Thurston County
FLOOD HAZARD MITIGATION PLAN

FINAL

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

WHY PLAN FOR FLOODING?

Recent floods have shown that Thurston County needs to address floods on a countywide basis. The floods of 2007 – 2009, cost county residents in excess of $10 million in uninsured property losses. Even though drainage basin plans and flood plans have been adopted for some watersheds, these plans do not cover all unincorporated areas. Additionally, as a participant in the federal Community Rating System (CRS), Thurston County can use this plan as key step toward significant reductions in flood insurance premiums. Thurston County can become one of the top-rated CRS counties in the nation with completion of this plan.

WHAT IS A FLOOD HAZARD MITIGATION PLAN?

Mitigation is defined as "sustained action taken to reduce or eliminate long-term risk to life and property" It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards on a defined planning area. The responsibility for hazard mitigation lies with many, including private property owners, business, industry, and local, state and federal government. Recognizing that there is no one solution for mitigating flood hazards, planning provides a mechanism to identify the best alternatives within the capabilities of a jurisdiction. A flood hazard mitigation plan achieves the following in order to set the course for reducing the risk associated with flooding:

- Ensuring that all possible activities are reviewed and implemented so that local problems are addressed by the most appropriate and efficient solutions.
- Ensuring that activities are coordinated with each other and with other community goals and activities, preventing conflicts and reducing the cost of implementing each individual activity.
- Coordinating local activities with federal, state and regional programs.
- Educating residents on the hazards, loss reduction measures, and natural and beneficial functions of their floodplains.
- Building public and political support for mitigation projects.
- Fulfilling planning requirements for obtaining state or federal assistance.
- Facilitating the implementation of floodplain management and mitigation activities through an action plan that has specific tasks, staff assignments and deadlines.

The Thurston County Flood Hazard Mitigation Plan identifies 32 mitigation initiatives, chosen through a facilitated process that focused on meeting these objectives.

PLAN DEVELOPMENT METHODOLOGY

Development of the Thurston County Flood Hazard mitigation Plan included five phases:

- **Phase 1, Organize and review**—A 12-member steering committee was assembled to oversee the development of the plan, consisting of County staff, citizens and other stakeholders in the planning area. A planning team consisting of key County staff as well as a technical consultant was assembled to provide technical support to the Steering Committee. Full coordination with other county, state and federal agencies involved in flood hazard mitigation occurred from the onset of this plan's development through its completion. A

multi-media public involvement strategy centered on a hazard preparedness questionnaire was implemented. A comprehensive review of existing plans and programs was performed that can support flood hazard mitigation. A key function of the Steering Committee was to identify guiding principles, goals and objectives for this plan. One of the principle objectives identified under this phase was to develop a plan that could easily integrate into the *Natural Hazards Mitigation Plan for the Thurston Region*.

- **Phase 2, Update the risk assessment**—Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury and property damage resulting from natural hazards. This process assesses the vulnerability of people, buildings and infrastructure to natural hazards. It focuses on the following parameters:
  - Hazard identification and profiling
  - The impact of hazards on physical, social and economic assets
  - Vulnerability identification
  - Estimates of the cost of damage or cost that can be avoided through mitigation.

  The flood hazard risk assessment for this mitigation plan meets the requirements outlined in Chapter 44 of the Code of Federal Regulations as well as the CRS requirements for assessment of the flood hazard. Phase 2 occurred simultaneously with Phase 1, with the two efforts using information generated by one another to create the best possible risk assessment.
- **Phase 3, Engage the public**—Under this phase, the Steering Committee developed a public involvement strategy to maximize the capabilities of the County. This strategy was implemented by the planning team and included two public meetings early in the plan update process, a public meeting to review the draft plan, a hazard mitigation survey, a County-sponsored website dedicated to the plan, and multiple media releases. This strategy was deemed by the Steering Committee as a key element in the success of this planning effort.
- **Phase 4, Assemble the updated plan**—The Planning Team and Steering Committee assembled key information from Phases 1 and 2 into a document to meet the CRS requirements. Under the CRS, a floodplain management plan must include the following:
  - A description of the planning process
  - A risk assessment
  - A mitigation strategy including goals, a review of alternatives and a prioritized action plan
  - A plan maintenance section
  - Documentation of adoption.
- **Phase 5, Plan adoption**—Upon completion of Phase 4, a pre-adoption review draft of the plan will be sent to the Insurance Services Office (ISO), FEMA's CRS contractor, for review and comment. Once pre-adoption approval has been granted by ISO, the final adoption phase will begin. This plan includes a plan implementation and maintenance section that details the formal process for ensuring that the plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the plan's progress annually and producing a plan revision every 5 years. This phase includes strategies for continued public involvement and incorporation of the recommendations of this plan into other planning mechanisms of the County, such as the comprehensive plan, capital improvement plan, and the *Natural Hazards Mitigation Plan for the Thurston Region*.

