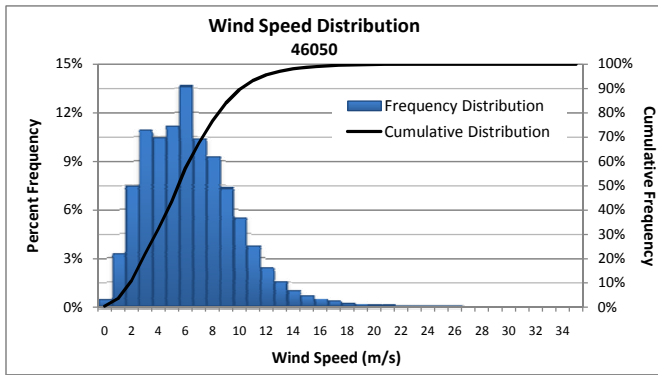
Station 46050 (LLNR 641) - STONEWALL BANKS - 20NM West of Newport, OR Annual - Joint Probability Distribution - Mean Wave Direction vs Wind Direction



Station 46050 (LLNR 641) - STONEWALL BANKS - 20NM West of Newport, OR Annual - Joint Probability Distribution - Wind Speed vs Wind Direction



Appendix 2 Histograms of METOCEAN Data from NDBC Buoy 46050



OSU Wave Statistics at NNMREC Test Berth

Figures A-1 through A-12 calculated from hourly 2-D wave spectra at NDBC Station #46050, 1996-2008. Each monthly histogram table represents the percent occurrence of binned Hm0 and Te values for the most recent 8 months for which there are at least 25 days of available buoy data.

