Oregon Territorial Sea Plan

Project Resource Inventory

Reedsport OPT Wave Park

FERC Project Number 12713

Reedsport OPT Wave Park, LLC

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I. Executive Summary

Reedsport OPT Wave Park ("OPT") filed a License Application for the 1.5 MegaWatt, ten (10) PowerBuoy® wave energy project with the Federal Energy Regulatory Commission ("FERC") in February 2010. FERC issued a "Ready For Environmental Analysis" Notice in June 2010. FERC's Environmental Analysis of the Project was made available through its eLibrary system in December 2010. In addition to the filings with FERC, OPT also filed applications with the Department of State Lands in December 2010 to comply with the filing requirements of Oregon Senate Bill 195 ("SB195"). These filings were an application for an Ocean Energy Lease and a "Fill" Permit. SB195 is applicable only to projects located in the Oregon Territorial Sea, have a capacity up to 5 MW, have entered into a Settlement Agreement, and file the required project applications by December 31. 2009. OPT filed a Settlement Agreement, Offer of Settlement, and Joint Explanatory Statement with FERC in August 2010. The Settlement Agreement was signed by 15 signatories, including three Federal Agencies, eight State of Oregon Agencies, three Non-Governmental Organizations, and OPT.

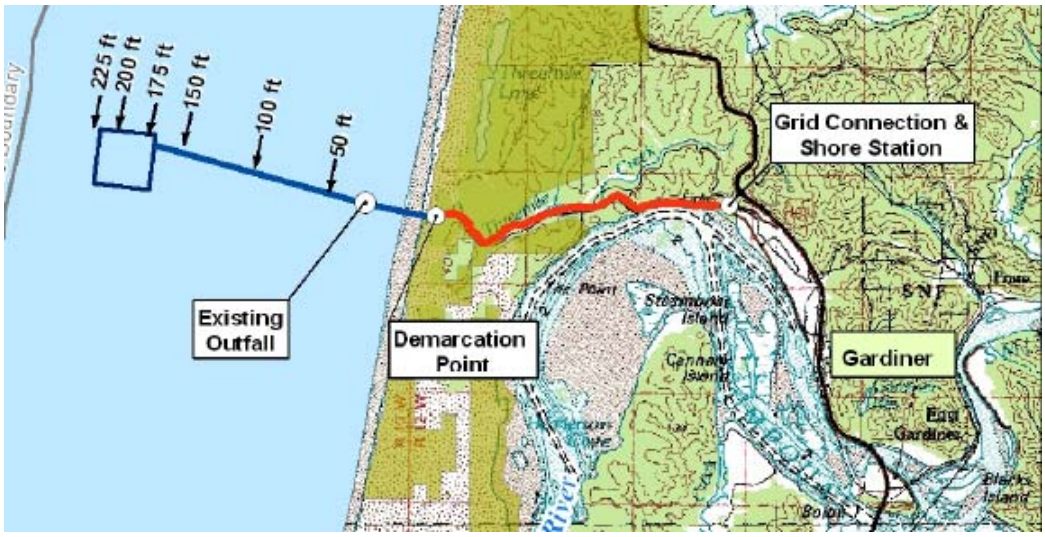
The Company proposes to deploy the 10 PowerBuoys approximately 2.5 miles (4 kilometers) off the coast of Reedsport and Gardiner in Douglas County, Oregon within a ½-mile-by-½-mile (0.25 square miles) area. The actual footprint of the constructed array is expected to be only about 1,000 feet by 1,300 feet (300 meters by 400 meters) or approximately 30 acres (0.05 square miles), excluding the navigation safety zone. The PowerBuoys will be deployed in an array of three rows, approximately in a northeast-southwest orientation. Two rows will consist of three PowerBuoys, and one row will consist of four PowerBuoys. The subsea transmission cable will be trenched in the sandy sea bottom before it enters the buried effluent discharge pipe, which crosses the shoreline underground at the southern end of nearly 23 miles of continuous beach. The effluent discharge pipe passes under intertidal and dune habitat within the Oregon Dunes National Recreation Area, an area that extends approximately 55 miles from Florence to Coos Bay. The terrestrial portions of the Project area are within the south-central portion of the Oregon Coast Range Ecoregion.

The underground transmission cable to be placed within the existing effluent pipe will connect to the existing Douglas Electric Cooperative (DEC) overhead transmission line located approximately three miles inland on the north bank of the Umpqua River. There will also be a shore station in close proximity to the DEC transmission line, located at the eastern terminus of the underground transmission cable about three miles inland.

The PowerBuoy generates power by using the up-and-down motion of the surface waves to cycle hydraulic cylinders. The rotary motion of the hydraulic motor is coupled to a generator which generates AC current that is smoothed into DC, and then is converted back to grid-compliant 60 Hz synchronous three-phase power. This AC to DC to AC electrical conversion occurs in each of the PowerBuoys. The 4,140 MegaWatt-Hours per year of clean, renewable energy generated by the Project will be delivered to the Pacific

Northwest transmission grid for use by Oregon electric customers.

Figure ES-1. Reedsport OPT Wave Park Project Map



The Coastal Zone Management Plan Consistency Determination is required as part of the FERC approval process and issue of the FERC Hydroelectric License. The determination process includes an inventory content. The inventory is to be developed in accordance with Part Two of the Oregon Territorial Sea Plan. The inventory contained in this submittal has been structured to address the prescribed elements of Part Two.

II. Inventory Content

The content and responses in the following sections are excerpted from the "*Territorial Sea Plan, Part Two: Making Resource Use Decisions,* Subparts A.2.c and A.2.d. Each item in the inventory prescription is excerpted (bold) and a response is provided (*italics*). Information has been compiled and/or summarized from prior regulatory submittals to the FERC and other State Agencies. Where appropriate, responses in certain sections refer directly to the sections in the relevant filings. The primary documents referenced are:

- FERC License Application Volumes 1 – IV (February 2010) [1]
- Draft Biological Assessment and Essential Fish Habitat Assessment, FERC Project No. 12713 (OPT, June 2010) [2]
- Environmental Assessment for Hydropower License, Reedsport OPT Wave Park Project – FERC Project No. 12713-002 (FERC, December 2010) [3]
- Reedsport OPT Wave Park Settlement Agreement and Joint Explanatory Statement (filed with FERC, August 2010) [4 and 5]

c. Inventory Content

At a minimum, the following factors shall be considered for inclusion in the inventory as appropriate to the magnitude, likelihood of effects, and the significance of potentially affected resources and uses:

1.) The proposed action:

(a) Location (using maps, charts, descriptions, etc.);

The project is located approximately 2.5 nautical miles of the coast of Douglas County, near Reedsport. The center of the PowerBuoy array is: 43.75501°, -124.23521°.

The project location map is Figure IS-1 in Volume I of the FERC License Application. The project description is contained as Exhibit A of Volume I. The project boundary map is shown as Exhibit G-1 of the application.

(b) Numbers and sizes of equipment, structures;

The project will consist of:
Ten (10) PB150 PowerBuoys
One (1) Underwater Substation Pod
One (1) 1.5 MW, 13.8 kiloVolt transmission cable, consisting of both marine and terrestrial components.
One (1) Shore Station – approximately fourteen feet (14') x fourteen feet (14')

Equipment sizes are contained in the Project Description of the FERC License Application (Volume I, Exhibit A) [1].

(c) Methods, techniques, activities to be used;

The following description is excerpted from the Joint Explanatory Statement [5] *submitted with the Settlement Agreement:*

"The PowerBuoys and mooring systems consist of fabricated modular components to be manufactured in Oregon and assembled at existing shore-based shops and shipyards prior to installation. Barges are planned to be used to ferry the Project components to the site. The PowerBuoys would be launched by towing or transporting them to the site aboard crane-equipped buoy tender vessels. The Company developed the techniques described below over the course of several years and they reflect experience gained from multiple deployments of PowerBuoys and continuous improvement to PowerBuoy deployment approach and operation. The Company utilizes a "world class" approach and some of the techniques to be used in this Project represent recent, proven advances in the commercial marine field. The Company has also incorporated consideration for decommissioning of the Project into the Project design.

The mooring system will be deployed using typical offshore construction vessels. The Company will install the mooring system in stages as follows:

- ***Site Preparation*** *- Anchor locations will be selected, recorded, and marked.*
- ***Anchor Installation*** *- A crane barge or other suitable vessel will be used to place the anchor at its proper location on the seabed. Appropriately-sized tug boats will be used to position the barge or vessel while the anchors are lowered to the seabed into their respective positions for the PowerBuoy location(s).*
- ***Mooring Line Installation*** *- Mooring lines will be installed using a vessel with lifting equipment that can set the subsurface floats (SSF) by lowering them into position with both the anchor and mooring lines attached. The SSFs will be affixed onto the tendon line, which is connected to the anchor. The anchor, tendon line, and SSF will be placed into the pre-assigned position. The SSFs will be left on station with the mooring lines attached, under tension, and moored to the anchors on the seabed.*

Once the anchors, SSFs and mooring lines are in place, the PowerBuoy will be deployed. Each PowerBuoy will be towed to the site by an appropriate ocean tug boat. The PowerBuoy will be towed to the berth in a horizontal position with the ballast tanks flooded with air to ensure buoyancy.

Each PowerBuoy is physically retained in position by the mooring lines, and each of the mooring lines will be connected to the PowerBuoy at the site. To position

the PowerBuoy, the mooring lines will be picked up (using pre-rigged lines at the surface) and attached to the PowerBuoy's bridle connection. Once the mooring lines have been connected, the ballast tanks at the base of the PowerBuoy (the round part of the heave plate which is at the bottom of the spar) - which when deployed, will be 110 feet underwater - will be filled with seawater to cause the PowerBuoy to move from a horizontal orientation to a vertical one. Once the ballast tank is flooded, the PowerBuoy will be held above the water line by the float and the remaining buoyancy in the spar. The spar also includes a "trim tank" that can be used to adjust the buoyancy of the spar and position it for optimal PowerBuoy performance. Once adjusted, installation operations will continue with hook-up of the power cable.

Electrically, each PowerBuoy has a nominal 575 V cable feed including fiber-optics, and these are designed to be readily connected at the surface by accessing the PowerBuoy from a small boat. The power/fiber optic cable will exit the bottom of the PowerBuoy, descending to the seabed in a lazy 'S' shape with floats attached to the cable and a clump weight at the seabed. This lazy 'S' shape both allows for the heaving motion of the PowerBuoy and prevents cable sweep at the seabed. This cable will provide the installation with power and communications capability.

From the PowerBuoy array area to the effluent pipe outfall, the subsea transmission cable will be buried using standard methods for burying transmission cables in sand substrate (e.g., trenching or jet plowing). The cable will be buried to a minimum depth of about 3 to 6 feet (about 1 to 2 meters). The Company intends to use trenching or jet plowing to bury the cable, but the method will be determined by final selection of a cable deployment contractor. A pull line will be used to run the transmission cable through the effluent pipe. Additional details of this methodology will be developed following selection of the contractor that will deploy the subsea cable.

The site will be made electrically safe by isolating and locking out the 13.8 kV connection feed to the PowerBuoy, thus isolating all electrical supplies. The PowerBuoy will have been put into a safe/locked down process before installation, and will then remain in a safe state until fully installed and commissioned. Once deemed secure by the project manager and marine safety officer, the support vessels will return to port, removing any equipment and personnel no longer required at the site." (End of excerpt)

A shore station will be erected in close proximity to the effluent pumps and existing Douglas Electric Cooperative Overhead lines. OPT plans to use a prefabricated or above grade steel frame & concrete foundation for the shore station. The transmission cable will enter the shore station and be terminated appropriately to disconnect and metering equipment contained in the shore station. Cables will exit the shore station and be

interconnected with the existing overhead lines. This cabling will be constructed in accordance with generally accepted overhead line construction practices and applicable Douglas Electric Cooperative construction specifications.

(d) Transportation and transmission modes needed to serve/support the proposed project;

Marine transportation routes to and from the project area will be established consultation with the Southern Oregon Ocean Resources Council (SOORC), Oregon Department of Fish & Wildlife, and OPT (Settlement Agreement Appendix C). [4]

A buried submarine cable will be used as the transmission cable for the marine portion of the project. The cable continue along an existing, buried effluent pipe from the effluent pipe outfall, approximately one-half mile seaward, to approximately three (3) miles inland.

Existing roads will be used for the terrestrial portion of the project.

(e) Materials to be disposed of and method of disposal;

No materials are to be disposed of on the project site.

(f) Physical and chemical properties of hazardous materials to be used or produced, if any;

No hazardous materials are to be used or produced.

(g) Navigation aids; and

The PowerBuoys are similar in shape and color to Private Aids to Navigation found along the Oregon Territorial Sea. The project will use US Coast Guard approved navigation lights. Light flash patterns and sequencing will be determined in accordance with consultation among OPT, Settlement Agreement parties, and the US Coast Guard. Navigation markers are anticipated to be placed at the periphery of the project area in accordance with the Fishing and Crabbing Plan (Settlement Agreement Appendix C).

