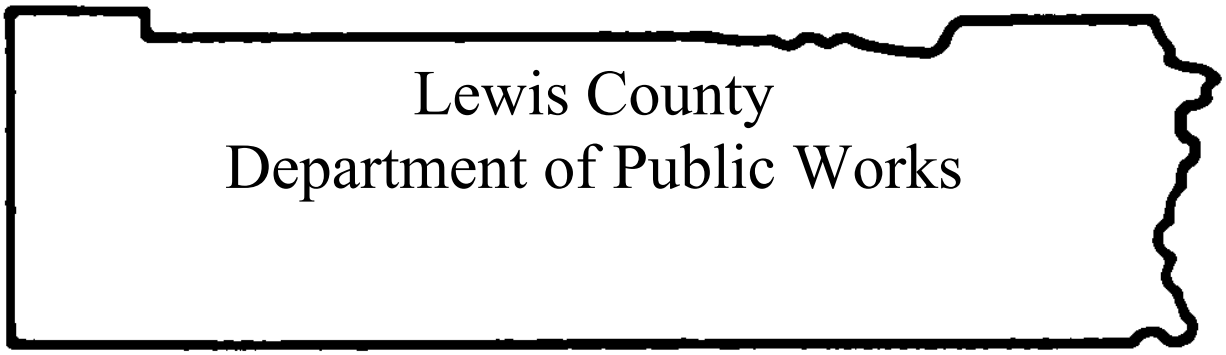

PRELIMINARY DRAFT

UPDATE to the

1994 Comprehensive Flood Hazard Management Plan for Lewis County, WA

May 2004

Lewis County Public Works
350 North Market Blvd.
Chehalis, WA 98532-2626

BOARD OF COUNTY COMMISSIONERS

Eric Johnson, District No. 1
Richard Graham, District No. 2
Dennis Hadaller, District No. 3

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EXECUTIVE SUMMARY

The Lewis County Comprehensive Flood Hazard Management Plan (CFHMP) has been prepared with joint funding provided by Lewis County and the State of Washington Flood Control Assistance Account Program (FCAAP) as established under the authority of Revised Code of Washington (RCW) Chapter 86.26.

Three major watersheds are located in Lewis County, the Chehalis, Nisqually, and Cowlitz River watersheds. The Nisqually and Cowlitz Rivers originate in the Cascade Mountains within the eastern part of Lewis County. Floods on these two rivers tend to be heavily impacted by the snowpack conditions in the Cascades. The headwaters for the Chehalis River are in the foothills south and east of the city of Chehalis. Snowpack is not a factor in Chehalis River flooding because of the low elevation headwaters. The river is extremely prone to flooding from heavy precipitation events that regularly occur during the fall and winter.

This CFHMP addresses flood issues on the Chehalis, Nisqually, and Cowlitz Rivers. The major focus for the plan is on the Chehalis/Centralia region where flooding has historically caused millions of dollars in damages. Specific flood issues and problem areas were analyzed, and recommendations made for alleviating these problem situations. Flood problems on the Nisqually and Cowlitz Rivers were examined in less detail. For these two rivers, specific problem sites were inventoried, and flood control efforts were documented.

Extreme floods on the Chehalis River and its tributaries have caused considerable damage. The January 1990 flood was the largest recorded on the Chehalis River during the 63-year period of record. The flood caused an estimated $19.2 million in damages throughout the watershed. In Centralia and Chehalis alone, residential damages totaled $4.3 million with approximately 905 residential dwellings being damaged during the flood. Commercial damage totaling $6.8 million was reported by 43 firms. Public facility damage, mostly to roads and the Lewis County Fairgrounds, totaled about $2.8 million. Agriculture damage was estimated at $1.3 million, emergency aid cost $0.6 million, and transportation delays cost about $2.1 million.

Because flooding has been a chronic problem in the Centralia/Chehalis region for so long, much effort has been spent historically on developing flood control solutions. The U.S. Army Corps of Engineers (COE) has been particularly active in analyzing and proposing flood control solutions. Most of the COE-proposed solutions have involved large flood control structures. Construction of large flood control structures is the only alternative that will actually prevent flooding from occurring in the Centralia/Chehalis region, but none of these structures has ever been built. Section 7.0 of this CFHMP documents the COE efforts, as well as summarizing the activities of the U.S. Soil Conservation Service (SCS), Federal Emergency Management Agency (FEMA), and the U.S. Bureau of Reclamation (USBR).

Approach

Early in the development of this plan, a Planning Advisory Committee (PAC) was formed to guide the CFHMP. The PAC consisted of a core group of permanent members from the county, Ecology, ENSR Consulting and Engineering (ENSR), and KCM, Inc. Depending on the subject of each meeting, participants from various county departments and the Cities of Centralia and Chehalis were included.

The PAC held a meeting on October 5, 1992, for the public and representatives from the Cities of Centralia and Chehalis to develop a valley consensus on the focus of the CFHMP. Based on these proceedings, long-term goals and short-term objectives were developed.

The overall long-term goals of this CFHMP are to

- reduce flood hazards and
- reduce long-term flood control costs to Lewis County.

These goals are to be accomplished through the following short-term objectives:

1. The emphasis of the CFHMP will be on the populated areas along the Chehalis River and its major tributaries. Most of the detailed analysis of flood hazard reduction strategies focuses on this region.

2. The CFHMP will focus on nonstructural measures that will help prevent the worsening of flood impacts in the future. Research completed through October 1992 documented that numerous major structural flood control measures have been proposed since 1935, but none of them has ever been built. Because it is unlikely that financing for such structures will be easier to obtain in the future, it was agreed that the CFHMP should not reconsider major structural measures to prevent flooding from occurring in the Centralia/Chehalis area.

3. The emphasis for the Cowlitz and Nisqually River basins is to identify potential flood hazards in the parts of these drainage that lie in Lewis County. A complete analysis of flood hazard reduction measures will not be attempted.

4. Public education was identified as an important element of this CFHMP. This objective was met by prioritizing public awareness and public education on flood hazard reduction alternatives.

5. Lewis County expressed the desire to be a good neighbor to downstream residents on the river covered by this plan. Impacts to downstream jurisdictions of the various actions evaluated in this plan were analyzed.

The approach adopted for developing flood hazard management measures for the Centralia/Chehalis area is based on flood characteristics identified in Section 6.0 and the absence of support for previously proposed structural measures described in Section 7.0.

Since 1935, the COE and other agencies have proposed numerous structural flood control measures to prevent flooding in the Chehalis River valley. These measures include:

- Modification of Skookumchuck Dam

- Flood-proofing structures

- Construction of several multipurpose storage projects (Ruth Dam, North Fork Newaukum Dam, South Fork Newaukum Dam, Boistfort Dam, Meskill Dam, and Skookumchuck Dam)

- Small headwater dams

- Channel clearing

- Channel excavation

- Urban area levees

- Pump stations

- A combination of the flood control measures listed above

None of the major structural flood control measures proposed has been approved or constructed. The primary factors preventing implementation of the proposed projects are a benefit-to-cost ratio of less than one, preventing cost-sharing participation by the COE, and the absence of cost-sharing by sponsoring agencies, such as the Cities of Centralia and Chehalis or Lewis County. Other concerns affecting project implementation include environmental considerations and regulatory approvals.

Following the PAC meeting on October 5, 1992, it was understood that flood prevention in Centralia/Chehalis area could only be accomplished with major structural flood control measures. However, it was also recognized that none of the major structural flood control measures investigated during the past 60 years have ever been constructed and therefore it was concluded to focus this CFHMP on nonstructural flood hazard management measures. In accepting that flooding will continue during extreme flood events, this CFHMP has focused on:

1. How to minimize the impacts of flooding in those areas of the flood plain that are already developed

2. Preventing development or other activities that will create a new flood hazard for themselves or increase the flood hazard for others

The recommended nonstructural flood management measures address both of these concerns. These measures include ongoing improvements in flood warning and emergency response procedures; flood-proofing of individual structures; conducting flood audits for residential and commercial buildings on the flood plain; modifying the flood damage prevention ordinances of Centralia, Chehalis, and Lewis County to achieve consistency in the valley; using best available historical flood records to assess flood hazards; and modifying Federal Insurance Rate Maps (FIRMs) so that they represent flood hazard areas based on the actual flood inundation history.

An inherent characteristic of nonstructural solutions for flood hazard management is the difficulty in addressing very specific flood problems. In general, nonstructural recommendations are more procedural or policy-oriented and, therefore, do not usually focus on a specific flood location. Although the flood hazards in the Chehalis/Centralia valley are general in nature, it was possible to identify specific urgent problem areas where flooding is particularly troublesome or expensive to residents. These specific flood hazard areas are addressed in the CFHMP.

Recommendations

The recommendations in this CFHMP, detailed in Section 8.0, are summarized below. An assessment of the environmental impacts of these recommendations is provided in Section 9.0.

- Flood warning and emergency response:

  - Install additional river gauging stations. Current river monitoring provides flow information for a large portion of the Chehalis River; however, flood responsiveness could be

increased with additional gauge sites. Flood preparation lead time would be increased with gauge installation within the upper reaches of the Chehalis drainage. Additional telephone-linked gauges would reduce personnel needed to visually inspect river levels. New gauges are recommended for the ungauged sections of the upper Chehalis River, the South Fork of the Chehalis River, and for major tributaries in the Centralia/Chehalis region. The Newaukum gauge near Chehalis should be updated to provide telephone-linked capabilities.

- Establish regional coordination on flood forecasting. Lewis County, Chehalis, and Centralia currently each have independent efforts for flood forecasting. Combining resources for flood forecasting is recommended.

- Formalize and update road closure database. This information could be linked to river stages adding more predictability and lowering response time to road closures.

- Increase distribution of flood information materials. Lewis County should expand the distribution of flood information.

• Flood-Proofing:

- Distribute flood-proofing fact sheets and reference materials to citizens residing in flood prone areas.

- Acquire the COE flood audit program. Lewis County should continue the flood audit program themselves.

- Establish elevation and relocation as the preferred flood-proofing method for the Centralia/Chehalis area.

• Ordinance Interpretation and Enhancements:

- Revise ordinances for consistency. Lewis County, Chehalis and Centralia's flood hazard ordinances should be modified to be consistent.

- Pursue revision of the FIRMs. Lewis County should submit the COE Flood Warning Map to FEMA along with a request for a "Letter of Map Revision" to the FIRM in the Centralia/Chehalis area.

- Update local flood elevation database. This CFHMP recommends that Lewis County compile a database of historical flood elevations and areas of inundation. Where these data show flooding beyond the limits shown on the FIRM, Lewis County should require applicants for development to elevate their structures accordingly.

- Add compensatory storage requirements to the Flood Damage Prevention Ordinance to minimize the cumulative effect of fill material in the flood plain.

- Establish a forum for coordination between Lewis County, Chehalis, and Centralia flood officials. These officials should meet regularly to discuss flood issues. Through this forum they can maintain consistency among all flood programs and share ideas and resources.

- Increase public disclosure. Lewis County should include notification of flood plain status with all county permitting for land development, and purchase and sale of property. In addition, it should develop a method for ongoing notification to existing landowners, such as through a notice sent with tax mailings.

- Upgrade critical facilities. The county should inventory the existing critical facilities for conformance with its Flood Damage Prevention Ordinance. A remedial plan should be developed for nonconforming facilities.

- Pursue FEMA community rating system. FEMA's Community Rating System is a program that allows communities to lower their flood insurance rates by engaging in activities that will lessen flood hazard. Since many of the COE activities discussed in this plan would count for credit in the Community Rating System, Lewis County should apply for inclusion.

- Implement rigorous administration of variances. Variances should be granted very infrequently.

- Adopt stormwater management ordinance and technical manual. These stormwater management tools will help Lewis County deal with its stormwater more effectively.

• Lewis County should create a county-wide surface water management utility to assist with funding for flood projects.

• Once it has created a surface water management utility, Lewis County should undertake basin planning. Using a basin planning approach, the county will plan for entire watersheds, resulting in the most successful surface water management.

• Specific problem areas:

- Hospital access -- The county should continue its pursuit of funding for a dry access road to the hospital.

- I-5 -- Lewis County should work with the Washington State Department of Transportation to assure that modifications to I-5 through the Chehalis River valley result in elevation of the freeway to above the 100-year flood level.

- Wastewater treatment plants -- Lewis County should coordinate with staff at the Centralia and Chehalis wastewater treatment plants to assure that, as upgrades are planned for the plants, those upgrades include measures that will decrease the plant's vulnerability to flooding.

- Skookumchuck levee -- Lewis County should continue to support the currently proposed Skookumchuck levee project.

- County fairgrounds -- Since it is likely that the fairgrounds will continue to be flooded during extreme flood events, precautions should be taken to minimize damage to facilities located there.

- River bank protection -- Bank protection should continue to be dealt with on a case-by-case

basis. The county should incorporate more bioengineered bank protection methods into its regular practices.

UPDATE

This update provides clarifications and new information about Lewis County programs and regulations for the 1994 CFHMP. Where appropriate, the update will also include information from the 2001 CFHMP Amendment. In 2001, Lewis County approved the CFHMP Amendment for the Upper Cowlitz River Basin to address channel meanders and bank erosion. The project study area included the Cowlitz River from the eastern county boundary to Lake Scanewa, Tilton River, Rainey Creek and Cispus River. The 2001 CFHMP Amendment was prepared by GeoEngineers, Inc and followed State requirements for CFHMP and channel migration zone analysis.

This update is to meet the updating requirement of the Community Rating System program. Lewis County (LC) and the Cities of Centralia and Chehalis were notified in May 2003 to have an approved update by October 2004. At the same time, it is recognized that the 1994 CFHMP is in need of a complete revision. A complete revision is anticipated to begin in late 2004.

The format used in this updating effort is as follows.

1. **Affected text will be shaded**
2. **New information is in bold, under the "UPDATE" heading.**
3. **Updated section of affected and new text will be boxed.**

In 1998, the Washington State Legislature passed the Watershed Management Act (WMA-Chapter 90.82 RCW) to provide a framework for citizens, interest groups and government organizations to resolve water resource issues. For implementation purposes, drainage basins were identified into 62 Water Resource Inventory Areas (WRIA). For this update, we will be referencing the river basins by their designated WRIA number.

There are four watersheds, also called Water Resource Inventory Areas (WRIA), in Lewis County. These are the: Chehalis River or WRIA 23; Cowlitz River or WRIA 26; Nisqually River or WRIA 11; and Deschutes River or WRIA 13. The upper headwaters of the Deschutes River watershed in Lewis County are under one ownership for timber management. For this reason, WRIA 13 is not included in our project area.

Lewis County lies in southwestern Washington with a total landmass of 2,452 sq miles, and measures about 90 miles (east to west) by 25 miles (north to south).

Five goals were developed for the 2001 CFHMP Amendment, which expanded the two long-term goals developed in the 1994 CFHMP. The five goals are:

1. **Reduce public exposure to flood risk**
2. **Reduce flood damage to public and private properties**
3. **Minimize adverse environmental or natural resource impacts from measures in the CFHMP**
4. **Identify, evaluate and develop selection criteria for structural and non-structural measures that mitigate flood hazards**
5. **Reduce the financial impact to the public from flood related cost**

The February 1996 flood is the flood of record on all major drainages in WRIA 23. The U.S. Army Corps of Engineers (COE) updated their flood frequency curves for the Chehalis River in 1997.

The COE had published flood frequency curves for a 1980 FEMA report, and made revisions in 1989. The recomputed frequency curves are significantly higher than those published in 1980 and 1989 as shown in Table 6.3R.

This was also the greatest flood discharge on the Cowlitz River (WRIA 26) and on the Nisqually River (WRIA11). Approximately $30M in public damages were reported in Lewis County. More information about the February 1996 flood is in Chapter 6.

After the 1996 flood event, the Flood Action Council (FAC), a group of economic development, business activists and commercial interests developed a preliminary plan of modifying the Skookumchuck Dam and providing additional flood storage with overbank excavation of the Chehalis River. The Lewis County Board of County Commissioners (BOCC) took the lead by establishing a countywide flood control district zone; and used local and state funding to study modifications to the 1984 Authorized Project (Skookumchuck Dam). The Skookumchuck Dam project had evolved to the point of having the COE conduct Preconstruction Engineering and Design (PED) work from February 1988 through August 1990. Prior to the PED, WSDOT had plans to widen and raise segments of I-5 near Centralia and Chehalis. These post-1996 local flood studies were made to also present a flood hazard management alternative for flood relief other than raising I-5.

On July 7, 1998, Lewis County asked the COE to resume work on the PED, and to consider additional flood hazard reduction measures. The City of Centralia was the project sponsor through the feasibility phase. Lewis County provided cost sharing and serves as the project implementation and construction sponsor.

The study area for the authorized project includes the mainstem Chehalis River, its floodplain and tributaries from the South Fork Chehalis River confluence to Grand Mound, the Cities of Centralia and Chehalis, surrounding areas in Lewis and Thurston counties, the Town of Bucoda, and along the Skookumchuck River to a point above the Skookumchuck Dam. Tributaries in the study area include the Skookumchuck and Newaukum Rivers, and several smaller creeks (Hanaford, China, Salzer, Coal, Dillenbaugh, and Berwick).

The COE began the scoping process for the EIS by conducting two public meetings on September 28-29, 1999 in Chehalis and Rochester. Supplemental studies were completed to address concerns raised during the scoping and project development processes. The COE conducted a Post Authorization Study, the Chehalis River General Reevaluation Study (GRS). This study is a re-analysis of a previously completed and authorized study using current planning criteria and policies, which is required due to changed conditions/assumptions. The results for this GRS is summarized in the "Draft EIS, Centralia Flood Damage Reduction Project" by the COE dated July 2002.

Since 1994, new and amended regulations have been adopted to address flood hazards in Lewis County. These are addressed in Chapter 5.

Many of the flood management recommendations noted in Chapter 8 of the 1994 CFHMP have been implemented. Most notable changes are: major modifications within the Lewis County Division of Emergency Management to establish and maintain a flood warning system and flood prediction services; additional river gages and monitoring stations; elevation and relocation projects; consistent, local flood hazard ordinances; upgrades of critical facilities; adoption of stormwater management, and fill/grade ordinances; participation in the Community Rating System; and FIRM revisions. For more information, see Chapter 8. Appendix L summarizes actions undertaken by the County and

Cities for flood hazard management mitigation since adoption of the CFHMP in 1994.

1.0 INTRODUCTION

The Lewis County Comprehensive Flood Hazard Management Plan (CFHMP) has been prepared with joint funding provided by Lewis County and the State of Washington. This section describes the purpose of comprehensive flood hazard management plans, the legal authorization for these plans, administration of the flood control program in Washington State, the requirements of comprehensive flood hazard management plans, and an overview of the contents of the Lewis County CFHMP.

The Lewis County CFHMP has been prepared by ENSR Consulting and Engineering in association with KCM, Shapiro and Associates, Inc. (SHAPIRO), and Applied Environmental Services.

UPDATE

This update provides clarifications and new information about Lewis County programs and regulations for the 1994 CFHMP. Where appropriate, the update will also include information from the 2001 CFHMP Amendment. In 2001, Lewis County approved the CFHMP Amendment for the Upper Cowlitz River Basin to address channel meanders and bank erosion. The project study area included the Cowlitz River from the eastern county boundary to Lake Scanewa, Tilton River, Rainey Creek and Cispus River. The 2001 CFHMP Amendment was prepared by GeoEngineers, Inc and followed State requirements for CFHMP and channel migration zone analysis.

This update is to meet the updating requirement of the Community Rating System program. Lewis County (LC) and the Cities of Centralia and Chehalis were notified in May 2003 to have an approved update by October 2004. At the same time, it is recognized that the 1994 CFHMP is in need of a complete revision. A complete revision is anticipated to begin in late 2004.

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1.1 Plan Authorization

The State of Washington requires that each public entity desiring state financial assistance for flood control maintenance develop a CFHMP. Up to 75 percent of the funding for such plans is available through the Flood Control Assistance Account Program (FCAAP). FCAAP was established under the authority of Revised Code of Washington (RCW) Chapter 86.26, "State Participation in Flood Control Maintenance." The Washington Department of Ecology (Ecology) is responsible for administering the program, as described in Washington Administrative Code (WAC) Chapter 173-145, "Administration of the Flood Control Assistance Account Program." Both of these Washington codes are included in Appendix A.

1.2 Basic Principles and Purpose of Comprehensive Flood Hazard Management Plans

The purpose of CFHMPs is to provide a road map for flood control activities. Although these plans attempt to analyze the drainage basin as a whole, the plans typically pertain to a particular political jurisdiction, usually a county or city. Itemized requirements for these plans are described in Section 1.3 below. As long as these requirements are met, the entity preparing the plan has much leeway to individualize its plan to meet its individual needs. Each river basin in the state is unique, both in physical characteristics and in the management approach being applied to that basin, so solutions to flood problems can also be unique.

While this comprehensive plan pertains specifically to flood hazard management, it must be integrated with other regulations, particularly building codes, land-use regulations, and environmental regulations. The process of developing these plans is as important as the final document itself. Flood hazards impact many individuals, they are extremely expensive, and they are a health and safety issue. If the CFHMP is to be effective, the community bound by the CFHMP must be supportive of the recommendations in the plan. In the end, each plan should contain a priority listing of flood control activities and projects. Once this plan has been approved by Ecology, the county is eligible to apply for 50 percent grant funding from the State to implement activities and projects in its plan.

The following principles are fundamental to comprehensive flood hazard management:

1. Respect the river's natural hydrologic processes. Traditional flood control efforts have focused on controlling the river's natural tendencies of channel shifting and overbank flow during floods. It is often more cost-effective in the long term and more environmentally sound to accommodate these natural river processes, rather than attempting to control them.

2. Focus on the cause of flood damage. Flood damage can be related to upstream land management and development in flood-prone areas. Recognizing that flooding is a natural process, and only becomes a problem when people develop in areas that flood, is an important concept.

3. Consider the entire watershed, not just local conditions. Because watersheds do not respect political boundaries, local flood management activities impact downstream jurisdictions.

4. Incorporate public participation and coordinate among all affected agencies. Because flood hazard reduction affects most people in the county and overlaps with the responsibilities of other governmental agencies, it is necessary for these groups to be involved in the planning process. Without involvement from these groups, it is nearly impossible, in the end, to get support from them.

5. Examine all the issues. In the past, many flood control efforts have taken place immediately following a flood. Usually, there is not enough time to consider flood causes and alternative solutions when planning is done in this crisis mode. True comprehensive planning for flood hazard reduction must be carried out in a manner which allows thorough examination of the issues and solutions.

6. Incorporate other resource protection goals. Coordinating flood hazard reduction measures with other resource protection programs is obviously the best use of financial resources.

7. Coordinate between public works, planning, and building departments, and other department activities. Because of their differing mandates and responsibilities, these departments can sometimes work at cross purposes in the area of comprehensive flood hazard reduction. Each department must remember to look past their daily permitting decisions to the ultimate goals of the county or city in flood hazard reduction.

8. Incorporate comprehensive planning solutions. Flood hazard reduction should be part of the county or city's overall comprehensive plan. When flood control structures are necessary, recreation and public access might be integrated into the project.

1.3 Plan Requirements

The requirements of a CFHMP, as defined in RCW Chapter 86.26, are: 1) to determine the need for flood control work, 2) consider alternatives to instream flood control work, 3) identify and consider potential impacts of instream flood control work on the state's instream resources, and 4) identify the river's floodway. Specific elements of the plan, as outlined in WAC Chapter 173-145, are as follows:

1. Determination of the need for flood control work

   a. Description of the watershed
   b. Identification of types of watershed flood problems
   c. Location and identification of specific flood problems
   d. Description of flood damage history
   e. Description of potential flood damages
   f. Short-term and long-term goals and objectives for the planning area
   g. Descriptions of regulations which apply within the watershed, including but not limited to local shoreline management master programs, and zoning, subdivision, and flood hazard ordinances

2. Consideration of alternative flood control work

   a. Description of potential measures of instream flood control work
   b. Description of alternatives to instream flood control work

3. Identification and consideration of potential impacts of instream flood control work on the following instream uses and resources:

   a. Fish resources
   b. Wildlife resources
   c. Scenic, aesthetic, and historic resources
   d. Navigation
   e. Water quality
   f. Hydrology
   g. Existing recreation

4. Area of coverage for the comprehensive plan shall include, at a minimum, the area of the 100-year flood plain within a reach of the watershed of sufficient length to ensure that a comprehensive evaluation can be made of the flood problems for a specific reach of the watershed. Comprehensive plans shall also include flood hazards not subject to riverine flooding such as areas subject to coastal flooding, flash flooding, or flooding from inadequate drainage. Either the meander belt or floodway shall be identified on aerial photographs or maps which will be included with the plan.

5. Conclusion and proposed solution. The CFHMP shall be finalized by the following action from the appropriate local authority:

   a. Evaluation of problems and needs
   b. Evaluation of alternative solutions
   c. Recommended corrective actions with proposed impact resolution measures for resource losses
   d. Corrective action priority

6. A certification from the State Department of Community Development that the local emergency management organization is administering an acceptable comprehensive emergency action plan.

Once a CFHMP is accepted by Ecology, the county can apply for funding for flood control maintenance projects recommended in the CFHMP. As defined in WAC Chapter 173-145, maintenance projects are those necessary to preserve or restore the natural condition, or to restore man-made flood control facilities to their former condition, using in-kind replacement materials or acceptable alternatives. Maintenance projects are necessary due to anticipated or actual damage or destruction from flooding by action of erosion, stream flow, sheet runoff,

or other damages by the sea or other bodies of water. The amount of FCAAP funding available for any maintenance project cannot exceed 50 percent of the total project cost, including planning and design costs.

1.4 Comprehensive Flood Hazard Management Planning Process

The process of developing a CFHMP is similar to other comprehensive planning. The steps involved can be summarized as follows:

1. Establish citizen and agency participation process
2. Set flood hazard management short- and long-term goals and objectives
3. Inventory and analyze physical conditions in the watershed(s)
4. Determine need for flood hazard management measures
5. Identify alternative flood hazard management measures
6. Evaluate alternative measures
7. Hold public workshop(s) to evaluate alternatives
8. Develop flood hazard management strategy
9. Complete draft CFHMP and State Environmental Policy Act (SEPA) documentation
10. Submit final CFHMP to Ecology
11. Hold public hearing and pass intent to adopt resolution
12. Notify Ecology that the final plan is adopted

Once the plan has been adopted, the county may proceed with the flood hazard management steps identified in the plan. FCAAP funding may be available for these implementation projects at a 50 percent matching rate.

1.5 Lewis County as a Planning Unit

This CFHMP has been developed with funding from Lewis County and, therefore, focuses on flood concerns within the county boundaries. Rivers and flooding do not respect political boundaries, however, so this plan must also consider the potential impacts of Lewis County activities on residents downstream from Lewis County.

In addition to adjacent political jurisdictions, Lewis County has several municipal corporations within its boundaries, the largest being the cities of Centralia and Chehalis. Each of these cities has established flood control policies. These individual municipal policies and programs are coordinated with Lewis County's policies and programs. During flood situations, these three jurisdictions work together to provide emergency services to the community.

Several other planning efforts were active in the Chehalis River basin during the time this plan was being developed. The most notable of these planning efforts is the Chehalis River Watershed Action Plan, coordinated by the Lewis Conservation District. The conclusions and recommendations in the Lewis County planning effort have been coordinated with the results of the Watershed Action Plan.

1.6 Lewis County Plan

Lewis County CFHMP has been prepared in accordance with RCW Chapter 86.26 and WAC Chapter 173-145. An overview of each section of the CFHMP is presented below. Sections 2.0 through 9.0 present all of the background technical, environmental, and regulatory information necessary for the development of this CFHMP.

Section 2.0. "Lewis County Socioeconomic Characteristics" describes the economic, cultural, scenic, aesthetic, and historic resources of Lewis County.

Section 3.0. "Physical Characteristics of Lewis County Watersheds" presents information about drainage areas, flow characteristics, water use, and flow gauging on watersheds within Lewis County.

Section 4.0. "Environmental Setting" describes the instream uses and resources of the area with regard to fisheries, wildlife, wetlands, historical resources, navigation, water quality, and recreation.

Section 5.0. "Regulatory Mechanisms for Flood Control" describes the federal, state, county, and city regulations and ordinances currently governing flood control in Lewis County.

Section 6.0. "Flood Characteristics" presents the flood history of the area, identifies historical flood problems in the county, and presents the magnitude of 100-year floods at various locations in the county.

Section 7.0. "Historical Flood Hazard Reduction Efforts" describes activities undertaken by various entities in the Chehalis River Basin to reduce flood hazards.

Section 8.0. "Flood Management Measures for the Chehalis/Centralia Area" describes the recommended actions for flood hazard management.

Section 9.0. "Environmental Assessment" provides an assessment of the environmental impacts associated with the flood hazard management recommendations.

1.7 Lewis County Plan Goals and Objectives

The overall long-term goals for this CFHMP are to:

- reduce flood hazard and
- reduce long term flood control costs to Lewis County.

These goals are to be accomplished through the following short-term objectives:

1. The emphasis for this plan is on the populated areas along the Chehalis River and its major tributaries. Most of the detailed analysis of flood hazard reduction strategies focuses on this region.

2. The objective for the Cowlitz and Nisqually River basins is to identify potential flood hazards in the parts of these drainages that lie in Lewis County.

3. Public education was identified as an important element of this CFHMP. This objective was met by prioritizing public awareness/public education flood hazard reduction alter-natives. This document should be used as a public reference on flood hazard issues.

4. Lewis County expressed the desire to be good neighbors to downstream residents on the rivers covered by this plan. Impacts of the various actions evaluated in this plan were analyzed.

UPDATE

Five goals were developed for the 2001 CFHMP Amendment, which expanded the two long-term goals developed in the 1994 CFHMP. The five goals are:

1. **Reduce public exposure to flood risk**
2. **Reduce flood damage to public and private properties**
3. **Minimize adverse environmental or natural resource impacts from measures in the CFHMP**
4. **Identify, evaluate and develop selection criteria for structural and non-structural measures that mitigate flood hazards**
5. **Reduce the financial impact to the public from flood related cost**

1.8 Planning Advisory Committee

A Planning Advisory Committee (PAC) was formed for the Lewis County CFHMP to guide the development of the CFHMP. The PAC consisted of a core group of permanent members and, depending on the subject of each meeting, participants from various county departments and the cities of Centralia and Chehalis.

Permanent PAC members include:

Bob Berg	Director, Lewis County Department of Public Services
Homer Waltrip	Lewis County Operations Superintendent
Dick Fleming	Lewis County Engineer
Chuck Gale	Department of Ecology
Tony Melone	KCM, Inc.
Cynthia Carlstad	ENSR Consulting and Engineering

Other participants on the PAC include:

Jeanne Massingham	Lewis County Emergency Management Division
Mike Zengel	Lewis County Community Development Planning Section
Bill Forth	Lewis County Public Services
Denis Sabin	Lewis County Building Department
Bob Nacht	City of Chehalis
Terry Calkins	City of Centralia Public Works Administrator

The PAC held a meeting on October 5, 1992, for the public and representatives from the cities of Centralia and Chehalis. The meeting was scheduled to develop a valley consensus on the focus of the CFHMP. Research completed through October 1992 documented that numerous major structural flood control measures have been proposed since 1935, but none of them has ever been built. Based on these precedents, it was agreed that this CFHMP would focus on nonstructural measures that would help prevent the worsening of flood impacts in the future.

UPDATE

The PAC will be reformed once a total revision of the CFHMP occurs.

<u>Work Group</u>

One requirement of the CRS program is to update the CFHMP every five years. To best achieve this, a work group consisting of county and city staff responsible for implementing flood related regulations met on a regular semi-monthly basis from September 2003 to provide updates. The affiliated jurisdictions, departments and individuals are:

Lt. Steve Mansfield	**LC, Emergency Management Services**
Jill Kangas	**LC, Emergency Management Services**

Shirley Kook	**LC, Engineering**
Stearns Wood	**LC, GIS**
Matt Hyatt	**LC, GIS**
Fred Chapman	**LC, Building Official**
Robert Johnson	**LC, Community Development**
Craig Swanson	**LC, Community Development**
Roy Browning	**City of Centralia, Community Development**
Bobbi Boone	**City of Chehalis, Community Services**

In January 2004, the workgroup was directed to perform a minimal updating effort because a complete revision is proposed in the immediate future to meet current Lewis County project and funding needs for flood hazard management.

A list of abbreviations and definitions used throughout this update are provided in Appendix K. Appendix L summarizes actions undertaken by the County and Cities since adoption of the CFHMP in 1994.

2.0 LEWIS COUNTY SOCIOECONOMIC CHARACTERISTICS

This section discusses the socioeconomic characteristics of Lewis County. Socioeconomic characteristics, including recreational opportunities, cultural resources, population and land uses, and existing transportation networks are relevant to flood hazard management planning because they affect the types of flood solutions that will be the most effective.

2.1 Political Jurisdictions

The four largest political jurisdictions within Lewis County, other than the county government itself, are the Gifford Pinchot National Forest, Snoqualmie National Forest, Mt. Rainier National Park, and the Mount St. Helens National Volcanic Monument. The State of Washington also has jurisdiction over approximately 1,100 acres of state park land within the county.

Two national forests occupy portions of Lewis County. The Gifford Pinchot National Forest stretches over most of the eastern third of the county. Starting at Walupt Lake, the Cispus River runs through this area and is a tributary to the Cowlitz River which also runs through parts of the Gifford Pinchot National Forest. The Snoqualmie National Forest has jurisdiction over the area draining into the upper reaches of the Skookumchuck River, a tributary to the Chehalis River.

Two national park facilities are also present in Lewis County. Originating on the slopes of Mt. Rainier, the uppermost reaches of the glacially-fed Cowlitz River are within the jurisdiction of Mount Rainier National Park. Another major river system of Lewis County, the Nisqually River, also originates in Mt. Rainier National Park. Over 39,400 acres of the Park are located in the northeastern part of the county. Approximately 13 square miles of the Mount St. Helens National Monument are located in the south-central part of Lewis County. None of the major rivers of Lewis County originate from this area.

2.2 Population and Land Use

Population growth in Lewis County was rapid in the 1970s, but has slowed since 1980. The population grew by 23.2 percent between 1970 and 1980. During the next 5 years, the population growth rate increased by only 0.8 percent. The slowdown in growth is believed to be the result of a 1981-82 economic recession. For the entire 10-year period between 1980 and 1990, the population grew by 5.9 percent. Population projections for the next decade predict that the population will increase by only 0.7 percent overall. Population characteristics based on 1990 census information are shown in Table 2-1.

The Lewis County Comprehensive Land Use Plan Citizens Advisory Committee, in cooperation with the Lewis County Board of Commissioners, Lewis County Planning Commission, and Lewis County Planning Department, has divided the county into four land use areas, which are classified as Urban, Suburban, Rural Mixed Use, and Natural Resource Use. At the present time, the county has no official acreage numbers for these categories.

Urban areas are considered to be those areas that are served by both Class I public water systems (systems having more than 15 service connections and/or 25 or more people on the system) and sanitary sewer systems, or are within future planned services areas. Centralia, Chehalis, and Winlock are designated Urban areas.

Areas that are serviced by Class I public water systems but rely on on-site subsurface sewage disposal methods are considered Suburban areas.

Rural Mixed Use areas are those areas that are not served by either sanitary sewers or Class I public water systems. "A great amount of agricultural, forestry, and mineral extraction activities takes place in rural areas. The area consists of industry and commercial uses, farms and scattered residences and lower density residential developments, recreational lakes, and rivers" (Lewis County Comprehensive Plan, Citizens Advisory Committee 1991). Lewis County is comprised of 7.9 percent farmlands which fall into this Rural Mixed Use category.

Natural Resource Land Use areas are considered to be those areas with "large contiguous blocks of forest land containing a minimum of 5,000 acres and classified in timber and current use property tax classifications consistent with Chapters 84.28 (Property Taxes - Reforestation Lands), 84.33 (Property Taxes - Timber and Forest Lands), and 84.34 (Property Taxes - Open Space, Agricultural, and Timber Lands - Current Use Assessment - Conservation Futures) RCW. The primary use of these lands is for commercial timber production, mineral resource extraction, watershed, wildlife, viewshed, utility sites and lines, and electronic and communication facilities." (Lewis County Comprehensive Plan, Citizens Advisory Committee, 1991). Nearly one-third of Lewis County is covered by the Gifford Pinchot and Snoqualmie National Forests which fall into this Natural Resource Land Use category.

UPDATE

In 1999, Lewis County adopted a comprehensive plan and land use regulations in compliance with the Growth Management Act (GMA), zoning all unincorporated areas of the county. The origin plan was amended in 2000 and 2002. Prior to that time the county had been largely unzoned. Incorporated cities within the county, likewise have adopted comprehensive plans and development regulations, designating and controlling land use within their boundaries.

Incorporated and unincorporated urban areas (Urban Growth Areas) are designated and zoned for urban levels of development. Incorporated cities plan for and designate land uses within their corporate boundaries consistent with adopted comprehensive plans and development regulations. Urban growth areas, adjacent to incorporated cities, were designated consistent with the GMA and are intended for urban development. Such areas are expected to develop at higher intensities and eventually be annexed into the cities and are zoned for residential, commercial and industrial uses. For a full discussion of land use within incorporated cities, refer to each city's comprehensive plan.

Unincorporated Lewis County land use is regulated consistent with historic and traditional land use patterns and at intensities consistent with rural levels of public services. Approximately three-quarters of the 2,452 square miles of Lewis County is devoted to long-term natural resource use—timber, agriculture or mineral. Less than one-quarter of the land is designated for rural, non-resource uses, including rural residential, commercial and industrial uses.

Under current zoning, the unincorporated county is classified into the following land use categories:

1. Resource Land of Long-term Commercial Significance
- **A. Forest Resource Land – commercial forestry activities**
- **B. Agricultural Resource Land – commercial farming activities**
- **C. Mineral Resource Land – commercial mineral extraction**

2. Rural Development Districts – rural uses including residential, limited commercial
- **A. One Dwelling per 5 Acres**
- **B. One Dwelling per 10 Acres**
- **B. One Dwelling per 20 Acres**

3. Limited Areas of More Intense Rural Development (LAMIRD)

A. Small Towns – high intensity rural settlements
B. Crossroad Commercial – high intensity commercial activities
C. Freeway Commercial – rural interchange activities
D. Rural Residential Centers – high density residential subdivisions
E. Rural Area Industrial – high intensity industrial activities
F. Public Tourist Service Areas – public recreational areas

Open space land is designated in the county comprehensive plan and includes parks, wilderness areas, resource lands, and corridors. The open space designation overlays other zoning and makes up about 75% of the county. Open space corridors follow stream and river valleys and are comprised of steep slopes, agricultural resource land, and flood hazard areas. Unlike park and recreation aras, open space lands may be either public or private ownership and are often not available to public access. Privately owned lands in flood hazard areas (over 40,000 acres) and lands currently managed by Tacoma City Light under conservation easements (over 15,000 acres) are part of this later category. Table 2-1R summarizes the land uses in the county.

For a more complete discussion of existing and future land uses within Lewis County, refer to the following:

- **"Lewis County Comprehensive Plan", Amended April 2002.**
- **"City of Centralia Comprehensive Plan", November 1998.**
- **"City of Chehalis Comprehensive Plan", July 1999.**
- **"City of Morton Comprehensive Plan", June 23, 1997.**
- **"City of Mossyrock Growth Management Directory", 1996.**
- **"City of Napavine Comprehensive Plan", May 1997.**
- **"City of Pe Ell Comprehensive Plan", June 1997.**
- **"City of Toledo Comprehensive Plan", February 13, 1997.**
- **"City of Vader Comprehensive Plan", June 16, 1996.**
- **"City of Winlock Comprehensive Plan", June 30, 1998.**
- **Growth Management Act, Chapter 36.70A RCW**

2.3 Public Services and Utilities

The larger municipalities of Lewis County, such as Centralia, Chehalis, and Morton, have city- provided water systems. The main sources of drinking water for the Centralia/Chehalis area are the Chehalis and Newaukum Rivers. The remainder of towns in the county rely on either small community or private wells for their drinking water.

UPDATE

Domestic water supply for the City of Chehalis is from the North Fork of the Newaukum River and Chehalis River. Centralia also draws from several groundwater wells. During times of drought, Centralia can withdraw from the Newaukum River.

The City of Morton has an intake at the Tilton River. The Town of Pe Ell obtains its municipal water from Lester, Grim and Mahaffey Creeks, which are tributaries of the Chehalis River on Weyerhaeuser timber holdings. Additional water services in the county are provided by: three public Lewis County Water Districts (LCWD); Boistfort Water (a community, non-profit water distribution system) that uses Stillman Creek as its source; and American Water Resources (a private owner and manager of 33 small water systems in the county).

Within Lewis County, the towns of Chehalis, Centralia, Morton, and Winlock have secondary sewage treatment facilities provided by each municipality. The remaining population of Lewis County relies on individual septic systems and leaching fields for sewage treatment.

UPDATE

The cities of Chehalis, Centralia, Morton, Mossyrock, and Napavine have sewer service. With the exception of Napavine, secondary sewage treatment is provided by each municipal facility. The City of Chehalis also treats sewage from both the City of Napavine and Lewis County Water and Sewer District #1 (LCWSD#1). The Town of Pe Ell has a sewage facility that serves 320 customers inside their town limits and 3 customers outside the town limits. The facility is located at the northwest corner of the town limits along the Chehalis River. The remaining population of Lewis County relies on individual septic systems and leaching fields for sewage treatment.

The main supplier of electricity to the county is the Lewis County Public Utility District (P.U.D.). The P.U.D. serves all areas of the county except the city of Centralia, which is served by Centralia City Light. Another source of electricity in the county is the Centralia Steam-Electric Plant located in northwest Lewis County. Pacific Power and Light Company of Portland, Oregon owns and operates the plant's two units, which burn low-sulfur coal to produce a rated output of 1.4 million kilowatts of electricity.

UPDATE

The main supplier of electricity to the county with the exception of the City of Centralia is the Lewis County Public Utility District (LCPUD). Centralia City Light supplies power to the City of Centralia and some adjacent areas (i.e., Cooks Hill, Seminary Hill, Salzer Valley and the Johnson Creek areas). Trans Alta owns and operates the Centralia Steam Electric Plant's two units, which produce a rated output of 1.4 million kilowatts of electricity.

Downstream of Randle and upstream of Mossryock Dam, LCPUD owns and operates the Cowlitz Falls Dam. The dam impounds Lake Scanewa, which is an impoundment of the Cowlitz River for a distance of about 11 miles and the Cispus River for about 1.5 miles. The dam was built in the early 1990s and is operated as a run-of-the-river dam with very little regulation or storage in Lake Scanewa. The operating license requires the LCPUD to draw down Lake Scanewa and operate the reservoir as a free flowing reach of river during floods. The LCPUD also monitors sediment accumulations in the lake to ensure flood levels will not increase in the Randle valley area of the Cowlitz River (River Mile 94 to 103).

There are electricity generating facilities located in Lewis County that do not directly provide local service. These facilities are:

1) Tacoma Power public utility dams in the Cowlitz and Nisqually Rivers; and

2) Chehalis Power in the Port of Chehalis Industrial Park.

In WRIA 26, the City of Tacoma owns and operates Mayfield and Mossyrock Dams, built in 1963 and 1968, respectively for hydropower. The City also owns and operates another dam in the Nisqually River: Alder Dam located in neighboring Thurston County. Chehalis Power is a natural gas-fired-combined-cycle facility. The facility obtains water from the City of Chehalis and industrial waste water is discharged and treated at the same local wastewater treatment plant. Electrical power produced is transmitted to the

Bonneville Power Administration. Construction began in May 2001 with commercial operations starting in October 2003.

Lewis County is served by three local radio stations, one daily newspaper (The Daily Chronicle), and two weekly papers (Lewis County News and the Morton Journal). Cable television service is provided by Cook Cablevision.

UPDATE

The following service providers offer telephone service in the county: Qwest; AT&T; US West Communications; Century Tel; TDS Telecom; Toledo Telephone Company, Inc.; and Local Access Communications. Cable service in the Centralia and Chehalis area is by ComCast. Some cable service is provided in the county, but mostly through use of personal satellite dishes.

Thirty-nine public schools and four private schools provide education to the youth of Lewis County. Centralia Community College, established in 1925, enrolls over 1,500 full-time students and 2,500 part-time students yearly. A branch campus, the Centralia Community College East City Center, is located in Morton. Four-year college/university facilities are available at City University which has a facility in Centralia. The University offers both bachelor and master degree programs.

For a more complete discussion of utility systems within Lewis County, refer to the following:

- **Chapter 7, "Lewis County Comprehensive Plan", Dept of Community Development, Amended April 2002.**

2.4 Transportation and Navigation

The primary north-south transportation corridor passing through Lewis County and the cities of Centralia and Chehalis is Interstate 5 (I-5). The Chehalis/Centralia area lies 85 miles midway between the metropolitan areas of Seattle and Portland, Oregon. U.S. Highway 12 traverses Lewis County from east to west and crosses the Cascade Mountains at White Pass. White Pass is the only major all-season route south of Seattle and north of the Columbia River allowing access to eastern Washington. State Route (SR) 7, SR 508, and U.S. Highway 12 all intersect in Morton, which is located 32 miles east of I-5.

UPDATE

The road system in the county is made up of local public and private roads, interstate, U.S. highways, and state routes. There are over 1,888 mi of public and private roads within the county. The County maintains 1,065 mi of roadways, 196 bridges, and 5,110 culverts. The nine cities (Centralia, Chehalis, Morton, Mossyrock, Napavine, Pe Ell, Toledo, Vader, and Winlock) are responsible for their own roadways within their city limits. Unless there is an agreement between the County and the cities, the County currently maintains the roadways in the Urban Growth Areas (UGAs). In addition, there are 165 mi of recorded private roadways, and 215 mi of primary and secondary forest access roads.

Roadway Type	Federal/State (mi)	County (mi)	City (mi)	Private (mi)	Total (mi)
I-5	35.65	0	0	0	35.65
US Hwy 12	84.66	0	0	0	84.66
SR 6	25.86	0	0	0	25.86
SR 7	16.16	0	0	0	16.16
SR 122	7.89	0	0	0	7.89
SR 123	7.56	0	0	0	7.56
SR 505	16.48	0	0	0	16.48
SR 508	31.83	0	0	0	31.83
Stevens Canyon	21.73	0	0	0	21.73
Arterial	0	32.64	37.82	0	70.46
Collector	0	155.02	15.26	0	170.28
Access	0	757.29	142.37	0	899.66
Forest Access	215	0	0	0	215
Private	0	0	0	165	165
Total	462.82	944.95	195.45	165	1768.22

The primary north-south transportation corridor passing through Lewis County and the cities of Centralia and Chehalis is Interstate 5 (I-5). Lewis County is sponsoring proposals for two new freeway interchanges in the vicinity of the existing LaBree Road overcrossing and north of Centralia. An existing interchange at Exit 76 in Chehalis is proposed for improvements and upgrades in the near future. The Chehalis/Centralia area lies 85 miles midway between the metropolitan areas of Seattle and Portland, Oregon. U.S. Highway 12 traverses Lewis County from east to west and crosses the Cascade Mountains at White Pass. White Pass is the only major all-season route south of Seattle and north of the Columbia River allowing access to eastern Washington. State Route (SR) 7, SR 508, and U.S. Highway 12 all intersect in Morton, which is located 32 miles east of I-5. Scenic and recreation highways total over 212 miles within Lewis County.

ROADWAY	LOCATION	LENGTH (mi)
US Highway 12	East/west roadway connecting Yakima, Lewis and Grays Harbor Counties	84.65
State Route 6	East/west roadway between Lewis and Grays Harbor Counties	25.86
State Route 7	North/south roadway from US Hwy 12 to Pierce County	16.16
State Route 122	East/west roadway on north side of Mayfield Lake, connects to US Hwy 12	7.89
State Route 123	North/south roadway connecting Mt Rainier Nat'l Park and White Pass	7.56
State Route 505	East/west roadway connecting I-5 and SR 504	16.48

State Route 508	**East/west roadway connecting I-5 and SR 7**	**31.83**
Stevens Canyon Rd	**East/west roadway from Paradise Visitor Center to SR 123 and US Hwy 12**	**21.73**

Three major airports are located in Lewis County. The Chehalis/Centralia Airport has a 5,000-foot runway and can accommodate corporate jets and commercial aircraft such as Boeing 727s. Municipal airports are also located at Morton and Toledo/Winlock. The town of Packwood, in eastern Lewis County, has a smaller airfield. Sea-Tac International Airport is a 1-hour drive north of Centralia.

UPDATE

There are four public airports and 19 private airstrips located in Lewis County. The Chehalis-Centralia Airport is located within the city limits of Chehalis and has a current operating 5,000-foot runway. Other publicly owned airports are: Strom Field (at Morton); Packwood County (at Packwood); and South Lewis County/Ed Carlson Memorial Field (at Toledo).

Commercial transport is available by rail or truck in Lewis County. Passenger railway service is provided to the county by Amtrak. The two main rail freight providers in the county are Burlington Northern and Union Pacific. Several trucking companies are located within the county, for both inter- and intra-state freight hauling, for most general commodities, and cargos such as wood products and heavy equipment. Because of the inland location of Lewis County, no commercially navigable waterways exist within the county and, therefore, no shipping or barging facilities are available. The nearest port is the Port of Longview in Cowlitz County.

UPDATE

Commercial transport is available by rail or truck in Lewis County. Burlington Northern & Santa Fe Railway (BNSF) owns and operates this main rail line in the county. Amtrak provides passenger railway service to Centralia along the BNSF rail line. Several trucking companies are located within the county, for both inter- and intra-state freight hauling, for most general commodities, and cargos such as wood products and heavy equipment. Because of the inland location of Lewis County, no commercially navigable waterways exist within the county and, therefore, no shipping or barging facilities are available. The nearest shipping port is the Port of Longview in Cowlitz County. The Port of Centralia and Port of Chehalis are two regional business parks located in Lewis County and lease space to distribution centers that traverse up and down I-5.

For a more complete discussion of transportation systems within Lewis County, refer to the following:

- **Chapter 6, "Lewis County Comprehensive Plan", Dept of Community Development, Amended April 2002.**
- **"Six Year Transportation Improvement Program 2003-2008", Dept of Public Works, November 18, 2002**

2.5 Cultural Resources

Numerous cultural resource sites are located in Lewis County. Eight sites in the Centralia/Chehalis area and nine sites in other areas of the county are listed on the National Register of Historic Places. These areas include Centralia Union and Burlington Northern Depots, Claquato Church, and the La Wis Guard Station. The Cowlitz Falls South Archaeological Site in the vicinity of Morton has been determined eligible for the National Register. Various other archaeological and historic sites have been identified in the county, but have yet to be placed on the Register.

UPDATE

Numerous cultural and historical resource sites are located in Lewis County. Forty sites are listed on the National Register of Historic Places. WSDOT has two historic bridges on State Routes (SR): Chehalis River on SR 6, and South Fork Newaukum River on SR 508. Table 2.2R lists these places.

2.6 Scenic, Aesthetic, and Historical Resources

Lewis County is an area abundant with scenic, aesthetic, and historical resources. The gateway to the spectacular Mount St. Helens National Volcanic Monument is located on U.S. Highway 12 in southern Lewis County. The Monument was designated in 1986 after eruptions of the volcano ceased. The Centralia/Chehalis area, also known as the Twin-Cities, is rich with historical sites. The downtown areas of both cities have been renovated to focus on the history of the towns. Walking tours are given of the 21 historical outdoor murals painted on the downtown buildings of Centralia. Several other historical and scenic sites are located in the area including Claquato Church, Lewis County Historical Museum, Borst Homestead, and Rainbow Falls. During the summer months, the Centralia/Chehalis Railroad Association gives rides to tourists on its antique steam train.

2.7 Recreation

The central location of Lewis County in western Washington and its mild climate make for a diverse area abundant with recreational opportunities.

2.7.1 Snow-Related Activities

Numerous snow-related activities can be enjoyed in Lewis County. White Pass Ski Area, located on U.S. Highway 12 at the eastern boundary of the county, offers both downhill and cross-country skiing along with various other snow-related activities, such as snow-shoeing, snowmobiling, and sledding. Several other major ski areas of the Cascade Mountain Range are located within a short driving distance of the county.

2.7.2 Hiking, Camping, and Picnicking

Lewis County has approximately 3,800 public and private camp sites in its many national, state, and county parks and camping areas. There are also numerous city parks and private resort areas. Five Washington State parks are found in Lewis County: Lewis and Clark State Park, Rainbow Falls State Park, Ike Kinswa State Park, Matilda Jackson State Park, and Carlisle State Park. Combined, the state parks have a total of 172 camp sites on 1,128 acres. Portions of the Mount Rainier National Park and Mount Saint Helens National Volcanic Monument are located in the county, and both are excellent places to enjoy hiking, camping, and picnicking. Mount Rainier, the highest point in Washington State at 14,410 feet, is frequented by mountain climbers. The Seminary Hill wilderness area, east of Centralia, provides many hiking trails and abundant wildlife.

2.7.3 Fishing

Fishing is a very popular recreational activity in the Pacific Northwest and Lewis County is no exception. Lewis County contains many popular sport fishing lakes, rivers, and streams. The Chehalis, Cowlitz, and Nooksack Rivers all have runs of salmon, steelhead, and sea-run cutthroat trout, and all are open to sport fishing. The most popular trout lakes in the county are the Swift and Riffe Reservoirs, Carlisle Lake, and Mayfield Lake. Washington State record fish have been caught in Mayfield Lake (7.26-lb. Tiger Muskie Pike, 1991) and Wobbly Lake (9-lb. Eastern Brook Trout, 1988).

