

The Use of the Territorial Sea Plan Section Two, Present and Future, by the State of Oregon Department of Land Conservation and Development in the Certification and Conditioning of Wave Energy Projects and Activities in the Territorial Sea Subject to the Requirement for Federal Permits or Licenses, in Light of the Mandate for Amendments Pursuant to Executive Order 0807, and with Reference to the Actual Example of the Reedsport Wave Energy Project Settlement Agreement and FERC License Application



**Oregon Ocean Policy Advisory Council
Territorial Sea Plan Working Group
Newport Chautauqua, February 11, 2009**

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Section Two of the TSP (a Review)

- Was written with knowledge of, and an eye to partially paralleling, the National Environmental Policy Act of 1969
- CZMA's consistency clause applies (through enforceable policies) to all federal licenses or permits that could affect the coastal zone
- Section 2 is firmly grounded in Goal 19
- Three subsections:
 - Resource inventory and effects evaluation
 - Joint review panels
 - Local government consultation
- My remarks today will be limited to the first subsection on resource inventories and effects evaluation in light of their applicability in the Reedsport Wave Energy Project licensing process

Section Two of the TSP – Objective: Implement Goal 19

Goal 19: To conserve marine resources and ecological functions for the purpose of providing long-term ecological, economic, and social value and benefits to future generations.

- **Establishes Ocean Stewardship Area**
- **Gives priority to protection and restoration of renewable resources**
- **Inventory and effects assessment required**
- **Implementation requirements**
 1. **Uses of ocean resources**
 2. **Management measures**
 3. **Contingency plans**

Terminology of Ecological Impact or Risk Assessment

- Before, After, Control, Impact (BACI design)
- Stressors
- Signatures (same as CWA *pollutants*, e.g., toxics, sound or electromagnetic radiation)
- Receptors = any part of ecosystem affected
- Exposure
- Effects
- Baseline studies = inventories
- Monitoring = effects evaluation (+ below)
- Targeted effects studies (lab or *in situ*)

The Reedsport Declaration of Cooperation

- Developed under the Oregon Solutions Process as directed by Governor Kulongoski in October 2006
- Completed June 2007
- Agreed to use issues raised as basis for beginning of settlement negotiations
- Issues identified
 - Ecological issues = 22
 - Public safety/recreation issues = 14
 - Fishing/crabbing issues = 12
 - General issues = 12

Ecological Issues on DOC Impact Matrix

Activity (stressor)	Receptor												
	A. Ocean Waves	B. Ocean Currents	C. Sediment and Benthic Habitats	D. Plankton and euphausiids/mysids	E. Fouling Community	F. Pelagic Fish and Invertebrates	G. Forage Fish and Invertebrates	H. Demersal Fish	I. Epibenthic Macroinvertebrates	J. Benthic Infauna	K. Seabirds	L. Pinnipeds	M. Cetaceans
Emplacement													
1. Buoy or Device													
2. Mooring System			2					U	2	2			
3. Electrical Transmission System			2					U	2	2			
Operation													
4. Mooring System			2		2			2			2	2	1
5. Buoy or Device	2	2	2	U	2	1	2	2			2	1	1
6. Electrical Transmission System			2	U	2			1					
7. Chemical Coatings, Fluids and Anodes				2	2						2	U	U
8. Acoustic Guidance System											U	1	1
Decommissioning													
9. Buoy or Device Removal													
10. Transmission System Removal			2					U	2	2			
11. Anchor Removal or Decommissioning			2					U	2	2			
Maintenance and Vessel Use During All Project Phases													
12. Vessel Access – Spills, etc.			2	2	2	2	2	2	2	2	2	2	2

1 = Level 1 (potential impact/exposure is high) 2 = Level 2 (potential impact or exposure is low) U = Uncertain impact and exposure

Levels of Concern and Actions

	Level 1	Level 2	Uncertain
Definition	Potential impact is high and/or potential exposure is high.	Potential Impact and exposure are expected to be low.	Unknown impact and exposure
Potential Actions <i>(The lists are illustrative of actions that may be taken to support evaluation of an issue. Not all Level 1 will require the actions listed. Further, Level 2 and Uncertain issues may become Level 1 issues after initial literature search.)</i>	<ul style="list-style-type: none"> ▪ Literature Search ▪ Specialist/expert consulted ▪ Modified structure or operation of the project ▪ Laboratory study conducted ▪ Site-specific baseline data collected ▪ Post-implementation study conducted ▪ Real-time monitoring 	<ul style="list-style-type: none"> ▪ Literature Search 	<ul style="list-style-type: none"> ▪ Literature Search to determine if other actions in Level 1 are warranted.

Ecological Issues from the Reedsport Declaration of Cooperation

No.	Issue/Summary	Relative Impact/Next Steps
1	<p>Marine Mammal Injury/Entanglement Each buoy of the proposed project is connected to the sea floor via 4 to 5 inch diameter synthetic cables. The proposed project is in the migratory path of gray whales and there is concern that whales may become entangled in the mooring system. Experts from the Hatfield Marine Science Center and NOAA Fisheries have suggested acoustic guidance to move the whales around the array.</p>	<p>Level 1: Need further understanding of migratory paths, effectiveness of acoustic guidance, and injury mechanisms. Need to acquire additional information during settlement to support study plan development.</p>
2	<p>Effects of Acoustic Guidance on Mammal and Fish Behavior If acoustic guidance is employed to prevent marine mammal entanglement there could be detrimental impacts to marine mammal migration and fish behavior. Further, there may be an impact from mammals and fish being excluded from the habitat.</p>	<p>Level 1: Need to quantify frequencies and sound pressure levels and to further address impacts. Study plans need to be developed during the settlement process.</p>
3	<p>Effects of Electromagnetic Field (EMF) on Sharks EMF will be created both around the PowerBuoy and the sub sea transmission cables. The buoys will produce electricity at a frequency of less than 12 Hz and it will be transmitted in the subsea cable at a frequency of 60 Hz. Initial evaluation indicates that the level and frequency of the EMF will not attract sharks from great distances. There is an outstanding question as to whether sharks in the area will experience behavioral changes as a result of the low frequency EMF of the buoys.</p>	<p>Level 1: Need to further quantify frequencies and field levels of the EMF and to develop a study plan to understand the impact of EMF on the behavioral response of sharks.</p>