(h) Proposed time schedule.

The Company has requested a thirty-five (35) year license term for the project in its FERC License Application. Construction of the ten (10) PowerBuoy project is anticipated to begin May 2012. The length of the construction period has not been determined and will be coordinated with

appropriate state and federal agencies. The construction period will also be coordinated with Settlement Agreement stakeholders in accordance with Appendix C (Fishing and Crabbing Plan) of the Settlement Agreement [4]*. OPT anticipates that all necessary licenses, permits, and other authorizations will be obtained prior to the proposed start date.*

2.) Location and description of all affected areas, including areas for onshore support facilities.

The location of the Project area is included in the response to (1)(a). Descriptions of these affected areas are contained in Section 3 and Section 5 of the Applicant Prepared Environmental Analysis (FERC License Application, Volume II) [1] *and Section 3 of Environmental Analysis for Hydroelectric Project – Reedsport OPT Wave Park – FERC Project P-12713-002* [3]*.*

The nearest port facilities to the project area are the Ports of Umpqua and Coos Bay. The Oregon Wave Energy Trust commissioned an assessment in 2009 of Oregon's wave energy infrastructure. A report titled "Wave Energy Infrastructure Assessment in Oregon" [6] *was published and contains the following information on the capabilities of the Ports of Umpqua and Coos Bay.*

<u>Port of Umpqua</u>

<u>Entrance:</u>

- *Jetties – North and South*
- *Channels:*
  - *o Entrance – dredged 26 feet (7.9m)*
  - *o Main – dredged 22 feet (6.7m)*
- *Turning Basins – dredged 22 feet (6.7m), 9 foot (2.7m) controlling (2007)*
- *Overhead limitations:*
  - *o Power line, 52 foot (15.8m) clearance, just West of highway bridge – 10 miles (16.1km) above the entrance*
  - *Bridge limitations:*
    - *o Highway bridge*
    - *10 miles (16.1km) above the entrance, swing span – 36 feet (11m) closed*
    - *o Railroad bridge*
    - *10.3 miles (16.6km) above the entrance, swing span*

<u>Wharf & Dock Capabilities</u>

- *Gardiner*
  - *o International Paper Oil Wharf – 20'd, 150'l (6.1m, 45.7m)*
  - *o International Paper Wood Chip Wharf – 20'd, 350'l (6.1m, 106.7m)*
- *Reedsport*
  - *o American Bridge Bulkhead*

o Fred Wahl Marine Construction – 24'd, 350'l (7.3m, 106.7m)
o Salmon Harbor Wharf – 14'd, 100'l (4.3m, 30.5m)

Infrastructure

- *Railway access – yes*
- *Marine Railway – 900 ton (816.5tonne), 150 feet (45.7m)*
- *Dry dock – no*
- *Tidal graving dock – 260 feet long, 60 feet wide (79.3x18.3m)*

Port of Coos Bay

Entrance:

- *Jetties – North and South*
- *Channels:*
  - *o Bar – dredged 47 to 37 feet (11.3-14.3m)*
  - *o Main (entrance to Isthmus Slough)– dredged 37 feet (11.3m)*
  - *o Isthmus Slough to Millington – 22 feet (6.7m)*
- *Turning Basins:*
  - *o North Bend – dredged 37 feet (11.3m)*
  - *o Coos Bay – dredged 37 feet (11.3m)*
- *Overhead limitations:*
  - *o Power line, 167 foot (50.9m) clearance, 100 yards (91.4m) West of highway bridge*
- *Bridge limitations:*
  - *o Central Oregon and Pacific Railroad bridge*
    - *7.5 miles (12.1km) above the entrance, swing span, 197 foot (32.6m) horizontal clearance*
  - *o Highway bridge*
    - *8.1 miles (13km) above the entrance, 149 foot (37.5m) Clearance*

Wharf & Dock Capabilities

- *Roseburg Forest Products Wood Chip Dock – 40'd, 1430'l (12.2m, 435.9m)*
- *Ocean Terminals Dock – 38'd, 750'l (11.6m, 228.6m)*
- *Weyerhaeuser Co. Dock – 30'd, 1440'l (9.1m, 438.9m)*
- *Oregon Chip Terminal Wharf – 36'd, 1086'l (11m, 331m)*
- *Sause Brothers, Bayshore Dock – 32'd, 735'l (9.8m, 224m)*
- *Glenbrook Nickel Co. Dock – 36'd, 576'l (11m, 175.6m)*
- *Georgia-Pacific & Coos Bay Docks – 35'd, 1226'l (10.7m, 373.7m)*

Infrastructure

- *Railway access – yes*
- *Marine Railway – 5000 ton (4536 tonne), 400x100 feet (121.9x30.5m)*
- *Dry dock – 200 foot (61m)*
- *Crane – 100 ton (90.7tonne) mobile cranes, 42 ton (38 tonne) gantry crane*

• *Commercial Air Service – yes, SkyWest/United Express*

The infrastructure report also listed other regional shore based wave energy support facilities. The report is available on OWET's website at http://oregonarc.com/blog/wp-content/uploads/2010/03/20100305-FinalReport-small.pdf.

3.) Physical and chemical conditions such as:

(a) Water depth;

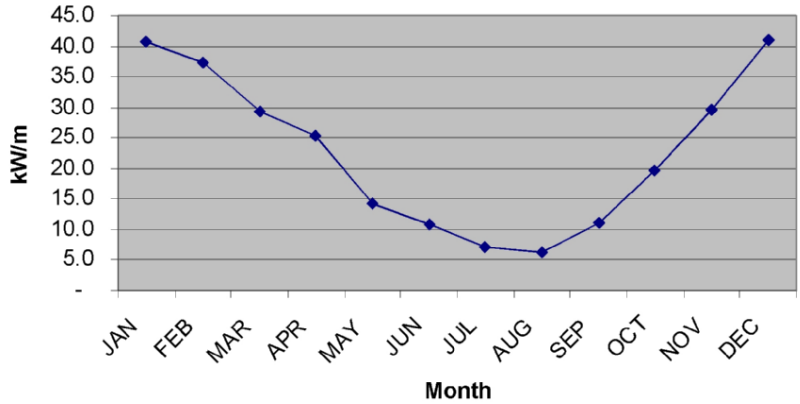
The water depth in the area of the ten (10) PowerBuoy Array is approximately 165 feet to 225 feet. A submarine cable will be buried in a corridor from the array to the effluent pipe outfall. The outfall is located in depths of approximately 30 – 50 feet.

(b) Wave regime;

A resource variability analysis was performed as part of the Company's evaluation of several Oregon wave park sites. This included the following wave profile power flux (Figure 1) excerpted from an EPRI conducted wave energy feasibility definition study for a number of sites in Oregon in 2004 [7]. *EPRI reported that the Coquille River Station (CDIP 0037) data buoy, located at a depth of 210 feet (64 m) about 70 miles (110 km) had the wave profile shown in Figure 1. The EPRI study evaluated data accumulated from 1984 – 1996. EPRI concluded that Oregon has very powerful waves and that the total wave energy resource potential off the coast of Oregon has the potential to supply about 20 percent of the state's total electrical demand.*

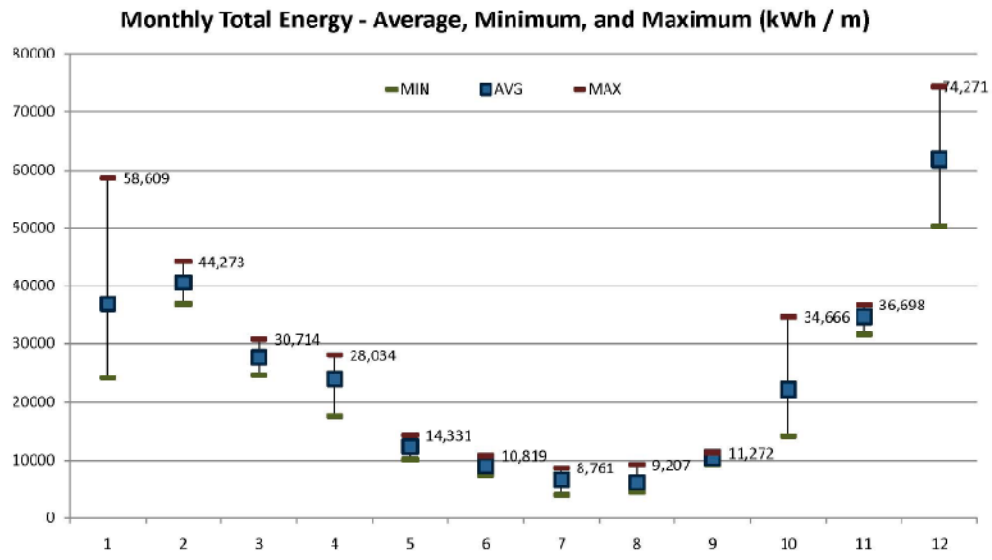
The maximum Significant Wave Height (H_s) recorded during this period was 7.8 meters. The Peak Wave Period (T_p) was 15.06 seconds. The estimated single extreme wave event was 15 meters. Appendix A of the 2004 EPRI report contained monthly Scatter Diagrams which are provided in Appendix A.

Figure 1. EPRI Monthly Average Wave Power (kw/m)



The Oregon Wave Energy Trust (OWET) also commissioned a Wave Resource Assessment as part of its Utility Market Initiative [8]. The analysis was conducted on 5 years of hourly data collected from National Oceanic and Atmospheric Administration (NOAA) buoy 46229 off the coast of Reedsport, Oregon. This buoy is in a water depth of (187 meters). The monthly total wave energy (kiloWatt-hour/m) averages, minimums, and maximums are shown below in Figure 2. The graph represents quality controlled data from the NOAA National Data Buoy Center (NDBC) program. Not all of the data captured hourly may be represented because of the quality control criterion. Figures 2 – 5 are excerpted from this OWET sponsored report.

Figure 2. Oregon Wave Energy Trust Utility Market Initiative Monthly Wave Energy Assessment



Daily variability within each twenty-four (24) hour period of the five (5) year dataset is shown in Figure 3. As expected, the data shows the greatest variability during the winter months.