2.7.4 Boating

Boating is another popular recreational activity in Lewis County. Several boat launches are available at various private, state, and county parks, campgrounds, and resorts in the area. Two boat launches are provided by Tacoma City Light at Riffe Lake, one of the County's most popular lakes. A boat launch at Ike Kinswa State Park also allows access to Riffe Lake. although no commercially navigable waters exist in Lewis County due to its inland location, plenty of opportunities are available for boaters with small recreational water craft to enjoy the county's abundant lakes and rivers.

2.7.5 Local Events

One of the most popular local events in Lewis County is the Southwest Washington Fair. Attendance for 1991 reached well over 100,000, with nearly 2,000 exhibitors and over 9,500 individual fair exhibits. The Fair Association also sponsors numerous fair interim events. One of the most popular of these events is the Spring Youth Fair. This smaller version of the Southwest Washington Fair focuses on children, and is open to exhibits by youth under the age of 18. Both of the events bring a large number of attendees and exhibitors from outside the county, including eastern Washington and Canada. Other popular events sponsored by the Fair Association are the Lewis County Rodeo, Timberland Valley Dog Show, and Summerfest, a Fourth-of-July celebration. A popular summertime event held in Morton is the world renowned Loggers Jubilee. The Jubilee celebrates the old and new methods used in the art of logging, one of the county's principal economic activities. Jubilee events include contests such as log rolling and pole climbing, various demonstrations of logging techniques, an arts/crafts fair, parades, and the famous lawnmower races. Between 5,000 and 8,000 tourists are estimated to attend the 3-day event each summer.

UPDATE

TABLE 2-1R. LAND USE

Federal Lands			
National Forests	**413,937 ac**		
National Parks/Monuments	**43,491**		
Wilderness Areas	**101,931**		
Subtotal		**559, 359 ac**	**(36.1%)**
State Lands		**107, 561 ac**	**(6.9%)**
Private Resource Lands			
Mineral Resource Lands	**7,138**		
Class A Farm Lands	**11,716**		
Class B Farm Lands	**35,298**		

Forest Resource Lands	**449,139**		
Subtotal		**503,291 ac**	**(32.4%)**
Urban Areas			
Cities	**11,794**		
City Urban Growth Areas	**7,641**		
County Urban Growth Areas	**3,519**		
Subtotal		**22,954 ac**	**(1.5%)**
Rural Areas			
LAMIRD	**9,073**		
Residential: 1 DU/5 ac	**95,114**		
Residential: 1 DU/10 ac	**104,229**		
Residential: 1 DU/20 ac	**149,555**		
Subtotal		**357,971 ac**	**(23.1%)**
Total		**1,551,136 ac**	

TABLE 2-2R. REGISTER OF HISTORIC PLACES

REGISTER	SITE	LOCATION
National Register	George E. Birge House	Centralia
	Boistfort High School Bldg	Curtis
	Joseph Borst House*	Centralia
	Burlington Northern Depot Bldg	Chehalis
	Centralia Downtown Historic District	Centralia
	Centralia Union Depot Bldg	Centralia
	Chehalis Downtown Historic District Bldg	Chehalis
	Claquato Church Bldg	Claquato
	Wesley Everest Gravesite*	Centralia
	Grace Evangelical Church of Vader Bldg	Vader
	Hillside Historic District	Chehalis
	Holy Cross Polish National Catholic Church	Pe Ell
	John R. Jackson House	Chehalis
	La Wis Wis Guard Station No. 1165 Bldg	Packwood
	O. B. McFadden House*	Chehalis
	Mineral Log Lodge	Mineral
	North Fork Guard Station No. 1142	Randle
	Ohanapecosh Comfort Station No. O-302	Mt Rainier National Park
	Ohanapecosh Comfort Station No. O-303	Mt Rainier National Park
	Ben Olsen House (Vermeren Home)	Vader
	Olympic Club Saloon	Centralia
	O. K. Palmer House	Chehalis
	Pennsylvania Ave. West Side Historic District	Chehalis
	Randle Ranger Station Work Center	Randle
	St. Helens Hotel	Chehalis
	The Sentinel Monument	Centralia
	Three Lakes Patrol Cabin	Mt Rainier National Park
	US Post Office Centralia Main Bldg	Centralia
	US Post Office Chehalis Main Bldg	Chehalis
	Weyerhaeuser Pe Ell Bridge*	Pe Ell
	Wolfenbarger Site	Curtis
State Historic Register	Armistice Day Riot (Centralia Massacre Site)	Centralia
	Fort Borst Block House*	Centralia
	Hubbard Bungalow*	Centralia
	John Adams House	Winlock
	Lindeman House	Ethel
	McCormick Logging Railroad Tunnel	Pe Ell
	Packwood Lake Guard Cabin	Packwood
WSDOT Historic Bridges	Chehalis River on SR 6*	Chehalis
	South Fork Newaukum River on SR 508*	Onalaska

*** Denotes placement in the FEMA floodplain**

3.0 PHYSICAL CHARACTERISTICS OF LEWIS COUNTY WATERSHEDS

Lewis County is dominated by three major watersheds, the Nisqually, Chehalis, and Cowlitz River basins (Figure 3-1). The Chehalis River has its headwaters in the foothills of the Cascade Mountains of Lewis County, and drains into the Pacific Ocean near Aberdeen. The Cowlitz River originates in the Cascade Mountains, exits Lewis County near the town of Vader, and empties into the Columbia River near Kelso. The Nisqually River's headwaters are in Lewis County, but the river exits the county near Elbe and eventually flows into Puget Sound northeast of Olympia. This chapter describes the climate, physiography, geology, soils, and groundwater resources of these three watersheds.

UPDATE

There are four watersheds, also called Water Resource Inventory Areas (WRIA), in Lewis County. These are the: Chehalis River or WRIA 23; Cowlitz River or WRIA 26; Nisqually River or WRIA 11; and Deschutes River or WRIA 13. The upper headwaters of the Deschutes River watershed in Lewis County are under one ownership for timber management. For this reason, WRIA 13 is not included in our project area. Figure 3-1R shows the WRIA boundaries in Lewis County.

Lewis County lies in southwestern Washington with a total landmass of 2,452 sq miles, and measures about 90 miles (east to west) by 25 miles (north to south).

3.1 Climate

The climate of a given region is the average weather conditions over an extended period of time. Climate takes into consideration the following factors: temperature, atmospheric pressure, humidity, clouds, precipitation (including snowfall), visibility and wind.

On average, Lewis County ahs the same climate as that of the rest of the greater Puget Sound region since there are no significant natural topographic barriers sheltering Lewis County from the rest of the Sound. Most of the region's rainfall occurs during the colder months, between October and April, inconjunction with the frequent passage of low pressure systems (storm systems) through the area. The warmer months, May through September, experience significantly less rainfall due to the fact that the main jet stream that prevails over the Pacific Northwest during the colder months shifts its position to the north, and takes much of the precipitation along with it. The influx of storm systems during the fall and winter months also present the area with significantly higher winds due to the intense nature of low pressure systems. The region's highest occurrence of cloud cover is also during the fall and winter months because of the increased number of low pressure systems and precipitation activity.

Climatic statistics for City of Centralia and Lewis County weather stations are summarized in Tables 3-1 and 3-2. Trends in temperature, rainfall, snowfall, and winds at the City of Centralia weather station are summarized in Sections 3.1.1 through 3.1.4.

TABLE 3-1. Climatic Statistics for the City of Centralia Weather Station

Temperature	Average Number of Days
Below 32° F	2
Above 90° F	7
Growing Season	180
Precipitation	**Average Number of Inches**
Snowfall, Sleet, Hail	8.80
Rain	46.71

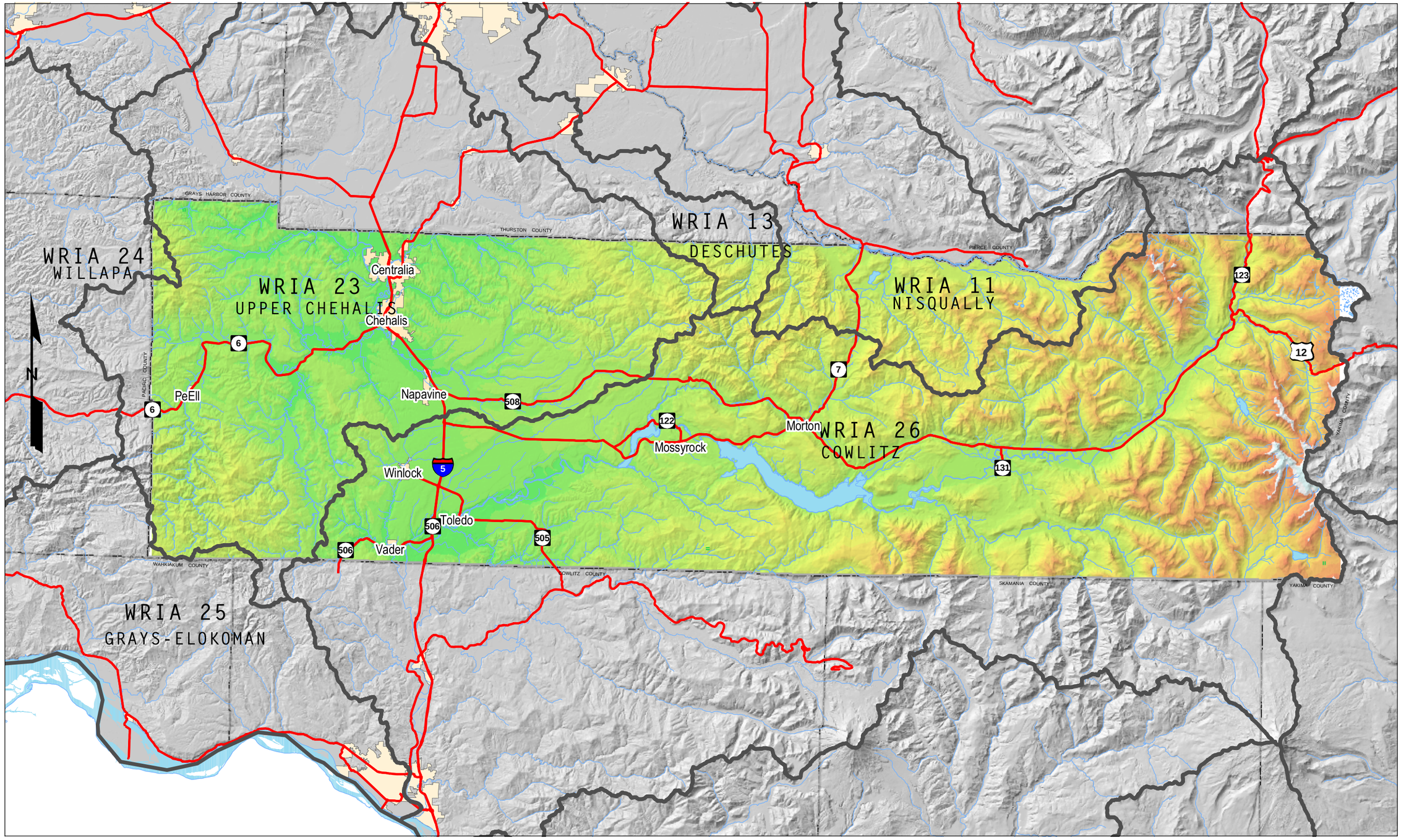

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Figure 3-1R
Water Resource Inventory Areas (WRIA)
and Topography

Lewis County
Comprehensive Flood
Hazard Mangement Plan

Heating and Cooling Degree Days	Average Number of Degrees
Heating Degree Day Normals	5,081
Cooling Degree Day Normals (65° F base, 1951-1980)	172

TABLE 3-2. Climatological Data for Lewis County Weather Stations

Station	Elevation	Average Annual Precipitation (in)	Avg Monthly Temperatures January	Avg Monthly Temperatures July	Average Annual Snowfall (in)
Centralia	185	46.71	39.0	64.8	9.9
Kosmos	775	62.01	35.8	64.0	20.3

3.1.1 Temperature

Temperature for Lewis County conforms to that of the rest of the Puget Sound region, both on an average and extreme basis. The warmest month of the year is typically July or August, when the monthly mean temperature hovers around 65° F. The coldest month of the year is January, when average monthly temperatures usually reach 39° F. The average annual temperature for the region ranges between 50° F and 53° F. The annual distribution of temperature ranges for the City of Centralia weather station is tabulated in Table 3-3.

Maximum and minimum temperatures occur during the months of July and January, respectively. Typical maximum temperatures during the month of July reach around 79° F, with record high temperatures being recorded at over 100° F. Minimum temperatures during the month of January are usually around 33° F, but record temperatures have been recorded as low as -16° F.

TABLE 3-3. Temperature Range for the City of Centralia Weather Station

Month	Minimum Temperture	Maximum Temperature	Mean Temperature
January	33.1° F	44.7° F	39.0° F
February	35.1	50.1	42.6
March	35.5	53.6	44.6
April	38.5	60.3	49.4
May	43.4	67.4	55.4
June	48.6	72.1	60.4
July	51.5	78.0	64.8
August	51.6	76.8	64.3
September	48.3	72.1	60.2
October	42.7	61.7	52.3
November	37.6	51.2	44.4
December	35.3	46.1	40.7
Annual	41.8	61.2	51.5

3.1.2 Rainfall

The greatest amount of rainfall occurs between the months of October and March. The abundance of rainfall during this period is due to the frequent storm systems that pass over western Washington. In Centralia, monthly rainfall totals for this time of year typically range between 5 and 8 inches of rain. For the rest of the

year, average monthly totals range only between 0.8 and 2 inches. The month with the highest average rainfall is November with an average of 7.77 inches. The month with the lowest average is July with only 0.84 inches. Daily rainfall amounts have been known to reach as high as 3.9 inches. On the average, annual precipitation is 46.71 inches with annual records showing a range from as low as 28 inches to a high of 60 inches.

3.1.3 Snowfall

On the average, snowfall in the region is not heavy, but the potential does exist for extremely large amounts on occasion. The average annual snowfall is approximately 9 inches with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January with the monthly average at about 4.5 inches.

3.1.4 Winds

Winds in the region rarely exceed 30 mph; winds of this speed usually only occur during the fall and winter months in conjunction with rainstorms and/or thunderstorms that pass through the vicinity. Wind speeds between 15 and 30 mph account for approximately 10 percent of the winds between the months of November and February. Wind speeds in this range (15 to 30 mph) only account for about 2 percent of the winds for other months. The rest of the wind speeds typically range between 0 and 15 mph (about 90 percent of the time). Wind speeds have been measured in excess of 70 mph during the winter months. The majority of the highest wind speeds measured have originated from the south and southwest directions (southerly and southwesterly, respectively).

3.2 Physiography

Lewis County is bounded on the east by the crest of the Cascade Mountain Range, and extends west to the Willapa and Doty Hills. The county crosses three physiographic provinces: the Cascade Range, the Puget-Willamette Lowlands, and the Pacific Coast Range. The Chehalis River valley occupies most of the northern, northwestern and western parts of the county, and the Cowlitz River valley occupies most of the southern, central and eastern parts. The uplands of the eastern county are composed of rugged mountainous and alpine topography, modified by glacial activity and drained by rivers that flow generally westward. The landscape is characterized by long, steep slopes and relatively straight, parallel drainages. Ridge tops have an average elevation of approximately 4000 ft.

3.2.1 Chehalis River

The Chehalis River originates in the Cascade foothills surrounding the cities of Centralia and Chehalis, and eventually flows into Grays Harbor at Aberdeen. The river basin, located at the southern end of the Puget Trough, has a total drainage area, including tributaries, of approximately 2,114 square miles. The valley is characterized by a broad, well-developed flood plain, and low terraces surrounded by highly dissected uplands of low to moderate relief, that have broad, rounded ridges. Many perennial streams drain these ridges. Elevations within the basin range from 170 feet at Chehalis to over 5,000 feet at the headwaters. Most uplands in the basin average 300 to 600 feet in elevation. A low divide occurs between the Chehalis River Basin and the Cowlitz watershed to the south a few miles south of Chehalis, between the communities of Napavine and Winlock. This shallow divide, at approximately 470 feet in elevation, was created when the ancient Cowlitz Glacier deposited sediment on the upland plain. At their closest point, the Chehalis and Cowlitz Rivers, the two largest rivers in southwestern Washington, are only 16 miles apart.

The slope of the upper Chehalis River from its source to Chehalis is steep, falling an average of 16 feet per mile. The slope flattens to about 3 feet per mile in the plain surrounding Centralia and Chehalis. The Chehalis River, in the Centralia/Chehalis valley, has a meandering channel that occupies a fairly uniform flood plain averaging over 1 mile wide. Most of the valley is inundated during a severe flood such as the January 1990 flood.

Tributaries to the Chehalis River in the Chehalis-Centralia valley include Dillenbaugh Creek, Newaukum River, Salzer Creek, Cola Creek, China Creek, Skookumchuck River, and Coffee Creek (Figure 3-2).

UPDATE

The Chehalis River valley in WRIA 23 is characterized by the Willapa Hills in the west, and by the Cascade foothills in the east with broad, developed floodplains downstream of its confluence with the South Fork of the Chehalis River. Elevations range from 3,110 ft at Baw Faw peak to 140 ft at the northern county line. The river gradient from its source to the floodplain is steep with an average gradient of 16 ft per mile (0.30%).

The Chehalis River uplands are undergoing tectonic uplifting. The Farallon Plate located off the coast of Oregon and Washington is being driven under the continental mass. This action causes a buckling effect which raises the coastal hills and lowers the inland valleys. When the continental plates slip and cause an earthquake, the tension that is causing uplifting of the coastal hills and lowering of the upland valleys is released, and it causes a rebounding, opposite effect. This lowering and lifting of the Chehalis River valley changes the gradients of streams and other waterbodies.

The tectonic action along with the heavier precipitation and sedimentary rock in the Chehalis-Centralia floodplain generates bedload material, which must be moved from the river channel. Sedimentary rock is usually weaker and easier to erode, and this process is hastened by high peak flows. A river channel with a low gradient tends to form meanders as a way to remove heavy bed material. The change in channel gradient from tectonic activity can compound this meandering action.

3.2.1.1 Skookumchuck River

The Skookumchuck River, one of the major Chehalis River tributaries, originates in the Snoqualmie National Forest northeast of Centralia, and empties into the Chehalis River at Centralia. The total drainage area for the Skookumchuck River is 181 square miles. Elevations within the basin range from 150 feet at the mouth to over 3,000 feet at the headwaters. The slope of the Skookumchuck River from its source to the town of Bucoda is steep, falling an average of 19 feet per mile. Below Bucoda the slope flattens and is about 5 feet per mile near Centralia. Except for the uppermost portion, the Skookumchuck River flows as a meandering channel in a flood plain, varying in width from a few hundred feet to 0.5 mile. The Skookumchuck River has several tributary creeks. The largest tributary, Hanaford Creek, has a drainage area of 58.4 square miles.

Three development activities are notable within the Skookumchuck River system. The first is the City of Centralia, which occupies several square miles at the lower end of the basin. The second development activity is Skookumchuck Dam, located about 20 miles upstream from Centralia and operated by Puget Sound Power and Light (PSP&L). Skookumchuck Dam was completed in 1971 and has been considered several times for flood control use. Another development activity of note in the Skookumchuck basin is the Centralia Steam Generating Plant on Hanaford Creek. This coal-fired facility has the authority to divert up to 54 cfs of water from the Skookumchuck River.

3.2.1.2 Newaukum River

The Newaukum River is the second major tributary to the Chehalis River in Lewis County. The Newaukum River's headwaters are in the Cascade foothills southeast of the City of Chehalis. At the U.S. Geological Survey (USGS) gauge near Chehalis, where it flows into the Chehalis River, the Newaukum River has a drainage area of 155 square miles. Elevations in the Newaukum River basin range from approximately 180 feet near the confluence with the Chehalis River to 3,200 feet in the upper basin.

The Newaukum River is made up of three forks, the north, middle, and south forks. Upstream sections on both the north and middle forks, above Forest, have slopes of 83 feet per mile; the south fork has a slope of 188 feet per mile above Onalaska. The average channel slope for the entire drainage is 35 feet per mile.

3.2.1.3 Dillenbaugh Creek

Dillenbaugh Creek flows into the Chehalis River, from the east at Chehalis. It originates in the steep foothills southeast of Chehalis, and has a drainage area of approximately 15 square miles. The gradient of Dillenbaugh Creek in the upper reaches is approximately 70 ft per mile. After it flows out onto the Newaukum River floodplain, the gradient drops as Dillenbaugh Creek parallels the Newaukum and Chehalis Rivers for nearly 3 miles before finally flowing into the Chehalis River. Dillenbaugh Creek collects much of the City of Chehalis' storm drainage in the lower reach.

3.2.1.4 Salzer Creek

Salzer Creek flows into the Chehalis River, from the east just south of the Centralia city limits and drains 24.5 square miles. The basin originates in the low-lying hills east of Centalia/Chehalis, and has a maximum elevation of about 800 ft. The stream gradient of Salzer Creek is relatively flat. Coal Creek, a major tributary of Salzer Creek, has a drainage area of 6.4 square miles and has a steeper slope.

3.2.1.5 China Creek

China Creek is a relatively small, short stream that flows through the City of Centralia to the Chehalis River. The watershed extends about 5 miles east of the Chehalis River at Centralia. It encompasses approximately 6 square miles, ranging in elevation from 180 ft to 570 ft. Much of the land is moderately steep. Most of the channel consists of pipes and culverts through Centralia.

3.2.1.6 Coffee Creek

Coffee Creek is a tributary of the Skookumchuck River. With headwaters in Thurston County, Coffee Creek flows south through the Zenkner Valley to the Skookumchuck River north of Centralia. The watershed encompasses 7.3 square miles of moderately sloping hills. Watershed elevations range from 186 ft at the confluence with the Skookumchuck River to 645 ft at the northern tip of the watershed. Stream gradient is low in the lower 4 miles of the watershed. Coffee Creek has been moved from its natural location to a periphery channel bordering the edge of adjacent hills and valley floor.

UPDATE

Coal Creek

Coal Creek is a small tributary of Salzer Creek that flows west and northwest for approximately 20.5 miles. The drainage area is 6.4 square miles, with steep channel slopes east of I-5.

3.2.2 Cowlitz River

The Cowlitz Valley extends from the Cascade crest westward about 80 miles into the southwestern part of Lewis County. The eastern part of the valley is characterized by a deeply cut trough and flat bottom lands, and the western part is characterized by bottom lands, terraces, and broad plains that are surrounded by glacially smoothed uplands of moderate relief. The western part, or lower end, of the Cowlitz Valley lies within the northern end of the Willamette Lowlands physiographic province. The major bottom lands have an elevation of 50 to 800 feet in the western part of the Cowlitz Valley, and 800 to 1,200 feet in the eastern part.

UPDATE

The terrain in WRIA 26, the eastern half of the county, consists primarily of upland and mountainous terrain incised deeply by the main stem and tributary channels of the Tilton and Cispus Rivers. The highest relief areas, which reach elevations of 6,000 to 7,000 ft NGVD, are represented by the southern slope of Mt. Rainier and the Tatoosh and Sawtooth Ranges in the north, and by the Goat Rocks

Wilderness area in the east. The central and southern portion of the Cowlitz River is primarily moderate to high relief uplands with peaks and buttes ranging from 4,000 to 5,000 ft. The elevation of the Cowlitz River decreases westward from peaks in the east and northeast to the bottom lands at the county boundary near the Town of Vader.

The Cowlitz River watershed also includes the Tilton and Cispus Rivers. Other major tributary creeks are: Rainey, Skate, Butter, Johnson, Silver, Winston, Mill, Salmon, Foster, and Olequa.

The Cispus watershed drains the extreme southeastern portion of Lewis County, and the northern edge of Skamania County. The basin is a single linear basin drained by tributary streams, similar to that of the Upper Cowlitz basin. The Cispus River extends from the western edge of the Goat Rocks Wilderness to lake Scanewa, formerly the confluence of the Cowlitz and Cispus Rivers. Most of the land within the basin is in the Gifford Pinchot National Forest; and managed for forest products, recreation and wildlife.

Stream flow in the basin is derived from precipitation and snowmelt. The upper reach of the river includes the main stem, North Fork Cispus, and Yellowjacket Creek. These tributaries contribute large sediment volumes. The reach consists of a wide valley with low to moderate channel gradients, and broad floodplain terraces bounded by steep valley walls. The channesl are primarily low to high sinuosity meander bends with occasional sections of braid bars.

Further downstream, the channel gradient increases, valley width decreases, and sediment deposition decreases. No floodplain terraces are present downstream of its confluence with Yellowjacket Creek. Smaller tributaries enter the Cispus, but any sediment entering this reach is transported through it.

Just before the Cispus flows into Lake Scanewa, the channel enters a wide valley with low to moderate channel gradients, and broad floodplains bounded by sloping to steep valley walls. Meander bends with increasing sinuosity were noted in the 2001 analysis. Several large tributaries capable of large sediment volumes enter this lower reach. Significant volumes appear to have accumulated at the Cispus confluence with Lake Scanewa, resulting in widened channels, bank erosion, and upstream intrusion of the lake.

3.2.3 Nisqually River

The Nisqually River originates on Mount Rainier. It is fed by the Nisqually Glacier and forms part of the boundary between Lewis County and Pierce County to the north, before emptying into Puget Sound between Olympia and Tacoma. Several large tributaries of the Nisqually River, including the Little Nisqually River and Mineral and Catt Creeks, drain the mountainous northeastern part of Lewis County.

3.3 Geology

The geology of Lewis County is composed primarily of igneous and sedimentary bedrock of the Tertiary Period, and unconsolidated glacial sediments of the Pleistocene Epoch. Subsequent to formation of the bedrock, between 7 and 55 million years ago, the surface of the area underwent geologic uplift, raising the volcanic and sedimentary rocks above sea level. Deformation, in the form of faulting and folding, accompanied the uplift. Landslides and erosion followed in the western part of the county; glaciation, glaciofluvial deposition, erosion, and recent volcanic activity followed in the eastern half of the county. All of these events shaped the present-day physiography and relief of Lewis County.

3.3.2 Bedrock Geology

The oldest rocks in Lewis County are the basalt and basaltic breccia flows of the Doty Hills, in the western part of the county. The flows consist of augite basalt that is generally structureless, although pillow and columnar structures are commonly observed. This rock is of middle to late Eocene age, or about 40 to 55 million years old. It is submarine in origin, having poured out from fissures in the ocean floor.

Much of the area west of the Cascades was covered by the ocean and had a shallow, fluctuating coastline during the late Eocene and Oligocene Epochs (27 to 40 million years ago). Alluvial sand and silt of the eroding, older Cascade-area mountains were being deposited into this shallow water. These alluvial deposits were compressed and hardened over time, and became sedimentary rock. Closer to the older Cascade core, the sediment, in some areas, was deposited in freshwater, and is characterized by thin beds of carbonaceous shale and coal, such as those in Hanaford Creek and along the Tilton River, north of Morton.

As the erosion of the older part of the Cascades was occurring during the middle to late Eocene and into the Oligocene, new volcanic eruptions were emitting flows of molten rock that would eventually rebuild the foothills and mountains of the present-day Cascades. The most prominent flows occurred during the late Eocene and are composed of extrusive basic igneous rock, mainly andesite, andesitic volcanic breccia, and, to a lesser extent, basalt. Slightly older, nonmarine siltstone and sandstone are interbedded with the volcanics in a few areas. Massive volcanic flows continued throughout the Oligocene and into the Miocene, depositing andesite and andesitic breccia that are in evidence today in the mountainous areas north of Randle.

Dikes of acid igneous rock, primarily diorite, granodiorite, quartz monzonite, and some granite, later penetrated the existing geologic formations in the eastern part of Lewis County. These structures are common in the southeastern corner of the county, at Tumwater Mountain and Vanson Peak.

Erosion from the Cascades during the Miocene Epoch (7 to 27 million years ago), deposited alluvium in broad, shallow basins of stagnant water. This material was eventually consolidated and became the very soft, or weak, siltstone bedrock found in the Wilkes Hills, southeast of Toledo. The siltstone is characterized by interbedded coal, preserved organic matter, and leaf impressions.

3.3.2 Glacial Geology

The Pleistocene Epoch (2 million to 10,000 years ago) in Lewis County was marked by several episodes of erosion and sculpting of existing landforms, and deposition of glaciofluvial sand and gravel, and glacial till. The oldest glacial sediments in Lewis County are the glaciofluvial deposits of the Logan Hill Formation. The Logan Hill Formation is composed of highly weathered sand, gravel, silt, and clay, approximately 1 million years old, derived from the Tertiary rocks of the Cascades. The outwash was deposited from the massive glacier, flowing westward from the crest of the Cascades, that carved out the Cowlitz and Tilton River valley troughs. Streams flowing from the melting glacial ice transported, sorted, and deposited the material in a fan-shaped, broad plain at the front of the foothills. The extent or perimeter of this plain is roughly defined by the communities of Salkum (east), Chehalis (northwest), Napavine and Winlock (west), and Vader (southwest) (Figure 2-1).

Younger glacial till deposits of the Hayden Creek Formation make up the terraces or plains of the upper Nisqually River Valley. These deposits are the result of glaciation of the upper Nisqually. Till and outwash of the Hayden Creek Formation also occupy the large U-shaped valley of the Cowlitz River and its tributaries, and the surrounding glacially smoothed uplands. These deposits are visible in roadcuts between Salkum and Morton on U.S. Highway 12 and between Onalaska and Morton on State Highway 508. Typically, they are covered by a

thick layer of highly weathered volcanic ash. This ash was apparently aerially deposited on the ice of the valley glaciers during the late Pleistocene, then later laid down like a blanket over the underlying till and outwash when the ice receded.

Small cirque glaciers developed in the Cascades during the late Pleistocene at elevations above 2,500 feet. These glaciers formed primarily on the north slopes of ridges and extended down drainages to the north and northeast, sculpting out bow-shaped cirques, hanging valleys, rocky ridgecrests, aretes, and U-shaped valleys. Thin till deposits from this event remain near the heads of alpine drainages and adjacent side slopes.

Ice-recessional sand and gravel were deposited near the end of the Pleistocene (approximately 12,000 years ago) as ice was making its final retreat. Coarse glacial outwash was deposited as terraces in both the Cowlitz and Nisqually River Valleys. The outwash deposits in these two valleys were derived from glaciers occupying these valleys. Coarse outwash sand and gravel were also deposited in the Chehalis River Valley at and surrounding the city of Centralia. These deposits were derived from the Puget Lobe of the Cordilleran Ice Sheet, which originated in British Columbia, covered all of the Puget Lowland, and terminated just north of Lewis County. As the ice sheet receded, meltwater, flowing from the ice, filled part of the Chehalis River Valley with clean quartzitic sand and hard, rounded pebbles, cobbles, and stones.

In addition to the dramatic eruptions of Mt. St. Helens during the 1980s, Lewis County has experienced many eruptions of Cascade volcanoes. Mazama ash, from the 6,600-year old event that resulted in the formation of Crater Lake in southern Oregon, can be found in most upland soils in the western part of the county. Ash layers from Mount Rainier and numerous Mt. St. Helens eruptions, in addition to Mazama ash, are present in upland soils of the central and eastern parts of the county.

The dominant geologic process that has operated within the last 10,000 years in Lewis County is erosion. Erosion of bedrock, glacial, and tephra deposits has resulted in the deposition of alluvium in the valley or lowland areas of Lewis County. Along the Nisqually River and in the Cowlitz River Valley, the alluvium is derived primarily from coarse-textured glacial outwash, and volcanic ash**,** ~~and~~ pumice. As a result, the alluvium in those valleys is coarse and noncohesive in nature. Fresh alluvium is deposited adjacent to the Cowlitz and Nisqually Rivers by seasonal floods. The Chehalis River and its tributaries drain dominantly older, rounded, lower relief hills of the west half of the county. These hills, composed of softer, more highly weathered, and finer-grained rock, supply alluvium to the Chehalis River that is finer in texture than that of the Nisqually and Cowlitz River Valleys.

3.4 Soils

Soil is formed through the processes of physical and chemical weathering of geological material over time. The characteristics and properties of the soil at any given place are determined by the interaction of the following five factors:

1. Physical and mineralogical composition of the parent material

2. Climate under which the soil material has accumulated and has existed since accumulation

3. Plant and animal life in the soil and on the surface of the soil

4. Topography, or the lay of the land

5. Age of the soil, or the length of time the forces of soil formation have acted on the parent material

Lewis County soils have been mapped by the U.S. Department of Agriculture, Soil Conservation Service (SCS) (Figure 3-3). Table 3-4 summarizes the major soil classifications in Lewis County.

Soils in the valley bottoms of all three drainage basins are derived from alluvium. These soils tend to be very deep (greater than 60 inches deep), and range from poor to excellent in drainage characteristics. In the upper Cowlitz and Nisqually drainages, the valley floor alluvium contains pumice and volcanic ash which makes these soils excessively drained in places. The drainage characteristics of upland soils in all the river basins, varies based on slope and parent material. Glacial till and fine-grained bedrock parent material weathers to a poorer drained soil than soil derived from outwash sand and gravel, alluvium, or coarse-grained bedrock. Cool upland and cold mountain soils are only present in the very uppermost portions of each of the three drainages.

The small-scale soil map of Lewis County (Figure 3-3) is not detailed enough for local land-use planning, but a few general observations can be made about some of the map units (U.S. Soil Conservation Service 1987). Reed-Chehalis, Ledow-Cloquato, and Spanaway soils are most often used for urban development. Siler-Schooley-Greenwater and Salkum-Prather-Lacamas soils are also appropriate for urban areas, but because these soil classifications are poorly drained and are subject to seasonal flooding adequate drainage systems, land surface sculpting, and diking are required. Spanaway soils, upon which much of Centralia was built, have good potential for light urban development. Indianola, Nisqually, and Spanaway soils have limited potential for on-site sewage disposal systems because of the high permeabilities. Salkum-Prather-Lacamas soils are not suitable for dense urban use because of their low permeabilities. Winston-Olequa, and Melbourne-Buckpeak-Centralia soils have a fair potential for urban and homesite development, except where sloping. They are primarily used for light development, such as homes and small rural businesses. The Buckpeak, Schneider, and Baumgard soils are poorly suited to urban and homesite development because of the slope, which is typically underlain by bedrock or unstable, colluvial soil material. Cinebar-Newaukum soils have good potential for urban development and can be found near large population centers and recreational areas.

Numerous soil groups are suitable for agriculture. Winston-Olequa, Salkum-Prather-Lacamas, Melbourne-Buckpeak-Centralia, Baumgard-Schneider-Olympic, Cinebar-Newaukum, and Cispus-Nevat soil groups are the most suitable for crops because of their warm, moderate to well-drained, and fairly level nature. Reed-Chehalis, Ledow-Cloquato, and Siler-Schooley-Greenwater soils have good potential for cultivated crops, hay, and pasture, but are commonly limited by seasonal wetness. Reed-Chehalis, Ledow-Cloquato, and Cinebar-Newaukum soils can also be appropriate for specialty crops and vegetables because they are organic-matter-rich, moderately permeable, and well-drained. The sandy, somewhat excessively drained Indianola and Nisqually soils, which are part of the Spanaway soils group, and the well drained soils in the Reed-Chehalis and Ledow-Cloquato map units are well suited to tree nurseries. These coarse to medium textured soils provide adequate root aeration and good drainage for seedlings. Most soils in the county have good or fair potential for timber production except Stahl-Reichel, Cattcreek-Cotteral, Reed-Chehalis, Siler-Schooley-Greenwater, and Salkum-Prather-Lacamas.

3.5 Groundwater Resources

Groundwater in Lewis County is derived from the following three aquifer systems: bedrock aquifers of Tertiary rocks, glaciofluvial deposits of the Pleistocene Epoch, and recent alluvial deposits. Glaciofluvial deposits, the

most important source of groundwater, include the Logan Hill Formation, the Lacamas Creek unit, the Newaukum terrace unit, the Layton Prairie unit, undifferentiated terrace deposits, and glacial outwash. The bedrock aquifer is composed of basalt, shale, and other sedimentary rocks. Well yields in this aquifer are typically low, except in the North and South Forks Newaukum River area. Recent alluvial deposits in the Cowlitz, Chehalis, and Newaukum River valleys compose the third general category of water-bearing materials in Lewis County. As an aquifer, these deposits are not as productive as the glaciofluvial deposits.

UPDATE

The primary drinking water supply for Lewis County residents is groundwater.

Groundwater occurrence is variable in WRIA 23. One exception is the Newaukum artesian basin where yields of several hundred gallons per minute are common. This artesian basin has an area of about 25 square miles, and is charged from precipitation that occurs on adjacent uplands.

4.0 ENVIRONMENTAL SETTING

This chapter reviews the environmental setting in Lewis County associated with water quality, fisheries, wildlife, and wetland resources. It provides an overview of the existing environmental conditions pertaining to the well populated Chehalis watershed. These environmental aspects are relevant to flood hazard planning because they may impact design and location of flood control structures and be a factor in determining the appropriateness of nonstructural flood hazard reduction measures. Emphasis is placed on the Chehalis watershed to be consistent with the planning objectives outlined in Section 1.7.

4.1 Water Quality

The surface waters in Lewis County support a wide variety of beneficial uses including irrigation, fisheries production, livestock watering, wildlife habitat, and recreation. Each beneficial use entails certain minimum water quality requirements. To protect these beneficial uses, the Washington State Department of Ecology has established water quality standards for all surface waters in the state. The state water quality standards and index values are described below followed by specific water quality conditions associated with the Chehalis River.

4.1.1 Water Quality Standards

Each river, lake, and stream has a designated water quality classification based on the present and potential use of the water, as well as any natural limitations on water quality. Ecology has developed four major water quality classes: Class AA (extraordinary), Class A (excellent), Class B (good), and Class C (fair). Each class has been assigned specific water quality standards for physical, chemical, biological, and aesthetic parameters.

To assess and characterize surface waters in addition to ensuring compliance with the applicable water quality standards, Ecology monitors surface water quality at numerous locations throughout the state, including Lewis County. Four ambient water quality monitoring stations are established on the Chehalis River. Water quality measurements of temperature, dissolved oxygen, fecal coliform bacteria, pH, turbidity, suspended sediment, specific conductivity, and nutrients are periodically taken at each of the monitoring stations. The water quality monitoring station descriptions and parametric coverage are outlined in Table 4-1 and a brief overview of the significance of each water quality parameter is described below.

4.1.1.1 Temperature

Temperature changes in water bodies can alter the aquatic community. Increased temperatures can result in a change from a cold-water fishery to a warm-water fishery because high water temperatures may be directly lethal to salmonids and other cold water fish species. High temperatures also can limit reproduction of cold-water fish, and may alter important habitat components such as aquatic plants and insects (EPA 1986). Moreover, the ability of water to absorb oxygen decreases with increasing water temperature.

Elevated water temperatures may result from eradication of the riparian vegetation that shades the water body. Higher water temperatures also may be associated with decreased stream flow due to diversions, industrial cooling water return flows, and/or irrigation water return flows.

To protect cold-water fisheries, Ecology has established standards for maximum allowable water temperature. The Class AA standard is 16°C and the Class A standard is 18°C.

4.1.1.2 Dissolved Oxygen

Inadequate dissolved oxygen can be lethal to cold-water fish species such as trout and salmon. During their early life stages, cold-water fish generally require at least 8 mg/l (ppm) of dissolved oxygen. Adults can tolerate as little as 4 mg/l for 1 day, but the average dissolved oxygen concentration over any 30-day period should not fall below 6.5 mg/l (EPA 1986).

Dissolved oxygen concentrations can be depressed through addition of organic materials to the water body. The decomposition of these materials removes dissolved oxygen from the water column. The inorganic plant nutrients nitrogen and phosphorus can indirectly cause depletion of dissolved oxygen levels. These nutrients can stimulate blooms of algae and other aquatic plants that can cause wide diurnal fluctuations in dissolved oxygen content, with oxygen supersaturation during the day and depletion at night. The death and decay of these plants can remove dissolved oxygen from the water.

Ecology has established standards for minimum allowable dissolved oxygen concentrations. The Class AA standard requires a minimum of 9.5 mg/l. The Class A standard is 8 mg/l.

4.1.1.3 Fecal Coliform Bacteria

Fecal coliform bacteria propagate only in the intestines of humans and other mammals. Hence their presence in surface water bodies indicates that fecal contamination has occurred. The microorganisms responsible for salmonella, cholera, typhoid, hepatitis, tuberculosis, and other diseases may be present in feces (Geldreich 1972). While fecal coliforms themselves are not pathogenic (i.e., disease-causing), they provide an index as to the potential presence of pathogenic viruses and bacteria. For example, when fecal coliform densities exceed 200 organisms/100 ml, the incidence of pathogenic salmonella increases sharply (EPA 1976).

High fecal coliform concentrations do not necessarily mean that a water-borne disease epidemic is imminent. Whether or not pathogens are present in sufficient doses to cause human diseases is dependent on the number of disease carriers (if any) in the human or animal population responsible for the fecal contamination. The specific use(s) of the water (e.g., irrigation, recreation, domestic use) and the amount of water that must be ingested to constitute an infectious dose are also important factors. The source of the fecal contamination--human or animal--is very important. Humans are the sole reservoir of typhoid, cholera, dysentery. and several other diseases. Animals play no part in the propagation of these purely human diseases. On the other hand, animal feces may contain certain organisms that are pathogenic to humans and to other animals as well. Fecal coliforms and other enteric microorganisms do not persist indefinitely in the aquatic environment. Thus, concentrations will decrease with time.

The Class AA standard requires that fecal coliform bacteria shall not exceed a geometric mean of 50 organisms per 100 ml, with not more than 10 percent of the samples exceeding 43 organisms per 100 ml. The Class A standard calls for a maximum geometric mean of 100 organisms/100 ml, with not more than 10 percent of the samples exceeding 200 organisms/ 100 ml.

4.1.1.4 pH

pH is a measure of the acidity or alkalinity of the water. The pH of pure water is 7.0 (neutral). It is an important factor in the chemical and biological systems of natural water. The solubility and toxicity of heavy metals and certain other pollutants is directly related to pH. pH also affects the corrosivity of the water.

The pH of natural waters can be affected through contamination with acids (e.g., sulfuric acid) or bases (e.g., cement, sodium hydroxide). Heavy algal blooms can cause wide diurnal fluctuations in pH.

The state standards specify a pH range of 6.5-8.5 for both Class AA and Class A waters.

4.1.1.5 Turbidity

Turbidity is caused by suspended or colloidal organic and/or inorganic matter in the water column. Turbidity deceases water clarity and light penetration, which may lead to decreased photosynthesis by aquatic plants. This can reduce the amount of cover and food available for aquatic insects and fish. Turbidity also makes it more difficult for fish to find food. Very high turbidities can kill fish by clogging the gills.

Turbidity can arise from natural as well as man-made sources. Glacial silt and volcanic ash are examples of the former; erosion from croplands and construction sites is an example of the latter.

In recognition of the role of natural sources of turbidity, the state standards for Class AA and Class A waters require that turbidity should not exceed five units, or 10 percent, over background (natural) turbidity.

4.1.1.6 Suspended Solids

Suspended solids consist of sand, silt, and/or organic particles that are carried in the water column in an undissolved state. When the velocity of the water decreases, the material carried in suspension begins to drop out of the water column. The larger, heavier particles tend to drop out first. The smallest particles may remain in suspension until the water is virtually stationary (e.g., in a lake or reservoir).

Suspended solids contribute to increased turbidity, as discussed above. Suspended solids may also cause abrasive injuries and clog the gills of fish. Spawning beds may be destroyed when suspended materials settle out and coat the bottom of the channel. The State of Washington does not have standards for suspended solids.

4.1.1.7 Nutrients

Nitrogen and phosphorus can lead to excessive growth of algae and other aquatic plants. Algal blooms can cause taste, order, and aesthetic problems. They prevent sunlight from penetrating to lower depths, thereby inhibiting the productivity of other plant species. Some species produce toxic substances. In "soft" waters, the intense photosynthesis associated with algal blooms can lead to wide diurnal fluctuations in pH. Decomposition of aquatic plants can deplete the dissolved oxygen supply in the water column and create toxic anaerobic conditions in the bottom sediments. There are no state water quality standards for nitrogen and phosphorus.

4.1.2 Water Quality Index Values

Ecology has developed a water quality index system designed to facilitate the interpretation of water quality results. An index value is calculated for each water quality parameter listed above in addition to an overall water quality index. The indices are based on measurements recorded at the monitoring station. The higher the water quality index number, the lower the water quality. An index value below 20 for temperature, dissolved oxygen, fecal coliform bacteria, or pH indicates that the water segment meets state standards for Class A waters. Index values between 20 and 60 are indicative of marginal water quality, while values above 60 are indicative of poor water quality (Ecology 1988).

4.1.3 Chehalis River Water Quality

Water quality index values for the Chehalis River system are summarized in Table 4-2. Table 4-3 summarizes the water quality monitoring results associated with the Chehalis River. Water quality in the Chehalis River is generally excellent to extraordinary. The reach of the Chehalis River between its headwaters and Rock Creek is

considered to be of extraordinary quality and has been designated by Ecology as a Class AA surface water. All other reaches of the Chehalis River have been designated as Class A, indicative of excellent water quality. Three reaches of the Chehalis River are discussed below to highlight their special characteristics.

4.1.3.1 Chehalis River: Rock Creek to Newaukum River Segment

The section of the river between Rock Creek and the Newaukum River has been designated Class A (excellent). Based on recent water quality data from the monitoring station at Dryad, water quality in this reach generally meets the Class A criteria. The general excellence of the water quality is reflected in the overall water quality index value of 11 for this sampling station. Nevertheless, the Class A standards for temperature and fecal coliform bacteria were exceeded on several occasions. Water temperatures occasionally rose above the Class A standard of 18°C during the summer months. Fecal coliform bacteria densities exceeded 200 organisms per 100 ml in seven of the 158 samples collected during 1978-1990. The elevated temperatures may be ascribed to lack of shade and/or water diversions or inflows. The fecal coliform densities probably reflect short-term episodes of fecal contamination from livestock.

4.1.3.2 Chehalis River: Newaukum River to Scammon Creek Segment

The reach of the Chehalis between Scammon Creek and the Newaukum River has been designated Class A, but with a special condition that allows dissolved oxygen levels to fall as low as 5 mg/l (ppm) during the summer months. The normal Class A standard requires a minimum dissolved oxygen concentration of 8 mg/l. The special condition was issued because oxygen levels in the designated reach of the Chehalis River commonly violate Class A standards during the period between June 1 and September 15.

During 1985-1990, dissolved oxygen concentrations in the Chehalis River at Centralia fell below 5 mg/l and below 8 mg/l on ten occasions. Water temperatures exceeded the Class A standard of 18°C thirty-two times. Fecal coliform densities were greater than 200 organisms/100 ml in 35 of the 161 samples collected during the 12-year period (Lewis County Conservation District, October 1992).

Concentrations of nitrogen and phosphorus were high on a number of occasions during the past 3 years, as evidenced by a water quality index for nutrients of 23. The overall water quality index (all parameters) was 27, indicating that water quality generally was worse than the Class A standards (Table 4-2).

The observed nutrient and fecal contamination may be attributable to runoff from farms, dairies, and ranches (Ecology 1990). Considering that the two largest communities in Lewis County, Chehalis and Centralia, are located in this reach, it is possible that urban runoff also may be partially responsible. The elevated water temperatures may be ascribed to lack of riparian shade and/or irrigation or drainage ditch inflows. The low dissolved oxygen concentrations during the summer months probably reflect the combined effects of high temperatures and organic enrichment.

4.1.3.3 Chehalis River: Scammon Creek to Grays Harbor

This reach of the Chehalis River has been designated Class A by Ecology. A water quality monitoring station is located at the town of Porter in Grays Harbor County, approximately 60 miles downstream of Centralia. Based on the overall water quality index of 15 for the Porter monitoring station, water quality in the upper end of the reach generally meets the Class A standards (Table 4-2). However, water temperatures exceeded the standard of 18°C fifteen times and fecal coliform densities exceeded 200 organisms/100 ml on twelve occasions during the past 12 years. High nutrient levels during the past 3 years have resulted in a water quality index value of 23 for nutrients (Ecology 1990).

4.2 Wetlands

4.2.1 Overview

Wetlands and riparian plant communities are found throughout Lewis County. Riparian plant communities form bands of varying widths along streams and rivers. Wetlands are found within the riparian areas and also in areas away from streams. The primary distinction between riparian communities and wetlands is that the former may encompass vegetation that is not dependent on periodic inundation, while the latter always contain hydrophytic vegetation and/or soils.

Riparian communities often constitute important wildlife habitats, providing food, shelter, and protected access to water for a wide variety of birds and mammals. Aquatic habitats also are enhanced by riparian vegetation. Riparian vegetation shades the stream, which helps to prevent excessive water temperatures. Plant materials and insects fall from the vegetation into the water, providing food for fish and other aquatic organisms. Trees and shrubs that fall into the water provide cover for fish. Moreover, riparian vegetation may reduce water quality degradation associated with bank erosion.

Wetlands are dynamic systems that provide wildlife habitat, storm runoff and flood storage, water filtration and purification, groundwater recharge, shoreline protection, sediment and pollution containment, and nutrient cycling. In addition, wetlands typically are productive ecosystems that support large, diverse populations of plants and animals. The water storage function of wetlands can help to reduce downstream flooding by detaining runoff during high flow events. Many vegetated wetlands also function as natural water filters. Filtration occurs in these systems where water flow velocities are slowed by wetland plants, causing suspended sediments to fall out of the water column. Further water quality enhancement is achieved through microbial activity and plant uptake, which act to decompose and absorb nutrients and chemical pollutants.

In recognition of the ecological significance of wetlands, federal and state laws have been promulgated to protect wetland resources from adverse impacts associated with dredging, agricultural and urban development, and other activities. Under the current government regulations, activities that affect wetlands must obtain permits and may be required to provide mitigation measures. These measures could include habitat restoration, wetlands enhancement, and creation of artificial wetlands.

4.2.2 Wetland Inventory

4.2.2.1 Introduction

A Lewis County Wetland Inventory was conducted around the cities of Centralia and Chehalis by Applied Environmental Services Incorporated (AES). Numerous tributaries and creeks drain into the Chehalis River valley from both the east and west. This wetland inventory primarily focused upon the watershed drainage areas east of Centralia/Chehalis. Specifically, Dillenbaugh, Salzer, and China Creek watersheds contribute significantly to the urban area flooding problems associated with this valley.

A wetlands inventory is a required component of this CFHMP. Steps taken to address flood control issues include an identification and consideration of potential impacts of flood control work on aquatic resources which include wetlands. The wetland inventory is only one of the many facets analyzed to address the flood issues. The Centralia/Chehalis valley wetland inventory was prepared to conform to the guidelines specified in the Flood

Control Assistance Account Program (FCAAP). FCAAP guidelines outline the tasks necessary to collect wetlands data and to complete a reconnaissance level wetlands field inventory within the study area.

Information collected in this study was used to assess the role of wetlands in flood hazard management during the development of the CFHMP. The wetlands inventory study area extends from approximately Maurin Road, where Dillenbaugh Creek reaches the valley floor, to China Creek east of Centralia. It is important to note that wetland inventory maps are not 100 percent inclusive; wetland boundaries are approximate.

4.2.2.2 Wetland Definitions

Several wetland definitions have been used by federal and state agencies for various laws, regulations and programs. Four primary definitions are applied to wetlands in Washington State: Section 404 of the Clean Water Act; the Flood Security Act of 1985; the Shoreline Management Act; and the U.S. Fish and Wildlife Service's (USFWS) definition.

Ecology states:

> For the purpose of conducting a wetland inventory, all wetland inventories in the state of Washington should use the USFWS definition. All areas that function as a wetland should be mapped, even if they aren't regulated. Local governments must know the location of the entire resource, not a portion of it. Also the standard use of the USFWS definition for wetland inventories will provide consistency between all local inventories, as well as the NWI [National Wetlands Inventory]. (Ecology 1989; Ecology 1991 FCAAP requirements).

The USFWS definition of a wetland is:

> Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water ...Wetlands must have one or more of the following attributes: 1) at least periodically, the land supports predominantly hydrophytes, 2) the substrate is predominantly undrained hydric soils, and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year. (Cowardin et al. 1979).

In other words, for purposes of a wetlands inventory, the presence of any one of the three wetland parameters (vegetation, hydrology, or soils) is enough to be noted on the inventory map. This differs from a jurisdictional wetlands delineation where all three wetland parameters must be confirmed prior to defining the area as wetland. So, by definition, an inventory typically encompasses more acreage than a formal delineation. However, the National Wetlands Inventory (NWI) and the field reconnaissance used in this flood control plan may not have identified or included all of the wetlands that could be affected by federal and state wetland regulations.

4.2.2.3 Objectives

The objectives of the wetland inventory were to:

- Inventory and map wetlands within the Centralia/Chehalis corridor
- Classify wetlands according to Cowardin et al. (1979)

- Categorize inventoried wetlands by the Ecology (1989) *Four-Tiered Rating System*

- Spot check a number of the previously inventoried wetland areas to provide confidence that previously performed wetland work is still valid and consistent with today's environmental conditions

- Document the methods used to conduct the wetland inventory and provide a discussion of the results and their implications to future planning in the Centralia/Chehalis Valley

4.2.2.4 Methods and Materials

Review of Existing Resources

Prior to field verification, a paper inventory was conducted to identify potential wetland areas within the Centralia/Chehalis Valley. The following resources were reviewed:

- 1" = 2000' U.S. Geological Survey (USGS) quadrangles from Centralia (1985), Napavine (1985), Adna (1986), Rochester (1986), and Tenino (1973).

- 1" = 2000' U.S. Fish and Wildlife Service National Wetlands Inventory (USFWS, NWI) of the same locations: Centralia (1981), Napavine (1981), Adna (1980), Rochester (1981), and Tenino (1981).

