



King County

Conference Notes

**“The Future Ain’t What it Used to Be:
Planning for Climate Disruption”**

Summary of Coastal Areas Breakout Session

October 27, 2005

Qwest Field Conference Center

Seattle, Washington

Sponsored by King County

Report prepared by Jennifer E. Kay

Information on the conference is available at:
<http://metrokc.gov/climateconference2005>

Coastal Areas Session Steering Committee

Douglas Canning, Washington Department of Ecology, **Co-chair**

Burr Stewart, Strategic Planning Manager, Port of Seattle, **Co-chair**

Sarah Brace, Science Liaison, Puget Sound Action Team

Mark Foutch, Mayor, City of Olympia

Eric Grossman, Western Coastal and Marine Geology Program, United States Geological Survey

Angela Grout, Marine and Sediment Assessment Group, King County-DNRP

Alice LeBlanc, AIG-Environmental

Randy Shuman, Ph.D., Science and Data Management Manager, King County-DNRP

Jon Sloan, Senior Ecologist, King County-Dept. of Development and Environmental Services

“The Future Ain’t What it Used to Be: Planning for Climate Disruption”
October 27, 2005
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Summary of Coastal Areas Breakout Session

On Thursday, October 27, 2005, King County hosted a one day meeting to engage a broad cross-section of Washington State governments, businesses, tribes, farmers, non-profits, and the community-at-large in a dialogue about climate change impacts and potential adaptations in Washington State. The following is a summary of the coasts breakout group presentations and discussion. More information on the meeting, including electronic copies of the breakout group presentations, is available at: <http://metrokc.gov/climateconference2005>.

The coasts breakout session included a morning session for education and updates about climate change science as it pertains to coasts and an afternoon session dedicated to discussion of adaptation and response alternatives:

MORNING SESSION

- Welcome and Introduction to the Coastal Sector, Burr Stewart, Port of Seattle (5 min)
- Sea Level Rise and Coastal Hazards, Douglas Canning, WA Dept. of Ecology (30 min)
- Climate Change and Ecological Implications, Eric Grossman, USGS (30 min)
- Summary, Conclusions, Questions, Burr Stewart, Port of Seattle (10 min)

AFTERNOON SESSION

- Welcome and Introduction to the Afternoon Format, Burr Stewart, Port of Seattle
- The Policymaker’s Challenge: Turning Science into Action, Mark Foutch, Mayor, City of Olympia (20 minutes)
- Open Discussion of Adaptation and Response Alternatives, Burr Stewart, moderator (50 minutes)

The Coasts breakout session identified the following three items as priorities in their afternoon report to the plenary:

- **Priority 1:** Improve and increase public education and outreach efforts to aid in the transfer and translation of technical information to the general public.
- **Priority 2:** Develop incentive-based strategies to discourage development in threatened coastal areas.
- **Priority 3:** Adequately fund scientific monitoring and modeling efforts, with an emphasis on systems-based approaches.

Participants

The Coasts breakout group attracted 82 participants from a variety of backgrounds: 41 Government, 12 Non-profit, 11 Students, 10 Business, 7 Individuals, and 1 Farmer.

Summary of Morning Session

Presentations

Burr Stewart, “Welcome and Introduction to the Coastal Sector”

Burr started with some introductory remarks. He stated this is a new type of meeting because attendees included a mix of planners, scientists and the general public. Discussions at the meeting would have to address many levels. He also stated climate change is a new kind of issue. We (humans) influence the environment. The environment also influences us. Burr expressed that this type of meeting is agony; because there is such a short amount of time to accomplish the enormous task of discussing climate change impacts science and adaptation strategies. Burr said the meeting was to get the planning process started, to both ask questions and get answers and to get things down on paper. The morning session would focus on the science. In the afternoon session, we would discuss adaptation strategies and set priorities and next steps. Anyone who has ideas that they don't have time or the right moment to express, Burr encouraged them to write them on the flip chart in the back. Also, Burr asked that attendees e-mail Jennifer Kay, the student recorder, with any additional ideas.

Douglas Canning, “Sea Level Rise and Coastal Hazards”

Doug is with the Shorelands Program, Washington Dept. of Ecology (Ecology) and Climate Impacts Group, University of Washington

Doug cautioned that he will be trying to deliver 40 minutes worth of information in 20 minutes, so a notes version of this PowerPoint presentation with more complete speakers notes will be posted on the conference website. He began with some introductory remarks. His presentation would cover what we know, what we know we don't know, and had some of his own policy alternatives mixed in. The basis for his presentation about climate change and coasts is work he completed in the late 1980s-1990s for the Washington Department of Ecology and the Climate Impacts Group. However, he also would mix in his own speculations.