Figure 3. Daily Wave Energy Availability

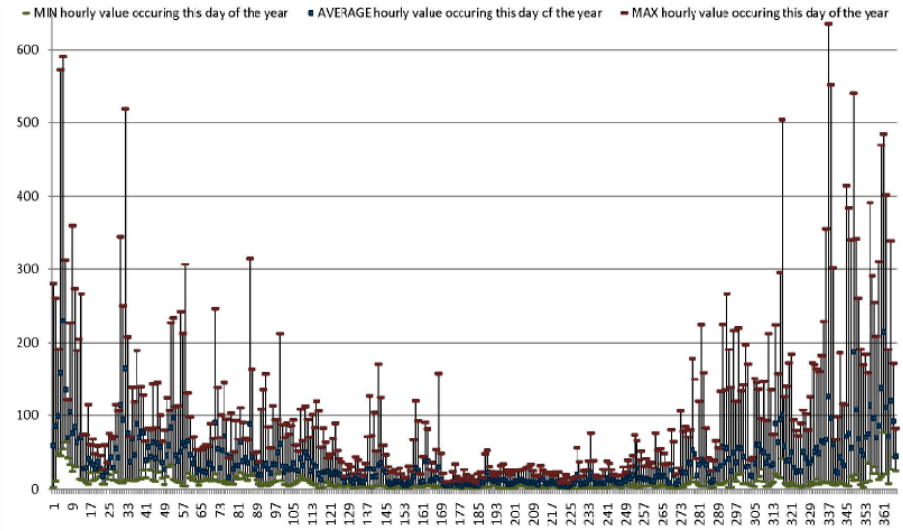
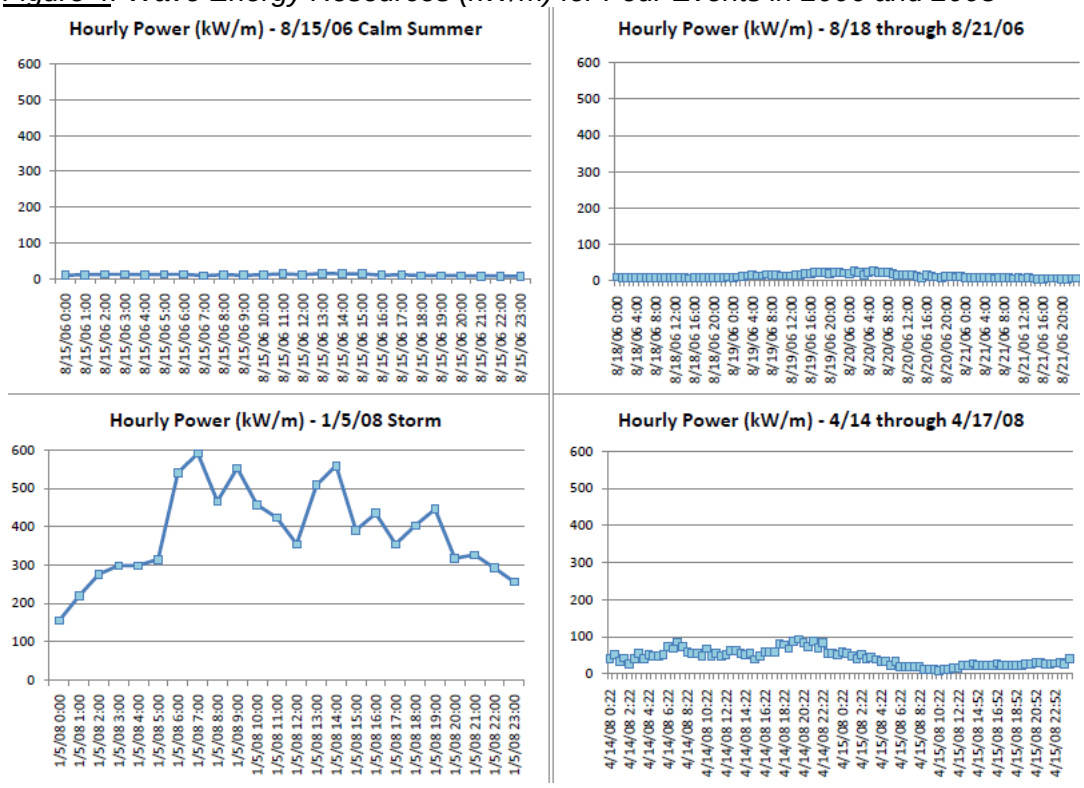
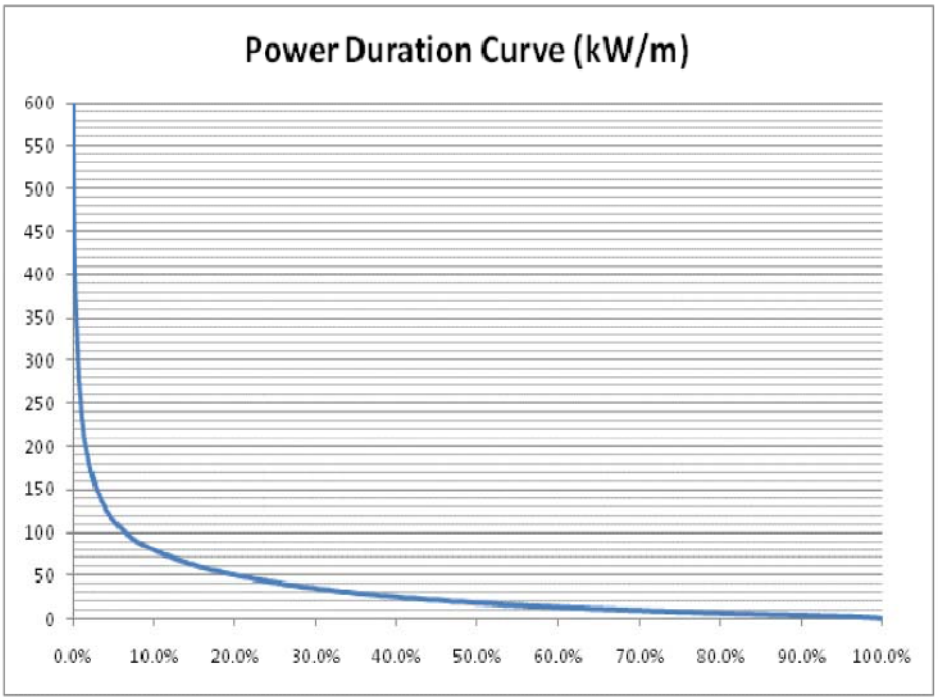


Figure 4. Wave Energy Resources (kW/m) for Four Events in 2006 and 2008



The NDBC program data can be used to generate a power duration curve for a specific level of wave energy. The curve indicates the average probabilities of the resource potential. Figure 5 indicates the annual average power duration. The curve indicates that 75% of the time (upper quartile), the wave resource is approximately 8 kW/m or greater. The wave resource is approximately 40 kw/m in the lower quartile (25% of the time). This potential can also be represented as in a tabular format as a Scatter Diagram. The Scatter Diagram plots wave heights and periods and assigns occurences of each during the month. Monthly Scatter Diagrams and Power Duration Curves are included in Appendix A.

Figure 5. Power Duration Curve



(c) Current velocities;

Figure 5.C.2-2 (FERC License Application, Volume II) [1] *is a visual representation of current patterns along the Oregon Coast. A daily composite is generated by the Oregon Coastal Ocean Observing System (OrCOOS). The overarching goal of OrCOOS is to establish and maintain an observing system to preserve and enhance the safe and sustained use of Oregon's coastal ocean. OrCOOS expects to achieve this goal by facilitating the integration of a wide variety of near real-time ocean observing and modeling systems.*

(d) Dispersal, horizontal transport, and vertical mixing characteristics of the area;

The project area is in the open ocean in approximately 165 to 225 feet. The ten (10) PowerBuoy array is anticipated to have a small impact on the horizontal transport characteristics in the far field (more than 1 km from the array). A comprehensive Wave, Current, and Sediment Study Plan will be implemented as part of the Settlement Agreement to gain additional knowledge of the horizontal and vertical mixing impacts of the array. Some preliminary work has been performed with existing numerical models. As part of the study plan, these models will be calibrated against instrumentation to be able to predict the array effects.

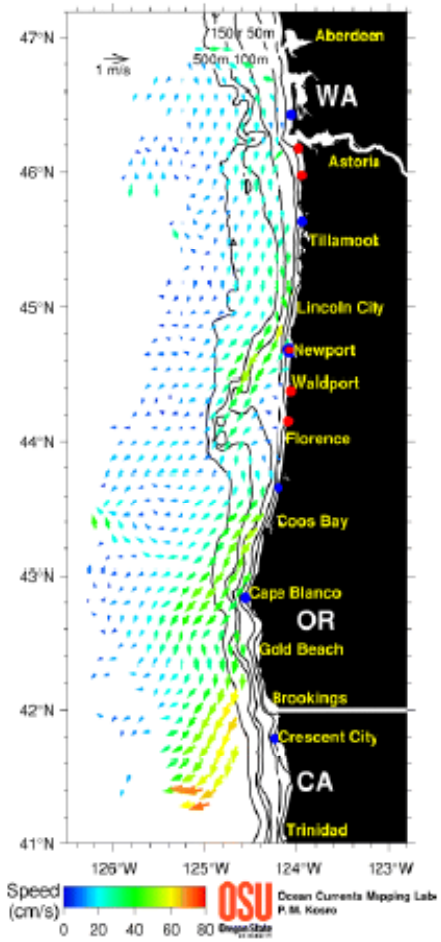


Figure 6. OrCOOS Generated Current Patterns Along the Oregon Coast

The following excerpts and Figures 7 and 8 are provided from the "Sediment Transport Study: Baseline Studies and Modeling for the Reedsport Site". [9]

"Preliminary numerical simulations of the potential effect of a WEC array on the wave height in the area carried out and indicate the following.

- *Wave height variations up to 15% are possible immediately in the lee of an array with length scales of variability similar to the distances between the individual devices. This variability is significantly smoothed at distances ~1km from the array. Far-field effects are confined to about 3% variability in the wave height.*
- *These results are very preliminary and must be calibrated and validated using observation of the shadow region around an actual buoy. We note that the details of the shadow regions may also be a function of the particular design of a structure." (End of excerpt)*

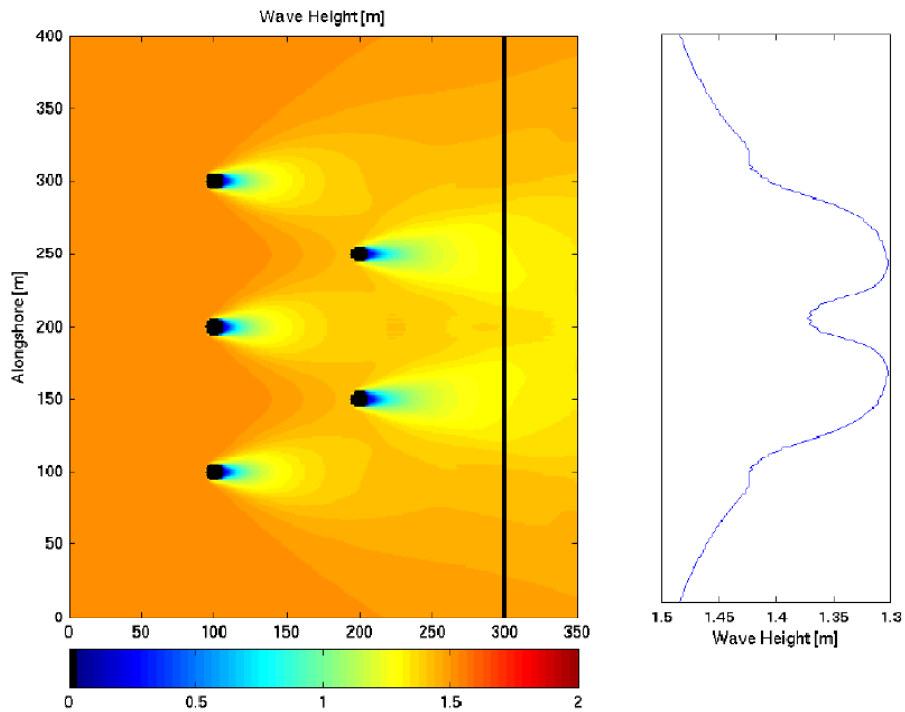
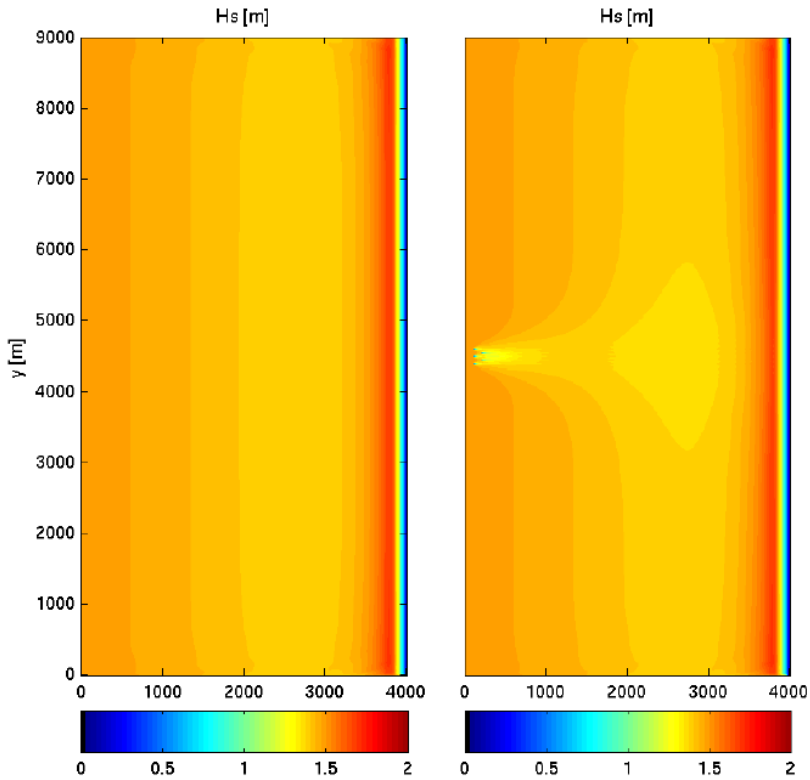


Figure 7. Effects of five Wave Energy Converters (Right) and the Wave Profile 100 meters Behind the Array

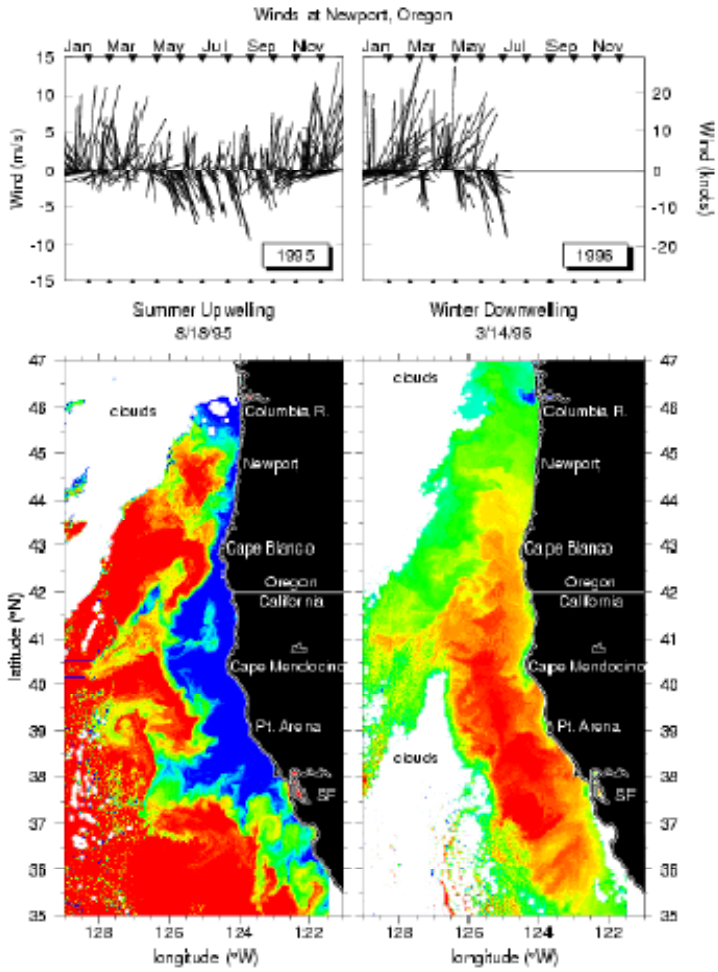
<u>Figure 8</u>. Wave Heights over a Planar Shelf without (Left) and with a FiveWave Energy Converter Array (Right)



(e) Meteorological conditions; and

Figure 5.C.2-3 (FERC License Application, Volume II) [1] *is a visual representation of winds and temperature patterns along the Oregon Coast. This figure is shown below.*

Figure 9. Oregon Coastal Wind and Temperature Patterns



Note: Daily sticks point toward the direction the wind is blowing and their length indicates the strength of the wind. Figures adapted from Kosro (2007) and GLOBEC (2001).