- *Soils Survey of Lewis County*, U.S. Department of Agriculture, Soil Conservation Service (SCS) 1987.

- 1" = 3700' scale black and white aerial photographs of the valley from 1976.

- *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

AES produced reconnaissance maps of potential wetlands within the Centralia/Chehalis Valley. The regional USGS, NWI, and SCS maps were computerized. Overlay composite maps were produced that illustrate major roadways, rivers, streams, wetlands and hydric soils. Scaled maps with the above data included, were used as field maps for interpretation of wetlands.

Field Investigation

Guidelines of FCAAP specify that wetlands data be part of all CFHMPs. If a large-scale inventory has not been completed, a preliminary map of wetlands that augments the NWI by mapping potential wetlands should be produced. However, if the existing wetlands inventory is adequate, field verification may be omitted. It was determined that to produce the most accurate inventory map possible, field verification of selected wetlands was necessary to assure that previous wetland work was still valid.

The expansiveness of the Centralia/Chehalis flood plain and the number of different, yet connected wetlands made it necessary to focus on defined problem areas within the inventory study site. The three main targeted areas included the lower Dillenbaugh Creek Watershed, the Fairgrounds portion of the Coal/Salzer Creeks

Watershed, and a portion of the China Creek Watershed slightly upstream of Centralia. In addition, a number of additional spot verifications were performed.

Areas that had been identified as wetlands during the paper inventory phase were verified. A general reconnaissance of the Chehalis valley was conducted to locate previously unidentified wetlands. Field investigators visited several wetlands in each of the targeted areas. All wetlands visited were evaluated based upon the USFWS wetland definition. Wetland Inventory Data Forms were completed and can be found in Appendix B.

4.2.2.5 Wetland Determination

At each verified site, the shape and size of the wetland was compared to the draft wetland map assembled prior to field work. Soils, vegetation, and hydrology were evaluated to determine the extent of the wetland.

Soils

Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile (SCS 1987). Because of wet, anaerobic conditions, hydric soils exhibit certain characteristics that can be observed in the field. Such characteristics or indicators include high organic content, accumulation of sulfitic material, greenish or bluish gray color (gley formation), spots or blotches or orange color (mottling), and dark soil colors (low soil chroma). For the purposes of this inventory, soils analysis was not performed. Soils data were obtained from the Lewis County Soils Survey (USDA, SCS 1987) and not field verified.

Vegetation

Representative vegetation within mapped wetland areas was examined in the field and plant species were recorded for each vegetation stratum. Wetland plants are specifically adapted for life under saturated or anaerobic conditions. *Hydrophytic vegetation* data consist of a listing of all dominant plant species present in the vegetation unit. Plant species are divided into three strata: tree, shrub, and herb. Stratum dominance is calculated for each. Dominant species are those in each stratum (tree, shrub, herb) that, when ranked in decreasing order of abundance and cumulatively totaled, immediately exceed 50 percent of the total dominance measure for that stratum. Any additional plant species constituting 20 percent or more of the total dominance measure for the stratum are also considered dominant (FICWD 1989). The U.S. Army Corps of Engineers (COE) and the USFWS have determined the estimated probability of each plant species' occurrence in wetlands and have assigned an "indicator status" to each species to reflect their findings (Reed 1988). When more than 50 percent of the dominant species in each unit have a wetland indicator status of obligate wet (OBL), facultative wet (FACW), or facultative (FAC), the unit meets the hydrophytic vegetation criterion.

Vegetation data can be found in the inventory data sheets (Appendix B).

Hydrology

Water must be present in order for wetlands to exist; however, it need not be present throughout the entire year. Wetland hydrology is considered to be present where there is permanent or periodic inundation, or soil saturation, for a significant period (usually a week or more) during the growing season, which is March through October (FICWD 1989). Wetland hydrology indicators include areas of ponding or soil saturation, evidence of previous water inundation, such as dry algae on bare soil and drainage patterns. Wetland hydrology data obtained for the representative wetlands are included on the inventory data forms (Appendix B).

Wetland Classification System

Wetland areas within the Centralia/Chehalis Valley were classified by USFWS according to definitions described in *Classification of Wetlands and Deepwater Habitats of the United States*, by Cowardin et al. (1979). Inventory areas are broken down by system, subsystem, and class. The term "system" refers to a complex of wetland and deepwater habitats that share the influence of similar hydrologic, geomorphologic, chemical, or biological factors. Systems are subdivided into specific categories called "subsystems." The "class" is the highest taxonomic unit below the subsystem level. It describes the general appearance of the habitat in terms of either the dominant vegetation life form or the physiography and composition of the substrate features that can be recognized without the aid of detailed environmental measurements.

Each site determined to be a wetland was roughly categorized following the Ecology (1990) *Washington State Four-Tiered Wetlands Rating System* and classified using Cowardin et al., (1979). The Ecology 1990 rating system was used instead of the new Ecology (1992) rating form for the quick field estimates used in this inventory. The results of the field investigation represent only the verification of a selected portion of the wetland inventory, not a jurisdictional wetland delineation.

The inventory process does not allow for the detailed data collection necessary for a regulatory wetland determination. Inventories can be used to inform planners that a particular site has been initially identified as a wetland and should be delineated if site-specific regulatory information is required. Some sites were not directly investigated because of access restrictions, use by livestock, or sheer magnitude of wetlands in the basin. These areas were observed "over the fence." If they appeared to have either wetland plant species or hydrology, they were shown as wetlands on the field maps. These areas tend to be drawn generously (i.e., the largest area that is potentially wetland was outlined) to avoid leaving out areas that could not be assessed.

4.2.2.6 Results

Wetlands Inventory Maps

A wetland map, located in the map pocket, was produced for this project. It is a compilation of the hydric soils, based upon the Soils Survey of Lewis County (SCS 1987) and the NWI maps of the Centralia/Chehalis flood plain. Hydric soils are shown with a stippled pattern. Wetland classifications were taken directly from the NWI map.

The field verification performed on June 23 1993, provided an accurate reconnaissance of the wetlands listed in the NWI. A number of wetland observations were made in the areas of concern. The observation location and the Wetland Inventory Data Form number are noted on the wetlands map with circled numbers. Wetland Inventory Data Forms appear in Appendix B. Wetlands were classified according to Cowardin et al. (1979) to the class level. The location and size of wetlands are approximate and not intended for regulatory purposes.

Wetland Community Descriptions

Each wetland community type within the Centralia/Chehalis inventory area is described below.

<u>Palustrine Emergent Wetlands (PEM)</u>

Cowardin et al. (1979) define palustrine emergent wetlands as those nontidal areas dominated by erect, rooted, herbaceous hydrophytes present for most of the growing season in most years. These areas are commonly known by many names, including marsh, meadow, and slough. In the Centralia/Chehalis Valley, many emergent wetlands are used as pasture or agricultural fields along the river, the creeks, or in isolated depressions. Common

plants found in these wetlands include soft rush *(Juncus effusus)*, cattail *(Typha* spp.), and miscellaneous grass species. Hydrologic conditions during the wet season range from seasonally saturated to inundated based upon hydric soils as mapped by the Lewis County Soils Survey (SCS 1987).

Palustrine Scrub/Shrub (PSS)

Cowardin et al. (1979) describe scrub/shrub wetlands as those areas dominated by woody vegetation less than 20 feet tall, either true shrubs or small trees. These wetlands may either be a successional stage leading to forested wetland or they may be relatively stable communities (Cowardin et al. 1979). Scrub/shrub wetlands are commonly known as shrub swamps. In the Centralia/Chehalis area, portions of the valley adjacent to the numerous creeks are dominated by scrub/shrub wetlands. Common plants found in these wetland areas include hardhack *(Spirea douglasii)*, willow *(Salix* spp.), and red-osier dogwood *(Cornus stolonifera)*. Hydrologic conditions during the wet season range from seasonally saturated to inundated, based upon NWI and field verification. Many of the palustrine scrub/shrub wetlands contain hydric soils as mapped by the Lewis County Soils Survey (SCS 1987).

Palustrine Forested Wetlands (PFO)

Palustrine forested wetlands are characterized by Cowardin et al. (1979) as wet areas with woody vegetation that is 20 feet or taller. Normally they possess an overstory of trees, an understory of young trees and shrubs, and an herbaceous layer (Cowardin et al. 1979). This generalization is true for the Centralia/Chehalis Valley. Forested wetlands are a feature present in the landscape of the Centralia/Chehalis Valley. Common plants found in these wetland areas include cedar *(Thuja plicata)*, alder *(Alnus rubra)*, and large willow *(Salix* spp.). Hydrologic conditions during the wet season range from seasonally saturated to inundated, based upon NWI and field verification. Many of the palustrine forested wetlands contain hydric soils as mapped by the Lewis County Soils Survey (SCS 1987).

Wetland Inventory Summary
Wetlands within the Centralia/Chehalis Valley generally appear to fit into the following categories:

- Forested wetland bordered by river or creek
- Scrub/shrub wetland
- Emergent wetlands

Typically these categories occur adjacent to one another. Fifteen wetland communities within the Centralia/Chehalis Valley are described and summarized in Appendix B.

The scope of an inventory of this type is broad, and as such presents a useful overall picture of the wetland resources to be incorporated into flood control planning. Wetland boundaries on the wetland inventory map are approximate. Precise boundaries of individual wetlands can be obtained through a formal delineation (Federal Interagency Committee for Wetland Delineation 1989), followed by a survey of the wetland boundary by a licensed land surveyor.

4.3 Fisheries

Fisheries constitute an important resource in Lewis County. Fisheries vary according to type and quality of the aquatic habitats, which are related to several factors. Streamflow levels, water depth, water quality, and physical

characteristics, such as the type of material forming the channel bed and banks and the presence of logs and other debris, are important factors affecting habitat quality.

The Chehalis River hosts many fish species including trout and salmon as well as bass, perch, crappie, bullhead, and sunfish. Although warm-water species are found in the rivers within Lewis County, none are considered to be of sporting or commercial importance. A complete listing of the fish species identified in Lewis County is provided in Appendix C.

The Upper Chehalis River provides habitats supporting chinook and coho (silver) salmon, steelhead, and sea-run cutthroat trout. In addition, native cutthroat and rainbow trout reside in the Upper Chehalis River. Approximately three million coho salmon fingerlings supplied by the Skookumchuck hatchery are released in the Upper Chehalis River every year.

The mainstem of the Chehalis River from the Skookumchuck River to the Newaukum River provides water for migration of fall and spring chinook, coho, and chum. Limited rearing and spawning is expected to occur in this reach. This may be attributed to high water temperatures during the summer months and urban and agriculture non-point pollution reducing river oxygen levels. The entire mainstem of the Chehalis River and 31 linear miles of tributaries are utilized by salmon (Washington State Department of Fisheries, November 1975).

The Skookumchuck and Newaukum Rivers, primary tributaries to the Chehalis, also provide spawning and rearing waters for coho, spring chinook, and fall chinook salmon. In addition, chum have been located on the North Fork of the Newaukum River. Spawning and rearing of these fish occur on the Skookumchuck River between the Skookumchuck Dam and the confluence with the Chehalis River. Above the Skookumchuck Dam, salmon use is limited due to salmon migration barriers at dam locations. All of the Skookumchuck mainstem and 41 linear miles of tributary streams are believed to currently provide salmon production (Washington State Department of Fisheries, November 1975).

The Newaukum River watershed has four river reaches supporting vital fish habitat. All of the mainstem, 17 miles of the North Fork, and all of the South Fork are utilized for salmon production. In addition, 4 linear miles of the Newaukum mainstem tributaries, 41 linear miles of the North Fork tributaries, and 17 miles of the South Fork tributaries are used for salmon production. These streams furnish cold water temperatures and deep pools suited for maturation of adult spring Chinook. Chinook spawning within the North Fork of the Newaukum River is generally restricted to the lower 10 miles because of stream diversions. The South Fork of the Newaukum River below Kearney Creek generally provides the best rearing habitats for juvenile coho and spring Chinook within the Newaukum River watershed (Washington State Department of Fisheries, November 1975).

4.4 Wildlife

Lewis County encompasses many different ecosystems, from evergreen coniferous forest to lowland marshes. The variety of habitats available in the county has made it ideal for numerous types of wildlife. The riparian corridors adjacent to the rivers in Lewis County are especially important to birds and small mammals because riparian areas tend to have highly diverse vegetation as well as protected access to water; many species of wildlife are dependent upon them. Passerine and water birds, in particular, rely on the riparian corridors for food and nest sites. Of the 53 bird species commonly found in Lewis County, 42 (or 79 percent) are dependent upon the riparian and wetland habitats typically associated with river systems.

There are four primary categories of wildlife within the Chehalis River watershed: big game, upland wildlife, fur-bearers, and waterfowl. Upland wildlife account for the greatest number of species in the basin. The Upper Chehalis River, above the confluence with the Newaukum River, provides habitat for big game (black-tailed deer, black bear, and elk), game birds (pheasant, grouse and pigeons), and fur-bearers (beavers, minks, muskrats, and river otters). Seasonal flooded areas along the Upper Chehalis River and its tributaries create habitats for various water fowl. The Upper Chehalis River is within the Pacific Flyway for migratory birds. The Chehalis River segment above Grand Mound also supports a diversity of wildlife. Forested areas support cover for big game species such as deer, bear, and elk as well as many upland bird species. Fur-bearing animals and water fowl found in the Upper Chehalis River are also found upstream of Grand Mound (Lewis County Conservation District, October 1992).

The Newaukum River basin also provides habitats for diverse wildlife. Big game include black-tailed deer, black bears, and cougar. Upland species of native blue and ruffed grouse, ring-necked pheasant, mountain quail, cottontail rabbit, mourning dove, and band-tailed pigeon are found in the agricultural or forested areas. Fur-bearers consist of beaver, muskrat, mink, raccoon, weasel, river otter, skunk, red fox, coyote, and possum. Water fowl include mallard, pintail, wood duck, coot, Canada goose, and blue heron. In addition, ground squirrels, forest rodents, and amphibians and reptiles are found to reside in the Newaukum River basin (Lewis County Conservation District, October 1992).

Protected species of songbirds, birds of prey, and Northern spotted owl also inhabit the Chehalis River basin. Recent studies indicate that bald eagles and ospreys use all of the major rivers in Lewis County, especially in the winter months. Bald eagles have been listed as threatened and endangered species by the U.S. Fish and Wildlife Service and the Washington State Department of Wildlife (WDW), respectively. In addition, the osprey has been listed by WDW as a threatened species throughout the state. Both bald eagles and ospreys are dependent upon the riparian and shoreline habitats associated with the rivers in Lewis County for food and nest sites. The 1989 Midwinter Bald Eagle Survey reported that 14 adult and 6 immature bald eagles were identified in Lewis County (Dick Taylor, personal communication). The following threatened or endangered species are known to be within or near the Chehalis River watershed:

Bald Eagle	Brown Pelican	Snowy Plover
Marbled Murrelet	White Pelican	Upland Sandpiper
Northern Spotted Owl	Peregrine Falcon	Ferruginous Hawk
Olympic Mudminnow	Aleutian Canada Goose	Giant Olympic Salamander
Western Pond Turtle	Sandfill Crane	Red-legged Frog

A complete listing of the mammals, birds, fish and amphibians/reptiles found in Lewis County is included in Appendix C.

UPDATE

Table 4-1R lists the threatened, endangered and candidate species of fish and wildlife.

TABLE 4-1R. THREATENED, ENDANGERED AND CANDIDATE SPECIES

Bald Eagle	**Olympic Mud Minnow**
Band-Tailed Pigeon	**Oregon Spotted Frog**
Bufflehead	**Osprey**
California Wolverine	**Pacific Fisher**
Canada Lynx	**Pacific Lamprey**
Cascades Frog	**Pacific Townsend Big-Eared Bat**
Coastal/Puget Sound Bull Trout	**Peregrine Falcon**
Columbia Torrent Salamander	**Red-legged Frog**
Ferruginous Hawk	**River Lamprey**
Giant Olympic Salamander	**Tailed Frog**
Gray Wolf	**Valley Silverspot**
Great Blue Heron	**Van Dyke's Salamander**
Grizzly Bear	**Western Gray Squirrel**
Larch Mtn Salamander	**Western Pocket Gopher**
Long-Eared Myotis	**Western Pond Turtle**
Long-Legged Myotis	**Western Toad**
Marbled Murrelet	**Whulge's Checkspot**
Mardon Skipper	**Wood Duck**
Northern Goshawk	
Northern Spotted Owl	
Olive-Sided Flycatcher	

For a more complete discussion of wildlife and fish resources, refer to the following:

- **"Integrated Streambank Protection Guidelines", WDFW, 2002.**
- **"Salmon and Steelhead Habitat Limiting Factors, WRIA 22 and 23", Washington State Conservation Commission, May 2001.**
- **"Fish Passage Design at Road Culverts", WDFW, March 1999.**
- **"Fish Passage Barrier Assessment and Prioritization Manual", WDFW Habitat and Land Services Program, October 1998.**
- **"A Catalog of Washington Streams and Salmon Utilization", Washington Dept of Fisheries, November 1975.**
- **www.wa.gov/wdfw**

5.0 REGULATORY MECHANISMS FOR FLOOD CONTROL

5.1 Introduction

This chapter provides a comprehensive overview of the existing federal, state and local regulations and programs that guide and limit activities that may occur in flood-prone areas. While many federal, state, and local regulations potentially affect flood hazard management in Lewis County, some of the programs only apply in rare instances and others impact day-to-day activities.

Regulatory mechanisms for managing flood hazards are designed to address a range of land use issues in flood-prone areas, including existing and proposed development, recreational opportunities, agricultural practices, historic and cultural preservation, and utility corridor placement. Regulatory programs also may affect community and economic development issues, such as industrial location, and environmental degradation issues, such as water quality maintenance and sensitive habitat areas protection.

Mechanisms for controlling land use in flood-prone areas vary in scale and scope. Large-scale regulatory programs include federal and state environmental protection acts; federal, state, and county farmland, sensitive areas, and/or wetland preservation acts or ordinances; and local jurisdiction comprehensive land use plans. Smaller-scale programs include county and city ordinances such as flood damage prevention, zoning, grading, building, and drainage ordinances, designed to control specific development activities or features.

Development activities in flood-prone areas of Lewis County are managed through a combination of federal, state, and local regulations and programs. Regulations and programs discussed in this chapter are grouped by implementing jurisdiction.

5.2 Federal Regulatory Mechanisms

Various federal regulations apply to development and resource management in Washington's inland flood-prone areas. The implementation of federal regulations within the state may be triggered by federal funding of proposed projects, projects that could impact navigable waters of the United States (e.g., dredge and fill activities), and projects that could impact the integrity of specified natural resources, such as water quality and identified threatened or endangered species. Applicable federal regulations include the following:

- National Flood Insurance Act
- National Environmental Policy Act (NEPA)
- Clean Water Act
- Endangered Species Act
- Rivers and Harbors Act
- Wild and Scenic Rivers Act
- Historic Preservation Act

The Endangered Species Act, Rivers and Harbors Act, Wild and Scenic Rivers Act, and Historic Preservation Act relate only indirectly to flood hazard reduction and are not described in detail here. The federal regulations and programs most applicable to flood control in the Lewis County are described in the following sections.

5.2.1 National Flood Insurance Act

The National Flood Insurance Act (1968) initiated the National Flood Insurance Program (NFIP). The purpose of this program is to make affordable flood insurance available to communities that adopt comprehensive flood plain management regulations. Communities which do not participate in the NFIP are not eligible for government-funded flood disaster relief. The NFIP is administered by the Federal Emergency Management Agency (FEMA) through the Federal Insurance Administration (FIA) office.

Historically, the NFIP has been administered in two phases, the emergency program and the regular program. The emergency program is initiated when the FIA notifies a community that it has been identified as a flood-prone area. Notification is provided in the form of a Flood Hazard Boundary Map (FHBM), a preliminary delineation of flood hazard areas with no elevations shown. After receiving the FHBM, a community may apply to the FIA for limited amounts of insurance. The community is required to adopt minimum flood plain management regulations and encouraged to establish flood elevations.

A community may enter the regular program upon adoption of a flood hazard ordinance approved by FEMA. A technical flood insurance study which includes hydrologic and hydraulic analyses is usually performed, and is referenced in the ordinance as the basis for the regulatory program. The products of the study are the Flood Insurance Rate Map (FIRM) and the Flood Insurance Study. The Flood Insurance Study provides data on the width of the floodway and flood plain, cross-sectional area, and flood water velocity at a given point in the stream. The FIRM delineates areas adjacent to rivers that are subjected to flood risks. The maps and report are useful tools for flood plain planning.

Since 1990, communities which have adopted programs or regulations to reduce flood-related damages have been eligible to receive reduced insurance rates under the Community Rating System (CRS). Communities must apply to FEMA for a rate reduction and be certified by them before policy holders within the community can receive a rate reduction. The following four groups of activities count toward the credit for insurance rate reduction:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness

Lewis County and the cities of Chehalis and Centralia participate in the regular NFIP. Each of these jurisdictions administers its own program through its building or public works department. These programs are described in detail in Sections 5.4.1.1, 5.4.2.1, and 5.4.3.1.

Sometimes the FIRMs are found to not fully describe the extent of flooding that actually occurs. This discrepancy results in people getting flooded who aren't eligible for insurance and can occur for several reasons. First, the accuracy of the boundary lines on the FIRM is limited by the scale of the map, so properties near the flood boundary may be incorrectly drawn to be outside the flood plain. Second, the FIRM is based on hydraulic modeling of floods which may not be a completely accurate simulation of floods. Third, as conditions change within a drainage basin, the severity of flooding may actually increase. Revision of the FEMA flood plain designations is possible; the revision process is described in Section 8.4.2.

5.2.2 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.) established a process requiring federal agencies to consider environmental impacts of agency-sponsored development projects and of agency decisions on permits and approvals required for privately sponsored development projects. The NEPA process typically consists of two steps, an evaluation of the potential for environmental impacts, and either an assessment of those impacts, or issuance of a determination that environmental impacts will not be significant. These steps are described in more detail below.

Determination of the need for an environmental impact statement (EIS) is often made through the preparation of an environmental assessment (EA). A permit applicant usually provides much of the information and analysis used to prepare the EA. If the EA concludes that the proposed activity would not have significant adverse environmental impacts, a Finding of No Significant Impact (FONSI) document is prepared by the federal agency. The FONSI explains why an EIS is not required.

NEPA requires an EIS be prepared for any major federal action that would have significant adverse environmental impacts. Permits issued by a federal agency are considered to be federal actions which may require an EIS. The document must thoroughly evaluate any adverse environmental impacts of the proposed action and its alternatives. Significant emphasis must be placed upon the consideration of alternatives, including ways to mitigate harmful environmental effects. Once the EIS is completed and accepted by the lead agency, or a FONSI has been issued, the NEPA conditions are satisfied.

5.2.3 Clean Water Act (CWA)

The Clean Water Act of 1977 (P.L. 92-500) and the Water Quality Act of 1987 (amendments to the Federal Water Pollution Control Act) provide the backbone for the national approach to water quality policy and action. The goal of this federal law is the total elimination of pollutant discharge into the nation's rivers, lakes, and wetlands.

Four sections of the CWA are discussed below. Section 401, Water Quality Certification, pertains to any activity that requires a federal permit and that may result in a discharge to state water. Section 402, the National Pollutant Discharge Elimination System (NPDES), addresses the discharge of wastewater into the nation's waters. Section 404, Dredge and Fill Requirements, regulates the disposal of these materials into "waters of the nation," including wetlands. Sections 208 and 319, described together, focus on the control of non-point source pollution.

5.2.3.1 Section 401 (Water Quality Certification)

Section 401 of the CWA is intended to ensure that activities that require a federal permit (such as U.S. Army Corps of Engineers (COE) Section 404 permit for filling of a wetland) comply with the CWA, state water quality laws, and any other appropriate state regulations. In Washington, Section 401 is implemented by Ecology through a certification process (Chapter 173-225; RCW 90.48; Chapter 173-201-035(8)(e)). A Water Quality Certification states that the activity will comply with water quality standards and discharge limitations for waters of the State of Washington (Chapter 173-201 WAC). Usually, the federal agency notifies Ecology that application has been made for a federal permit. Issuance of a certification is exempt from State Environmental Policy Act (SEPA) requirements (described in Section 7.3.3).

Most instream construction activities, such as bank stabilization and gravel removal, will unavoidably violate state water quality standards (particularly turbidity standards) on a short-term basis. Such projects require a Temporary Modification of Water Quality Standards. This temporary modification is an administrative order

issued by Ecology to control short-term activities that are essential to the public interest. The modification may be required before Ecology can issue a Water Quality Certification, and must comply with SEPA requirements.

5.2.3.2 Section 402 National Pollutant Discharge Elimination System (NPDES)

Section 402 of the CWA sets forth regulations for point-source wastewater discharges, both municipal and industrial. Pursuant to the 1987 Water Quality Act Amendments, the NPDES program now includes stormwater point sources such as pipes, conduits, ditches, channels, and other artificially constructed systems used for collecting and conveying stormwater runoff. Once it enters these conveyance structures, urban and industrial runoff can be considered a point source subject to NPDES permit requirements. These stormwater discharges are the portion of the NPDES program that is related to flood hazard management.

Urban and industrial runoff can be a major source of sediments and other pollutants. Erosion from stormwater can cut away banks and carry sediment which can pollute wetlands, destroy fish spawning habitat, and damage property. Water quality of local streams and lakes can also be degraded by urban runoff. As stormwater flows across impervious surfaces such as parking lots and streets, the water can pick up oils, heavy metals, nitrogen, phosphorus, bacteria, and particulates which impair water quality.

In the State of Washington, Ecology administers the NPDES program. The 1987 amendments to the CWA, and the regulations promulgated by EPA, require municipalities and industries to acquire discharge permits for stormwater discharges. A phased approach has been utilized for municipalities, with deadlines for large municipalities (greater than 100,000 people) occurring earliest. Pending regulations, under what is called Phase 2, may apply to commercial businesses and/or smaller municipalities. Most industries can obtain permit coverage under a Baseline General Permit developed by Ecology and adopted in the Fall of 1992.

5.2.3.3 Section 404 (Dredge and Fill Requirements)

The U.S. Army COE is charged with regulating the “navigable waters” of the United States. “Navigable waters” include all presently, historically, and reasonably potential navigable waters, and all waters subject to ebb and flow of the tide up to mean higher high water in tidal waters and up to ordinary high water in fresh water areas. In recent years COE's jurisdiction under the CWA has been broadened to include regulation of dredged or fill material discharges into "waters of the United States." "Waters of the United States" include adjacent wetlands and tributaries to navigable waters and other waters, the degradation or destruction of which could affect interstate or foreign commerce. COE's jurisdiction also includes wetlands not connected to another water body by a tributary or stream.

Section 404 of the Clean Water Act requires a permit for the discharge of dredged or fill material into waters of the United States, including wetlands. Dredged material is defined as material removed from the nation's waters, and fill material is defined as material used for replacing aquatic areas with dry land or changing the bottom elevation of a water body.

Two types of permits are issued under Section 404, nationwide and individual permits. The nationwide permit is available for small projects; the review process for obtaining a nationwide permit is generally less than 20 days. Individual permits are required for large projects. The review process for individual permits is more detailed and usually takes longer.

Nationwide permits, in general, authorize specific categories of work, including minor road crossing fills, replacement, repair, and rehabilitation, and mooring buoys. Nationwide Permit 26, which applies to wetlands,

can be appropriate for fills involving loss or substantial adverse modification of less than one acre of isolated waters or waters that are above the headwaters (adjacent to a tributary water body that has an average annual flow of less than 5 cubic feet per second). Fills of 1 to 10 acres of isolated wetlands or wetlands located above the headwaters of tributary water bodies also require review of associated environmental impacts by COE as well as EPA; the USFWS; the National Marine Fisheries Service; and the Washington Departments of Fisheries, Wildlife, and Ecology.

An individual permit is appropriate for discharge of dredged or fill material within COE's jurisdiction which is not covered under the Nationwide Permit 26. Individual permits are required for wetland fill proposals involving the following:

- All fills under 10 acres that were not authorized under Nationwide Permit 26
- All fills greater than 10 acres
- Fills of any size in adjacent wetlands that are located below the headwaters (adjacent to a water body with an average annual flow of greater than 5 cfs) of a stream
- Fills of any size in tidal waters and their adjacent wetlands

Review under the individual permit application process requires COE to decide whether the benefits of the project outweigh the potential environmental impacts. A 30-day public review period is also required. COE makes a NEPA determination at the end of the review period.

Proposed activities in wetlands may be subject to other laws in addition to or in association with a Section 404 permit. For example, Ecology has the right to place conditions on, or request denial of, a Section 404 permit if a proposed project does not comply with state water quality laws. COE cannot generally issue a Section 404 permit if the state has denied water quality certification (discussed in Section 7.2.3.1). Furthermore, if any local agency permit associated with the project is denied, the COE will also deny the 404 permit.

5.2.3.4 Sections 208 and 319 (Nonpoint Source Controls)

National attention became focused on nonpoint source pollution with the enactment of the federal Clean Water Act in 1972. Section 208 of the CWA directed states to conduct planning for water quality management, including control of nonpoint sources. In 1981, Ecology prepared the Nonpoint Source Water Quality Plan, which presented a summary of Washington's Section 208 nonpoint planning efforts and charted future efforts. A keystone of Ecology's 208 plan is the preparation of separate plans for agricultural practices, forest practices, urban runoff, and other nonpoint sources.

In 1987, the Clean Water Act was reauthorized and contained a new provision, Section 319, addressing nonpoint sources. Section 319 requires each state to assess the impact of nonpoint source pollution and develop a management program for controlling nonpoint sources (Ecology 1988). The primary strategy employed by Ecology in addressing nonpoint sources has been the implementation of Best Management Practices (BMPs). BMPs are "agronomic, managerial, or structural techniques providing minimum essential controls needed to mitigate water quality problems" (Ecology 1988).

UPDATE

Endangered Species Act (ESA)

ESA has added significant complexity to planning within areas subject to flooding. Several areas of ESA regulatory authority are now being developed and implemented, including:

1. **Section 4(d) rules that identify state and local controls to prevent "take" from occurring from otherwise permittable actions;**
2. **Section 7 federal consultation pertaining to specific in-stream work activity; and**
3. **Controls being developed pursuant to WRIA planning.**

All of these have the potential to impact the requirements for development and repair including during emergency/flood conditions. Although specific requirements of ESA continue to evolve, it is critical that habitat restoration impacts be considered in conjunction with implementation of this CFHMP.

The purposes of the ESA of 1973 are to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, to provide a program for the conservation of such endangered and threatened species, and to take such steps as may be appropriate to conserve, to the extent practicable, the various species of fish, wildlife and plants facing extinction. The ESA is intended to preserve and restore conditions leading to enhanced survivability of the threatened and endangered species in the study area.

The ESA also declares that all Federal departments and agencies shall seek to conserve endangered and threatened species and shall use their authorities in furtherance of the purposes of this Act. These policies are applicable to standard construction practices, as well as to those undertaken in conjunction with repair to damage occurring during emergency circumstances.

Implementation of the ESA is intended to maintain or increase the quality and quantity of habitat necessary to sustain and restore threatened and endangered species. It is also intended to maintain or restore the physical processes affecting natural basin hydrology, and to manage water use and allocation in a manner that would optimize in-stream flows for salmonid spawning, incubation, rearing, adult residency, and migration. Consequently, the need for channel forming and maintenance of flows is addressed. Other objectives pertain to water and sediment quality and sediment delivery by providing for water and sediments of a quality that will support productive, harvestable, wild salmonid populations unimpaired by toxic or deleterious effects of environmental pollutants. To achieve these objectives, it will be necessary to manage watershed, stream channels, wetlands, and marine areas for natural rates of sediment erosion, deposition, and routing within the limits of salmonid life requirements.

Federally funded activities undertaken within critical areas or buffers may require consultation and trigger the need for formal discussions with regards to ESA. The county has a process in place to comply with ESA for projects with a federal nexus. When emergency activities are undertaken within critical areas or buffers, NMFS must be consulted. Emergency consultation procedures allow action agencies to incorporate endangered species concerns into their actions during the response to an emergency.

A memorandum of understanding (MOU) between state and local agencies dated December 16, 1996 regarding procedures for any emergency flood control work within fish or wildlife habitat areas when the normal permitting process cannot be utilized exists. The projects shall only occur in a county declared as

a disaster area by the President, Governor, or local official. The signatory agencies are: WDFW, Washington State Association of Counties, Washington State Military Dept, WSDOT, and Ecology. The document is Ecology Order No. DE97WQ-002.

Lewis County has also implemented a procedure for routine ditch maintenance and culvert replacement. If stream identification is in question, Dept of Public Works and WDFW is contacted to determine the stream status. A site visit and discussion occurs to formulate a feasible scope, then the County applies for permits as in Section 5.3.4.

5.3 State Regulatory Mechanisms

The State of Washington has several regulations directly applicable to flood hazard reduction. Some of these programs are implementation programs for federal regulations (NFIP/Flood Plain Management Program), and others are the state equivalents of federal programs (NEPA/SEPA). All of these are administered by the State of Washington. Each of the following regulations and programs is described in subsequent sections:

- Flood Plain Management Program
- Shoreline Management Act
- State Environmental Policy Act (SEPA)
- State Hydraulic Code
- Water Resources Program - Surface and Groundwater Codes
- Growth Management Act
- Forest Practices Act

Among the features that trigger implementation of these regulations is the size and type of proposed project, a project's location in proximity to specified shorelines or river systems, and a project's potential for impacts on water quality and fish and wildlife habitat. For example, projects that divert streams into culverts, build structures in floodways, or increase sedimentation and surface runoff may be subject to state regulations.

The discussion of state regulatory programs in this section is not exhaustive. The programs described here are those programs that relate directly to flood hazard. Other state resource management mechanisms that apply indirectly to flood control include the Department of Natural Resources' Aquatic Lands Management Program and the Department of Wildlife's Bald Eagle Protection Rules and Endangered Species Program (which implements the Federal Endangered Species Act).

5.3.1 Flood Plain Management Program

The state's flood plain program (Chapter 86.16 RCW) seeks to integrate federal, state, and local regulatory programs in a comprehensive effort to reduce flood damages. The core of the state's program is the adoption by local jurisdictions of a flood damage prevention ordinance based upon federal standards contained in the National Flood Insurance Program (NFIP) (see Section 5.2.1). Property owners in flood-prone jurisdictions with such an ordinance are eligible for federal insurance. Section 5.4.1.1 discusses Lewis County's Flood Damage Prevention Ordinance.

Washington State has adopted the NFIP as the state minimum standard and has imposed other requirements upon local governments. These additional state requirements target the protection of health and safety. While these

provisions primarily address permitted types of development, an advisory standard pertaining to wetlands management is included in Chapter 173-158 WAC. The standard describes the beneficial role wetlands play in alleviating flood damage. The advisory standard also suggests a program by which local governments, with technical assistance from Ecology, can identify and map critical wetland areas located within base flood plains that should not be filled.

5.3.1.1 State Participation in Flood Control Maintenance

The State Participation in Flood Control Maintenance (Chapter 86.26 RCW) Act authorizes the Flood Control Assistance Account Program (FCAAP). Through FCAAP, administered by the Flood Plain Management Unit of Ecology, local governments participating in the NFIP and meeting state requirements are eligible for matching funds to repair or restore existing flood control facilities, to maintain or improve channel capacity, and to develop comprehensive flood control management plans such as this document. An optional element of this program provides for local governments to use the planning process to develop a wetlands management strategy for the community's flood-prone areas.

5.3.1.2 County Flood Control

The enactment of RCW 86.12 in 1907 allowed counties to levy taxes, exercise eminent domain, and take action to control and prevent flood damage. The law was substantially enlarged in 1991 by Senate Bill 5411 (ESSB 5411) which added three new sections to Chapter 86.12 RCW. The intent of the bill was to develop a "coordinated and comprehensive state policy to address the problems of flooding and the minimization of flood damage..." To that end, the bill provides a greatly expanded role for counties in the formulation and adoption of CFHMPs. The following minimum plan elements were mandated:

- Designation of flood-prone areas
- Establishment of a comprehensive scheme for flood protection
- Establishment of land use regulations in areas subject to periodic flooding
- Establishment of construction activity restrictions, including flood-proofing requirements for structures in areas subject to periodic floods
- Establishment of restrictions on land clearing activities and development practices that exacerbate flood problems

Counties have the responsibility for basin plan development, but the process was intended to include full participation from cities, towns, and special districts within the basin.

5.3.1.3 Flood Control Zone Districts

Since 1961, RCW 86.15 has provided for the establishment of flood control zone districts (FCZDs) within the counties of the state for "undertaking, operating or maintaining flood control projects or stormwater control projects." A FCZD may be initiated either by a majority vote of the county council or by a petition signed by 25 percent of the voters registered within a proposed zone. The county council is also authorized to establish a county-wide FCZD, which could then be divided into subzones. Establishment of any FCZD is dependent on the approval of all the cities, towns, and flood control districts within the proposed zone boundaries.

FCZDs are quasi-municipal corporations, legally separate from counties. The county council and county executive, working through the county engineer, administer FCZDs. The county council may also choose to appoint an unpaid advisory committee of not more than 15 members for each district. A district supervisor runs the day-to-day operations of the FCZD.

FCZDs give the county council a broad range of revenue collection alternatives. These include the following:

- Monies available to counties for flood control can be transferred to a FCZD with authorization of the county council.

- An excess annual ad valorem (property tax) levy can be assessed with approval of voters within the FCZD.

- An assessment can be collected against properties, including state property, specially benefitted by a FCZD improvement.

- Voluntary assessments (for up to 15 years) can be collected with the written agreement of property owners.

- Service charges can be authorized by county council resolution.

- An annual levy, not exceeding $0.50 per $1,000 of assessed value, can be imposed when such levy will not take away from other taxing districts.

- Revenue bonds and (voter approved) general obligation bonds can be sold to fund capital costs.

The supervisor of the district initiates FCZD improvements through resolution. The resolution specifies that a comprehensive plan of development for flood control has been prepared, and that the proposed improvements contribute to the goals of that plan; that the plan has been submitted to Ecology 90 days before initiating the improvement; or that a comprehensive plan stormwater control has been prepared for the area that will be served by the proposed stormwater control facilities. In addition, the resolution must include a statement that engineering plans and studies for the improvement are on file with the county engineer, that project costs have been estimated, and that the improvement will benefit the FCZD.

5.3.2 Washington Shoreline Management Act of 1971

The Washington State Shoreline Management Act (SMA) of 1971 (Chapter 90.58 RCW) establishes a policy of protection against "adverse effects to the public health, land and its vegetation and wildlife, and the waters of the state and their aquatic life." The SMA:

- Defines several shoreline designations

- Provides guidance to Ecology and local jurisdictions when developing procedures, rules, and plans for shoreline activities

- Establishes timelines for the development of local shoreline management plans

- Identifies activities generally exempt from certain shoreline permits

The SMA defines three classifications of shorelines as follows:

1. Shorelines: "All of the water areas of the state, including reservoirs, and their associated wetlands, together with the lands underlying them, except 1) shorelines of statewide significance, 2) shorelines on segments of streams upstream of a point where the mean annual flow is 20 cfs or less and the wetlands associated with such upstream segments, and 3) shorelines on lakes less than 20 acres in size and wetlands associated with such small lakes."

2. Shorelines of statewide significance: These are explicitly listed in the SMA and generally include the Pacific Coast Shoreline, the Strait of Juan de Fuca and adjacent salt water, lakes more than 1,000 acres in size, and rivers with an average annual flow of more than 1,000 cfs.

3. Shorelines of the state: the total of all Shorelines and Shorelines of Statewide Significance which are governed by the SMA

The SMA requires permits for development along shorelines of the state if the value exceeds $2500 (defined "substantial development") or interferes with the normal public use of the water or shorelines of the state. Normal maintenance or repair of existing structures, construction of residential bulkheads, emergency construction, construction of barns or similar agricultural structures on wetlands, construction or modification of navigational aids, construction of a single family residence on wetland, construction of docks for pleasure boats, irrigation systems, and pre-existing agricultural drainage and diking systems are exempt from the permit requirement. A "conditional use" permit can be issued to allow greater flexibility in varying the application of the use regulations of the master program. Through conditional use permits, special conditions may be attached to the permit by the appropriate local government agency to prevent undesirable effects of the proposed use. "Variances" can also be granted to provide relief from unnecessary regulatory hardships. Permits are issued by local governments and reviewed by Ecology to ensure that proposed developments are consistent with local shoreline master programs and the SMA.

UPDATE

The SMA requires permits for development along shorelines of statewide significance and of the state if the value exceeds $5000 or interferes with the normal public use of the water or shorelines of the state.

The SMA provides the following guidance to Ecology and local jurisdictions when prioritizing uses on shorelines of state-wide significance:

1. Recognize and protect the state-wide interest over local interest
2. Preserve the natural character of the shoreline
3. Consider long over short term benefit
4. Protect the resources and ecology of the shoreline
5. Increase public access to publicly owned areas of the shorelines
6. Increase recreational opportunities for the public in the shoreline
7. Provide for uses that have been found acceptable based on appropriate environmental, economic, engineering, and other technical studies

5.3.3 State Environmental Policy Act (SEPA)

Washington, along with numerous other states, has used NEPA (Section 5.2.2) as a model for a state process (SEPA) to disclose and analyze environmental impacts of projects. The State Environmental Policy Act (SEPA) is not a permit, but an environmental review process similar to NEPA.

The SEPA process starts when someone submits a permit application to an agency, or when an agency proposes to take some official action. The lead agency (that which has the lowest level of permitting authority) evaluates the application for its potential environmental impacts and circulates the proposal to affected agencies for comment. If potential environmental impacts are insignificant, a Determination of Nonsignificance(DNS) is issued by the lead agency. If the proposal has some environmental impacts that can be easily mitigated, a Mitigated Determination of Nonsignificance (MDNS) is issued. If environmental impacts are significant, a Determination of Significance (DS) is issued, and an EIS must be prepared. The content of an EIS under SEPA is similar to an EIS under NEPA, with emphasis on evaluation of alternatives. Public review is an important component of an EIS.

SEPA is directly applicable to flood plain management because it forces an environmental assessment. The effect of a proposed project on flooding is one of the environmental impacts that must be evaluated in the environmental review. Consistency of a proposed project with existing plans and policies may also be evaluated. Conversely, flood hazard reduction projects may also be subject to SEPA. Completion of the SEPA process may be required before Hydraulic Project Approval (HPA), Shoreline Substantial Development permits, or many other permits are approved.

Some projects are categorically exempted from the SEPA process. Examples of projects exempt from SEPA include single family homes, commercial buildings under 4,000 square feet, small parking lots (20 cars or less), and small landfills or excavations (100 cubic yards or less). Local jurisdictions are allowed to set size criteria for five categories of exemptions; however, the size criteria must be within the limits established through SEPA and if a project is located in an environmentally sensitive area, the project cannot be categorically exempt from SEPA requirements (Ecology 1984).

5.3.4 Washington State Hydraulic Code of 1949

The Washington State Hydraulic Code regulates projects within the state's fresh and salt waters. The purpose of the code is to preserve fish life and supporting habitat in and around the waters of the state. Hydraulic projects are defined in the code as construction or performance of other work that will use, divert, obstruct, or change the natural flow or bed of any of the fresh or salt waters of the state. The code is jointly administered by the state Departments of Wildlife and Fisheries. The Department of Fisheries takes the lead for the Hydraulic Project Approval (HPA) in salt and fresh waters containing salmon. In fresh waters containing trout or steelhead, the Department of Wildlife takes the lead. For the three rivers in Lewis County, the Department of Fisheries takes the lead on the HPA process.

Activities which fall within the definition of a hydraulic project require an HPA. Application for an HPA consists of submitting a completed form to the proper agency accompanied by plans of the proposed hydraulic project. Any of the following constitutes application for an HPA:

- Completed hydraulic project approval application submitted to the Department of Fisheries or the Department of Wildlife

- Completed forest practices application submitted to the Department of Natural Resources if the project is part of a forest practice as defined in WAC 222-16-010(19) (described in Section 5.3.7)

- Section 10 or 401 public notice circulated by the COE or United States Coast Guard

Review of the application generally takes up to 45 days and may be denied if the project is deemed harmful to fish life and adequate mitigation cannot be assured by conditioning the approval or modifying the project. Verbal approval for emergency work may be granted upon request to repair existing structures, move obstructions, restore banks, or protect other property that is subject to immediate danger by weather, flow, or other natural conditions. Verbal approval is also granted immediately for driving across a stream during an emergency.

The Hydraulic Code specifies technical provisions for hydraulic projects (WAC 220-110-050 through 220-110-220 for fresh water). While standardized technical provisions are specified for the activities listed below, additional restrictions may be required for individual applications. The following flood hazard reduction activities have technical provisions specified:

- Bank protection
- Bridge, pier, and piling construction
- Bridge construction - stringer type
- Channel change - temporary or permanent
- Channel realignment
- Temporary bypass culvert or flume
- Dredging
- Gravel removal
- Log and log jam removal
- Logging
- Pond construction
- Water diversions

The code is currently being revised to include provisions for regulating the quality and quantity of stormwater discharges to fish-bearing waters. Additional changes are proposed for the section relating to bank protection (WAC 220-110-050) with proposed additions providing greater emphasis on bioengineered bank protection or use of bioengineering elements in traditional bank stabilization projects. An example of the latter is the planting of large woody vegetation within banks to be stabilized with rock riprap, thereby providing riparian cover for fisheries.

UPDATE

The hydraulic code is administered by the State Department of Fish and Wildlife. The two separate state agencies were merged in 1994.

5.3.5 Water Resources Program - Surface and Groundwater Codes

Ecology administers the state's comprehensive water resources program in accordance with Chapter 90.03, 90.45, and 90.54 RCW. The primary goal of the program is to ensure that waters of the state are properly allocated to achieve full utilization for the greatest benefit to the people of the state, and to regulate uses in accordance with established rights. Ecology's responsibilities under this program include surface and groundwater planning and management, water rights adjudication, project assistance, and water well technology.

The water resources program impacts flood hazard reduction in two basic ways. First, any diversion of water from rivers and streams requires a permit from Ecology. Second, if a flood hazard reduction project requires re-routing of a stream channel, the project must be reviewed for impacts to water-users along the stream.

5.3.6 Growth Management Act

In April 1990, the Growth Management Act, or GMA (House Bill No. 2929), was passed by the Washington Legislature. This act takes an important first step towards managing growth in the state's fastest growing counties. The act defines 13 broad goals to guide the development and adoption of comprehensive plans and development regulations of those counties and cities that are required or choose to plan under this act. The goals that relate to surface water and environmental issues include the following:

- Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development

- Encourage the retention of open space and development of recreational opportunities, conserve fish and wildlife habitat, increase access to natural resource lands and water, and develop parks

- Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forests and productive agricultural lands, and discourage incompatible uses

- Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water

GMA is administered by the Washington Department of Community Development. Section 4.0 of the GMA defines the counties or cities that are required to develop and adopt a comprehensive plan as 1) counties that have both a population of 50,000 or more and that have experienced a population increase of at least 10 percent in the last ten years (Lewis County is expected to meet this criterion in July of 1993), 2) cities within such counties, and 3) any other county (and cities within such counties) regardless of its population that has experienced a population increase of more than 20 percent in the previous 10 years.

Elements of the comprehensive plan are spelled out in Section 7.0 of the GMA. These elements include housing, land use, utilities, transportation, as well as a capital facilities plan, and the designation of urban growth area boundaries. Local governments are also required to classify and designate "resource lands of long-term commercial significance" and "critical areas." This designation was to have been completed by March 1, 1992.

5.3.7 Forest Practices Act

Forest practices have been addressed through the Clean Water Act (Section 208), the Washington State Forest Practices Act (Chapter 76.09 RCW), and the Forest Practices Rules (Title 222 WAC). The primary purpose of these rules and regulations is to protect water quality through application of BMPs. Sediment and drainage controls and requirements for reforestation are included in the rules and regulations.

Forest practice regulations are developed by the state Forest Practices Board and by Ecology. In accordance with the state Water Pollution Control Act (Chapter 90.48, Revised Code of Washington), the state forest practice regulations are designed to ensure compliance with federal clean water standards. The Department of Natural Resources administers the Forest Practices Rules and Regulations. The Forest Practices Rules and Regulations were revised in 1988 based on the 1987 Timber, Fish and Wildlife (TFW) Agreement, and again in 1992. The revisions have strengthened protection of riparian habitat and noncommodity values, and attempted to address the cumulative impacts of timber harvesting while providing increased flexibility in forest management. These rules apply to state and private land, and address timber harvesting, road building, harvest regeneration, and chemical application.

The main importance of Forest Practices rules relative to flood hazard reduction is in assuring that forested parts of watersheds are managed in a responsible manner. Poorly managed forests can contribute to increased flooding, especially in small watersheds.

UPDATE

Watershed Management Act (WMA)

The Washington State Legislature passed the Watershed Management Act (WMA) in 1998 to implement watershed planning within each of the State's 62 WRIAs. The plans are to ensure that the state's water resources are used wisely by protecting existing water rights, instream flows for fish, and the economic health of the local communities. The WMA provided the guidelines and funding to bring government organizations, citizens and interest groups to plan for water resources in their respective WRIA.

5.4 Local Regulatory Mechanisms

Individual counties and cities within Washington have many regulatory mechanisms to provide for development/resource management, including flood control. Several of the federal and state programs described above are administered at the local level. Local jurisdictions adopt their own Flood Hazard and SEPA ordinances (or choose to implement the state's) and their own Shoreline Master Programs, as directed under the state Shoreline Management Act. In addition to the federal and state programs administered at the local level, local governments may create their own regulatory programs. These include broad-based land use and resource management plans, such as the Comprehensive Land Use Plan for Lewis County, and specific building and housing codes that establish construction standards for development in flood-prone areas.

Intergovernmental agreements are another regulatory tool that is often useful in defining the roles and responsibilities of jurisdictions whose actions impact each other. Intergovernmental agreements can be useful for flood hazard reduction for two reasons. First, flood events do not recognize political boundaries; a lack of development regulations in a jurisdiction upstream can result in flooding problems for a jurisdiction downstream. Second, resource management regulations or activities in areas adjacent to river systems, such as U.S. Forest Service forestry practices, can impact stream flow and water quality in these systems, and may conflict with other

regulations promulgated to manage the systems. The Washington Timber/Fish/Wildlife agreement is one such intergovernmental agreement. This agreement between state agencies, interested members of the public, affected industries, and treaty Indian tribes was developed to protect and manage the state's forest resource, and has had a beneficial effect on fisheries habitat and water quality protection.

The local regulatory programs in Lewis County, as well as those within the cities of Chehalis and Centralia, are described in the following sections. Because of the close proximity of these three jurisdictions, understanding the respective regulatory programs that relate to flood hazard is an important element of this plan. The prevailing philosophy in all of Lewis County is one of minimizing the complexity and burden of regulations. The basic regulatory framework, similar in all three jurisdictions, includes the following:

- Flood hazard zone ordinances
- Shoreline Master Programs
- State Environmental Policy Act (SEPA)
- Uniform Building Code

In addition to this basic framework, Chehalis has a stormwater management program, Lewis County utilizes flood control zone districts, and each of the jurisdictions has a comprehensive plan. Only the Lewis County comprehensive plan is described in this document. Implementation of the regulatory programs in each jurisdiction is described in the sections below.

5.4.1 Lewis County Regulations

Lewis County has several programs that relate to flood hazard management:

- Flood Damage Prevention Ordinance
- Shoreline Master Program
- Comprehensive Land Use Plan
- SEPA
- Uniform Building Code
- Flood Control Zone (Diking) District

UPDATE

Additional regulatory programs have been implemented in Lewis County. A current list with the applicable reference to the Lewis County Code (LCC) is as follows.

1. **Flood Damage Prevention (Chapter 15.35 LCC)**
2. **Shoreline Management (Chapter 17.25 LCC)**
3. **Comprehensive Land Use Plan**
4. **SEPA (Chapter 17.110 LCC)**
5. **Uniform Building Code (Chapter 15.05 LCC)**
6. **Flood Control Zone District**
7. **Fill and Grade (Chapter 15.05 LCC)**
8. **Building Setbacks (Chapter 15.15 LCC)**
9. **Stormwater Management (Chapter 15.45 LCC)**
10. **Critical Areas and Resource Lands (Chapter 17.35 LCC)**

5.4.1.1 Flood Damage Prevention Ordinance

The Lewis County Flood Damage Prevention Ordinance, adopted in March of 1987, is the most direct regulatory tool related to flooding in Lewis County. Adoption of this ordinance allowed Lewis County to participate in the NFIP, discussed in Section 5.2.1. This ordinance promotes the public health, safety, and general welfare, and minimizes public and private losses due to flood conditions in specific areas. The goals of the ordinance are to:

- Protect human life and health
- Minimize expenditure of public money on costly flood control projects
- Minimize the need for rescue and relief efforts associated with flooding which are undertaken at the expense of the general public
- Minimize prolonged business interruptions
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone, and sewer lines, streets, and bridges located in areas of special flood hazard
- Help create a stable tax base by providing for the sound use and development of areas of special flood hazard
- Ensure that potential buyers are notified that property is in an area of special flood hazard
- Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions

The ordinance applies to those lands within the 100-year flood plain under county jurisdiction, as delineated in the 1981 FEMA report "The Flood Insurance Study for Lewis County" and the accompanying Federal Insurance Rate Maps (FIRMs). The methods and provisions employed under the ordinance are the following:

- Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in increases in erosion or in flood heights or velocities
- Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction
- Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters
- Controlling filling, grading, dredging, and other development which may increase flood damage
- Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas

Floodways are areas of special hazard located within the 100-year flood plain. Since developments in the floodway may entail significant hazards, the ordinance applies the following provisions to the floodway:

1. Landfill is prohibited. New commercial construction, substantial improvements, and other development may be allowed only if certification by a registered professional engineer or architect is provided demonstrating that encroachments will not result in any increase in flood levels during the occurrence of the 100-year flood discharge.