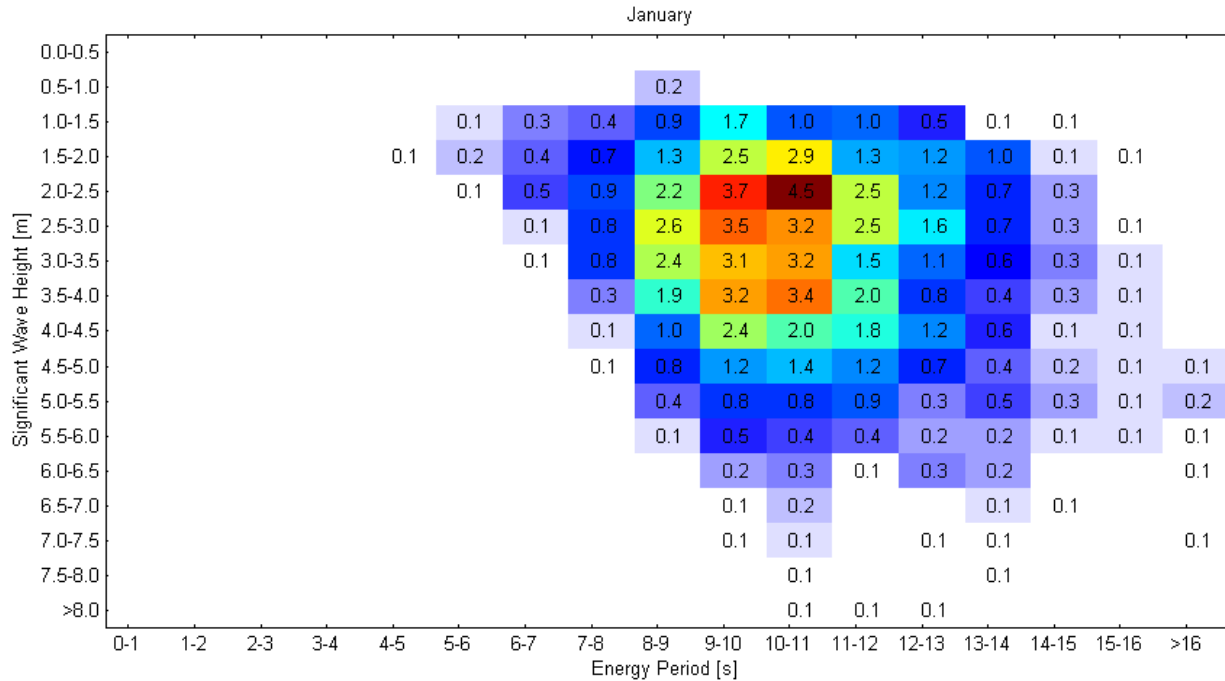


Figure A-1 Histogram of SWH vs. Energy Period for January

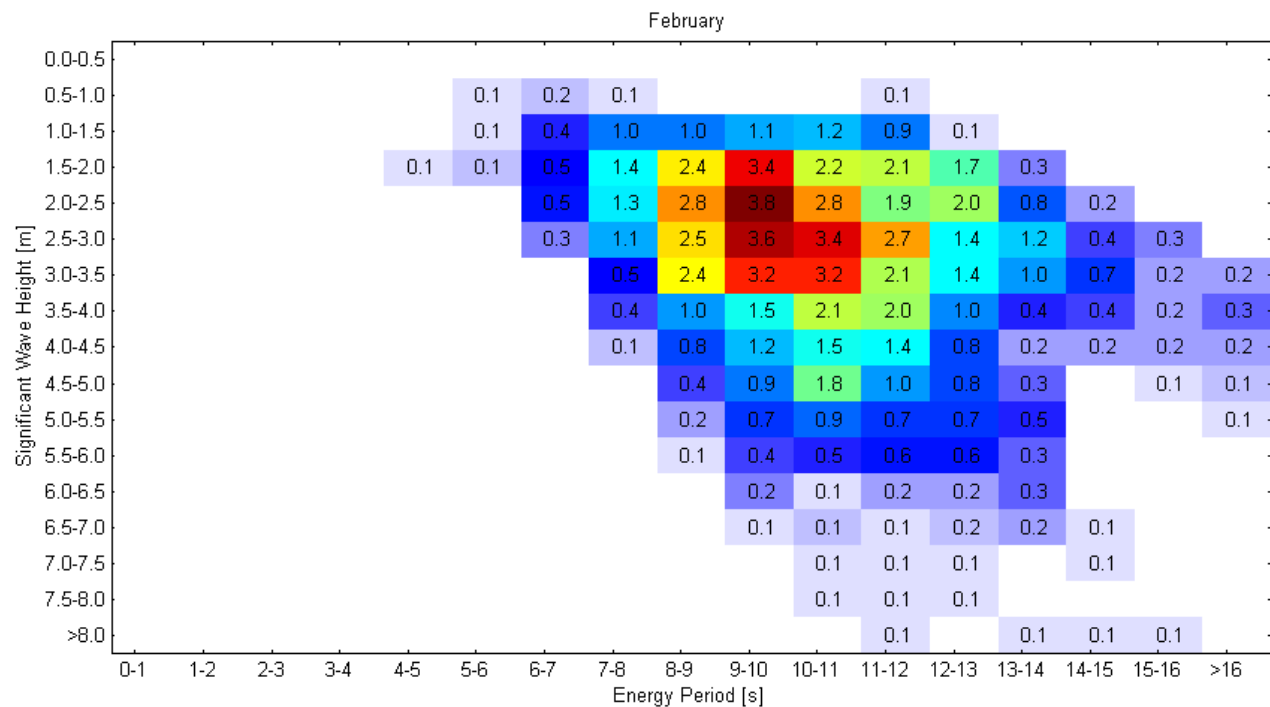


Figure A-2 Histogram of SWH vs. Energy Period for February

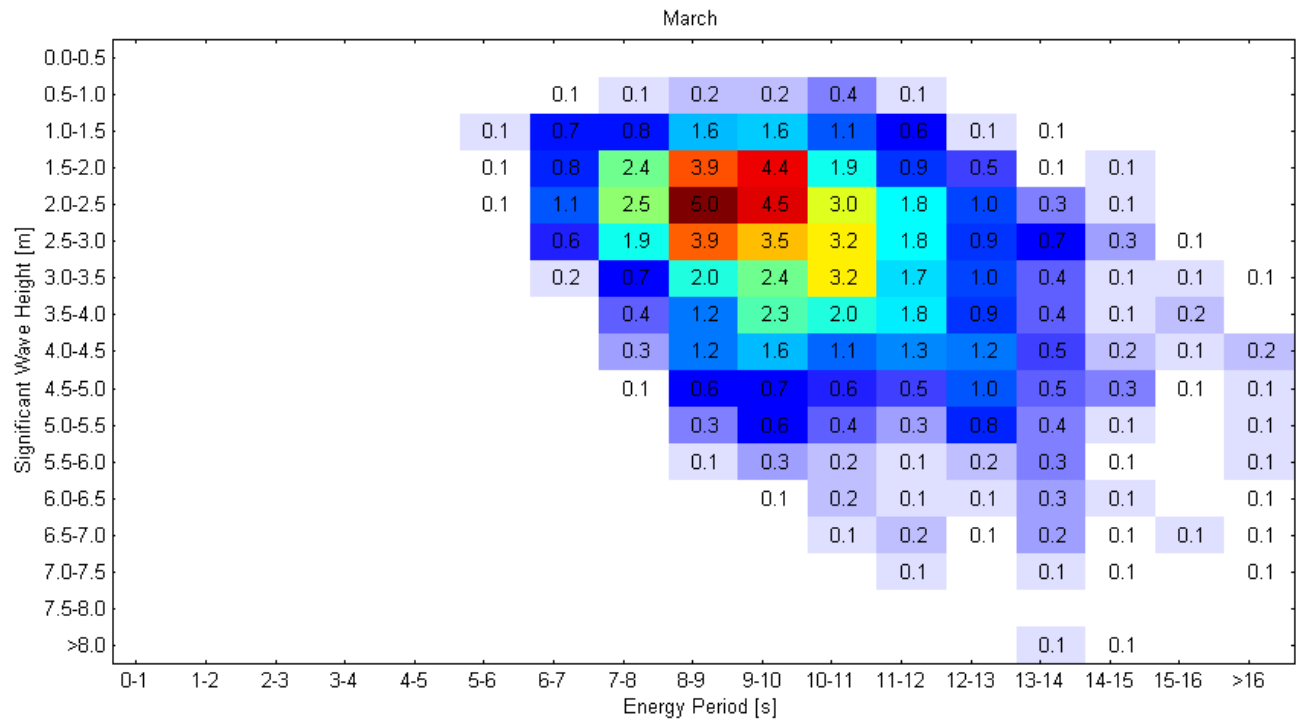


Figure A-3 Histogram of SWH vs. Energy Period for March

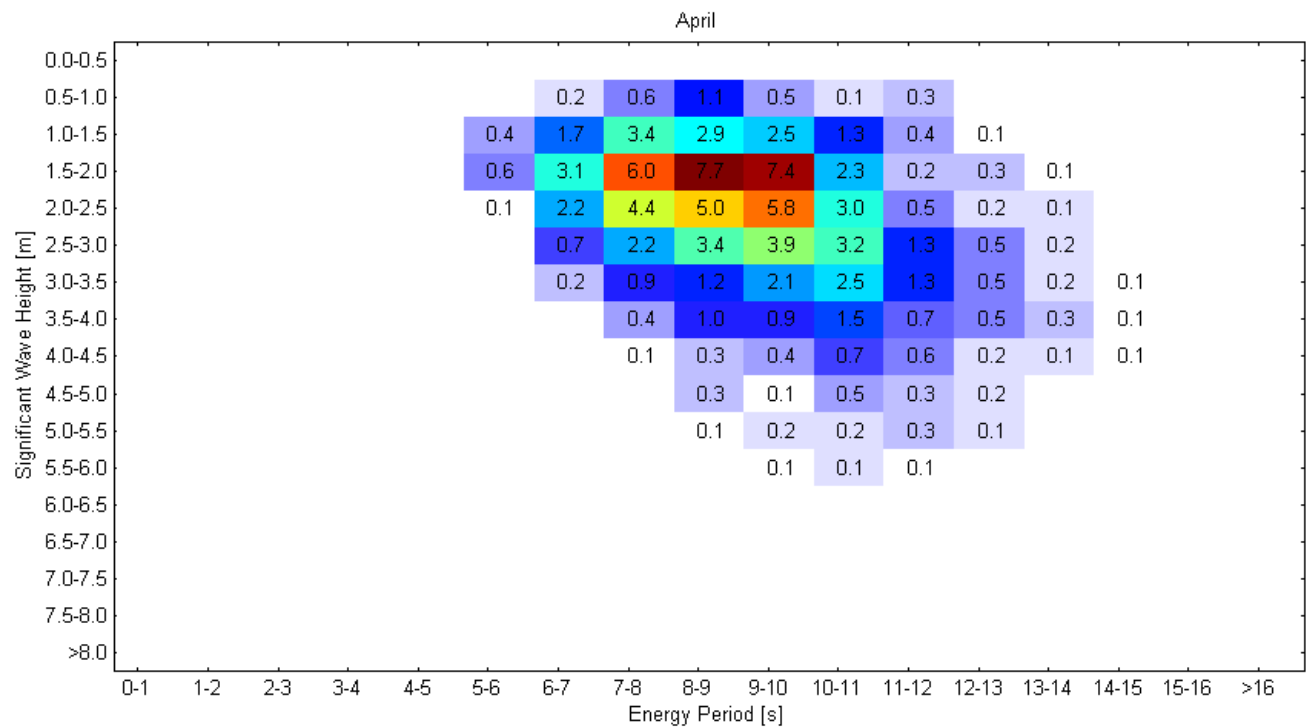


Figure A-4 Histogram of SWH vs. Energy Period for April

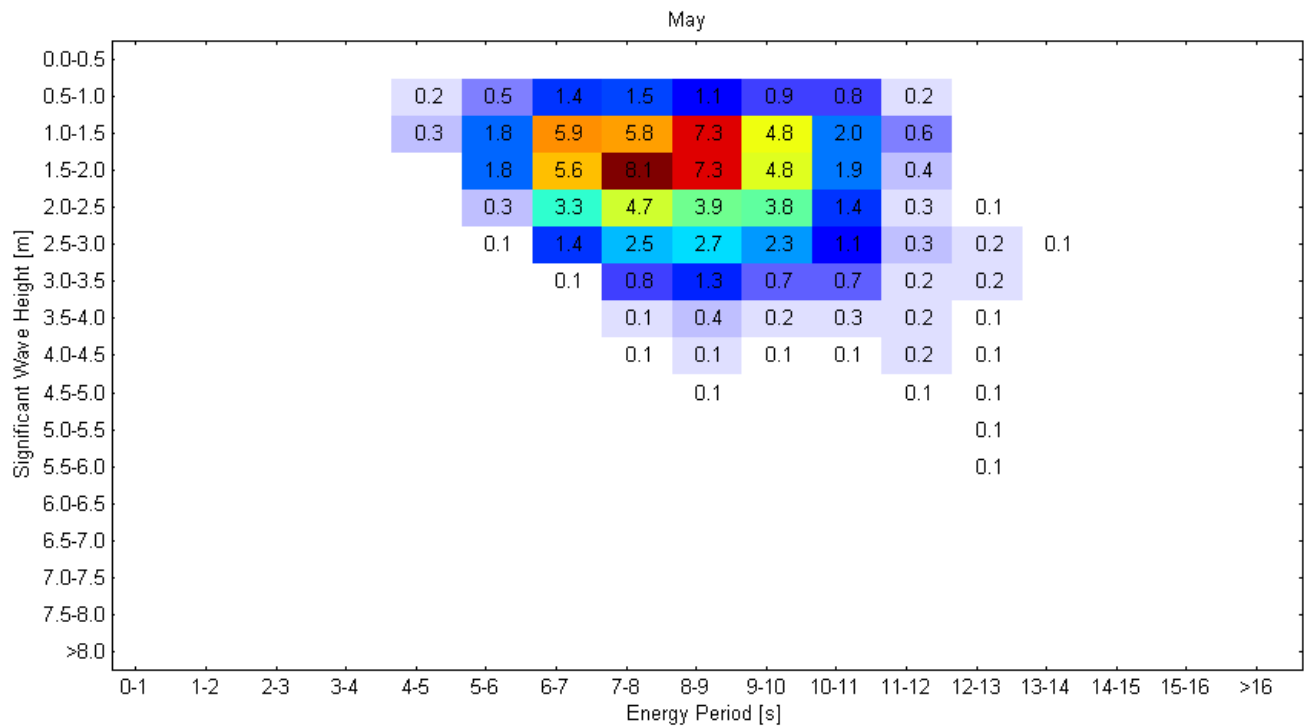


Figure A-5 Histogram of SWH vs. Energy Period for May

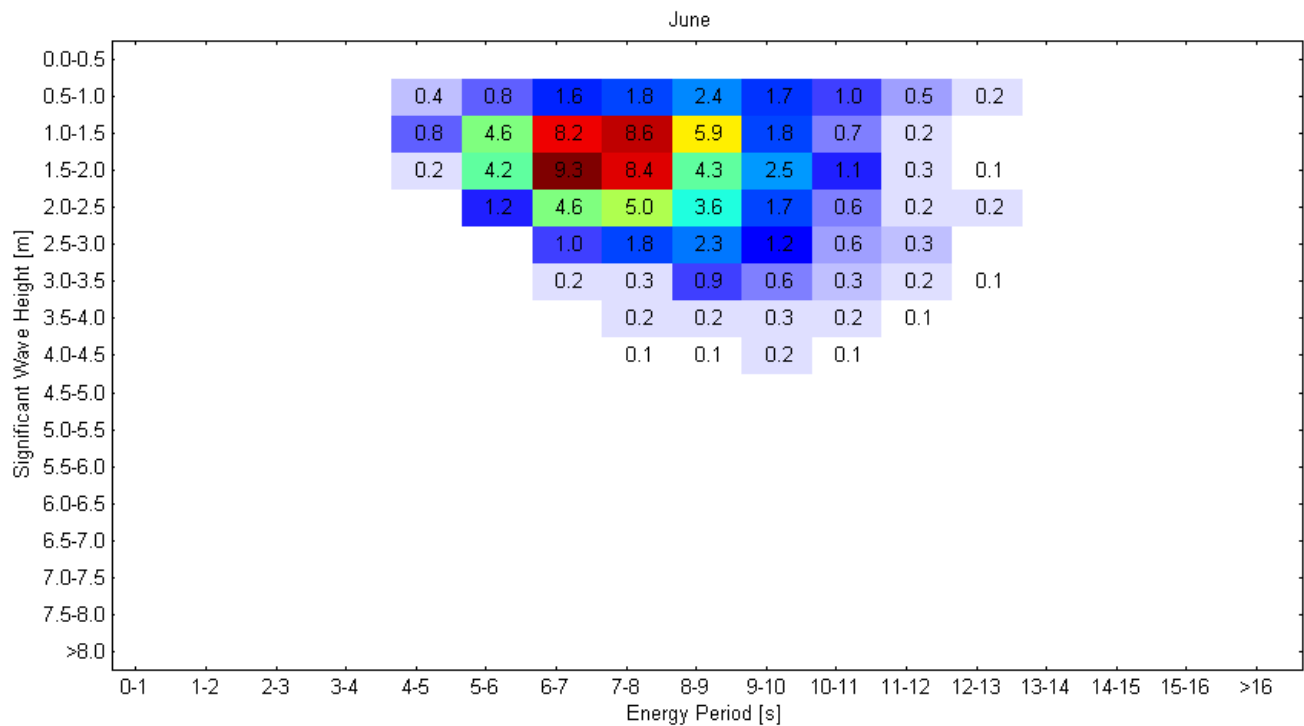


Figure A-6 Histogram of SWH vs. Energy Period for June

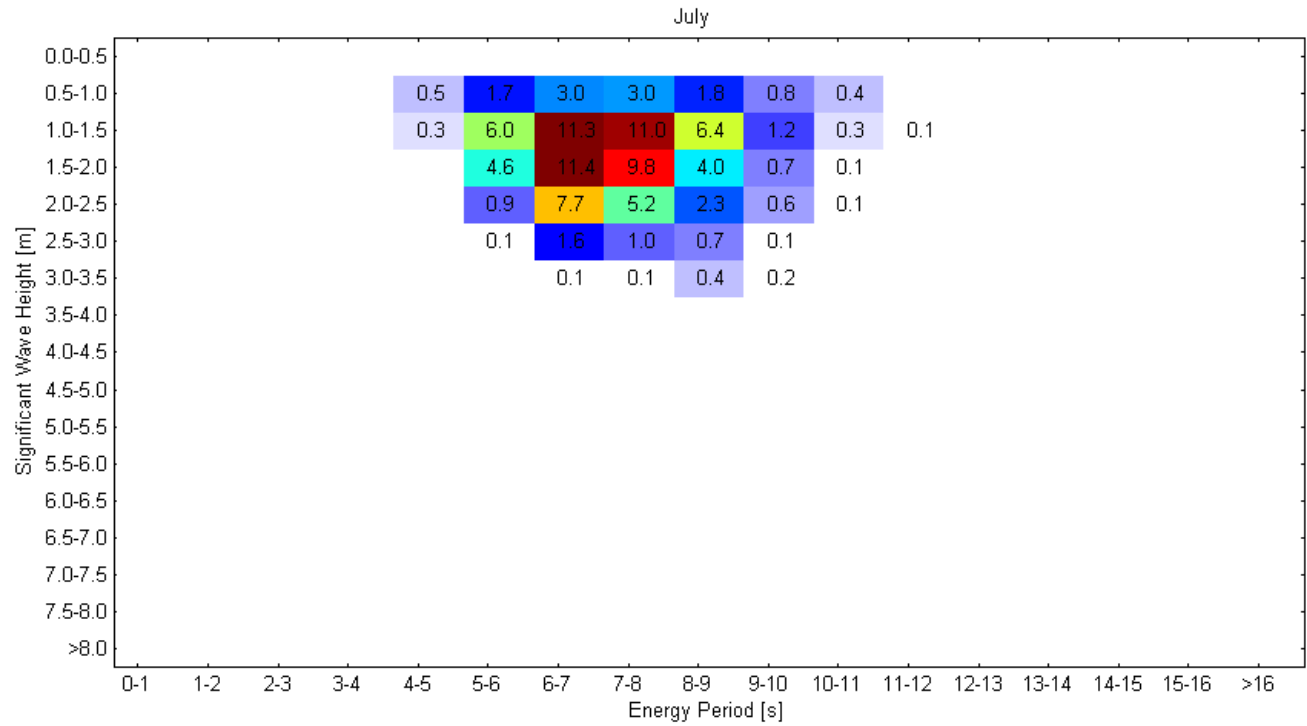


Figure A-7 Histogram of SWH vs. Energy Period for July

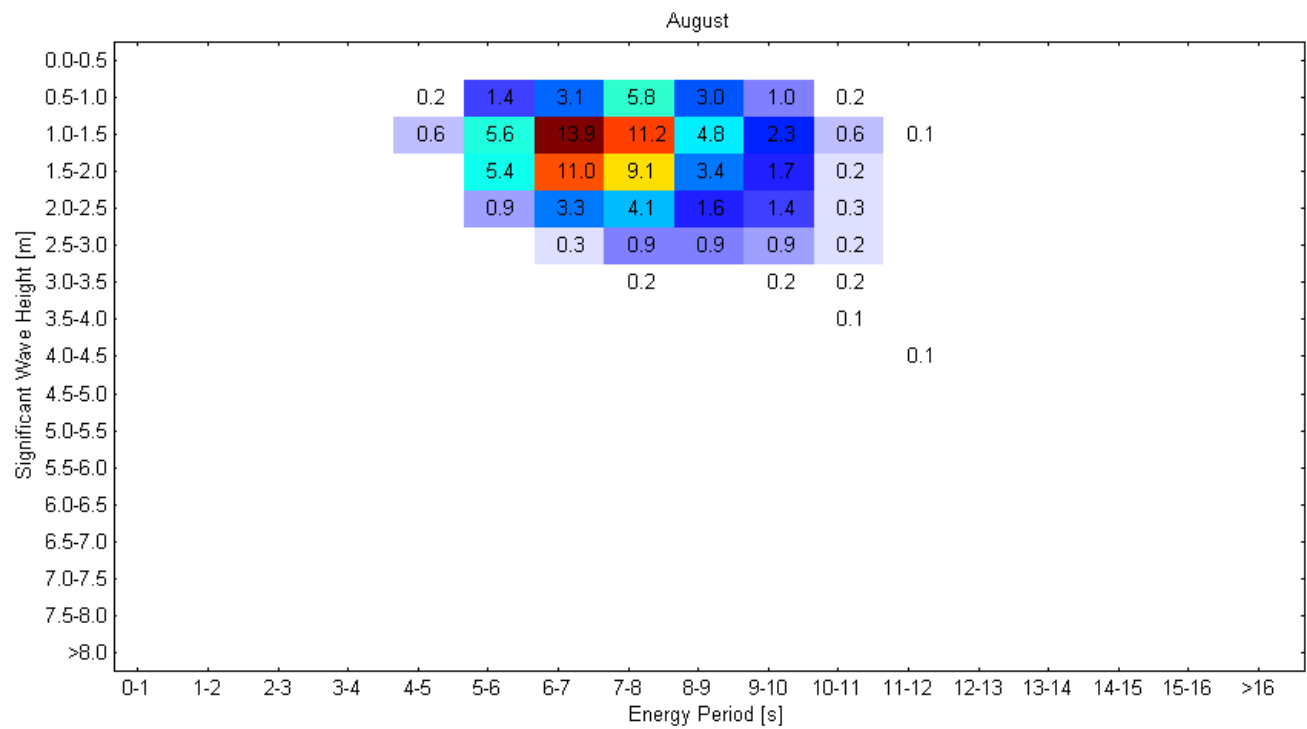


Figure A-8 Histogram of SWH vs. Energy Period for August

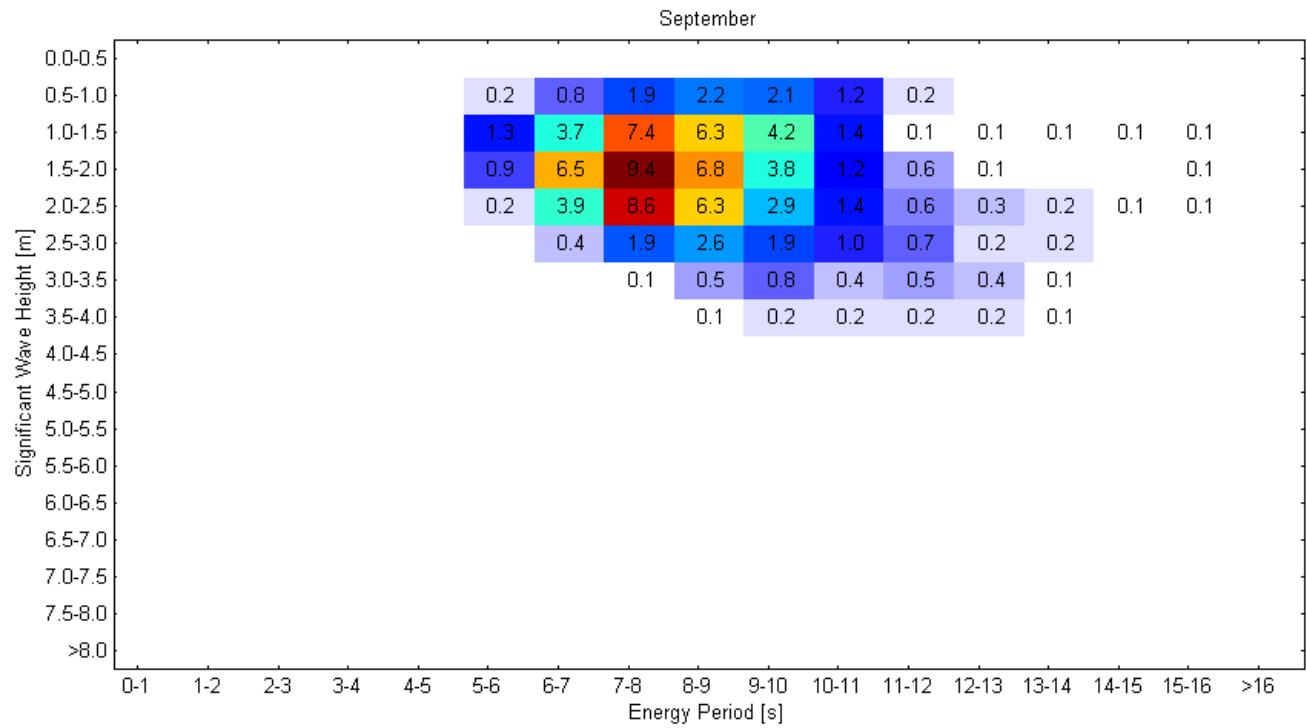


Figure A-9 Histogram of SWH vs. Energy Period for September

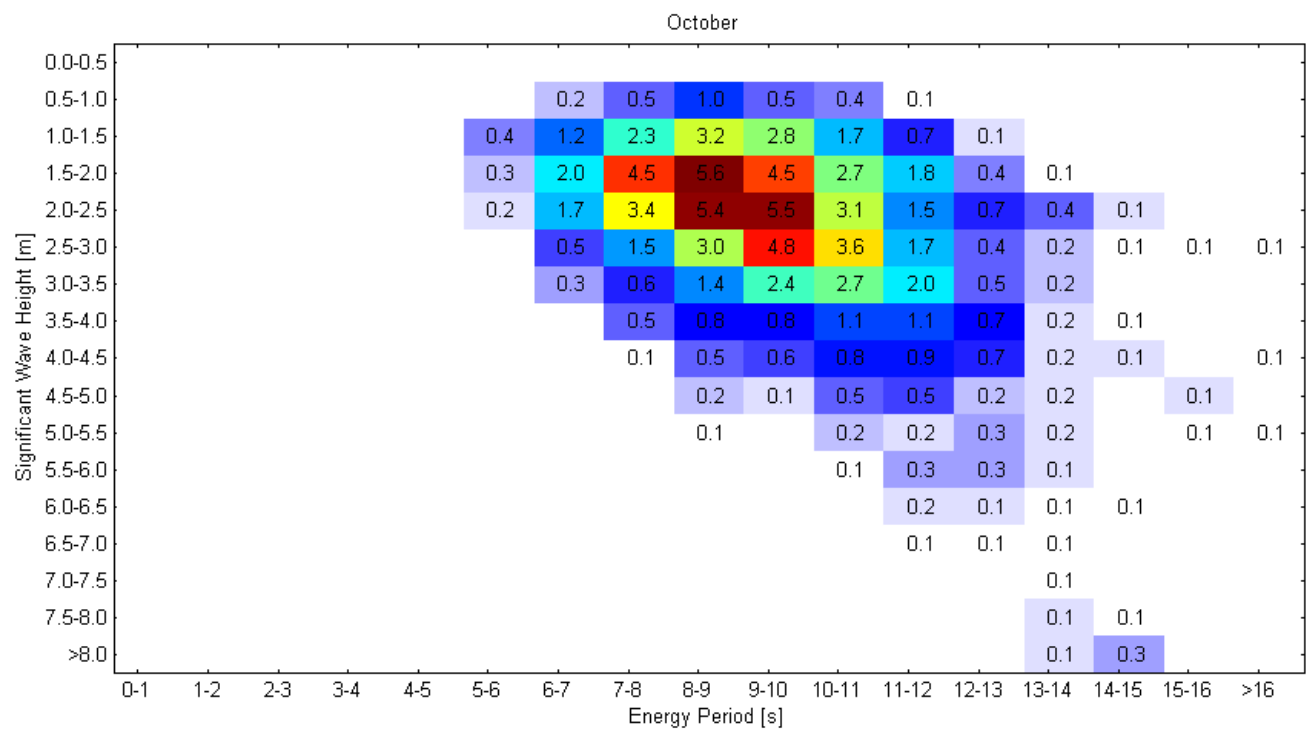


Figure A-10 Histogram of SWH vs. Energy Period for October

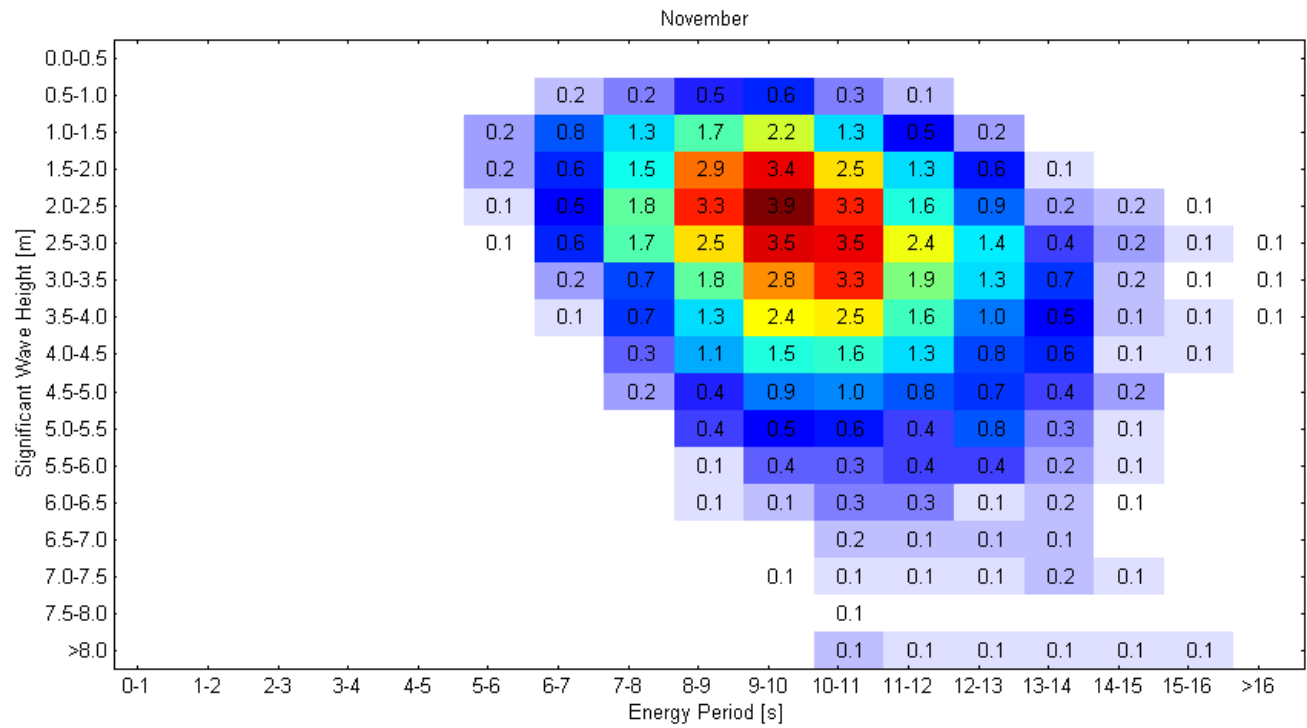


Figure A-11 Histogram of SWH vs. Energy Period for November

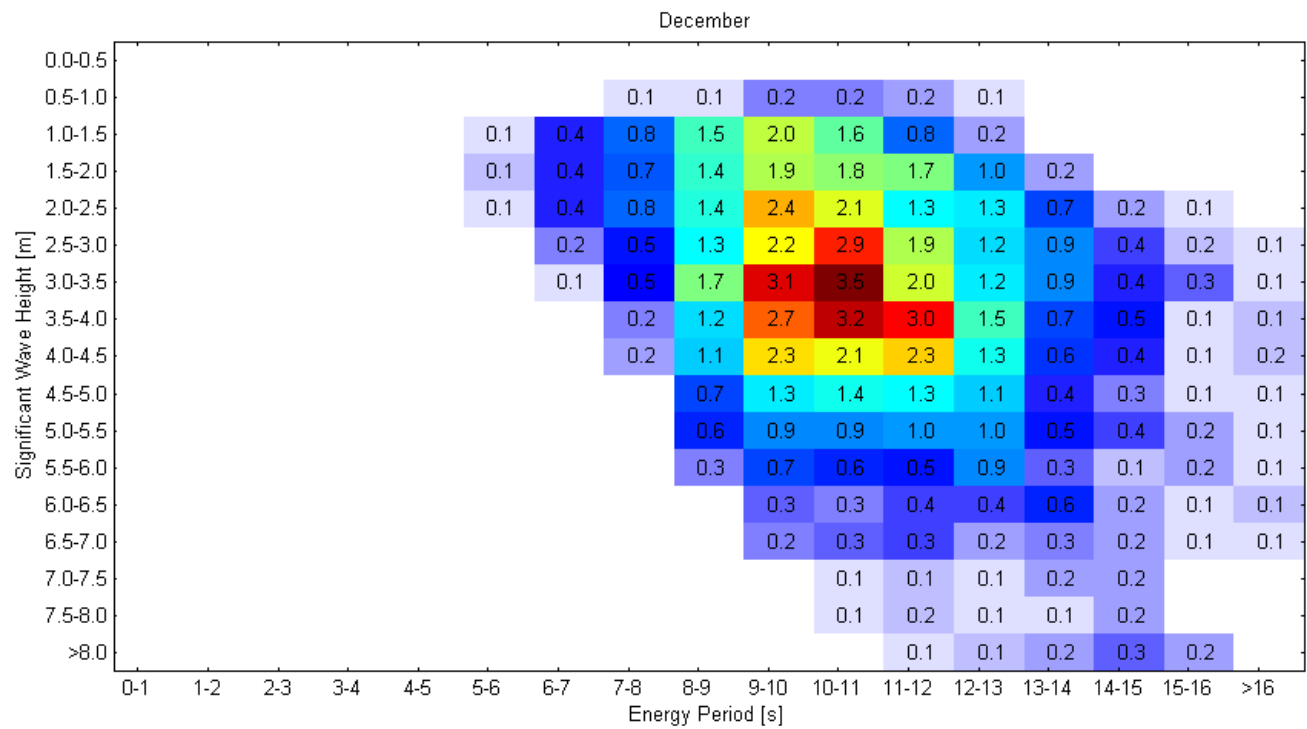


Figure A-12 Histogram of SWH vs. Energy Period for December

EXHIBIT B
STANDARD TERMS AND CONDITIONS FOR GOODS

These Standard Terms and Conditions for Goods shall govern the purchase by OSU from the Contractor and shall replace and supersede any terms and conditions presented by Contractor or any sales quotations, order acknowledgements, or similar forms unless otherwise specified in the Solicitation Documents or on the face of the Purchase Order issued by OSU.

1. DEFINITIONS:

As used in this Contract, the terms set forth below are defined as follows:

- a. "Contract" means only the documents listed below, which, in the event of any conflicts among them, must be interpreted in the following order of precedence:
