
FLOODING

Action Plan

Priority Problem

The interaction of human activities with dynamic natural systems has increased the magnitude, frequency, and impacts of flood events. These events affect water quality through increased erosion and co-mingling of flood waters with industrial and agricultural products and waste products. Each time a significant flood occurs, water quality and aquatic wildlife are negatively impacted as contaminants enter the system.

Goal

Improve Floodplain Condition

Optimize the Watershed’s hydrologic characteristics to move water from the uplands to the estuary decreasing conflicts with human habitation or development while improving the ecosystem. Specifically, identify, design, and implement projects that delay runoff (e.g., flatten storm hydrographs), increase floodplain storage capacity, and facilitate drainage where appropriate. Each of these projects will be done in a manner that is consistent with fish and wildlife habitat restoration and enhancement.

Goal

Develop and Maintain a Comprehensive Floodplain Management Plan

Tillamook County has adopted a comprehensive Flood Hazard Mitigation Plan (FHMP) to guide floodplain management in the County. As specified in the FHMP, comprehensive floodplain management requires the incorporation of land use planning, structural and non-structural floodwater control, and event-response strategies. The intent is to reduce the risks to life and property and enhance natural floodplain function, including the restoration of wetland, riparian, and aquatic habitat. The FHMP will be coordinated with all habitat protection and restoration projects in the Watershed. The FHMP must comply with federal and state laws, local ordinances, and the CCMP.

Objectives

Implement a GIS-based, unsteady state hydrodynamic model by year 2001.

Complete 20 projects within the two years following adoption of hydrodynamic model which:

- measurably reduce runoff rate in the Watershed's uplands (increasing interflow and ground water recharge, thereby reducing stream temperatures and increasing summer flows);
- improve drainage characteristics in the Watershed's lowlands (*e.g.*, connect sloughs and rivers to enhance fresh water exchange in sloughs);
- increase floodplain storage capacity in the Watershed's lowlands (*e.g.*, set back levees to increase floodwater capacity, increase riparian area, and create opportunity for sediment deposition); and
- improve the natural environment's capacity to withstand and benefit from flood events.

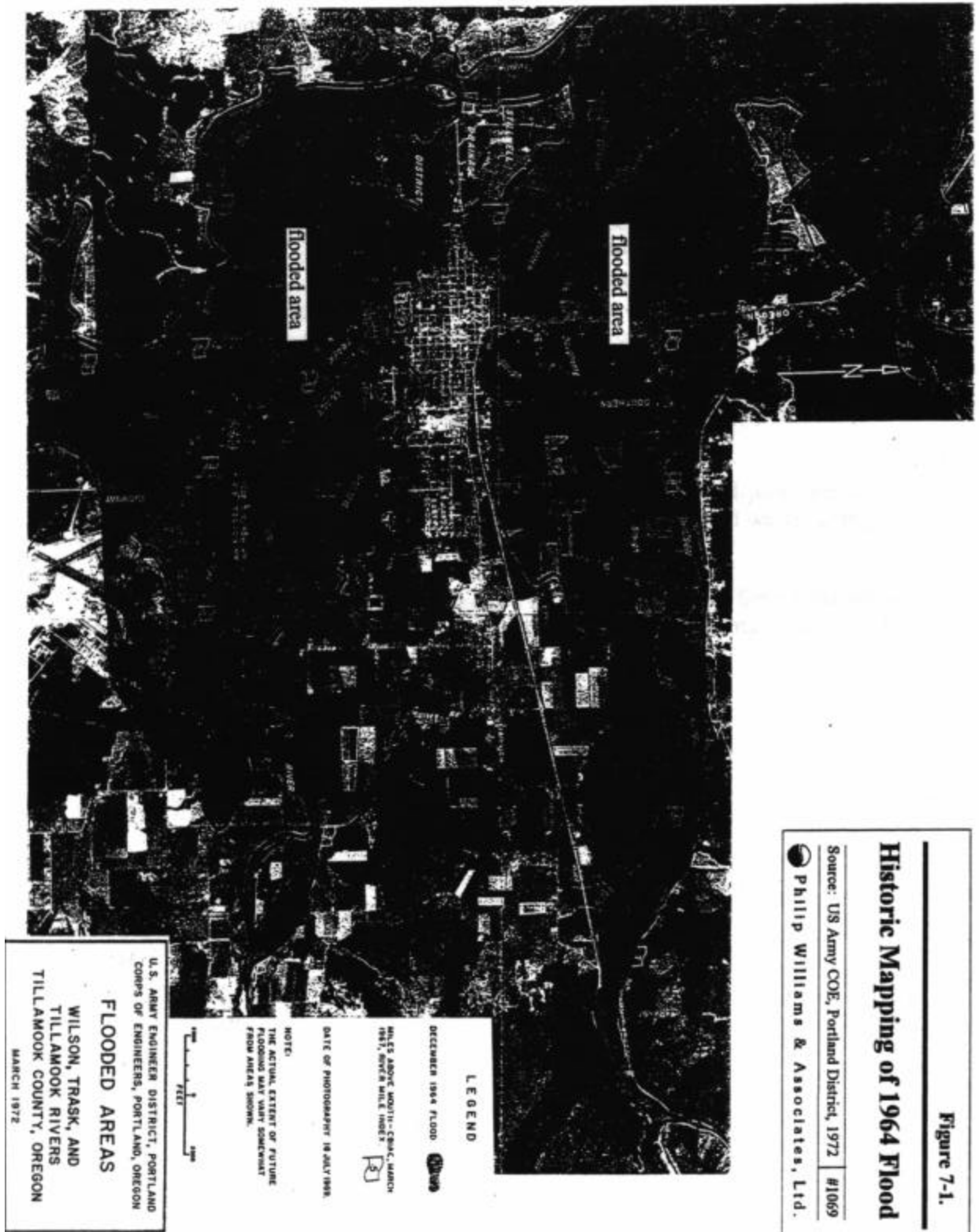
Raise at least 60 houses at least 3 feet above the 100-year flood elevation by year 2001, and other houses as resources permit.