2. If the first provision is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions in the ordinance.

The Flood Hazard Ordinance is administered through the Lewis County Building Department. It establishes development permit review and administrative procedures, conditions for variances, and flood hazard reduction provisions and standards. For any flood hazard area, a development permit must be obtained before construction or development begins. This permit is required for all structures, including mobile homes, and dredge and fill activities. When an application for development is submitted to the Building Department, the location is checked against the FIRM to determine if the site of the proposed development is within the FEMA flood plain. If the proposed development lies within the FEMA flood fringe (the 100-year flood plain outside the floodway), a surveyed elevation is required as part of the application, and structures on the proposed site are required to be elevated to 1 foot above the 100-year flood elevation.

Development within the FEMA floodway is discouraged. New residential structures are prohibited entirely. Commercial development is allowed, but only if accompanied by an engineer's certification that the proposed development would not raise flood levels at all during the 100-year flood. While applications for development within the floodway are discouraged, some applications have been approved. Variances are possible for development within the floodway but Lewis County does not encourage them (Dennis Sabin, personal communication).

The variance procedure specified in the ordinance lists issues to be considered in granting a variance. These issues include a technical evaluation, all relevant factors and standards specified in other sections of the ordinance, and the following factors:

- Danger of materials being swept onto other lands
- Necessity to the facility of a waterfront location
- Availability of alternative locations
- Relationship of the proposed use to the comprehensive plan and flood plain management program for that area

Generally, variances can be granted for new construction on lots one-half acre or less in size if the lot is contiguous to and surrounded by lots with existing structures constructed below the 100-year flood level. A variance may also be issued for the reconstruction, rehabilitation, or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places without regard to certain provisions for flood hazard reduction.

While the language within Lewis County's Flood Damage Prevention Ordinance is quite standard (it is based on the model ordinance developed by the State of Washington), Lewis County does have the discretion to administer the ordinance more aggressively if it chooses. The county could strengthen the ordinance by restricting development further in flood hazard areas. Modifications to the ordinance may lower insurance rates, as well as reduce the actual damage that occurs from floods.

Lewis County coordinates the requirements for applicants under the Flood Damage Prevention Ordinance with the Shoreline Master Program (described in the following section). While these are two separate programs, if an applicant falls under the jurisdiction of both programs (each requiring a permit), that applicant only needs to apply for a shoreline permit. Lewis County coordinates the permit requirements for both programs, and incorporates those requirements into a single permit (Mike Zengel, personal communication).

5.4.1.2 Shoreline Master Program

As required by the Washington State Shoreline Management Act (Section 5.3.2), a Shoreline Master Program (SMP) for Lewis County was developed in 1975 by the Lewis County Shoreline Citizen Advisory Committee and the Lewis County Regional Planning Office. The SMA is based on the philosophy that the shorelines of the state are among the most valuable and fragile of natural resources and unrestricted development of this resource is not in the best interest of the public; therefore, planning and management are necessary in order to prevent the harmful effects of uncoordinated and piecemeal development of shoreline areas. The Chehalis River, including the Skookumchuck and Newaukum branches, is the only "shoreline of statewide significance" on the Chehalis River system. Salzer, Hanaford, and Lincoln Creeks are all classified "shorelines of the state" as is Dillenbaugh Creek downstream from its I-5 crossing.

The county SMP regulates development based on shoreline designations called environments. The four environment designations are urban, rural, conservancy, and natural. Shorelines of the state within Lewis County were assigned an environment designation based on criteria developed by the SMP Citizen Advisory Committee and the Planning Department. The SMP regulates numerous activities along shorelines, and each activity is regulated differently depending on the environmental designation of each shoreline. The SMP regulates 21 shoreline uses such as agriculture, dredging, flood plains, landfills, marinas, recreation, residential, roads and bridges, and shoreline works and structures.

In Lewis County the Shoreline Master Program is administered through the Building Department. As described in the preceding section, this program is coordinated with the Flood Damage Prevention Ordinance to allow applicants to prepare only one permit for proposed developments that fall under both programs (Mike Zengel, personal communication).

UPDATE

A Shoreline Master program for Lewis County was developed in 1975 and amended in 1980 and 1998. Lewis County sets policy, rules and regulations to achieve the policies of the State Act.

Specific water bodies subject to the Act are Shorelines of Statewide Significance, which are streams with a mean annual flow of 1,000 cfs or more, and lakes with a surface area of 1,000 acres or more. Shorelines of the State are those rivers and streams of at least 20 cfs mean annual flow, and lakes greater than 20 acres.

The three shoreline designations are urban, rural and conservancy. Shorelines of Statewide Significance and Shorelines of the state within the county were based on criteria developed by the state SMA. Specific lands subject to the provisions of the local SMP are: 1) all lands extending landward 200 ft in all directions from the ordinary high water mark (OHWM): 2) all water bodies subject to the SMP with their associated wetlands; and 3) all water bodies subject to the SMP with their associated floodways.

The SMP is administered by the Planning Department.

5.4.1.3 Comprehensive Plan

The Lewis County Comprehensive Land Use Plan, adopted in June of 1991, provides a means for protecting Lewis County's traditional economic base and conditions which can further the growth of the economy. The plan establishes the overall direction for land use planning in Lewis County and provides the framework for each component of the plan. The plan distinguishes urban areas from suburban and rural areas and places the emphasis for growth in areas where adequate public facilities and services can be provided in an orderly and economic manner. The plan attempts to ensure an adequate supply of land to meet both the immediate and future needs of urban density land use. It also provides a framework for protecting existing land uses which may be impacted by new land uses and identifies the need for joint planning between the cities within Lewis County and the county government.

Several of the following guiding principles for development of the Comprehensive Land Use Plan are relevant to flood hazard management planning:

- Growth is anticipated and planned, but encouraging more people to come to Lewis County is not an objective of the plan.

- There is a strong belief in and a desire for local control. Central to this idea is the use of sub-area planning as a means for achieving that control by the people most directly affected.

- The plan seeks to protect the property rights of landowners and ensures their freedom to use their property within the legal bounds, provided they do not incur undue adverse consequences for their neighbors, the general public, and the environment.

- Developments must pay their own way and take care of problems created. The general public or other private parties should not have to bear the cost created by the development.

- Lawful existing uses should be "grandfathered in." Any new development should be cognizant of its neighbors' uses and try to avoid conflicts or adverse impacts.

- Traditional economic uses should be protected and extra care taken not to stifle economic development. The concept of the right to farm, forest, or extract mineral resources is endorsed.

- The viability of Lewis County's economic base is important for providing jobs, taxes for schools and government, and a healthy environment for business.

- The protection of such items as the environment, air and water quality, freshwater aquifers, and the native flora and fauna are important. The plan encourages avoidance of any unnecessary waste or damage, but relies on other regulatory agencies established as the primary protectors of these resources.

- Waste management, which includes convenient and efficient deposit sites, recycling, reduction of solid waste, and pre-treatment of industrial wastes, should be an integral part of Lewis County living.

- County planning should be coordinated with the planning of other entities.

- The plan does not recommend the adoption of zoning for Lewis County. Zoning is an issue that should be dealt with on a sub-area planning basis.

The plan recommends that growth and physical development problems which are not experienced county-wide be addressed through subarea plans. Subareas, intended to be natural geographical units, are formally designated by the Board of County Commissioners based on recommendations from the Lewis County Planning Commission and the Planning Department. Strong support must be demonstrated for creation of the subarea. Larger subareas are desirable because of the greater efficiency in administration. While the intent of planning on a subarea basis is to allow maximum local control, subarea plans must comply with the enabling legislation under which Lewis County plans. To date, no subareas have been created in Lewis County.

The Comprehensive Plan is divided into the following three elements: land use, circulation, and public resource and recreation policy. The land use element delineates four use areas: urban, suburban, rural mixed, and natural resource use. The circulation element deals with facilities and services, and transportation. The public resource and recreation element recognizes the importance of the natural resource base in Lewis County, and declares that "Areas defined as being critical areas or environmentally sensitive areas should be identified and protected."

Lewis County does not actively pursue the programs identified in the Comprehensive Plan. Rather, the plan is intended to guide growth and development as it occurs naturally in Lewis County. Up to this time, Lewis County has not been required to participate in the level of comprehensive planning required under the state Growth Management Act except for the requirement to identify resource and critical areas, and to adopt a critical areas ordinance (Lewis County, like many counties in the state, has not complied with the deadline for this). In July 1993, Lewis County expects to reach the GMA population growth threshold of 10 percent in the last 10 years. At this time the county will be required to begin planning under GMA; this process is not expected to be complete before July 1996 (Mike Zengel, personal communication).

UPDATE

The County Comprehensive Plan was prepared to comply with the state GMA requirements for growth management planning embodied in Chapter 36.70A RCW. The purpose is to identify a vision for the community and to allocate and provide for growth consistent with the thirteen goals of the GMA. The County Plan was initially adopted locally in June 1999, and upon revision, amended in April 2002 to be in compliance with the GMA. Subsequent development regulations have been drafted, revised and adopted to implement the objectives of the plan.

Urban development would be phased in designated Urban Growth Areas (UGAs), and rural development would be focused within designated rural centers. The balance of the rural areas would be self sufficient with densities ranging from one unit per five acres to one unit per twenty acres. About 2.1% of the county lands are available for urban and intense rural development. Private resource lands for mining, agriculture and forestry total about 33%; federal lands about 36%; state lands about 7%; and rural residential lands about 22%. The plan was drafted to protect the property rights of landowners and ensure their freedom to use their property within the legal bounds, provided they do not incur undue adverse consequences for their neighbors, the general public, and the environment. There would be greater potential loss of habitat within areas designated for growth, but overall, less geographic areas would be impacted by development activities. Focusing both urban and rural development into areas most suited for growth will lessen the impacts and ease implementation of flood hazard mitigation.

5.4.1.4 SEPA

SEPA responsibilities are shared between the Planning Department and the Building Department in Lewis County. When a shoreline substantial development permit is required, the Building Department assumes the duties of lead agency. If no shoreline substantial development permit is required, the Planning Department carries out the SEPA responsibilities (Mike Zengel, personal communication).

UPDATE

SEPA is intended to ensure that environmental values are considered during decision-making by state and local agencies. The rules direct agencies to:

- **Consider environmental information (impacts, alternatives and mitigation) before committing to a particular course of action**
- **Identify and evaluate probable impacts, alternatives and mitigation measures that emphasize important environmental impacts and alternatives (including cumulative, short-term, long-term, direct, and indirect impacts)**
- **Encourage public involvement in decisions**
- **Prepare environmental documents that are concise and clear**
- **Integrate SEPA with existing agency planning and licensing procedures**
- **Integrate SEPA with agency activities in a timely manner to ensure that planning and decisions reflect environmental values, avoid delays in the process, and resolve potential problems.**

SEPA is administered through the Department of Community Development.

5.4.1.5 Uniform Building Code

Lewis County has adopted the Uniform Building Code (UBC) to provide standards for construction accomplished under county permits. The UBC specifies construction details for such special situations as flood-proofing, seismic shaking, and steep slopes. When structures are built within the 100-year flood plain, under the NFIP, the UBC spells out the required dry flood-proofing which prevents the structure from getting wet during a flood (Dennis Sabin, personal communication).

UPDATE

Structures built within the 100-year flood plain in Lewis County must meet local flood hazard regulations and NFIP requirements. The local flood hazard ordinance, Chapter 15.35 LCC, used requirements from the model NFIP flood hazard ordinance for floodproofing both residential (Section 15.35.270 LCC) and non-residential (Section 15.35.280 LCC) buildings. All habitable buildings must be elevated one foot above the base flood elevation, and use flood resistant materials.

5.4.1.6 Diking Districts

Special districts known as Flood Control Zone Districts (Section 5.3.1.3), or diking districts, were authorized under RCW 86.15. The general administration of these districts is described in Section 5.3.1.3. In Lewis County, diking districts have been established in the Coffee Creek drainage, surrounding the South Chehalis Industrial Park along Dillenbaugh Creek, and in the Plummer Lake area (Dick Fleming, personal communication). The establishment of diking districts can be an effective way to deal with localized flood hazards. Because these special districts have taxing authority and the ability to obtain government assistance, they can plan and implement local flood control solutions. The drawback of diking districts is that since they are typically formed to address a localized flooding problem, the extensive use of diking districts may result in a piecemeal approach to flood hazard reduction.

UPDATE

Special districts can be initiated by petition of ten property owners located within the proposed district, or by authorities within the proposed special district. These districts can be: a diking district; a drainage district; a diking, drainage, and/or sewerage improvement district; an inter-county diking and drainage district; a consolidated diking district, drainage district, diking improvement district, and/or drainage improvement district; or a flood control district. RCW 85.38 and 86.09 outline the process for administering these districts. Special districts are governed by a three-member governing body, who are elected in special district elections.

Lewis County Flood Control District #1 (LCFCD#1) was formed in 1991 to address improvements and maintenance on sections of Dillenbaugh and Dillytwig Creeks between Bishop Road and Jackson Highway.

Lewis County Flood Control District #2 (LCFCD#2) was formed in 1991 to reduce flood damage associated with flooding related to Salzer Creek. The district encompasses properties in the City of Centralia, Centralia's UGA and Lewis County sandwiched between Interstate 5 and the Chehalis Western Railroad grade. This district is unusual in that 74 property owners agreed by a nearly unanimous vote to fund a 2200-ft long levee in the south end of the district. The levee was designed to provide a 45-year level of protection from Salzer Creek bank overflows. The COE performed the feasibility study and construction. The project was completed in September 2000.

Lewis County Flood Control District #3 (LCFCD#3) was established in 1997 to construct a 600-ft long dike between two existing dikes along the west bank of Silver Creek in Randle. Flows in 1996 overtopped and flowed overland from this gap. The District also proposed gravel mining at the mouth of Silver Creek to help fund construction. The mining did not pan out as it posed conflicting objectives with ESA; and stability issues as this reach of the Cowlitz River is subject to frequent channel meandering. LCFCD#3 was dissolved in 2002.

There are two multiple jurisdictional diking districts in WRIA 23. The Thurston-Lewis Diking and Drainage District No. 1 covers the Hanaford Creek Valley. The Thurston-Lewis Improvement Drainage District No. 7 covers the Zenkner Valley and Coffee Creek drainage basin. These are relatively old districts, established in 1922 and 1921, respectively, with records kept in Thurston County.

The Davis Lake Drainage District (Morton, WA) is in WRIA26. This district was created in the 1960s, the status of this district is unknown as it has fluctuated from being inactive to active. In addition, there are various water and sewer districts. The official names of these water and sewer districts were revised a few years ago to be consistent with State requirements. Although the official names combine water and sewer, some of these local districts may provide only one utility service. Table 5-1R lists the known districts by their current official name and provided service. Figure 5-1R shows the locations of these special districts.

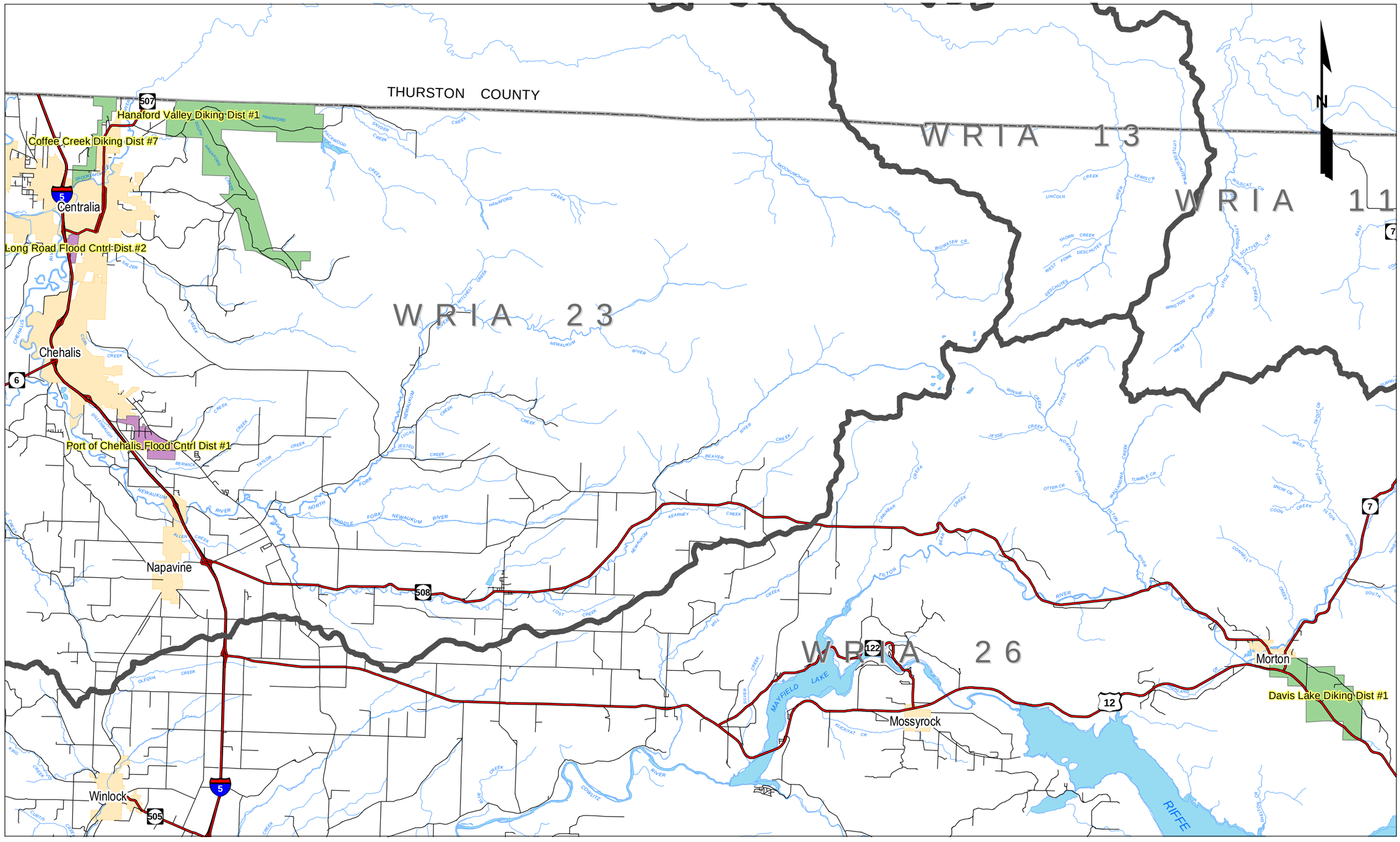
UPDATE

Fill and Grade (Chapter 15.05 LCC)
The Appendix of Chapter 33 1992 UBC was amended and adopted to regulate both private and public fill and grade activities for the purpose of safe guarding life, limb, property and the public.

Building Setbacks (Chapter 15.15 LCC)
This chapter of the LCC establishes standard setbacks or distances for buildings along Lewis County road rights-of-ways. Although this regulation is to promote the general safety, health, welfare, comfort and well-being of the residents of Lewis County, and to provide notice to prospective builders, it indirectly affects flood hazard management activities by: 1) ensuring that existing and potential drainage ways along public roads are adequate; and 2) establishing a minimum hydrologic travel distance of any potential, new impervious surfaces away from the county roadways.

Stormwater Management (Chapter 15.45 LCC)
The provisions of this chapter are intended to guide new development or redevelopment within the County to mitigate for stormwater impacts. The provisions include criteria to address runoff quantity, runoff quality, erosion and sediment control BMPs during and post construction, and maintenance and operation plans of completed drainage facilities. The regulations utilize Ecology's stormwater management manual, or other applicable manuals in Western Washington as approved by Ecology and deemed acceptable by Lewis County. Runoff detention is required for the 25-yr, 24-hr design storm.

Critical Areas and Resource Lands (Chapter 17.35 LCC)
The purpose of the Critical Area and Resource Land (CARL) regulations is to identify and protect critical areas and the activities associated with resource lands throughout the rural zoning areas and unincorporated cities within Lewis County. For all development permits issued by Lewis County, an associated CARL review is required. Critical areas that are reviewed by the Planning Department are: wetlands, fisheries habitat, wildlife habitat, frequently flooded area, aquifer recharge areas, and geologically hazardous areas. Appropriate setback buffers are applied depending on the level of intensity of the development from critical areas. The critical areas chapter also outlines the appropriate mitigation, where there are associated impacts from development.



Date: March 2004

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Figure 5-1R
Special Districts
(Flood Control and Diking-Drainage)

Lewis County
Comprehensive Flood
Hazard Mangement Plan

5.4.2 City of Centralia Regulations

The regulatory framework in Centralia is very similar to Lewis County. Centralia has a flood plain ordinance, a Shoreline Master Program, the SEPA process, and the UBC.

UPDATE

All development permits within the unincorporated City of Centralia UGA are administered through the City according to an interlocal agreement with Lewis County consistent with Lewis County code provisions.

5.4.2.1 Flood Plain Ordinance

The City of Centralia's Flood Plain Ordinance (No. 1639, November 1988), like Lewis County's ordinance, was adopted to allow participation in NFIP. Applications for development within the City of Centralia are submitted to the Building Department initially. The Building Department screens the applications for location within the FEMA flood plain (by locating the proposed sites on the FIRM). If the proposed development lies within the flood plain, the applications are referred to the Public Works Department. Developments within the FEMA flood fringe must be elevated to at least 1 foot above the elevation of the 100-year flood (these elevations are based on the FIRM). Although historical flooding has inundated areas not identified on the FIRM, Centralia does not currently require elevated structures in areas not specified on the FIRM. Development is not allowed in the FEMA floodway. Requests for variances are few; they are seldom granted (Terry Calkins, personal communication).

UPDATE

If the proposed development lies within the flood plain, the applications are referred to the Dept of Community Development.

Centralia also has a Shoreline Master Program, described below. Unlike in Lewis County, applicants in areas regulated by both the Flood Plain Ordinance and the Shoreline Master Program are required to apply for, and obtain, both permits.

5.4.2.2 Shoreline Master Program

Centralia has a Shoreline Master Program patterned after the State of Washington's model program. In appearance and implementation, Centralia's program is similar to Lewis County's. Centralia's program applies to development within 200 feet horizontally from the floodways of the Skookumchuck and Chehalis Rivers (shorelines of statewide significance). Because no development is allowed in the floodway, which includes most of the riparian belt associated with these shorelines, the requirements under the Shoreline Master Program are not burdensome (Terry Calkins, personal communication).

5.4.2.3 SEPA

The responsible official for all activities in Centralia that fall under SEPA is the Director of Public Works. Centralia has adopted the model State of Washington SEPA program with the highest categorical exemptions for minor new construction. This allows construction of up to 20 dwelling units, structures covering up to 30,000 square feet, or landfill and excavation of up to 500 cubic yards of material without triggering the SEPA process.

UPDATE

The Director of Community Development administers SEPA.

5.4.2.4 Uniform Building Code

Centralia has adopted the UBC to provide standards for construction accomplished under city permits. It specifies construction details for such special situations as flood-proofing, seismic shaking, and steep slopes. When structures are built within the 100-year flood plain, under the NFIP, the UBC spells out the required flood-proofing.

UPDATE

Required flood-proofing or elevation must meet the requirements of Centralia's adopted flood plain management ordinance.

5.4.3 City of Chehalis Regulations

The City of Chehalis currently addresses flood hazard through five different regulatory mechanisms, the Flood Hazard Zone Ordinance, the Shoreline Master Program, the Stormwater Management Program, SEPA, and the UBC.

UPDATE

The City of Chehalis currently addresses flood hazard through three different regulatory mechanisms:

1. **Uniform Development Regulations**
   Uniform Codes
   SEPA
   Shoreline Master Program,
   Flood Hazard Zone
   Wetlands
   Land Use
2. **Land Disturbing Activity Ordinance**
3. **Stormwater Management Ordinance**

5.4.3.1 Flood Hazard Zone Ordinance

The City of Chehalis entered the NFIP upon adoption of their Flood Hazard Zone Ordinance (207B). The City Building and Planning Department implements the Flood Hazard Zone Ordinance through a permit review process similar to those described for Lewis County and Centralia. When a development application is received in the Building and Planning Department, the location of the proposed development is compared with the FIRM, and appropriately provisioned if the application is located within the FEMA flood plain. Since Chehalis's

building and planning departments are combined, and are administered by one person, very little coordination within the city government is required to assure consistency and completeness. Chehalis requires elevation of structures within the flood fringe to 1 foot above the 100-year flood level just as in Lewis County and Centralia. Chehalis requires further elevation, above what the FIRM shows, in areas where historical evidence has shown flood levels to be higher. This is true of the area south of the Ocean Beach Highway, where elevation requirements are 3 feet higher than elevations shown on the FIRM. Elevation of all developments must be certified by an engineer or surveyor (Bob Nacht, personal communication).

Variances to the elevation requirements for flood fringe developments have occurred. In particular, Chehalis does not require elevation for additions to structures at the current level as long as the addition is "wet flood-proofed" or constructed so that the structure resists damage from flooding. Construction with materials such as concrete, steel, pressure-treated wood, and styrofoam insulation are considered "wet flood-proofing." It is also possible for commercial establishments to obtain variances to the elevation requirements. In particular, a car dealership obtained a variance based on the fact that most of their merchandise was portable and could be driven off-site in the event of a flood. The exterior of the structure itself was required to be "wet flood-proofed." Variances are not possible for residential structures (Bob Nacht, personal communication).

UPDATE

Flood Hazard Zone (FHZ) (DR – Part III; Chapter 17.21)

The City of Chehalis initially entered the NFIP upon adoption of Ordinance 207-B on March 24, 1980. The Department of Community Services currently implements the Uniform Development Regulations, Ordinance 750-B, which includes Chapter 17.21 – FHZ. The regulations are implemented through a permit review process similar to those described for Lewis County and Centralia.

When the Department of Community Services receives a development application, the location of the proposed development is compared with the FIRM, and appropriately provisioned if the application is located within the FEMA flood hazard zone. The Chehalis building and planning departments are combined, and administered by the Community Development Manager. Consequently, minimal coordination is required within the city government to assure consistency and completeness.

Development within special flood hazard areas that requires elevation or floodproofing must be elevated or floodproofed to or above the flood protection elevation (base flood elevation plus one foot or base flood elevation plus three feet for critical facilities), or to the flood of record elevation at the specific location as identified by the City, whichever minimum elevation is higher. A FEMA Elevation Certificate is required for any new, substantially remodeled buildings, or substantial additions to structures.

5.4.3.2 Shoreline Master Program

Chehalis has adopted the State of Washington model Shoreline Master Program. The appearance and implementation of this program are similar to Lewis County and Centralia. This program applies to the Chehalis and Newaukum Rivers as well as the lower part of Dillenbaugh Creek (below the I-5 crossing).

UPDATE

SMP (Resolution 19-81 & DR-Part III, Chapter 17.18)

Chehalis has adopted the Lewis County 1981 SMP. The implementation of this program is similar to Lewis County and Centralia. The City has revised its SMP and submitted it to Ecology for approval. The revised SMP is reflected in Part III, Chapter 17.18 of the Uniform Development Regulations; however, it will not be enforced until approved by Ecology. This SMP applies to parts of the Chehalis and Newaukum Rivers as well as parts of Coal, Salzer and Dillenbaugh Creeks.

5.4.3.3 Stormwater Program

In 1991 Chehalis completed a Stormwater Management Plan. This plan specifies capital works projects to deal with stormwater originating within the Chehalis boundaries. In October of 1992 a stormwater utility was formed as a way to generate funding for the projects identified in the stormwater plan. Basically the plan requires property owners adjacent to the city's stormwater drainage system to pay stormwater utility fees and maintain specified channel cross sections in the storm drains adjacent to their property. Utility rates are based on impervious surface area, and are reduced if the property owner provides on-site detention and treatment for stormwater.

UPDATE

Utility rates are based on impervious surface area. A property owner can appeal their estimated stormwater usage allocation, if they make an improvement that will reduce the impact on the stormwater system. The appeal is then reviewed by the Public Works Director, and approved or denied on its merit.

5.4.3.4 Uniform Building Code

Chehalis has adopted the UBC to provide standards for construction accomplished under city permits. When structures are built within the 100-year flood plain, under the NFIP, the UBC spells out the required flood-proofing (Bob Nacht, personal communication).

UPDATE

<u>Uniform Codes (DR – Part I, Chapter 17.09, Section 17.09.080)</u>

Pursuant to the State Building Code Act (RCW 19.27A), certain codes, rules and regulations, as the same now exist or may hereafter be amended, supplemented or added to, shall be, and the same hereby are, adopted by reference, including additions, deletions and amendments to the Uniform Codes (WAC 51-40 through 51-47); the Washington State Energy Code (WAC 51-11); the Washington State Historic Building Code (WAC 51-19); and the Washington State Ventilation and Indoor Air Quality Code (WAC 51-13), which are promulgated by the Washington State Building Code Council. In addition, certain uniform code appendices and specialized codes are also adopted by reference and are enumerated in Appendix E of the DR.

In the event of conflict between provisions of the codes, rules or regulations enumerated in Appendix E, the first named code, rule or regulation shall govern over those following except as provided in the WAC 51-40 (Building Code).

Chehalis has adopted the Uniform Building Code (UBC) to provide standards for construction accomplished under city permits. When structures are built within the 100-year floodplain, under the NFIP, the UBC spells out requirements for flood protection.

UPDATE

SEPA (DR-Part III, Chapter 17.15)

Purpose of this chapter is to implement the SEPA, RCW 43.21, and to ensure that environmental values are given appropriate consideration in the City's decision-making process. The responsible official for all activities that fall under SEPA is the Community Development Manager. Chehalis has adopted Part III, Chapter 17.15, to be used in conjunction with WAC 197-11, as amended by Ecology. Chehalis has adopted the categorical exemptions enumerated in WAC 197-11-800 through 197-11-890, provided:

1. **Categorical exemptions shall not be applicable if any portion of the proposal occurs within a jurisdictional wetland.**

2. **Categorical exemptions shall not be applicable if any portion of the proposal occurs within any shorelines management jurisdictional area.**

3. **Certain categorical exemptions shall not be applicable for conditional use proposals identified in the "100" sections (Special Provisions) of Part V.**

4. **WAC 197-11-800(1)(b)(i) is amended to read: The construction or location of any residential structures of nine dwelling units.**

5. **WAC 197-11-800(1)(b)(iii) is amended to read: The construction of an office, school, mercantile, service, storage, utility or similar non-residential building with 12,000 sq ft of gross floor area and with associated parking facilities designed for 40 automobiles. The construction of an assembly (group A) building with 5,000 sq ft of gross floor area and with associated parking facilities designed for 40 automobiles.**

6. **WAC 197-11-800(1)(b)(iv) is amended to read: The construction of a parking lot designed for 40 automobiles.**

7. **WAC 197-11-800(1)(b)(v) is amended to read: Any landfill or excavation of 500 cubic yds throughout the total lifetime of the fill or excavation; and any fill or excavation classified as a Class I, II or III forest practice under RCW 76.09.050 or regulations thereunder.**

Wetlands (NWI) (DR – Part III; Chapter 17.24)

The purpose of this chapter is to identify, map, regulate and protect jurisdictional wetland areas consistent with state and federal regulations. The policy of the City is to utilize existing local, state, and federal regulatory systems wherever possible and applicable, and require review of the requirements of this chapter within those systems.

Any development permit application, which proposes activity, located within 200 ft of a NWI mapped area shall require a wetland determination and/or delineation report completed by a qualified professional as part of the complete application package. Any required wetland delineation shall be attached to any development permit application and shall contain the approval or acknowledgement of the US Army Corps of Engineers. All proposals for development within a delineated wetland shall submit a JARPA, a SEPA checklist, and a site development plan in sufficient detail so as to constitute a construction plan.

Land Use (DR - Part V)

This part of the DR establishes specific standards for development based on zoning. The standard setbacks (distances for building along city rights of ways and adjacent properties) are specified in this part of the DR. These requirements indirectly affect flood plain management by: 1) ensuring that existing and potential drainage ways along public roads are adequate; and 2) establishing a minimum hydrologic travel distance of any potential new impervious surfaces away from the city right-of-ways.

Land Disturbing Activity (Ordinance 454B; CMC 15.28)

Chehalis has specific rules and regulations to control all land disturbing activity within the city. This information is contained in CMC 15.28, the Public Works Standards and UBC Chapter 70. The City has basic control objectives, which are to be considered in developing and implementing an erosion and sedimentation control plan. The following summarizes the objectives: 1) identify critical areas; 2) limit time of exposure; 3) limit exposed areas; 4) control stormwater runoff; 5) manage site runoff; and 6) control sedimentation.

An application is to be submitted upon the required forms, signed by the property owner or authorized agent of the owner, and approved by the Public Works Department. The minimum plans for land-disturbing activities shall comply with the most recent version of the UBC Chapter 70, the provisions of CMC 15.28, and Public Works Standards. The stricter shall apply. Certain activities are exempt, unless the excluded activity is to occur within an environmentally sensitive area. Land filling within the regulatory floodway is not permitted.

TABLE 5-1R. SPECIAL DISTRICTS

NAME	JURISDICTION/DRAINAGE BASIN	SERVICE TYPE
Diking and Drainage District No. 1	Thurston-Lewis Counties/ Hanaford Valley	Dike, drainage
Improvement Drainage District No. 7	Thurston-Lewis Counties/ Coffee Creek	Drainage
Davis Lake Drainage District	Morton	Drainage
Flood Control District No. 1	Port of Chehalis/Dillenbaugh Creek	Drainage
Flood Control District No. 2	Long Road/Salzer Creek	Dike, drainage
Flood Control District No. 3	Randle/Silver Creek	Dike

*** Dissolved in 2002**

6.0 FLOOD CHARACTERISTICS

6.1 Chehalis River Flood Characteristics

This section summarizes the following information: historical flow data on the Chehalis River and two of its major tributaries, the Newaukum and Skookumchuck Rivers; flood problems associated with the Chehalis River; costs related to flooding; and a profile of the January 1990 flood.

Flooding has been a familiar problem to residents in the Chehalis River valley, particularly in the urbanized areas of Centralia and Chehalis. The main flood season for the Chehalis River is in late autumn and winter. Most major floods result from heavy rains during this period. Some floods are augmented by melting snow, but because the Chehalis River originates in the Cascade foothills, it is influenced less by snowpack than many Cascade mountain range rivers. The distribution of flooding within the Chehalis River basin varies between flood events, depending on the response of major tributaries. Variations in the amount and timing of storm rainfall causes tributaries to peak at different times with each storm event. This unpredictability makes flood forecasting difficult for this region.

River forecasts originate from the Portland River Forecast Center of the National Weather Service (NWS) which furnishes them to the Seattle office of NWS. The Seattle office of the NWS transmits the forecasts nationally by way of a commercial communications satellite. The forecasts are received in the Reservoir Control Center at the NWS directly from a satellite antenna and printed on the teletype data terminal. Forecasts are furnished to the news media as a public service for local residents and public agencies to provide lead time to take defensive action before serious flooding occurs.

River forecasts are difficult to quantify for various reasons. Forecasts require continuous information on recent and expected atmospheric conditions in the affected area. This information is difficult to obtain for a coastal region because of the lack of specific data on the moisture supply of an air mass over the Pacific Ocean. Forecasts are generally better when the storm is centered near the precipitation index stations, but this is typically not the case. In addition, the storm center, direction, and travel speed can greatly affect the forecasts, and these factors are also difficult to determine with great precision. The NWS usually takes a conservative approach to forecasting.

6.1.1 Historical Streamflow Records

The first records of river stage and discharge on the Chehalis River date from October 1928 when the U.S. Geological Survey (USGS) installed a staff gauge 1.5 miles southwest of Grand Mound. The staff gauge was replaced with a recording gauge in October 1934 and continuous records at this site are available since 1934 (Chehalis River near Grand Mound). The first gauging on the Skookumchuck River was in 1950, when the National Weather Bureau installed a staff gauge on the Harrison Avenue bridge. A wire-weight gauge and resistance gauge were installed at the Pearl Street bridge over the Skookumchuck River in Centralia on October 8, 1964. The resistance gauge permits remote readout in the City Engineer's office and the wire weight provides a calibration facility for the resistance gauge. Observations at Harrison Avenue were discontinued in 1965, but the record at Pearl Street has continued seasonally to the present. Skookumchuck River records for the Harrison Avenue and Pearl Street bridges are on file at the Weather Bureau River District Office in Seattle.

As shown in Table 6-1, water levels and streamflow are recorded at numerous locations on the main stem of the Chehalis River and its tributaries. Chehalis River flow data are presently reported from USGS streamgauge stations and NWS stations. The NWS stations record only water levels, while the USGS stations record water levels and flow.

A summary of streamflow data is presented in Table 6-2 for the following three USGS stations: the Chehalis River near Grand Mound, approximately 7 miles downstream from the Skookumchuck River confluence; the Newaukum River near Chehalis; and the Skookumchuck River near Bucoda. The data show that the monthly distribution of flow is similar for the main stem of the Chehalis River and two major tributaries flowing through the Centralia/Chehalis valley (Figures 6-1The largest monthly flows occur in December through February, with this 3-month period accounting for over half of the annual runoff volume. The smallest mean monthly flows occur from July through September, when monthly flows range from only 1 to 3 percent of the annual runoff.

Annual flood data are summarized in Table 6-3. Historical data are shown for the annual flood, the date of the flood, and the ranking of each flood for the period of record at each station. Data in Table 6-3 are listed by "water-year" defined by the USGS as the 12-month period starting with October and continuing to the following September. This convention has been adopted by the USGS so that snowpack that accumulates in the fall can be correlated with snowmelt runoff that occurs in the spring. This allows the data to be published by the USGS as occurring in the same water-year, even though the period spans two calendar years. Therefore, in some instances the water-year for a flood may vary from the calendar year in which the flood occurred. For example, the flood of November 1986 is considered by the USGS to have occurred in the 1987 water-year (October 1986 through September 1987).

Flood data in Table 6-3 show that almost all annual floods occurred during the fall/winter period from November through February. For the 63-year period of record on the Chehalis River near Grand Mound, 59 annual floods occurred during this period. Of the remaining four, two occurred in March and two in April. Similarly, most peak annual floods on the Newaukum and Skookumchuck Rivers also occurred during the November through February period.

Examination of the flood data in Table 6-3 reveals some interesting trends. First, recent years have experienced some of the largest floods on record. For example, the 1990 and 1987 floods on the Chehalis River rank as the first and third largest, respectively, during the past 63 years. Similarly, on the Newaukum River three of the largest five floods during the past 50 years occurred in 1987, 1990, and 1991. On the Skookumchuck River the 1991 and 1990 floods rank as the first and third largest during a 23-year period of record. These flood data support the perception that flooding has been worse in recent years. In fact, floods in recent years have been some of the largest to occur during the past 63 years. Conversely, flood records for the Chehalis River also show that some of the smallest floods have occurred in recent years. For example, the floods of 1988 and 1989 rank 58th and 63rd for the 63-year period of record.

The flood records also illustrate that the severity of floods in any year can vary between the main stem Chehalis River and major tributaries in the Centralia/Chehalis valley. While the 1990 flood on the Chehalis River is the largest flood on record, this flood is the fourth largest on the Newaukum River and third largest on the

Skookumchuck River. The largest flood on record at each of the three stations occurred during a different year: 1990 on the Chehalis River, 1987 on the Newaukum River, and 1991 on the Skookumchuck River.

UPDATE

Table 6-1R is an updated summary and ranking of ten peak flows in WRIA 23, 26 and 11. The February 1996 flood was the flood of record in WRIA 23, the Upper Chehalis basin. Recorded flows in WRIA 23 show numerous peak flows from the period 1971 to 1996. Weather and streamflow records are not long enough to determine a definite trend, but there is a general belief that weather conditions are cyclic and the last 30 years reflect a period of extremely wet weather conditions.

The records show that the severity varies between and within river basins. For example, note the different ranking of flow events in the Chehalis River near Grand Mound than the Newaukum River near Chehalis. This is reasonable as topography, soils, channel features, land uses, and localized climate conditions, affect the magnitude and conveyance of flows.

Table 6-2R ranks the largest floods of record in WRIAs 11, 23 and 26 by storm event. The Cowlitz River gaging station at Packwood is upstream of the dams, and upstream of major tributary streams (Tilton River, Cispus River, Olequa Creek). The Cowlitz station below Mayfield Dam is included in Table 6-4R to show the tempering effects from controlled dam releases. The salient point from this table is the variability of flooding due to basin conditions.

The ranking of the peak flows does not necessarily correlate to the ranking of flood events. Extent of areal damage, depth of flooding, and antecedent weather conditions must be considered.

As part of a flood insurance study, FEMA (1981) estimated flood magnitudes at various locations in the Chehalis River basin for return periods ranging from 10 to 500 years. These flood estimates are summarized in Table 6-4. For comparison to the recent extreme flood of January 1990, the USGS (Hubbard 1991) has estimated the return period of the peak flow on the Chehalis River near Grand Mound to be about 100 years. The return periods of the peak floods on major tributaries were less, estimated to be 30 years on the Newaukum River and 45 years on the Skookumchuck River.

The U.S. Army COE has investigated flood damages in the Centralia-Chehalis valley and, based on historical records, has identified water levels at selected gauges that cause zero damage and major damage in the valley. These gauge heights provide a reference for quickly assessing the severity of anticipated floods, and triggering initiation of emergency flood response operations in Lewis County (COE 1991).

6.1.2 Overview of Flood Hazards

Damage during a flood is typically caused by one of two river processes active during flooding. The first process is inundation, defined as floodwater and debris flowing through an area. Inundation occurs when the water in the river channel rises to the level where it flows over the riverbanks and onto the surrounding flood plain. The level of damage caused by inundation is determined by the velocity and depth of the water, the amount of debris in the water, and the level of development in the inundated area. Areas of flood inundation can be determined through hydrologic analysis and study of historical records. Inundation areas may vary from flood to flood because of the impact of different hydraulic responses from the river system or possible failures of flood control structures.

The second river process that causes damage during a flood is bank erosion. Bank erosion occurs when a river scours its banks, causing the channel to shift position. Sometimes the river will actually move to an entirely new channel during a flood. Bank erosion can also threaten structures high above the flood plain by undermining the bank near where the structure is located. Areas prone to bank erosion can be identified through mapping and hydrologic analysis, but the occurrence of channel migration and channel "jumps" cannot be predicted with confidence.

In the Centralia/Chehalis valley, flood hazard is mainly associated with inundation. Bank erosion presents a hazard in localized areas, such as along the Skookumchuck River in Centralia and on the South Fork Newaukum River near Onalaska. Areas that regularly become inundated along the mainstem Chehalis River, including backwater flooding on Coffee, China, Salzer and Dillenbaugh Creeks, typically contain slow-moving water. Structural damage to buildings caused by high velocity flow in the inundated areas has not been a significant problem historically. Overbank flow along the Skookumchuck River does typically have higher velocities than the mainstem Chehalis, although extensive erosion or structural damage from the Skookumchuck River has not been reported during any historical flood.

Flooding in the Chehalis River system, including the Skookumchuck and Newaukum Rivers, is disruptive and potentially dangerous to residents of the area. Inundation by floodwaters disrupts transportation routes such as Interstate 5, the main north-south transportation route between Seattle and Portland; forces evacuation of homes and commercial establishments; and can put sewage treatment plants out of service temporarily. A mainline of the Burlington Northern Railroad also crosses the flood plain from east to west on the Chehalis River near Chehalis. The tracks are subject to damage at various locations during large floods. The Chehalis-Centralia airport is protected by a dike system, but the dikes were overtopped during the January 1990 flood event, closing the airport. Except for the urban areas of Centralia and Chehalis, only scattered developments exist in the flood plain. Most of the flood plain is devoted to agricultural or related purposes.

6.1.3 January 1990 Flood

The most devastating flood in the history of Lewis County occurred between January 8 and 12, 1990. Preliminary analysis by the COE (1991) indicates the flood had a return period (recurrence interval) of about 100 years for much of the mainstem Chehalis River above Grand Mound, and a return period of about 45 years for the Skookumchuck River near its mouth. Much of the following narrative is drawn from the COE 1991 publication "Flood Summary, Chehalis River Basin, January 1990 Event and Nov. '90 Addendum" and the "Interagency Hazard Mitigation Region X Report."

UPDATE

February 1996 Flood

The February 1996 flood is the flood of record on all major drainages in WRIA 23. The COE updated their flood frequency curves for the Chehalis River in 1997. The COE had published flood frequency curves for a 1980 FEMA report, and made revisions in 1989. Their recomputed frequency curves are significantly higher than those published in 1980 and 1989 as shown in Table 6-3R.

This was also the greatest flood discharge on the Cowlitz River (WRIA 26) and on the Nisqually River (WRIA11).

Several antecedent conditions were in place before the February 6, 1996, the largest flood of record in WRIA 23. The ground throughout the basin was at or near saturation. Recent snowfall as low as 500 ft above sea level had occurred. Warm moist subtropical air was transported from the Pacific Ocean into the Pacific Northwest with a freezing level above 8,000 ft. There was also a strong polar jet stream with maximum core wind speeds in excess of 150 knots. Storms fed upon the jet stream, and this powerful jet stream sustained and strengthened the storms as they moved in off the eastern Pacific Ocean. Local atmospheric conditions had set up a blocking pattern, which meant the major troughs and ridges around the Northern Hemisphere were stationary. There was a major trough to the west of the Pacific Northwest and a major ridge to the east. This pattern makes ideal conditions for weather systems to be at maximum strength. The atmosphere remained in this pattern for at least 96 hours, maximizing precipitation amounts. Large quantities of water were released from the heavy amounts of rain and snowmelt.

6.1.3.1 Meteorology

Precipitation from a stalled, southwesterly weather system over the Chehalis-Nisqually-Puyallup River region produced copious rainfall and runoff at some stations in the Chehalis basin, primarily in the upper half of the basin, that approached or exceeded previous records. Storm amounts for the Centralia precipitation station are tabulated in Table 6-6for comparison with other large storms observed during nearly 100 years of record (1893-1990). The January 1990 quantities were the second largest on record for a 1-day duration, fourth largest for 2 days, and fifth largest for 3 days.

The total 2-day storm rainfall over the Chehalis River basin above Grand Mound was estimated to be about 5.3 inches (using an average of the precipitation stations around the basin, weighted by an estimate of the relative area each station represented over the basin). This estimate compares with the average basin runoff of 5.1 inches. One factor in the high runoff observed for this event was the persistent wet weather that occurred prior to the 8th of January. Ground conditions were in a wet condition during the early rainfall, resulting in minimal infiltration and causing runoff to nearly equal precipitation.

The warm temperature of the air mass allowed a greater than usual amount of moisture to be carried inland. Freezing levels rose from 3,000 feet to near 6,000 feet. Snowmelt was not a significant contributor to the flood runoff, however, as the portion of the Chehalis River basin above these elevations is small and the snowpack was negligible.

6.1.3.2 Hydrologic Data

Peak flows and other hydrologic data and characteristics for pertinent Chehalis River basin stations are listed in Table 6-7. Hydrographic data are summarized for river flows and water levels at seven USGS streamgauge stations and two NWS stations. Flooding also occurred on Salzer and China Creeks; however, only limited flood data are available on these creeks. The Skookumchuck River flows listed in Table 6-7 for the Centralia, Bucoda, and Pearl Street stations are best estimates, but may be inaccurate due to the effects of out-of-channel flows on

flow estimates at these locations.

The uppermost gauge in the Chehalis basin is on the Chehalis River near Doty. The discharge at Doty rose quickly with the rainfall and receded as quickly after the rainfall ceased at the nearest raingauge at Frances. The bankfull discharge (the maximum discharge contained within the actual channel) is unknown, but the average annual maximum discharge at the Doty gauge is about 9,500 cfs. Flood runoff at Doty was above this average for 22 hours.

The Newaukum River, at the gauge near Centralia, peaked at 10,600 cfs about 4½ hours after precipitation ceased at the Frances station. A limited record of hourly data was available for the Newaukum River gauge.

In addition to the Newaukum River, the Chehalis River also received inflow from Salzer and China Creeks before it reached the Skookumchuck River. Verbal reports from city officials indicate that China Creek probably peaked at about 1700 hours on January 9 and Salzer Creek peaked late at night on January 9. High water marks were established at a number of locations on Salzer Creek and China Creek. Inundation limits were mapped for China Creek by the City of Centralia. Rated discharges for the high water marks and associated times of occurrence are not available.

Flow in the Skookumchuck River is recorded at three USGS locations: near Vail, near Bucoda, and below Bloody Run Creek, near Centralia (located approximately 19 miles upstream from Centralia). River stages are also observed at the NWS gauge at Pearl Street. Discharges at the Vail gauge rose almost in phase with those at the Doty gauge on the Chehalis River, and peaked at 5,410 cfs, 1 hour later than Doty. The flow at Vail peaked immediately after the rainfall intensity at Cinnebar began to diminish. Calculations by the COE showed the peak discharge at the mouth of the Skookumchuck River to be approximately 11,700 cfs, which the COE estimated to be about a 45-year event. Comparing peak discharges to their drainage areas for the Skookumchuck River in Table 6-7, the magnitude of runoff on the Skookumchuck River was less per square mile than for the Chehalis River above the confluence with the Skookumchuck.

Flow measured on the Chehalis River near Grand Mound, a mainstem gauge downstream from the Skookumchuck River confluence, rose at about the same rate as gauges further upstream on the Chehalis River. The hydrograph remained above zero damage stage for 115 hours and above major damage for approximately 40 hours. The peak discharge of 68,700 cfs was a new record for the Grand Mound gauge and was estimated to be a 100-year recurrence interval flood.

Comparison of the runoff and precipitation averaged over the basin revealed that this flood was unusual. The basin-averaged runoff for the Chehalis River near Grand Mound was 5.1 inches. This runoff is nearly the same as the basin-averaged precipitation, suggesting that most of the rain that fell ran off during the storm. The next downstream gauge on the Chehalis River, located 26½ miles downstream at Porter, showed that runoff intensity decreased downstream from Grand Mound.

UPDATE

Table 6-4R lists 23 gaging stations that have relevance to local river conditions. Five stations are outside the county; and 18 are within the county. Out of the 18 stations in the county, there are four stations that are National Weather Service (NWS) flood forecast stations. These four flood forecast stations are in WRIA 23 at: Doty, Chehalis, Mellen St and Pearl St. Two stations provide only flood elevations: Cowlitz

River near Toledo, and Chehalis at City WWTP. The County has an agreement with USGS for joint operation of 10 stream gauges. Figure 6-6R shows the locations of these gages.

Stream flow data are given in "water year", which is defined by USGS as the 12-month period starting with October and continuing to the following September. This convention has been adopted by the USGS so that snowpack that accumulates in the fall can be correlated with snowmelt runoff that occurs in the spring. This allows the data to be published by the USGS as occurring in the same water-year, even though the period spans two calendar years.

6.1.3.3 Flood Damages

Flood damage information was obtained by the COE from field investigations, damage survey reports, and personal interviews with homeowners, farmers, businessmen, and federal, state, county, city, and public utility officials. Eyewitness accounts of flooding and reports of damage in local newspapers were also used in identifying and quantifying flood damages.

The January 1990 flood in the Chehalis River basin caused an estimated $19,189,000 in damages, the highest on record. Floodwater affected the cities of Centralia, Chehalis, Montesano, Elma, Bucoda, and Oakville. A breakdown of damages for Centralia and Chehalis is presented in Table 6-8. Residential damages throughout the basin totaled $4,313,000, with approximately 905 residential dwellings in the Chehalis/Centralia area damaged during the flood. Commercial damages were also concentrated in Centralia and Chehalis, with Chehalis being the hardest hit. Significant damage was reported by 43 firms basinwide, and totaled $6,801,000. Public damages, totalling $2,829,000, mainly consisted of damage to county, state, and federal roads, and the Lewis County Fairgrounds. Agricultural damages were $1,324,000, and included losses of 150 cattle and 42,000 fryer chickens. Approximately 10,000 acres of agricultural land were flooded, including 4,000 acres of cropland. Emergency aid damages were $640,000, of which $485,000 was for temporary housing. The category of Aircraft Losses associated with traffic delays totaled $2,172,000. Delay and rerouting costs due to the 4-day closure of I-5 represented $2,098,000 of this total.

Floodwater covered about 9,000 acres (6,600 agricultural and 2,400 urban) in the immediate Centralia-Chehalis area. All north-south roads between the cities, and many roads within the cities, were closed, isolating residential, commercial, industrial, and public facilities. The only hospital in the area was completely cut off from the rest of Centralia, requiring emergency patients to be moved by helicopter. About 3,000 persons were displaced in the Centralia-Chehalis area during the flood. Two deaths in Centralia near the Skookumchuck River and one in Chehalis on Interstate Highway 5 were directly caused by the flood.

Interstate 5, the main north-south route between Seattle and Portland, was covered for about 2 miles by waters up to 5 feet deep. A 20-mile segment of Interstate 5 was closed for 4 days requiring lengthy detours. Large tractor-trailer combinations were diverted over other highways, across the Cascade Mountains, through Yakima, and back through the Columbia River Gorge, adding 250 miles to the normal 175-mile Seattle-Portland trip. Smaller traffic was able to use a 90-mile-long detour on a two-lane mountain highway through Morton.