Doug gave his presentation “Sea Level Rise and Coastal Hazards in Washington State”. Below, are some key points that he made and his replies to questions from the audience:

- Coastlines always leave us discovering surprises. For example, there are old landfills on the beach that are subject to erosion from sea level rise. Biological effects of climate change in the coastal zone are less well-researched than sea level rise effects.
- Observed sea level rise is ~1.0-2.5 mm/year or 0.3-0.75 ft per century. There is uncertainty in both measurements and modeling. Measurements are uncertain because tide gauges are sitting on the land which moves. When everything is in motion, it is difficult to get a fix on existing sea level.
- Why do we think that sea level will rise with global warming? First, when water warms, it expands. The melting of glaciers and snow fields add to the amount of water in the ocean. Ground water mining, and resulting possible land level drop, and water impoundment is a

challenge for modelers because some of these activities add to the amount of water in the oceans, and some prevent water from reaching the oceans.

- Another important factor is vertical land movement. Neah Bay and Astoria are being uplifted tectonically which reduces existing and future effective sea level rise. Puget Sound is experiencing tectonic subsidence which increases the effective rate of sea level rise. We are still getting new information on the impact of tectonics. For example, we just got new information that the Toke Point tide gauge on the north shore of Willapa Bay indicates a rate of tectonic subsidence similar to that in Olympia. This was a surprise because earlier information indicated a near-zero rate of vertical land movement in that region.

Question: Can you explain how tectonic uplift influences sea level rise?

Doug Canning: As the Juan de Fuca oceanic plate subducts under the North American Plate, the Washington coast arches up and Puget Sound subsides. [From presentation's "speaker's notes": The Puget Sound basin is subsiding at rates up to 2.0 mm/year while the Pacific Ocean coast is uplifting at rates up to 2.5 mm/year. However, the data are rather approximate due to the difficulty of making this kind of measurements and comparisons. This warping of the Earth's crust is due to the collision of the North American plate with the smaller, off-shore Juan de Fuca plate. Every so often the pressure of that collision is relieved when there's a major subduction zone earthquake at the trench, and the Washington coastal plain snaps down about meter or two and the process begins anew. These subduction zone earthquakes are similar to the recent Sumatran earthquake in character and intensity.]

Question: How would a subduction zone earthquake influence sea level?

Doug Canning: A subduction zone earthquake would likely result in a one or more meter drop in the coastal plain level resulting, in effect, in a one (or more) meter rise in local sea level. The effects in Puget Sound are uncertain after an earthquake.

- There are also barometric pressure effects on sea level. Short term low barometric pressure allows sea level rise. For example, tides were 2 feet higher than predicted in Tacoma on November 21 2001 due to lower than normal barometric pressure.
- El Nino also affects sea level. Winter increases in sea level along Washington coasts during El Nino. For example, in 1997-98 winter tide levels were 1.3 ft above monthly means. On low barometric pressure days, tides along ocean beaches were 2-3 feet above predictions.
- IPCC scenarios for sea level rise range between 0.5 and 3.0 meters. These scenarios are much improved from earlier scenarios even though they still cover a wide range.

Question: What about melting glaciers – Are they included in the sea level rise figures?

Doug Canning: The melting of mountain glaciers is included in the IPCC global climate change scenarios. On the other hand, more catastrophic, but low probability possibility of melting of large ice sheets is not included in the sea level rise estimates. For example, if the West Antarctic ice sheet were to collapse, sea level would rise approximately 7 m. The melting of the entire Antarctic and Greenland ice caps would raise sea level by approximately 77 m. (NOTE: 70 m from Antarctica and 7 m from Greenland)

Question: What about the Arctic sea ice?

Doug Canning: A key point, the Arctic sea ice is floating on the ocean surface so its melting would have no effect on global sea level rise.