MITIGATION GUIDING PRINCIPLE, GOALS AND OBJECTIVES

Through a facilitated process, the Steering Committee identified a set of guiding principles, goals and objectives. These planning components all directly support one another. Goals were selected that meet multiple guiding principles; objectives were identified that fulfill multiple goals, and mitigation initiatives were identified that achieve multiple objectives. The planning components are as follows:

- Guiding Principles
    1. Provide a methodical approach to flood hazard planning that can integrate with other planning mechanisms that enhance or support floodplain management.
    2. Enhance the public's awareness and understanding of the flood hazard.
    3. Create a decision-making tool for policy and decision makers.
    4. Promote compliance with state and federal program requirements.
    5. Ensure inter-jurisdictional coordination on all floodplain management activities.
- Goals
    1. Foster all sectors of the community working together to create a flood-hazard-resilient community.
    2. Ensure that local and state government entities have the capabilities to develop, implement and maintain effective floodplain management programs in the Thurston region.
    3. Ensure that the communities in the Thurston region collectively maintain the capacity to initiate and sustain emergency operations during and after a flood disaster.
    4. Ensure that local government operations are not significantly disrupted by flood hazard events.
    5. Reduce the vulnerability to flood hazards in order to protect the life, health, safety and welfare of the community's residents and visitors.
    6. Reduce the adverse impact on critical facilities and infrastructure from flood hazard events within the Thurston region.
    7. Increase public awareness of vulnerability to flood hazards and preparation for floods.
    8. Maintain, enhance, and restore the natural environment's capacity to deal with the impacts of flood hazard events.
- Objectives
    1. Eliminate or minimize disruption of local government operations caused by flood hazard events.
    2. Maintain a regionally coordinated warning and emergency response program that can detect the flood threat and provide timely warning.
    3. Utilizing best available data and science, continually improve understanding of the location and potential impacts of flood hazards, the vulnerability of building types and community development patterns, and the measures needed to protect life safety.
    4. Continually provide state, county and local agencies with updated information about flood hazards, vulnerabilities and mitigation initiatives.

5. Establish partnerships among all levels of government and the business community to improve and implement regionally consistent floodplain management practices (such as prevention, property protection, public education and awareness, natural resource protection, emergency services, and capital improvements).
6. Develop or improve early warning emergency response systems and evacuation procedures for flood hazard events.
7. Work to lower emergency service response times, including through improvement to transportation facilities.
8. Consider the impacts of flood hazards in all planning processes that address current and future land uses within the planning area.
9. Evaluate the risks to public safety and existing development (e.g., critical facilities, infrastructure, and structures) in flood hazard areas.
10. Sponsor and support public outreach and education activities to improve awareness of flood hazards, and recommend roles that property owners can take to prepare, respond, recover and protect themselves from the impacts of these events.
11. Consider the impacts that future development will have on the environment's capacity to withstand the impacts of flood events and the opportunities this development may create for environmental restoration.

MITIGATION INITIATIVES

The flood hazard mitigation action plan is a key element of this plan. It is through the implementation of the action plan that Thurston County can strive to become flood disaster-resilient through sustainable hazard mitigation. The action plan includes an assessment of the capabilities of the County to implement hazard mitigation initiatives, a review of alternatives, a prioritization schedule, and a mitigation strategy matrix that identifies the following:

- Description of the action
- Objectives addressed
- Lead implementation agency (or agencies)
- Estimated benefits
- Estimated costs
- Timeline for implementation
- Funding sources
- Prioritization

For the purposes of this document, mitigation initiatives are defined as activities designed to reduce or eliminate losses resulting from the impacts of flooding.

