

*Printed from Minding the Coast: Its Everybody's Business  
Proceedings of the 16<sup>th</sup> International Conference of  
The Coastal Society, Williamsburg, VA USA*

Merging Coastal Research with Land-use Planning for Improved  
Coastal Hazard Management

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Abstract

The emergence of an erosional trend within the Columbia River Littoral Cell has motivated the investigation of coastal processes to serve as baseline data for predicting future shoreline conditions. The Southwest Washington Coastal Erosion Study, a five year regional scale research study jointly directed by the Washington State Department of Ecology and the US Geological Survey, is responsible for collecting and analyzing data as well as developing useful products for end-users to assist in the land-use planning decision making process. A Coastal Information Clearinghouse has been created to facilitate the transfer of knowledge between the study and identified stakeholders, to archive and distribute research results and develop end-user products. The goal of the Clearinghouse is to facilitate the merger of scientific data with land-use planning to improve hazard management within the Columbia River Littoral Cell. This includes a coordination of efforts with state and local government agencies and an overarching educational component to develop an awareness of coastal hazards and elicit appropriate management responses to current crises and the long-term planning process.

Background

Erosion throughout the region is a relatively new but major management consideration for state and local governments. Historically, the northern Oregon and southwest Washington coasts have developed on a rapidly accreting shoreline, with some areas experiencing shoreline progradation in excess of 1 km over the past century. Resource management issues dealt with the problem of accreting and drifting dunes that interrupted views and limited public access. Traditional coastal erosion and development hazards in the region were treated as localized problems with negligible regional impacts. The coastal management response to erosion in this region has not been well defined and has been based on general policies with little substantive basis.

During the past decade, the situation has rapidly changed, and coastal communities are experiencing erosion at an unprecedented rate. Hazards associated with coastal erosion problems have prompted expensive engineering proposals to combat natural forces. Beaches, once nourished with sediment from the Columbia River, are moving towards a new equilibrium resulting from a depleted sand supply. Although there is much speculation about the causes of erosion, virtually no scientific or technical data existed to make informed management decisions. In response to escalating coastal erosion problems, the Washington State Department of Ecology and the US Geological Survey Coastal and Marine Geology Program has embarked on a five-year regional scale coastal

behaviour study of the Columbia River Littoral Cell, stretching from Tillamook Head, OR to Point Grenville, WA (Figure 1). Several distinct areas within the littoral cell, identified as “hot spots” in Figure 1, have exhibited severe erosional trends and served as the impetus to begin a regional scale investigation. Ocean Shores, WA (Point Brown), for example, is an area that has prograded over 2 km since the completion of the Grays Harbor north jetty in 1917. However, erosion in excess of 20 m has been documented over the past year.

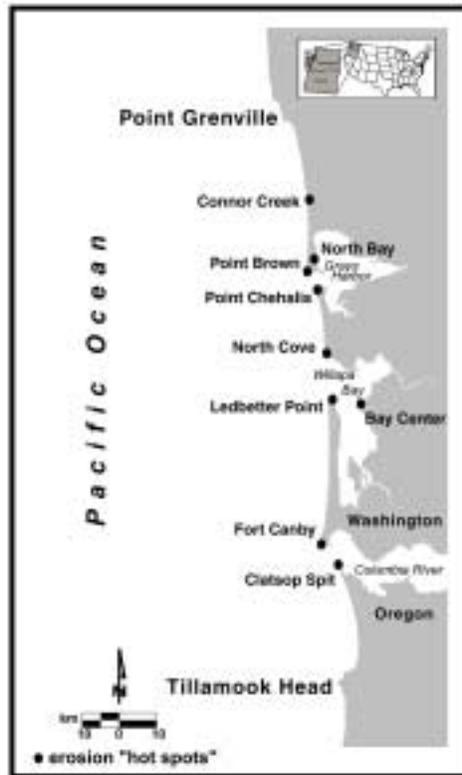


Figure 1. Erosion “hot spots” within the Columbia River Littoral Cell

The regional scale study will examine potential links in the coastal response between established “hot spots” throughout the littoral cell. Efforts to monitor the movement of sediment throughout the cell will enable model application for future shoreline position prediction. One of the primary management problems facing planners, natural resource managers and researchers is the lack of monitoring data for the littoral cell upon which predictions and coastal management strategies can be formulated. The development of a knowledge base in conjunction with the Study, provides the opportunity to integrate the scientific understanding of the coastal zone with future management decisions, ensuring the long-term economic and environmental sustainability of the Columbia River Littoral Cell.