- There are regional changes in sea level. A Canadian climate change model shows that the Eastern Pacific will rise more than the Equatorial Atlantic or the NW Atlantic.
- Combining it all together for Washington: Tacoma could go up a meter of sea level rise, Seattle 0.8 meter, Neah Bay 0.3 meters by 2100.
- Olympia provides a good model for adaptation. They wrote a report that projects future sea level rise with and without climate change. The Port of Olympia Peninsula has included climate change in their 100 year flood line. They have not been diking.
- Coastal erosion increases with higher sea level. For example, during the 1997-98 El Nino – the beach line eroded away and new condos were endangered. When normal conditions return, beach building also comes back.
- Existing legal programs have no detail or specificity to deal with climate change (e.g., Shoreline Management Act, Growth Management Act, Floodplain Management Act, Puget Sound Plan, Aquatic Lands Management Act).
- The response to sea level rise can be thought of as a risk response.

Question: Your biography says you meet with local governments quarterly. I am from Clallam County and there is no discussion in Port Angeles about moving back (to avoid sea level rise). Do you have any insights?

Burr Stewart: We will deal with this in the afternoon session.

Doug Canning: We can also talk separately.

Question: How can communities get involved in planning for sea level rise?

Doug Canning: This conference should help us start that dialogue.

Eric Grossman, “Climate Change and Ecological Implications”

Eric is with the United States Geological Survey (USGS) Coastal and Marine Geology Program in Santa Cruz, California.

Eric began by mentioning his talk will cover impacts to coastal ecosystems and include discussion of response of other species in addition to humans to climate change. He would focus on predicted changes and impacts including processes, uncertainties and science needs. Eric started his presentation “Climate Change and Ecological Implications”. Below are some key points and Eric’s answers to questions from the audience:

- “Take Home Messages:” – Climate change will impact coastal ecosystems already greatly impacted by humans. Ecological interactions are highly dynamic: They vary spatially/temporally within coastal zone. Although there are a wide range of adaptation

outcomes, we need greater knowledge and predictive capacity to know which strategies will work best.

- Humans affect land use, damming/flow regulations, logging and removal of large woody debris, diking and draining of wetlands, sediment flux and salinity.
- Puget Sound Nearshore Restoration Program beginning to take actions including: 1) mapping and measurements of change 2) identification of climate forcings – both the magnitude and the timing 3) identification of impacts including habitat availability and ecosystem connectivity, invasive species etc. etc.
- The large-scale circulation of Puget Sound could change as the mixing of salty marine and fresh water from rivers/streams changes with variations in regional precipitation and temperature. Diking in the wetlands/marshes is resulting in a change in the flux of sediment to the Sound and open ocean. Where channelization of river flow is high, often a surplus of sediment is transported across important habitats leading to burial, scour, excess nutrient/contaminant. Where sediment inputs are low, we observe stranded marshland tens to hundreds of meters off of the shoreline. In many locations throughout the Sound we observe a decrease in marsh/tidal channel habitat including a decrease in connectivity, and a threat of anoxia, eutrication and siltation.
- Collins (2000) found a 70-80% loss in Skagit Delta habitat.
- Eelgrass meadows are important for food, habitat structure and to stabilize sediment. They could be significantly altered by increasing sea level and changes in climate. They are temperature tolerant on the large scale (grow at a range of latitudes), but individual localities may still be sensitive. There has been a recent eelgrass die off in the San Juan Islands. Wyllie-Echeverria et al. (2003) found only 10-20% of original eelgrass remains at these San Juan Island sites and is highly fragmented.
- Pocket Estuaries are an important stepping stone. There has been a 89% decrease in pocket estuary habitat in Skagit Bay alone (Beamer et al. 2003)
- The Skagit River has diked flow into two conduits instead of a large number of channels. This has greatly reduced freshwater/marine mixing and sediment flux to the coasts. Channelization has also greatly limited migration corridors.
- Conclusions: 1) Climate change impacts will add complexity to ecosystems already affected by human activities 2) Dynamic ecological interactions require improved understanding of spatial/temporal variability 3) We need baseline and environmental variability data, monitoring to evaluate change and test models public interest and engagement in process.

Question: Was the Skagit reconstructions of 1880s done by Brian Collins?

Eric Grossman: Yes, he has a large presence on web. This is a good way of understanding the template for climate change today.

Question: How easy or difficult is it to restore eelgrass?

Eric Grossman: Eelgrass restoration efforts have largely been ineffective, however, there is a new study being conducted in the San Juan Islands using a seed-buoy technique. I was invited to help investigate. Recruitment is highly susceptible to many environmental issues. I am not sure how successful restoration efforts will be.