Construct 10 livestock and equipment pads in flood-prone areas by 2001 to reduce pollution from petrochemicals and animal wastes during major floods.

Secure and/or remove known hazardous chemicals from areas where they pose a real threat to water quality during flood events by 2005.

Flooding Action Plan

- FLD-01 Develop a GIS-Based, Unsteady State Hydrodynamic Model
- FLD-02 Implement Watershed Drainage Modification Projects
- FLD-03 Elevate and/or Relocate Structures, Livestock and Equipment
- FLD-04 Update Existing Floodplain Map
- FLD-05 Regulate New Construction and Development in the Floodplain
- FLD-06 Effectively Clear Mapped Lowland Floodways and Floodplains of Hazardous Materials



FLD-01	Develop a GIS-Based Unsteady State Hydrodynamic Model
What	Develop a comprehensive computer model of the Tillamook Bay Watershed which combines watershed hydrology with floodplain hydraulics and tidal influence. Use the model to update the Flood Insurance Rate Maps, to understand and predict river flows, develop ecosystem restoration and enhancement projects, and to investigate project proposals that will reduce future flood frequency and severity.
Why	A detailed computer model is an analytical tool to predict river flows and flood elevations for current and potential floodplain configurations. The model will help planners evaluate the feasibility of flow modification projects described in FLD-02.
How (Who.¹When.²)	<p>The hydrodynamic model will be created as part of a COE feasibility study in the Tillamook Bay Watershed or as an effort of the Performance Partnership membership. Model results will help justify specific projects which the COE, the local sponsor, and other partners can undertake to reduce flood impacts and improve water quality in the Watershed.</p> <p><i>Step 1</i> Implement the COE Feasibility Study. (COE. By 2000.)</p> <p><i>Step 2</i> Assemble hydrologic and floodplain data required to complete a comprehensive flood model. (COE, SWCD, Performance Partnership. By 2000.)</p> <p><i>Step 3</i> Build and verify the flood model through detailed measurements of rainfall and river stage. (COE or Performance Partnership. By 2001.)</p> <p><i>Step 4</i> Identify projects that reduce flood impacts and improve aquatic habitat. (Performance Partnership, SWCD, Project Impact, COE. By 2001.)</p>
Where	The model and supporting data must be housed locally. The most appropriate locations are the Tillamook Coastal Watershed Resource Center or the Tillamook County Soil & Water Conservation District.
Lead Agency	Tillamook County SWCD.
Other Partners	COE, Performance Partnership, Tillamook County, ODF, NRCS, ODFW, DEQ, DSL, OWRD, USF&W, DOGAMI, NOAA, Philip Williams & Associates, Danish Hydraulic Institute, Spencer Gross, Tillamook County Flood Control Group.
Anticipated	Feasibility study: \$3,000,000, including \$500,000 for model

¹ Coordinating entity; ensures that identified partners are on schedule.