(f) Water quality.

A Water Quality Report has been prepared for the project titled "APPLICATION FOR THE CERTIFICATION OF COMPLIANCE WITH WATER QUALITY REQUIREMENTS AND STANDARDS PURSUANT TO SECTION 401 OF THE CLEAN WATER ACT, 33 USC 1341" [10].

4.) Bathymetry (bottom topography)

A Marine Geophysical Survey is included as Appendix D in Volume II of the Final License Application to FERC [1]. *The bottom topography is relatively featureless as shown in Figures 10 and 11.*

Figure 10. *Bathymetric Survey Area*

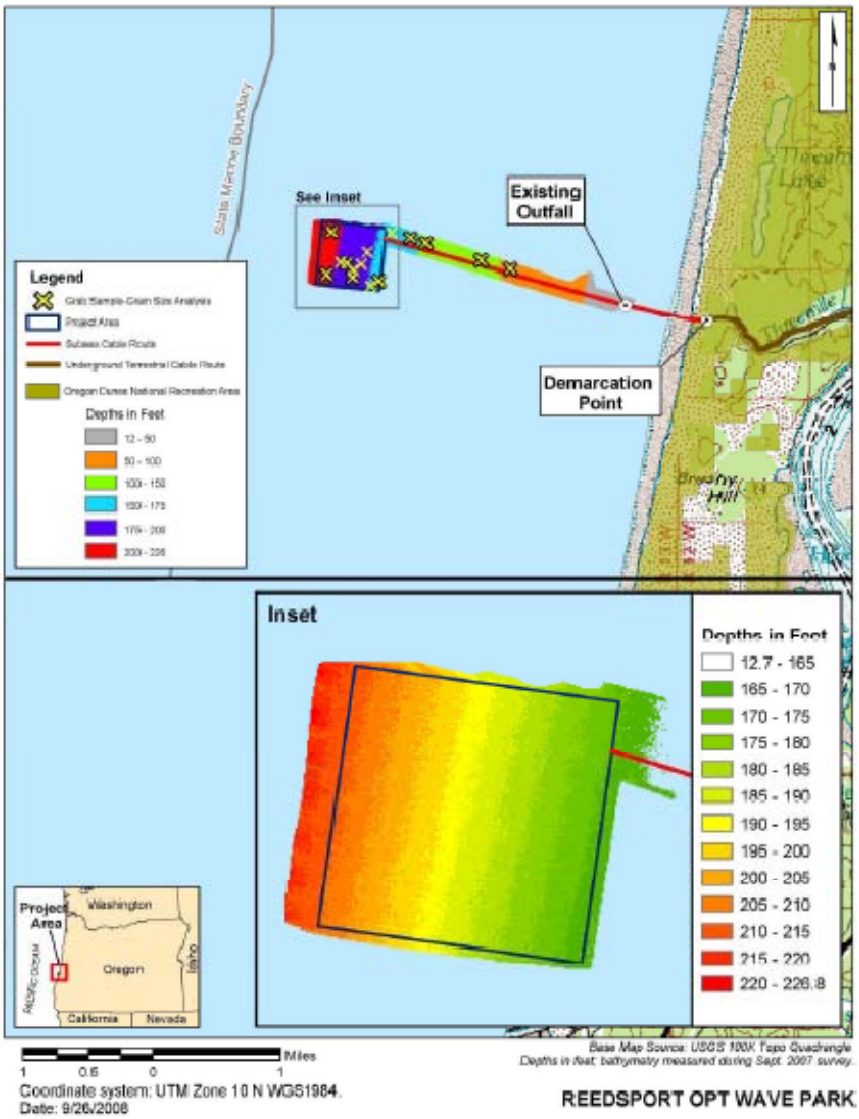
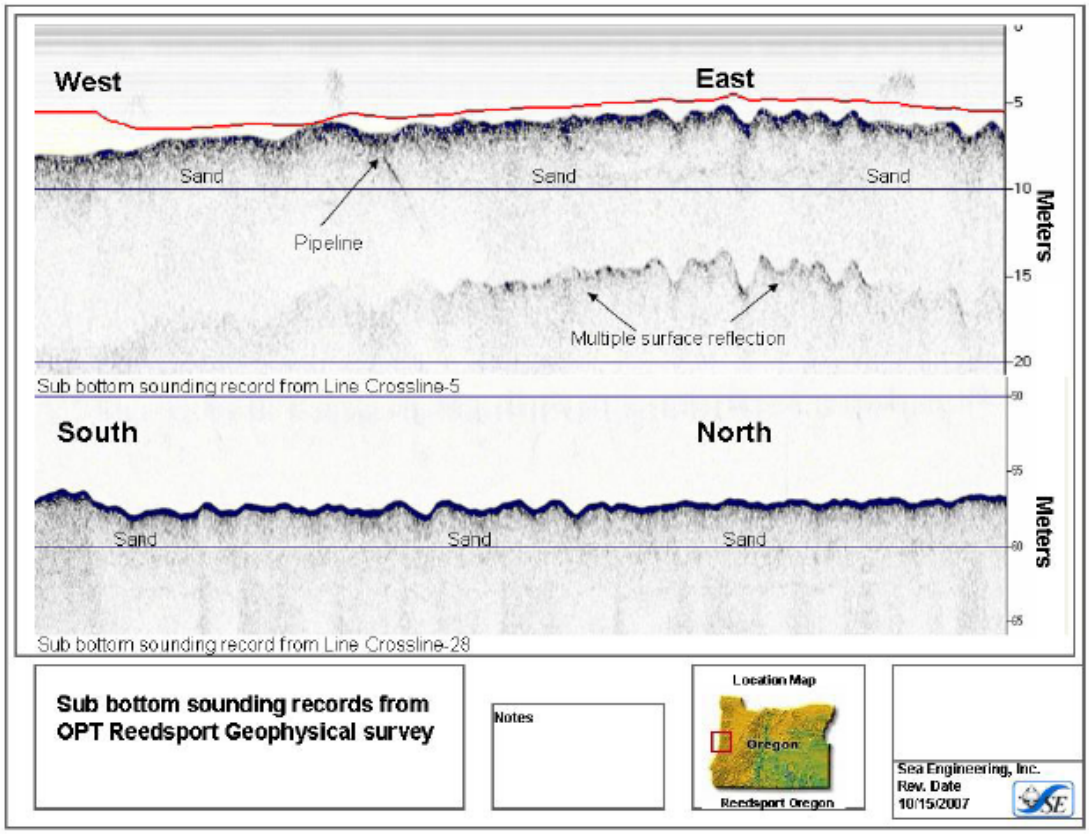


Figure 11. Horizontal Cross-sections of the Project Area.



5.) Geological structure and hazards.

The Marine Geophysical Survey did not identify any geological structure or hazards in the project area other than the effluent pipeline.

6.) Biological features, including:

(a) Critical marine habitats (see Definitions);

The ten PowerBuoy® Array is expected to occupy an area of approximately thirty acres near Reedsport, within the approximate 1,000 square miles of the Oregon Territorial Sea. The Oregon Territorial Sea is a diverse ecosystem. During the more than three (3) years of License Application preparation and Settlement Agreement discussions, the applicant and stakeholders had the opportunity to develop the project's biological features as required under this section. These features are described in the following documents which have been submitted to the Department of Land Conservation and Development and filed with the Federal Energy Regulatory Commission.

Sections 4.1 and Table 4-1 of the draft Biological Assessment and Essential Fish Habitat Assessment Reedsport OPT Wave park FERC Project 12713 [4] *provide a list and listing history of Federally Protected, Threatened, and Endangered Species that may Occur within the project*

Area. Sections 4.2 and 4.3 of the draft Biological Assessment provide a description of the individual species and critical habitat designation, respectively.

Information is also contained in: Sections 5.C.3 and 5.C.5 of the Applicant Prepared Environmental Assessment (Volume II of Final License Application to FERC) [1]*, and Sections 3.3.3, 3.3.4 and 3.3.6 of the Environmental Assessment for Hydroelectric License, Reedsport OPT Wave Park Project – FERC Project No. 12713-002* [3].

Additional information is contained in Appendix A of the Settlement Agreement [4]*, filed with FERC in August 2010. Appendix A contains Study Plans for Cetaceans, Fish & Invertebrates, Pinnipeds, and Avians. These plans contain information similar in content and form to the preceding documents.*

(b) Other habitats important to the marine ecology, such as kelp and other algae beds, exposed seafloor gravel beds, seagrass beds, rocky reef areas, marine mammal rookeries and haulout areas, seabird rookeries, and areas where fish and shellfish congregate in large numbers;

Not Applicable. The array project area lies 2.5 nautical miles offshore in pelagic marine waters. Broadly speaking, this part of the Pacific Ocean is expected to be primarily sandy substrate, high wave energy area with water depths on the order of 150 - 210 feet. It is anticipated that habitat here would be characterized as marginal or perhaps poor for listed species considered in this document.

A transmission corridor extends from the array to the effluent pipe outfall, located approximately one half mile offshore. The area along the proposed corridor is expected to be primarily sandy substrate.

(c) Fish and shellfish stocks and other biologically important species;

This information is contained in the document sections referenced in (a).

(d) Recreationally or commercially important finfish or shellfish species;

This information is contained in the document sections referenced in (a).

(e) Planktonic and benthic flora and fauna; and

This information is contained in the document sections referenced in (a).

(f) Other elements important to the primary productivity and the food chain.

This information is contained in the document sections referenced in (a).

7.) Mineral deposits, including sand, gravel and hydrocarbon resources.

The Marine Geophysical Report indicated that the fifteen (15) samples taken fall in the medium sand range based on the Wentworth Scale (1992) definition of sand as particles between 62 and 500 microns. No gravel was identified in the

samples taken during the geophysical survey.

Table 1. Bottom Grab Sample Results

Sample #	ID #	Median Grain Size (m*1e-6)
1	GS_12	185.355
2	GS_19	186.786
3	GS_34	187.775
4	GS_44	185.496
5	GS_52	190.829
6	GS_53	178.93
7	GS_64	182.687
8	GS_76	187.625
9	GS_81	171.468
10	GS_92	174.117
11	GS_101	185.315
12	GS_102	185.341
13	GS_103	174.737
14	GS_104	175.799
15	GS_105	181.868

No hydrocarbon resources known in the project area. In 1964, the federal government leased tracts totaling 581,000 acres (2,400 km^2) in offshore Oregon and Washington. Oil companies drilled six tests offshore Washington (three in state waters and three in federal waters) and seven tests in federal waters offshore Oregon. The OCS P-0130 well drilled offshore Oregon by Union Oil in 1966 was described as having "potential for commercial gas production" but none of the wells were completed as producers, and the federal leases expired in 1969. [11 – 14]

8.) Cultural, economic, and social uses (present and projected) associated with the affected resources, such as:

(a) Commercial and sport fishing;

The thirty acres of commercial and sport fishing which would no longer available to the fishing community represents a small reduction in the area available within the Oregon Territorial Sea. OPT has been sensitive to the needs of the commercial fishing community during the development of the project and the Settlement Agreement discussions. This collaborative approach included relocating the project to a deeper section of the proposed project area. OPT also understands the area in which the project is located. The Goal 19 process and siting of Renewable Energy Zones (REZ) is anticipated to determine the siting process for wave energy projects. The proposed ten (10) PowerBuoy project was sited in full compliance with Territorial Sea Plan. The project is undergoing the FERC and State of Oregon licensing and permitting processes in accordance with applicable regulations and statutes.

OPT believes that all of the Settlement Agreement signatories, which include representatives of fishing and recreational groups, desire to understand how wave energy project may affect fishing, economic, and other social uses of the project area. Wave energy represents a significant economic opportunity for the State and coastal communities. This economic opportunity has impacts on traditional

ocean users, which need to be better understood. This understanding will be obtained in the living laboratory of the proposed project. It will be studied within the framework of the six study plans of the Settlement Agreement and its appendices. An Adaptive Management Plan is an integral part of the functioning of the Settlement Agreement.