The dike that partially surrounds the publicly owned Chehalis-Centralia Airport failed and was outflanked, inundating the airport and a dairy farm with water generally 3 to 5 feet deep. Seventy airplanes were damaged and 75 head of dairy cattle were killed. Both the Centralia and the Chehalis Sewage Treatment Plants were put

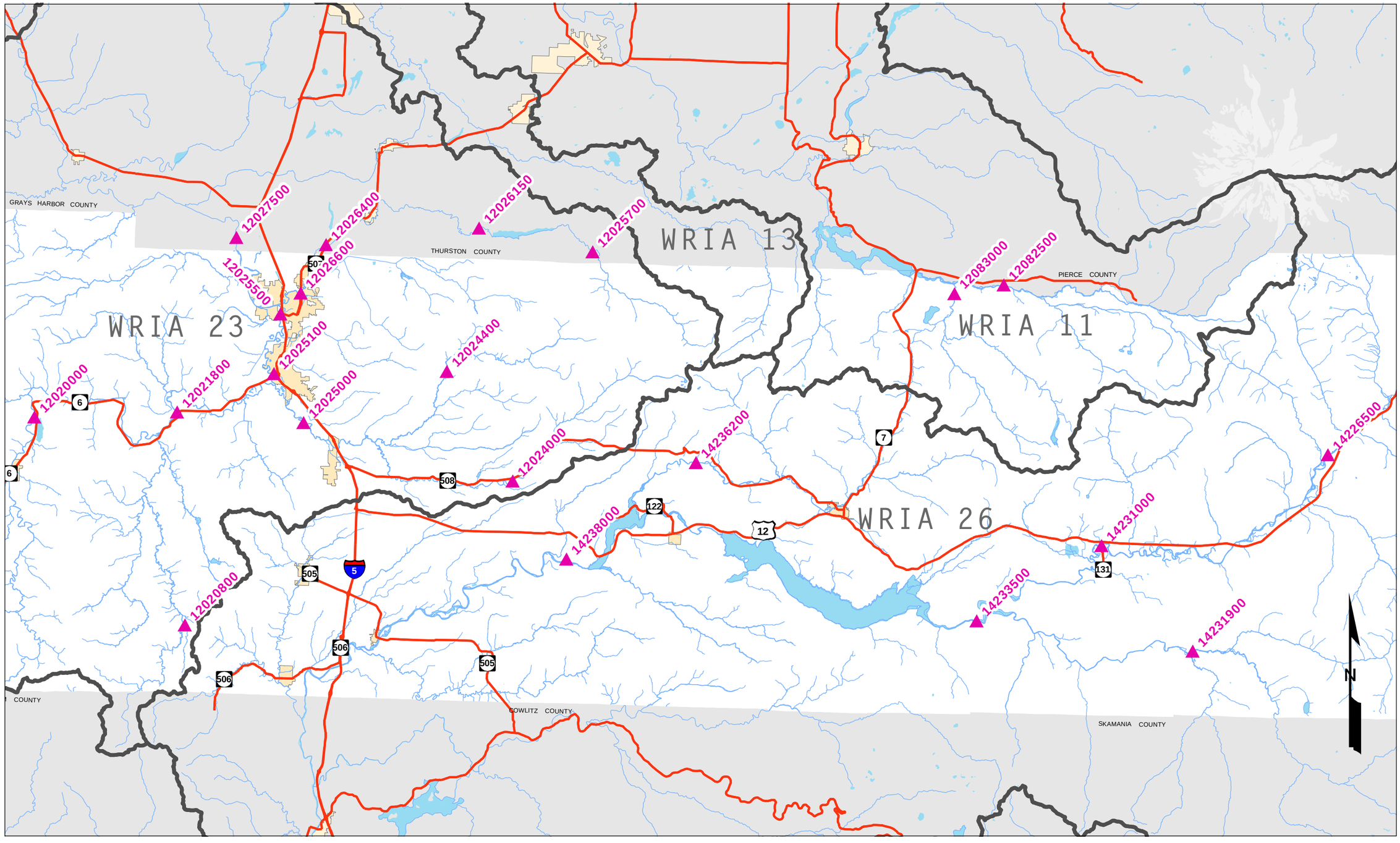

Figure 6-6R

River Gauges

▲ Active Gauges Pertinent to Lewis County

Lewis County
Comprehensive Flood
Hazard Mangement Plan

Date: March 2004

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out of service requiring the discharge into the floodwater of effluent that had only received primary treatment (settling out of solids) with no chlorination.

The dike around the Lewis County Fairgrounds, which also failed during the 1986 flood and had been rebuilt following the flood, was outflanked and overtopped, flooding many fair structures to their eaves. The Centralia landfill, which serves as the landfill for Lewis County and other cities, was also inundated. (The landfill, which is under consideration as a Superfund site, is slated for closure in the near future.)

UPDATE

The Centralia Municipal Landfill site has been capped and undergoing corrective action. Ecology has set up 13 monitoring wells around this Superfund site, which is located about 1000 ft east of the Chehalis River at the Lewis County/Centralia Transfer Station. Groundwater is sampled quarterly. Two monitoring wells in 1993 showed elevated concentrations of ammonia, chloride, total dissolved solids, iron, manganese and total organic carbon. Chloride concentrations have been decreasing since 1990, but the potential exists for water quality effects to Salzer Creek. The County is monitoring nitrate concentrations in response to elevated nitrate levels seen in samples for septic tank applications.

UPDATE

Flood Damages

In the past 30 years, Lewis County has experienced 16 federally declared disasters. Of these, 13 were either caused or exacerbated by flooding. Table 6-5R is from the *Lewis County Hazard Identification and Vulnerability Analysis* and lists floods that resulted in a Presidential Declaration of Disaster.

Care should be used in viewing the damage costs listed in Table 6-5R. These damage costs are approximate, and of primary and significant structures and businesses. Information about damages is collected by different agencies, and does not include unreported damages. The information is further confused when initial estimates of damage are refined. This can either result in a higher or lower value. At best, the Primary damage was erosion of public infrastructures (riverbanks, roads, bridges, and revetments). Costs for public damages are based on actual costs or cost estimates reviewed by FEMA. Private costs are based on information provided by victims, Red Cross and FEMA; and do not include any reduction in property values.

Precise information on private property damage is, for the most part, unavailable. FEMA collects several types of data for private property: human resources claims, and requests for short-term assistance and claims through the NFIP and the Small Business Administration (SBA). Human resources claims data and the damage reported in the newspapers are not necessarily alike. Human resources data is aggregated by zip code to protect the privacy of applicants, which makes it difficult to identify localized flood problems, trends, and causes.

Another factor to consider are the unreported private property damages. Flood insurance claims were either not filed due to lapsed flood insurance policies, or to fear of increased rates. Unfortunately, this is a common misconception: rates do not automatically increase based on submission of claims. In any case, the actual damages are likely understated, and do not reflect the true magnitude of problems.

The scope of the flood damages is related to the magnitude of the flood and location. Low lying areas, especially river valleys, have flooded regularly for hundreds of years. The 1996 flood event was the most severe and it affected Interstate travel, thus making the associated damage costs (estimated up to $100M) the highest to date. The $30M estimate given in Table 6-5R represents damage costs to public structures incurred within the county.

6.1.3.4 Emergency Activities during the Flood

The Cities of Centralia and Chehalis, as well as Lewis County, employed all their available resources during the flood emergency to protect property and provide for public safety. The Washington Department of Emergency Services, Washington State Patrol, and the Washington Department of Transportation, as well as the Civil Air Patrol, were also involved. On January 9, Governor Gardiner activated units of the Washington National Guard for sandbagging and evacuation duties.

On the morning of January 9, the Corps of Engineers activated its six-person Chehalis River Basin Flood Team. The team provided 114,000 sandbags and technical assistance to the local governments until the river dropped below flood stage on January 12. COE personnel monitored flood conditions by land and helicopter. On January 10, Representative Jolene Unsoeld, the Lewis County commissioners, and county public works and sheriff personnel were provided aerial tours of the flooded areas to identify damaged public and private facilities.

The U.S. Army MAST 59th Medical Detachment from Fort Lewis and the U.S. Coast Guard provided helicopter support for local rescue operations. They also provided emergency patient transport for the area's only hospital when it became inaccessible to ground transportation.

On January 12, Governor Gardener declared 13 counties in the state a disaster area (including the entire Chehalis basin). He requested a federal disaster declaration from FEMA on January 15; Lewis County was declared a major disaster area by President Bush on January 18. FEMA opened a disaster application center in Chehalis to help residents file claims for assistance. After serving hundreds of applicants, the center closed on January 20. On January 22, Governor Gardener and the acting regional director for FEMA signed an agreement releasing federal assistance for seven counties in Washington, including Lewis County in the Chehalis River Basin.

6.1.4 Summary of Flood Hazards in the Chehalis/Centralia Valley

The flood hazards in the Chehalis/Centralia Valley fall into two general categories, widespread inundation and local bank erosion. Much of the lowland area is inundated by floodwater almost annually. This widespread inundation is a natural phenomenon caused by the wide valley floor and low gradient of the Chehalis River through the Chehalis/Centralia area. While the widespread inundation is disruptive and damaging, the danger can be controlled by making residents aware of the flood risks and having flood warning systems that allow people adequate time to evacuate the region during severe floods. The widespread inundation by floodwater that occurs in the Chehalis/Centralia valley cannot be prevented without the construction and maintenance of major flood control structures. The COE has analyzed numerous flood control schemes for the valley; none of these structures has been built. COE analyses are described in Chapter 7.0 of this document.

Although the flood hazards in the Chehalis/Centralia valley are generalized in nature, it is possible to identify specific urgent problem areas where flooding is particularly troublesome or expensive to residents. The

following list of urgent problem areas was developed with input from the Lewis County Advisory Committee and the Cities of Centralia and Chehalis:

1. **Salzer Creek/Fairgrounds area** - Flooding in the lower portion of the Salzer Creek basin is exacerbated by backwater effects from the Chehalis River. During a flood event, backwater from the Chehalis River becomes trapped upstream from the I-5 roadway and Burlington Northern railroad embankments. A dike on the north side of Salzer Creek, upstream from the railroad embankment, was designed to protect the fairgrounds, immediately to the north, from backwater flooding. During the January 1990 flood, water entered the fairgrounds by overtopping and outflanking the dike. Once floodwater enters the fairgrounds, there is no outlet for it. Because the fairgrounds are significantly lower than Gold Street to the east, a greater depth of water is able to accumulate in the fairgrounds. A water depth of approximately 8 feet stood in the fairgrounds during the January 1990 flood.

2. **Wastewater Treatment Plants** - Both the Centralia and Chehalis wastewater treatment plants, located immediately adjacent to the Chehalis River, become inoperable during a major flood.

UPDATE

For the City of Centralia, the Mellen Street plant is still subject to risk at flood time and may become inoperable. Centralia's new wastewater treatment plant on Goodrich Road is out of the 100-year floodplain and should remain operable through any floods up and including the 100-year event.

3. **Dillenbaugh Creek Industrial Park area** - New industrial development is occurring along Dillenbaugh Creek. Dillenbaugh Creek collects much of Chehalis's storm runoff before the creek empties into the Chehalis River. The new industrial development will create more pressure to protect frequently flooded areas adjacent to Dillenbaugh Creek from flood damage, and will also create additional stormwater that will flow into Dillenbaugh Creek.

4. **Coffee Creek** - The lower end of the Coffee Creek drainage becomes inundated during floods, in some cases isolating residents upstream. Some of the floodwater comes by overland flow from the Skookumchuck River. The Zenkner Valley, where Coffee Creek flows, is naturally a very low gradient, poorly drained valley, and tends to collect standing water during the wet season.

5. **Galvin** - The area surrounding the small community of Galvin becomes inundated during low-level flooding. Floodwater from Lincoln Creek and the Chehalis River actually flows back upstream to rejoin the Chehalis River southeast of Galvin. This problem area resulted in an undermined highway during the January 1990 flood.

6. **Centralia Business District** - The Centralia Business District is vulnerable to flooding from the Skookumchuck River and China Creek. Overbank flow on the Skookumchuck River can have high velocities, resulting in damage to structures. Currently, much of the left bank (south side) of the river is leveed, but the levees do not meet current COE standards. China Creek is confined to pipes and culverts throughout most of the Centralia downtown area. During major floods, the capacity of these structures is exceeded.

7. **Hospital** - During the January 1990 flood, the hospital, which is located on Cooks Hill Road in Centralia, was not flooded, but all access routes to the hospital were inundated causing the hospital to be inaccessible from the ground.

The second category of flood hazard in Lewis County, bank erosion, affects localized areas. These bank erosion problems can be addressed through specific bank stabilization projects designed on a case-by-case basis. Bank erosion and abrupt channel changes are not readily predictable; therefore, these problems must be dealt with as they arise.

6.2 Nisqually and Cowlitz Rivers Flood Problems

As agreed upon at the first PAC meeting, the primary emphasis of this CFHMP plan is on the urbanized areas located along the Chehalis River and its major tributaries. The Cowlitz and Nisqually River basins encompass less populated areas in Lewis County and, therefore, are less prone to hazard associated with flooding. This section addresses areas within the Cowlitz and Nisqually River basins that were identified to have historical flood problems; however, it is not intended to completely define flood conditions. The subsections describe typical flood problems in the drainage basins and it is expected that similar types flooding problems will be encountered in the future.

The flood problems were identified by performing a field reconnaissance with Homer Waltrip of Lewis County Public Services. Sections of the upper Cowlitz River, upper Nisqually River, and associated tributaries were observed in historical flood damage areas. Most of the observed locations had flood protection measures installed to preserve county roads and facilities. While various agencies constructed the flood control projects, Lewis County is responsible for their maintenance.

UPDATE

Probable Hazard Areas (PHA) and Channel Migration Zones (CMZ)

An analysis was made of the upper WRIA 26 in 2001. The rivers in WRIA 26 exhibit different characteristics from the Chehalis River and tributaries in WRIA 23. They are glacier and snow based, transport an ever ready source of bedload, and have different channel features. As a first step, channel characteristics were developed to delineate specific river reaches. These characteristics include: gradient, ravine/valley geometry, channel configuration, and discharge. Then using available topographic maps dated 1986-87 and aerial photographs taken in 1996-97, specific river reaches were identified. Probable Hazard Areas (PHAs) are reaches with a high probable degree of flooding and/or channel movement. Significant characteristics that could potentially lead to damage were: gravel accumulation, braiding and channel migration. Potential consequences such as backwater flooding at the confluence of various creeks, channel widening, and bank erosion were also made.

These PHAs were mapped and provided to Lewis County. As of now, PHAs are only identified in the Cowlitz, Tilton and Cispus River of WRIA 26. Efforts are underway to fund a similar analysis of the Nisqually River in WRIA 11, and more downstream reaches in WRIA 26. The PHAs are in Figure 6-7R.

This type of analysis is different than the traditional flood inundation mapping, which is based on the magnitude of flood flows. This alternate flood hazard delineation accounts for riverine and basin

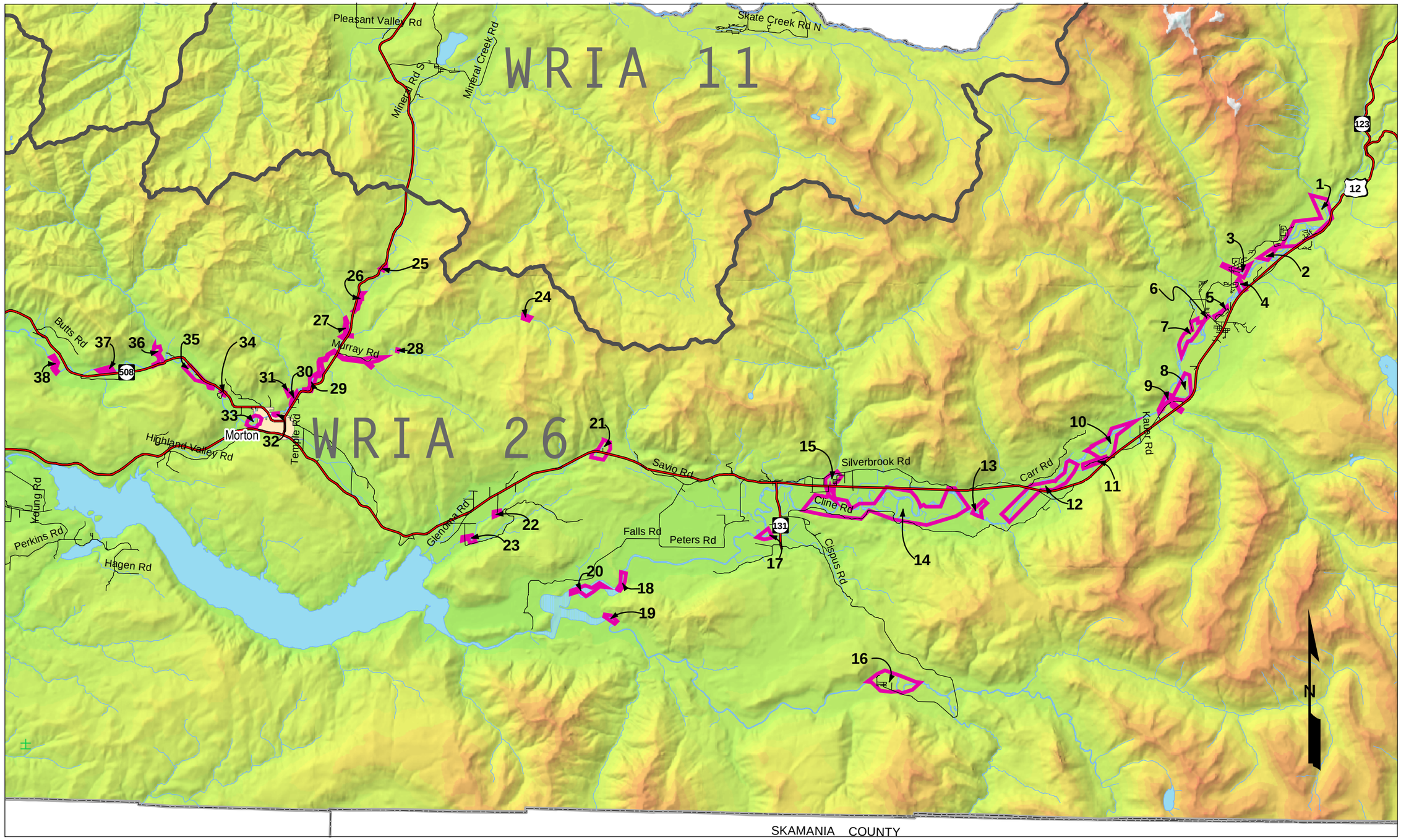

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Figure 6-7R
Upper Cowlitz
Probable Hazard Areas

Lewis County
Comprehensive Flood
Hazard Mangement Plan

responses due to flows, geomorphology, geology, topography, channel characteristics, sediment source, and land use.

PHAs are currently used as a planning tool in Lewis County Public Works, Emergency Management, and Community Development. It is also used as a precursor to CMZ mapping. The identification of many PHAs in a waterbody flags potential bank hazards, and may justify the need for a more detailed CMZ analysis.

CMZ mapping was conducted for the Upper Cowlitz and Rainey Creek basins in WRIA 26. This mapping need was identified from the "2001 CFHMP Amendment" where an alternative flood hazard management measure was made. PHAs were identified using topographic maps dated 1986-87 and aerial photographs dated 1996-97 to note observable channel migration movements over a 10-year period. These PHAs were further analyzed using state CMZ criteria, and then Lewis County further delineated migration potential areas (MPA) within the CMZ. Criterion for high, moderate and low risk MPA were developed, and used to delineate the respective MPAs to optimize planning options.

The mapping was completed in June 2003 and is available through the Lewis County Dept of Public Works. Initially, the information will be used as a planning tool for road maintenance and construction in Public Works. Community Development intends to use it in their update of the Critical Areas Ordinance, which is required by December 2005. Currently, it is used as a planning tool in the Building Division of Community Development when issuing building permits.

Channel migration zone mapping is also underway for a 5-mile reach of the Cispus River. The lands in the Cispus River basin are primarily USFS, but there is a small isolated area of county residences and roads west of the Cispus Learning Center. This area has been designated as a Limited Area of More Intense Rural Development (LAMIRD) in the County's Comprehensive Plan. The Cispus River is a very volatile river with a huge bed load and channel meandering movement. The river has taken down a USFS bridge and closed a campground—both have been closed to public use since 1996 when the bridge abutments were impaired. Complaints of severe bank erosion on private properties have been noted since 1996.

For a more complete discussion, refer to the following:

- **"CFHMP Amendment for the Upper Cowlitz River Basin", May 2001.**
- **"Landslide Hazards Evaluation", GeoEngineers, Inc. for Lewis County Public Works, January 28, 2000.**
- **"Geomorphic Evaluation and Channel Migration Zone Analysis", GeoEngineers, Inc. for Lewis County Public Works, June 2003.**

6.2.1 Nisqually River

The headwaters of the Nisqually River are located in the northeast portion of Lewis County. The Nisqually River originates from the Nisqually Glacier on Mount Rainier and flows westerly to form a section of the north Lewis County border before turning northeast into Pierce County. The Upper Nisqually River is very active. Its steep slope, high water velocities, and alluvial river valley provides conditions for frequent bank erosion and channel migration. Observed flood damage areas are a direct result of these processes. Two flood impacted sections of the Nisqually River were identified. Their locations are displayed in Figure 6-5 and described in the following pages.

Nisqually River near Pierce County Border and Highway 7

This section of the Nisqually River is located on Weyerhaeuser property near Mineral Mill Road (Figure 6-5). The river is actively cutting into its banks near a slight meander. The base of the meander appears to be a historical channel. There was concern that the river would erode the bank and eventually traverse into the old channel. County Highway 7 and residential homes are located just downstream of this area. Further bank erosion and possible channel migration would cause flooding damage to downstream residences and Highway 7. Bank stabilization was performed to maintain the existing channel configuration. The county installed a trench fill/riprap revetment along this river reach (Photograph 6-1).

Nisqually River near Hidden Valley Subdivision

Hidden Valley Subdivision is located east of the town of Ashford and north of State Highway 5 near the Lewis/Pierce County border (Figure 6-5). The subdivision was platted in the early 1960s and prior to the November 1990 flood, there were 12 full-time residences, about 20 to 25 summer cabins, and approximately 50 vacant lots. The subdivision was largely covered with a fairly mature stand of timber.

By 1984 the area was recognized as a flood hazard area. In 1986, a levee was built upstream of the Hidden Valley Subdivision in an attempt to confine the river to an old channel. During the 1990 floods, the old channel filled with an estimated 100,000 cubic yards of sediment and the river was redirected into a deserted channel near Wold Road and Wasson Way. The river traversed subdivision roads carrying a wide variety of debris and depositing material throughout the subdivision (Photograph 6-2). Some homes were destroyed and road access was eliminated. The Supplemental Flood Hazard Mitigation Report prepared by the Region X Interagency Hazard Mitigation Team recommended that re-occupancy of this area be prohibited. All available resources would be assembled and property owners would be offered a percentage of the assessed value in exchange for a quit claim to land. A settlement with property owners is still pending. The subdivision has been left uninhabited and the Nisqually River has been allowed to flow in its natural channel without further flood control modifications.

UPDATE

In 1997, Lewis County worked with the remaining homeowners to sell and relocate after the county Wold Road was destroyed. Buyout was the preferred alternative; but not all the owners wished to move, and the County rebuilt the road closer to the hillside.

Another regulatory requirement complicated the issue, which is that counties cannot vacate public roads abutting a body of salt and fresh water unless for public purposes or industrial use (RCW 36.87.130). This meant that Lewis County had to obtain buyout of all the properties served by that segment of road, before vacating the road.

Shortly after the road was completed in 1998, the Nisqually River moved toward the hillside at the downstream end of the new road. After this experience, the County recommended utilizing all efforts to buyout properties in a hazardous area. Generally, condemnation of property is a last resort.

6.2.2 Cowlitz River

The Cowlitz River extends from the Cascade crest westward into the southwestern portion of Lewis County. The river flows west/southwest prior to turning south near the town of Vader where it flows towards the Columbia River. The Cowlitz River basin encompasses a large part of the eastern and southern portions of Lewis County. Two dams are located on the Cowlitz River in central Lewis County: Mossyrock Dam, which forms Riffe Lake, and Mayfield Dam, located downstream of Mossyrock Dam. The dams provide flood control for the lower Cowlitz drainage; therefore, flood-prone areas within the Cowlitz basin tend to occur in the upper reaches near the towns of Randle and Packwood. Six flood-prone areas were identified on the Cowlitz River and its tributaries. The flood problems are primarily associated with bank erosion and channel migration. Bank stabilization techniques have been applied to each of the areas. The examples described below are typical of flood problems exhibited throughout the upper Cowlitz basin.

Cowlitz River near High Valley Park #6

This historically flood-prone area is located north of Packwood near High Valley Park #6 Subdivision (Figure 6-5), at a sharp meander in the river. During a 1977 flood, the river overtopped the bank at this location and followed an adjacent county road into High Valley Park. The flood waters caused residential and road damage in addition to power outages. As a result, a riverbank levee was constructed to protect this area. The levee extends approximately 100 yards along the south river bank (Photograph 6-3). The levee has prevented any further flood damage to date.

Cowlitz River near High Valley Park #8

This flood-prone area is located upstream of High Valley Park #6 (Figure 6-5). The river exhibited bank erosion and channel migration to an extent that it was impinging upon residential homes and county roads. Riprap material was used to stabilize the bank after the 1977 floods (Photograph 6-4). Following the 1990 floods, the county performed additional riprap repairs throughout this area.

Cowlitz River South of Purcell Creek

This area is located approximately one mile downstream of Purcell Creek (Figure 6-5). The area has an overflow channel adjacent to a county road. During the 1990 floods, the river breached the banks of the overflow channel and consequently caused approximately $80,000 of damage to the county road. To reduce further damage, the county constructed a flow-through dike across the overflow channel (Photograph 6-5). The dike restricts flow into the overflow channel. Two culverts allow adequate flow through the overflow channel for fish passage with flood waters conveyed by the main channel.

Butler Creek North of Packwood

Butler Creek joins the Cowlitz River approximately 1.5 miles northeast of Packwood (Figure 6-5). The creek descends steeply from the Tatoosh Range. Historically, the reach immediately above the confluence with the Cowlitz experienced overbank flow during flood conditions. The flooding would inundate a nearby fire station and county road. To reduce flood damage, riverbank levees were constructed on each side of Butler Creek (Photograph 6-6). The levees were installed in 1978 and have reduced further flood damage. The county frequently performs riprap repair in this area due to Butler Creek's high water velocities.

Silver Creek near Randle

Silver Creek enters the Cowlitz River near the town of Randle (Figure 6-5). Silver Creek's steep gradient and alluvial valley provides conditions for active channel migration and bank erosion. In the early 1970s, the Soil Conservation Service (SCS) constructed a riverbank levee near the confluence with the Cowlitz River (Photograph 6-7). Prior to levee construction, Silver Creek would overtop its banks during flood conditions and impact the public school in Randle. The levee has prevented any further damage to the school. Lewis County maintains this levee and typically replaces riprap material following flood flows.

Kiona Creek west of Randle

This flood-prone area is located slightly upstream from the intersection of Kiona Creek and State Highway 12 (Figure 6-5). Channel modifications were made to limit flood damage at a county maintenance facility located downstream (Photograph 6-8). In 1992, the county widened the channel by excavating approximately 100,000 cubic yards of material from this reach of Kiona Creek. This was performed to increase the conveyance capacity, reduce erosion potential, and realign the channel away from the county facility.

UPDATE

TABLE 6-1R. SUMMARY OF TEN PEAK ANNUAL FLOWS

	WRIA 11 Nisqually at National	Flow (cfs)	WRIA 23 Chehalis nr Grand Mound	Flow (cfs)	WRIA 23 Newaukum at Chehalis	Flow (cfs)	WRIA 26 Cowlitz at Packwood	Flow (cfs)	WRIA 26 Cowlitz below Mayfield Dam	Flow (cfs)
1	Feb 1996	21,200	Feb 1996	74,800	Feb 1996	13,300	Dec 1933	36,600	Nov 1995	68,400
2	Dec 1977	17,100	Jan 1990	68,700	Nov 1986	10,700	Dec 1977	36,200	Dec 1946	67,000
3	Jan 1974	15,000	Nov 1986	51.600	Jan 1990	10,400	Nov 1959	34,300	Jan 1965	64,700
4	Jan 1990	14,500	Jan 1972	49,200	Dec 1977	10,300	Feb 1996	32,900	Dec 1975	64,700
5	Dec 1975	13,200	Nov 1990	48,400	Nov 1990	10,300	Nov 1962	32,100	Nov 1959	60,800
6	Dec 1980	11,600	Dec 1975	48,000	Nov 1998	10,000	Dec 1975	30,600	Dec 1977	55,200
7	Jan 1975	11,000	Apr 1991	45,700	Jan 1972	9,770	Dec 1980	30,600	Feb 1951	51,200
8	Nov 1990	11,000	Jan 1971	44,800	Dec 1996	9,700	Dec 1917	28,800	Dec 1955	49,900
9	Nov 1959	10,900	Jan 1974	40,800	Jan 1974	8,440	Nov 1990	28,700	Nov 1962	49,500
10	Nov 1962	10,400	Dec 1977	38,700	Jan 1971	8,390	Nov 1934	26,500	Dec 1953	47,600

TABLE 6-2R. RANKING OF MAJOR FLOOD EVENTS

Flood Event	WRIA 11 Nisqually at National	WRIA 23 Chehalis nr Grand Mound	WRIA 26 Cowlitz at Packwood	WRIA 26 Cowlitz below Mayfield Dam
February 1996	1	1	4	1
January 1990	4	2	15	-
November 1986	11	3	14	47
January 1972	25	4	51	-
November 1990	8	5	9	23
December 1975	5	6	6	4
April 1991	-	7	-	-
January 1971	41	8	-	46
January 1974	3	9	11	-
December 1977	2	10	2	6

TABLE 6-3R. COMPARISON OF FLOOD RECURRENCE INTERVALS in WRIA 23

YEAR	DATE	MAXIMUM FLOW (cfs) at Grand Mound Gage	COE 1998 UPDATE	COE 1989 UPDATE	FEMA 1980
1996	Feb 6	73,900	100	400	600
1990	Nov 25	48,000	15	30	35
1990	Jan 10	68,700	70	250	400
1986	Nov 25	51,600	20	40	50
1972	Jan 21	49,200	15	30	35

TABLE 6-4R. GAGING STATIONS

STREAM	LOCATION	SITE #	AREA (sq mi)	AGENCY	RECORD PERIOD
WRIA 11					
Nisqually River*	National	12082500	133	USGS	1942 –
Mineral Creek	Mineral	12083000	75.2	USGS	1943 -
WRIA 23					
Chehalis River	Doty	12020000	113	USGS/NWS	1939 –
S Fork Chehalis	Wildwood	12020800	27	USGS	1998 –
Chehalis River	Near Adna	12021800	340	USGS	1998 –
S Fk Newaukum	Near Onalaska	12024000	42.4	USGS	1942-48,57-71,88-
NFk Newaukum	Near Forest	12024400	29.6	USGS	1998 -
Newaukum	Near Chehalis	12025000	155	USGS/NWS	1929-1931, 1942-
Chehalis River	Chehalis WWTP	12025100	618	USGS	1998 –
Chehalis River	Mellen St, Centralia	12025500	653	NWS	1949 -
Skookumchuck	Pearl St, Centralia	12026600	172	NWS	1964 -
Skookumchuck*	Near Vail	12025700	40	USGS/NWS	1967 –
Skookumchuck*	Bloody Run Creek	12026150	65.9	USGS/NWS	1929-33, 39-
Skookumchuck*	Bucoda	12026400	112	USGS/NWS	1967 -
Chehalis River*	Grand Mound	12027500	895	USGS/NWS	1928 –
WRIA 26					
Cowlitz River	Packwood	14226500	287	USGS	1911-19, 29-
Cowlitz River	Randle	14231000	541	USGS	1910-11, 33-
Cispus River	Yellowjacket Creek	14231900	250	USGS	1996 -
Cowlitz River	Kosmos	14233500	1,040	USGS	1947 –
Tilton River	Near Cinebar	14236200	141	USGS	1956 –
Cowlitz River	Mayfield Reservoir	14237800	1,392	USGS	1962-
Cowlitz River	Below Mayfield Dam	14238000	1,400	USGS	1910-11, 34-
Cowlitz River	Riffe Lake, Mossyrock	14234800	1,154	USGS	1968-

*** Outside County boundaries**

TABLE 6-5R. PRESIDENTIALLY DECLARED DISASTERS

Federal Declaration #	Date	River/Area	Reported PublicDamages ($)
DR-1172	March 1997	Cowlitz	*
DR-1159	Dec 96 – Jan 97	Chehalis,Cowlitz	3,255,900
DR-1100	February 1996	Chehalis,Cowlitz	30,000,000
DR-1079	Nov-Dec 1995	Cowlitz	12,000,000
*	December 1994	Chehalis	40,000
DR-0883	December 1990	Nisqually	700,000
DR-0883	November 1990	Chehalis	1,050,000
*	February 1990	Chehalis	200,000
DR-0852	January 1990	Chehalis	1,439,380
*	November 1986	Chehalis	3,926,250
DR-545	December 1977	Cowlitz	1,359,800
DR-1079	December 1975	*	*
DR-414	January 1974	*	*
DR-322	January 1972	Chehalis	2,060,250
*	January 1971	Chehalis	446,570

*** Information Pending**

7.0 HISTORICAL AND CURRENT FLOOD HAZARD REDUCTION EFFORTS

7.1 U.S. Army Corps of Engineers

7.1.1 COE Activities, 1930 - 1976

The Army Corps of Engineers has been active in the Chehalis River drainage for many years. As early as 1931, in House Document 148, 72nd Congress, 1st Session, they investigated improvements on the Chehalis River for navigation, flood control, power development, and irrigation. The COE concluded that no improvements were justified at that time.

In 1935, a Preliminary Examination (not published as a congressional document), by the COE of flood control for the Chehalis River concluded that a flood control reservoir or channel improvements at Centralia-Galvin, Oakville, Malone, and Potter were not economically justified.

The 1944 House Document 494, 78th Congress, 2nd Session, discussed a preliminary examination and survey for flood control on the Chehalis River and tributaries. This document considered construction of a levee system to protect Aberdeen, Cosmopolis, and Hoquiam. The COE concluded that any additional flood control in the basin was not economically feasible. Despite this conclusion, a levee system was subsequently authorized by Congress in 1944. The authorization expired in 1952.

Between 1946 and 1949, the COE analyzed the concept of multiple reservoirs on the upper Chehalis River, but determined that they were not feasible at that time. Later, the COE conducted a more localized evaluation of the flood problems along Lum Road in Centralia and recommended channel clearing on 1,660 feet of Coffee Creek. This evaluation, Coffee Creek Channel Excavation and Debris Removal under Section 208 of 1954 Flood Control Act, was completed in March of 1966.

Between 1966 and 1971, COE study efforts concentrated on identifying flood problem areas and possible solutions. Flood damage was occurring in the urban areas of Aberdeen/Hoquiam/ Cosmopolis, Oakville, and Centralia-Chehalis, and in rural areas along the Chehalis, Skookumchuck, and Newaukum Rivers. These studies indicated that large multiple-purpose storage projects in the Chehalis River basin were not economically justified and that levee and/or channel modifications at south Aberdeen-Cosmopolis, north Aberdeen/Hoquiam, and Centralia/Chehalis, along with small headwater dams, should be studied further. Enlargement of Skookumchuck Dam to provide flood control storage was considered and found to not be economically justified. A much larger dam would have been necessary to allow for flood control storage in addition to water supply.

Two informational documents were published by the COE in 1968. Flood Plain Information, Skookumchuck River, Bucoda, Washington delineated the flood plain along the Skookumchuck River, from the Lewis/Thurston County line to about 1 mile upstream of Bucoda. Flood Plain Information, Chehalis and Skookumchuck Rivers, Centralia-Chehalis, Washington delineated the flood plain along the Chehalis River from the Lewis/Thurston County line to Chehalis and along the Skookumchuck River from the mouth to the Lewis/Thurston County line. A 1974 report, Special Study, Suggested Hydraulic Floodway Chehalis and Skookumchuck Rivers, delineated the suggested hydraulic floodway for the area covered by the 1968 flood plain information report. The COE published another report in this series in 1976, Special Study, Suggested Hydraulic Floodway Chehalis and

Newaukum Rivers, that delineated the flood plain and suggested hydraulic floodway for the Chehalis River from Chehalis to Adna, and for the Newaukum River from its mouth to the I-5 bridge.

7.1.2 Centralia, Washington, Flood Damage Reduction Interim Feasibility Report and Environmental Impact Statement

During the period 1972 to 1982, the basin study was divided into interim reports, each covering a specific area. These areas included the following locations on the Chehalis River: 1) at South Aberdeen and Cosmopolis; 2) near Centralia; 3) at the Wynoochee Hydropower/Fish Hatchery facility; and 4) surrounding Aberdeen-Hoquiam. The objective of the planning effort in Lewis County was to reduce flood damages within both the flood problem area near the cities of Centralia and Chehalis and throughout the plan area covering the Skookumchuck Valley (Figure 7-1). Preliminary evaluation of potential flood damage reduction measures considered multiple-purpose storage dams, small headwater dams, watershed management, channel clearing, channel excavation, urban levees, and nonstructural measures. The urban levee system was the only alternative that initially appeared to be economically justified.

Subsequent feasibility studies focused on the urban levee alternative. These studies resulted in a tentative recommendation for a levee system providing a 200-year level of protection for 2,080 acres in Centralia. Levees to protect Fords Prairie, Galvin, and Chehalis were determined to not be economically justified. On August 5, 1980, Centralia expressed support for the levee system and agreed to serve as local sponsor, but recommended that prior to proceeding with the levee, the COE review the potential for modifying the private Skookumchuck Dam to provide flood control. Based on their subsequent analysis, the COE recommended modification of Skookumchuck Dam as the preferred flood control alternative in the Centralia, Washington, Flood Damage Reduction Interim Feasibility Report and Environmental Impact Statement (COE 1982).

7.1.2.1 Preferred Alternative - Modification of Skookumchuck Dam

Prompted by the City of Centralia's 1980 request, the COE initiated feasibility studies of modification of the existing private water supply dam on the Skookumchuck River, about 20 miles upstream from Centralia. Their results indicated that it would be a better solution, both economically and environmentally, than an urban levee system. Although a 1968 COE analysis had shown that using the dam for flood control was not feasible, subsequent coordination with the dam owner, Pacific Power & Light (PP&L), indicated that flood control could be feasible. Based on the experience they had gained in a decade of dam operation, PP&L believed that it would be possible to use part of their existing water supply storage for flood control storage during winter months. Hydrologic studies by the COE showed that 17,000 acre-feet of flood control storage could be provided at the dam. This storage would reduce the 100-year flood on the Skookumchuck River in Centralia from 13,300 to 6,700 cfs, a reduction of 2 to 5 feet in flood height. The reliability of the existing and future water supply requirements would also be maintained.

The Centralia, Washington, Flood Damage Reduction Interim Feasibility Report and Environmental Impact Statement recommended modification of the dam (Figure 7-2) to provide a low-level flood control outlet (12-foot-diameter tunnel) and to raise the controlled reservoir (15-foot high spillway gate) to provide flood control storage during winter months. The project would reduce flooding on 4,600 acres in the Skookumchuck River valley and on 17,500 acres in the Chehalis River valley. Total cost for this project was projected at $18.2 million (October 1982 prices) and would result in annual average flood damage reduction benefits of $2,506,000 in the Skookumchuck and Chehalis River valleys, primarily in the Centralia urban area. The average annual

costs were estimated to be $1,654,000 and the benefit-to-cost ratio for this plan was 1.5 to 1. Structural modifications to the dam would have been performed by the Corps of Engineers and would have included gating of the existing spillway along with constructing a 12-foot-diameter flood control tunnel with related intake and exit structures.

Once modifications were complete, PP&L would continue to operate the dam. Operational changes would involve maintaining a lower reservoir pool level during the early winter, to provide floodwater storage, with a programmed refill period between January 1 and March 1 to return the reservoir to the spillway crest (elevation 477 feet) before the summer dry season.

The COE believed that, with planned mitigation features, adverse environmental impacts associated with the plan would not be major. Principal adverse impacts anticipated included alteration of wetland and riparian areas associated with the Skookumchuck River, with reductions in habitat values and impacts to dependent wildlife populations, reduction in available waterfowl habitat in the reservoir, and loss of a small number of fur-bearers (beavers and muskrats) in the Skookumchuck Reservoir. Beneficial impacts included significant flood damage reduction for the Skookumchuck River valley and the communities of Centralia and Bucoda, a minor amount of flood damage reduction for the Chehalis River flood plain downstream of Centralia, and an anticipated improvement of spawning conditions for anadromous fish in the Skookumchuck River.

In addition to the preferred alternative of modifying the Skookumchuck Dam, ten other alternatives were considered by the COE in the 1982 Interim Feasibility Report. These alternatives are discussed below because they are relevant to the current flood hazard planning effort. Table 7-1summarizes the comparison between alternatives in the Interim Feasibility Report. Much of the following information is excerpted from that document (COE 1982).

7.1.2.2 Alternative 1 - No Action

Under the "No Action" alternative, no new action would be taken for flood damage reduction, through either structural or nonstructural means. Development of the flood plain would be restricted through existing zoning, State of Washington Flood Control Zone Program, the Shoreline Management Program, and any new ordinances that would be required for continued community participation in the Flood Insurance Program. These regulations would generally prohibit most development within the hydraulic floodway and require flood-proofing of structures within the flood plain. The Flood Insurance Program would indemnify insured property owners against losses. Undeveloped lands in the flood plain could be set aside for uses compatible with occasional inundation, such as recreation, fish and wildlife enhancement, open space, or certain agricultural activities. Existing average annual damages of $2,998,000 (October 1982 dollars) in the Skookumchuck Valley would continue and increase gradually.

This alternative was eliminated because it is not responsive to the wishes of Centralia and Chehalis flood plain residents for a reduction in flood threat to existing improvements. Relying on Alternative 1 would result in continuing exposure of flood plain residents to threats to life, health, and property.

7.1.2.3 Alternative 2 - Flood-Proof Structures

The "Flood-Proof Structures" alternative called for flood-proofing about 1,300 residential and 130 commercial or industrial structures in Centralia. Residential buildings would be raised so that the first floor level would be

above the 100-year flood. Commercial and industrial buildings would be modified so that all openings below the flood-water surface would be watertight. Existing flood plain zoning would continue, with no new buildings permitted within the floodway.

Flood insurance would continue to be available. Flood damages to residential and commercial structures and contents would be largely eliminated. Other adverse impacts from flooding would continue, however, including damages to public streets and utilities, cutoff of road and road access, disruption in police, fire, and ambulance service, and deposition of silt and debris. The COE felt that this proposal was not economically justified.

7.1.2.4 Alternative 3 - Multipurpose Storage

Construction of several upstream multipurpose storage projects, shown in Figure 7-3 was considered to provide flood control, irrigation, recreation, and low streamflow augmentation. Five new damsites were considered, along with modification of Skookumchuck Dam, to provide flood control storage. Construction of one or more of the following dams would reduce the frequency of overbank flooding and reduce average annual damages and hazards to life and property:

- Ruth Dam, located 8 miles west of Chehalis on the Chehalis River, would provide 108,000 acre-feet of flood storage.

- North Fork Newaukum Dam, located 9 miles east of Chehalis on the North Fork Newaukum River, would provide 9,000 acre-feet of flood storage.

- South Fork Newaukum Dam, located 4 miles northeast of Onalaska on the South Fork Newaukum River, would provide 15,000 acre-feet of storage.

- Boistfort Dam, located 16 miles southwest of Chehalis on the South Fork Chehalis River, would provide 16,000 acre-feet of flood storage.

- Meskill Dam, located 10 miles west of Chehalis on the Chehalis River, would provide 54,000 acre-feet of flood storage.

- Skookumchuck Dam, located 14 miles northeast of Centralia on the Skookumchuck River, would provide up to 35,000 acre-feet of storage. Prior to construction of the dam in 1968, the Corps of Engineers analyzed raising the dam to provide flood control storage above the water supply pool. At that time, this concept was not economically justified with a benefit/cost ratio of 0.3 to 1 (1976 price levels and interest rates).

7.1.2.5 Alternative 4 - Small Headwater Dams

Under Alternative 4, twelve small headwater dams, shown on Figure 7-3, would have been sited on tributaries to the Chehalis River above Centralia-Chehalis. The dams would have uncontrolled outlets to pass normal streamflows but would temporarily restrain portions of larger flows in lakes behind the dams. Total storage capacity of the system upstream of Centralia-Chehalis would be 14,500 acre-feet. The system would reduce the 100-year discharge at Grand Mound by about 3,000 cfs, representing less than a ½-foot reduction in flood crest at Centralia. Flood damage reduction would be minimal. This alternative was not economically justified.

7.1.2.6 Alternative 5 - Watershed Management

Alternative 5, "Watershed Management," called for management measures including reforestation, timber harvest control, and development control to reduce stream erosion and silting, and to decrease the magnitude of peak runoff associated with basin flooding. This alternative was abandoned because the COE determined that, because of the nature of major floods in the Chehalis River basin, watershed management in the upper Chehalis River basin would have little effect on major floods. Also, watershed management measures were already being undertaken in the basin under the direction of the Soil Conservation Service (SCS) and the State of Washington.

7.1.2.7 Alternative 6 - Channel Clearing

Under Alternative 6, "Channel Clearing," vegetation and debris would be cleared from about 73 acres along the banks and channel of the Chehalis River (shown on Figure 7-4) between river mile (RM) 63 near Galvin and RM 75 at the confluence with the Newaukum River. Annual maintenance would be required to assure the continued effectiveness of this alternative. Removal of vegetation would decrease the flow resistance and provide a small increase in the capacity of the existing channel. The COE determined that the flood damage reduction would be minimal because the increase in channel capacity would not be significant when compared to the flood discharge. Uncontrolled flooding would continue.

7.1.2.8 Alternative 7 - Channel Excavation

Selected reaches (shown on Figure 7-4) of the Chehalis, Skookumchuck, and Newaukum Rivers in the study area would be excavated to increase their flood carrying capacity and lower their flood crests. Four plans were examined, but none were economically justified with benefit-to-cost ratios ranging from 0.7 to 1 to 0.3 to 1. Alternatives 7A, 7B, and 7C included excavation of a "hump" in the river bed profile on the Chehalis River. Removal of the "hump" is commonly identified as a measure that would reduce flooding in the Chehalis River valley, but COE investigators concluded that this alternative is not economically feasible.

- Alternative 7A. The Chehalis River would be excavated from the mouth of the Skookumchuck River downstream for about 8,000 feet, and the Skookumchuck River would be excavated from its mouth upstream for 12,000 feet. About 289,000 cubic yards (yd^3) of material would be removed from the Chehalis River with excavation averaging 2 feet. The Skookumchuck River would be excavated an average of 3 feet with 191,000 yd^3 of material removed. The plan would lower the 100-year Chehalis River flood crest about 1.5 feet at Centralia.

- Alternative 7B. The Chehalis River would be excavated from ½ mile upstream of the mouth of the Skookumchuck River downstream for about 32,000 feet. The maximum excavation depth would average 12 feet with 1,755,000 yd^3 of material removed. Skookumchuck River excavation would be the same as alternative 7A. The plan would lower the 100-year Chehalis River flood crests about 4 feet at Centralia and about 1 foot at Chehalis.

- Alternative 7C. The Chehalis River would be excavated from 1 mile upstream of the mouth of the Skookumchuck River downstream for about 37,000 feet. Skookumchuck River excavation would be the same as alternative 7A. The plan would lower the 100-year Chehalis River flood crest about 5 feet at Centralia and about 1 foot at Chehalis.

- Alternative 7D. The Newaukum River would be excavated from 2 miles above the mouth upstream for about 33,000 feet. Excavation would average 5 feet in depth with 1,026,000 yd^3 of material removed. The plan would lower the 100-year flood crest by about 2 feet at the Larabee Road Bridge upstream of Chehalis.

7.1.2.9 Alternative 8 - Channel Excavation with Levees

The Chehalis River channel (shown on Figure 7-4) would be excavated from Centralia downstream for about 7 miles and for 2 miles in the vicinity of the airport. About 3,000,000 yd^3 of material would be excavated. Part of the excavated material would be used to construct about 20 miles of levees on both banks of the Chehalis and Skookumchuck Rivers and Salzer Creek and to provide protection for about 5,800 acres of land.

This proposal was not economically justified. Although it would provide significant flood damage reduction, this alternative would be highly impactive to fisheries and wildlife resources and would require substantial annual maintenance to retain channel capacity.

7.1.2.10 Alternative 9 - Urban Area Levees

A number of alternative levee segments (shown in Figures 7-5) providing flood protection for the cities of Centralia and Chehalis and the unincorporated areas of Galvin and Fords Prairie were analyzed. Only those segments within or adjacent to the city of Centralia and providing protection from the Chehalis and Skookumchuck Rivers and Salzer and Coffee Creeks were found to be economically justified. A levee system (shown on Figure 7-6) about 12.3 miles long could protect 1,980 acres from a 200-year flood. Two road bridges and three railroad bridges would have to be raised. Interior drainage facilities would include 63 acres of ponding areas, one permanent pumping station, and 11 temporary pumps. Fish and wildlife mitigation measures would be required.

7.1.2.11 Alternative 10 - Levees with River Modification

The Chehalis River channel would be straightened and enlarged from the Main Street Bridge to the Mellen Street Bridge. Levees providing 100-year flood protection would be constructed on both banks of the modified Chehalis River channel and also on both banks of the Skookumchuck River. Pumping plants would be required at Salzer and China Creeks. About 20,000 feet of channelization and 120,000 feet of levee would be required. This alternative was not economically justified. Impacts to fish and wildlife and existing land uses would be high.

In addition to the above ten structural alternatives, the COE considered the following nonstructural measures (Table 7-2).

7.1.2.12 Land Use Regulations

Land use regulations such as zoning ordinances, subdivision regulations, and building and housing codes could aid in flood hazard management. The entire Chehalis/Skookumchuck River system is already under the statewide Shoreline Management Program. Portions of the study area outside the cities of Centralia, Chehalis, and Bucoda are also covered by the Washington Flood Control Zone Program, which controls and regulates

flood plain development. The cities of Centralia and Chehalis have existing zoning ordinances which, to some extent, regulate future development in the flood plain. Existing city of Chehalis zoning is particularly explicit in controlling flood plain development. In addition, both cities are participating in the Federal Flood Insurance Program and as part of that program adopt flood plain regulations meeting Federal Insurance Administration standards. Although existing and proposed regulations will limit the increase in flood damage to future development within the 100-year flood plain, they will not impact the high level of flood damages to existing flood plain development or address potential future damages from floods exceeding a 100-year frequency.

7.1.2.13 Flood Insurance

Flood insurance indemnifies a policyholder for financial losses suffered during a flood. As noted above, local jurisdictions are participating in the Federal Flood Insurance Program and land use regulations required as part of the program will limit the increase in flood damage. The insurance itself, however, can only indemnify for financial losses suffered during a flood and will not reduce flood damages to either existing or future development.

7.1.2.14 Evacuation and Relocation

Evacuation and relocation involves removing residential and commercial structures from the flood plain and relocating these activities to a flood-free site. The 100-year flood plain in Centralia contains about 2,390 residences and about 315 commercial, industrial, or public structures, including much of Centralia's central business district. Because of this large investment on the flood plain, consideration of evacuation and relocation for the entire flood plain area was not considered to be economically or politically feasible. The relocation of smaller areas of the flood plain was not publicly acceptable.

7.1.2.15 Purchase of Development Rights

This alternative would involve local governments purchasing the rights to develop the presently undeveloped flood plain areas. This measure would not address the high level of flood damages to existing development in the flood plain, but could be effective in preserving the capacity of the hydraulic floodway and limiting the increase in flood damages to future development. The COE believed, however, that these objectives could also be accomplished under the regulations resulting from the Flood Insurance Program, the Washington Flood Control Zone Program, and the Shoreline Management Program. At that time, the local governments considered these regulations adequate, and were not interested in purchasing development rights.

7.1.3 Current COE Activities in the Chehalis River Basin

In recent years, and particularly in response to the flooding on the Chehalis River in 1990, the COE has initiated several flood damage reduction studies.

7.1.3.1 Follow-up Evaluations of Skookumchuck Dam Modification

In May of 1990, COE studies resulted in reduction of construction cost estimates for the Skookumchuck Dam modification from $24.8 million to $15.8 million. However, the new economic analysis also reduced the estimate of average annual flood damages. The new damage estimate appeared sufficient to justify only a $6 to $8 million project. In September of 1990, further analysis of costs and benefits raised the benefit-to-cost ratio to

0.69 to 1, which was still well below economic feasibility. The COE sent a negative report to the Division Office in September; the report recommended cessation of further study of Skookumchuck Dam modification by the COE.

UPDATE

Centralia Flood Damage Reduction Project

After the 1996 flood event, the Flood Action Council (FAC), a group of economic development, business activists and commercial interests developed a preliminary plan of modifying the Skookumchuck Dam and providing additional flood storage with overbank excavation of the Chehalis River. A special flood control district was proposed to implement this plan, but it was rejected by the Lewis County Board of County Commissioners (BOCC) because it did not meet the legal criteria for creation.

The BOCC took the lead by establishing a countywide flood control district zone; and used local and state funding to study modifications to the 1984 Authorized Project (Skookumchuck Dam). The Skookumchuck Dam project had evolved to the point of having the Corps conduct Preconstruction Engineering and Design (PED) work from February 1988 through August 1990. Prior to the PED, WSDOT had plans to widen and raise segments of I-5 near Centralia and Chehalis. These post-1996 local flood studies were made to also present a flood hazard management alternative for flood relief other than raising I-5.

Lewis County asked that the Corps resume work on their PED work on July 7, 1998, and to consider additional measures with the authorized dam modification element for a flood hazard reduction plan for the Centralia-Chehalis urban area. Although the City of Centralia was the project sponsor through the feasibility phase, Lewis County assumed sponsor responsibilities for project construction and to provide the appropriate cost sharing. The Corps resumed work in July 1998.