4	<p>EMF on Rays EMF will be created both around the PowerBuoy and the sub sea transmission cables. The buoys will produce electricity at a frequency of about 1 Hz and it will be transmitted in the subsea cable at a frequency of 60 Hz. Initial evaluation indicates that the level and frequency of the EMF will not attract sharks from great distances. There is an outstanding question as to whether rays in the area will experience behavioral changes because of the low frequency EMF of the buoys.</p>	<p>Level 1: Need to further research the effects of EMF on rays to develop a study plan to understand the impact of EMF on the behavioral response of rays.</p>
5	<p>Pinniped Haul Out The floats of the PowerBuoy system present an ideal opportunity for pinnipeds to haul out and colonize. Several design options have been discussed to prevent the pinnipeds from resting on the float. One option incorporates a fence around the float and the other provides a very rough surface on the top of the float in order to make it undesirable for the pinnipeds to remain on the float.</p>	<p>Level 1: Need to further define the options and to evaluate their potential effectiveness.</p>
6	<p>Mooring and Subsea Cable Installation The installation of the mooring system and subsea cables will involve the use of heavy construction equipment including cranes, barges, tugs, and trenching equipment that may harm or kill individuals of some aquatic species.</p>	<p>Level 2: Need to better define the construction process so that an adequate assessment of risks can be determined.</p>
7	<p>Mooring Line Fouling The proposed project will consist of approximately 20 kilometers of synthetic mooring lines that will quickly become encrusted with biofouling. In turn this fouling will have an impact on food supply and may have impact on the quantity and type of fish species that will be located in and around the proposed project.</p>	<p>Level 2: Need to better quantify the impact and make an assessment of the potential impacts, whether positive or negative.</p>
8	<p>Alteration of Seabed Habitat The proposed project will consist of approximately 30 anchors that are monolithic, concrete blocks approximately 7-meters long by 7-meters wide by 3-meters high. The anchors are presently designed to protrude above the ocean floor. It is expected that the anchors will act as an artificial reef and will alter the overall marine habitat and species assemblages.</p>	<p>Level 2: Need to better quantify the impact and make an assessment of impacts. Anchor system may be redesigned so that it is flush with ocean floor.</p>

9	<p>Seabird Collisions The wave power project will consist of large floating buoys which are moored with 4 to 5 inch diameter synthetic lines. Diving birds in their pursuit of food located in close proximity to the buoy system may collide or become entangled in the mooring system or the buoy itself.</p>	<p>Level 2 - Need to better determine the mooring system design and how it may impact diving birds.</p>
10	<p>Seabird Nesting The PowerBuoy design may provide a nesting opportunity for seabirds. Colonization of seabirds on the wave power array may not be desired and as such design alternatives will be required in order to minimize the opportunity for nesting.</p>	<p>Level 2: Need to develop design alternatives that can be evaluated during settlement discussions.</p>
11	<p>Lighting Impacts to Seabirds The wave power array will be lit at night in accordance with USCG regulations to aid the navigation of mariners. It is expected that the 14 buoy array will have approximately 4 to 8 lights, similar in color, intensity, and flash frequency to traditional navigational lights. This type of lighting may have a detrimental impact on seabirds.</p>	<p>Level 2: Once the lighting plan has been established with the USCG, the impact on seabirds needs to be assessed. More information will be provided during settlement discussions.</p>
12	<p>Oil Leakage Impact to Seabirds The PowerBuoy system contains small amounts of hydraulic fluids that in the event a catastrophic failure event could be leaked into the ocean. Although the fluids used are biodegradable, there could be significant impacts to seabirds before dispersal and degradation of the hydraulic fluids.</p>	<p>Level 2: Need to perform a failure analysis and assess the risk of catastrophic failure that would result in fluid leakage.</p>
13	<p>Spills during construction and Installation During the installation and construction of the wave power park, a number of vessels, including tugs, barges, cranes, and workboats will be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials. There is a risk that during construction and installation, that there could be a spill of such materials.</p>	<p>Level 2: Need to evaluate the risk of leakage based on industry accepted norms for marine construction. These risks will be used to assess the impact to the affected aquatic species.</p>

14	EMF on Plankton EMF will be created both around the PowerBuoy and the sub sea transmission cables.	Uncertain: It is unknown whether EMF has an impact on plankton. Additional research is required and will be presented during settlement discussion.
15	EMF on Salmon EMF will be created both around the PowerBuoy and the sub sea transmission cables.	Uncertain: It is unknown whether EMF has an impact on salmon. Additional research is required and will be presented during settlement discussion.
16	Impact of Installation/Removal on Fish Eggs During construction and removal of the proposed project there will be a significant disturbance to the seabed which may result in the disturbance or destruction of fish eggs, resulting in a negative impact on populations.	Uncertain: Need to better quantify the impact of installation and removal techniques on fish eggs
17	Impact of Installation/Removal on Other Species During construction and removal of the proposed project there will be a significant disturbance in the water column which may disturb and temporarily displace some species.	Uncertain: Need to better quantify the impact of installation and removal techniques on species.
18	Oil Leakages Impacts to Pinnipeds and Cetaceans The PowerBuoy system contains small amounts of hydraulic fluids that in the event a catastrophic failure event could be leaked into the ocean. Although the fluids used are biodegradable, there could minor impacts to pinnipeds and cetaceans before dispersal and degradation of the hydraulic fluids.	Uncertain: Need to better understand how biodegradable hydraulic fluids disperse and degrade and how they might impact pinnipeds and cetaceans.
19	Sea Turtles Although there are several known species of sea turtles that may be found in the project area, there will likely be no impact of the project on these species.	Uncertain: Need to better characterize the existence of turtles in the project area.
20	Macroalgae The project must determine the existence of macroalgae along the proposed subsea transmission path and to assess the potential effects to macroalgae/eelgrass.	Uncertain: Further discussion is needed

Ecological Issues from the Reedsport Declaration of Cooperation

21	Cumulative Effects This project has raised the importance of identifying and quantifying the cumulative effects of wave energy projects along the coast.	Uncertain: This issue will be addressed as part of the state wide planning process.
22	Noise/Vibration The PowerBuoy® produces some levels of noise and vibrations which may have potential effects to marine life, primarily marine mammals	Uncertain: Need to quantify frequencies and sound pressure levels and to further address impacts.