Comment: About eelgrass Aquaculture Opportunity Studies, Ron Thom addressed this. He found it was almost impossible to directly seed eelgrass. Instead, he has tried creating a favorable biological/chemical environment so that the eelgrass starts growing on its own.

Eric Grossman: Yes – it may be almost impossible to reseed.

Comment: The more we commit to infrastructure along the coast, the more we stress habitat in addition to our own vulnerability.

Eric Grossman: There are many things that we could do to return the system to a more “natural” state of processes. We could restore more equitable distribution of sediment and water fluxes to the coast through an increase in the number of smaller distributaries.

Comment: I think you are soft pedaling these issues. I think we can translate these changes into economic impacts. If we translate the impacts into \$\$\$\$\$, I think the economics will speak louder than the habitat loss.

Eric Grossman: It is tricky. We need to understand how to restore habitat before we return acreage. We need to return the “normal processes”. Many scientists and resource manager are working on it.

Question: What is the tradeoff between existing erosion decreasing nutrients and sea level increasing nutrients?

Eric Grossman: The USGS is looking at sediments to understand the quality/amount of nutrients reaching sites. There will be information coming in from these geochemical studies including biomarkers to develop proxies for eelgrass abundance to examine how the type, amount, and quality of nutrient reaching estuarine habitats has changed with human land-use activities, and how these affect ecosystem function. There is a salinity-organic decay feedback on marsh decay with sea level rise and marine water inundation.

Question: Does the USGS have an outreach program? How can we transfer existing knowledge and technology to the local communities?

Eric Grossman: In the Skagit, the USGS has been working for 2 years. There are many people involved. It is time for a Skagit Delta conference or workshop to get people together to discuss science goals, results and restoration recommendations. We should have a website in a couple of months.

Comment: There is a conference in Victoria going on right now about fisheries ecosystems and climate change. We should look for the proceedings to find out more about climate change impacts on fish.

Burr Stewart, “Summary, Conclusions, Questions”

Burr reminded us to brainstorm and get our ideas focused and on paper over lunch so that we could have a productive afternoon discussion.

Summary of Afternoon Session

Burr Stewart, “Welcome and Introduction to the Afternoon Format”

Burr started us out with an analogy for climate change. If you had a fire department and a building inspector, you would be prepared. We need both fire code inspection and fire fighters – that’s what this conference helping us develop.

Mark Foutch, “The Policymaker’s Challenge: Turning Science into Action”

Mark is the Mayor of Olympia. He has served on the Olympia council for 14 years and has been involved in many regional, state, and national issues affecting cities. He is currently Vice President of the Association of Washington Cities and represents cities on the Governor’s Emergency Management Council.

He offered the perspective of local elected officials, most of whom are part-time, and confronted with a great variety of day to day issues that make it difficult to focus beyond the current year, let alone deal proactively with long-term strategies, especially those where the facts aren’t widely accepted.

Olympia’s location was the first place where American pioneers, coming north from the Columbia, struck navigable salt water, giving reliable access to ocean transportation. Early seaborne commerce caused the first United States Customs house to be located there, so Governor Stevens established his territorial capital there in 1853. Despite recurring political challenges Olympia was able to retain that status since statehood in 1889.

While the City now extends over five square miles, mostly well above sea level, its heart and soul are still downtown. That original low-lying peninsula was expanded around 1900 using dredge spoil from deepening the shallow harbor channel. Consequently much of downtown is just a few feet above current high tide and the west edge of downtown has experienced flooding on occasion when Capitol Lake (an artificial impoundment of the Deschutes River) experiences high inflows from winter rains coincident with extreme high tides and northerly winds on Budd Inlet’s west bay. Not all of the downtown is currently at risk from projected levels of sea level rise. The terrain rises steadily from 7th Avenue south and the State Capitol campus stands well above the old downtown.

Olympia has big plans and dreams for its downtown. Under the City’s GMA comprehensive plan, downtown is zoned for hundreds of multifamily housing units, and the City has made significant efforts to attract developers of mixed-use housing/commercial buildings as well as new State office buildings. Compact downtown development reduces impacts on traffic, enabling people to get along with fewer car trips. But the most underdeveloped parts of downtown are on the lowest-lying, former industrial land. This is just one example of how two policy goals (adapting to climate change, GMA principles) can conflict, introducing political “friction” into efforts to respond to a sometimes-controversial long-term threat.