 - i. The Solicitation Document and its Attachments and Addenda, if any; and
 - ii. The Purchase Order Issued by OSU
- b. "Contractor" means a person or organization with whom OSU has contracted for the provision of goods pursuant to this Contract;
- c. "Contractor Intellectual Property" means any intellectual property owned by Contractor and developed independently from Contractor's performance of this Contract;
- d. "OAR" means the Oregon Administrative Rules;
- e. "ORS" means the Oregon Revised Statutes;
- f. "OSU" means the State of Oregon, acting by and through the State Board of Higher Education, on behalf of Oregon State University.
- g. "Solicitation Document" means the Request for Quotes, Invitation to Bid, Request for Proposals, or any other written document issued by OSU that outlines the required specifications necessary to submit a responsive quote, bid, proposal, or any other response;

2. ACCESS TO RECORDS:

Contractor shall maintain books, records, documents, and other evidence and accounting procedures and practices sufficient to reflect properly all costs of whatever nature claimed to have been incurred and anticipated to be incurred in the performance of this Contract. OSU, the Oregon State Board of Higher Education, Oregon Secretary of State, federal government, and their duly authorized representatives shall have access to the books, documents, papers, and records of Contractor which are directly pertinent to this Contract for the purpose of making audit, examination, excerpts, and transcripts. Contractor shall maintain such books and records for OSU's review for at least six years beyond the Term of the Contract unless OSU authorizes a shorter period in writing. Contractor shall promptly remedy any discrepancies involving deviation from the terms of this Contract and shall promptly reimburse OSU for any commitments or expenditures found by OSU to have been in excess of amounts authorized by OSU.