The study area for the authorized project includes the mainstem Chehalis River, its floodplain and tributaries from the South Fork Chehalis River confluence to Grand Mound, the Cities of Centralia and Chehalis, surrounding areas in Lewis and Thurston counties, the Town of Bucoda, and along the Skookumchuck River to a point above the Skookumchuck Dam. Tributaries in the study area include the Skookumchuck and Newaukum Rivers, and several smaller creeks (Hanaford, China, Salzer, Coal, Dillenbaugh, and Berwick).

The Corps began the scoping process for the EIS by holding two public meetings on 28 and 29 September 1999 in Chehalis and Rochester, respectively. Supplemental studies were completed to address concerns raised during the scoping and project development processes. The Corps conducted a Post Authorization Study, the Chehalis River General Reevaluation Study (GRS). This study is a re-analysis of a previously completed and authorized study using current planning criteria and policies, which is required due to changed conditions/assumptions. The results may affirm the prior study, reformulate or modify it, or find that no plan is currently justified. The results for this GRS is summarized in the "Draft EIS, Centralia Flood Damage Reduction Project" by the Corps dated July 2002.

The EIS evaluated seven alternatives with modifications/design within some alternatives. The preferred alternative is a series of setback levees with modifications to the Skookumchuck Dam to increase flood

storage and non-structural features to be included in the local sponsor's revised floodplain management plan. The new plan for the project is to be in compliance with the Executive Order 11988 to occur during the project design process.

Many of these non-structural measures are already implemented at the County and City level. Some of the measures are listed below.

- **Elevation of structures – Elevate affected structures in the identified sub-areas**
- **Define a new 100-year FEMA floodplain – Generate a new map after the project is completed and the project plan has been approved**
- **Flood warning system – Coordinate flood emergency management information and services**
- **Restriction of development – Community will use the new floodplain and floodway maps to ensure local ordinances are enforced**
- **Restriction of fill in the floodplain – Have compensatory storage in local floodplains**
- **Stormwater management – Increase detention from the 25-yr design storm to meet Ecology's stormwater criteria**

Potential restoration sites were also identified during the GRS. Incorporating appropriate fish and wildlife habitat restoration measures to the maximum extent practicable is one of the main project criteria. Implementation of the preferred alternative was determined to not substantially change the hydrology and hydraulics of flood flows along the Chehalis and Skookumchuck rivers and tributaries. Mitigation actions in the State Route 6 and Scheuber Road floodplain area would reconnect portions of the Chehalis River to the greater floodplains.

Public comments for the final EIS are accepted through March 2004.

7.1.3.2 Salzer Creek Flood Damage Reduction Study - Section 205 Initial Reconnaissance Report

In response to a March 1988 request by the City of Centralia for assistance with flooding along Salzer Creek, the COE conducted a reconnaissance study under authority of Section 205 of the 1948 Flood Control Act (Figure 7-7). This project area was eligible for federal participation in flood protection under ER 1165-2-21 because the 10-year discharge at the mouth of Salzer Creek is estimated to be 1,030 cfs, which is greater than the 800 cfs minimum flow requirement. Data developed for the 1982 Interim Feasibility Report and Environmental Impact Statement, Centralia, Washington (COE 1982), and the Soil Conservation Service's Flood Hazard Analyses, Salzer - Coal Creeks, Lewis County, Washington (SCS 1975), dated May 1975, were used in the preparation of that report. The following narrative is extracted from the COE Initial Reconnaissance Report on Salzer Creek (COE 1988).

Background

Flooding in the lower Salzer Creek basin causes damage within the city of Centralia, the city of Chehalis, and in unincorporated Lewis County. Flooding within the Salzer Creek basin can occur from two different sources: high flows in the Chehalis River that back up water Salzer Creek, or high flows on Salzer Creek itself. The most

serious floods occur with backwater flooding. For most events, Salzer Creek can be expected to peak about 6 to 8 hours before the Chehalis River. Studies indicate that when Salzer Creek experiences a 100-year flood, the Chehalis River would approximate the 75-year flood level. In addition to creating a backwater effect on Salzer Creek, water surface elevations on the Chehalis River with discharges in excess of about a 25-year-frequency event overtop Interstate 5 (I-5) both upstream and downstream from the Salzer Creek confluence, resulting in flooding conditions in both Chehalis and Centralia. The Skookumchuck River overflow may also contribute to the flooding near the mouth of Salzer Creek. No attempt was made by the COE to analyze the effect of overland flow from the Skookumchuck River in this level of investigation.

Salzer Creek drains 24.5 square miles at its confluence with the Chehalis River. The basin originates in low-lying hills that have a maximum elevation of about 800 feet. The stream gradient is relatively flat except for a major tributary, Coal Creek (drainage area 6.4 square miles), which has a steeper slope. Stream flows are generated primarily from rainfall, with little or no snowmelt. Stream flows are highest during the October through March period and are characterized by quickly rising flows resulting from a series of maritime storm fronts. High stream flows from spring snowmelt do not occur in this basin.

Project Description

The COE determined the most feasible flood damage reduction alternative to be a closure structure and small levee across Salzer Creek in the vicinity of I-5 to prevent backwater flooding from the Chehalis River, and a pump (or pumps) to convey ponded Salzer Creek water across the closure structure (Figure 7-8). Additional features of the plan would include improvements to the Salzer Creek channel upstream of the closure structure, improvement of the existing levee which protects the Centralia-Chehalis airport, and the retention of wetlands within the Salzer Creek basin. The project would protect not only improvements along Salzer Creek, but also a portion of I-5 which is subject to flooding and the Centralia-Chehalis Airport.

The project would consist of the following main elements (shown in Figure 7-8):

- A short levee segment and a closure structure with a pump plant across lower Salzer Creek just west (downstream) of the I-5 bridge over the creek. The levee would stretch from I-5 east to high ground and would protect the right bank only. It would have 3:1 (horizontal:vertical) side slopes, a 12-foot top width, and vary from 8 to 16 feet in height. The levee would be designed with a top elevation that allows 3 feet of freeboard over the 100-year water surface elevation.

- Raising and improving the airport dike to provide appropriate flood protection.

- Two new short levee segments to tie the airport dike to the I-5 embankment.

- Designation of a ponding area and channel improvement along Salzer Creek to improve conveyance.

- Improvement of the I-5 median barrier. Grouting of the existing I-5 median barrier structure from Mellen Street to the overpass of Salzer Creek would prevent overtopping from the Chehalis River. This grouting is basically to contain the flooding and provide the necessary freeboard while allowing traffic passage on the northbound side of I-5. The highway is now closed to traffic in both directions when the Chehalis River overtops the right-of-way.

For the purposes of the initial reconnaissance study, a 100-year level of protection was selected, assuming that both the Chehalis River and Salzer Creek are experiencing coincident 100-year floods. Other features of the plan include a portable pump and the relocation of utilities, a bridge, a road, and highway signs. Protection against flooding along the left (south) bank of Salzer Creek was not fully evaluated at this level of study and would be investigated further in a reconnaissance phase.

Preliminary Environmental Analysis

Salzer Creek has runs of anadromous fish as well as several resident species. Wetland and riparian habitat is also a concern. Field reconnaissance of these, as well as cultural resource values, would be conducted during reconnaissance and feasibility study phases. Careful levee alignment and other environmental design criteria, including setback considerations, would be employed to avoid significant adverse impacts. An Environmental Assessment (EA) and FONSI would be required and a Section 404 evaluation would be needed if there is placement of fill material in Salzer Creek or adjacent wetlands.

Preliminary Estimate of Flood Damages

The flood plain considered in the COE analysis was on the right bank of Salzer Creek upstream of its confluence with the Chehalis River at the City of Centralia, about 550 acres. There are approximately 95 homes on the flood plain, ranging in value from $25,000 to $50,000, and 23 commercial establishments, including a shopping mall. The Southwest County Fairgrounds is also in the flood plain. Total damages from a 100-year event were estimated to be $234,000 (October 1988 prices and conditions).

Preventable Costs

If in place at the time, the project would have eliminated or greatly reduced damages in much of Centralia and Chehalis east of I-5 in the Salzer Creek drainage during the January 1990 flood. The interstate could have been kept open during the flood. Damages to over 1,000 acres of residential, commercial, and industrial property would have been eliminated or greatly reduced, including the Chehalis-Centralia Airport and the Lewis County Fairgrounds.

Preliminary Estimate of Average Annual Benefits

With the project providing 100-year protection, average annual inundation damages would be reduced to $25,000, yielding an average annual inundation reduction benefit of $209,000.

Preliminary Construction Cost Estimate

Table 7-3 summarizes the proposed project construction costs and Table 7-4 provides a comparison of annual benefits and costs computed by the COE. The estimates in Table 7-4 were prepared in 1988 and updated by the COE in September 1990. Nevertheless, the breakdown in Table 7-4 illustrates the relative costs of key construction activities.

Project Status

The City of Centralia signed the Feasibility Cost Sharing Agreement in September 1990, and has been seeking cost-sharing funds ever since that time. Estimated feasibility study cost is $650,000 (sponsor to pay half of this), and estimated construction cost is $3 million (sponsor to pay roughly one-quarter). The City of Centralia is the main sponsor. Participating sponsors are the City of Chehalis and Lewis County. In April 1993, affected property owners in the Salzer Creek basin did not approve the formation of a special district to fund this project. Therefore, the Salzer Creek Pump Station is no longer being considered.

7.1.3.3 Section 205 Initial Reconnaissance Report on China Creek at Centralia

In response to a March 1988 request by the City of Centralia for help with flooding along China Creek, the COE conducted an initial reconnaissance study under authority of Section 205 of the 1948 Flood Control Act. The Interim Feasibility Report and Environmental Impact Statement, Centralia Washington (COE 1982) and the Soil Conservation Service report entitled Flood Hazard Analyses, China Creek, Lewis County, Washington (SCS 1977) along with the Section 205 Initial Reconnaissance Report on China Creek at Centralia (COE 1988) were used as sources of information for the following summary discussion.

China Creek is a tributary to the Chehalis River and has a drainage area of 5.32 square miles at its mouth. The lower reach of the basin, below the Burlington Northern Railroad (BNRR) crossings (drainage area 0.87 square mile), is well developed and highly channelized with numerous constricted and covered sections. The upper portion of the basin is relatively undeveloped and wooded, and is surrounded by low-lying hills having a maximum elevation of about 600 feet. Stream gradients are mild to relatively flat from the confluence with the Chehalis River to 1 to 2 miles upstream of the BNRR.

Flood-producing stream flows occur from October through March and are generated primarily from maritime rainstorms with little or no snowmelt. Flooding near the mouth of China Creek is affected by backwater from the Chehalis River. Flooding in the project area can also result from overflows from Skookumchuck River entering China Creek near the BNRR during periods of high discharge. No streamflow records are available for China Creek. The 10- and 100-year-frequency floods on China Creek are estimated to be 235 cfs and 480 cfs, respectively.

Alternatives including levees, flood-proofing, channel modification, detention storage, and diversion were identified for flood damage reduction. Extensive development around and over the channel eliminated most of these alternatives, including levees and channel modification. An alternative which provides detention storage and diversion of flood waters upstream from the BNRR may be the most effective solution to reducing flood damages from China Creek. A program of periodic channel maintenance by Centralia would also help reduce the potential for flood damage.

The recommended alternatives are not eligible for federal participation under ER 1165-2-21 criteria because the 10-year discharge on China Creek in the project area is estimated to be only 235 cfs. Federal participation criteria require the 10-year flood to be greater than 800 cfs. The COE recommended that no further studies of the flood problems from China Creek at Centralia be undertaken using the authority of Section 205 of the 1948 Flood Control Act, as amended.

7.1.3.4 Centralia-Chehalis Flood Warning and Flood Response Study

In January 1990, the Chehalis River at Centralia experienced a 100-year flood, and the greater Centralia-Chehalis area found it difficult to respond to this disaster. Property damage was estimated at $15 million, and three lives were lost. In March 1990, Lewis County asked the COE to perform a nonstructural study, and to work with the county and the cities of Centralia and Chehalis to improve their flood warning and flood response plan. The COE completed a reconnaissance report in August 1990 which indicated that substantial flood damage reduction and safety benefits could accrue from improving flood warning, the public's awareness of the flood problem, and the government's flood response plan. In early FY 91 the Seattle District COE received $40,000 to complete the non-cost-shared feasibility phase.

During the feasibility phase the following products were completed: 1) a public brochure that advises Centralia and Chehalis citizens what to do before, during, or after the flood; 2) a flood warning map that predicts what areas of Centralia and Chehalis would be flooded based on information received from upstream river gauges; and 3) a flood warning checklist that alerts city and county officials as to what city and county facilities may be threatened during a flood. No construction project was identified in the feasibility phase.

UPDATE

The COE has investigated flood damages in the Centralia-Chehalis valley and based on historical records, has identified water levels at selected gauges that cause zero damage and major damage in the valley as summarized in Table 7-1R. These gauge heights provide a reference for quickly assessing the severity of anticipated floods, and triggering initiation of emergency flood response operations in Lewis County.

The COE has developed a *Flood Phases Guidelines Manual* in 1993 that includes the flood phase warning map for the Centralia-Chehalis valley. This map was developed prior to the 1996 flood of record, but the four flood phases in the flood warning map are still accurate and used for local alerts and flood emergency preparedness. Reproductions of the map are inserted annually in the local newspapers. Large wall maps are posted in county and city offices along with a graphic and narrative description of each of the four flood phases.

7.1.3.5 Newaukum River at Chehalis Flood Reduction Study

In 1989, under COE Section 205 Authority, the Seattle District COE investigated flood solutions to the flooding problem centered around the Chehalis Avenue Apartments in Chehalis. The solution proposed by the COE was an approximately 1,000-foot-long levee and pump plant to the south of the apartments. The potential project had a benefit-to-cost ratio of only 0.2 to 1, and further consideration of the project ceased in November 1989. Flood-proofing by home, apartment, and business owners was encouraged by the COE.

7.1.3.6 Centralia Flood Damage Reduction Study

The Seattle District COE also completed a reconnaissance study to provide flood damage reduction on the Skookumchuck River in Centralia. The study identified the most feasible alternative as two levees along Skookumchuck River at Centralia, drainage control measures, flood-proofing, and flood warning/response measures. This alternative has been approved for further study under the Section 205 Continuing Authority program.

The proposed flood damage reduction program was estimated to cost $2 million with a benefit-to-cost ratio of 2.8 to 1. In April 1991, the City of Centralia was notified that the estimated cost to accomplish a feasibility study was $250,000. As the local sponsor, the City would be responsible for 50 percent of the study cost. In August of 1991, the City of Centralia formally notified the COE that they did not wish to pursue a feasibility study for levees on the Skookumchuck River. Centralia planned to continue investigations into the feasibility of constructing the Skookumchuck Dam flood control project in conjunction with the dam owner and other local entities.

7.2 FEMA Region X Interagency Hazard Mitigation Team

The FEMA Region X Interagency Hazard Mitigation Team is composed of numerous federal, state and local agencies (Table 7-5). The Supplemental Flood Hazard Mitigation Report (FEMA 1991), prepared by the Region X Interagency Hazard Mitigation Team after the November 1990 floods, made recommendations concerning the recurring flooding in the Centralia-Chehalis area. Current flood control structural proposals identified in the area included: 1) a dam on the Skookumchuck River which provides incidental flood control benefits for Centralia; 2) a levee segment on the Skookumchuck River which protects a portion of Centralia; and 3) a levee which protects the Chehalis-Centralia Airport.

The following recommendations were made by the Interagency Hazard Mitigation Team (FEMA 1991) and were identified as being interdependent and best implemented simultaneously:

1. State government with FEMA support should provide leadership to encourage all home-owners and business-owners who receive flood damage to flood-proof their homes and businesses. Flood audits should be performed on selected structures.

2. The federal government should aid the local governments and individuals in improving their flood warning and flood response system.

3. All potentially feasible structural projects should be investigated and their costs, benefits, and impacts thoroughly researched.

    a. The COE was studying flooding problems along the lower Salzer Creek.
    b. The COE was studying flooding problems along the Skookumchuck River.
    c. The City of Centralia should address the China Creek flooding problem.
    d. The City of Chehalis should address the Riverside Road problem.

7.3 U.S. Soil Conservation Service

Flood hazard analyses by the SCS are conducted according to recommendations in A Report by the Task Force on Federal Flood Control Policy, House Document No. 465 (89th Congress; ordered and printed August 10, 1966), especially recommendation 9(c), "Regulation of Land Use," which recommended that preliminary reports be issued where guidance may be needed before a complete flood-hazard information report can be prepared, or when a full report is not scheduled.

Authority for funding flood hazard analyses is provided in Section 6.0 of Public Law 83-566, the Watershed Protection and Flood Prevention Act, which authorizes SCS to cooperate with other federal, state, and local

agencies in investigations and surveys of the watersheds, rivers, and other waterways as a basis for coordinated programs. Funds for cooperative flood hazard studies are included in the SCS appropriation for river basin surveys and investigations.

7.3.1 Flood Hazard Analysis of Coffee Creek, February 1978

This study was requested by the City of Centralia. The objective was to conduct a detailed flood hazard analysis of the Coffee Creek flood plain in and adjacent to the north portion of Centralia. This flood hazard study was carried out in accordance with the April 1973 Joint Coordination Agreement between the Washington State Department of Ecology and the Soil Conservation Service. The information below is summarized from the SCS report.

Coffee Creek is a tributary of the Skookumchuck River with headwaters in Thurston County flowing south through Zenkner Valley to the Skookumchuck River just north of Centralia. Stream gradient is low in the lower 4 miles of the watershed. The watershed encompasses 7.3 square miles of moderately sloping hills (15 to 40 percent) of silty clay loam. The higher valley floors are silty clay alluvial flood plains. The lower valley floors are peat and muck, both over dense clay. Watershed elevations range from 186 feet at the confluence with the Skookumchuck River to 645 feet at the northern tip of the watershed. The SCS report addresses the lower 3.4 miles of the watershed.

Development in the Coffee Creek basin trends toward higher residential and commercial densities. Approximately 10 percent of the watershed lies within the city limits of Centralia. Forty percent of the remainder is in forest under active timber harvesting, and 50 percent in agriculture--mostly pasture with related grasses and legumes.

Because Coffee Creek floods are usually caused by large rainstorms in the region, flooding in Coffee Creek will usually be associated with flooding in adjacent basins. Thus, the 100-year frequency flood on Coffee Creek would be associated with high backwater of the Skookumchuck River. Local problems are due to overland sheet or shallow flooding with ponding in topographic areas associated with old stream channels and natural depressions. Historically, major floods have occurred in winter months and damages are to urban structures and not agricultural areas. No flow data are available for Coffee Creek.

Two types of major flooding potential in the Coffee Creek area are apt to be found together in any one flood. The lower area of the watershed is bounded on the east and the south by the Skookumchuck River. The point where Coffee Creek enters the Skookumchuck River is only 1.6 miles from the confluence of the Skookumchuck with the Chehalis River. Flooding of the two rivers affects this area greatly.

The second type of flooding has to do with Coffee Creek alone. Lower reaches of the creek have been moved from the flood plain to a higher location near the toe of the hills on the west side. The lower areas in the old creek alignment provide an excellent area for collecting surface waters. The current conveyance system is not regularly maintained to keep the channel clear of obstructions such as bridges, fences, pipes, and vegetative growth which increases the potential for Coffee Creek to seek new channels.

The SCS flood hazard study developed information needed to show portions of the Coffee Creek flood plain subject to inundation by select frequency floods. The resulting flood boundaries for the 100-year flood are presented on six photomaps. A total of 395 acres is subject to inundation by the 100-year flood in the study area.

Flood potential should be rechecked on the SCS model when significant land use changes are proposed in the future. It is also important to note that this study did not address flooding in the Coffee Creek basin caused by overland flow from the Skookumchuck River.

7.3.2 Flood Hazard Analysis of China Creek, March 1977

An analysis of flooding on China Creek was requested by the City of Centralia on January 30, 1974. The objective was to conduct a detailed flood hazard analysis of the China Creek flood plain in and adjacent to Centralia. This flood hazard study was carried out in accordance with the April 1973 Joint Coordination Agreement between Ecology and the SCS. The information below is summarized from the SCS report.

China Creek is a relatively small, short stream that flows through the City of Centralia to the Chehalis River. The watershed extends about 5 miles to the east of the Chehalis River at Centralia. It encompasses approximately 3,802 acres, or approximately 6 square miles. The watershed ranges in elevation from 180 feet to 570 feet. Much of the land is moderately steep, with 15 to 30 percent slopes, and the soils are predominantly silty-clay loam with moderate water-holding capacity.

A large urban buildup area is concentrated at the confluence of China Creek with the Chehalis River (River Mile 67.28). The last 2 miles of the creek are contained in a series of bridges, long culverts, rock and concrete lined channels, and densely vegetated banks. The creek provides an opportunity for surface water to enter as well as leave the channel in and around the City of Centralia. High flows in the channel are controlled by the bridges and culverts, the most critical being on the east side of the city, approximately 2 miles upstream, where China Creek passes beneath the Burlington Northern Railroad and Railroad Avenue Bridges.

There are no stream gauge data on China Creek. Flooding typically occurs whenever there is flooding on the Chehalis River. Thus, the 100-year frequency flood on Coffee Creek would be associated with high backwater of the Chehalis River.

Two sources of floodwater impact the China Creek Basin. The first is the backwater effect of the Chehalis River on China Creek during high flood flows. The Chehalis River dominates the elevations in the lower reaches of China Creek up to Ash Street. Flood damages have occurred both to the south and west of Centralia by backwater, with China Creek being only a minor contributor. The SCS estimated that nearly 100 single- to four-family residential units, 30 small businesses, and five public buildings may be affected by this type of flooding. It is also probable that the river will cause water to enter the southwest end of the City of Centralia at elevations higher than those generated by China Creek.

Shallow surface flooding (less than 1 foot average depth) can occur in and around the creek when storm drains are plugged and the surface water entrances to the creek are blocked, as reported in the storm of December 1933.

A man-made constriction exists in the flood plain at the crossing of the Burlington Northern Railroad embankment just northwest of Railroad Avenue, about 2 miles upstream from the confluence with the Chehalis River. Above this location, the flood plain is used for agricultural purposes with large areas subject to shallow flooding. Below this restriction the channel collects, as well as contributes, to the sheet flow or shallow flooding in and around streets and gutters of the urban areas of the city.

The SCS study provided peak discharges, water surface elevations and profiles, and flood boundary and floodway information for select frequency floods. They did not consider any structural changes on the streams. The results of this study were presented as a base from which Lewis County and the City of Centralia may compare the effects of future alternatives for development. The SCS did, however, recommend that clearing the bridges and channels of sediment and debris and heavy vegetation would reduce floodwater elevations, especially for smaller floods.

The study also emphasized that land use and development trends within the watershed, coupled with the outside influence of the Chehalis and Skookumchuck drainages, have a direct effect on future flooding potential. The SCS results indicated that it was realistic to expect a ½- to 1-foot rise in the current predicted flood elevations within the 10 to 15 years following the study. In the lower flood plain, the area flooded would increase by 25 percent.

7.3.3 Flood Hazard Analysis, Salzer-Coal Creeks, May 1975

An analysis of flood hazard for Salzer-Coal Creeks was requested by the Lewis County Commissioners on May 1, 1973. The objective of this study was to conduct a detailed flood hazard analysis of the Salzer-Coal Creek flood plain in and adjacent to Centralia. This flood hazard study was carried out in accordance with the April 1973 Joint Coordination Agreement between Ecology and the SCS. It provides flood frequencies, boundaries, profiles, and encroachment information. Also, SCS has constructed a computer model of the Salzer-Coal Creek watershed. The information below is summarized from the SCS report.

Salzer and Coal Creeks drain 24.5 square miles of relatively steep terrain, carrying alluvium to the Chehalis River on the Puget-Willamette lowland. The elevations in the watershed range from 170 feet at the outlet to near 800 feet at the upper reaches. The study area covered by this report is the lower 8 miles of Salzer Creek and 3 miles of Coal Creek.

Only a short stream gauge record exists for Salzer Creek (1968-1970). The most damaging flooding occurs during Chehalis River floods. The 100-year frequency flood on Salzer-Coal Creeks would be associated with high backwater of the Chehalis River. The backwater effect of the Chehalis River dominates the flow of Salzer Creek up to approximately the Pacific Avenue bridge during the 100-year event. On Coal Creek this influence continues upstream to about 1,200 feet downstream from the National Avenue bridge. The water surface profiles also show significant changes under the bridges crossing the streams. This is a good indication that the roads are acting as effective dams (i.e., the bridges lack the conveyance to pass the 100-year event) and impoundment areas exist upstream from each of these bridges.

At the time of the SCS study, trends for flood protection of a home or industry built on the Salzer-Coal Creek flood plain were to require land fills on the flood plains to the level of an infrequent flood event (i.e., 100-year-frequency flood). This practice not only destroys wildlife and migratory bird habitat, but reduces water storage areas and causes higher flood elevations in future floods. The elevation of future floods depends upon the level of the Chehalis River at the peak discharge on Salzer-Coal Creek, the amount of land fill, and the conditions in the channel.

The SCS identified several bridges in the study area that lacked the capacity to convey the 100-year flow, or have restrictions (i.e., pipes, cables) which would tend to collect debris during high flows. An example is the Coal

Creek bridge on National Avenue with a water main, sewer main, and gas main below the bridge clogging the channel.

Based upon Lewis County Regional Planning Commission forecasts of the future development in the watershed, a SCS computer model (TR-20 and WSP-2) was programmed to forecast future peak flows. The model assumed intensive industrial or urban land use in the lowlands below Alvord Road on Salzer Creek and below the first crossing of the Coal Creek Road on Coal Creek. It was assumed there would be only slight changes of land use in the lowlands of the upper watershed. The highland area and the steep slopes of the watershed were assumed to be maintained in timber production. The channels were assumed to remain as unimproved channels with no changes in the present bridges or overland storage. The results of the forecast changes in land use show an 11 percent increase in peak flow for the 100-year event near the bus station; however, increase in flow would cause only minor changes in floodwater surface elevations. This is because the flood plains are wide, flat, and contain overland storage water. If the overland storage were reduced by encroachment and/or structural changes in the channel, large differences in the water surface profile could result.

Aggressive two-zone (floodway and floodway fringe) land use planning and development was recommended for the lower basin. Under the two-zone approach, flood-protected and elevated construction would be allowed in the outer fringe of the flood plain, and development would be severely restricted in the inner floodway area. Homes or apartments and commercial buildings may be allowed in the fringe provided they are protected by adequate flood-proofing. In the floodway, more open space land uses compatible with periodic flooding (i.e., agriculture, golf courses, parking lots, etc.) should be permitted.

The SCS report recommended that the following nonstructural measures be considered as well as structural flood control measures for flood plain management:

- Land use planning
- Flood plain control regulations
- Flood plain development policies
- Flood plain filling regulations
- Flood plain acquisition
- Flood plain zoning
- Flood warning system
- Flood insurance
- Tax adjustment
- Health regulations
- Building codes

UPDATE

Lewis County Flood Control District #2 (LCFCD#2) was formed in 1991 to reduce flood damage associated with flooding from Salzer Creek. See the UPDATE in Section 5.4.1.6.

7.3.4 U.S. Bureau of Reclamation

In its publication Upper Chehalis River Basin Reconnaissance Report (USBR 1965), the U.S. Bureau of Reclamation (USBR) investigated the multipurpose land and water resource development potentials of the Upper

Chehalis River Basin. Multipurpose development considered in this report included irrigation, flood control, fish and wildlife, and recreation. Water quality control, municipal and industrial water, navigation, and power generation were evaluated, but would not be involved in a development plan. The study area included only the upper part of the Chehalis River Basin, which was defined as that portion of the basin lying upstream from the confluence of the Chehalis and Black Rivers in Grays Harbor County near Oakville.

A reconnaissance land classification survey made by the Bureau of Reclamation in 1960 and 1961 covered a total of 282,000 acres. They determined that the Upper Chehalis River Basin contains about 120,000 acres of arable land, of which about 85,000 acres, or 70 percent, are suitable for irrigation under long-range development plans.

The following plans for irrigation development in the Chehalis River Basin were analyzed (Figure 7-9): 1) storage at the Doty site on Elk Creek to serve lands in Adna Area, and at the Alpha site on South Fork of Newaukum River to serve lands in Newaukum Area; and 2) alternatives to Doty storage at the PeEll, Dryad, Meskill, and Ruth sites on the Chehalis River, Boistfort and Point Hill sites on the South Fork Chehalis River, and alternatives to Alpha storage at the Logan Hill, Middle Fork, and Bear Creek sites on the North Fork Newaukum River and Onalaska site on the South Fork Newaukum River. The Bloody Run site on the Skookumchuck River was also evaluated. The first plan was superior in providing storage and facilities within the range of requirements for multiple purposes considered in the plan formulation. Alternative storage sites in (2) were eliminated for cost or geologic reasons. Dam and reservoir site data for each site are provided in Table 7-6.

The plan was presented as having an engineering feasibility and a benefit-cost ratio of 1.22 to 1. Financial assistance to the water users would be necessary. The plan would provide full-scale irrigation development for an almost solid area or block of land.

Reservoir operation for flood control was provided for in the development plan to the extent feasible. It was projected that flood damages could be reduced by the project primarily below the confluence of the Newaukum and Chehalis Rivers.

Doty Reservoir

Doty Reservoir would provide an irrigation water supply for 26,260 acres, with a total diversion requirement of 54,000 acre-feet (af). Irrigation water would be released into Elk Creek and pumped at two locations into closed pipe distribution systems. Return flow, amounting to 5,900 af during the irrigation season from the upstream area, would be reusable at the downstream location. Thus the net reservoir diversion for irrigation would be 48,100 af annually.

Minimum releases to sustain fish life would be made from the reservoir in addition to irrigation releases. The reservoir would be held down in the winter months to provide flood control and filled in the spring months. Releases would be made in the summer for fish and irrigation purposes. Operation of the reservoir would provide an average reservoir content of 64,000 af (1,790 acres surface area) during the April through August season for sport fishing. Including the releases for fish, Doty Reservoir would develop an average of 65,200 af annually for conservation purposes out of the 113,700 af annual runoff at the site. The reservoir would have filled 25 of the 35 years studied and would not empty. In a dry summer such as 1934, the reservoir would have been drawn down to a minimum content of 29,000 af (1,070 acres surface area).

Flood control operation was found to be economically justified at Doty Reservoir. Doty Reservoir would be operated to provide a reduction of flood crests on Elk Creek and Chehalis River. Between November 1 and March 15 of each water year, 10,000 acre-feet of joint-use space would be available for flood control. A gated spillway with 2,000 cfs capacity at minimum flood control pool elevation would be installed to permit evacuation of the reservoir prior to inflow of flood waters. Flood control benefits accruing as a result of Doty Reservoir operation would be $14,000 (1965 dollars) annually based on a 100-year period of analysis, according to data furnished by the Army Corp of Engineers.

Alpha Reservoir

Alpha Reservoir would provide an irrigation water supply for 24,550 acres, with a diversion requirement of 50,600 af annually. In addition, a minimum release of 30 cfs would be maintained below the dam for fish. During the winter months (October 15 through April), a flow of 150 cfs would be maintained at the mouth of the South Fork Newaukum River. Inflow below the damsite would meet most of these large winter flows; consequently, storage releases would only be required occasionally.

During the 35 years of streamflow data studied, the reservoir would have filled 28 years and emptied 12 years. The reservoir at the capacity selected would yield an average of 75,200 af annually, including the natural flow at the damsite utilized for fish releases and irrigation diversions. Operation during the months of April through August would provide 34,100 af (500 acres surface area) for sports fishing and recreation. Use of the Alpha Reservoir for flood control was determined to be economically infeasible.

UPDATE

TABLE 7-1R. SIGNIFICANT HIGH WATER STAGES

River	Station	River Stage for Zero Damage (ft)	River Stage for Major Damage (ft)
Skookumchuck	Pearl St, Centralia	83.2	85.2
Chehalis	Mellen St, Centralia	65.0	68.5
Cowlitz	Packwood	10.5	*
Cowlitz	Randle	18.0	22.0
Nisqually	National	10	*

*** Information Pending**

8.0 FLOOD MANAGEMENT MEASURES FOR CHEHALIS/CENTRALIA AREA

8.1 Perspective on CFHMP Development

The approach adopted for developing flood hazard management measures for Lewis County, particularly the Centralia/Chehalis area, is based on flood characteristics identified in Section 6.0 and the absence of support for the previously proposed structural flood control measures described in Section 7.0.

Extreme floods on the Chehalis River and its tributaries cause considerable damage in the Centralia/Chehalis area. The January 1990 flood was the largest recorded on the Chehalis River during the past 63 years. The flood caused an estimated $19.2 million in damages throughout the watershed. In Centralia and Chehalis alone, residential damages totaled $4.3 million with approximately 905 residential dwellings being damaged during the flood. Commercial damage totaling $6.8 million was reported by 43 firms. Public facility damage mostly to roads and the Lewis County Fairgrounds totaled about $2.8 million. Agricultural damage was estimated at $1.3 million, emergency aid cost $0.6 million, and transportation delays cost about $2.1 million.

UPDATE

The February 1996 flood was the flood of record in WRIAs 23 and 11.

To prevent flood damages in the Centralia/Centralia area, the U.S. Army Corps of Engineers and other agencies have proposed numerous structural flood control measures since 1935. Almost every reasonable structural measure has been investigated through the years. These previous efforts include investigation of multipurpose storage reservoirs on the Chehalis River and various tributaries, small headwater dams, channel clearing, many alternatives for channel dredging, numerous alternatives for levees, pump stations for tributaries, and combinations of these flood control measures.

None of the major structural flood control measures proposed to prevent flooding in the Centralia/Chehalis area has been approved or constructed. The two main reasons for this are project benefit-to-cost ratios of less than one, preventing cost-sharing participation by the COE, and the absence of cost-sharing by sponsoring agencies, such as the cities of Centralia and Chehalis or Lewis County. Other concerns affecting project implementation, which would have a greater impact today than when many of the structural measures were originally proposed, include environmental considerations and regulatory approvals. The most recent structural flood control proposal was the Salzer Creek pump station. While this project had a benefit to cost ratio greater than one, a vote by affected property owners in the Salzer Creek basin defeated the necessary revenue-generating mechanism that would have been provided by formation of a special district.

At a meeting on October 5, 1992, which was attended by the public and representatives of Centralia, Chehalis and Lewis County, the focus of this CFHMP was discussed. The main topic of discussion was whether this CFHMP should continue to propose new or evaluate further structural flood control measures similar to those investigated previously. It was understood at the meeting that flood prevention in the Centralia/Chehalis area could only be accomplished with major structural flood control measures. However, it was also recognized that none of the major structural flood control measures investigated during the past 60 years has ever been constructed.

Because none of the major flood control measures has been constructed (regardless of whether the reason was an inadequate benefit-to-cost ratio, absence of a sponsoring agency for cost-sharing, or environmental impact considerations), it was agreed at the October 5 meeting that this CFHMP should not reconsider major structural measures to prevent flooding from occurring in the Centralia/Chehalis area. This decision accepts that flooding will continue to occur during extreme events and inundate the flood plain along the Chehalis River and its tributaries.

The alternative to proposing structural flood control measures in this CFHMP is to focus on nonstructural flood hazard management measures. In accepting that flooding will continue to occur during extreme flood events, this CFHMP has focused on two concerns. The first is how to minimize the impacts of flooding in those areas on the flood plain that are already developed. The second concern is to prevent development or other activities that will create a new flood hazard by themselves or increase the flood hazard for others.

The following sections describe flood hazard management measures for both concerns. These measures include:

- Ongoing improvements to flood warning and emergency response procedures
- Flood-proofing of individual structures
- Conducting flood audits for residential and commercial buildings on the flood plain
- Modifying the flood damage prevention ordinances of Centralia, Chehalis, and Lewis County to achieve consistency in the valley
- Using best available historical flood records to assess flood hazards
- Modifying Federal Insurance Rate Maps (FIRMs) to represent flood hazard areas based on the actual flood inundation history in the area

An inherent limitation of nonstructural recommendations to flood hazard management is the difficulty in addressing very specific flood problems. In general, nonstructural recommendations are more procedural or policy-oriented and, therefore, do not usually focus on a specific flood location. A few recognized flood problems in the valley, such as land access to the hospital, passage along Interstate 5, and inundation of the wastewater treatment plants, are addressed in this CFHMP.

As development continues to occur in the county, flood hazards will continue to increase unless efforts are undertaken to control changes in the amount and rate of runoff caused by development. The cumulative effects of increases in stormwater runoff lead to increased flooding downstream in collector creeks and rivers. Increased flooding in creeks and rivers ultimately affects county roads and other facilities, and hence the safety and welfare of county residents. Therefore, another nonstructural recommendation of this CFHMP is to adopt a stormwater ordinance regulating the impacts of new development on increases in stormwater runoff.

One illustrative example where the benefits of a stormwater ordinance are evident is on Dillenbaugh Creek. Presumably, residential development will continue to occur in the upper valley above Jackson Highway. While each individual development will have only a minor impact on stormwater runoff, the future build-out condition will have a much greater impact on increasing the amount and rate of runoff into the lower valley. The new

industrial park is located further downstream. Without stormwater control, the extensive impervious area of this development will further add to stormwater inflow to Dillenbaugh Creek. The cumulative effects of development will be to increase flooding and adversely impact water quality. A stormwater ordinance and dedicated funding for basin planning will allow the effects of development to be investigated and their impacts mitigated as development occurs, before the flood hazard can be created.

Based on discussions with the county, there is no dedicated funding source for flood hazard management. Most flood project work is conducted with funding from the roads program and is typically limited to road drainage improvements. This funding approach to flood hazard management is not adequate to undertake the investigations necessary to identify future flood hazards and take measures in advance to prevent flooding from worsening. The county needs a program for the identification and prevention of future flood problems that is separate from the roads program.

This CFHMP examines various alternatives for funding a flood hazard management program for the county. Based on our assessment, the best approach is the formation of a county surface water utility. Similar programs have already been adopted in Western Washington by the more densely populated counties of Snohomish, King and Pierce, and the less populated counties of Whatcom, Skagit, and Clark. An advantage of this approach is that a utility can be formed and rate structure established by the County Commissioners. Also, funding for the utility does not have to be a tax; it can be a fee or service charge that receives funds from public property as well as tax-exempt property.

To prevent flooding from worsening, Lewis County needs to be more pro-active in identifying potential flood problems before they occur and taking measures to mitigate the adverse impacts of development. This CFHMP provides the "road map" for implementing a comprehensive program in Lewis County.

UPDATE

The February 1996 flood in the Pacific Northwest was a watershed event for Lewis County. After the February 1996 flood event, a group of economic development, business activists and commercial interests met to develop solutions to avert this kind of disaster. A hydraulic computer model was developed for the Chehalis River to simulate flood conditions and derive updated floodplain maps from this flood of record. Preliminary flood reduction concepts were made, which were analyzed with non-structural measures. A highway project was requested to consider flood management measures that would also help the community. Lewis County and the two Cities approached state and federal agencies about a regional flood approach to be included into a federal highway project. A citizen flood advisory committee formulated guidelines to select, prioritize and fund smaller scaled flood hazard reduction projects. Land use planning was enacted in Lewis County.

The City of Centralia adopted the Lewis County 1994 CFHMP with an addendum on August 28, 1999. Their addendum states: "Despite the inability to implement Structural solutions in the past, the City of Centralia remains committed to implement Structural solutions that have acceptable Costs to Benefits".

8.2 Flood Warning and Emergency Response

An effective flood warning and emergency response system can greatly reduce the costs associated with flooding. The goal of a flood warning and emergency response system is to provide timely information to flood

plain residents so that they may take appropriate measures to limit flood damage. To achieve this goal, the primary components of a flood warning system should include:

- Flood information and public education to increase awareness of flood-prone areas and flooding risks, encourage flood control measures to prepare citizens for a flood emergency, and improve citizen response to flood emergencies

- An effective and timely flood forecasting system

- A flood warning communications network that provides timely information to appropriate officials, organizations, and citizens

- Established emergency response procedures, plans, and personnel to effectively implement flood warning and emergency response actions

8.2.1 Lewis County Existing System

Lewis County has developed a flood warning and emergency response system to assist in reducing flood damages. Lewis County has emphasized the development of timely and correct flood forecasting information to accurately predict flooding so appropriate measures can be taken to limit flood damage. Each element of Lewis County's flood warning and emergency response system is described below.

8.2.1.1 Public Education/Information

Easily accessible public flood information is available to citizens of Lewis County. Public flood information includes flood hazard brochures, a flood hazard video, and an informational pre-flood season newspaper advertisement. These information sources furnish public instruction on locations of flood hazard areas, actions to be taken before, during, and following a flood, and people to contact if additional flood information is needed.

The informational brochures are available from Lewis County Emergency Management and are distributed annually at the Southwest Washington Fair. An educational video can be checked out from the Lewis County Emergency Management Division. The local newspaper, The Chronicle, runs a full-page flood information advertisement each year prior to the flood season. These three sources provide citizens with flood damage prevention checklists so they can evaluate how well they are prepared for future flood events.

In addition to the flood information video and brochures, Lewis County has participated in a project with the COE for the development of a flood warning map. This map graphically displays various flood phases relative to river gauge heights. Four flood phases were identified; each flood phase corresponds to an increase in the area inundated by a flood. Phase 1 flooding refers to river gauge heights that result in flood inundation only at low, flood-prone areas. Phase 1 flooding typically occurs every few years. Phase 2 floods may cause many lands and surrounding areas to be inundated. Flooding may reach hazardous levels near river channels. Phase 3 flooding refers to flood levels that occurred during the January 1990 flood. Phase 4 flooding, which exceeds the January 1990 floods, will inundate the majority of commercial and residential areas within the Chehalis/Centralia region, with flood waters reaching extremely hazardous levels. The flood warning map describes and displays each of the flood phases, the roads and areas predicted to be inundated at each phase, and the associated river gauge height for each flood phase. This map is available at the Lewis County Emergency Management Division and

was reproduced in the local newspaper in association with pre-flood season information. A reproduction of the flood warning map is shown in Figure 8-1A and Figure 8-1B.

The flood warning map associates specific flood phases with probable road closures. In conjunction with this, Lewis County has begun to compile a database itemizing road closures with specific flood events. The road closure database compilation began with the April 5, 1991, flood. A chronological record is kept of hazardous road conditions as they occur during a flood. This road closure record provides historical information to predict future flood-related road hazards. Table 8-1 shows a listing of the road closures that occurred during the April 5th flood.

8.2.1.2 Flood Forecasting System

The Lewis County flood forecasting system is a combined effort of county agencies, the COE, the National Weather Service (NWS), and local residents. The county agencies most involved in initial flood forecasting are the Lewis County Public Works Department and the Sheriff's Department. Deputies and Public Works road crews who patrol the Chehalis/Centralia area work in close cooperation with the Emergency Management Division and report any antecedent conditions which may lead to flooding. Area land owners and long-time residents of the county who have gained historical knowledge of flooding situations are also a valuable asset in flood forecasting. Both public service and local residents maintain a watchful eye on flood conditions and report any substantial flood information as it becomes apparent.

Imminent flooding is also predicted from information gathered from staff gauges installed on the county's major area rivers and tributaries. Several gauges are dial-in/recording gauges, which eliminates the need for manual reading of the gauges. These gauges are monitored at the Emergency Operations Center (EOC). The river gauge heights, observations made by public service employees and local residents, and COE and NWS information are used to determine if flood advisories or warnings should be issued. Once a flood warning has been issued, emergency response procedures are activated at the EOC.

8.2.1.3 Flood Warning Communications Network

Emergency public information is disseminated according to the type of information being released and the existing disaster conditions. The Emergency Broadcast System (EBS), which operates through designated radio and television stations, is primarily intended for the transmission of information vital to immediate personal safety and survival. The local designated EBS station is KELA (1470 AM). Emergency and warning transmissions may also be broadcast via normal frequency radio and television channels (e.g., radio stations KMNT at 103 AM and KITI at 1420 AM). Amateur radio (shortwave, CB, etc.) is used when other communications are unavailable. Newspapers are used for warnings of expected flooding and post-flood information. Residents may call the NWS (1-206-357-MILD) for recorded weather information or tune in the NOAA weather station at 162.475 megaHertz. Three local emergency/information phone numbers (for Centralia, Chehalis, and Lewis County) have been established to answer the public's questions or receive important flood information from residents. Only verified information is released by Lewis County's EOC to limit unnecessary alarm to the public. Residents are also encouraged to set up neighborhood notification networks.

8.2.1.4 Emergency Response Procedures

The Lewis County Emergency Management Division is responsible for carrying out the emergency response program in the county. The Emergency Management Division coordinates disaster preparedness, mitigation, response, and recovery efforts of county agencies and departments. In the event of a flood emergency, the Emergency Management Division will fully activate the EOC, if necessary, to coordinate flood emergency response activities of all Lewis county agencies including those for the cities of Centralia and Chehalis. City, county, and state emergency representatives base their operations at the EOC. The EOC maintains and provides updated flood information as well as responding to sandbag operations or evacuations as needed. The EOC does not have jurisdiction over other incorporated cities in the county.

Each emergency response agency has assigned disaster responsibilities based upon its mandated functions and capabilities. Coordination of these responsibilities is through the EOC. Table 8-2 is a list of cooperating agencies with a brief summary of each agency's responsibilities. Lewis County has developed a Comprehensive Disaster Preparedness Plan which outlines the specific emergency response procedures and responsibilities.

UPDATE

This UPDATE section outlines the current procedure and programs pertinent to Section 8.2, Flood Warning and Emergency Response.

In accordance with RCW 38.52.110 (1), in responding to a disaster, or the threat of a disaster, the Board of County Commissioners (BOCC) is directed to utilize the services, equipment, supplies, and facilities of existing departments, offices, and agencies of the state, political subdivisions, and all other municipal corporations to respond to such a disaster. The Lewis County Division of Emergency Management (DEM) is responsible for coordinating the mitigation, preparation, response and recovery efforts pertaining to flood events.

DEM contracts with all incorporated and unincorporated areas within the flood plain to establish and maintain a county-wide warning system, monitor flood predictions services, disseminate warning information, and provide public education to the citizens of the county. The Comprehensive Emergency Management Plan (CEMP), Flood Phase Guidelines Manual, Lewis County Emergency Warning Notification Plan, and National Weather Service Notification collectively provide the guidelines for the warning system. DEM has policy and procedure in place for how flood warning information is to be disseminated to first responders, county and city officials, and the general public.

When a flooding event is possible, the National Weather Service (NWS) issues media advisories, watches and warnings based upon forecasts or model indications that rivers may approach flood stage. When additional local information is available, it will be added to the NWS bulletins and distributed to the public as necessary. The Warning System often begins with the transmission of NWS bulletins by National Warning System (NAWAS), A Centralized Computerized Enforcement Service System (ACCESS) transmission, NWS fax, or Emergency Alert System (EAS) messages. Once, received, the message is evaluated, confirmed, and then disseminated to first responders, city and county officials, and the general public.

Flood Threat Recognition System

The NWS is the only nationally approved flood-warning agency. Regional and local media broadcast NWS advisories, watches and warnings as soon as they are issued. Lewis County relies on the hazard warning capabilities of the federal and state government, industry and the media. Each flood plain resident is responsible for being aware when a threatening situation is developing or exists, and keeping informed through media reports.

Local agencies may also have area specific information that is distributed in local media news releases. Local area information is based upon predictions, river gauge monitoring, modeling, historic records, and data analysis. If additional evaluation information is needed, it is often provided by the NWS, U.S. Army Corps of Engineers (COE), Public Works Engineering staff, and/or community weather spotters.

Event information can be received and distributed by media, EAS, fax, pager, recorded telephone message, mobile broadcast speakers, telephone, NOAA Weather radio, radios, website, ham radio operations, or door-to-door contacts as the situation requires. Redundant systems are set up to include direct first responder and volunteer contacts.

The messages include the following contents: type of alert, location of incident, description of hazard conditions, time of arrival, severity, future predictions, recommended actions and safety information.

The Lewis County response agencies use the flood stage forecast map to determine what areas the predicted flood will affect. The flood plain map is incorporated into a CD GIS ArcExplorer computer program with a flood plain overlay. Copies of this program have been distributed to all response agencies.

Emergency Warning Dissemination

In addition to the notification as noted above, the dissemination of emergency warning information includes posting on the county's website, a recorded telephone message, call centers at the Emergency Coordination Center, and E911 Communications. Information posted on the county website includes river and road condition reports as well as event bulletins.

Emergency Management maintains a responder agency and critical facilities Notification Warning Plan. It includes telephone numbers, pagers, cell phones, faxes and radios for broadcasting notifications to these agencies as well as the general public.

Public Education Campaigns

Emergency Management conducts several annual public education campaigns including Disaster Preparedness Campaign in April, Sheriff's Family Emergency Services Day in July, NOAA Weather Radio Month in September, and Flood Preparedness and Flood Insurance Campaign in November. A two page newspaper insert is prepared for flood preparedness every fall. Press releases are also posted on the county website at www.co.lewis.wa.us.

8.2.2 Recommendations

Lewis County has actively pursued increasing public awareness on flood hazards. Within the last few years, the county has substantially improved its flood warning and emergency response system. The following recommendations are directed to further decrease flood damage by continuing to refine flood forecasting capabilities and public awareness.

8.2.2.1 Install Additional River Gauging Stations

Lewis County Emergency Management Division forecasts flooding from data collected at four river gauges (Massingham 1993). The gauges include:

1. Chehalis River at Centralia. This gauge is located on the Mellen Street bridge. It records flow received from a 653-square-mile drainage area. The river level is obtained via telephone communications. Low level flooding is predicted to occur at a gauge height of 65.0 feet (COE 1991).

2. The Chehalis River at Doty. This gauge is located approximately 26 miles upstream from the city of Chehalis. It records flow received from a 113-square-mile drainage area. The river level is obtained via telephone communications. Low-level flooding is predicted to occur at a gauge height of 11.6 feet (COE 1991).

3. Skookumchuck River at Pearl Street. This gauge is located in the city of Centralia, 2.3 miles upstream from the confluence of the Skookumchuck with the Chehalis River. The gauge records flow received from a 172-square-mile drainage area. The river level is obtained via telephone communications. Low level flooding is predicted to occur at a gauge height of 83.2 feet (COE 1991).

4. Newaukum River near Chehalis. This gauge is located 4.1 mile upstream of the confluence with the Chehalis River. The gauge records flow received from a 155-square-mile drainage area. The river level is visually inspected and called in to the EOC. Low-level flooding is predicted to occur at a gauge height of 9.1 feet (COE 1991).

The flow data are monitored and recorded prior to suspected flood events and throughout flooding conditions at the Emergency Operations Center (EOC). In addition, the EOC records river levels on ungauged tributaries (Coffee Creek, Hanford Creek, China Creek, Salzer Creek, Coal Creek, and Dillenbaugh Creek) from visual observations made by public service employees and local residents. Flood warnings and emergency response activities are enacted as water stages reach significant levels.

Current river monitoring provides flow information for a large portion of the Chehalis River drainage area; however, flood responsiveness can be increased by additional staff gauge installation. Flood preparation lead time would be inceased with gauge installation within the upper reaches of the Chehalis drainage. Additional telephone-linked gauges would reduce personnel needed to visually inspect river levels.

Sections of the upper Chehalis River drainage are ungauged. The South Fork of the Chehalis River can furnish a significant amount of flow to the mainstem Chehalis River and is not monitored. It is recommended to install a telephone-linked gauge on this river reach. The gauge would provide additional real-time data to increase the quality of flood prediction information.

It is recommended that the Newaukum gauge near Chehalis be updated to provide telephone linked capabilities. Historically, the Newaukum River has shown a quick flow response to precipitation. Updating the Newaukum gauge would increase the timeliness of the information gathered at this location. It would further decrease personnel required to visually inspect the gauge.

UPDATE

Response capabilities of the Newaukum river gage near Chehalis have been made. All river gages are linked to the Internet and to the county's website.

It is recommended that the county continue to evaluate the possible installation of gauges on major tributaries within the Centralia/Chehalis area. Developing a database of flow information is important for flood forecasting applications. The data can be used to correlate river levels with flood damage. This will increase the confidence and accuracy of flood prediction in the future.

UPDATE

Since the 1996 flood, Lewis County has installed five additional gaging stations in WRIA 23: 12020800/Wildwood; 12021800/Near Adna; 12024400/Near Forest; 12025100/Chehalis WWTP; and 12024000/Near Onalaska. These gages are identified in Table 6-4R in the UPDATE in Section 6.1.3.2. Internet links are provided to these stations through the county's website.

8.2.2.2 Interlocal Coordination on Flood Forecasting

Various flood forecasting methods are being used in Lewis County. The City of Chehalis is involved in a program that collects river levels at seven locations during a flood event. The seven staff gauges are located on major tributaries within the city of Chehalis. The goal of the program is to correlate tributary river stage crests with the crest of the Chehalis River at Melon Street. Identifying a consistent correlation or consistent phase relationship between a tributary and the Chehalis River could be used as predictive tool.

UPDATE

The City of Chehalis is involved in a program that collects flood levels at seven locations during a flood event. The goal of the program is to collect real-time flood information as it relates to the greater Chehalis area, and the Chehalis River gauge at Mellen Street in Centralia. The correlation or consistent phase relationship between the stations and the Chehalis River is used as a predictive tool.

The seven monitoring stations are located within Chehalis. The stations consist of 4"x6" treated timbers embedded in concrete. The stations are scaled to the nearest foot, and interpolated to the nearest ½ foot (0.5'). The City contracted with Gibbs & Olson engineering consultants in 1998 to establish a certified benchmark for each of the stations.

Lewis County is involved in a program that uses historical flow data to predict flooding. The historical flood flow records are plotted to reveal any trends. The existing flood flow conditions are compared for similar trends. If similar trends are observed, it is assumed flooding will occur.