The Olympia City Council recognized the potential significance of climate change and sea level rise as early as 1990. The policy issue was assigned to Public Works, which was then the building permit

center as well as responsible for all major city infrastructure. A 1993 study of sea level rise impacts on the downtown predicted a net increase (combining land subsidence with actual rise in sea levels) of 1-3 feet per century. Significant parts of the downtown, including key infrastructure such as the sewage treatment plant, would be threatened, along with Olympia's main water source at McAllister Springs, in the Nisqually watershed, just three feet above current salinity levels.

City policies flowing from those early steps followed two basic paths: Reducing the impact of City operations and the Olympia community on global warming, and preparing downtown for sea level rise.

Many of the actions taken might have been done for other reasons; or they achieved many goals besides those relating to climate change and sea level rise: City energy conservation saves public money; controlling building heights along the waterfront preserves a feeling of openness; planting trees helps the public accept more-dense residential development, necessary under GMA planning; public information, education, and volunteer opportunities raise awareness of multiple issues including climate change. And moving the McAllister aquifer withdrawal point upgradient would eliminate contamination threats from surface water and possible accidents on the nearby highway and railroad main line (Department of Ecology water rights transfer still pending after 10 years).

For any problem brought to elected officials' attention, their basic questions in response can always be categorized as "How Big Is The Problem?," "How Much Time Do We Have?," "What Resources Do We Have Now?," and "What More Do We Need?" Sea level rise is no different.

For the first two questions, our initial study assumed a relatively modest amount of sea level rise steadily over a long period. This would seem to be "do-able" with resources available to us locally: Planning, zoning and development standards, locally-funded infrastructure improvements augmented by State and Federal grants. But is our assumption correct? If the amount and/or rate of sea level rise is going to increase rapidly, State and Federal assistance will become vital—particularly in the realms of science and political validation for local efforts.

What is "rapid" in policy terms? Consider this example: Urban and suburban Washington State's voters became alarmed about the effects of rapid population growth on their quality of life in the late '70s and early '80s. That resulted in the 1990 Growth Management Act. The State Office of Financial Management would provide population growth planning targets to the affected jurisdictions. Early implementing places like Olympia and Thurston County adopted their comprehensive plans by 1995; others have yet to adopt satisfactory plans. And that was when the public generally agreed on the threat, and policies to meet it. I'd suggest that, while public awareness and acceptance are increasing, sufficient political support does not yet exist for individual local governments, acting independently, to implement more than modest preventive measures to deal with sea level rise.

Most of Olympia's "prevention" actions to date are noncontroversial, partly because they satisfy other goals as noted above. These are "easy wins" but have little real impact on climate change or the City's ability to respond to sea level rise. We have engaged in some "adapting/protection" by following FEMA's redrawing of the downtown flood insurance contours: We now require an additional foot of foundation on buildings in that area. Other measures might be to require the bottom floor of new buildings to be parking only—but that conflicts with our goal of a pedestrian-

friendly downtown, which calls for visually-interesting activities like retail display windows at sidewalk level.

Fortunately, much of Olympia's waterfront is in parkland or in other single public ownership—the Port of Olympia occupies the entire northern section of the downtown peninsula, including much of the fill area. But implementing an “abandon/retreat” strategy would still encounter significant economic and political opposition in the absence of clear scientific evidence and strong policy direction from higher than local authority. After all, local officials are not guaranteed tenure of office!

GMA gave local governments, whether they wanted it or not, “political cover” to implement significant changes in land use, transportation, and infrastructure funding, often in the face of emotional opposition from current residents, organized neighborhoods, and development interests. A general acceptance that there was a problem, and general understanding of necessary measures, often turned to opposition when individual interests were at stake. State action, in effect a “GMA” for sea level rise, is needed if local governments are to have a realistic chance of taking timely action beyond the “easy wins.”

Prevention is cheaper and more effective than remediation. And if sea level rise overtakes the nation and the world before we are ready, there will be zero chance of outside resources sufficient to help local governments respond effectively. That's why Mark was so encouraged by the recent report on climate change by the Puget Sound Action Team, out of the Governor's office, and the resulting media coverage.

Question: Did you consider setting back the houses in Olympia?