Although one of the driving influences for preparing this plan was CRS, this plan does not focus solely on CRS credits. It was important to the County and the Steering Committee to examine initiatives that would work through all phases of emergency management. Some of the initiatives outlined in this plan fall outside CRS credit criteria, and CRS creditability was not the focus of their selection. Rather, the focus was on the initiatives' effectiveness in achieving the goals of the plan and whether they are within the County's capabilities. Table ES-1 presents a summary of the hazard mitigation initiatives identified by this plan update. Detailed descriptions for these initiatives can be found in Chapter 9.

TABLE ES-1.
SUMMARY OF HAZARD MITIGATION INITIATIVES

Initiative #	Description	Priority
FMI-1	Identify properties that are potential candidates for elevation, relocation or buyout based on an evaluation of flood risks, project feasibility, and planned flood risk reduction capital projects. A list of targeted high-priority acquisitions should be prepared and annually updated. An example of a high-priority project would be a property identified by FEMA as a repetitive loss property. Once the list is established, pursue funding opportunities to implement the projects.	Medium
FMI-2	Using the best available data on flood risk, conduct outreach to property owners to alert them to the risks and ways to deal with them, to inform them about potential opportunities to mitigate the risks, and to assess their interest in participation should funding be available. Property owners who are interested in participating in one of these programs should be informed that having flood insurance might help qualify them for funding assistance.	High
FMI-3	Continue a conservative approach to woody debris management and maintenance, using state- or County-established best management practices.	High
FMI-4	Continue to maintain compliance and good standing with the programmatic requirements of the National Flood Insurance Program.	High
FMI-5	Strive to maintain Thurston County's Community Rating System classification of no higher than Class 5, as a primary measure of successful flood risk reduction.	High
FMI-6	Expand multi-jurisdictional and multi-stakeholder coordination efforts and seek inter-local agreements or other contractual relationships in support of achieving long-term comprehensive flood risk reduction solutions, potentially in conjunction with salmon recovery efforts and regional flood risk reduction efforts.	High
FMI-7	Undertake a feasibility study on the formation of a countywide flood control zone district. This study should focus on the following: • What are the capital costs of flood risk reduction projects within the county? • What would be the costs to the constituents of Thurston County to implement a flood control zone district? • How would this affect other Thurston County programs? • What would be the benefit to the constituents of Thurston County? • Recommendations for structure and organization of the district.	Medium
FMI-8	Analyze the findings of the flood control zone district feasibility report and determine if its recommendations should be adopted. Create a prioritized list of flood risk reduction projects and programs throughout the county that could be funded under this mechanism.	Medium
FMI-9	Invest in flood prediction and forecast modeling to support all facets of the Thurston County floodplain management program, including but not limited to flood hazard identification, flood threat recognition in support of flood notification programs, climate change adaptation, and risk assessment.	High
FMI-10	Complete an inventory of all publicly maintained stormwater facilities.	High
FMI-11	Create an inventory and establish a priority list for culvert replacement that takes into account fish passage, flood depth reduction and future losses avoided.	High
FMI-12	Utilizing the best available data, science and technology, enhance the existing flood notification program, striving to identify a notification protocol within systems that have real-time flood threat recognition capability.	High