3. AFFIRMATIVE ACTION:

Pursuant to OAR 580-061-0030, Contractor certifies that Contractor has not discriminated against Minority, Women or Emerging Small Business Enterprises in obtaining any required subcontracts.

4. APPLICABLE LAW; JURISDICTION AND VENUE.

- a. This Contract is governed and shall be construed in accordance with the laws of the State of Oregon, without resort to any other jurisdiction's conflict of law rules or doctrines. Any claim, action, or suit between OSU and Contractor that arises out of or relates to performance of this Contract must be brought and conducted solely and exclusively within the Circuit Court for Marion County, for the State of Oregon.
- b. Notwithstanding the foregoing paragraph, if a claim must be brought in federal forum, it must be brought and adjudicated solely and exclusively in the United States District Court for the District of Oregon. This paragraph applies to a claim brought against OSU only to the extent Congress has validly abrogated OSU's sovereign immunity and is not consent by OSU to be sued in federal court. This paragraph is also not a waiver by OSU of any form of immunity, including without limitation sovereign immunity and immunity based on the Eleventh Amendment to the United States Constitution.
- c. Except as set forth in the paragraph above, the parties consent to in personam jurisdiction in the above courts and waive any objection to venue and any objection that the forum is inconvenient.

5. ASSIGNMENT/SUBCONTRACT/SUCCESSORS:

Contractor shall not assign, sell, transfer, or subcontract rights, or delegate responsibilities under this Contract, in whole or in part, without the prior written approval of the OSU Procurement and Contract Services Department, and any attempt by Contractor to assign, sell, transfer, or subcontract rights or delegate responsibilities under this Contract, without first