(b) Aquaculture;

No aquaculture projects exist or are proposed for the foreseeable future in the project area. The project will not interfere with or affect aquaculture projects situated outside of the array boundary.

(c) Scientific research;

The project site will be of tremendous scientific interest as a wave energy living laboratory. This is the "first of a kind" wave energy project located in North America using full scale, utility grade wave energy devices. Researchers from Oregon State University, Pacific Northwest National Laboratories, Settlement Agreement Stakeholders, the US Department of Energy, Oregon Wave Energy Trust, equipment suppliers, and West Coast utilities have expressed interest in the project. In addition, the West Coast Governor's Agreement on Ocean Health is a potential recipient of data generated by the project.

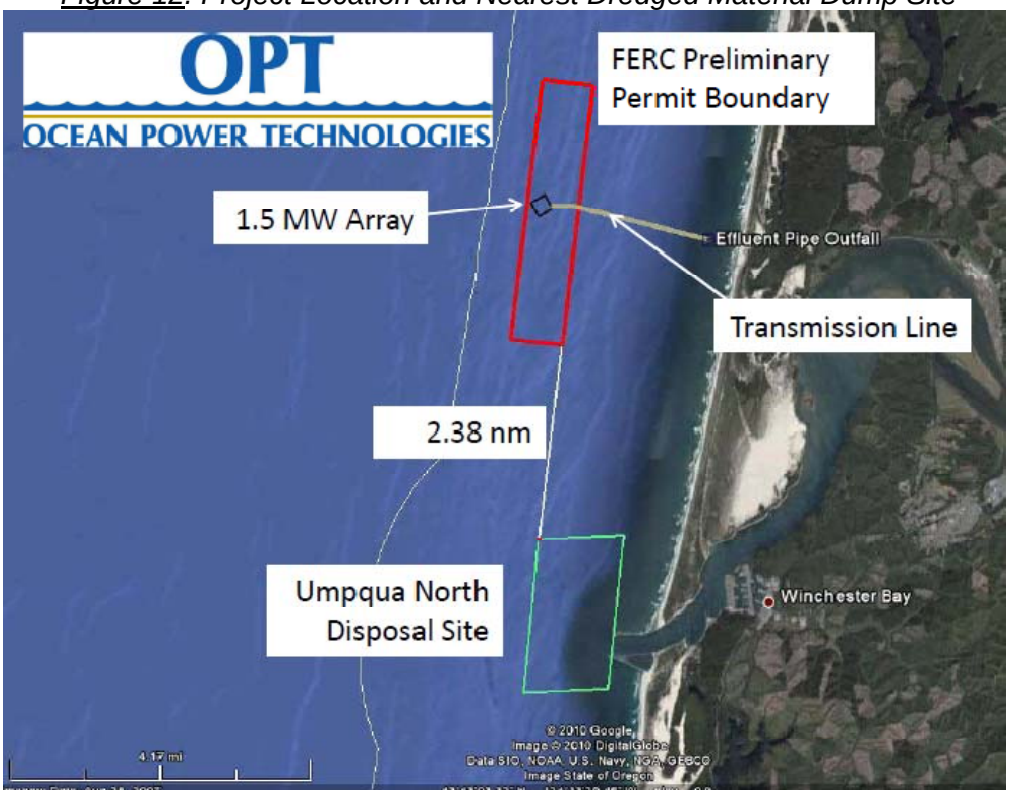
The project's Settlement Agreement was signed by fourteen (14) Federal and State Agencies and Non-Governmental Organization. The Settlement Agreement contains a suite of extensive scientific studies in the areas of: Cetaceans and Acoustic Studies; Pinnipeds; Avians; Wave, Current, and Sediment Transport, Electromagnetic Fields (EMF); and Fish and Invertebrates Studies [4].

(d) Ports, navigation, and DMD sites;

The project site was selected with consideration of normal navigation lanes used by vessel traffic along the Oregon Coast. "The Coast Pilot 7 (NOAA, 2007a, as cited by OPT) recommends that vessels traveling along the Oregon Coast proceed along rhumb lines from Cape Blanco (approximately 65 miles south of the project site) to the Columbia River entrance. This suggested travel path falls approximately 17 miles to the west of the proposed boundary for the PowerBuoy Array [3]. *The site is in sufficient proximity to ports for routine Operations and Maintenance activities. It is sufficiently distant from nearby ports and traffic lanes so it doesn't present any substantive issues to coastal traffic transiting the Oregon coast.*

The closest distance between the Reedsport FERC Boundary and the Umpqua North Disposal site is 2.38 nautical miles. This distance is measured from the SE Corner of the project boundary (as defined by the Original Preliminary Permit issued by FERC in 2007) to the NW Corner of the disposal site [15]. The figure below indicates the position of the Umpqua Disposal Site, the FERC Preliminary Permit Project Boundary, and the proposed boundary for the 1.5 MW project.

Figure 12. Project Location and Nearest Dredged Material Dump Site



(e) Recreation;

A discussion of recreation is contained in the Environmental Assessment for Hydropower License – Reedsport OPT Wave Park Project P-12713-002. Table 15 [3] *provides the top beach recreational activities pursued from Newport to Reedsport (Shelby and Tokarczyk, 200). Ocean beach activity is not a top activity when the survey when sorted in number of days survey participants participated in the activity. It was indicated as one of the one of the top five activities in the survey.*

The primary impact of the project to beach goers is the closure of Sparrow Park Road during the short duration effluent pipe cable pulling activity. OPT will be required to obtain a Ocean Shore Permit from the Department of Parks and Recreation. It is anticipated that the permit will contain conditions to minimize impacts of construction to the public and complete construction activities in the most efficient manner.

Marine recreational uses include recreational boating, whale watching, and sport fishing. Sport fishing is addressed in Section (a). OPT proposes to develop a navigation exclusion zone around the project in conjunction with the Oregon Department of Fish & Wildlife and the SOORC. This zone is for the safety and protection of vessels, particularly recreational boaters.

"Whale watching in the project area occurs from the Umpqua Lighthouse north to Sea Lion Caves. The Umpqua Lighthouse receives moderately low use (200 – 800 people per week) compared to other locations such as Depoe Bay, which

can receive more than 6,000 per week [3].

"The Umpqua Lighthouse is six (6) miles away from the project site and one of twenty-eight whale watching sites along the Oregon coast".[3] *In its Environmental Analysis, FERC anticipated that the project would not affect the distance whales are swimming near the lighthouse. The analysis futher states "because of the small footprint of the PowerBuoy array (1,000 feet by 1,300 feet), any change in the migration route of whales passing the project is likely to be minor and would not affect viewing opportunities."*

"The project is not anticipated to impact the surf energy at Winchester Bay, which is located approximately six (6) miles south of the array location." (See previous discussion in Section 3d.) [3]

(f) Tourism;

"Six (6) million beach visits to the coastal regions occur annually. Seventy percent of these visits are made by Oregonians. In addition to the ocean and beach recreation, the Oregon Dunes National Recreation Area is located near the project site. It is part of the Siuslaw National Forest, which includes more than 630,000 acres of diverse ecosystems extending from Tillamook to Coos Bay." [3] *No adverse effects to tourism were noted in the Environmental Assessment to tourism which have not been discussed above.*

(g) Mineral extraction; and

During the thirty-five year term of the FERC License, mineral extraction will not be practicable within the array boundary and submarine transmission cable boundaries. Upon decommissioning, the area within these boundaries is anticipated to fully available for mineral extraction.

(h) Waste discharge.

There is no anticipated impact on the flowrate of the effluent pipeline from the transmission cable for the project. The effluent pipeline was designed to discharge twenty million gallons of effluent daily. A potential waste water treatment project, not associated with this wave energy project, has the potential to discharge approximately 50,000 gallons per day of effluent. The cable within the effluent pipeline is planned to be specified with the reasonably anticipated chemical and physical composition of potential uses of the pipeline and former mill property.

9.) Significant historical or archeological sites.

No Significant historical or archeological sites are known to be present in the proposed project area. The State Historic Preservation Office indicated that "the project will have no effect on any known cultural resources". [16]

III. Effects Evaluation: Purpose & Content

The purpose of the effects evaluation is to determine whether the proposed action can meet the resource or user-protection standards referred to in Subsection 2.b, Standards For Decision-Making.

1.) Written Evaluation. The government agency shall use the inventory information or cause it to be used to write an evaluation of all reasonably foreseeable adverse effects of the proposed actions. Where relevant, the evaluation shall describe:

(a) The potential short-term and long-term effects on resources and uses of the continental shelf, the Oregon nearshore ocean, and onshore areas based on the following considerations:

i. Biological and ecological effects, including those on critical marine habitats and other habitats, and on the species those habitats support. Factors to consider include:

- ***The time frames/periods over which the effects and recovery will occur;***
- ***The maintenance of ecosystem structure, biological productivity, biological diversity, and representative species assemblages;***
- ***Maintaining populations of threatened, endangered, or sensitive species; and***
- ***Vulnerability of the species, population, community, or the habitat to the adverse effects of pollution, noise, habitat alteration, and human trespass;***

In June 2010, the Federal Energy Regulatory Commission issues its "Notice of application accepted for filing, ready for environmental analysis, and soliciting motions to intervene and protests, comments, terms and conditions, recommendations, and prescriptions" for the project. Comments and prescriptions were filed on August 30th by the National Marine Fisheries Services, Department of the Interior[1], and Oregon Department of Fish and Wildlife. The Company filed a response to the Agency comments on October 14th indicating that the Agency filings substantively agreed with the Settlement Agreement filed with the Commission.

The proposed 1.5 MegaWatt, ten (10) PowerBuoy project and the environmental studies agreed to by all parties under the Settlement Agreement have been the subject of extensive consultations for more than three (3) years. These consultations have been conducted among fifteen (15) parties. These parties include Federal and State Agencies collectively designated as "Fish Agencies". The Settlement Agreement was signed by

[1] The US Fish and Wildlife Service represents the Department in the Settlement Process.

three (3) Federal Agencies, eight (3) State Agencies, three (3) Non-Governmental Agencies, and the Company.

"NOAA Fisheries, USFWS, and ODFW are collectively referred to as the Fish Agencies. Each Fish Agency has separate and distinct statutory authorities and no agency is deemed, by virtue of concurrent approvals, to be sharing its statutory authority with any other agency or to be conceding that the approval of any other agency is required for exercise of the first agency's authority. … If a Fish Agency disapproves a study, operating or implementation plan, report, or facility design, the Company shall not file the disapproved study, operating or implementation plan, report, or design with the Commission until the dispute resolution process specified in section 7.5 of the Settlement Agreement has been completed, unless otherwise directed by the Commission." [5] *The Fish Agencies could not have entered into this Settlement Agreement if it was not consistent with "best available scientific information" and their statutory responsibilities.*

The Federal Energy Regulatory Commission gave notice of the availability of the Commission's environmental assessment of the project on December 3, 2010. The potential environmental effects of the licensing the project were examined by Commission staff and third party consultants. In its notice, FERC concludes that "licensing the project, with appropriate environmental protective measures, would not constitute a major federal action that would significantly affect the quality of the human environment". [3] *On December 8, 2010, the Commission issued letters to the National Marine Fisheries Services and US Fish and Wildlife Service requesting Formal Consultation Under the Endangered Species Act.*

The Environmental Assessment Conclusion recommends licensing of the project as proposed by OPT, with some staff modifications. The Assessment's Executive Summary provides a succinct synthesis of the project's effects. [5] Impacts to Geologic and Soil Resources and Water Resources are indicated as minor effects. Some potential changes to Aquatic Resources are noted. However, the Settlement Agreement Study Plans and Adaptive Management Plan would "help evaluate any unanticipated adverse effects on aquatic resources and identify and any potential mitigation measures that may be required". [3] *In the Marine Mammals, Reptiles and Bird resource summary, the Commission notes some potential for whale entanglement, particularly if derelict fishing gear becomes entangled on the array. Mitigating measures are proposed by staff in this section of the Environmental Assessment.*

The Commission notes that the project's small scale and distance between features is unlikely to attract salmon or increase the salmon predation rate in the Threatened and Endangered Species and Essential Fish Habitat section. This section also notes that the potential for adverse effects on whales or offshore avians during project construction and operation is low.