TABLE ES-1.
SUMMARY OF HAZARD MITIGATION INITIATIVES

Initiative #	Description	Priority
FMI-13	Update the County emergency response plan to reflect any changes to flood notification protocol within the county.	High
FMI-14	Utilizing the best available data, science and technology, maintain and enhance as data becomes available the Level 2, user-defined HAZUS-MH model that was constructed to support this planning effort.	High
FMI-15	Develop a post-flood disaster action plan that establishes protocols for the County such as substantial damage determination, the recording of perishable data (such as high water marks), grant support, staffing, continuity of operations, and recovery.	Medium
FMI-16	Perform a comprehensive assessment of floodplain restoration, reconnection and enhancement of floodplain storage opportunities in the county.	Medium
FMI-17	Work with the County departments responsible for implementation and maintenance of the County's capital improvements programs to identify flood hazard mitigation projects that are eligible for hazard mitigation grants. Once projects are identified, pursue grant funding for those projects shown to be cost-effective.	High
FMI-18	Collaborate with Pierce County and Tacoma Power to identify appropriate operational procedures of Alder Lake Dam that will minimize the flood risk on the Nisqually River.	High
FMI-19	Continue to develop and implement an annual public outreach strategy that seeks to leverage public information resources and capabilities within the county.	High
FMI-20	Continue to pursue/ maintain Thurston County floodplain management program compliance with the National Marine Fisheries Service biological opinion regarding the National Flood Insurance Program.	High
FMI-21	Establish a link between the Thurston County Flood Hazard Mitigation Plan and the Natural Hazards Mitigation Plan for the Thurston Region. The Flood Hazard Mitigation Plan will become the flood hazard component of the Natural Hazards Mitigation Plan upon its next update. All future updates to the two plans will occur on the same planning cycle upon plan integration.	High
FMI-22	Obtain digital data and create GIS maps of the flood inundation from possible failures of the Skookumchuck Dam on the Skookumchuck River and the Alder and LaGrande Dams on the Nisqually River. Using this data, assess the risk associated with these facilities utilizing the best available date and science.	High
FMI-23	Develop evacuation plans for communities and residents downstream from the Nisqually and Skookumchuck River dams.	High
FMI-24	Draft a prioritized list of road segments and bridges that should be elevated above the 100-year floodplain and culverts that will fail under flood flow. Upgrade these structures if state or federal funds become available.	High
FMI-25	Develop a southeast flood detour plan for the Thurston County Comprehensive Emergency Management Plan.	High
FMI-26	Map the channel migration zones for all rivers in the region and the extent of high quality riparian habitat.	Medium

TABLE ES-1.
SUMMARY OF HAZARD MITIGATION INITIATIVES

Initiative #	Description	Priority
FMI-27	To support initiative # FMI-1, undertake a study of identified repetitive flood loss areas to determine the following: • Repetitive losses not captured by flood insurance data • Causes of the repetitive flooding • Assets impacted by the repetitive flooding (this would include assets such as livestock, out-buildings and rescue costs not already identified by FEMA) • Possible alternatives to remediate the repetitive flooding	Medium
FMI-28	Revise shoreline regulations to encourage shoreline protective structures to be bioengineered.	High
FMI-29	Review the recommendations of adopted stormwater drainage basin plans to determine which ones are still relevant for implementation.	High
FMI-30	Prepare new drainage basin plans for the high groundwater areas.	High
FMI-31	To support implementation of the Thurston County Critical Areas Ordinance, encourage research that establishes best management practices for bioengineering and other techniques that provide streambank protection and improve fisheries through the use of large woody debris. Support local demonstration projects that could support such research.	Medium
FMI-32	Where feasible, consider the adoption of appropriate higher regulatory standards (including but not limited to freeboard, comp storage, lower substantial damage thresholds, setbacks and fill restrictions) as means to reduce future flood risk and support a no-adverse-impact philosophy of floodplain management.	Medium

IMPLEMENTATION

Full implementation of the recommendations of this plan will require time and resources. This plan reflects an adaptive management approach in that specific recommendations and plan review protocols are provided to evaluate changes in vulnerability and action plan prioritization after the plan is adopted. The true measure of the plan's success will be its ability to adapt to the ever-changing climate of hazard mitigation.

Funding resources are always evolving, as are programs based on state or federal mandates. Thurston County has a long-standing tradition of progressive, proactive response to issues that may impact its citizens. This tradition is reflected in the development of this plan. The Thurston County Board of Commissioners will assume responsibility for adopting the recommendations of this plan and committing County resources toward its implementation. The County's track record in floodplain management is commendable. Its well-established programs and policies have maintained the flood risk at a steady level without increase. The framework established by this plan will help maintain this tradition in that it identifies a strategy that maximizes the potential for implementation based on available and potential resources. It commits the County to pursue initiatives when the benefits of a project exceed its costs. Most important, the County developed this plan with extensive public input. These techniques will set the stage for successful implementation of the recommendations in this plan.