acquiring written approval of the OSU Procurement and Contract Services Department, is void. No such written approval from OSU relieves Contractor of any obligations of this Contract, however, and any assignee, new owner, transferee or subcontractor will be considered an agent of Contractor. Contractor shall remain liable to OSU under the Contract as if no such assignment, sale, transfer, or subcontract had occurred. The provisions of this Contract are binding upon and will inure to the benefit of the parties to the Contract and their respective permitted successors and assigns.

6. COMPLIANCE WITH APPLICABLE LAW:

Contractor shall comply with all federal, state and local laws, regulations, executive orders and ordinances applicable to the Contract. Without limiting the generality of the foregoing, Contractor expressly agrees to comply with the following laws, regulations and executive orders to the extent they are applicable to the Contract: (i) Titles VI and VII of the Civil Rights Act of 1964, as amended; (ii) Sections 503 and 504 of the Rehabilitation Act of 1973, as amended; (iii) the Americans with Disabilities Act of 1990, as amended; (iv) Executive Order 11246, as amended; (v) the Health Insurance Portability and Accountability Act of 1996; (vi) the Age Discrimination in Employment Act of 1967, as amended, and the Age Discrimination Act of 1975, as amended; (vii) the Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended; (viii) ORS Chapter 659, as amended; (ix) all regulations and administrative rules established pursuant to the foregoing laws; and (x) all other applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations. These laws, regulations and executive orders are incorporated by reference herein to the extent that they are applicable to the Contract and required by law to be so incorporated.