#### Coastal Monitoring & Analysis Program

The merger of the technical knowledge base developed through the Study with state and local coastal management occurs within the framework of the Coastal Monitoring &

Analysis Program (CMAP). The research program has milestones intended to provide useful and effective products for coastal management applications and for the integration of science and management. These milestones include:

- Develop a Coastal Information Clearinghouse to integrate Study results with planning and management efforts and to serve as a reference for future coastal research.
- Develop and maintain a project web site to highlight ongoing research efforts and assist in the transfer of data products.
- Facilitate community participation, technical transfer, educational outreach and information systems integration to ensure research efforts and deliverables have local value and provide the necessary technical information for decision-making.
- Develop a Geographic Information System (GIS) database to enhance spatially-based management and facilitate a collaborative local GIS access plan.

These milestones will provide a foundation for improved coastal management at the state and local level. The components of the research program are synthesized through outreach and product development efforts geared toward the end-user. The transfer of knowledge is accomplished through an information clearinghouse initiated to facilitate information flow to a variety of stakeholders. The information, products and systems developed during this project will be the deciding factor on how the Columbia River Littoral Cell is managed and developed into the next century.

CMAP, housed within the Washington State Department of Ecology's Shorelands and Environmental Assistance Program, consists of three major activities, the Southwest Washington Coastal Erosion Study, a beach morphology monitoring program and technical assistance for coastal communities. Figure 2 diagrams the information flow, initiated by CMAP, continuing to the Coastal Information Clearinghouse and on to the end-user. The initial flow is guided by the goals of CMAP which serve as the basis for the activities that supply the Clearinghouse with an array of information. Transfer of information to the end-user is accomplished through a number of outreach and product development efforts.

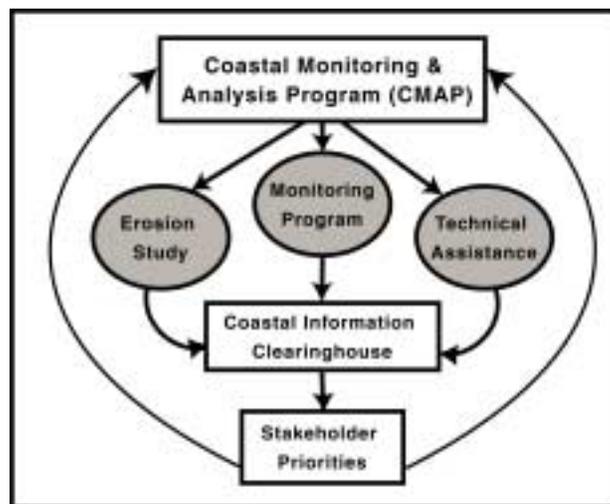


Figure 2. Coastal Monitoring & Analysis Program information flow schematic.

### The Coastal Information Clearinghouse

Data and information collected by the Study will be managed by the Coastal Information Clearinghouse, established to archive research results for development and distribution. The Clearinghouse contains data from a number of sources, including monitoring data, shoreline change analysis, geological investigations, the study library and presentation graphics. Specific goals of the Coastal Information Clearinghouse include:

- Improve the public awareness of coastal processes and hazards.
- Assist in the identification of appropriate coastal erosion management measures.
- Translate Study results into coastal management tools for state and local governments.
- Facilitate technical transfer, educational outreach and information systems management and integration.
- Integrate scientific information with the decision-making process.

End-user products, developed by the Clearinghouse, will foster and maintain interest in the study, improve awareness of research results and increase coordination among state and local natural resource managers.

Three stakeholder groups have been identified for product and research results dissemination, including the local, statewide and State and Federal agency audiences. The local audience consists of city and county officials, resource-based industries, coastal property owners and proprietors. The statewide audience is comprised of citizens, legislators, consultants, educators and non-profit organizations. Finally, the Federal and State agency audience includes natural resource agencies such as the US Army Corps of Engineers, Department of Ecology, Environmental Protection Agency, Washington State Department of Natural Resources, Washington State Department of Fish and Wildlife, State Parks and Recreation Commission, Department of Community Trade and Economic Development, US Geological Survey, US Fish and Wildlife Service and National Oceanic and Atmospheric Administration.

A list of contacts has been developed from the identified stakeholders to serve as the basis of communication for the Study. Periodic correspondence is distributed to contacts based on specified areas of interest; topics include technical reports, educational materials and map mailings. Although anyone is eligible to receive all study mailings, data and products are developed for specific audiences with varying levels of technical expertise.

### Outreach, Education and Product Development

An integral element of the overall outreach effort is the establishment of a link between CMAP and the end-user communities through the development of useful data products and educational materials geared towards a lay audience. The initial step of this process was to create a database to serve as an educational and research tool by archiving data resources and maintaining a Study library complete with publications, journal articles, books, photographs, maps and videos. Subsequent outreach products target specific audiences with varying levels of technical expertise. In general, the outreach program is a multifaceted process intended to educate the end-user through the identification of appropriate response measures to coastal crises and land-use planning efforts.