Cross-Walking the DOC Issues and the Studies

No.	Aquatic/Water Quality Issues	Relative Impact	# of baseline studies (out of a total of 20) that pertain to the aquatic/water quality issue
AQ1	Marine Mammal Injury/Entanglement	Level 1	1
AQ2	Effects of Acoustic Guidance on Mammal and Fish Behavior	Level 1:	5
AQ3	Effects of Electromagnetic Field (EMF) on Sharks	Level 1	2
AQ4	EMF on Rays	Level 1:	1
AQ5	Pinniped Haul Out	Level 1	1
AQ6	Mooring and Subsea Cable Installation	Level 2:	9
AQ7	Mooring Line Fouling	Level 2	4
AQ8	Alteration of Seabed Habitat	Level 2: .	6
AQ9	Seabird Collisions .	Level 2 -	1
AQ10	Seabird Nesting	Level 2	1
AQ11	Lighting Impacts to Seabirds	Level 2:	1
AQ12	Oil Leakage Impact to Seabirds	Level 2:	1
AQ13	Spills during construction and Installation	Level 2:	1
AQ14	EMF on Plankton	Uncertain	2
AQ15	EMF on Salmon	Uncertain	2
AQ16	Impact of Installation/Removal on Fish Eggs	Uncertain	3
AQ17	Impact of Installation/Removal on Other Species	Uncertain	6
AQ18	Oil Leakages Impacts to Pinnipeds and Cetaceans	Uncertain	3
AQ19	Sea Turtles	Uncertain	0
AQ20	Macroalgae	Uncertain	3
AQ21	Cumulative Effects	Uncertain	1
AQ22	Noise/Vibration	Uncertain	1

Cross-Walking the Studies with the TSP

1. Study: Local Wave Environment

- **Justification:** Characterization of the wave environment is necessary to model array effects on wave height, period and energy. This information is also necessary to optimize the efficiency of the deployed equipment.
- **Existing Information:** Numerous NOAA buoys offshore Oregon record wave direction, amplitude and frequency/period.
- **Needed Information:** Wave amplitude and frequency/period measurements at the proposed site are needed over at least an annual cycle.
- **Proposed Study:** Applicant will deploy instrumentation to record wave amplitude, frequency/period and direction for a period of one year. Results would be compared to NOAA buoy output to determine the existing buoys' skill at predicting site conditions.
- **Methodology:** In situ buoy deployment with needed instrumentation.
- **Cost Factors:** Factors include cost of buoy deployment, recovery, data downloads and analysis.
- **DOC Issues Crosswalk:** G1, G6
- **TSP Part Two Crosswalk:** *Inventory Content 3b – Wave Regime*

Cross-Walking the Studies with the TSP

2. Study: Ocean Currents*

- **Justification:** Ocean currents, along with waves, drive the littoral transport system. Additionally, ocean currents act as the transport system some biological properties and for any accidental spills. Information on currents, especially seasonal and episodic meteorological responses, will be needed to support transport models.
- **Existing Information:** Information about Oregon's ocean currents is general. There have been some high resolution studies of waves and currents on the central Oregon coast, but none are presently known for the project site.
- **Needed Information:** Surface currents at the project site need to be documented, especially with respect to seasonal and meteorological cycles/episodes.
- **Proposed Study:** Applicant will characterize ocean currents in the vicinity of the littoral sub-cell (and larger cell, if necessary).
- **Methodology:** One option is to deploy current meters (acoustic Doppler current profilers or ADCPs) at the site for a year; the other may be to deploy high-resolution radar at the site to study both waves and currents.
- **Cost Factors:** Cost factors depend on method, but current meters will require at-sea deployment and recovery; radar methodology will be deployed from shore. Both require sophisticated data analysis. This may be a good area for partnering with Oregon State University.
- **DOC Issues Crosswalk:** G1, G6
- **TSP Part Two Crosswalk:** *Inventory Content 3c – Current velocities*

Cross-Walking the Studies with the TSP

3. Study: Local Littoral Transport*

- **Justification:** A wave energy park will likely modify both the wave energy and the ocean currents. Models used to predict effects on the littoral transport cell will require information on local littoral processes, especially areas likely to develop erosive or depositional environments.
- **Existing Information:** Existing information describes each littoral cell. There is no existing site-specific information.
- **Needed Information:** This Study might be addressed, in part, with a high-resolution HF study of the local waves and currents, before and after the array deployment. Oregon State University's College of Oceanic and Atmospheric Sciences (COAS) has this capability in-house.
- **Proposed Study:** Modeling.
- **Methodology:** Wave and current data from other studies can be assimilated in the appropriate model(s).
- **Cost Factors:**
- **DOC Issues Crosswalk:** G1, G6
- **TSP Part Two Crosswalk:** Inventory Content 3d – Dispersal, horizontal transport, and vertical mixing characteristics of the area

Cross-Walking the Studies with the TSP

4. Study: Bathymetry and Surficial Geology

- **Justification:** Deployment of anchoring systems will require a high resolution profiling of the sediment layer and sub-bottom (i.e., underlying hard substrate or basement) to assure adequate sediment depth. Any cultural resources (i.e., shipwrecks) will also need to be identified, if present.
- **Existing Information:** Existing information is very coarse in spatial resolution. There is general bathymetry and bottom type information to support the hypothesis that the site is fine sand throughout.
- **Needed Information:** The water depth and sediment depth and type need to be documented with appropriate resolution over the entire site.
- **Proposed Study:** Acoustic sub-bottom profiling and depth sonar can be combined in a single survey of the site. Side-scan sonar can be used to estimate sediment type from reflectivity. Sediment samples will be needed to ground truth the side-scan sonar results; they will be provided by the next study
- Study. The applicant will provide
- **Methodology:** High -resolution acoustic sub-bottom profiling, bathymetry and side-scan sonar surveys.
- **Cost Factors:** It may be possible and desirable to conduct this study concurrently with the characterization of background EMF with a magnetometer.
- **DOC Issues Crosswalk:** AQ8(L2); AQ20(U), G4, G6, G8,
- **TSP Part Two Crosswalk:**
 - *Inventory Content 4 – Bathymetry*
 - *Inventory Content 7 – Mineral deposits, including sand, gravel and hydrocarbon resources*