7. CONFIDENTIALITY:

This Contract is subject to the limitations and conditions of the Oregon Public Records Law, ORS 192.410-192.505.

8. DELIVERY:

All deliveries are F.O.B. destination with all transportation and handling charges paid by the Contractor, unless specified otherwise in the Solicitation Documents or on the face of the Purchase Order issued by OSU. Responsibility and liability for loss or damage remain with the Contractor until final inspection and acceptance, when responsibility passes to OSU except as to latent defects, fraud and Contractor's warranty obligations.

9. EXPORT CONTROL:

Contractor acknowledges that OSU has students and faculty who are foreign nationals who may work with the services, product or technology received from Contractor pursuant to this Contract. Contractor represents that it has informed OSU in writing, prior to executing this Contract if it is providing OSU any product or technology subject to the U.S. Export Administration Act of 1979, the Export Administration Regulations and the International Traffic in Arms Regulations, and if so, under what Commerce Control List number(s) or U.S. Munitions List number(s) it is controlled.

10. FORCE MAJEURE:

Neither OSU nor Contractor shall be held responsible for delay or default caused by fire, riot, act of nature, terrorist acts, or other acts of political sabotage, or war where such cause was beyond, respectively, OSU's or Contractor's reasonable control. Contractor shall make all reasonable efforts to remove or eliminate such a cause of delay or default and shall, upon cessation of the cause, diligently pursue performance of its obligations under this Contract. However, if a default or delay due to a force majeure event continues for an unreasonable time, as determined by OSU, then OSU is entitled to terminate the Contract.