PART 1 —
PLANNING PROCESS AND PROJECT BACKGROUND

CHAPTER 1.
INTRODUCTION

1.1 WHY PREPARE THIS PLAN?

Flood hazard mitigation is a way to reduce or alleviate the loss of life, personal injury, and property damage that can result from flooding through long- and short-term strategies. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of floods. The responsibility for flood hazard mitigation lies with many, including private property owners, business, industry, and local, state and federal government.

Numerous state and federal programs and regulations promote flood hazard mitigation planning. Notable among these are two programs of the Federal Emergency Management Agency (FEMA): the National Flood Insurance Program (NFIP) and the Community Rating System (CRS). These programs provide benefits in the form of reduced flood insurance costs for communities that meet minimum requirements for floodplain management. Thurston County participates in both the NFIP and the CRS.

A previous Thurston County flood hazard management plan was prepared in 1999 (TRPC, 1999). Given the many changes in local development and other conditions since then, as well as evolving local, state and federal regulations and programs, the County has developed this new flood hazard mitigation plan as an up-to-date tool for flood preparedness and flood hazard mitigation. Elements and strategies in this plan were selected because they meet various state or federal program requirements as well as the needs of Thurston County and its citizens.

This plan identifies resources, information, and strategies for reducing risk from flood hazards. It will help guide and coordinate mitigation activities. The plan was developed to meet the following objectives:

- Meet the needs of Thurston County as well as state and federal requirements.
- Meet planning requirements allowing Thurston County to enhance its CRS classification.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.
- Create a linkage between the flood hazard mitigation plan and established plans of Thurston County so that they can work together in achieving successful mitigation.

All citizens and businesses of Thurston County are the ultimate beneficiaries of this plan. Participation in development of the plan by key stakeholders helped ensure that outcomes will be mutually beneficial. The plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.2 GUIDELINES FOR FLOOD PLANNING

The first priority for this plan is to benefit the citizens of Thurston County by providing the greatest possible protection against the hazard posed by potential flooding. In addition, the plan has been developed to follow as closely as feasible the guidelines for flood planning presented by FEMA for the CRS program and by Washington State for the Flood Control Assistance Account Program (FCAAP).

1.2.1 CRS Steps for Comprehensive Floodplain Management Plan

Developing a comprehensive floodplain management plan is among the activities that earn CRS credits toward reduced flood insurance rates. To earn CRS credit for a floodplain management plan, the community's process for developing the plan must include at least one item from each of 10 steps (see Appendix B for details):

- Planning process steps:
  - Step 1, Organize
  - Step 2, Involve the public
  - Step 3, Coordinate
- Risk assessment steps:
  - Step 4, Assess the hazard
  - Step 5, Assess the problem
- Mitigation strategy steps:
  - Step 6, Set goals
  - Step 7, Review possible activities
  - Step 8, Draft an action plan
- Plan maintenance steps:
  - Step 9, Adopt the plan
  - Step 10, Implement, evaluate and revise.

1.2.2 FCAAP Requirements for Comprehensive Flood Control Management Plan

Eligibility for Washington's FCAAP funding for flood projects requires that the requesting jurisdiction complete a comprehensive flood control management plan. The plan must include six components, as summarized below and described in detail in Appendix B:

- Determination of the need for flood control work
- Alternative flood control work
- Identification and consideration of potential impacts of in-stream flood control work on the in-stream uses and resources.
- Coverage, at a minimum, of the area of the 100-year floodplain 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, as well as flood hazard areas not subject to riverine flooding (e.g., coastal flooding, flash flooding, or flooding from inadequate drainage)
- Conclusion and proposed solutions
- Certification from the Department of Community, Trade and Economic Development that the local emergency management organization is administering an acceptable comprehensive emergency operations plan.