Mark Foutch: Individual houses are not in downtown areas that are vulnerable to sea level rise. However, they want to put it more multiple-unit houses in downtown to minimize impact. There is a conflict between reducing vulnerability to climate change and mitigating against it by promoting high density housing in the urban core.

Question: Could you turn Capitol Lake into an estuary?

Mark Foutch: There is a commission working on understanding the impacts of removing the dam and letting the Deschutttes River return to its natural course. The dam forming Capitol Lake, and the recent Heritage Park project, have added some additional flood protection to the west side of downtown.

Question: Do you have trouble with salt water intrusion?

Mark Foutch: For the sewage treatment plant which is located downtown, there is now increased water pressure meaning that you have to pump harder. Even if the peninsula were diked, deeper water at high tide would require increased pressure for the pumping of treated effluent. However, this might be mitigated a bit by tide timing.

Question: Are there hazardous materials in Olympia?

Mark Foutch: The Cascade Pole site on the Port property is a “recovering” EPA-designated contaminated area that impacted water quality. Sea level rise could require higher dikes or stronger sea walls around the area being recovered and treated. Otherwise, there is no very large hazardous materials storage such as fuel tanks. Much of that sort of risk was removed as the original industrial downtown waterfront was converted to recreational uses.

Question: Did you consider accelerated bluff erosion?

Foutch: The land around the harbor is all in public ownership. It's primarily parks. This serves as a buffer. However, the state capitol is on a bluff, but well set back from the lower downtown elevation. Changing Capitol Lake to a tidal estuary might have impacts on that bluff, however. This is one of the factors the study should address.

Question: How did you manage to extend wetland zoning?

Mark Foutch: We have a committed and engaged community. It is easy to be an environmentalist and get things done in Olympia. It's very rewarding.

Panel Discussion

Moderator: Burr Stewart, Strategic Planning Manager, Port of Seattle

Panelists:

Sarah Brace, Science Liaison, Puget Sound Action Team

Douglas Canning, Washington Department of Ecology

Mark Foutch, Mayor City of Olympia

Eric Grossman, Western Coastal and Marine Geology Program, United States Geological Survey

Alice LeBlanc, AIG-Environmental

Randy Shuman, Ph.D., Science and Data Management Manager, King County-DNRP

Jon Sloan, Senior Ecologist, King County-Dept. of Development and Environmental Services

Purpose and Structure of the Panel Discussion

The purpose of the panel discussion was to brainstorm lots of adaptation strategies, to discuss the implications of different strategies and then to prioritize the extensive list. The format was to have comments from individual panel members and lots of questions and discussion from the coastal breakout session attendees. The panel discussion lasted from 1:45 to 3:00 pm.

“Open Discussion of Adaptation and Response Alternatives”

Burr started by asking some questions: Do we want to try fight or flight adaptation strategies? Essentially, the question for sea level rise is do we protect, accommodate or retreat? Perhaps we should alter FEMA maps – if we alter the flood plain, changes could trickle down to existing regulations. He then encouraged lots of discussion and idea generation in the session.

Doug Canning: Changing the FEMA maps will be difficult – their mandate is to base modeling and projections on the historical record. Changing this FEMA mandate is a legislative matter.

Alice LeBlanc: Hurricanes this year have influenced the historical record. The Insurance Information Institute is adjusting this year based on the fact that 6 of the most expensive hurricanes in history occurred in the last 4-5 years including Katrina (#1) and Wilma (#4). There is intense discussion in the insurance industry about using the historical record. The reinsurers – those who hold the ultimate responsibility for paying out the claims– are saying they need more money. Changing the basis for rates to more heavily weight recent events and add projections of future events could provide the rate increases the reinsurers want.

Audience question: Is there a way to preserve natural systems more than we do now? Can we try some type of lifecycle permitting? In other words, is there a way to base regulations on how long buildings stand? If the buildings are not going to be around when sea level rises, then it will be hard to enforce restrictions.

Burr Stewart and Dong Canning: This question could be addressed by the concept of rolling easements which rose out of Jim Titus' paper published, I believe, in the Maryland Law Review.

Audience comment: Local governments need to take a comprehensive look at the future. They should build plans and knowledge with the community with the help of overarching state guidance.

Audience comment: It will be very important to educate the community. Building support will require going from community-to-community.

Audience comment: Climate change creates urban problems too – we need to deal with construction regulations issues.

Audience comment: What if we had money to buy undeveloped land? We could focus on land that would serve as a buffer for sea level rise or other climate change induced problems.