² By end of named year.

Cost development. A 50% local match is required, and although half of this may be in-kind services, this is still a serious obstacle for Tillamook County SWCD, the local sponsor. The Tillamook County Performance Partnership has requested financial assistance from the State.

Monitoring Monitor CCMP objective:

- Implement a GIS-based unsteady state hydrodynamic model by year 2000.

Regulatory Issues Permission to access private properties for floodplain survey.

Related Actions

- FLD-02 Implement Watershed Drainage Modification Projects
- FLD-04 Update Existing Floodplain Map
- HAB-03 Prioritize Upland Protection and Enhancement Sites
- HAB-04 Prioritize Floodplain/Lowland Protection and Enhancement Sites
- HAB-18 Prioritize Tidal Sites for Protection and Enhancement
- HAB-23 Update the Estuary Plan
- HAB-24 Reconnect Sloughs and Rivers to Improve Water Flow
- WAQ-06 Ensure Adequate Wastewater Treatment Capacity
- WAQ-08 Ensure Adequate Urban Runoff Treatment and Retention
- WAQ-12 Evaluate Shellfish Growing Area Classifications
- WAQ-13 Update Shellfish Management Plan Closure Criteria
- SED-06 Develop, Implement, and Enforce a Stormwater Management Ordinance
- CIT-01 Implement an Oregon State University Extension Watershed Master Series
- CIT-02 Implement Associate of Arts Oregon Transfer Degree in Environmental Studies
- CIT-08 Sustain the Tillamook Coastal Watershed Resource Center

FLD-02 **Implement Watershed Drainage Modification Projects**

What

Implement hydromodification projects in the Watershed to improve local drainage, enhance floodplain storage function, and/or modify the upland's runoff characteristics. Select and design projects based upon their ability to reduce conflicts between natural floodplain action and human development while improving aquatic habitat and water quality.

Design projects to create an integrated, watershed-scale approach to flood mitigation. Flood management will be addressed in a comprehensive manner rather than in the traditional fragmented fashion. The COE and SWCD Tillamook Bay and Estuary, Oregon Feasibility Study; FEMA Project Impact; USFWS Integrated River Management Strategy for Oregon; and the Tillamook County Flood Hazard Mitigation Plan will identify in advance areas where specific repair activities are permitted, to avoid damaging habitat during crisis flood fighting and repairs.

Specific flood management projects will include the following where appropriate:

- reconnecting rivers and sloughs,
- setting back dikes and levees,
- breaching dikes or installing structures that effectively open the floodplain,
- slowing water flow through stream channel and riparian improvements,
- building spillways, and other drainage structures,
- raising and/or moving structures from the floodplain.

Why

Flooding is a unifying natural process for all three of the original TBNEP resource management priority problems – water degradation, erosion and sedimentation, and fish and wildlife habitat loss – contributing to both their quality and impairment. The Flood of 1996 focused attention on flooding. To resolve the flood problems in the Tillamook Bay area, and also to solve the original priority problems, management efforts will need to balance multiple objectives: to reduce flood related hazards and damages, while minimizing the potential long-term environmental impacts and economic costs of flood control and floodplain management practices.

How (Who.When.)

Projects may be selected based upon insights gained through the computer model of FLD-01 or from local experience with past floods. Pilot projects based on past floods may begin before the watershed models are operational. In any case, project design criteria are the same.

Step 1 Secure easements or other access to lands where projects could alleviate flooding. (Tillamook County and Performance Partnership. By 2001.)

- Step 2* Design projects, carefully considering short- and long-term impacts. Emphasize water quality, natural resource values and flood mitigation. (COE. By 2001.)
- Step 3* Implement hydromodification projects. (Tillamook County SWCD and COE. 20 projects by 2005.)

Where Projects will be designed and implemented by the agency or entity that owns or manages the land in question. Example: The Partnership may work with the Tillamook County Public Works Department to prioritize, fund, and implement actions suggested by the COE Study.

Lead Agency COE.

Other Partners SWCD, Performance Partnership, FEMA Project Impact, NRCS, ODFW, NW Oregon RC&D, EDCTC, TCWRC, DEQ, DSL, OWRD, Tillamook County Flood Control Group.

Anticipated Cost Plan development administration: \$75,000.
Easements and implementation: unknown, site-specific.

Monitoring Complete 20 projects within the two years following adoption of hydrodynamic model.