An Erosion Study Advisory Committee consisting of representatives from the coastal counties, local officials and the Southwest Washington Coastal Erosion Study staff has been formed as the primary link between the Study and local communities. The committee serves a number of roles, most prominently, as an avenue to communicate ongoing Study efforts and to address local conditions and concerns. In addition, committee members serve as points of contact for local issues and provide input in the development of useful products. The committee meets on a bimonthly basis at locations throughout the littoral cell. Typically these meetings include an update of current research activities, input from local representatives and a discussion of new findings and conclusions. Among the goals of bringing this committee together is to assemble a group of individuals with the ability to influence natural resource management decisions on a regional scale, identify emerging coastal issues and appropriate management responses and to provide examples of the diversity of the coastal zone within the littoral cell. The study will be reliant on future intergovernmental coordination to implement a successful long-range regional scale plan.

The first annual Southwest Washington Coastal Erosion Study workshop was held in March 1998 in Ocean Shores, WA to present initial findings and results to the end-user community. The workshop assembled a diverse group of natural resource managers at all levels of government to present an in-depth overview of the Southwest Washington Coastal Erosion Study and a “state-of-the-knowledge” of the Columbia River Littoral Cell and to discuss the integration of scientific knowledge with land-use planning and resource management. Larger public forums provide additional opportunities to communicate with a more general audience. The Beachcomber’s Fun Fair and Willapa Science Conference are two examples of such events. Sponsored by local entities, these events target lay audiences in an attempt to spur interest in coastal and environmental issues. Typical Study involvement comes in the form of presentations, posters and panel discussions. Information is geared toward non-technical audiences, with an emphasis on developing an awareness and understanding of coastal processes and associated hazards.

In addition to the scientific publications documenting Study data and results, educational reports, intended for a non-technical audience, are being developed. A series of focus sheets illustrate the history and motivations for the study, as well as specific research components. The first of the research oriented focus sheets describes the work of the beach morphology monitoring program designed and initiated by the study. Additional focus sheets will highlight Ground Penetrating Radar (GPR), seismic radar survey collection, onshore geological investigations and data transfer opportunities. To assist in the development of increased understanding of the coastal zone, a glossary of coastal terminology was created. The glossary includes terminology used in coastal science, engineering, geology, management and the technologies that characterize, measure, describe or quantify the physical properties, processes and changes in the coastal zone. The intent of the glossary is to provide a non-technical audience with a reference for reading and understanding professional journals, project proposals or data analysis.

Currently, two virtual products are under development, including a Study web site and an interactive “field trip”. The web site contains current research activities, results and conclusions and contact information for Local, State and Federal partners. E-mail links to CMAP staff and a response form soliciting comments encourage viewers to communicate coastal experiences and individual priorities to serve as additional input into the flow of communication. An interactive virtual “field trip” of the Columbia River Littoral Cell will highlight the dynamic nature of the regional coastal system by incorporating study data and analysis as well as pictures, video clips and other educational materials to help foster an understanding of the coastal system and its associated hazards.

The implementation of a beach morphology monitoring program provides an invaluable source of data for planners and resource managers. An annual report will be published to present the “state-of-the-beaches” within the littoral cell. The document will discuss seasonal fluctuations in beach form, compare current results to previous data and look for trends in sediment transport and associated shoreline change. The long-term product developed from these reports will be a morphodynamic vulnerability index to evaluate coastal hazards within the littoral cell. The index will identify high hazard areas within the region to enable proactive planning measures and limit the exposure of existing and future development to risk.

#### Conclusions

Historically, the prograding beaches throughout the Columbia River Littoral Cell have limited the development and implementation of coastal management policies to deal with hazard management. Today, however, this rapidly developing Pacific Northwest coast is experiencing erosion at an unprecedented rate, subjecting property and infrastructure to increased risk from coastal hazards. A severe lack of information about the coastal processes effecting this change has made it increasingly difficult to make scientifically based management decisions. The Southwest Washington Coastal Erosion Study has been established in an attempt to develop a regional understanding of the coastal behaviour observed within the littoral cell. Data collection and analysis efforts are two major components of the study. In addition, the development of the Coastal Information Clearinghouse to present and archive knowledge generated through the study enables data development and distribution to assist in management applications. Stakeholders have been identified, and processes have been established to produce and distribute educational materials and assist in the transfer of technical knowledge to end-users.

#### Acknowledgements

Funding for the Southwest Washington Coastal Erosion Study is provided by the United States Geological Survey and the Washington State Department of Ecology. Additional support is provided by the NOAA Coastal Services Center.

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