Cross-Walking the Studies with the TSP

5. Study: Physical Characterization of Benthic Habitat*

- **Justification:** The grain size, homogeneity, and amount of organic material in the sediment are prime determinants of habitat for the biota. These characteristics are likely to change as energy is removed from the wave train and deposition of finer sediments is possible. Additionally, more organics may be supplied by the higher density of organisms inhabiting the hard substrates.
- **Existing Information:** As in other cases, data of this type exist, but they are quite coarse in spatial resolution, and none are known at the site. Recent data collected by EPA's EMAP program (2003) gives a general idea of sediment characteristics at similar depths on the shelf.
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide characterizations of the grain size, homogeneity, and amount of organic material in the native sediment.
- **Methodology:** Any common grab device, including corer, Van Veen, Shipek, Smith-Macintyre will suffice. A larger piece of gear will also provide enough sample for characterization of the Infauna as well. Suggested transects: one transect along the 50m isobath (center of deployment); and three transects normal to 50m isobath, at both ends and center of deployment.
- **Cost Factors:** These samples can be used to ground truth the reflectivity information from the side-scan sonar survey.
- **DOC Issues Crosswalk:** AQ6(L2), AQ8(L2); AQ16(U), AQ17(U), AQ20(U), G4, G6, G8,
- **TSP Part Two Crosswalk:**
 - *Inventory Content 6 a – Critical marine habitats*
 - *Inventory Content 6 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 shell fish congregate in large numbers;*
 - *Effects Evaluation - i. Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP

6. Study: Characterization of Benthic Infauna*

- **Justification:** The benthic Infauna are in large part the basis of the demersal food web. Changes in the physical benthic habitat will likely lead to changes in the infauna.
- **Existing Information:** Recent data collected by EPA's EMAP program (2003) gives a general idea of benthic infaunal characteristics at similar depths on the shelf.
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide identification and enumeration of adequate sediment samples to characterize the study area; this should include some analysis of the meiofauna (usually passes through a 1.0 mm sieve).
- **Methodology:** Grab sampler such as box corer, Van Veen, Smith-Macintyre, with enough area/volume to yield statistically relevant sample sizes. A random stratified sample plan may be appropriate for this study. Possible transects: one transect along the 50m isobath (center of deployment); and three transects normal to 50m isobath, at both ends and center of (14 or 200) buoy deployment.
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ6(L2), AQ8(L2);AQ17(U), AQ20(U), G4, G6, G8,
- **TSP Part Two Crosswalk:**
 - *Inventory Content 6 a – Critical marine habitats*
 - *Inventory Content 6 e – Planktonic and benthic flora and fauna*
 - *Effects Evaluation i - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP

7. Study: Characterization of Epibenthic Macrofauna*

- **Justification:** The benthic epifauna are a large part the basis of the demersal food web. Changes in the physical benthic habitat and infauna will likely lead to changes in the epifauna.
- **Existing Information:** Recent data collected by EPA's EMAP program (2003) gives a general idea of epibenthic macrofaunal characteristics at similar depths on the shelf.
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide
- **Methodology:** Bottom trawl such as try-net, otter trawl or beam trawl. The trawl should dig into the sediment enough to assure capture of Pacific Sandlance, or they should be sampled by other means. An ROV survey might complement the trawl data.
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ6(L2),AQ8(L2);AQ16(U), AQ17(U), G4, G6, G8,
- **TSP Part Two Crosswalk:**
- *Inventory Content 6 e – Planktonic and benthic flora and fauna*
- *Effects Evaluation i – Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP

8. Study: Characterization of Pelagic Nekton*

- **Justification:** The pelagic nekton (swimming fish and invertebrates inhabiting the water column) are expected to change in distribution and abundance due to project effects, especially the provision of physical structure in historically open water.
- **Existing Information:** The resident nektonic biota of Oregon are well known, though there were apparently northward range extensions of some warmer water species during the 1996 El Niño (e.g., blue marlin, chub mackerel).
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide
- **Methodology:** Mid-water trawl and purse seine; other capture or census methods as applicable.
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ2(L1), AQ3(L1), AQ6(L2),AQ7(L2);AQ8(L2), AQ16(U), AQ17(U), G6
- **TSP Part Two Crosswalk:**
 - *Inventory Content 6 c* – Fish and shellfish stocks and other biologically important species
 - *Inventory Content 6 d* – Recreationally or commercially important finfish or shellfish species
 - *Effects Evaluation i* - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.

Cross-Walking the Studies with the TSP

- **9. Study: Characterization of Key Forage Plankton (Euphausiids and Mysids)***
- **Justification:** Vertically migrating species of relatively large planktonic crustaceans (especially euphausiids, and in some cases mysids) form an important source of food for many key groups, including fish, seabirds and whales. The creation of a wave energy park in previously open water will likely have some effect on the availability of this group as forage in the water column. Measurements of presence/absence of forage plankton can provide an indication of change in the area/system while species composition measurements can provide an indication of predators likely present.
- **Existing Information:** There is general information on the distribution and abundance of euphausiids and Mysids on the Oregon continental shelf. NOAA's triennial (now biennial) West Coast groundfish surveys have traditionally collected acoustics data on the "deep scattering layer".
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide
- **Methodology:** Tucker Trawl or large zooplankton net (50 cm or larger opening). This approach could be augmented by using acoustic surveys with appropriate ground truthing.
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ6(L2),AQ7(L2);AQ8(L2), AQ14(U), AQ17(U), G6
- **TSP Part Two Crosswalk:**
- *Inventory Content 6 e – Planktonic and benthic flora and fauna*
- *Effects Evaluation i - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP

10. Study: Site Use by/Presence of Salmonids (Smolts and Spawners)*

- **Justification:** Wild salmonid stocks in the Pacific Northwest are largely diminished, and many evolutionarily significant units (ESUs) are under ESA protection. Hence, any predicted salmon takings by the project will come under great scrutiny. Since this project lies just north and west of the Umpqua River, any outmigrating wild stocks will be of special interest.
- **Existing Information:** General information exists on the ocean ecology of Pacific salmon, including general paths of migration of smolts and spawners.
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide
- **Methodology:** ESA species are a problem, as takings are kept to an absolute minimum. Hence, the study should use any tools available that do not injure fish, smolts or spawners. Are acoustic tags used on coastal coho like the Columbia stocks? Anybody?
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ2(L1), AQ6(L2),AQ7(L2);AQ15(U), AQ17(U), G6
- **TSP Part Two Crosswalk:**
 - *Inventory Content 6 c* – Fish and shellfish stocks and other biologically important species
 - *Inventory Content 6 d* – Recreationally or commercially important finfish or shellfish species
 - *Effects Evaluation i* - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.

Cross-Walking the Studies with the TSP

11. Study: Characterization of Background Electrical and Magnetic Fields

- **Justification:** Any electromagnetic fields emanating from the buoys and transmission system will be superimposed on the background of the earth's magnetic field and induced electrical field generated by the seawater flowing through it. Animals with the EMF sensory capability use it to sense animal motion within the context of this dynamic background.
- **Existing Information:** There may be enough general information applicable to the site to obviate the need for data collection as a baseline.
- **Needed Information:** Need site-specific information.
- **Proposed Study:** The applicant will provide
- **Methodology:** Magnetometer survey, if needed.
- **Cost Factors:** It may be possible to conduct the geophysical (acoustic and EMF) surveys together. The magnetometer may also help to find any more recent shipwrecks that would be of either cultural interest or a possible source of toxic chemicals.
- **DOC Issues Crosswalk:** AQ3(L1);AQ4(L1), AQ14(U), AQ15(U);G6
- **TSP Part Two Crosswalk:**
 - *Inventory Content 6 f* – Other elements important to the primary productivity and the food chain.
 - *Effects Evaluation i* - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.

Cross-Walking the Studies with the TSP

12. Study: Characterization of Acoustic Background

- **Justification:** Any sound emanating from the buoys and transmission system will be superimposed on the background of the ambient sound field generated by wind and waves, animals and man's activities. Animals with the acoustic sensory capability use it within the context of this background noise.
- **Existing Information:**
- **Needed Information:** Need site-specific information.
- **Proposed Study:**
- **Methodology:** In situ hydrophone deployment.
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ2(L1);AQ22(U), G6
- **TSP Part Two Crosswalk:**
- *Inventory Content 6 f* – Other elements important to the primary productivity and the food chain
- *Effects Evaluation i* -. Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.

Cross-Walking the Studies with the TSP

13. Study: Site Use by/Presence of Seabirds*

- **Justification:** Use of the site by the various groups of seabirds needs to be documented prior to buoy deployment, in order to provide a baseline for effects evaluation. Seabird use is expected to be strongly seasonal. This study will need a control site and will need to be of multi-year duration.
- **Existing Information:**
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide seabird surveys, performed at appropriate time and space scales.
- **Methodology:**
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ6(L2), AQ9(L2);AQ10(L2), AQ11(L2), AQ12(L2), G6
- **TSP Part Two Crosswalk:**
- *Inventory Content 6 c – Fish and shellfish stocks and other biologically important species*
- *Effects Evaluation i - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP

14. Study: Site Use by/Presence of Cetaceans*

- **Justification:** Use of the site by cetaceans needs to be documented prior to buoy deployment, in order to provide a baseline for effects evaluation. Cetacean use is expected to be strongly seasonal, especially the spring and fall migrations of gray whale. This study will need a control site and will also need to be of multi-year duration.
- **Existing Information:** There is general information on cetacean distribution and abundance on the Oregon Shelf.
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide
- **Methodology:**
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ1(L1); AQ2(L1), AQ6(L2), AQ18(U), G6
- **TSP Part Two Crosswalk:**
 - *Inventory Content 6 c – Fish and shellfish stocks and other biologically important species*
 - *Effects Evaluation i - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP

15. Study: Site Use by/Presence of Pinnipeds*

- **Justification:** Use of the site by the various species of seals and sea lions needs to be documented prior to buoy deployment, in order to provide a baseline for effects evaluation. Pinniped use is expected to be strongly seasonal. This study will need a control site and will need to be of multi-year duration.
- **Existing Information:**
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will provide
- **Methodology:**
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ2(L1), AQ5(U); AQ6(L2), AQ18(U), G6
- **TSP Part Two Crosswalk:**
- *Inventory Content 6 c* – Fish and shellfish stocks and other biologically important species
- *Effects Evaluation i* - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.

Cross-Walking the Studies with the TSP

16. Study: Neuston Survey/Presence of Invasive Species*

- **Justification:** There is concern that providing hard substrates in an open-water environment may have consequences in the distribution of invasive species. There is also concern that the deployment of many structures in previously open water could affect the recruitment of meroplankton, especially if those surfaces are coated with toxic compounds.
- **Existing Information:** There are general neuston surveys related to numerous projects on the Oregon Shelf (e.g., Rumrill work on *McArthur* offshore Coos Bay). Marine invasive species surveys are not known at this time.
- **Needed Information:** Need site-specific information.
- **Proposed Study:** Applicant will conduct a meroplankton survey or deploy settling plates during peak recruitment period (late spring through early summer?).
- **Methodology:**
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ7(L2); G6
- **TSP Part Two Crosswalk:**
 - *Inventory Content 6 e* – Planktonic and benthic flora and fauna
 - *Effects Evaluation i* - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.