Regulatory Issues Clean Water Act Section 404.
City and County Ordinances.
Oregon Removal/Fill Law ORS 196.800B 196.990.
Endangered Species Act, including Biological Opinion and Finding of No Significant Impact (FONSI).

- Related Actions**
- FLD-01 Develop a GIS-Based, Unsteady State Hydrodynamic Model
 - FLD-04 Update Existing Floodplain Map
 - HAB-01 Characterize Riparian and Instream Habitat
 - HAB-02 Assess and Map Riparian and Wetland Habitat
 - HAB-04 Prioritize Floodplain/Lowland Protection and Enhancement Sites
 - HAB-06 Protect and Enhance Lowland Riparian Vegetation
 - HAB-07 Protect and Enhance Instream Habitat
 - HAB-08 Protect and Enhance Freshwater Wetland Habitat
 - HAB-11 Encourage Protection and Enhancement on Private Lands
 - HAB-14 Ensure Minimum Stream Flows
 - HAB-17 Characterize Estuarine and Tidal Habitats
 - HAB-23 Update the Estuary Plan
 - HAB-24 Reconnect Sloughs and Rivers to Improve Water Flow
 - HAB-30 Support the Oregon Plan for Salmon and Watersheds
 - WAQ-10 Implement Temperature Management Strategies
 - WAQ-11 Implement Suspended Sediments Management Strategies
 - WAQ-13 Update Shellfish Management Plan Closure Criteria
 - SED-02 Implement Practices That Will Improve Sediment Storage and Routing
 - OPSW: DEQ-4S, 6S
DLS-9, 13, 26, 27
ODF-15S

FLD-03 Elevate and/or Relocate Structures, Livestock and Equipment

What

Reduce environmental damages and water pollution from flooding, and enable riparian enhancement. One effective method is to raise structures at least 3 feet above the 100-year flood elevation, incorporating hydraulically “invisible” foundation design. Another option is to relocate a structure to higher ground. If the owners are willing, flood-prone property can be purchased and permanently removed from eligibility for development. Livestock and equipment refuge areas (cow pads) can reduce damages and the potential for livestock and equipment to contaminate floodwaters. These pads are built high enough and large enough to provide adequate refuge for several days if necessary.

Why

Moving structures out of the floodplain offers many opportunities for habitat restoration and water quality improvement. Presently, many homes and businesses are inundated with sediment and contaminated waters during a flood. Elevating or relocating these structures eliminates these damages entirely. Livestock and equipment are a similar concern. Thousands of dairy cattle stood in flood water for 2 to 3 days during the floods of February 1996 and 700 died, with 600 injured or ill. Vehicles and equipment were also submerged and/or swept away. Economic damage and water contamination were undoubtedly severe. Cow and equipment pads minimize both problems.

Structural flood control projects now in place in Tillamook County do not adequately protect the Bay, people or their property. Further, these projects are expensive to build and maintain, and can do great harm to the natural environment and riverine function. The approach to repetitive flood damage now favored by the COE and the Federal Emergency Management Agency (FEMA) is to reduce the impacts of flooding, rather than try to control it.

How (Who.When.)

- Step 1* Secure funding for structure raising or relocation and cow pad projects. Federal funds may require a local match, which would need to be secured before work can begin. (Tillamook County and cities, NRCS, SWCD. Ongoing.)
- Step 2* Determine the best approach for flood damage mitigation (vertical or horizontal avoidance, or relocation). (FEMA. By 2000.)
- Step 3* Write individual contracts and agreements between homeowners, contractors, and Office of Emergency Management (OEM) to mitigate future flood damage through avoidance or relocation. (Tillamook County and cities. By 1999, ongoing.)
- Step 4* Write individual contracts and agreements between operators, contractors, and FEMA to construct cow pads at least 3 feet above the 100-year flood elevation. (Tillamook County. Ongoing).