UPDATE

The National Weather Service issues flood forecasts. Refer to the UPDATE in Section 8.2.1.4.

It is recommended that the City of Chehalis and the County Engineer coordinate flood forecasting efforts. Interlocal communication and coordination would focus flood forecasting into a consistent and compatible methodology. Working together that provide a means of evaluating techniques and developing new methodologies which could provide better predictive capabilities.

8.2.2.3 Formalize and Update Road Closure Database

The county records the road closure date, time, road name, and road flooding problem throughout flood events. The information is used to maintain a listing of current road closures. This information could also be used as a predictive tool. It is recommended that the county record river stages in conjunction with road condition information during a flood event. This information should be compiled in a database so flood stages can be related to road closures. This would allow road closure predictions during future flood events and enable quicker dispatch of road crews to set barriers on flood impacted roads.

UPDATE

The County WEB site posts information on river and road conditions reports, event bulletins, and road closures.

8.2.2.4 Increase the Distribution of Flood Information Materials

Education is an important and low-cost method of reducing flood damage. Having easily accessible flood information can greatly increase public awareness of flooding risks and encourage flood damage reduction measures. Citizens become frustrated when they cannot easily obtain information they need. This plan recommends that the county continues the distribution of the flood information brochure, video, and newspaper advertisement; however, a broader-based distribution should be used. The flood brochures and video should be distributed to libraries throughout the county. The newspaper advertisement and flood information should make it apparent that the information is available throughout the county. Currently, flood information is only available at the Emergency Management office, limiting accessibility to outlying county residents.

UPDATE

Emergency Management conducts several annual public education campaigns. Refer to the UPDATE in Section 8.2.1.4.

8.2.2.5 Additional Recommendations

Several other alternatives are available to increase the effectiveness of Lewis County's flood warning and emergency response system. The recommendations mentioned below are discussed further in Section 8.4.2 since they apply to both flood warning/emergency response and ordinance enhancement (Section 8.4.2).

- Update the Federal Insurance Rate Maps (FIRMs) based on historical flood inundation records. This would provide more accurate flood hazard information.

UPDATE

After the February 1996 flood, it was generally confirmed that the flood insurance rate maps developed by FEMA in 1981 needed to be updated. See the UPDATE in Section 8.4.2.1.

- Provide a public disclosure ordinance. The ordinance would require disclosure of a property's flood plain status at the time of purchase.

UPDATE

Plat maps for land subdivisions show the FEMA flood boundaries and state a condition to comply with the county's flood damage prevention ordinance, Chapter 15.35 LCC.

- Document flood warning and emergency response activities for submittal to the Community Rating System (CRS). These activities will count as credits to reduce flood insurance premiums.

UPDATE

Flood warning and emergency response activities are reported annually to the Community Rating System (CRS) program.

8.3 Flood-Proofing

8.3.1 Available Techniques

Flood-proofing is defined by the COE as "Any additions, changes, or adjustments to properties and structures which reduce or eliminate flood damage to lands, water and sanitary facilities, structures, and contents of buildings" (COE 1984). Flood-proofing actions can be required for future flood plain development or implemented on existing development.

While flood-proofing does not provide complete protection during an extreme flood event, it is one device that can be applied with other flood control measures to reduce flood damage. Flood-proofing can allow a building to function during flood periods. Flood-proofing also increases the protection provided by other partial protection flood control projects, improves the availability of flood insurance, and, if properly understood, can heighten the awareness of flood risk.

There are many homes and businesses in the Chehalis-Centralia area that are built on the flood plain and would be (or have been) flooded during an extreme flood event. Construction of these flood plain structures predates the preparation of flood insurance rate maps by FEMA and local ordinances regulating flood plain development. Citizens residing in flood-prone areas should be aware of flood-proofing techniques so that they may flood-proof their homes and other buildings. Common flood-proofing techniques are briefly described below. Further information can be obtained by referring to the FEMA publications: Flood-Proofing Non-Residential Structures (FEMA 1986) and Design Manual for Retrofitting Flood-prone Residential Structures (FEMA 1986).

Flood-proofing techniques are classified according to the type of protection they provide. Permanent flood-proofing techniques are always in-place and require no action if flooding occurs (e.g., floodwalls and levees, closures and sealants, elevation, relocation); contingent flood-proofing techniques require installation prior to flood occurrence (e.g., flood shields, watertight doors, movable floodwalls); and emergency flood-proofing techniques are improvised when flooding occurs (e.g., sandbag dikes, earth-filled retaining walls). The most common flood-proofing practices are described below.

Elevation

Elevation is one common technique to flood-proof a structure. This technique involves raising structures to an elevation above the flood hazard. It is often feasible for new construction and selected existing structures. Structures may be elevated on columns, fill material, foundation walls, or other foundation types. This type of flood-proofing is a permanent measure and will usually require little action when preparing for a flood. If performed correctly, elevating a structure can eliminate flood damage in all but the most severe floods. Figure 8- displays examples of elevating residential structures.

Floodwalls and Levees

Floodwalls and levees are another technique for flood-proofing structures. Traditionally, these flood-proofing methods have been considered structural alternatives to protect large areas or numerous structures. However, these methods can be applied to existing and future single structures within flood-prone areas.

Basically, floodwalls and levees act as barriers to keep flood waters away from structures. Floodwalls are generally concrete or masonry walls of various configurations that may encircle entire structures, protect only the lower elevations of the structure, or be built only around threatened openings of structures. Levees are earth-filled embankments with gently to moderately sloped sides. Levees require a greater amount of space and typically require greater maintenance. Floodwalls and levees can be used to protect any type of structure and require no alterations to the structure. Examples of the use of floodwalls and levees in Lewis County are shown in Figure 8-3. As shown in the figures, these measures provide permanent flood protection with limited actions required in preparing for a flood.

Closures and Sealants

Closures are permanent or temporary flood-proofing measures which cover openings to prevent water from entering a structure. They can be as simple as temporarily placing panels over a door or as extensive as filling an opening with some form of water-resistant material such as concrete. Temporary closures require sufficient warning time so they can be properly installed prior to experiencing flooding. Closure systems are most effective when there is a limited amount of openings. Having closures on many openings may result in excessive leakage.

Leakage can be reduced by using sealants or gaskets concurrently with closures to ensure watertightness. Sealants are waterproof coatings applied to any type of closure in order to reduce permeability. The coating is generally a compound painted or sprayed onto walls or closures. They are typically applied to buildings displaying good structural integrity because the building must withstand the significant hydrostatic pressures produced by the flood waters.

Sandbag Dikes

Sandbag dikes are an emergency flood-proofing measure which can be quickly initiated using stored materials. Sandbag dikes act as a temporary barrier to keep flood waters away from structures. A sandbag dike is a low-cost method but requires extensive labor. This method also requires advance warning to mobilize personnel to install the sandbags. It is important that the materials are prepared prior to flooding and maintained during the flood event.

The flood-proofing methods described above outline common techniques that can be applied to existing or future structures prone to flood hazards. Other techniques are available and information explaining these techniques and their evaluation is available in the references cited at the beginning of this section. It is important, as detailed in the cited references, that all flood, site, structure, and cost characteristics are considered prior to implementing any flood-proofing method.

UPDATE

Since 1994, Lewis County regulations have adopted floodproofing measures from the model NFIP ordinance for habitable and non-residential structures. These measures are in Chapter 15.35 LCC. Habitable space is as defined in Section 209 of the UBC.

The aforementioned requirements for habitable and non-residential structures have also been adopted for the Cities of Centralia and Chehalis. See Sections 5.4.2 for City of Centralia regulations and 5.4.3 for City of Chehalis regulations.

8.3.2 Flood Audit Study

A flood audit study is currently being performed for the cities of Centralia and Chehalis. The COE is conducting the study to inform specific property owners of flood hazards and flood-proofing techniques. The COE identified 15 flood-prone areas within the cities of Centralia and Chehalis based on historical FEMA flood damage reports (Figures 8-4 and 8-5. Residents within the areas were solicited to participate in the flood audit program. Approximately 200 property owners (a 10 percent response) are involved in the flood audit program.

The participating property owners were interviewed to obtain detailed information related to flood problems. Elevations were obtained for property items such as basement, first floor, garage, shed, and adjacent ground. In addition, elevations were gathered for specific items such as TV, washer/dryer, furniture, furnace, electrical outlets, etc. The collected information was placed into a database computer program to determine the property items impacted at various river levels.

The study will provide Individual Action Plans for each property and Neighborhood Action Plans for the communities. The plans will relate water levels experienced at each property to river levels reported at gauging stations. This will enable property owners to take appropriate actions based on river levels reported over the radio and TV. The Individual Action Plans will include:

- Property location maps
- Evacuation route maps
- Interview sheets showing elevations of various floods, floors, and selected property items
- Flood inundation graphs displaying property items inundated at various flood levels
- Flood-proofing fact sheets explaining how to prepare and prevent future flood damages

The Neighborhood Action Plans will consist of:

- Property location maps
- Evacuation route maps
- Flood inundation graphs for each neighborhood

This study is expected to be completed by the end of 1993.

8.3.3 Recommendations

Because flood-proofing can be applied by individuals to properties experiencing flood risk, this flood damage reduction measure can be very inexpensive to implement. Flood-proofing needs little community involvement to be successful, but success is greatly increased if a public agency provides technical assistance and guidance. The following recommendations are made for increasing public assistance.

8.3.3.1 Distribute Flood-Proofing Fact Sheets and Reference Materials

Citizens residing in flood-prone areas should be made aware of flood-proofing techniques if they desire to flood-proof their homes. The county should make flood-proofing references and fact sheets available to citizens. The flood-proofing materials should be distributed with the flood information brochures to libraries, fire departments, chambers of commerce, and city offices located throughout the county. The increased distribution would increase the probability of educating property owners unfamiliar with preventative flood-control measures.

UPDATE

The County distributes flood-proofing references and fact sheets of flood proofing techniques annually, including the owners of repetitive loss properties. The Cities distribute their information annually to everyone in their flood prone areas.

8.3.3.2 Acquire the COE Flood Audit Program

Upon completion of the COE flood audit study, the flood audit computer program will be available to Lewis County communities. The county should acquire the flood audit program for further use. Acquiring and learning the program would have limited costs and provide valuable flood hazard information to citizens not involved in the initial study. The county could offer property owners a flood audit at a nominal fee. If the results of the current flood audit study are well accepted, it is anticipated that other property owners would seek out this service.

UPDATE

Upon completion of the COE flood audit study in 1991, Lewis County and the Cities acquired the flood audit computer program.

8.3.3.3 Elevation and Relocation

Raising or moving a structure is a permanent flood-proofing technique. This should be considered as the recommended alternative in Lewis County. Implementing relocation or elevation has high short-term costs; however, in the long term, these actions may provide the lowest cost alternative in the very high flood hazard areas. The advantages of these alternatives are:

- No maintenance commitment
- Reduction of expenditures for flood insurance claims
- Reduction of expenditures for repair of existing flood and erosional controls
- Increased flood storage and conveyance
- Increased river access and preservation of wildlife habitat
- Lower flood insurance rates for property owners

UPDATE

Since participation into the Community Rating System, the County and Cities have approved many home elevation and floodproofing projects. Table 8-2R lists the number of home elevation and floodplain removal/buyout projects since 1994.

After the February 1996 flood, the County applied for grant funding to elevate 17 homes in Galvin. Since 1994, Centralia has received approximately $4,210,000 to elevate homes in the floodplain.

8.4 Ordinance Interpretation and Enhancements

Flood damage prevention ordinances for Lewis County, Centralia, and Chehalis, described in Sections 7.4.1.1, 7.4.2.1, and 7.4.3.1, respectively, are the basic regulatory tools for flood hazard reduction in the Centralia/Chehalis region. With the goal of attaining a regulatory program for flood control that is comprehensive, strong, and simple, this section provides first a comparison of the three ordinances highlighting substantive differences, and second enhancements to each of the ordinances that will strengthen the flood hazard reduction program in the Centralia/ Chehalis region. The actual ordinances are provided in Appendix D.

8.4.1 Consistency of Flood Damage Prevention Ordinances

Because the physical boundaries of flooding do not respect political boundaries in the Centralia/Chehalis region, it is important to have consistent regulations between the three governments. If the regulatory programs are not consistent, the actual level of flood hazard protection is determined by the most lenient regulation. The substantive differences between each of the three governments' ordinances are described in this section.

The three ordinances are similar in form and content; each of them was based on the NFIP model ordinance. The general structure of each ordinance includes the following:

- Purpose of ordinance and general methods employed by the ordinance
- Definitions of terms
- General provisions, basis for establishing areas of special flood hazard, relationship to other regulations
- Administration of the ordinance including application and appeal procedures, conditions for variances, and penalties for noncompliance (except Chehalis')

- Standards for flood hazard reduction, for development in the flood fringe and floodway, and for residential and nonresidential structures

The information presented in this section was obtained through a careful review of the three ordinances. This review focuses on the substantive differences, i.e., those differences that may affect the level of flood protection between jurisdictions. Minor differences not discussed here also occur in wording and definitions. These minor differences are not believed to substantively affect the flood protection gained under the ordinances. Table 8-3 summarizes the major differences between ordinances. Table 8-4 provides recommendations for rectifying these differences. The major differences are also discussed below.

Definitions

The first inconsistency between the three ordinances is in the definition of "Start of Construction." Lewis County and Centralia define "Start of Construction" as the date a building permit is issued, as long as the actual construction begins within 180 days. Chehalis defines the "Start of Construction" as the first placement of permanent construction of structures on the site. While this difference in definitions is an administrative detail and usually has little impact on implementation of the ordinance, having a consistent definition across the three jurisdictions would eliminate the potential for confusion among developers crossing jurisdictional boundaries. The building permit issuance date is the favored definition because it is an easily trackable date.

Development Applications

Several variations occur when an individual submits an application for a development permit in a flood hazard zone. First, only Lewis County requires applicants to certify the exact location of their proposed structures on the FIRM or another map that can easily be related to the FIRM. While precise location of the proposed structures is very important in protecting it from flood hazard, this information is obtained in some manner by all jurisdictions, either from information provided by the applicant, or from the investigation carried out by the agency official. No change is recommended for any of the ordinances.

The second difference in the application process is related to the source of elevation data for the lowest habitable floor of the structure. The language in each ordinance is different. Lewis County requires the elevation to be certified by a licensed land surveyor; Centralia specifies that the elevation to be provided is the "as built" elevation; Chehalis does not specify. It is recommended that each jurisdiction change the wording in their ordinance to require an elevation certified by a licensed land surveyor and based on the elevation of the lowest floor of the structure "as built." These specifications will eliminate receipt by the agency of elevations that are estimated, sometimes to the detriment of flood protection, and will also assure that variations between plans and actual constructed elevations are caught.

The last difference in the development application procedure between jurisdictions is that Lewis County coordinates requirements under the Flood Hazard Program and the Shoreline Master Program for the applicant. When a Shoreline Master Program Substantial Development Permit is necessary in addition to the Flood Hazard Permit, one permit-the Substantial Development Permit-is issued. This Substantial Development Permit includes flood hazard requirements. Centralia and Chehalis do not coordinate these two programs; applicants subject to both programs must obtain two permits.

UPDATE

Several variations were identified in 1994: sources of verification of location on the application; definitions for the lowest floor of the structure; sources of elevation data; and coordination of requirements between the Flood Hazard Program and the Shoreline Master Program. All jurisdictions use site plans submitted by the applicant to verify the exact location of their proposed structure on the FIRM or another map that can be easily related to the FIRM. Source of elevation data is given by licensed land surveyors at finished floor elevations. Finished floor elevations at the lowest habitable floor (including basements). All three jurisdictions use the Joint Aquatic Resources Permit Application (JARPA) form for applications to the local flood hazard and shoreline master programs.

Variances

Language addressing variances is different in each ordinance. Under NFIP, variances to the elevation requirements should not occur frequently; the Lewis County and Chehalis ordinances clearly state this intent. The provision for allowing variances to elevation requirements was designed primarily to allow for infilling of existing residential neighborhoods. Variances should not be granted for large lots, new subdivisions, or expansions of existing neighborhoods.

A second passage related to variances, present in both Lewis County and Centralia's ordinances but missing from Chehalis', deals with lowering the flood-proofing standards for invulnerable nonresidential structures in the flood hazard zone. This passage reads:

> "Variances may be issued for nonresidential buildings in very limited circumstances to allow a lesser degree of flood-proofing than watertight or dry-floodproofing, where it can be determined that such action will have low damage potential, complies with all other variance criteria . . ."

Chehalis currently does issue variances in such situations; inclusion of the above statement in their flood hazard ordinance would provide clear justification for variances in these instances.

UPDATE

All three jurisdictions' ordinances have the same criteria for variances. The recommended passage is now in all three ordinances.

Appeals and Enforcement

Appeals of requirements, decisions, or determinations related to development permits are heard by the Boards of Adjustments in Chehalis and Centralia, and the Board of County Commissioners in Lewis County. Centralia is the only jurisdiction that currently specifies a time limit for appeals; they allow 10 days from the decision date. Lewis County and Chehalis should add a 10-day time limit for appeals to each of their ordinances.

UPDATE

Appeals of requirements, decisions or determinations related to development permits are heard by a Hearings Examiner in Lewis County and City of Chehalis, and by a Board of Appeals in the City of Centralia. Lewis County has a 10-day time limit for appeals in 2.25.120 LCC.

The enforcement policy of each jurisdiction, as specified in the ordinances, varies. Chehalis' ordinance does not specify penalties for noncompliance, or how cases of noncompliance are treated. Centralia's ordinance states that noncompliance is treated as a misdemeanor, with penalties of up to $5,000 per violation. Lewis County also specifies penalties for noncompliance; their ordinance authorizes fines of up to $1,000 per day per violation. Chehalis should add a section dealing with penalties for noncompliance, and set fines at a level comparable to Lewis County and Centralia.

UPDATE

The enforcement policy of each jurisdiction varies. Failure to comply with the procedural requirements for Chehalis is a misdemeanor per their public nuisance (Section 7.04.130 CMC). The maximum penalty is $1,900 and 90 days in jail.

Flood Fringe Development Standards

The actual standards for development in the flood fringe portion of the flood plain also differ between jurisdictions. First, Lewis County and Centralia include standards for construction materials and methods used for electrical, heating, ventilation, plumbing, and air conditioning equipment; Chehalis does not. Inclusion of such specifications would clarify Chehalis' ordinance as well as assuring consistency between the jurisdictions.

Second, the elevation to which structures must be built is specified to be the base flood (100-year flood) in Chehalis' ordinances; Lewis County and Centralia specify 1 foot above base flood. Since 1 foot above the base flood is recommended by FEMA, Chehalis should modify its ordinance accordingly.

Third, requirements for the design of fully enclosed areas below the lowest floor of structures, currently missing from Chehalis' ordinance, is recommended. This requirement leads to safer structures that do not decrease floodwater storage.

Fourth, a statement requiring "applicants for nonresidential construction to be notified that flood insurance premiums for flood-proofed nonresidential buildings will be based on rates that are 1 foot below the flood-proofed level" is recommended for Chehalis' ordinance. This declaration forces better communication between the permitting authority and the applicant concerning the risks and financial disadvantages of developing in flood hazard areas.

The last recommended modification to the general standards sections for construction in the flood fringe is additional provisions for manufactured homes. Lewis County and Chehalis' ordinances include very specific provisions for the location and elevation of manufactured homes, including access to the structures. Because of the special dangers associated with manufactured homes, inclusion of this language is recommended for Centralia's ordinance.

UPDATE

The actual standards for development in the flood fringe portion of the flood plain also differ between jurisdictions.

1. Lewis County and Centralia include standards for construction materials and methods used for electrical, heating, ventilation, plumbing, and air conditioning equipment; Chehalis does not.

Inclusion of such specifications would clarify Chehalis' ordinance as well as assuring consistency between the jurisdictions. These specifications are now included in Section 17.21.150, CMC.

2. **The elevation to which structures must be built is specified to be the base flood (100-year flood). Lewis County, Centralia and Chehalis specify the flood protection elevation as base flood plus one foot or base flood plus three feet for critical facilities.**

3. **Requirements for the design of fully enclosed areas below the lowest floor of structures was recommended in Chehalis' ordinance. This requirement leads to safer structures that do not decrease floodwater storage. Chehalis has addressed this in Section 17.21.180 CMC, which lists requirements for the design of fully enclosed areas.**

4. **A statement requiring "applicants for nonresidential construction to be notified that flood insurance premiums for flood-proofed nonresidential buildings will be based on rates that are 1 foot below the flood-proofed level" is recommended for Chehalis' ordinance. This declaration forces better communication between the permitting authority and the applicant concerning the risks and financial disadvantages of developing in flood hazard areas. Chehalis has addressed this recommended modification in Section 17.21.190 CMC.**

5. **Additional provisions for manufactured homes are provided. Lewis County and Chehalis' ordinances include very specific provisions for the location and elevation of manufactured homes, including access to the structures. Because of the special hazards associated with manufactured homes, inclusion of this language is recommended for Centralia's ordinance. This has been addressed by Chehalis in Sections 17.21.140 and 17.21.200, which specify flood protection elevation and anchoring of manufactured homes; and by Centralia in Section 16.12.170, which does the same and references FEMA's "Manufactured Home Installation in Flood Hazard Areas" guidebook for additional techniques.**

Floodway Development Standards

Development within the floodway, a special flood hazard zone, is typically restricted more than in the surrounding flood fringe. Lewis County prohibits land filling in the floodway outright. Both Centralia and Chehalis include land filling with activities that are allowed only if hydraulic analysis demonstrates that no perceptible rise in flood levels would occur because of development. In practice, because of the large width of the flood plain, most individual structures, including filling of land, can be shown to be insignificant. The cumulative effect of many individual fill projects is not insignificant, however. For this reason, it is recommended that Centralia and Chehalis modify their ordinances to clearly state that filling of land is prohibited in the floodway.

The second difference between how each ordinance regulates the floodway is how manufactured homes are treated. Lewis County and Centralia do not specify any restrictions for manufactured homes apart from other residential structures; Chehalis prohibits manufactured homes in floodways unless placed in vacant spaces in existing mobile home parks or subdivisions. These strict restrictions are recommended for Lewis County and Centralia also. This restriction is justified because of the extreme vulnerability of manufactured homes to flood damage.

The last major difference in floodway regulation between ordinances is construction or reconstruction of residential structures in the floodway. Lewis County's and Chehalis' ordinances do not specifically address it; Centralia's tightly restricts it. Under NFIP, development in the floodway should be prohibited or at least highly discouraged. Lewis County and Chehalis should modify their ordinances to include language similar to Centralia's for restricting construction and reconstruction in the floodway.

UPDATE

Development within the floodway, a special flood hazard zone, is typically restricted more than in the surrounding flood fringe. The recommendations made in the 1994 CFHMP are summarized as follows:

1. Centralia and Chehalis should modify their ordinances to clearly state that filling of land is prohibited in the floodway.

Lewis County prohibits land filling, substantial improvements, and new construction in the floodway outright. The definition of 'substantial improvement ' is consistent among

Other development is allowed only if "certification by a registered professional engineer or architect is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge". Centralia and Chehalis allow new construction, substantial improvements and other development if the aforementioned certification is met for the proposed project. This requirement is in sections: 15.35.310 for Lewis County, 17.21.220 for Chehalis, and 16.12.190 for Centralia.

As further protection, Chehalis' fill and grade ordinance prohibits fill in the floodway. Lewis County and Chehalis have an identical requirement about undesignated floodways, and shallow flooding areas (AO zone in FIRM).

2. Lewis County and Centralia should restrict the placement of manufactured homes in floodways due to the extreme vulnerability of manufactured homes to flood damage.

The 1994 CFHMP found that Lewis County and Centralia did not specify any restrictions for manufactured homes apart from other residential structures; Chehalis prohibited manufactured homes in floodways unless placed in existing mobile home parks or subdivisions.

The current flood ordinances specify that manufactured homes have to meet the floodway and flood elevation requirements. Manufactured homes are treated like frame structures so any placement of manufactured homes in floodways are regulated as such in the cities' flood hazard ordinances. See sections 16.12.170 and 16.12.190 for Centralia; and 17.21.140, 17.21.200 and 17.21.220 for Chehalis.

The placement of manufactured homes is also regulated through the comprehensive land use zoning and ensuing development regulations. The comprehensive plans were adopted in 1998 through 2000 for the three jurisdictions. Lewis County requires that mobile homes occupied continuously for more than 60 days shall meet requirements of mobile home in Chapter 15.25; otherwise, it should be in a mobile home park per Chapter 15.30. Section 15.35.295 specifies recreational vehicles cannot be on the site for more than 180 consecutive days, and be fully licensed and ready for highway use.

3. Discourage construction or reconstruction of residential structures in the floodway.

The 1994 CFHMP found that Lewis County and Chehalis ordinances do not specifically address it; Centralia's tightly restricts it. Under NFIP, development in the floodway should be prohibited or at least highly discouraged.

All three jurisdictions now prohibit new construction or reconstruction of residential structures (including manufactured homes) in special flood hazard areas with designated floodways with the same exceptions as allowed in 86.16.041 RCW. The exceptions in 86.16.041(2) RCW are used in Section 15.35.040 (25) LCC for Lewis County; Section 16.12.040 Centralia Muncipal Code (CMC) for Centralia; and Section 17.21.230 Chehalis Development Regulations (CDR) for Chehalis. Designated floodways are the regulatory floodways, which have been delineated on the flood insurance rate map or the flood boundary/floodway map as defined in Section 15.35.040(8) LCC for Lewis County; in Section 17.21.040 CDR for Chehalis; and Section 16.12.060 CMC for Centralia.

A distinction is made between two jurisdictions' ordinances for 'special flood hazard areas without designated floodways'. Lewis County in Section 15.35.310 LCC requires applicants to "utilize the best available information from a federal, state, or other source to consider the cumulative effect of existing, proposed, and anticipated future development and determine that the increase in the water surface elevation of the base flood will not be more than one foot at any point in the community. Building and development near streams without a designated floodway shall comply with the requirements of 44 Code of Federal Regulations 60.3(b)(3) and (4), and (c)(10) of the National Flood Insurance Program regulations." The City of Chehalis in Section 17.21.240 CDR uses similar wording to define special flood hazard areas without designated floodways.

Special Sections

The final set of differences between the three ordinances relates to special sections and provisions that are not included in all three ordinances. The first of these special sections is a wetlands management section, part of Centralia's ordinance. The focus of this wetlands section is on recognizing the function of wetlands in flood storage, and protecting wetlands that provide this important function. Lewis County and Chehalis should add such a section to their ordinances. This section will empower each jurisdiction to protect important wetlands and to obtain additional technical and financial assistance to identify and assess the role of the region's wetlands in flood hazard reduction.

The second, and very important, special section is one dealing with critical facilities. Lewis County's and Centralia's ordinances include a section on critical facilities in the "Specific Standards" for flood hazard protection. Critical facilities are those for which even a slight chance of flooding might be too great. These facilities include schools, nursing homes, hospitals, police, fire and emergency response installations, and installations which produce, use, or store hazardous materials or hazardous waste. This section of Lewis County's and Centralia's ordinances stipulate that "Critical facilities shall be, to the extent possible, located outside the limits of the base flood plain. . . Critical facilities constructed within the base flood plain shall have the lowest floor elevated to three feet or more above the level of the base flood elevation at the site. Flood-proofing and sealing measures must be taken to ensure that toxic substances will not be displaced by or

released into flood waters. Access routes elevated to or above the level of the base flood plain shall be provided to all critical facilities to the extent possible." This section is recommended for Chehalis' ordinance.

A consistent basis for the flood hazard regulatory programs in the Centralia/Chehalis region can be attained if each of the three jurisdictions modifies their respective flood hazard ordinances as recommended in this section. Actual implementation may vary a bit between jurisdictions, but the guidebook upon which the daily decisions are made will be consistent. This standardized regulatory framework will enhance the flood hazard reduction program in each jurisdiction.

UPDATE

Chehalis and Lewis County address wetlands in Chapter 17.24 CMC, and Chapter 17.35 LCC, respectively. These chapters outline the identification, mapping, regulations (of pertinent state and federal agencies), buffers, and mitigation for wetlands.

All three jurisdictions' ordinances have a section about critical facilities, which are identical in content. New construction is to be outside the 100-year floodplain, unless there no feasible alternative site is available. Lowest floor elevation is at three feet or more above the 100-year flood elevation. Floodproofing and sealing measures are required. Access routes to these critical facilities shall be elevated to or above the base flood elevations.

A consistent basis for the flood hazard regulatory programs in Lewis County can be attained if consistency is kept in the jurisdictions' (existing and potential CRS communities) flood hazard ordinances. Actual implementation may vary a bit between jurisdictions, but the guidebook upon which the daily decisions are made will be consistent. A standardized regulatory framework will enhance the flood hazard reduction program in each jurisdiction.

8.4.2 Flood Damage Prevention Ordinance Enhancements

This section provides a review of potential enhancements to the existing flood hazard ordinances. Since each of the governments has a flood hazard ordinance already, the goal of this assessment is to maximize the utility of the flood hazard ordinances without adding unnecessary complications to the administrative process.

8.4.2.1 FEMA Updates

The FIRMs are intended to show areas prone to flood damage. Every time a flood occurs, much discussion arises concerning the accuracy of the FIRM. Often areas shown on the FIRM to be outside the flood hazard areas are flooded. In the Centralia/Chehalis region, the most notable discrepancy is over flood levels for the Skookumchuck River. The COE and FEMA assign a different recurrence interval to the same flow on the Skookumchuck River. The January 1990 flood was a 100-year flood by FEMA's calculations, and a 45- to 50-year flood according to the COE calculations. According to the COE, the current levee system along the Skookumchuck River would be overtopped by a 100-year flood.

When a community believes that the FIRM is inaccurate, the following three basic solutions exist to obtain more accurate flood information:

1. Petition FEMA to restudy the area in question.

2. The community itself may commission (and pay for) a restudy. Once the restudy is completed, the results must be submitted to FEMA for review. If FEMA finds the study acceptable, they will revise the FIRM.

3. The community can adopt more stringent elevation requirements based on observed flood heights.

The first option, petitioning FEMA for a restudy, is the least expensive, but usually most time consuming solution. A simple request to the local FEMA office will establish a community on the priority list for restudy. FEMA funds the restudy, but usually a large time lag occurs between the request and actual completion of the restudy. The level of restudy also varies, with the following three general options available:

- A complete restudy is the most extensive modification.

- A "Limited Map Maintenance Program" is the second most detailed restudy approach. This option usually involves modeling a 7-mile section of river.

- A significantly less detailed approach is through a "Letter of Map Revision." This option allows the community to provide FEMA with data supporting modification to the FEMA map. FEMA will issue a letter that describes the changes and officially revises the effective map based on the data provided by the community. A simpler version of the "Letter of Map Revision" is called a "Letter of Map Amendment" which applies to individual or multiple lots. Most of the time, an individual homeowner will petition FEMA to have their home removed from the FEMA flood plain based on certified lowest floor elevations that are above the flood plain elevation. The changes are issued in a letter, which excludes the structure or parcel from the flood plain.

UPDATE

Copies of the approved Letters of Map Revisions (LOMR) and Letters of Map Amendments (LOMA) are kept at each jurisdictions' community development department.

The second option for obtaining more accurate FEMA maps is through a community-funded restudy. As with the FEMA-funded restudies, these analyses can cover all or part of the drainage basin. Funding may be available for such studies from programs such as FCAAP. The major drawback of restudies funded and conducted by the community itself is that the results of the study must be reviewed and approved by FEMA before a revised FIRM will be issued. The review process can be time-consuming, a drawback that limits the incentive for self-funded restudies.

The easiest method for Lewis County to acquire updated FEMA maps is through the "Letter of Map Revision" and "Letter of Map Amendment" process. Through this process, it is possible to obtain a more accurate FIRM simply by submitting data to FEMA substantiating higher flood levels. In the Centralia/Chehalis region, the COE Flood Warning Map discussed in Section 8.2.1 (Figure 8-1) may provide enough evidence to justify FIRM revisions. This map, shown in Figure 8-1 with the FEMA 100-year flood plain superimposed, shows that much of Centralia is not adequately protected under the current FIRM. Because the January 1990 flood, shown as Phase 3 on the map, was roughly equivalent to the 100-year flood (less on the Skookumchuck River), the FEMA flood plain should be equal to or outside the Phase 3 flood inundation everywhere. The "Letter of Map

Amendment" process can be initiated by submitting a request, along with the COE map, to the FEMA office in Bothell, Washington.

One major limitation of all the FEMA restudy options is that FEMA flood plain maps are developed for the present day conditions in the watershed. As a watershed continues to develop and more of the land is covered with impervious surfaces and storm drainage systems, the severity of flooding will increase, and the time lag between rainfall and flood will decrease, leaving less time for last-minute flood preparation. Since FEMA does not recognize a "future conditions floodway," the only solution to this problem is to restudy the area periodically when development conditions have changed substantially.

UPDATE

After the February 1996 flood, it was generally confirmed that the flood insurance rate maps developed by FEMA in 1981 needed to be updated. In 1997, the County developed a hydraulic (UNET) model of the Centralia-Chehalis valley in WRIA 23 after the February 1996 flood. With the assistance of state and federal agencies interested in the application of the model, the areal model simulation was expanded and updated with two-foot contour data.

In 2003, the County undertook a Cooperative Technical Partnership (CTP) agreement with FEMA to work on developing new and updated digital flood insurance rate maps (FIRM) and flood insurance studies (FIS) for the unincorporated areas of the county in WRIA 23. The completion date is pending the project status of the flood reduction project as summarized in the UPDATE in Section 7.1.3.1 to avoid the creation and adoption of two different sets of FIRMs.

8.4.2.2 Elevation Requirements beyond FEMA

Use of historical flood data to justify higher elevation requirements than specified on the FIRM is a good method for improving the flood hazard protection program without large cost to local government. If local information suggests that flood elevations are actually higher than those shown on the FIRM, the community may adopt the higher standards for their regulatory program. The local data may originate as historical observations, higher water marks, or photographs of past flooding. These higher standards will not affect insurance rate zones, but the higher standards will provide a higher level of flood protection to residents of the area.

In the Centralia/Chehalis region, the COE Flood Warning Map, discussed in Section 8.2.1, is an excellent source for historical flood elevation data. This map could be used to enhance the FIRMs. Since the comparison between the FEMA flood plain and the January 1990 flood (Figure 8-1) shows significant discrepancies, Lewis County, Centralia, and Chehalis are justified in requiring elevation to at least the flood heights shown on the COE map.

If the local governments do not choose to incorporate the COE Flood Warning Map into their flood programs as a basis for requiring higher elevations for structures, perhaps the map could be incorporated in the building permit process as an advisory. The position of the proposed structure within the flood warning map could be included as a caveat on the permit, with recommendation that the structure be elevated based on the elevation on the flood warning map rather than the elevation required under NFIP. This approach would make the higher level of flood protection voluntary.

8.4.2.3 Compensatory Storage

Adding the requirement for compensatory storage to the Flood Damage Prevention Ordinance is a method for reducing the effects of filling in the flood fringe. Whenever fill material is added to the flood fringe, the area that the fill occupies is removed from the potential flood storage area. Under compensatory storage requirements, an individual placing fill in the flood fringe must excavate an area of equivalent volume to eliminate the effects of the fill material on flood storage.

8.4.2.4 Implementation

The effectiveness of the flood hazard reduction program is determined by the implementation of the regulatory tools that exist. The Building Department in Lewis County, the Public Works Department in Centralia, and the Building and Planning Department in Chehalis are where the actual day-to-day decisions are made about how development applications are treated. These offices must be working under a clear mission to prevent future flood hazard problems.

A second important component of effective implementation of the flood hazard reduction programs in each jurisdiction is good communication and cooperation between governments. Historically, cooperation between governments has been good. The use of interlocal agreements that would formalize the roles and responsibilities of each of the three jurisdictions does not appear to be necessary. Continued cooperation using vehicles already in place, such as the Tri-Council, to address regionwide flood policies and issues is recommended. Also, officials responsible for the flood programs in each jurisdiction should meet regularly (monthly or quarterly) to discuss their respective flood programs and current issues. These forums for communication will assure that the continuity of programs recommended in Section 8.2.3.1 continues. Also, the jurisdictions could share resources for functions they all need, just as they currently share emergency response operations during floods. Lewis County and Chehalis currently both have flood prediction efforts which they have developed independently. Perhaps these efforts would advance more quickly if the governments approached them jointly.

The last component of implementation that this plan recommends is increasing the public disclosure for property in flood-prone areas. Buyers of land are often unaware of the flood plain status of the land they purchase. No county or state requirements currently exist for disclosure of this information. Construction in flood plains may result in human health and property damages to the purchaser of flood plain property as well as additional costs to the taxpayers of the county. The solution to this problem is to integrate notification of flood plain status and education on flood hazards with county regulatory processes for land developments, purchase, or sale. The statement, "This property is located within the FEMA-mapped flood plain and may be subject to flood damages" should be attached to future deeds of sale for property within FEMA-mapped flood plains. The same statement should be attached to the recorded plat map. This CFHMP should be made available to all potential buyers of property in flood plain subdivisions when requested. Additional mechanisms for hazard disclosure can be developed for implementation through the County Auditor and Assessor. These may include a statement of flood plain status of land with tax-notice mailings or a general mailing indicating flood plain status and availability of this CFHMP.

8.4.2.5 Critical Facilities

Provisions for critical facilities discussed above in Section 8.2.3.1 are a very important enhancement needed in Lewis County's flood program. While Lewis County's ordinance currently includes provisions for critical facilities, problems exist with the location of and access to several critical facilities in the county. Critical

facilities should be located outside the flood hazard zone, if at all possible. When a critical facility must be located in the flood hazard zone, it should be elevated to at least 3 feet above the elevation required for other structures (using the best available flood height data). Facilities that store hazardous materials must flood-proof and seal the storage areas to ensure that toxic substances are not displaced or released into floodwaters.

Access to critical facilities presents a special difficulty. Whether or not the critical facility is sited outside the flood hazard area, it must have access routes that are also dry during times of flood. The hospital in Lewis County is a good example of such a problem site. During the January 1990 flood, the hospital itself was above flood inundation. All roads to the hospital were under water, however, leaving helicopter transport the only way to reach the hospital. Subsequent to the 1990 floods, Lewis County has unsuccessfully attempted to acquire funds for an access route to the hospital that would be available during floods. Providing dry access to the hospital, along with all other existing critical facilities in the Centralia/Chehalis region, is a strong recommendation of this plan.

UPDATE

Local flood regulations among the three jurisdictions require the facility to be three feet or more above the 100-year flood elevation, and access roads at or above the 100-year flood elevation.

8.4.2.6 Community Rating System

The cost of federal flood insurance and the lack of knowledge about the federal flood insurance program may deter homeowners from purchasing flood insurance. In addition, the lack of public knowledge about flood hazards may result in a lack of appreciation for the magnitude of the flood threat and associated risks that individual property owners face, thereby limiting property owner involvement in the flood insurance program. The FEMA Community Rating System (CRS) program provides a reduction in flood insurance premiums for communities that initiate flood protection activities beyond the minimum NFIP requirements. Many of the activities that earn credit through the program (Table 8-5) involve public education about flood hazards, flood insurance, and flood protection. Many of the activities undertaken by the COE in the Centralia/Chehalis region should count for credit in the CRS program. The county should submit the required documentation to enter the CRS.

UPDATE

The National Flood Insurance Program (NFIP) provides federally backed flood insurance that encourages communities to enact and enforce floodplain regulations. To be covered by a flood insurance policy, a property must be in a community that participates in the NFIP. To qualify for the program, a community adopts and enforces a floodplain management ordinance to regulate development in flood hazard areas. The basic objective of the ordinance is to ensure that such development will not aggravate existing flooding conditions and that new buildings will be protected from flood damage.

Lewis County, Chehalis and Centralia participate in the NFIP. Under the Community Rating System (CRS), there is an incentive for communities to do more than just regulate construction of new buildings to minimum national standards. Under the CRS, flood insurance premiums are adjusted to reflect community activities that reduce flood damage to existing buildings, manage development in areas not mapped by the NFIP, protect new buildings beyond the minimum NFIP protection level, help insurance agents obtain flood data, and help people obtain flood insurance. The objective of the CRS is to reward communities that are doing more than meeting the minimum NFIP requirements to help their citizens prevent or reduce flood losses. The CRS also provides an incentive for communities to initiate new flood

protection activities. The goal of the CRS is to encourage, by the use of flood insurance premium adjustments, community and state activities beyond those required by the NFIP.

The CRS schedule describes the 18 floodplain management activities credited by CRS and the documentation required to receive credit for each activity. These activities are divided into four categories. The four categories and activities are listed below.

- **Public Information Activities (Series 300)**
  Elevation Certificates
  Map Information
  Outreach Projects
  Hazard Disclosure
  Flood Protection Information and Assistance

- **Mapping and Regulatory Activities (Series 400)**
  Additional Flood Data
  Open Space Preservation
  Higher Regulatory Standards
  Flood Data Maintenance
  Stormwater Management

- **Flood Damage Reduction Activities (Series 500)**
  Floodplain Management Planning
  Acquisition and Relocation
  Flood Protection and Drainage System Maintenance

- **Flood Damage Reduction Activities (Series 500)**
  Floodplain Management Planning
  Acquisition and Relocation
  Flood Protection and Drainage System Maintenance

- **Flood Preparedness Activities (Series 600)**
  Flood Warning Program
  Levee Safety and Dam Safety.

In January 1994, the City of Centralia, City of Chehalis and Lewis County applied to participate in the NFIP's CRS. The three agencies implement various flood hazard management activities and receive credits for these activities. In return, property owners located in the above jurisdictions receive a reduced flood insurance premium. These property owners receive the reduced flood insurance premium in recognition for the governmental agency's efforts to mitigate the effects of flooding in the above communities.

The three agencies entered the CRS with a rating of "10". For more information about the current rating of each jurisdiction, contact the jurisdiction's community development department or Building Official. Each point reduction results in a 5% reduction of the community flood insurance premiums, with a maximum cap at 45% reduction.

For more information, refer to the following:

- **"CRS 2002 Coordinator's Manual", FEMA, 2002.**

8.4.2.7 Variances

Rigorous administration of variances to the flood hazard ordinances would enhance the current NFIP. The intent of the NFIP is that variances should only be allowed in rare circumstances. Primarily, for residential structures, variances to elevation requirements should only be granted for existing residential areas with individual lots smaller than 1/2 acre in size. Variances should not be granted to expansions of subdivisions, homes on acreage outside the residential area, or for new subdivisions. Nonresidential structures should only be granted variances if the structure and outdoor operations are not vulnerable to flood damage.

UPDATE

All three jurisdictions' ordinances have the same criteria for variances. The recommended passage is now in all three ordinances. See the UPDATE in Section 8.4.1 about variances.

8.4.3 Surface Water Management Ordinance and Technical Manual

The previous section provided potential enhancements to existing flood hazard ordinances. This section takes a step further in recommending the adoption of a stormwater management ordinance and technical manual. Adopting a stormwater ordinance and technical manual will provide Lewis County with additional planning mechanisms necessary to control future development impacts on flooding and other resources.

Stormwater management concepts have generally focused on water quality while flood hazard management has focused on water quantity. Even though there are fundamental differences, the two are very interrelated. Solving a flood hazard problem may in effect improve water quality (e.g., preventing bank erosion). It is very important to consider all the impacts when performing flood hazard management. Effective stormwater management integrates both water quantity and water quality needs into local management programs.

Lewis County is not under any regulatory obligation to develop a stormwater program; however, this CFHMP recommends that the county begin a pro-active approach and adopt a stormwater ordinance and technical manual regulating the impact of new development on stormwater runoff. The stormwater ordinance and technical manual can be modeled after those currently being adopted by Puget Sound counties.

Cities and counties in the Puget Sound basin are adopting ordinances requiring stormwater controls for new development as part of the 1991 Puget Sound Water Quality Management Plan. The plan outlines the goals of a stormwater management program as:

- To control erosion and manage the quantity and quality of runoff from public and private activities
- To protect and enhance water quality, and achieve water quality and sediment quality standards
- To reduce the discharge of pollutants to the maximum extent practical
- To protect beneficial uses

- To achieve the items above in a manner that makes efficient use of limited resources to address the most critical problems first (PSWQA 1991)

Stormwater ordinances and a technical manual provide the minimum standards to achieve these goals. Stormwater ordinances address as a minimum: 1) the control of off-site water quality and quantity impacts; 2) the use of source control best management practices and treatment best management practices; 3) the effective treatment, using best management practices, of the storm size and frequency specified in the manual for proposed development; 4) the use of infiltration, with appropriate precautions, as the first consideration in stormwater management; 5) the protection of stream channels and wetlands; and 6) erosion and sedimentation control for new construction and re-development projects (PSWQA 1991).

A model ordinance has been developed by the Washington Department of Ecology (Ecology 1992). The model ordinance can be adopted by local governments as a stand-alone ordinance, or existing ordinances can be modified to reflect local programs and procedures. An example of a stormwater management ordinance developed for the City of Tukwila is attached in Appendix E.

Ecology has developed a technical guidance manual for use by local governments in stormwater planning. A local government may adopt Ecology's manual or develop its own. The manual defines minimum standards and provides guidance on how to prepare and implement local stormwater management programs. The technical manual includes:

- Best management practices for the control of erosion and sedimentation from construction sites, including standards for operations, maintenance, and inspection procedures.

- Hydrologic analysis procedures, including selection of design storms and estimation of runoff.

- Design, operation, and maintenance standards for public and private retention/detention facilities and conveyance systems. Emphasis is to be placed on systems which will maximize water quality benefits as well as water quantity control, such as the inclusion of biofiltration techniques where practicable.

- Techniques for the reduction of elimination of pollutants in runoff from problem land uses (PSWQA 1991).

UPDATE

Lewis County and the City of Chehalis adopted stormwater management ordinances in 1998 and 1992, respectively. Both jurisdictions use the most current Ecology "Stormwater Management Manual for Western Washington". Information about the County ordinance is in the UPDATE Section 5.4.1, and the Chehalis ordinance is in Section 5.4.3.3.

8.4.4 Recommendations

It is important that Lewis County make full use of its regulatory flood programs. The following recommendations will assist the county in increasing the level of flood protection.

8.4.4.1 Revise Ordinances for Consistency

Consistency of flood programs between Lewis County, Chehalis, and Centralia is important if the highest level of flood protection is to be achieved. Lewis County should work with Chehalis and Centralis to modify its flood damage prevention ordinances as described in Section 8.4.1 and summarized in Table 8-4.

UPDATE

All three jurisdictions have made changes within their local flood damage prevention ordinances. See UPDATE in Section 8.4.1.

8.4.4.2 Pursue Revision of FIRM

As described in Section 8.4.2.1, several options for revising FIRMs are available through FEMA. Because of the availability of the COE Flood Warning Map which documents actual flood elevations in the Centralia/Chehalis region, the "Letter of Map Revision" approach is the most desirable for Lewis County. Lewis County should submit a request for a "Letter of Map Revision," along with the COE map, to the FEMA office in Bothell, Washington. Based on the COE map, FEMA may issue a letter revising the FIRM in the Centralia/Chehalis vicinity to correspond to the inundation limits on the COE Flood Warning Map.

UPDATE

After the February 1996 flood, it was generally confirmed that the flood insurance rate maps developed by FEMA in 1981 needed to be updated. See the UPDATE in Section 8.4.2.1.

8.4.4.3 Update Local Flood Elevation Database

Whether or not Lewis County chooses to pursue a revision of the FIRMs, it is recommended that it begin a concerted effort to collect historical flood elevation data. The actual elevations and inundation limits for historical floods should be incorporated into Lewis County's regulatory program. Applicants for development should be required to elevate structures according to the historical flood information.

UPDATE

Since the 1996 flood, Lewis County and the Cities have been using and recommending documented water levels as the basis for new flood elevations.

8.4.4.4 Add Compensatory Storage Requirements to Flood Hazard Prevention Ordinance

This CFHMP recommends that Lewis County add a requirements for compensatory storage to its Flood Damage Prevention Ordinance. As discussed in Section 8.4.2.3, the requirement for compensatory storage will minimize the cumulative effect of fill in the flood fringe.

8.4.4.5 Establish Forum for Coordination between Flood Officials

Lewis County flood officials should work under a strong mandate to prevent flood risks to county residents to the fullest extent possible. A large part of the effectiveness of the program is good communication and coordination between Lewis County, Chehalis, and Centralia. The flood officials for each of these governments should establish a forum for regularly meeting to discuss flood issues and policies. The officials should attempt to combine efforts on flood projects whenever possible to maximize their limited financial and staff resources.

8.4.4.6 Increase Public Disclosure

Informing and educating residents about the flood hazard that exists are continuous and necessary activities. Notification of the flood plain status of property should be included in the county regulatory processes for land developments, purchase, or sale. The statement, "This property is located within the FEMA-mapped flood plain and may be subject to flood damages" should be attached to future deeds of sale for property within FEMA-mapped flood plains. The same statement should be attached to the recorded plat map.

Lewis County should also work to develop mechanisms for hazard disclosure to existing residents, such as a statement of flood plain status of land sent with tax-notice mailings.

UPDATE

Plat maps for land subdivisions show the FEMA flood boundaries and state a condition to comply with the County's flood damage prevention ordinance, Chapter 15.35 LCC.

8.4.4.7 Upgrade Critical Facilities

It is recommended that Lewis County document the existing condition (elevation, hazardous materials storage, and access) of all critical facilities in the Centralia/Chehalis region. Where deficiencies exist, the county should work to upgrade the condition of the facilities, just as it is currently doing for the hospital (see Section 8.7.1).

UPDATE

Upgrades have been made to existing facilities. See the UPDATE in Sections 8.4.2.5 and 8.7.

8.4.4.8 Pursue FEMA Community Rating System

The FEMA Community Rating System, described in Section 8.4.2.6, provides an opportunity to obtain lower flood insurance rates. Lewis County should apply to FEMA's Bothell, Washington, office for inclusion in the Community Rating System. Many of the flood warning and emergency response activities undertaken by the COE count toward credit in the Community Rating System. Reduced flood insurance rates would make flood insurance attractive to more residents in the Centralia/Chehalis area.

UPDATE

The County and Cities applied to participate in the NFIP's CRS in January 1994. See the UPDATE in Section 8.4.2.6.

8.4.4.9 Implement Rigorous Administration of Variances

Lewis County's Flood Damage Prevention Ordinance lays out the conditions under which variances may be granted. County officials should apply the variance criteria rigorously when making decisions on requests for variances. The intent of the NFIP is that variances should be granted infrequently.

UPDATE

The County and Cities use the same criteria for variances. The recommended criteria from the NFIP model ordinance is in the three local regulations. See the UPDATE in Sections 8.4.1 and 8.4.2.7.

8.4.4.10 Adopt Stormwater Management Ordinance and Technical Manual

As discussed in Section 8.4.3, Lewis County should adopt a stormwater management ordinance and supporting technical manual. Many of the localized flooding problems originate from stormwater runoff. A stormwater management ordinance will provide a mechanism to the County for more effective management of its stormwater.

UPDATE

Lewis County and the City of Chehalis adopted stormwater management ordinances in 1998 and 1992, respectively. Information about the County ordinance is in the UPDATE Section 5.4.1, and the Chehalis ordinance is in UPDATE Section 5.4.3.3.

8.5 Funding Options for Water Management

8.5.1 Introduction

Adequate financing is a major obstacle to implementation of comprehensive stormwater runoff and flood control programs in Lewis County. Traditional county sources of financing have not been sufficient to provide basin-wide planning, major drainage improvements, adequate maintenance of existing systems, and administration of regulations that control private sector activities which impact the systems. A critical question is what particular "mix" of financing options are best suited to meet the county's immediate short-term needs under existing legislation and local authority.

This section briefly defines the available funding options and discusses the various types of problems for which they can be used. Specific water management financing methods which might be used in Lewis County are also discussed. Based on funding and financing options available to the county, a recommendation is made for implementation of comprehensive flood control programs.

At the present time, the following sources of revenue are being used for constructing and maintaining drainage and flood control facilities in Lewis County:

- County road fund (road related drainage)
- River improvement fund (flood control maintenance)
- Flood control assistance account program (state grant for maintenance)
- Special districts

  -Diking districts
  -Drainage districts
  -Consolidated drainage districts
  -Drainage improvement districts
  -Flood control districts

- Developer fees and charges (plan review and inspection)
- Special appropriations (local, state, and federal resources for emergencies or special projects)

The county relies primarily on the road fund for drainage-related maintenance and repair and for matching river improvement funds. This source of revenue is for the most part limited to culvert replacement, capacity improvements, and repair of flood damage.

The respective special districts carry out their construction and maintenance programs using tax levies and assessments approved by their respective commissions or supervisors independent of the county. The county, however, does collect the taxes/assessments and make all distributions of funds as approved by the District Boards.

Two special districts are active in Lewis County and are described below.

Lewis County Flood Control District #1 (LCFCD#1)

LCFCD#1 was formed in 1991. The focus of the district in on a section of Dillenbaugh Creek between Bishop Road and Jackson Highway. Chehalis Industrial Park resides in the district and has been flooded historically. Flood waters overtop the banks of Dillenbaugh Creek and flow overland into the industrial park. The district is attempting to reduce these flood impacts.

The district was formed by the Chehalis Industrial Commission and the Port of Chehalis. The district includes 24 property owners. The district privately funded a Dillenbaugh Creek improvement project. The project involved widening the creek near the industrial area to increase the conveyance capacity. The project is approximately 1/3 complete. The district is attempting to find additional funding to complete the remaining 1,500 feet of creek enhancement.