It is reasonable to conclude that effects will be minimal and will be closely

monitored under the Settlement Agreement. If any adverse effects are encountered, the Adaptive Management Plan contains provisions to address the effects. Upon decommissioning of the project, it is anticipated that any changes which may have occurred will begin to reverse themselves. Oregon's decommissioning procedures under Part 5 may require continued habitat monitoring after the project structures are removed. Reviews of the project by the National Marine Fisheries Service, US Fish and Wildlife Service, Oregon Department of Fish & Wildlife, and the Federal Energy Regulatory Commission indicate that some minor impacts may be anticipated. If unanticipated, adverse effects are encountered, they will be managed under the Settlement Agreement's Adaptive Management Plan. Therefore, Ocean Power Technologies requests the Department issue a favorable Coastal Zone Management Plan Consistency Determination based on the:

- *Minimal or minor anticipated project ecosystem and biodiversity impacts;*
- *Comprehensive environmental review conducted by the Federal Energy Regulatory Commission and the consultations with National Marine Fisheries Service, US Fish and Wildlife Service, and Oregon Department of Fish and Wildlife during project permitting and the Settlement Process; and*
- *a Settlement Agreement containing a comprehensive suite of environmental studies where unanticipated, adverse effects are management under an Adaptive Management Plan.*

ii. Conformity and compatibility with existing and projected uses of ocean resources such as fishing, recreational uses, ports and navigation, and waste discharge.

The project has been licensed and permitted in accordance with applicable Territorial Sea Plan regulations, which effective when the Preliminary Permit was issued in 2007. Additional regulations were promulgated in November 2009. The Federal Energy Regulatory Commission is obligated under law to be consistent with the State's The Department, along with seven (7) other State Agencies who also determine compatibility with existing and projected uses of ocean resources in the project area, are Settlement Agreement signatories. The FERC License Application, and various Company filings with Federal and State Agencies, are in compliance with applicable rules governing compliance, conformity and compatibility under these statutes. No comments have been received during or resulting from the FERC Scoping Meeting in April 2010 or other filings which indicate that the project does not meet the applicable regulatory requirements.

iii. Local and regional economies.

OPT has conducted extensive discussions with fisherman regarding the project and the impacts of the project on commercial

fishing. As a result of these discussions, OPT agreed to move the array into deeper waters. The Fishing and Crabbing Plan (Appendix C of the Settlement Agreement), is intended to be a means for the fishing community and OPT to adaptively manage unanticipated adverse issues specific to the commercial fishing community.

FERC's Environmental Assessment [4] analysis of the project indicates that the PowerBuoy area, approximately 30 acres, would make it "unlikely that the presence of 10 PowerBuoys would pose any substantial economic harm to most fishing vessels".

iv. Archeological and historical resources.

No known archeological or historical resources are located within the Area of Potential Effects (APE). The area near the shore station has been significantly disturbed. The three nearest archaeologically significant sites are located outside of the APE. OPT provided a map indicating these site to the Oregon State Historic Preservation Office (SHPO). SHPO indicated that "the project will have no effect on any known cultural resources". [16] *OPT will implement a Cultural Resources Survey, Monitoring, and Contingency Mitigation Plan consistent with the MOU signed with the the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians. An Inadvertent Discovery Plan is anticipated to be incorporated in the plan.*

v. Transportation safety, accidents.

The project is located outside of the normal shipping lanes used along the Oregon coast as indicated in the Coast Pilot 7. The boundaries of the project will be appropriately marked in accordance with the Fishing and Crabbing Plan (Appendix C of the Settlement Agreement). [4]

OPT plans to work together with relevant regulators to establish a navigation buffer and "No Fishing" area around the project. The PowerBuoys will be lit in accordance with US Coast Guard regulations, with consideration given to the effect of navigation lights on avians. An Emergency Response Plan and Spill Prevention, Control, and Countermeasure (SPCC) Plan will be implemented.

OPT will implement a transportation moratorium, excluding emergency maintenance, and predetermined transit lane for Project related vessels during construction and normal maintenance. OPT will also join the Oregon Fisherman's Cable Committee.

Information on the scope of the measures OPT will undertake is

contained in the Fishing and Crabbing Plan (Appendix C) and the Recreation and Public Safety Plan (Appendix B). Both of these Plans are contained in the Settlement Agreement.

vi. Geologic hazards.

The PowerBuoy array will not be affected by land based geological hazards. A tsunami wave height is anticipated to be reasonably modest compared to the PowerBuoy design wave height.

vii. Cumulative effects of project in conjunction with effects of past projects, other current projects, and probable future projects.

There are no similar projects along the Oregon coasts at this time. The Humboldt Wave Energy project, the nearest project in terms of scope, surrendered its Preliminary Permit. No FERC licensed projects are anticipated to be constructed in 2012.

Currently, the Department is conducting consultations with stakeholders to determine the location of Renewable Energy Zones (REZ) in the Oregon Territorial Sea. A cumulative effects analysis may be premature pending the final determination of these zones. OPT understands that the Southern Coastal area may be the first area to establish the REZ areas and guidelines. The earliest projected completion date is June 2011. The process will continue for the Central and Northern Coastal areas until the entire 362 miles of the Oregon Coast is assessed.

The Environmental Assessment for Hydropower License, Reedsport OPT Wave Park Project – FERC Project No. 12713-002 prepared by the Federal Energy Regulatory Commission [3] *contains a significant discussion in Section 3.3 of the report. In general, FERC indicated that the Settlement Agreement Study Plans address a number of issues raised during the licensing process. The Prevention, Mitigation, and Enhancement measures contained in the FERC application, the Settlement Agreement Study plans (primarily the environmental plans in Appendix A), and the Adaptive Management Plan (AMP) are intended to inform the Settlement Group of the project's environmental effects in six areas. These study areas are: Cetaceans, EMF, Fish & Invertebrates, Pinnipeds, Avians, and Wave, Current, and Sediment.*

OPT anticipates that future projects will generate a cumulative effects analysis which will include this project. Preliminary Permits have been issued for OPT's Coos Bay (P-12749) and Reedsport Expanded Project (P-13666). If required, a cumulative effects analysis incorporating Reedsport Array (P-12713) would be addressed under these projects, contingent upon the results of the Goal 19 Renewable Energy Zone recommendations pending from the Department.

(b) Financial and technical capability of the applicant to perform.

Reedsport OPT Wave Park, LLC (Applicant) is a wholly owned subsidiary of Ocean Power Technologies, Inc. (OPT). OPT is a publicly traded company which is listed on NASDAQ. The Company's stock trades under the symbol "OPTT". Current financial reports and financially related news releases can be found on OPT's website under Investor Relations.

(c) Surveillance and monitoring -- agencies' ability to monitor performance and to respond if needed.

The Settlement Agreement, signed by fifteen (15) signatories including the Department, provides a robust suite of study plans to monitor performance of the project. The Agreement also contains an Adaptive Management Plan (AMP), which allows Settlement Agreement Parties to respond to study results within a flexible framework. The Agreement for establishing screening criteria, mechanisms for responding to study or monitoring results from the studies performed, development of response plan and their implementation, frequency of Implementation Committee meetings, dispute resolution mechanisms, and fish and wildlife emergency circumstances.

The project will be constructed, operated, and maintained in accordance with the terms and conditions of applicable Federal, State, and local licenses, permits, authorizations, easements, and other required regulatory authorizations. State Agencies have the right to inspect the project facilities and records upon reasonable notice to OPT, to the extent that access is restricted. [4]

(d) Feasible alternatives to achieve the purpose or objective of the proposed action.

The objective of the ten (10) PowerBuoy PB150 project is to obtain relevant operating, performance, and environmental data to inform stakeholders regarding the effects of wave energy development and projects. The information obtained from the project is intended to guide stakeholders and inform decision making regarding a proposed larger project at the site. An expanded fifty (50) MegaWatt project (P-13666) is proposed for the Reedsport site

Obtaining environmental information from this unique living laboratory on the effects of wave energy projects is critical to assessing future commercial projects. The "best available scientific information" has been provided in the licensing and permitting documentation for this project. The next step in this process is to gather the data as provided for in the six (6) major topical areas of Appendix A of the Settlement Agreement. This assumes that the Department and other applicable regulatory agencies, issue all of the relevant regulatory authorizations. It is anticipated that this "first of a kind" wave energy project in the United States will expand the body of available scientific information. This data is anticipated to support development of future

commercial wave energy and marine renewable projects in Oregon and nationally.

(e) Evaluations for development of nonrenewable resources shall also determine:

i. The probability of exposure of biological communities and habitats to adverse effects from operating procedures or accidents;

Not Applicable. This is a renewable energy project.

ii. The sensitivity of these biological communities and habitats to such exposure; and

Not Applicable. This is a renewable energy project.

iii. The probable effects of exposure on the marine ecosystem.

Not Applicable. This is a renewable energy project

2.) Reasonably Foreseeable Adverse Effects. For purposes of the above evaluation, the determination of "reasonably foreseeable adverse effects" shall be based on scientific evidence. The evaluation need not discuss highly speculative consequences. However, the evaluation shall discuss catastrophic environmental effects of low probability.

Reasonable Foreseeable Effects are discussed in detail in Section 3.3 of FERC's Environmental Analysis. [4] In its analysis, FERC indicated that four (4) species are "Likely to be Adversely Affected". These species are the Steller Sea Lion, Humpback Whale, Southern Resident Killer Whale, and Marbled Murrelet. The environmental studies are anticipated to provide results regarding whether this classification for these species is correct or a reclassification to "Not Likely to Adversely Affect" is appropriate.

3.) Use of Available Environmental Information. State and federal agencies may use existing data and information from any source when complying with the requirements for resource inventory and effects evaluation. All data and information used for the inventory and evaluation, including existing data from federal environmental impact statements or assessments, shall meet the same standards of adequacy required for the inventory and the evaluation (see Subsections A.2.c. and A.2.d.)

The available environmental information was provided in the following documents:

- *Reedsport OPT Wave Park, LLC, Application for a FERC License Application Volumes 1 – IV (February 2010).* [1]
- *Reedsport OPT Wave Park, LLC, Draft Biological Assessment and Essential Fish*

Habitat Assessment, FERC Project No. 12713, June 2010. [2]

- *Federal Energy Regulatory Commission, Environmental Assessment for Hydropower License, Reedsport OPT Wave Park Project – FERC Project No. 12713-002, December 2010.* [3]
- *Reedsport OPT Wave Park, LLC, Reedsport OPT Wave Park Settlement Agreement, July 2010 (filed with FERC, August 2010).* [4]
- *JOINT EXPLANATORY STATEMENT for the SETTLEMENT AGREEMENT DATED JULY 28, 2010 REGARDING CONSTRUCTION AND OPERATION OF THE REEDSPORT OPT WAVE PARK FERC No. 12713 DOUGLAS COUNTY, OREGON, July 2010, (filed with FERC, August 2010).* [5]