11. GOVERNMENT EMPLOYMENT STATUS:

Contractor certifies that it is not currently employed by the federal government and not an employee of OSU.

12. INDEMNITY, RESPONSIBILITY FOR DAMAGES:

- a. Contractor shall be responsible for all damage to property, injury to persons, and loss, expense, inconvenience, and delay which may be caused by, or result from, any willful or negligent act or omission of Contractor, its subcontractors, or employees under this Contract. Contractor shall save, defend, indemnify, and hold harmless OSU, the Oregon State Board of Higher Education, the State of Oregon and their agencies, subdivisions, officers, directors, agents, members, and employees from all claims, suits, and actions resulting from or arising out of the willful or negligent acts or omissions of Contractor or its subcontractors, officers, agents, or employees acting under this Contract.
- b. Without limiting the generality of this section a., Contractor expressly agrees to defend, indemnify, and hold OSU, the Oregon State Board of Higher Education, the State of Oregon and their agencies, subdivisions, officers, directors, agents, members, and employees harmless from any and all claims, suits, actions, losses, liabilities, costs, expenses and damages arising out of or related to any claims that the services or any other tangible or intangible goods delivered to OSU by Contractor that may be the subject of protection under any state or federal

intellectual property law or doctrine, or OSU's use thereof infringes any patent, copyright, trade secret, trademark, trade dress, mask work, utility design, or other proprietary right of any third party; provided, that OSU shall provide Contractor with prompt written notice of any infringement claim.

- c. Contractor shall have control of the defense and settlement of any claim that is subject to a. or b.; however, neither Contractor nor any attorney engaged by Contractor shall defend the claim in the name of the State of Oregon or any agency of the State of Oregon, nor purport to act as legal representative of the State of Oregon or any of its agencies, without first receiving from the Oregon Attorney General, in a form and manner determined appropriate by the Attorney General, authority to act as legal counsel for the State of Oregon, nor shall Contractor settle any claim on behalf of the State of Oregon without the approval of the Attorney General. The State of Oregon may, at its election and expense, assume its own defense and settlement in the event that the State of Oregon determines that Contractor is prohibited from defending the State of Oregon, or is not adequately defending the State of Oregon's interests, or that an important governmental principle is at issue and the State of Oregon desires to assume its own defense.

13. INSPECTIONS:

Goods furnished under this Contract are subject to inspection and test by OSU at times and places determined by OSU. If OSU finds goods furnished to be incomplete or not in compliance with the Contract, OSU, at its sole discretion, may either reject the goods, require Contractor to correct any defects without charge, or negotiate with Contractor to sell the goods to OSU at a reduced price, whichever OSU deems appropriate under the circumstances. If Contractor is unable or refuses to cure any defects within a time deemed reasonable by OSU, OSU may reject the goods and cancel the Contract in whole or in part. Nothing in this paragraph is to in any way affect or limit OSU's rights as a Buyer, including the rights and remedies relating to rejection under ORS 72.6020 and revocation of acceptance under ORS 72.6080.

14. INSURANCE:

Contractor shall secure at its own expense and keep in effect during the term of this Contract general liability or professional liability insurance as deemed applicable by OSU with limits of not less than four million dollars (\$4,000,000) aggregate, unless otherwise specified in writing by OSU. Insurance policies are to be issued by an insurance company authorized to do business in the State of Oregon with a rating of A or better, or as deemed acceptable by OSU. If requested, Contractor shall provide proof of insurance of said insurance policy. If any of the liability insurance is arranged on "claims made basis, tail" coverage will be required at the completion of this Contract for a duration commiserate with the statute of limitations for tort claims in Oregon.

15. INVOICES:

Contractor shall send invoices to OSU for goods and services accepted by OSU to OSU's Department at the address specified in the Purchase Order. Contractor shall include in each invoice:

- a. The Purchase Order number;
- b. The quantity of goods ordered, the quantity of goods delivered, the date goods were delivered, the price per unit;
- c. A detailed description of any services performed, the dates services were performed, the rate or rates for services performed, and the total cost of services; and
- d. The total amount due and the payment address.

OSU shall pay Contractor for services performed at the prices and rates specified herein. Contractor shall look solely to OSU for payment of all amounts OSU owes to Contractor. Payment of OSU contracts is normally made within 30-45 days following the date the the invoice is received. After 45 days, Contractor may assess overdue account charges up to a maximum of two-thirds of one percent (2/3 of 1%) per month or eight percent (8%) per annum on the outstanding balance (ORS 293.462).

16. NECESSARY COMPONENTS:

Unless specified otherwise, Contractor shall include all components, hardware and parts necessary for complete and proper assembly, installation and operation of goods.

17. NON-COMPLIANCE:

If any goods or component parts are recalled by a regulatory body or the manufacturer, or discovered by Contractor not to comply with applicable regulatory standards or the Specifications, Contractor shall immediately notify OSU of the recall or non-compliance, and shall provide copies of the recall notice or notice of non-compliance, as applicable, and all other supporting documentation for the recall or non-compliance determination. OSU may elect to (a) reject goods in whole or in part, or (b) revoke its acceptance of goods in whole or in part. If OSU rejects goods or revokes its acceptance of goods, Contractor shall remove the particular goods from OSU's possession at no cost to OSU and shall reimburse OSU for all payments made for those goods.

18. NOTICE:

Unless otherwise specified, any notice pursuant to this Contract shall be validly given if in writing and delivered to the other party via e-mail, fax, or by registered or certified mail, postage prepaid, to the respective addressees of Contractor and OSU.

19. OSU NAME AND TRADEMARK:

Contractor's shall not use names, marks or trademarks identifying OSU, or any department or office of OSU, or in any other way identify OSU without prior written approval from OSU's Office of University Advancement.

20. PARKING:

Contractors doing business on the OSU campus may be required to have a permit to park, if utilizing restricted street parking or parking lots. Contractor parking permits may be picked up from OSU's Office of Transit & Parking Services.

21. RECYCLABLE PRODUCTS:

Contractors will use recyclable products to the maximum extent economically feasible in the performance of the Contract.

22. RETIREMENT SYSTEM STATUS:

Contractor is not a contributing member of the Public Employees' Retirement System and will be responsible for any federal or state taxes applicable to payment under this Contract. Contractor will not, by virtue of this Contract, be eligible for federal Social Security, employment insurance, workers' compensation or the Public Employees' Retirement System, except as a self-employed individual.

23. SAFETY AND HEALTH REQUIREMENTS/HAZARD COMMUNICATION:

goods supplied under this Contract shall comply with all federal Occupational Safety and Health Administration (OSHA) requirements and with all Oregon safety and health requirements, including those of the State of Oregon Workers' Compensation Division. Contractor shall notify OSU prior to using products containing hazardous chemicals to which OSU employees may be exposed. Products containing hazardous chemicals are those products defined by Oregon Administrative Rules, Chapter 437. Upon OSU's request, Contractor shall immediately provide Material Safety Data Sheets, as required by OAR 437-155-025, for the products subject to this provision.

24. SEVERABILITY:

The invalidity, illegality or enforceability of any provision of this Contract shall not affect the validity, legality or enforceability of any other provision of this Contract, which shall remain in full force and effect and shall be liberally construed in order to effectuate the purpose and intent of this Contract.

25. SEXUAL HARASSMENT:

The State Board of Higher Education has adopted polices applicable to Contractors that prohibit sexual harassment, and Contractor's company and employees are required to adhere to OSU's policy prohibiting sexual harassment in their interactions with members of the OSU community.