Cross-Walking the Studies with the TSP

17. Study: Presence of Toxic Chemicals in Water Column and Sediment*

- **Justification:** The applicant will want to make sure that the sediment at the site is devoid of any prior chemical contamination prior to its activities. This study will need a control site and will need to be of multi-year duration for later effects evaluation.
- **Existing Information:** Recent data collected by EPA's EMAP program (2003) gives a general idea of the relative rarity of sediment toxicity at similar depths on the shelf, based on a random stratified sampling scheme of 50 stations between 20 and 120 m water depth on the Oregon shelf. Water column values are generally known.
- **Needed Information:** Characterization of sediment chemistry for EPA priority pollutants, including organics and metals; also documentation of water column values of metals.
- **Proposed Study:** The applicant will provide
- **Methodology:**
- **Cost Factors:**
- **DOC Issues Crosswalk:** AQ13(L2); AQ18(U), G6
- **TSP Part Two Crosswalk:**
- *Inventory Content 1f* – Physical and chemical properties of hazardous materials to be used or produced, if any
- *Inventory Content 6 f* – Other elements important to the primary productivity and the food chain.
- *Effects Evaluation i* - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.

Cross-Walking the Studies with the TSP

18. Study: Background Turbidity

- **Justification:** Turbidity is one of the water quality standards likely to be applicable to this activity in both the deployment and operational stages. Turbidity is a major factor in the effectiveness of visual predation, or conversely, prey escape.
- **Existing Information:**
- **Needed Information:** The near-bottom turbidity at the site needs to be documented prior to deployment.
- **Proposed Study:** The applicant will provide
- **Methodology:** In situ transmissiometer or nephelometer deployment. This could be deployed along with an ADCP string.
- **Cost Factors:**
- **DOC Issues Crosswalk:** G6
- **TSP Part Two Crosswalk:**
 - *Inventory Content - 3f – Water quality*
 - *Effects Evaluation i - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP

19. Study: Beach Gradient Profile*

- **Justification:** Beach gradient (depth with distance from shore) is a key expression and characteristic of the littoral system, and also a critical factor in defining tsunami run-up risk.
- **Existing Information:** Some Oregon beaches (mainly north end) have recently been profiled by the Oregon Department of Geology and Mineral Industries (DOGAMI).
- **Needed Information:** Profiles of beaches in project vicinity.
- **Proposed Study:** The applicant will provide profiling of beaches onshore of project area.
- **Methodology:**
- **Cost Factors:**
- **DOC Issues Crosswalk:** G1, G6
- **TSP Part Two Crosswalk:** *Inventory Content 5 - Geological structure and hazards*

Cross-Walking the Studies with the TSP

20. Study: Survey of Nontoxic Water Quality Parameters

- **Justification:** Applicant will likely want to document existing values of classical water quality parameters at site prior to project implementation; this also may be a requirement for ODEQ's Clean Water Act § 401 certification.
- **Existing Information:** General information exists for salinity, temperature, pH, dissolved oxygen concentration, and other water column parameters on the Oregon shelf. There is a long history at the so-called *Newport Line*, along which these types have been collected since the 1960s.
- **Needed Information:** Seasonal documentation of water quality parameters at the site. It may be possible to argue that no project influence will ever be expressed on these largely advectively controlled parameters, but they may be required for certification under the Clean Water Act.
- **Proposed Study:**
- **Methodology:** *In situ* sensor deployment; water samples from bottles if necessary.
- **Cost Factors:** It may make sense to combine any turbidity sampling using an *in situ* transmissiometer or nephelometer with the water column survey; it can likely be deployed on the same instrument.
- **DOC Issues Crosswalk:** G6
- **TSP Part Two Crosswalk:**
- *Inventory Content - 3f – Water quality*
- *Effects Evaluation i - Biological and ecological effects on marine habitats and other habitats, species those habitats support, including factors: ecosystem structure, biological productivity, biological diversity, representative species assemblages; maintaining populations of T&E or sensitive spp; vulnerability of species, population, community or habitat to adverse effects of pollution, noise, habitat alteration, human trespass.*

Cross-Walking the Studies with the TSP: Summary

- **TSP gives very broad mandate to assess the system and potential effects on it**
- **Also mandates cumulative effects analysis**
- **Supported every study developed by otherwise looking at the system through detailed stressor-receptor impact matrices**
- **Does not mandate consideration of alternatives (as does NEPA)**
- **Mandates a minimal description of the action and its manifestations**

Observations Applicable to Developing TSP Amendments Pursuant to EO 0807

- Information-based decision making is fundamental
- TSP amendments specific to renewable energy development might mandate a more detailed description of the action and all its manifestations (i.e., stressor signatures – physical, chemical, biological and socioeconomic)
- Adaptive management could be specifically defined and parameterized
- Siting appears to be a critical variable
- Settlement process brought out best behavior; but future licensing activities could be adversarial

Adaptive Management: Key Characteristics

- **We are information-limited**
- **Cannot meet mandates to assess impacts without more information**
- **Studies are designed to obtain baseline; monitoring for effects**
- **Management decisions are left to future adaptive management teams**
- **Agencies always retain authorities**

Goal 19: Management Policies

- **a. Adaptive Management:** to adapt management programs to account for variable conditions in the marine environment, the changeable status of resources, and individual or cumulative effects of uses;
- **g. Precautionary Approach:** to take a precautionary approach to decisions about marine resources and uses when information is limited.

Goal 19: Contingency Plans

State and federal agencies, when approving or taking an action that could, under unforeseen circumstances, result in significant risks to ocean resources and uses, shall, in coordination with any permittee, establish appropriate contingency plans and emergency procedures to be followed in the event that the approved activity results in conditions that threaten to damage the marine or estuarine environment, resources, or uses.