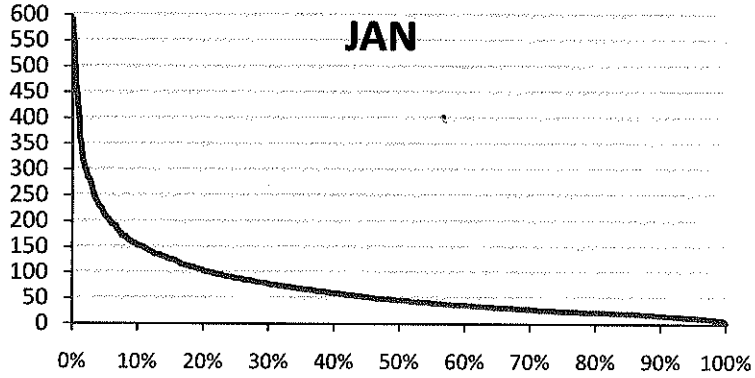
References

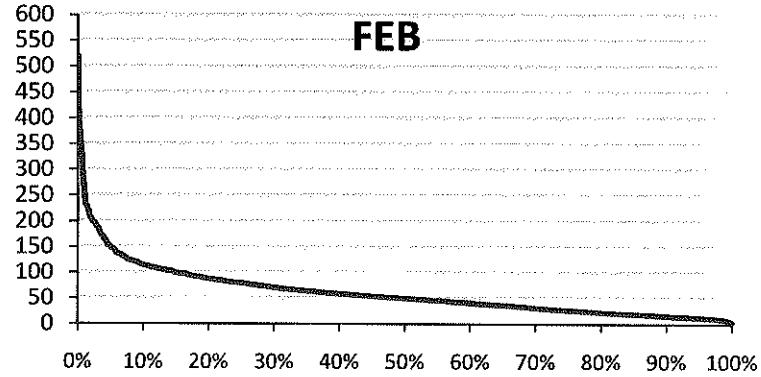
1. Reedsport OPT Wave Park, LLC, Application for a FERC License Application Volumes 1 – IV (February 2010).
2. Reedsport OPT Wave Park, LLC, Draft Biological Assessment and Essential Fish Habitat Assessment, FERC Project No. 12713, June 2010.
3. Federal Energy Regulatory Commission, Environmental Assessment for Hydropower License, Reedsport OPT Wave Park Project – FERC Project No. 12713-002, December 2010.
4. Reedsport OPT Wave Park, LLC, Reedsport OPT Wave Park Settlement Agreement, July 2010 (filed with FERC, August 2010).
5. JOINT EXPLANATORY STATEMENT for the SETTLEMENT AGREEMENT DATED JULY 28, 2010 REGARDING CONSTRUCTION AND OPERATION OF THE REEDSPORT OPT WAVE PARK FERC No. 12713 DOUGLAS COUNTY, OREGON, July 2010, (filed with FERC, August 2010).
6. Lavakris, J. and Smith, J., Wave Energy Infrastructure Assessment in Oregon, December 2009.
7. Presivic, M., System Level Design Performance and Costs – Oregon State Offshore Wave Energy Plant (Report WP-006 Rev 1) Electric Power Research Institute, November 2004
8. Pacific Energy Ventures, Wave Resource Assessment, Oregon Wave Energy Trust Utility Market Initiative, December 2009.
9. H.T. Özkan-Haller, J.C. Allan, *et. al*., Baseline Observations and Modeling for the Reedsport Wave Energy Site, December 2009.
10. Reedsport OPT Wave Park, LLC, "APPLICATION FOR THE CERTIFICATION OF COMPLIANCE WITH WATER QUALITY REQUIREMENTS AND STANDARDS PURSUANT TO SECTION 401 OF THE CLEAN WATER ACT, 33 USC 1341", January 2011
11. National Geophysical Data Center EXPLORATORY OIL & GAS WELLS Outer Continental Shelf - Offshore Oregon and Washington - Data Announcement 83-MGG-05 http://www.ngdc.noaa.gov/mgg/fliers/83mgg05.html
12. Vernon C. Newton Jr., (1980) *Prospects for Oil and gas in the Coos Basin, Western Coos, Douglas, and Lane Counties, Oregon*, Oregon Dept. of Geology and Mineral Industries, Oil and gas Investigation 6, p.58.
13. Dana B. Braislin, *et. al*., (1971) "Petroleum potential of Western Oregon and Washington and Adjacent continental margin," in *Future Petroleum Provinces of the United States - Their Geology and Potential*, American Association of Petroleum Geologists, Memoir 15, v.1, p.230.
14. P.D. Snavely Jr., J.E. Pearl, and D.L. Lander (1977) *Interim Report on Petroleum Resources Potential and Geologic Hazards in the Outer Continental Shelf - Oregon and Washington Tertiary Province*, US Geological Survey, Open-File Report 77-282.
15. Email from OPT to US Army Corps of Engineers (Christoffersen) dated 2/11/2010
16. SHPO Letter to OPT dated 10/26/2010 re. Case # 23724.

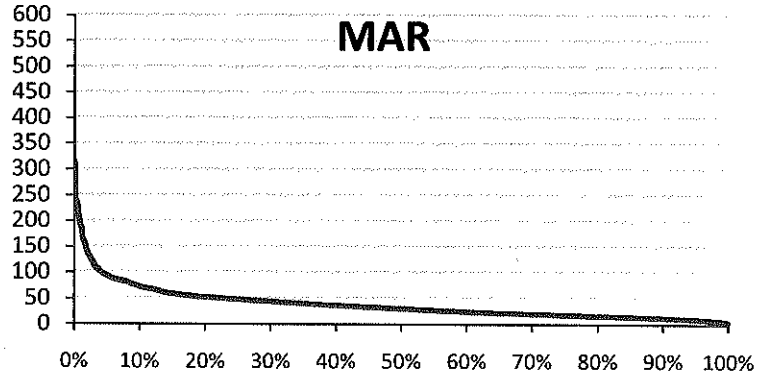
Appendix A

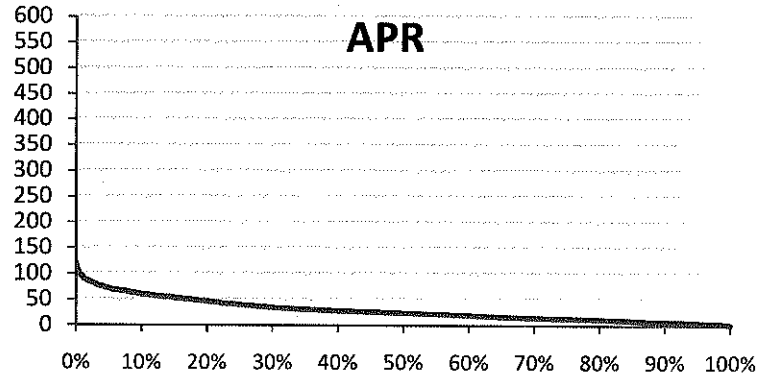
Monthly Power Duration Curves and Scatter Diagrams

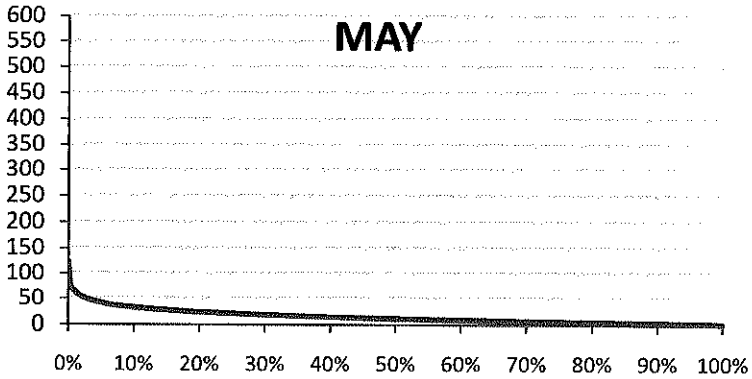
Monthly Power Duration Curves (KW/m)

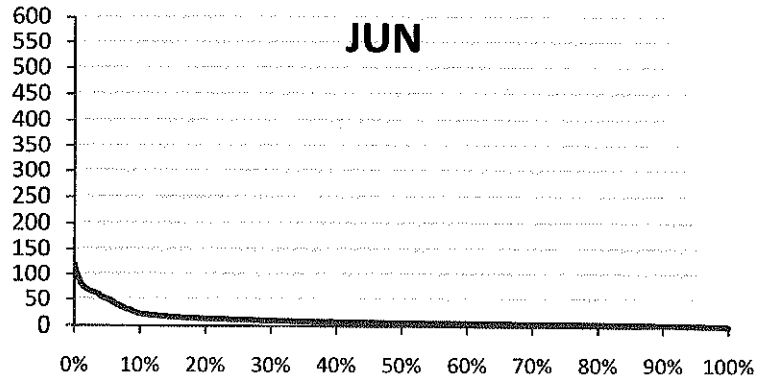




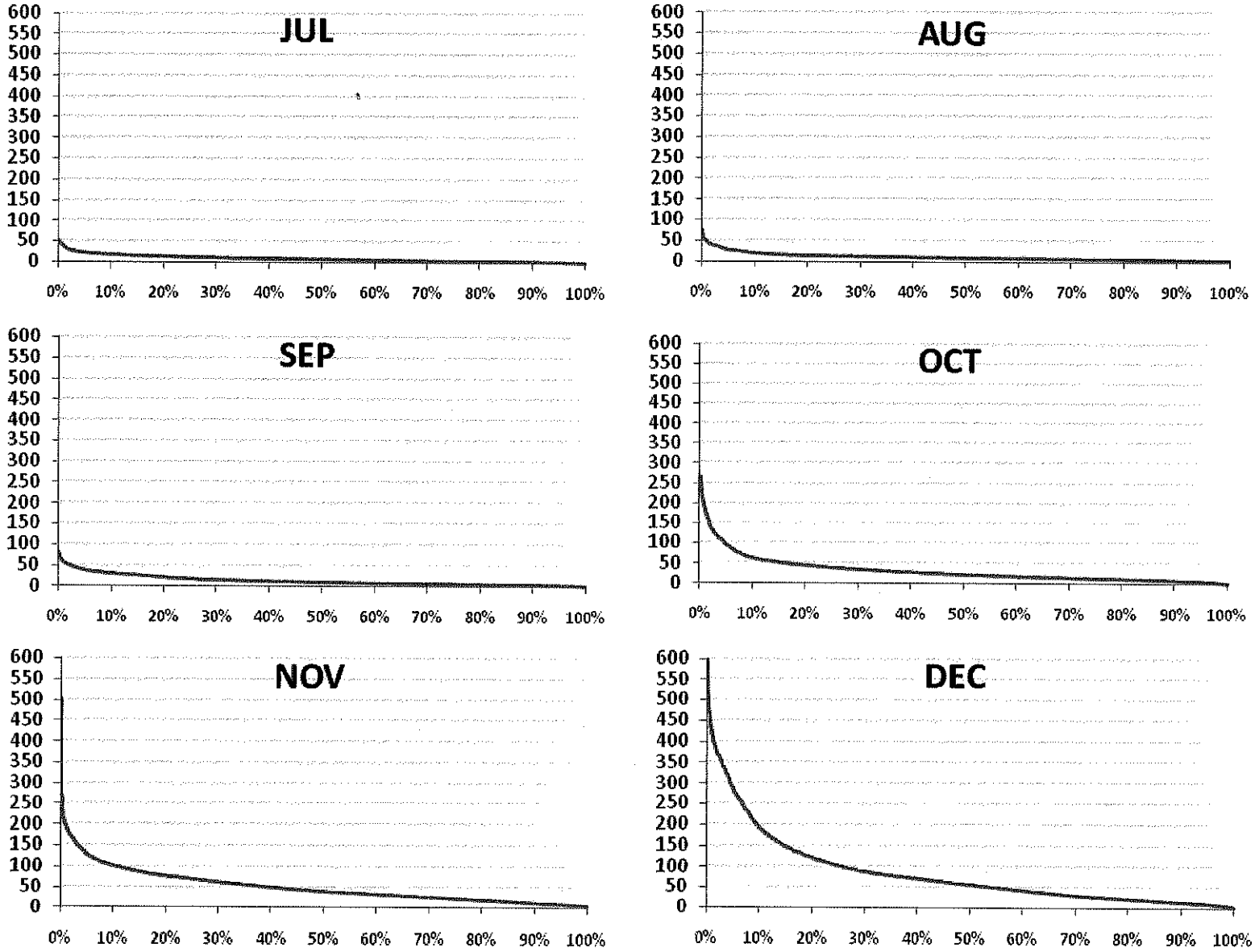








Monthly Power Duration Curves (KW/m)



Appendix A – Monthly Wave Energy Resource Scatter Diagrams

Table A-1: Scatter diagram Oregon January

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5.75	6.25	6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	4
4.75	5.25	5	0	0	0	0	0	0	1	1	3	2	5	0	0	0	1	0	0	13
4.25	4.75	4.5	0	0	0	0	0	0	1	2	3	9	6	3	0	2	0	1	0	26
3.75	4.25	4	0	0	0	0	0	1	3	5	7	13	14	8	2	3	1	2	0	59
3.25	3.75	3.5	0	0	0	1	1	3	5	6	9	14	21	10	6	4	2	0	0	82
2.75	3.25	3	0	0	0	1	1	2	12	14	17	31	24	9	4	3	1	1	0	120
2.25	2.75	2.5	0	0	0	4	5	7	14	16	20	28	27	9	10	7	1	2	0	149
1.75	2.25	2	0	0	0	1	3	6	19	15	23	33	22	9	6	5	3	3	0	149
1.25	1.75	1.5	0	0	1	2	5	7	12	10	14	15	20	7	6	2	2	1	0	103
0.75	1.25	1	0	0	0	0	0	0	2	4	4	10	7	3	2	0	0	0	0	34
0.25	0.75	0.5	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		744	0	0	2	9	14	25	68	75	100	156	148	58	37	28	12	10	1	744

Table A-2: Scatter Diagram Oregon February

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	1	1	0	4	2	1	0	9
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	1	5	4	3	1	1	0	0	15
4.75	5.25	5	0	0	0	0	0	0	0	1	0	4	4	6	3	3	1	0	0	22
4.25	4.75	4.5	0	0	0	0	0	0	4	1	4	8	16	7	2	1	0	0	0	43
3.75	4.25	4	0	0	0	0	2	0	6	4	9	21	34	13	4	3	1	2	0	99
3.25	3.75	3.5	0	0	0	0	0	1	11	5	25	30	34	10	4	7	1	1	0	129
2.75	3.25	3	0	0	0	0	2	9	10	28	47	50	41	29	15	12	1	2	0	246
2.25	2.75	2.5	0	0	0	2	4	7	39	33	73	77	65	26	17	8	5	1	0	357
1.75	2.25	2	0	0	2	7	10	13	37	60	72	82	72	28	11	16	14	5	0	429
1.25	1.75	1.5	0	0	1	8	11	8	22	40	31	39	43	12	11	16	8	6	1	257
0.75	1.25	1	0	2	2	2	2	3	15	5	12	14	17	4	3	5	1	0	0	87
0.25	0.75	0.5	0	0	0	0	0	0	0	0	0	2	5	1	0	2	0	0	0	10
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1,705	0	2	5	19	31	41	144	177	273	328	338	142	73	78	35	18	1	1,705