26. STANDARD COMPONENTS:

Unless specified, Contractor shall provide goods with all components and accessories that the manufacturer lists as "standard" for goods.

27. SURVIVAL:

The terms and conditions of this Contract that by their sense and context are intended to survive termination or expiration hereof shall so survive.

28. TAX COMPLIANCE CERTIFICATION:

Contractor certifies under penalty of perjury that Contractor is, to the best of the undersigned's knowledge, not in violation of any Oregon Tax Laws. For purposes of this certification, "Oregon Tax Laws" means a state tax imposed by ORS 320.005 to 320.150 and 403.200 to 403.250 and ORS chapters 118, 314, 316, 317, 318, 321 and 323 and the elderly rental assistance program under ORS 310.630 to 310.706 and local taxes administered by the Department of Revenue under ORS 305.620.

29. TERMINATION:

This Contract may be terminated at any time by mutual consent of both parties or by OSU upon thirty (30) days' notice in writing and delivered by certified mail or in person to the other party. In addition, OSU may terminate this Contract at any time by written notice to Contractor if (a) Federal or state statutes, regulations or guidelines are modified or interpreted in

such a way that the services are no longer allowable or appropriate for purchase under this Contract; (b) any license or certificate required by law or regulation to be held by the Contractor to provide the services required by this Contract is for any reason denied, revoked, or not renewed; or (c) OSU fails to receive sufficient legislative appropriations (or from applicable federal, state, or other sources) to permit OSU, in the exercise of its reasonable administrative discretion, to fulfill its obligations under this Contract, or if the OSU program for which this Contract was executed is abolished. This Contract may also be terminated by OSU for default (including breach of contract) if (a) Contractor fails to timely provide services or materials called for by this Contract; or (b) Contractor fails to perform any of the other provisions of this Contract, or so fails to pursue the work as to endanger performance of this Contract in accordance with its terms and conditions, and after receipt of written notice from OSU, fails to correct such failures within ten (10) days. The rights and remedies of OSU provided in the above clause related to defaults (including breach of contract) by Contractor shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

30. THIRD PARTY BENEFICIARY:

OSU and Contractor are the only parties to this Contract and are the only parties entitled to enforce its terms. Nothing in this Contract gives, is intended to give, or shall be construed to give or provide any benefit or right, whether directly, indirectly, or otherwise, to third parties.

31. WAIVER:

Failure of OSU to enforce any provision of this Contract will not constitute a waiver or relinquishment by OSU of the right to such performance in the future nor of the right to enforce any other provision of this Contract.

32. WARRANTIES:

Unless specified, Contractor shall deliver goods that are new, unused and produced from current production inventory. Contractor shall provide goods manufactured from only those components that the manufacturer offers in the manufacturer's current parts catalogue for goods and carry full manufacturer warranties. Contractor warrants all goods delivered to be free from defects in labor, material, and manufacture and to be in compliance with specifications in the Solicitation Document. All implied or expressed warranty provisions of the Uniform Commercial Code, at ORS Chapter 72, are incorporated into this Contract. All warranties run to OSU.

33. WORKERS' COMPENSATION:

The Contractor, its subcontractors, if any, and all employers providing work, labor or materials under this Contract are subject employers under the Oregon Workers' Compensation law and shall comply with ORS 656.017, which requires them to provide workers' compensation coverage that satisfies Oregon law for all their subject workers, unless such employees are exempt under ORS 656.126.

34. MERGER:

THIS CONTRACT CONSTITUTES THE ENTIRE CONTRACT BETWEEN THE PARTIES. THERE ARE NO UNDERSTANDINGS, ORAL OR WRITTEN, NOT SPECIFIED HEREIN REGARDING THIS CONTRACT. NO AMENDMENT, CONSENT, OR WAIVER OF TERMS OF THIS CONTRACT SHALL BIND EITHER PARTY UNLESS IN WRITING AND SIGNED BY ALL PARTIES. ANY SUCH AMENDMENT, CONSENT, OR WAIVER IS EFFECTIVE ONLY IN THE SPECIFIC INSTANCE AND FOR THE SPECIFIC PURPOSE GIVEN.

**EXHIBIT C
CERTIFICATIONS**

By signature on this certification the undersigned certifies that they are authorized to act on behalf of the Bidder and that under penalty of perjury the undersigned will comply with the following:

SECTION I. OREGON TAX LAWS

The undersigned hereby certifies under penalty of perjury that the undersigned is authorized to act on behalf of Bidder and that Bidder is, to the best of the undersigned's knowledge, not in violation of any Oregon Tax Laws. For purposes of this certification, "Oregon Tax Laws" means a state tax imposed by ORS 320.005 to 320.150 and 403.200 to 403.250 and ORS chapters 118, 314, 316, 317, 318, 321 and 323 and the elderly rental assistance program under ORS 310.630 to 310.706 and local taxes administered by the Department of Revenue under ORS 305.620.

SECTION II. AFFIRMATIVE ACTION

The undersigned hereby certifies that they have not discriminated against Minority, Women or Emerging Small Business Enterprises in obtaining any required subcontracts, pursuant to OAR 580-061-0030 (3).

SECTION III. COMPLIANCE WITH SOLICITATION

The undersigned agrees and certifies that they:

1. Have read, fully understands and agrees to be bound by the Invitation to Bid and all Exhibits and Addenda to the Invitation to Bid; and
2. Are an authorized representative of the Bidder, that the information provided is true and accurate, and that providing incorrect or incomplete information may be cause for rejection of the Bid or Contract termination; and
3. Will furnish the designated item(s) and/or service(s) in accordance with the Invitation to Bid and the Contract; and
4. Has provided a correct Federal Employer Identification Number or Social Security Number with the Bid.

SECTION IV. PERMISSIVE COOPERATIVE PROCUREMENTS

If Bidder is awarded a contract from this Invitation to Bid, Bidder hereby (check one)

- agrees
- disagrees

to offer the resulting contractual terms and prices to other public institutions.

Authorized Signature: _____

Date: _____

Name (Type or Print): _____

Telephone:(_____)_____

Title: _____

Fax:(_____)_____

FEIN ID# or SSN# (required): _____

Email: _____

Company: _____

Address, City, State, Zip: _____

Construction Contractors Board (CCB) License Number (if applicable): _____

Business Designation (check one):

- Corporation
- Partnership
- LLC
- Sole Proprietorship
- Non-Profit

Minority, Women & Emerging Small Business (MWESB) Certified Firm: Yes No

If yes, Minority, Women & Emerging Small Business (MWESB) Certification Number: _____

**EXHIBIT D
REFERENCES**

REFERENCE 1

COMPANY: _____ CONTACT NAME: _____
ADDRESS: _____ PHONE NUMBER: _____
CITY, STATE ZIP: _____ FAX NUMBER: _____
WEBSITE: _____ E-MAIL: _____
GOODS OR SERVICES PROVIDED: _____

REFERENCE 2

COMPANY: _____ CONTACT NAME: _____
ADDRESS: _____ PHONE NUMBER: _____
CITY, STATE ZIP: _____ FAX NUMBER: _____
WEBSITE: _____ E-MAIL: _____
GOODS OR SERVICES PROVIDED: _____

REFERENCE 3

COMPANY: _____ CONTACT NAME: _____
ADDRESS: _____ PHONE NUMBER: _____
CITY, STATE ZIP: _____ FAX NUMBER: _____
WEBSITE: _____ E-MAIL: _____
GOODS OR SERVICES PROVIDED: _____