Audience comment: We should do more costs studies. If we assess the value of the natural resource, we will have a stronger case for protecting them. If you haven't seen it, you all should at the UN's Millennium Ecosystem Assessment (www.maweb.org). The MEA is a 5-year project to look at the value of natural resources worldwide.

Audience comment: Could we have a fee that we collect over a long buildup period (i.e., a climate change rainy day fund)? We cannot predict a lot of impacts. With a rainy day fund, we could build up an investment to solve the unknown unknowns as they become apparent.

Audience comment: Many ESA species are not recovering. It will be hard to separate if their extinction had to do with direct impacts of people or Puget Sound warming. We need to prioritize our restoration strategies. We need to think hard about how to make already vulnerable species resistant to climate change impacts such as sea level rise.

Audience comment: We need to do public relations and public education. Support for action in Olympia came because of education. We also need to fund the utilities to make sure they can do public relations/education campaigns.

Alice LeBlanc: It is clear we need to talk about adaptation given the lifetime of the greenhouse gases we are emitting. But, we also need to talk about mitigation efforts. Adaptation and mitigation efforts are a two-way street. Perhaps we could impose a gas tax to fund the adaptation? We need strategies that link adaptation and mitigation together.

Audience comment: We need public education to identify stakeholder concerns. We also need to resolve conflicts between different agencies.

Audience comment: We should consider market-based adaptation. For example, we could force insurance companies to give incentives (lower rates) to those who are adapting and reducing vulnerability.

Audience comment: Can we regulate invasive species?

Audience comment: Bluff erosion and development will be a problem. We need greater set backs.

Audience comment: We could purchase coastal easements. We also could put higher taxes on non-renewable energy so that the real costs are included.

Audience comment: We should prioritize toxic problems understanding climate change.

Audience comment: We should use economic arguments.

Audience comment: We need to look at the effects of sea level rise on transportation corridors – such as low-lying roads and train tracks.

Audience comment: We need to organize the energy from this conference.

Audience comment: If we make new regulations, they should be mandatory.

Audience comment: Education efforts should include the contractor and real-estate industries too – not just the general public.

Audience comment: We need to measure the state of the ecosystems. It will be critical to have baseline measurements and sustained monitoring.

Audience comment: All of this talk about new regulations is great. But, we need to make sure we have enforcement of current regulations too.

Audience comment: We need to look for the low-hanging fruit. In other words, what actions will be highly visible and successful – this is where we should start.

Audience comment: We need to figure out how to make environment up on people's top 10 list. Climate change is not a linear problem. Decision making, science, and public opinion need to interact and feed each other.

Audience comment: We need to increase communication between different sectors: regulatory adaptations, education, and science all require money.

Audience comment: If we minimize impacts that mimic climate change (e.g., warm industrial effluent into water) – that could help reduce the total impacts in the future.

Audience comment: We need to move away from project based science towards system-based science. We need budgets for system-wide infrastructure.

Audience comment: We need to see communication across different levels of governments – state to county to city to individual houses.

Doug Canning: I will try to summarize what I think the three priorities are that have emerged from this discussion: 1) Education of policy makers, the general public, insurance and construction industries and the school teachers 2) Policy-making through incentives to get people away from the vulnerable coastal areas 3) Science that includes both original research to improve understanding, and long-term monitoring

Burr Stewart: Great. Let me see if I can fit these into our priorities for the plenary. All of the priorities discussed by Doug intersect making it very difficult to make a linear adaptation strategy. Science, education and adaptation will all interact. The first point was a focus on public outreach. We need to better display and share science and data. I think it would be nice to have comprehensive websites that go from the state to the local level. We need to educate many different groups. The second was the focus on minimizing development in vulnerable areas. For example, we need to focus on key ecological areas. We heard today that some are 80-90% destroyed/impacted. We need to get human development ready for sea level rise and increased flooding. We could do this with levees, retreating and rebuilding far away and defining zones where you cannot build. The last priority was continued science and collection of information. We require monitoring and measuring of ecosystems now. We need modeling using lots of climate change scenarios, not just one. With risk assessment information, we could help inform the areas where plans would do the most good and are the most essential. The goal is to have a more holistic systems management.