Table A-3: Scatter Diagram Oregon March

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0	0	5
4.75	5.25	5	0	0	0	0	0	0	0	0	0	0	3	5	1	2	0	0	0	11
4.25	4.75	4.5	0	0	0	0	0	0	0	0	1	5	11	11	3	1	1	0	0	33
3.75	4.25	4	0	0	0	0	0	1	4	9	6	9	31	9	4	5	4	0	0	82
3.25	3.75	3.5	0	0	0	0	0	4	1	3	17	19	52	10	6	5	3	2	0	122
2.75	3.25	3	0	0	0	1	8	7	15	19	34	49	55	22	8	7	3	5	0	233
2.25	2.75	2.5	0	0	0	2	6	16	45	33	46	64	36	20	13	13	5	4	1	304
1.75	2.25	2	0	0	1	7	21	31	84	74	82	87	63	32	33	20	15	9	0	559
1.25	1.75	1.5	0	0	8	16	16	29	85	76	52	56	41	22	17	10	12	5	0	445
0.75	1.25	1	0	1	2	4	7	13	17	19	14	19	12	10	6	0	0	1	0	125
0.25	0.75	0.5	0	0	0	1	0	0	7	3	2	7	2	2	0	0	0	0	0	24
0	0.25	0.125	0	0	0	0	0	2	13	1	1	0	0	0	0	0	0	0	0	17
		1,961	0	1	11	31	58	103	271	237	255	315	307	147	91	63	44	26	1	1,961

Table A-4: Scatter Diagram Oregon April

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	4
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	4
4.75	5.25	5	0	0	0	0	0	0	0	0	0	1	7	3	1	1	1	1	0	15
4.25	4.75	4.5	0	0	0	0	0	0	0	0	1	3	7	8	3	3	0	1	0	26
3.75	4.25	4	0	0	0	0	0	0	1	3	2	12	17	6	5	0	5	6	0	57
3.25	3.75	3.5	0	0	0	0	0	3	2	4	9	12	31	10	4	5	6	7	0	93
2.75	3.25	3	0	0	0	1	5	7	18	18	27	51	37	17	7	4	1	0	2	195
2.25	2.75	2.5	0	0	0	9	17	17	56	31	61	61	49	12	4	7	4	0	0	328
1.75	2.25	2	0	0	2	8	21	54	78	88	83	80	57	7	2	9	4	0	0	493
1.25	1.75	1.5	0	0	2	8	24	59	103	136	53	66	31	17	6	5	2	2	2	516
0.75	1.25	1	0	0	2	6	16	20	53	91	34	25	21	8	3	5	0	1	1	286
0.25	0.75	0.5	0	0	0	0	1	3	2	1	2	0	3	1	0	0	0	0	0	13
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		2,030	0	0	6	32	84	163	313	372	272	311	261	92	36	39	26	18	5	2,030

Table A-5: Scatter Diagram Oregon May

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.75	5.25	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.25	4.75	4.5	0	0	0	0	0	0	0	1	0	2	1	0	0	0	0	0	0	4
3.75	4.25	4	0	0	0	0	0	0	0	2	0	3	3	0	1	0	0	0	0	9
3.25	3.75	3.5	0	0	0	0	0	0	1	2	5	6	4	1	1	0	0	0	0	20
2.75	3.25	3	0	0	0	0	0	6	8	12	18	18	11	4	0	1	2	0	0	80
2.25	2.75	2.5	0	0	0	2	7	23	61	32	34	31	20	6	4	0	5	0	0	225
1.75	2.25	2	0	0	2	16	36	65	117	81	66	47	31	4	8	5	1	1	0	480
1.25	1.75	1.5	0	1	10	20	45	119	153	112	62	53	43	18	7	15	7	2	0	667
0.75	1.25	1	0	1	18	18	60	86	82	107	33	13	19	9	4	7	0	0	0	457
0.25	0.75	0.5	0	0	0	4	0	3	9	13	1	0	1	1	1	2	0	0	0	35
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1,977	0	2	30	60	148	302	431	362	219	173	133	43	26	30	15	3	0	1,977

Table A-6: Scatter Diagram Oregon June

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.75	5.25	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.25	4.75	4.5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
3.75	4.25	4	0	0	0	0	0	0	0	0	1	2	4	1	0	0	0	0	0	8
3.25	3.75	3.5	0	0	0	0	0	0	0	0	2	4	3	3	1	0	0	0	0	13
2.75	3.25	3	0	0	0	0	0	0	5	3	12	21	15	2	0	0	0	0	0	58
2.25	2.75	2.5	0	0	0	0	2	8	25	25	23	18	9	1	0	0	0	0	0	111
1.75	2.25	2	0	0	0	17	48	58	91	49	39	22	22	1	0	0	2	0	0	349
1.25	1.75	1.5	0	1	6	52	117	123	156	69	23	13	8	2	2	2	2	0	0	576
0.75	1.25	1	0	4	21	62	103	113	95	120	30	23	9	15	10	9	1	1	0	616
0.25	0.75	0.5	0	0	1	7	19	20	2	26	0	0	10	15	4	7	0	0	0	111
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1,843	0	5	28	138	289	322	374	292	130	104	80	40	17	18	5	1	0	1,843

Table A-7: Scatter Diagram Oregon July

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	4
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	4
4.75	5.25	5	0	0	0	0	0	0	0	0	0	1	7	3	1	1	1	1	0	15
4.25	4.75	4.5	0	0	0	0	0	0	0	0	1	3	7	8	3	3	0	1	0	26
3.75	4.25	4	0	0	0	0	0	0	1	3	2	12	17	6	5	0	5	6	0	57
3.25	3.75	3.5	0	0	0	0	0	3	2	4	9	12	31	10	4	5	6	7	0	93
2.75	3.25	3	0	0	0	1	5	7	18	18	27	51	37	17	7	4	1	0	2	195
2.25	2.75	2.5	0	0	0	9	17	17	56	31	61	61	49	12	4	7	4	0	0	328
1.75	2.25	2	0	0	2	8	21	54	78	88	83	80	57	7	2	9	4	0	0	493
1.25	1.75	1.5	0	0	2	8	24	59	103	136	53	66	31	17	6	5	2	2	2	516
0.75	1.25	1	0	0	2	6	16	20	53	91	34	25	21	8	3	5	0	1	1	286
0.25	0.75	0.5	0	0	0	0	1	3	2	1	2	0	3	1	0	0	0	0	0	13
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		2,030	0	0	6	32	84	163	313	372	272	311	261	92	36	39	26	18	5	2,030

Table A-8: Scatter Diagram Oregon August

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.75	5.25	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.25	4.75	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.75	4.25	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.25	3.75	3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.75	3.25	3	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	4
2.25	2.75	2.5	0	0	0	0	0	6	5	3	1	0	0	0	0	0	0	0	0	14
1.75	2.25	2	0	0	0	3	8	18	24	9	5	3	1	0	0	0	0	0	0	70
1.25	1.75	1.5	0	0	3	30	50	65	60	33	6	4	3	0	0	0	0	0	0	253
0.75	1.25	1	0	0	10	49	85	76	50	30	10	7	10	4	1	1	0	0	0	333
0.25	0.75	0.5	0	0	4	7	10	9	3	17	4	3	9	3	2	1	1	0	0	70
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		744	0	0	16	89	152	173	142	94	26	16	22	6	3	2	1	0	0	744

Table A-9: Scatter Diagram Oregon September

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.75	5.25	5	0	0	0	0	0	0	0	0	0	3	1	3	0	0	0	0	0	7
4.25	4.75	4.5	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
3.75	4.25	4	0	0	0	0	0	0	0	0	0	1	1	2	1	0	0	0	0	5
3.25	3.75	3.5	0	0	0	0	0	0	0	1	2	2	4	1	1	0	1	0	0	12
2.75	3.25	3	0	0	0	0	0	0	1	6	6	8	4	4	4	3	1	1	0	38
2.25	2.75	2.5	0	0	0	0	1	11	18	33	23	36	19	12	7	4	5	2	0	171
1.75	2.25	2	0	0	0	16	44	62	79	58	54	71	40	8	4	2	6	3	6	453
1.25	1.75	1.5	0	0	14	76	151	138	177	136	84	74	46	26	18	6	1	0	0	947
0.75	1.25	1	1	7	31	59	131	186	179	151	78	24	27	26	20	16	11	3	0	950
0.25	0.75	0.5	0	0	3	4	16	7	11	33	5	6	2	3	2	0	5	1	0	98
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		2,685	1	7	48	155	343	404	465	418	252	229	144	85	57	31	30	10	6	2,685

Table A-10: Scatter Diagram Oregon October

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
5.75	6.25	6	0	0	0	0	0	0	0	0	1	2	3	0	0	0	0	0	0	6
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	3
4.75	5.25	5	0	0	0	0	0	0	0	0	0	2	6	3	1	0	0	0	0	12
4.25	4.75	4.5	0	0	0	0	0	0	0	2	4	4	4	1	0	0	0	0	0	15
3.75	4.25	4	0	0	0	0	0	0	0	2	9	6	12	4	2	0	0	0	0	35
3.25	3.75	3.5	0	0	0	0	0	0	2	8	21	21	19	7	2	0	0	0	0	80
2.75	3.25	3	0	0	0	0	1	3	13	18	37	48	43	10	3	0	0	0	0	176
2.25	2.75	2.5	0	0	0	3	6	4	34	70	68	77	64	13	7	6	1	0	0	353
1.75	2.25	2	0	0	3	16	23	34	114	94	113	96	80	29	15	12	5	2	0	636
1.25	1.75	1.5	0	0	7	35	53	99	162	118	127	96	41	17	16	16	7	6	1	801
0.75	1.25	1	0	3	11	14	31	57	101	115	58	39	20	13	11	9	3	6	0	491
0.25	0.75	0.5	1	1	2	6	4	6	7	19	2	2	2	1	4	0	0	0	0	57
0	0.25	0.125	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
		2,668	1	4	24	75	118	203	433	446	440	394	296	99	61	43	16	14	1	2,668

Table A-11: Scatter Diagram Oregon November

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.75	6.25	6	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
5.25	5.75	5.5	0	0	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	7
4.75	5.25	5	0	0	0	0	0	0	1	1	4	5	5	5	2	2	0	0	0	25
4.25	4.75	4.5	0	0	0	0	0	0	2	4	7	6	9	6	1	4	0	0	0	39
3.75	4.25	4	0	0	0	0	1	0	6	3	5	2	13	6	4	1	0	0	1	42
3.25	3.75	3.5	0	0	0	0	1	3	10	15	21	38	33	11	5	0	0	0	0	137
2.75	3.25	3	0	0	0	0	4	4	21	37	58	63	56	17	3	2	0	0	0	265
2.25	2.75	2.5	0	0	1	4	7	10	43	59	72	90	54	17	8	7	3	1	0	376
1.75	2.25	2	0	0	2	14	14	13	61	94	116	62	29	9	6	7	9	2	0	438
1.25	1.75	1.5	0	0	1	5	6	32	70	79	62	53	43	9	4	2	3	1	1	371
0.75	1.25	1	0	1	3	1	8	34	20	36	7	17	30	7	9	7	5	0	0	185
0.25	0.75	0.5	0	1	0	0	2	1	1	0	8	1	1	1	0	0	0	0	0	16
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1,903	0	2	7	24	43	97	235	328	360	339	276	92	42	32	20	4	2	1,903

Table A-12: Scatter Diagram Oregon December

CDIP 0037		Upper Tp:	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	20.5	744
Coquille River		Lower Tp:	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	19.5	Total
Hs and Tp bin boundaries											Tp (sec)									JAN
Lower Hs	Upper Hs	Hs (m)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	hours
9.75	10.25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.25	9.75	9.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.75	9.25	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.25	8.75	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.75	8.25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.25	7.75	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.75	7.25	7	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
6.25	6.75	6.5	0	0	0	0	0	0	0	0	0	1	1	2	1	0	0	0	0	4
5.75	6.25	6	0	0	0	0	0	0	1	0	1	1	1	0	1	2	0	0	0	6
5.25	5.75	5.5	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	3
4.75	5.25	5	0	0	0	0	0	0	1	1	1	2	7	1	2	1	0	0	0	14
4.25	4.75	4.5	0	0	0	0	0	0	0	1	1	8	15	3	2	1	0	0	0	29
3.75	4.25	4	0	0	0	0	0	0	1	1	6	15	15	5	5	2	1	1	1	51
3.25	3.75	3.5	0	0	0	1	0	1	4	2	7	15	22	5	7	3	4	2	0	74
2.75	3.25	3	0	0	0	0	1	2	7	6	14	21	20	11	7	3	3	2	0	94
2.25	2.75	2.5	0	0	0	2	3	7	11	11	18	30	32	7	6	4	2	1	2	134
1.75	2.25	2	0	0	1	2	2	7	23	18	24	34	30	11	3	1	1	1	2	160
1.25	1.75	1.5	0	0	1	4	2	4	13	22	17	25	24	7	3	0	1	0	0	122
0.75	1.25	1	0	0	0	1	0	3	3	9	2	5	8	3	4	6	3	1	0	48
0.25	0.75	0.5	0	0	0	0	0	1	1	0	1	0	0	1	0	0	1	0	0	4
0	0.25	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		744	0	0	1	9	7	25	64	70	92	156	175	55	42	22	15	7	4	744