Where	As indicated by the COE Feasibility Study.
Lead Agency	Tillamook County Department of Community Development.
Other Partners	Cities in Tillamook Bay Watershed, businesses and homeowners, FEMA, SWCD, TCWRC, EDCTC, COE, NW Oregon RC&D, Oregon OEM, Tillamook County Flood Control Group.
Anticipated Cost	<p>Under the FHMP program, the average cost to raise one house is approximately \$25,000, of which the homeowner is responsible for 25% or \$6,250 (source: Tillamook County DCD).</p> <p>Cost per cow pad is site-specific. Tillamook County DCD currently has \$360,000 available for cow pads.</p>
Monitoring	<p>Monitor CCMP objectives:</p> <ul style="list-style-type: none">• Raise at least 60 houses at least 3 feet above the 100-year flood elevation by year 2001, and other houses as resources permit.• Construct 10 livestock and equipment pads in flood-prone areas by 2001 to reduce pollution from petrochemicals and animal wastes during major floods.
Regulatory Issues	<p>County Development Permit. State Removal/Fill law, ORS 196.800B196.990. COE 404 Permit. Location of cow pads and equipment pads may be affected by floodway building restrictions.</p>
Related Actions	<p>FLD-06 Effectively Clear Mapped Lowland Floodways or Floodplains of Hazardous Materials</p> <p>HAB-02 Assess and Map Riparian and Wetland Habitat</p> <p>HAB-04 Prioritize Floodplain/Lowland Protection and Enhancement Sites</p> <p>HAB-08 Protect and Enhance Freshwater Wetland Habitat</p> <p>HAB-11 Encourage Protection and Enhancement on Private Lands</p> <p>HAB-23 Update the Estuary Plan</p> <p>HAB-24 Reconnect Sloughs and Rivers to Improve Water Flow</p> <p>HAB-30 Support the Oregon Plan for Salmon and Watersheds</p> <p>WAQ-01 Define, Implement, and Enforce Pollution Prevention and Control Measures on Agricultural Lands</p> <p>WAQ-08 Ensure Adequate Urban Runoff Treatment and Retention</p> <p>CIT-02 Implement Associate of Arts Oregon Transfer Degree in Environmental Studies</p> <p>CIT-06 Establish a Land Trust or Conservation Organization</p>

FLD-04	Update Existing Floodplain Map
What	Update the County's map of the 100- and 500-year floodplain, accounting for changes in land elevation, Watershed development, land use, river channels, and woody debris jams.
Why	Floodplain maps are used to guide development and to determine insurance rates and availability for buildings and property. FEMA studies defined the 100-year floodplain in 1975 without benefit of better precipitation and climate data generated in the 1990s ³ . Since then, changes to the Watershed and floodplains themselves have likely affected hydrology and flood elevations. Moreover, earlier FEMA techniques for floodplain mapping did not account for real-world flood problems in Tillamook, such as log, debris, or sediment plugs. New floodplain maps can help solve these problems.
How (Who.When.)	<p><i>Step 1</i> Use the watershed hydrodynamic model, direct experience, and/or other analytical tools to revise estimates of 100-year and 500-year flood events. (COE. 2000.).</p> <p><i>Step 2</i> Review and update the floodplain map. Submit revised floodplain map to FEMA for approval. (FEMA, Tillamook County. 2001.)</p> <p><i>Step 3</i> Make revised floodplain maps available on GIS and use them in watershed assessments. (TCWRC. By 2001.)</p> <p><i>Step 4</i> Use revised maps to regulate development within floodplain. (Tillamook County and municipalities. By 2001.)</p>
Where	Floodplains Watershed-wide.
Lead Agency	FEMA.
Other Partners	Tillamook County Community Development Department. FEMA is responsible for quality control and final approval of the updated map. Tillamook Coastal Watershed Resource Center for GIS services.
Anticipated Cost	County staff costs: 1.0 FTE = \$50,000.
Monitoring	<p>Implementation, based on CCMP objective:</p> <ul style="list-style-type: none"> • Implement a GIS-based, unsteady state hydrodynamic model by year 2000.

³ Parameter-elevation Regressions on Independent Slopes Model (PRISM) studies, available at www.ocs.orst.edu.

Regulatory Issues The maps may affect NFIP zones and programs, and impact the content and implementation of County land use regulations.

Related Actions

- FLD-01 Develop a GIS-Based, Unsteady State Hydrodynamic Model
- FLD-02 Implement Watershed Drainage Modification Projects
- FLD-06 Effectively Clear Mapped Lowland Floodways or Floodplains of Hazardous Materials
- HAB-04 Prioritize Floodplain/Lowland Protection and Enhancement Sites
- HAB-16 Effectively Enforce Laws and Regulations
- HAB-23 Update the Estuary Plan
- CIT-06 Establish a Land Trust or Conservation Organization
- OPSW: DEQ-6S