Summary of Report to Plenary

Top three priorities (in no particular order of importance):

- **Priority 1:** Improve and increase public education and outreach efforts to aid in the transfer and translation of technical information to the general public.
- **Priority 2:** Develop incentive-based strategies to discourage development in threatened coastal areas.
- **Priority 3:** Adequately fund scientific monitoring and modeling efforts, with an emphasis on systems-based approaches.

General Discussion

At the beginning of the session, Burr suggested that the flip chart notes should be available to those who have ideas but do not have time to voice them. Thus, these flip chart notes were written by individuals from the coastal breakout session throughout the morning and afternoon and do not represent a consensus view of the group.

- Mobilizing Organizations: Which ones are helping? Which are obsolete? Which do we need to create?
- Need local/regional measurements and monitoring of environmental conditions, socio-economic values, and processes to test/develop models for forecasting change in coastal systems.
- Low impact development on shorelines need tax write-off to create financial incentives to preserve wetlands/shorelines.
- Port Townsend Marine Science Center
- New dock project >> restored eelgrass beds – being monitored by Battelle Marine Lab
- Reconsider transportation needs to help avoid saltwater intrusion to rivers from dredging (+ global warming?)
- Mitigate temperature inputs at all sources: stormwater, industrial, municipal, desalinization outfalls. BMPs to reduce temperatures.
- Under GMA, OFM tells counties how many people to plan to accommodate in the next 20 years. The county and city comprehensive plans then proceed under that assumption. With sea level rise, the State could validate and mandate individual communities' efforts by giving them a common planning assumption for the amount and the timing of sea level rise, then require them to show how they plan to respond (Adapt/Accommodate, Abandon/Retreat) according to each community's particular situation, needs, and resources. Grant preferences would be to communities who took early, positive steps to address the problem.
- Emphasize riparian habitat improvements with vegetation that will offer shade but also minimally impact view corridors.
- Plan for rebuilding/relocation of coastal transportation infrastructure (e.g. BNSF tracks along Puget Sound). In case like this, relocation has big environmental benefits (and BIG costs).
- Revise floodplain maps and incorporate into building regulations.
- Preserve natural systems as “buffer” against possible storm damage.
- Use climate change scenarios in FEMA mapping.
- The permitting process needs changes in coastal areas.
- At the city level, develop comprehensive vision of coastal development and plan accordingly.
- Strengthen education and community outreach efforts.

- Establish a “rainy day” fund from some sort of State-enacted fee and use this money to study sea level rise, fund planning and adaptation efforts by local governments, etc.
- Develop contingency plans for endangered species.
- Consider changing habitats in restoration plans.
- Increase/improve public education efforts about climate change and how governmental agencies are responding.
- Examine the role of media in education/outreach of public.
- Note that adaptation efforts may eventually not be able to keep pace with climate change. Underscores importance of reducing greenhouse gas emissions, and future impacts, ASAP.
- Develop a way for government agencies to better identify stakeholders’ concerns about climate change in the coastal zone.
- Examine/address conflict between governmental agencies with respect to climate change policy/actions.
- Provide incentives for individual/private coastal zone growth management. Examples include providing incentives for coastal homeowners to seek alternatives to bulkheads, seawalls, and other coastal armoring.
- Protect against invasive species (ballast water regulations).
- Establish a fund to purchase coastal easements.
- Prioritize shoreline projects by testing of sediments/soil for toxicity.
- Understand all of the economic arguments of sea level rise adaptation.
- Reroute transportation corridors away from coastline sooner rather than later (e.g. BNSF).
- Establish an organization to keep talk of adaptation moving forward.
- Regulations need to be mandatory, not voluntary.
- Develop community outreach.
- Fund monitoring for baseline measurement/monitoring efforts.
- Enforce current zoning regulations.

- Provide incentives to reduce vulnerable development and to avoid adverse impacts of sea level rise/coastal erosion.
- Identify “quick wins”/”low hanging fruit” to get adaptation process moving.
- Establish targeted public awareness/education campaigns.
- Improve/increase communication efforts between decision-makers, scientists, and the public.
- Link mitigation to adaptation.
- Fund efforts to study water inputs to Puget Sound.
- Move to systems-based analysis of the Puget Sound region.
- The PSAT Report-2005 has many suggestions and plans per coastal actions.
- ACCURATELY simplify technical information for public consumption. Too often, scientists are not involved in the simplification of their messages/results, and, as a result, information becomes inaccurate/distorted/lost in the translation. This results in a misinformed and confused public.