Lewis County Flood Control District #2 (LCFCD#2)

LCFCD#2 was formed in 1991. The district boundaries are in the City of Centralia and unincorporated Lewis County between Interstate 5 and the Chehalis Western Railroad grade (Figure 8-6). The goal of LCFCD#2 is to reduce flood damage associated with flooding in Salzer Creek. The district includes 64 residences, a church, and a nursing home. The district will raise approximately $8,000 per year from a levy consisting of $2 per $1,000 assessed value and $10 per acre. The funding will be used to construct a levee near the south end of the district. The levee will inhibit flood waters from damaging properties within the district. The COE will perform a feasibility study and design the levy under the authority of Section 205 of the Flood Control Act. Section 205 requires the district to buy the land where the levee will be built. Additional funding is being sought for this land acquisition.

The current level of funding for flood control projects is not adequate to maintain, repair, and replace existing facilities, let alone fund construction of new facilities needed as a result of changing land use patterns brought about by growth and development. In the absence of adequate funding to deal with flooding issues on a county-wide basis and considering the limited resources, the county is currently restricted to functioning in a

"reactionary" mode, not in the "preventive" mode that is essential when dealing with such a critical public safety program as storm drainage and flood control.

UPDATE

See the UPDATE in Section 5.4.1.6.

8.5.2 Funding Alternatives

The State Legislature has authorized counties to use a variety of financing concepts for stormwater and flood control management. From a practical standpoint, however, financing water management must reflect the needs and attitudes unique to Lewis County. The funding alternatives identified in this section need to be evaluated for consistency with existing public policies. The public will better understand water management issues and the rationale underlying the funding recommendation if the alternatives are clearly in tune with existing local policies on land use, economic development, and environmental protection. Such existing policies should not, however, preclude opportunities to introduce new financing concepts or adjust existing policies. Funding alternatives are described below.

8.5.2.1 Flood Control Zone Districts

Flood control zone districts, which are authorized by RCW 86.15, may be established by either a petition signed by 25 percent of the voters in the proposed district, or by action of the County Commissioners. A flood control zone district is governed by a board of supervisors who are the County Commissioners. These districts have the authority to use several different funding mechanisms including a regular levy, an excess levy, a service charge, local improvement districts (LIDs), and bonds. Prior to establishment of a flood control zone district, any incorporated areas within the proposed district will have to be provided with the opportunity to be excluded.

- **Regular Levy**: A regular levy requires authorization by the supervisors. The maximum amount that can be levied is 50 cents per $1,000 of assessed valuation.

- **Excess Levy**: This property tax requiring annual voter approval does not fall under the constitutional and statutory limitations of regular levies. An excess levy is also based upon property value, and would not affect existing county revenues. The levy, if approved *annually* by the voters, could generate substantial revenue for the flood control drainage program. However, considerable cost would be involved in generating voter familiarity with the issues on an annual basis, and there would be no certainty of funds from year to year.

- **Service Charge**: A "service charge" is allowed under a flood control zone district approach in a manner similar to that of a storm drainage utility discussed later.

UPDATE

After the February 1996 flood, the Flood Action Council, a group of economic development, business activists and commercial interests, petitioned the Lewis County BOCC to establish a flood control zone district. A countywide Flood Control Zone District was formed in the spring of 1997, but the BOCC rejected a petition for a proposed flood control project. The proposed project after review and recommendations from many affected agencies evolved into the Centralia Flood Damage Reduction

Project now undertaken by the COE. As of now, there is no levy exacted upon residents in the countywide flood control zone district.

8.5.2.2 River Improvement Fund

The River Improvement Fund was created under the taxing authority established by RCW 86.12 and has been a good source of financing for flood control maintenance. Originally, the purpose of the fund was to finance drainage activities related to flood control, but it can and is being used to fund other activities related to flood or stormwater control as specified in RCW 86.12.020.

The River Improvement Fund is generated from a county-wide levy which has the authority to levy $0.25 per $1,000 assessed value (AV). The levy rate for the fund has to be consistent throughout the county, but the revenue appropriation can vary among basins. The funds can be used to share costs of water management activities with local governments and match the FCAAP program. The revenue for the River Improvement Fund comes from the county-wide property tax which is subject to statutory limitations on both the rate and amount. The fund levy itself is subject to two rate limitations. The River Improvement Fund levy rate cannot exceed $0.25 per $1,000 AV and any increases in the River Improvement Fund levee may not force the overall county assessment beyond statutory limits currently in place. As with the Current Expense Fund, there is little relationship between the need for drainage or water management and the amount of property tax paid by individuals and businesses.

8.5.2.3 Other Districts

Other districts are classified into drainage, diking, and irrigation districts; Drainage or Diking Improvement Districts (DID); Special Districts; and Local Improvement Districts (LID).

The districts are created by request of the people in the proposed district boundary and have a varying taxing authority. A district has three elected commissioners serving as a board with broad powers to construct and maintain drainage related facilities within the boundaries. The district can own land and improvements and functions as a municipal corporation with powers to bond and raise capital, usually requiring a vote of the property owners. The district can enter into agreements for services with other governmental agencies.

The DIDs are governed by a three-person Board of Supervisors, two of which are picked and the third is usually the County Engineer. An improvement district functions more closely as an extension of county government. However, the Board of Supervisors does have the ability to establish annual assessments and determine operating budgets that provide for both maintenance and construction programs. Special districts are usually governed by the Board of Commissioners. Local Improvement Districts (LIDs) or Road Improvement Districts (RIDs) are created by the County Commissioners for a specific purpose, usually following a petition or request from property owners desiring the new facility. Special assessments are imposed upon properties in the district using formulas allowed under state law. These special assessment districts are for construction purposes only and do not provide for maintenance. The normal life of an LID is 12 to 20 years, after which the bonds that finance the improvements are retired.

UPDATE

See the UPDATE in Section 5.4.1.6 about special districts.

8.5.2.4 County Revenues

There are a number of county funding sources that can be used in a discretionary manner to finance storm drainage and flood control activities.

Current Expense Fund

The Current Expense Fund provides the general revenue used for county operations and services. It is derived from a number of sources including property and sales taxes, fees, licenses, fines, investment interest, and contributions for services from other governments. Taxes are the most significant source of revenue for the Current Expense Fund. Of the amount contributed by taxes, property taxes provide the largest percentage of revenue. Taxes are levied upon all taxable real and personal property. Not all of the levy goes into the Current Expense Fund. Dedicated levy amounts are deposited in other funds such as the River Improvement Fund discussed earlier.

The property tax is based on the assessed value of property and the levy rate per $1,000 AV. The County Commissioners sets the levy rate, which is subject to two statutory restrictions. RCW 84.52.043 sets the maximum levy rate for the all-county levy at $1.80 per $1,000 AV. In addition, RCW 84.55.010 restricts the amount of taxes levied to 106 percent of the highest of the three prior years' levy amounts plus an additional amount derived from taxing the assessed valuation of new construction. This latter restriction, called the 106 percent lid, has historically held the maximum levy rate below the $1.80 per $1,000 AV level.

State law also provides full or partial exemptions to certain types of property and classes of ownership. Some non-profit organizations such as churches and government are totally exempt from property taxes, while partial exemptions are given to low income/senior and handicapped citizens. Also, farm, open space, and timber land is generally valued at less than fair market value.

Road Fund

The Road Fund is generated by a number of different sources including a road tax levy and gasoline sales tax. A portion of the Road Fund is used to pay for drainage activities associated with county roads. Like the General Expense tax levy, the road fund is limited to a maximum rate of $2.25 per $1,000 AV and restricted by the 106 percent lid.

Road funds cannot be "diverted" for non-road related activities without jeopardizing the county's eligibility for state financial programs including the Rural Arterial Program (RAP).

Real Estate Excise Tax

RCW 82.46 allows counties and cities to levy an excise tax equivalent to 0.25 percent of the State of Real Property. These funds are totally "discretionary" and in the case of some communities, are used primarily for water management. These funds are usually utilized for capital facilities with the logic being that growth and development creates problems and the revenue generated through the transaction of property reduces the burden on the general public to provide for these facilities.

Debt Financing

Debt financing is often used to fund drainage-related capital improvement project activities. The sale of bonds to fund future flood control or storm drainage needs is an option; however, the debt service on bonds would represent an ongoing requirement for funding from some source. Various options for debt financing include the following:

- **General Obligation (GO) Bonds** are bonds for which the full faith and credit of the issuing government are pledged. The bonds are secured by an unconditional pledge of the issuing government to levy unlimited taxes to retire the bonds. GO bonds may require voter approval and may create a need to raise taxes. Interest rates are generally the lowest available.

- **Revenue Bonds** are bonds whose principal and interest are payable exclusively from earnings of an Enterprise Fund and therefore are more equitable than GO bonds. There are generally higher interest costs. Bonds usually contain restricted operations and the market is not as broad as for GO bonds. Usually there is no need for a bond referendum and often limits are not subject to debt ceiling.

- **Bond Anticipation Notes** are short-term interest-bearing notes issued in anticipation of bonds to be issued at a later date. Anticipated notes increase the issuer's risk and assume that long-term rates will fall.

- **Industrial Development Bonds (IDB)** are bonds issued for private and quasi-public endeavors. They are secured by revenues of the bond-financed property and used by governments to provide lower cost financing to promote industrial and commercial development. The public purpose of some IDB issuances causes questions; IDB may crowd out other demands on the municipal market. They are restricted by the "1982 Tax Equity and Fiscal Responsibility Act."

- **Industrial Revenue Bonds** are bonds issued by the county, the proceeds of which are used to construct facilities for a private business enterprise. Lease payments made by the business enterprise to the government are used to service the bonds. They are usually in the form of GO or Revenue bonds. They provide low-cost financing and higher marketability due to yield.

8.5.2.5 Grants and Loans

Grants or loans are not readily available for water management projects. However, the following is a list of options that the county might consider applying for, depending on the nature of the project.

Flood Control Assistance Account Program (FCAAP)

This program has a maximum of $4 million per biennium. It provides for flood plain management programs for comprehensive flood management planning and maintenance of flood management facilities. This report serves as the Comprehensive Flood Control Management Plan for WAC 173-158-040 and provides for ongoing participation in FCAAP.

Public Works Trust Fund

This fund provides $3.5 million per project, or $3.5 million per jurisdiction annually, for repair, replacement, reconstruction, rehabilitation, or improving existing sanitary and storm sewer systems to serve an existing population to current standards. Loans are to benefit the existing population only. Funding for growth is not allowed.

Centennial Clean Water Fund

This fund is a state program to provide financial and technical help to meet state and federal requirements for water pollution control. Facilities, groundwater protection, nonpoints, fresh water and education projects are all allowed, if they are associated with water quality projects. The Department of Ecology approves plans and design before construction. At least 50 percent of local share must come from local sources or loans.

U.S. Department of Agriculture/Community Facilities Loan

This is a federal program to construct, enlarge, extend or otherwise improve community facilities providing essential services to rural residents. Funds may be for projects supporting overall community development such as fire and rescue services, transportation, traffic control, community, social, cultural health and recreational benefits, industrial park sites, access ways, and utilities extensions.

U.S. Department of Agriculture/Farmers Home Administration

Loan funds from this federal program may be used to help sponsor improvements for flood prevention, irrigation, drainage, water quality management, sedimentation control, and water storage.

U.S. Department of Agriculture/Soil Conservation Service

A federal loan program for technical and financial assistance in planning and implementing improvements to protect, develop, and utilize the land and water resources in smaller watersheds.

8.5.2.6 Surface Water Management Utility Service Charge

The statutory authority for a surface water utility service charge is contained in RCW 36.89 and RCW 36.94. The authority may be implemented by passage of an enabling ordinance and a rate ordinance by the County Board of Commissioners. The rate ordinance must set forth the rate structure and the area to be covered. The area can either be all of the county or a portion of it. Significantly, all or a portion of the incorporated areas could be included without the consent of the local legislative bodies. A service charge system requires a billing system and a database on impervious surfaces, or other means of establishing the rates. The generally accepted methods of determining a surface water service charge or rate are described below.

Amount of Impervious Surface

Rates under this approach are set in direct proportion to the measured, estimated, or assumed extent of impervious area for each parcel of land. Impervious surface is that land occupied by building footprints, pavement, or other nonpermeable surfaces.

Density of Development

Under this approach, rates are determined by a runoff coefficient which is deemed to be appropriate for the type of land and the nature of the improvements on each parcel.

Flat Fee

This mechanism utilizes a constant or uniform fee for each property within pre-existing classes or can be applied on a community-wide basis.

A service charge for water management reflects a rationale that those who contribute runoff to the water system should pay in relation to the amount of runoff conveyed by the systems and facilities operated by the water management entity. Typically, an equivalent service unit represents the average amount of impervious surface on a single family residential lot. This average or equivalent service unit (ESU) is the basis for non-single family rates as illustrated in the following example:

Property =	Convenience store with 11,800 square feet of impervious surface
ESU =	The average amount of impervious surface on a single family residential property or 2,950 square feet
Rate/ESU (example only) =	$3.50
Calculation =	$\frac{\text{11,800 sq. feet of impervious surface}}{\text{2,950 sq. feet}} = 4$ ESUs
Monthly Service Charge (example only)	4 ESUs x $3.50 = $14.00 per month

A service charge allows for stable, dedicated funding that meets long-term needs. It may be supplemented by other funding mechanisms as needed. The revenue raised through a service charge may be used for basin planning, capital construction and maintenance, and for joint projects with cities, since they likewise can impose service charges.

The charge is based on contribution to drainage problems or benefits from their remediation. Public entities such as schools, churches, and state agencies, while exempted from property tax levies, may pay under the service charge concept for their contribution to drainage problems. Adoption of a service charge would not negatively impact other county revenues. The surface water drainage concept is currently used in Clark, Snohomish, Kitsap, King, Whatcom, and Thurston Counties. There are several court cases upholding the county's authority to create a surface water utility (see Teter vs. Clark County, Appendix F).

The application of the above funding options to the typical storm drainage and flood control problems in Lewis County are illustrated by the matrix in Table 8-6.

8.5.3 Funding Analysis

As noted in the introduction to this section, funding is perhaps the most critical element of a successful flood control and stormwater management program. Prior to initiating action for funding, a general policy or set of guidelines needs to be adopted that defines the position of the Board of Commissioners. This policy can be utilized to develop evaluation criteria to select the best means of generating revenue and subsequently implementing a county-wide program.

The following is a sample funding policy statement:

- Funding for flood control and storm drainage should be on a fair and equitable basis.

- The source of revenue should be continuous over an extended period of time rather than a "short-term," one-time effort.

- The funding established should be flexible to allow for multiple use based upon current and future needs.

- There should be ongoing public input relative to the prioritization of projects and programs funded.

- Local revenue should be applied to match state and federal funds wherever applicable.

- As a general policy, all drainage revenues in the county should be expended in a cooperative and coordinated manner with other agencies to maximize the benefit to the public.

- There should be ongoing reporting of the use of available funds to assure the public that such funds have been utilized to their maximum in a cost-effective manner and to the fullest extent possible.

- Boundaries of existing agencies/institutions/organization, such as drainage and diking districts, should be evaluated and boundary adjustments made to assure coordination is accomplished on a "basin" concept and funding by each entity allocated to the extent that is appropriate and possible.

- Where agencies or organizations exist and are doing an "acceptable" job, those agencies and organizations should continue to manage the funding and maintenance of drainage systems within their respective areas of responsibility (jurisdiction) within the framework of a county-wide plan/program and coordination.

- The county should continue to rely on the road fund for drainage maintenance and improvements associated with road right-of-way and drainage problems impacted by runoff from streets, roads, and highways.

Based upon the above policy, the criteria listed below have been developed to evaluate which of the previously identified funding sources might best meet the needs of Lewis County for both ongoing operations and maintenance as well as for capital improvements:

- Perceived equality
- Implementation cost and ease
- Workability, ease of administration
- Revenue capacity
- Consistency with local program needs
- Accountability
- Timing requirements
- Ongoing costs
- Potential side benefits
- Consistency with other policies
- Flexibility
- Applicability to entire service area
- Watershed differences
- Effectiveness of desired incentives
- Community understanding and level of acceptance.

Tables 8-7 and 8-8 summarize the evaluation process for both capital improvement and maintenance funding.

8.5.4 Conclusions

The best source of revenue for basin planning, capital construction, and maintenance is a utility service charge combined with current funding sources. In addition, the best source of revenue for large projects and major capital improvements would be the use of GO bonds in conjunction with grants/loans.

The existing sources of revenue for storm drainage and flood control are not adequate to meet the needs. Lewis County could pursue the above options to increase the revenue base and meet short-term needs, while continuing to work toward establishing a (funding) mix that will provide a stable, "dedicated" base to meet long-term needs.

8.5.5 Recommendations

Our recommendation is that Lewis County adopt the following short-term course of action:

1. Adopt a Funding Policy.

2. Adopt a "Resolution of Intent" to create a county-wide surface water management utility (see Appendix G).

3. Following public input, prepare an ordinance creating a county-wide surface water management utility (see Appendix H).

4. Based on a cost-of-service analysis and identification of specific drainage basins, establish a rate ordinance for each respective basin. As outlined earlier, this could be achieved as follows:

    a. County-wide charge of $0.50 to $1.00 per parcel to cover planning, regulatory, administration (implemented immediately).

b. Basin-specific service charge of $2.00 to $4.00 per residential parcel based upon the amount of equivalent impervious surface a parcel has (implemented following cost analysis).

c. Basin or subbasin service charge of varying amount per parcel to construct specific capital improvements (implemented following development of basin plan and capital improvement program).

5. Implement the rate ordinance using either a specific customer account system or using the County Assessor's property ownership file.

8.6 Basin Planning

Basin planning is a key component in reducing long term flood hazards. In the past, Lewis County has faced funding obstacles that limited their ability to enact an effective basin planning policy. Developing a funding source, as described in Section 8.5, would enable Lewis County to provide basin-wide planning.

This section recommends the use of a basin planning approach to guide Lewis County in reducing long term flood hazards and costs. To successfully control existing and future flood hazards, an effective basin planning infrastructure should be developed. This CFHMP has concluded that a nonstructural approach to flood management is the most appropriate for Lewis County at this time. Dedicated funding, a stormwater ordinance, and a basin planning policy form a nonstructural arrangement which will direct future flood plain and watershed activities. This arrangement will allow the effects of development to be investigated and their impacts mitigated before they create additional flood hazards.

River basins are complex, interdependent systems. Flow, topography, geology, water quality, and habitat are all interrelated. Changes impacting one part of the system can result in impacts throughout. For example, urbanization within a river basin can increase flood flows; confining flood flows with a levee may increase downstream erosion; increased erosion impacts fish resources, which in turn may impact recreational resources. Due to the interactions, a comprehensive understanding of the entire watershed is needed to effectively evaluate flood control measures or any land use changes.

Basin planning involves the following tasks:

1. Definition of overall goals and objectives for the basin planning program.

2. A basin inventory to characterize existing and future conditions and problems--information should be obtained on water quality, flooding, habitat, current and future land use, biological conditions, and beneficial uses.

3. Prioritizing river basins based on identified problems and specific criteria developed by the county with public involvement.

4. A determination of the causes of the identified problems.

5. An evaluation of alternative approaches to solve existing and anticipated problems including financing, maintenance, and design.

6. A selection of appropriate solutions which meet goals and objectives--this should include standards, physical improvements, financing, organizational structure, and maintenance procedures.

7. Implementation of the basin action plan as developed in Tasks 1 through 6.

Basin planning is a public process. Opportunities must be made for citizen involvement so that specific interests are addressed. Optimally, the basin plan will provide the guidance required to limit impacts of existing and changing land uses.

Dillenbaugh Creek basin can be used to illustrate the need for basin planning. The basin is typical of many areas around the county near urban areas. The basin is experiencing development and various land use changes which will impact flooding, water quality, wetlands, and habitat. Basin planning can be applied to investigate and mitigate impacts before they occur. Increased public interest in the basin has been displayed with the formation of Lewis County Flood Control District #1.

Dillenbaugh Creek drainage encompasses approximately 12 square miles (Figure 8-7). The upland area above Jackson Highway continues to undergo residential development. The new Chehalis Industrial Park is expanding between Jackson Highway and Bishop Road. Downstream, wetlands extend from the industrial park to Interstate 5. The rate of urbanization in this basin suggests that regulatory measures are needed to protect the existing water resources and limit impacts on flooding. It is important to recognize that the cumulative effect of increases in stormwater runoff is an increase in flood flows further downstream.

If no action is taken, it is anticipated that the following changes will occur:

- Flows will increase due to impervious area created from development.
- Instream erosion will increase.
- Fish and wildlife habitat will be lost.
- Vegetation will disappear due to clearing.
- Water quality problems will become more prevalent.

Initiating a basin planning policy could mitigate these impacts. Presumably, Lewis County would prefer Dillenbaugh Creek to provide adequate drainage to reduce flood hazards and allow further development without inhibiting water quality, recreational use opportunities, and environmental features such as vegetation, fish, and wildlife habitat. The basin planning process would identify existing and future problems, determine the causes, identify corrective alternatives (nonstructural or CIPs), evaluate each alternative based on a developed criterion, and recommend a preferred action. The result is a basin-wide action plan that provides local government with a planning document to guide further land use changes.

8.7 Specific Flood Problem Areas

In addition to the long-term recommendations of this CFHMP for developing a comprehensive approach to flood hazard management in the county, there are specific problem areas that require more immediate attention to reduce flood hazards. Specific flood problem areas exist at the hospital, along I-5, along the Skookumchuck River, at both the Centralia and Chehalis wastewater treatment plants, and at the county fairgrounds (Figures 8-8

and 8-9). Except for the fairgrounds, action is already underway to eliminate the flood hazards at these locations. This CFHMP supports these activities as being critical to the success of flood hazard management in the county.

8.7.1 Hospital Access

A recommendation of this CFHMP is to provide dry land access to all critical facilities in Lewis County. It is very important to maintain access to such facilities during severe flooding situations. If possible, critical facilities should be located outside the flood hazard zone. If a critical facility is located in a flood hazard zone, the facility and access roads should be elevated to at least 3 feet above the elevation required for other structures based on the best available flood height data.

During the January 1990 flood, the hospital, located on Cooks Hill Road in Centralia, was inaccessible by land due to flood waters inundating access roads. In an attempt to fund hospital access improvements, the county placed a bond issue on the ballot to form the Fords Prairie Transportation Benefits District (FPTBD). FPTBD would provide funding for the design and construction of a new hospital access road and bridge. In addition, FPTBD would make funding available for other road projects in the district. Formation of the district required 60 percent voter approval. The general and primary elections resulted in 55 percent and 59 percent voter approval, respectively. The election displayed voter interest; however, the 60 percent voter approval requirement was not met. This prompted the county to pursue alternative funding sources. The county successfully passed a real estate excise tax on the sale of property (1/4 of 1 percent). This made the county eligible for federal and state Public Works Trust Fund grants. The county applied and obtained two trust fund grants, a $1 million Intermodal Surface Transportation Efficiency Act (ISTEA) federal grant, and a $5 million State Transportation Improvement Board grant. A portion of the funding will be used to pay for hospital access improvements.

Currently, the county is in the process of selecting a consultant to prepare an environmental impact statement (EIS) for the hospital access project. It is anticipated the EIS will begin later this year. It is projected that the EIS and pre-design will be completed in 1994. Construction is tentatively scheduled to begin in 1995. The location of the hospital access road and bridge improvements are displayed in Figure 8-9.

UPDATE

Local flood regulations among the three jurisdictions require the facility to be three feet or more above the 100-year flood elevation, and access roads at or above the 100-year flood elevation.

Lewis County retained a consultant to prepare an EIS for the hospital access project, which was completed in 1994. The project did not receive adequate voter approval in 1995, and the project status currently is inactive.

8.7.2 I-5

Interstate 5 is the primary thoroughfare running north/south through Centralia and Chehalis. During the 1990 floods, I-5 became impassable due to flood waters over the roadway. This caused substantial traffic delays and limited access to flood-damaged areas.

The Washington Department of Transportation (WDOT) is currently evaluating modifications to 36 miles of I-5 in this area. The project was initiated by traffic capacity concerns; however, flooding impacts are to be considered. The road improvements being evaluated are:

- Widening the roadway to six lanes from Barnes Road Interchange near the Toutle River to Airdustrial Interchange in Tumwater

- Adding new interchanges or partial interchanges at LaBree Road (north of Chehalis), Hobson Road (north of Centralia), and a location 1 to 2 miles north of Reynold Avenue (north of Centralia).

- Elevating the interstate grade from the Mellen Street interchange in Chehalis to the National Avenue interchange in Centralia.

An EIS has been initiated for this project. EIS scoping was held during August 1992. During the scoping, flood hazards were raised as a public concern. In response to public concern, WDOT is evaluating a 6-foot grade elevation increase from Mellen Street to National Avenue. The elevation increase was based on preliminary review of existing data and discussion with the COE. This will be used for the purposes of the EIS.

This CFHMP recommends a detailed hydrologic and hydraulic analysis be performed as part of the preliminary and final design of the I-5 project. Road grade elevations have been estimated, but further hydrologic and hydraulic analysis is needed to determine an appropriate road elevation to meet Federal Highway Administration/WDOT standards. Due to the critical importance of I-5 to land transportation during extreme floods in the Centralia/Chehalis area, it is recommended that this section of I-5 be elevated to a finished road grade above the 100-year flood level.

UPDATE

During the 1990 and 1996 floods, I-5 became impassable due to floodwaters over the roadway, so flooding impacts are to be considered in the WSDOT project. While planning I-5 through the Centralia-Chehalis floodplain, it was necessary to raise the roadway at flood prone areas (up to 12 feet in some places) to meet federal standards.

The 1994 CFHMP recommended a detailed hydrologic and hydraulic analysis be performed as part of the preliminary and final design of the I-5 project. As part of the design analysis, the County initiated a detailed hydrologic and hydraulic analysis using the UNET model. The model used flood flow data from the 1996 flood. The results of this analysis are also applied toward new FIRM products as described in UPDATE Section 8.4.2.1.

With support from several federal and state agencies, a proposal was made to investigate and develop a comprehensive flood hazard management project to provide flood relief for the community and for the I-5 project. The COE led the effort to investigate and develop a comprehensive approach project. Together with the local stakeholders (Lewis County, City of Centralia, City of Chehalis, Thurston County, Mason County), the COE identified three potential flood reduction measures in their EIS. See UPDATE in Section 7.1.3.1 for more information about the COE project.

8.7.3 Wastewater Treatment Plants

Historically, Centralia and Chehalis wastewater treatment plants have been impacted by flooding. During the 1990 floods, the wastewater treatment facilities were required to discontinue operations. Water surface elevations rose to levels which inundated trickling filters and pumps. (Lehman 1993; Farrel 1993). As a result,

the treatment facilities became overloaded or pumps were damaged, causing temporary shutdowns. Three flood-related shutdowns have occurred at the Chehalis wastewater treatment plant and one at the Centralia wastewater treatment facility.

The City of Centralia took corrective measures to decrease further flood damage. Using FEMA mitigation funding, four improvements were made to the Centralia facility (Lehman 1993). The improvements include: 1) raising filter effluent pumps, 2) installation of a flood gate on the outfall, 3) installation of manhole inflow protectors, and 4) raising outlying pump station control panels. Operating personnel claim the modifications will allow continued primary and disinfection treatment during flood events similar to those encountered in 1990. If future shutdowns occur, it is likely to be due to power outages at outlying pump stations.

The City of Chehalis has not made any plant modifications following the 1990 floods. No modifications are expected until the facility receives its new NPDES discharge permit, currently being reauthorized. It is anticipated that future effluent limitations may require changes to the plant operations. Any capital improvements are expected to be directed toward achieving permit requirements. Currently, under a consent decree, the City of Chehalis is involved in a program to attain compliance with its NPDES permit. The program involves the rehabilitation of the wastewater collection system to ensure: 1) there are no raw sewage overflows or bypasses, 2) the plant routinely and consistently meets the effluent concentration limits in their permit, 3) all flows in excess of 4 MGD receive at least primary treatment with minimum effluent concentrations, and 4) excessive infiltration and inflow are removed. An engineering report was performed which inventoried the collection system and prioritized areas having the greatest inflow and infiltration. Recommendations were made to replace or modify specific sewer lines. The conveyance system modifications are currently taking place and are required to be completed by 1998.

It is recommended that further flood damage reduction measures be considered at Chehalis/Centralia treatment facilities. These measures include:

- Install dedicated power supplies at critical pump stations. Dedicated power will allow continued operation of treatment facilities during power outages caused by flooding or other natural emergencies.

- Integrate flood reduction measures into any future plant modifications that may take place as a result of new effluent limitations. All new plant systems should be located well above historical flood levels.

- Perform an engineering and economic evaluation of raising the walls of the trickling filters above historical flood elevations. Increasing the wall elevation would inhibit future shutdowns during flooding conditions.

- Perform a long-term feasibility study of constructing a regional wastewater treatment facility. The current plant locations make it very costly to limit severe flood impacts. It is possible that relocating, and constructing one regional facility may be the best alternative. This alternative may provide the only cost-effective solution which will address flooding as well as probable plant modifications required to reach new effluent limitations.

UPDATE

Construction is underway for a new Centralia wastewater treatment plant (WWTP) located on Goodrich Road west of Harrison Avenue. Sewage from the existing WWTP at Mellen Street will be conveyed to the new facility. WWTP operations are anticipated to be completely on line in 2004.

Chehalis purchased the Hamilton Meadows Farm in unincorporated Lewis County located two miles west of Chehalis and on the north side of State Route 6. A new WWTP will be constructed to replace the existing WWTP near Louisiana Avenue, and piping has been constructed from the WWTP to the new fields. During low flow periods when discharge into the Chehalis River is not permitted, treated effluent will be piped and sprayed onto the new cultivated tree fields.

Several floodplain management measures were used in the design and construction of both WWTP projects. Properties for both of these WWTP facilities were formerly ranches in the Chehalis River floodplain. The Centralia WWTP is situated along the edge of the floodplain, and elevated using material from the project site, thus utilizing the concept of compensatory storage. The cultivated tree farm for the Chehalis WWTP kept the agricultural land use of the floodplain, and also used the concept of compensatory storage by using material from the project site to construct field berms.

8.7.4 Skookumchuck Levee

Much of the Skookumchuck River is leveed near the city of Centralia. The Skookumchuck levee extends along the left bank (southern side) of the Skookumchuck River from below the confluence of Hanaford Creek to G Street in Centralia (Figure 8-9). The riverbank levee was originally built in 1934 and infrequent maintenance has allowed the levee to deteriorate. Inspections have shown that the levee does not meet minimum COE standards. In 1991 and 1992, the City of Centralia rebuilt an 800 foot section of the levee. The rebuilt levee elevation was extended to 1.5 feet above the 1990 flood levels. There is interest in performing further maintenance along other sections of the levee. The county has placed high priority on further Skookumchuck levee improvements.

The county has submitted, in coordination with the City of Centralia, an FCAAP grant application to obtain $200,000 in funding (Calkins 1993). If the grant is received and 50 percent matching funds can be obtained, the Skookumchuck levee will be rebuilt from Pearl Street to G Street. This CFHMP plan supports this levee improvement project and recommends the county and City of Centralia develop a financial plan to supply matching funds. It is anticipated that creative financial planning will be required given the funding history of past capital improvement projects. Without a clear source of matching funds, it is possible the FCAAP grant would have to be denied.

UPDATE

The levee currently meets minimum COE standards. There is interest by Centralia to maintain other sections of the levee.

The Skookumchuck levee was rebuilt from the Burlington-Northern Railroad, at its intersection with the old Union Pacific Railroad (UPRR) right-of-way, near Meridian Avenue and Prospect Avenue to G Street in 1997 after portions of the old UPRR grade was overtopped in the 1996 flood. The levee (approximately 1400 feet in length) was rebuilt to the present alignment and height.

8.7.5 County Fairgrounds

Southwest Washington County Fairgrounds is located in southern Centralia along Salzer Creek (Figure 8-9). Flooding in the lower Salzer Creek basin causes damage within the fairgrounds, City of Centralia, City of Chehalis, and unincorporated Lewis County. Flooding occurs from high flows in the Chehalis River that back water up Salzer Creek or from high flows in Salzer Creek itself. During a flood event, backwater from the Chehalis River becomes trapped upstream from the I-5 roadway and Burlington Northern railroad embankments.

Following the November 1986 flood, a dike on the north side of Salzer Creek was built to protect the fairgrounds. However, during the January 1990 flood, the fairgrounds again experienced flooding. Overbank flow from upper Salzer Creek entered the fairgrounds and had no outlet due to the newly constructed dike. The flood waters accumulated to a depth of approximately 8 feet.

To reduce further flooding, the COE determined that the most feasible flood reduction alternative would be a closure structure and small levee across Salzer Creek in the vicinity of I-5 to prevent backwater flooding from the Chehalis River, and a pump station to convey ponded Salzer Creek water across the closure structure. Additional features of the plan would include improvements to the Salzer Creek channel upstream of the closure structure, improvement of the existing levee which protects the Centralia-Chehalis Airport, and retention of wetlands within the Salzer Creek basin. The project would protect not only improvements along Salzer Creek, but also a portion of I-5 and the Centralia-Chehalis Airport. In April 1993, affected property owners in the Salzer Creek basin did not approve the formation of a special district to fund this project. Therefore, the Salzer Creek levee and pump station are no longer being considered. The defeat of this project makes the fairgrounds a continued flood hazard concern.

Based on past local support, it is unlikely that alternative structural flood reduction measures will be accepted in the near future. While the County Fairgrounds is a flooding concern, structural flood control measures to protect just the fairgrounds would be inconsistent in the absence of structural measures to protect residential and commercial property. Without citizen support for structural controls, the fairgrounds and surrounding areas will continue to be flooded in the future. Therefore it is recommended the County proceed with a nonstructural approach. A flood audit should be performed at each of the critical structures in this flood hazard area. Based on the flood audit, flood-proofing techniques should be implemented to limit flood damage. Each critical facility should be evaluated for the applicability of elevation, relocation, floodwall construction, or closures and sealant flood-proofing applications.

UPDATE

Some floodproofing measures have been implemented at the Southwest Washington Fairgrounds. Buildings were evaluated for the applicability of elevation, relocation, floodwall construction, or closures, and sealant flood-proofing applications. The fairgrounds administrative office has been elevated.

8.7.6 Bank Protection

The dynamic nature of rivers is manifested by the continual migration of the river channel. As a river changes its course, erosional forces act on the river bank. Within developed areas, bank erosion can result in property damage if corrective action is not taken. Lewis County currently maintains various bank protection areas

throughout the county. It is anticipated that further river channel encroachment will impact the developed areas of the Chehalis Valley. Bank erosion and abrupt channel changes are not readily predictable; therefore, these problems must be dealt with as they arise. The bank erosion problems can be addressed through specific bank stabilization projects, designed on a case-by-case basis.

This section provides a description of bank protection techniques available to Lewis County. It is recommended that the county use this information in evaluating bank erosion problems as they arise and as funding becomes available for corrective action. The information is also recommended as educational material for private land owners addressing flood hazard issues.

Bank protection is achieved by placing man-made or natural materials along the shoreline to stabilize and reinforce existing bank materials. A complete inventory of existing bank conditions should be conducted and causes of bank deterioration should be understood prior to implementing corrective measures. The various alternatives can be categorized according to their objectives: control of river alignment, protection of banks and in-stream structures, development of adequate conveyance capacity, flood plain protection, and streambed control. Each of the categories is briefly described below and fact sheets are included in Appendix I.

Alignment Control

Alignment control alternatives are designed to direct flow along a course that accommodates discharge without flooding or eroding banks and adjacent properties, but also allows the channel to develop according to geomorphologic processes. Alignment control alternatives include:

- Spur dikes
- Flow realignment
- Vane dikes
- Cutoff channels

Bank Protection/In-Stream Structure Protection

Bank protection measures are designed to produce a stable, durable streambank that can withstand floodwaters up to the predicted 100-year flood flow. Bank protection alternatives include:

- Re-establishing riparian vegetation (bioengineering)
- Cabling trees
- Constructing approach dikes
- Installing gabions
- Fencing
- Constructing windrow revetment
- Reducing bank slope
- Constructing standard trench fill revetment (riprap).

Conveyance Capacity

Conveyance capacity is the amount of discharge that can occur in a river before water spills over the bank and floods adjacent areas. It is determined by such factors as channel bed slope, cross-sectional area, and channel

roughness. Increasing the first two variables or decreasing the last variable increases conveyance capacity. Conveyance capacity alternatives include the following:

- Gravel bar scalping
- Construction of an overflow channel
- Use of an off-stream infiltration/detention basin
- Vegetation and debris removal
- Channel widening or deepening
- Use of tributary stream/storm sewer detention basins

Flood Plain Protection

The objective of flood plain protection alternatives is to protect property, structures, and occupants in the 100-year flood plain. Protection from inundation, floating debris, sediments, and the force of water flowing in the flood plain may be achieved through the following alternatives:

- Setback levees
- Low dikes (flood plain levees)
- Ring levees
- Cutoff levees
- Flood-proofing of structures

Streambed Control

Streambed controls are targeted at controlling bed slope, bed elevation, and water surface elevations and preventing streambed degradation and upstream headcutting. This is accomplished by dissipation of river energy that would otherwise alter the characteristics of the channel bed. The following are streambed control alternatives:

- Stabilizers
- Drop structures

The fact sheets in Appendix J describe each of the above alternatives' purpose, construction, and operation. Sketches are included to illustrate each alternative. Considerations relating to implementation, environmental impacts, and maintenance activities are also outlined.

UPDATE

There are a number of bank stabilization techniques. The applicability of each technique depends on the site conditions, conditions of the waterbody upstream and downstream of the site, risk of site damage, and habitat conditions at the site and in the reaches. At this time, WDFW's "Integrated Streambank Protection Guidelines" is the most complete reference for ESA compatible measures. These measures can also be accessed through WDFW's website at www.wa.gov/wdfw/hab/salguide/ispgdoc.htm.

As an effort to sustain a balance between healthy habitats and public safety, any in-stream work must meet WAC 173-145 and local regulatory requirements. During emergencies, specific mitigations are

coordinated between Lewis County and the federal/state permitting agencies to promptly execute emergency measures. See the ESA UPDATE after Section 5.2.3.4 and UPDATE in Section 5.3.4.

UPDATE

TABLE 8-1R. CITY OF CHEHALIS MONITORING STATIONS

STATION NAME	LOCATION
Interstate Avenue	West of I-5, south of motel
Stand Hedwall Park	West of I-5, north of Rice Rd
Riverside Drive	West of Riverside, north of Dillenbaugh Creek
Louisiana Avenue	West of Louisiana, south of Shoreline Dr
Florida Avenue	SW corner of Florida & Airport Rd
Coal Creek	West of National & north of Coal Creek
Salzer Creek	South of Exhibitor Rd & north of Salzer Creek

TABLE 8-2R. STRUCTURES ELEVATED AND REMOVED BY JURISDICTIONS

Jurisdiction	# of Elevations	# of Removals	Total
Lewis County	23	5	28
Centralia	150	7	157
Chehalis	3	15	18

9.0 ENVIRONMENTAL ASSESSMENT

9.1 Introduction

This CFHMP has been prepared following Chapter 173-145 of the Washington Administrative Code (WAC) and the document Comprehensive Planning for Flood Hazard Management presented by the Washington Department of Ecology (1991). A portion of the WAC describes the necessary environmental review associated with any recommended instream flood control work (WAC 173-145-040 3). The WAC is specific in its direction to identify and consider the potential impacts of instream flood control work on the following instream uses and resources: fish resources; wildlife resources; scenic, aesthetic, and historic resources; navigation; water quality; hydrology; and existing resources.

The goal of this CFHMP is to identify the necessary steps for the local government to organize an effective approach to correcting the flood problems in the County. As described in Section 8.1, the focus of this CFHMP is on nonstructural flood hazard management measures. The nonstructural measures are directed toward policy and procedural flood control solutions, which require no instream modifications and therefore have minimal, if any, environmental impacts. For completeness, each recommended flood control measure (structural and nonstructural) is evaluated for potential environmental impacts in the following section.

9.2 Alternative Assessment

9.2.1 Flood Warning and Emergency Response

Communication during a flood event is extremely important in preventing the loss of life and property. This recommendation does not involve any substantial work in or adjacent to water. The specific items recommended for flood warning and emergency response include:

1. Installation of additional river gauges
2. Interlocal flood forecasting coordination
3. Increased distribution of flood information materials
4. Formalizing and updating a road closure database
5. Establishment of a public disclosure ordinance
6. Updating Flood Insurance Rate Maps (FIRMS)

These activities will not impact the environmental elements identified in the WAC.

9.2.2 Flood-Proofing

Flood-proofing has been considered in the context of what features area residents and commercial building owners can add to their property to reduce the impact of floods. Although these activities are not instream flood control measures, they have been presented for discussion and justification. Flood-proofing options available to property owners include:

1. Structure elevation
2. Floodwalls and levees

3. Closures and sealants
4. Sandbag dikes

Structure Elevation

Raising structures to an elevation above the flood hazard does not pose any environmental impacts.

Floodwalls and Levees

Floodwalls are commonly applied to homes or specific structures and are typically constructed around the property to be protected by floods. They are usually limited in overall scope. Levees are larger structures often constructed of earth and may surround larger areas targeted for protection. In the context of this environmental assessment, floodwalls and levees pose no significant threat to the environmental elements evaluated. However, it must be noted that the cumulative affect of widespread levee application may cause an impact to the hydrology of the affected rivers or creeks. Widespread construction of levees may also create a cumulative change to the scenic and aesthetic resources.

Closures and Sealants

Closures and sealants are applications directly placed on homes or other structures. These options for property owners pose no environmental threat to the elements evaluated in this assessment.

Sandbag Dikes

Sandbag dikes are also applications directly placed on or adjacent to the home or structure. This option poses no environmental threat to the elements evaluated in this assessment.

9.2.3 Ordinance Interpretation

Three items have been identified as recommendations for consideration by Lewis County regarding ordinances: consistency, enhancement, and innovation. None of these items constitute an impact to the environmental elements of this assessment.

9.2.4 Funding Options

The establishment of a surface water utility, as recommended in this CFHMP, will not impact the environmental elements of this assessment.

9.2.5 Basin Planning

Implementing a basin planning policy in Lewis County will direct future flood plain and watershed activities. Integrated in this approach is a planning mechanism for evaluating and mitigating environmental impacts of watershed activities. Basin planning development, as recommended in this CFHMP, does not pose any environmental concerns.

9.2.6 Specified Flood Hazard Areas

This CFHMP recognized a few specific flood hazard areas in the Chehalis Valley. These are:

1. Hospital
2. I-5
3. Wastewater treatment plants (WTPs)
4. Skookumchuck River levee
5. County fairgrounds
6. Bank protection areas

Hospital

At the present time, the County is pursuing the development of an access road and bridge for the hospital. This road would provide dry land access to the hospital during flooding. This project is in the scoping phase, which will be followed by a project specific environmental impact statement (EIS).

UPDATE

Lewis County retained a consultant to prepare an EIS, which was completed in 1994. The project did not receive adequate voter approval in 1995. The status is currently inactive.

I-5

The Washington Department of Transportation (WDOT) is also in the process of expanding Interstate 5 in the project vicinity. Currently, WDOT is developing a draft EIS to evaluate the impacts of widening the interstate, constructing additional interchanges, and elevating the highway near the Centralia/Chehalis area for flood impact reduction.

UPDATE

The Final EIS for the I-5 widening project is pending. Construction for a four-mile segment from Exit 72 to Exit 76 is scheduled in 2007.

Wastewater Treatment Plants

It is expected that impacts associated with recommended and future WTP modifications will be minor and will result in improved water quality.

UPDATE

Environmental impacts associated with the WWTP improvements are addressed in their respective Environmental Impact Studies. The Final EIS for the Centralia WWTP was issued in December 1999, and for the Chehalis WWTP in January 2003. See the UPDATE in Section 8.7.3.

Skookumchuck River Levee

Improvements to the Skookumchuck River levee will be confined to discrete areas of damage from previous floods. This work will create minor and short-term impacts to aquatic resources. Construction will be limited to the appropriate timing associated with fish migration and spawning in accordance with the Washington

Hydraulics Code, which is administered by the Washington Department of Fisheries (WDF). No significant environmental impacts are expected to result from this alternative.
UPDATE

County Fairgrounds

Recommendations for the County Fairground area involve a flood audit and flood-proofing. As described in Section 9.2.2, flood-proofing techniques have minimal environmental impacts; however, cumulative effects of widespread floodwall and levee construction my impact the hydrology of the affected rivers or creeks.

Bank Protection

Bank protection, as an alternative, involves stabilization of specific locations along rivers and creeks in the flood zone that are experiencing erosion. Where possible, the proposed method of bank stabilization is to employ bioengineering applications. A variety of bioengineering applications is presented in the appendix of this report. However, there are certain sites within the flood zone where bioengineering is not appropriate and rock (riprap) armoring is the preferred method of bank stabilization.

Fish Resources

Bioengineering methods for bank stabilization typically involve the establishment of a more diverse riparian zone along the affected river bank (Finnigan et al. 1980, Adams and Whyte 1991). Bank vegetation provides for stable shorelines and habitat for fish. River bank areas that are stabilized by enhanced vegetation will result in a net benefit to the environmental conditions of the river (Beschta 1991, Sedell and Beschta 1991). The greatest impact to fish resources will be at those areas which receive riprap as the stabilization technique. Rock armoring typically does not accommodate the establishment of a riparian zone on the bank of the river or stream. The use of rock armor must be weighed in the context of the existing impacts caused by frequent flooding. These impacts include: increased sedimentation, bank scour, loss of localized instream habitat, and water quality degradation. Use of riprap for bank stabilization should be minimized to the extent possible. All bank stabilization construction activities should follow sound engineering design and regulatory review.

Wildlife Resources

As proposed, bank stabilization will not pose a significant threat or impact to wildlife resources. Rock armor is recommended for only those sites where no other practical option is available. These sites correspond closely to areas of the river that have existing riprap applications or are so severely degraded by flood impacts that habitat is currently compromised.

Scenic, Aesthetic, and Historic Resources

Impacts to the scenic, aesthetic, and historical resources will be confined to those areas that receive riprap armor (Adams and Whyte 1990). Bank stabilization applications involving bioengineering techniques will result in a natural appearance with enhanced habitat functions and value.

Navigation

Navigation will not be impacted by bank stabilization applications.

Water Quality

Short-term water quality reductions may be experienced during the construction of bank stabilization projects. Bank areas to receive stabilization must be prepared for construction activities and may result in the short-term exposure of soils to erosion.

Hydrology

Hydrology will not be impacted by bank stabilization applications.

Existing Recreation

Existing recreation will not be impacted by bank stabilization applications.

UPDATE

WDFW's "Integrated Streambank Protection Guidelines" is the most current, complete reference for ESA compatible measures. Any in-stream work must meet WAC 173-145 and local regulatory requirements. A State Hydraulic Permit Approval (HPA) is required for any in-stream work. Refer to the new ESA UPDATE after Section 5.2.3.4, and UPDATE in Sections 5.3.4.

APPENDIX K – LIST OF ABBREVIATIONS

ACCESS	**A Centralized Computerized Enforcement Service System**
BOCC	**Board of County Commissioners**
CDR	**Chehalis Development Regulations**
CEMP	**Comprehensive Emergency Management Plan**
CFHMP	**Comprehensive Flood Hazard Management Plan**
CMC	**Centralia Municipal Code**
CMZ	**Channel Migration Zone**
COE	**U.S. Army Corps of Engineers**
CRS	**Community Rating System**
CTP	**Cooperative Technical Partnership**
DEM	**(Lewis County) Division of Emergency Management**
EAS	**Emergency Alert System**
Ecology	**Washington State Dept of Ecology**
EIS	**Environmental Impact Statement**
ESA	**Endangered Species Act**
FAC	**Flood Action Council**
FEMA	**Federal Emergency Management Agency**
FHZ	**Flood Hazard Zone**
GIS	**Geograhical Information System**
GMA	**Growth Management Act**
HPA	**Hydraulic Permit Approval**
JARPA	**Joint Aquatic Resources Permit Application**
LAMIRD	**Limited Area of More Intense Rural Development**
LCC	**Lewis County Code**
LCFCD	**Lewis County Flood Control District**

LOMA	**Letter of Map Amendment**
LOMR	**Letter of Map Revision**
MOU	**Memorandum of Understanding**
MPA	**Migration Potential Area**
NAWAS	**National Warning System**
NGVD	**National Geodetic Vertical Datum**
NFIP	**National Flood Insurance Program**
NOAA	**National Oceanic Atmospheric Agency**
NWI	**National Wetlands Inventory**
NWS	**National Weather Service**
PED	**Preconstruction Engineering and Design**
PHA	**Probable Hazard Area**
RCW	**Revised Code of Washington**
SMP	**Shoreline Master Program**
UBC	**Uniform Building Code**
UGA	**Urban Growth Area**
WAC	**Washington Administrative Code**
WDFW	**Washington State Dept of Fish and Wildlife**
WMA	**Watershed Management Act**
WRIA	**Watershed Resource Inventory Area**
WSDOT	**Washington State Dept of Transportation**
WWTP	**Waste Water Treatment Plant**

APPENDIX L - LIST OF IMPLEMENTED ACTIONS

This appendix summarizes actions undertaken by Lewis County (County), City of Chehalis (Chehalis), and City of Centralia (Centralia) for flood hazard management since adoption of the "Lewis County Comprehensive Flood Hazard Management Plan (CFHMP)" in 1994.

This tabulation primarily addresses the recommended actions identified in the 1994 CFHMP, and may not be inclusive of all actions implemented by the three jurisdictions. A complete, full revision of the CFHMP is planned in the next two years to include actions not identified in 1994 CFHMP process.

For more details of the actions, please refer to the narrative in the appropriate updated sections of the CFHMP.

CFHMP SECTION	DATE	ACTION
5.4.1.2	2000	County amends 17.25 LCC
5.4.1.3	July 1999	Chehalis Comprehensive Plan adopted
5.4.1.3	November 1998	Centralia Comprehensive Plan adopted
5.4.1.3	June 1, 1999	Lewis County Comprehensive Plan adopted
5.4.1.6	November 23, 1998	County adopts fill & grade, 15.05 LCC
5.4.1.6	November 23, 1998	County adopts stormwater management, 15.45 LCC
8.1	August 28, 1999	Centralia adopts Lewis County CFHMP
8.1	1997	County develops hydraulic computer model of Chehalis River basin in Centralia-Chehalis area
8.2.1.4	2002	County Emergency Mgmt implements revised flood warning and emergency response procedures
8.2.2.1	1997-98	County installs 5 gaging stations in WRIA 23
8.2.2.1	1997-98	County completes response capabilities of Newaukum gage near Chehalis
8.2.2.1	1997	All river gages in the county are linked to Internet and County WEB site
8.2.2.2	1998	Chehalis establishes a certified benchmark for each of their 7 monitoring stations of the Chehalis River
8.2.2.3	1998	County posts information on river and road conditions reports, event bulletins, and road closures on County WEB site
8.2.2.4	Annually	See response to 8.2.1.4
8.2.2.5	1997	1981 FEMA maps need to be updated
8.2.2.5	2000	County requires plat maps show FEMA flood boundaries and state condition to comply with 15.35 LCC
8.2.2.5	Annually	Annual report of activities to CRS
8.3.3.1	Annually	County & Cities distribute flood proofing references and fact sheets of flood proofing techniques
8.3.3.2	1995	County & Cities acquire COE flood audit computer program
8.3.3.3	1998	County signs off on 17 home elevations in Galvin

CFHMP SECTION	DATE	ACTION
8.4.1	1995	County & Cities amend flood prevention ordinances to have regulations consistent with 86.16.041 RCW and NFIP model ordinance
8.4.2.1	1999	LOMR & LOMA are kept at each jurisdictions' community development departments
8.4.2.1	1997	County develops a hydraulic model of the Centralia-Chehalis valley in WRIA 23
8.4.2.1	2003	County signs a Cooperative Technical Partnership (CTP) with FEMA to develop new and update digital FIRM
8.4.2.5	1995	County & Cities require critical facilities to be 3 ft or more above 100-yr flood elevation, and roads to be at/above 100-yr flood elevation
8.4.2.6	January 1994	County & Cities applied to participate in NFIP's CRS
8.4.2.7	1995	County & Cities use the same criteria for variances in their flood hazard prevention regulations
8.4.3	1992	Chehalis adopts stormwater management ordinance
8.4.3	November 23, 1998	County adopts stormwater management, 15.45 LCC
8.4.4.1	1995	Revised ordinances for consistency. Refer to Section 8.4.1
8.4.4.2	2003	Pursue revision of FEMA. Refer to Section 8.4.2.1
8.4.4.3	>February 1996	County & Cities have been using documented water levels from Feb 96 flood as basis for new flood elevations
8.4.4.6	2000	County requires plat maps to disclose flood boundaries and state conditions of development. Refer to 8.2.2.5
8.4.4.7	1995	Refer to Section 8.4.2.5 for upgrading critical facilities
8.4.4.8	Completed	Pursue FEMA CRS. Refer to Section 8.4.2.1
8.4.4.9	Completed	Implemented rigorous administration of variances. Refer to Section 8.4.2.7
8.4.4.10	Completed	Adopted stormwater mangagement ordinances. Refer to Section 8.4.3
8.7.1	Inactive	Hospital access project in Centralia did not receive adequate voter approval in 1995
8.7.2	>1997	Detailed hydrologic & hydraulic analysis as part of preliminary design of I-5 project
8.7.3	2004	Centralia builds new WWTP to be on line in 2004
8.7.3	2003	Chehalis builds cultivated tree fields to receive treated effluent from proposed WWTP
8.7.4	1997	Centralia rebuilds Skookumchuck levee. Levee meets minimum COE standards
8.7.5	1996	Administrative office of the Southwest Washington Fairgrounds is elevated
8.7.6	2002	County uses bank stabilization techniques per State Dept of Fish & Wildlife's "Integrated Streambank Protection Guidelines"