FLD-05	Regulate New Construction and Development in the Floodplain
What	<p>Regulate development within the 100-year floodplain to minimize vulnerability to flood damage for new and existing structures. Avoid locating new, essential facilities (<i>e.g.</i> hospitals, fire stations, radio stations) within areas that flood. Relocate or retrofit existing facilities to assure their use during emergency conditions. Restrict development within the designated floodway to assure the unimpeded passage of flood waters.</p> <p>Floodways define areas near active channels where development is highly restricted. New development in the floodway must not raise the flood height, and must not increase hazardous flood currents. The remainder of the mapped floodplain is called the flood fringe.</p>
Why	<p>It is cheaper and easier to avoid floods than to try to control them. Floodwaters can become heavily polluted when they interact with developed areas. Undeveloped floodplains provide hydrologic and habitat benefits.</p>
How (Who.When.)	<p><i>Step 1</i> Update and map regulatory floodways and floodplains for each of Tillamook Bay's significant rivers and sloughs. (FEMA, Tillamook County. By 2001.)</p> <p><i>Step 2</i> Review and update ordinances restricting building permits within the floodplain for all jurisdictions in the County.</p> <p><i>Step 3</i> Develop ordinances to implement Oregon Revised Statutes (ORS) 455.447 regarding siting of Essential Facilities, Hazardous Facilities, Major Structures, and Special Occupancies in Tsunami Inundation Zones. (Tillamook County. By 2002.)</p> <p><i>Step 4</i> Provide technical assistance and cost-sharing, where possible, for structural or non-structural flood damage mitigation projects. (FEMA and Performance Partnership. Ongoing.)</p>
Where	Floodplains of each of Tillamook Bay's significant rivers and sloughs.
Who	Tillamook County and cities.
Other Partners	FEMA, COE, Department of Land Conservation and Development (DLCD), Performance Partnership, and Project Impact.

Anticipated Cost Staff costs: 0.25FTE = \$12,750.
Study costs: included in FLD-02.
Costs for mitigation projects site-specific, expected to be high.

Monitoring Implementation, based on CCMP objective:

- Implement a GIS-based, unsteady state hydrodynamic model by year 2000.
- Control runoff from all construction and development in urban areas by 2003.

Regulatory Issues Land use code changes.
Updated floodplain maps.
Oregon Revised Statutes (ORS) 455.447 regarding siting of Essential Facilities, Hazardous Facilities, Major Structures, and Special Occupancies in Tsunami Inundation Zones.

Related Actions OPSW: ODOT-20

FLD-06	Effectively Clear Mapped Lowland Floodways or Floodplains of Hazardous Materials
What	Remove or secure hazardous materials located in floodways or floodplains.
Why	Decrease the adverse impacts of flooding due to hazardous or toxic chemical spills.
How (Who.When.)	<p><i>Step 1</i> Generate accurate maps of the 100-year floodway and floodplain. (FEMA, Tillamook County. By 2002.)</p> <p><i>Step 2</i> Develop a plan to relocate or secure hazardous and dangerous chemical storage containers (using location information from DEQ and State Fire Marshal) so that they are not susceptible to spilling during a flood. (FHMP coordinator. 2001.)</p>
Where	Floodplains of each of Tillamook Bay's significant rivers and sloughs.
Lead Agency	FHMP coordinator.
Other Partners	Performance Partnership Stewardship Council, Tillamook County Emergency Services, Oregon DEQ, State Fire Marshal, Tillamook County Flood Control Group, watershed councils.
Anticipated Cost	Site-specific costs to move or secure hazardous materials (expected to be moderate).
Monitoring	<p>Track CCMP objectives:</p> <ul style="list-style-type: none"> • Secure and/or remove known hazardous chemicals from areas where they pose a real threat to water quality during flood events by 2005. • Construct 10 livestock and equipment pads in flood-prone areas by 2001 to reduce pollution from petrochemicals and animal wastes during major floods.
Regulatory Issues	Building permits needed for retrofitting or elevating.

Related Actions	FLD-01	Develop a Hydrodynamic Model
	FLD-04	Update Existing Floodplain Map
	HAB-08	Protect and Enhance Freshwater Wetland Habitat
	HAB-11	Encourage Protection and Enhancement on Private Lands
	HAB-15	Revise Local Ordinances to Increase Protection of Riparian Areas, Wetlands, and Instream Habitat
	HAB-16	Effectively Enforce Laws and Regulations
	HAB-23	Update the Estuary Plan
	HAB-30	Support the Oregon Plan for Salmon and Watersheds
	WAQ-01	Define, Implement, and Enforce Pollution Prevention and Control Measures on Agricultural Lands
	WAQ-05	Provide Farm Management Training Programs
	WAQ-08	Ensure Adequate Urban Runoff Treatment and Retention
	OPSW:	DEQ-9S