Contingency Plans

- **Assert that the adaptive management portion of the Reedsport Settlement Agreement comports with the spirit of the applicable Goal 19 management policies and contingency plans statements.**
- **Hence, I recommend that following approach to Section 2, Part (e) on insufficient/ incomplete information.**

2. Mandatory Policies

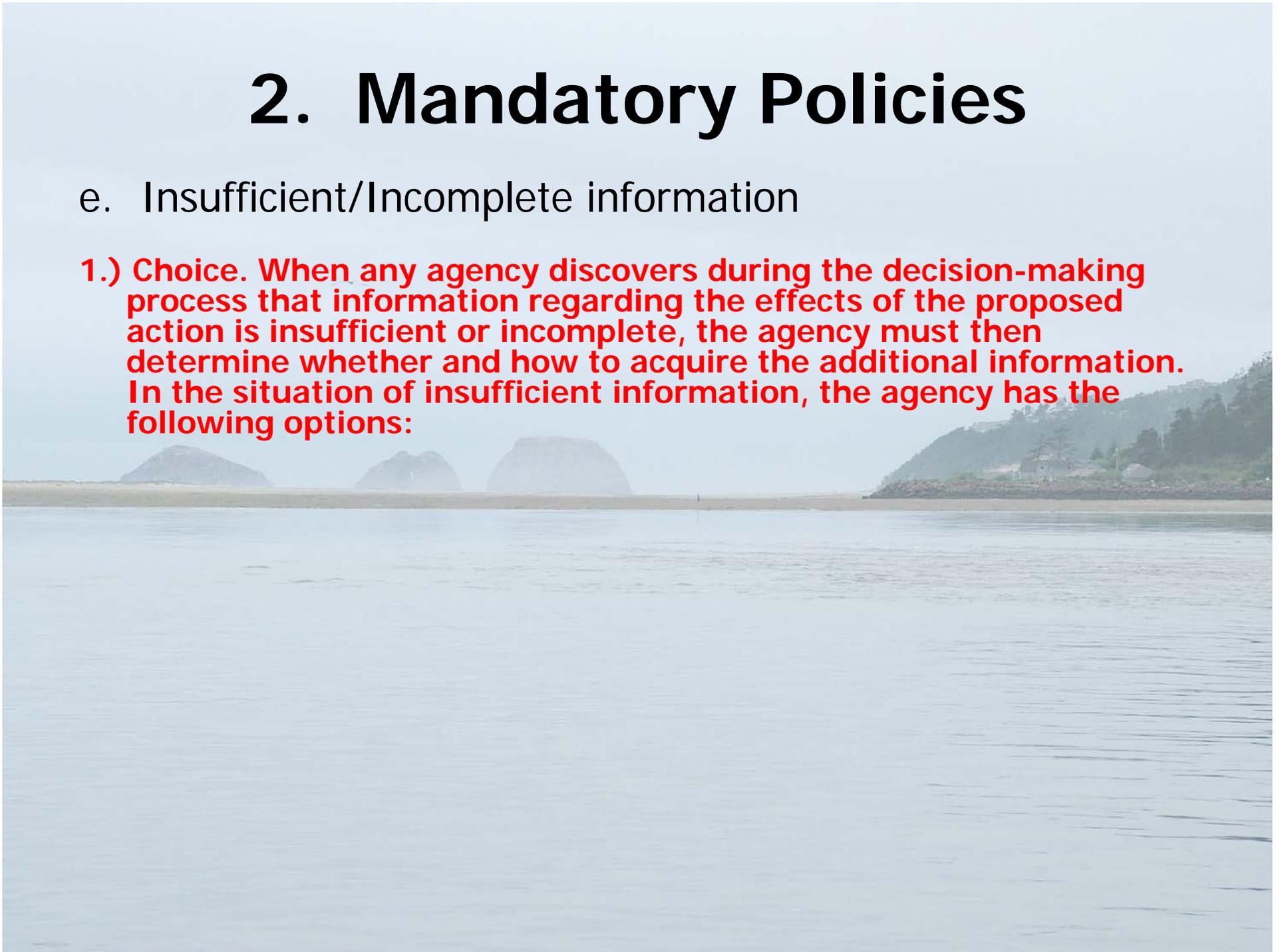
e. Insufficient/Incomplete information



2. Mandatory Policies

e. Insufficient/Incomplete information

- 1.) Choice. When any agency discovers during the decision-making process that information regarding the effects of the proposed action is insufficient or incomplete, the agency must then determine whether and how to acquire the additional information. In the situation of insufficient information, the agency has the following options:**



2. Mandatory Policies

e. Insufficient/Incomplete information

1.) **Choice.** When any agency discovers during the decision-making process that information regarding the effects of the proposed action is insufficient or incomplete, the agency must then determine whether and how to acquire the additional information. In the situation of insufficient information, the agency has the following options:

(a) Terminate, suspend, or postpone the decision-making process until the information is available.

2. Mandatory Policies

e. Insufficient/Incomplete information

1.) Choice. When any agency discovers during the decision-making process that information regarding the effects of the proposed action is insufficient or incomplete, the agency must then determine whether and how to acquire the additional information. In the situation of insufficient information, the agency has the following options:

(a) Terminate, suspend, or postpone the decision-making process until the information is available.

OR

(b) Determine whether the provisions of Subsection A.2.e.2. Limited Environmental Disturbance are appropriate to provide the needed information;

2. Mandatory Policies

e. Insufficient/Incomplete information

1.) Choice. When any agency discovers during the decision-making process that information regarding the effects of the proposed action is insufficient or incomplete, the agency must then determine whether and how to acquire the additional information. In the situation of insufficient information, the agency has the following options:

(a) Terminate, suspend, or postpone the decision-making process until the information is available.

OR

(b) Determine whether the provisions of Subsection A.2.e.2. Limited Environmental Disturbance are appropriate to provide the needed information;

OR

(c) In the case of Developmental Fisheries pursuant to ORS 506.455, apply the provisions of Subsection A.2.e.3.

2. Mandatory Policies

Amendment recommendation:

1.) Choice. When any agency discovers during the decision-making process that information regarding the effects of the proposed action is insufficient or incomplete, the agency must then determine whether and how to acquire the additional information. In the situation of insufficient information, the agency has the following options:

(a) Terminate, suspend, or postpone the decision-making process until the information is available.

OR

(b) Determine whether the provisions of Subsection A.2.e.2. Limited Environmental Disturbance are appropriate to provide the needed information;

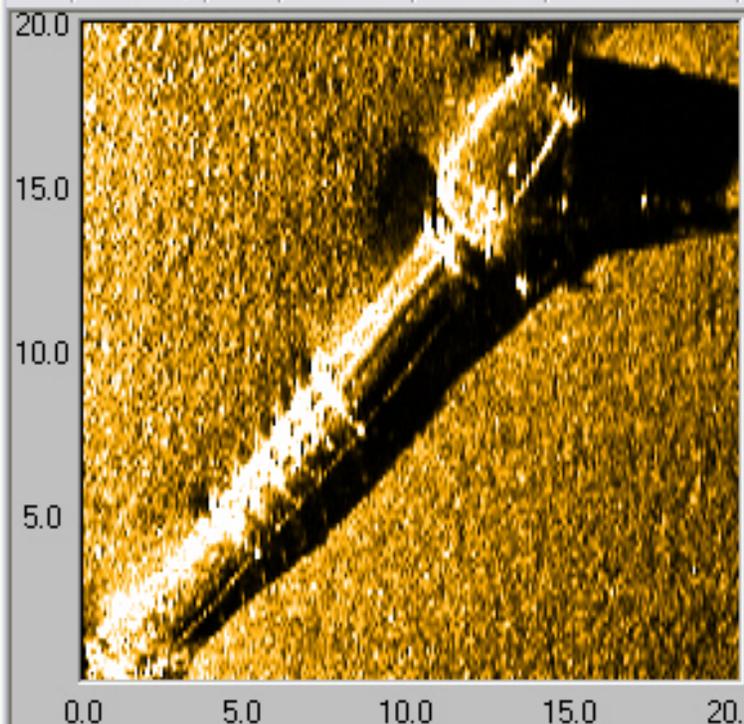
OR

(c) In the case of Developmental Fisheries pursuant to ORS 506.455, apply the provisions of Subsection A.2.e.3.;

OR

(d) Continue the decision-making process, but impose a mandatory adaptive management strategy under which all information needs will be addressed by appropriate studies, and a body authorized to require management actions necessary to meet these policies will undertake, at the minimum, annual review of all new information.

6/6/2008 1:41:55 Starboard, Range: 20.16m, Zoom: 1



Lat: 44:39.9888 N
Lon: 124:06.3077 W

Length: 24.7 m

Width: 4.7 m

Height1: 0.6 m

Height2:

Outline

Name: Target1003

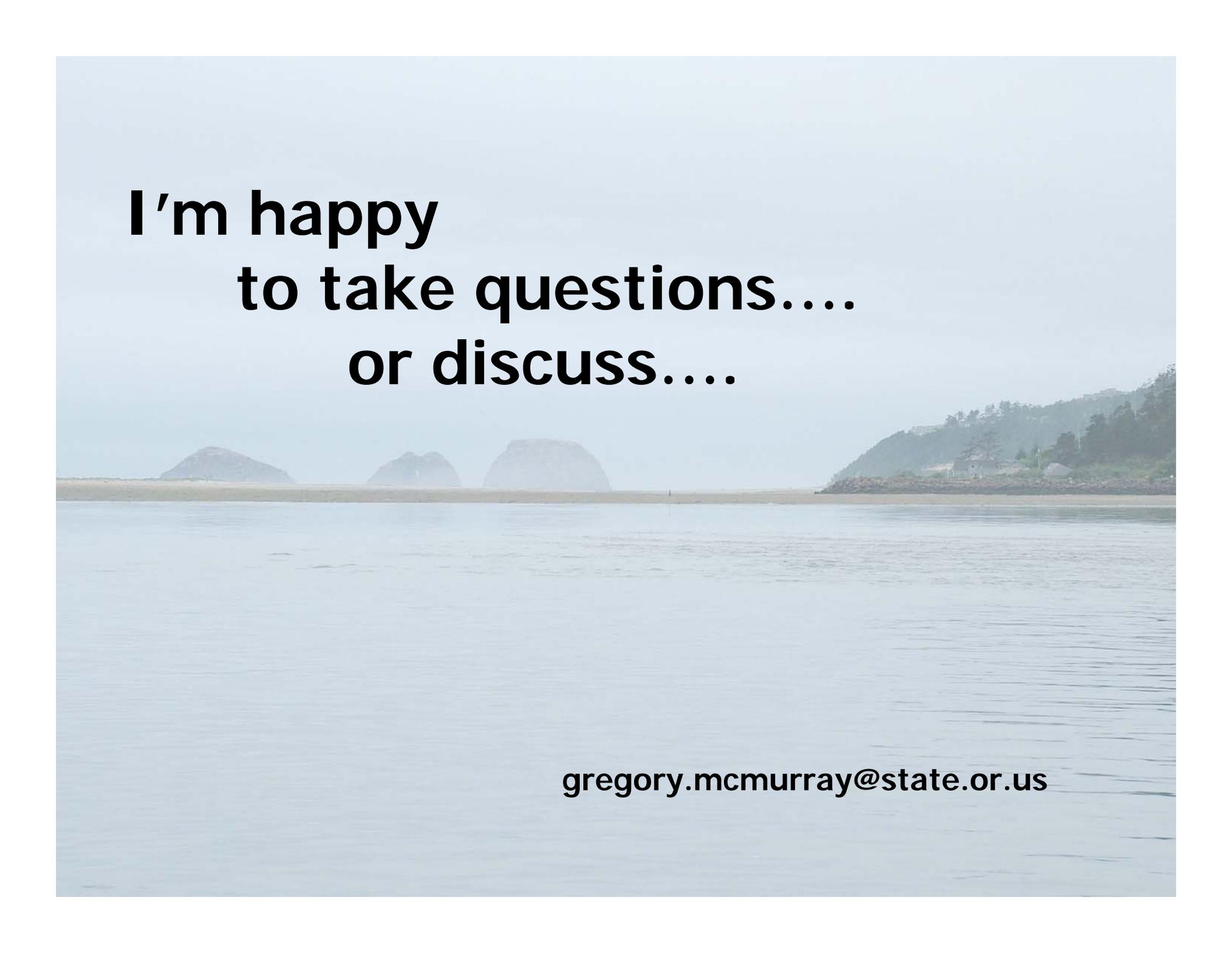
Classification: 0) None

Notes: The operator places target notes here. Multiple lines

Grow

Finavera Wave Energy Buoy



A scenic view of a coastline with three large rock formations in the distance and a forested hillside on the right.

**I'm happy
to take questions....
or discuss....**

gregory.mcmurray@state.or.us