1.3 HOW TO USE THIS PLAN

This flood hazard mitigation plan is organized into the following primary parts, which follow the organization of the CRS steps for floodplain planning:

- Part 1—Planning Process and Project Background
- Part 2—Risk Assessment
- Part 3—Mitigation Strategy
- Part 4—Plan Maintenance

Each part includes elements identified in the CRS's 10 steps. These steps are often cited at the beginning of a subsection to illustrate compliance with the requirement.

The following appendices provided at the end of the plan include information or explanations to support the main content of the plan:

- Appendix A—A glossary of acronyms and definitions
- Appendix B—Description of CRS and FCAAP Planning Requirements
- Appendix C—Public outreach information, including the questionnaire and summary and documentation of public meetings.
- Appendix D—A template for progress reports to be completed as this plan is implemented

CHAPTER 2.
PLAN DEVELOPMENT METHODOLOGY

The process followed to develop the Thurston County Flood Hazard Mitigation Plan had the following primary objectives:

- Form a planning team
- Define the planning area
- Establish a steering committee
- Coordinate with other agencies
- Review existing programs
- Engage the public.

These objectives are discussed in the following sections.

2.1 FORMATION OF THE PLANNING TEAM

This planning project was initiated and overseen by the Natural Resources Program of the Thurston County Planning Department. The Planning Department's mission is to plan for sustainable land use and development within the unincorporated areas of Thurston County so that residential and business communities can thrive within a healthy environment. The Planning Department is responsible for land use and comprehensive planning for Thurston County. Thurston County hired Tetra Tech, Inc. to assist with development and implementation of the plan. The Tetra Tech project manager assumed the role of the lead planner, reporting directly to the Thurston County project manager. A planning team was formed to lead the planning effort, made up of the following members:

- Mark Swartout—Thurston County Project Manager
- Tim Rubert—Thurston County Floodplain Manager
- Andrew Kinney—Thurston County Emergency Management
- Rob Flaner, Tetra Tech—Lead Project Planner
- Ed Whitford—Tetra Tech Risk Assessment Lead
- Dan Portman—Tetra Tech Technical Editor

2.2 DEFINING THE PLANNING AREA

The planning area was defined as all of Thurston County. To support future integration with the Natural Hazards Mitigation Plan for the Thurston Region, this plan assesses the flood risk for all municipalities in the planning area. However, it identifies mitigation initiatives only for the unincorporated areas of the county, since this will be the CRS plan of record for Thurston County. This may change in the future as the Thurston County Flood Hazard Mitigation Plan becomes integrated with the Natural Hazards Mitigation Plan.

2.3 THE STEERING COMMITTEE

A steering committee was formed to oversee all phases of the planning effort. The members of this committee included key Thurston County staff, citizens, and other stakeholders from within the planning area. The planning team assembled a list of candidates representing interests within the planning area that could have recommendations for the plan or be impacted by its recommendations. The team confirmed a committee of 12 members, listed in Table 2-1.

TABLE 2-1.
STEERING COMMITTEE MEMBERS

Name	Title	Jurisdiction/Agency
Allan Vanell (Chair)	Mayor (pro-tem)	Town of Bucoda (Chehalis River Council Represenative)
Tris Carlson	Citizen	Thurston County Storm and Surface Water Advisory Board/ Floodplain resident
Mark Swartout	Thurston County CRS Coordinator	Thurston County, Planning Department
Tim Rubert	Thurston County Floodplain Manager	Thurston County, Building Department
Andrew Kinney		Thurston County Emergency Management
Paul Brewster	Senior Planner	Thurston Regional Planning Council
Glen Connelly	Floodplain Manager	Chehalis Tribe
Jeff Clem	Manager	Riverbend Campground—Business within the Nisqually River floodplain
Sue Thorn	Citizen	Black River Floodplain-Also a member of the Chehalis River Council
Nicole Hill	Stakeholder	Nisqually Land Trust
Howard Glastetter	Citizen	Nisqually River floodplain; also a member of the Storm and Surface Water Advisory Board
Paul Pickett	Academic/Citizen	Thurston Evergreen State College

Leadership roles and ground rules were established during the Steering Committee's initial meeting on April 16, 2012. The Steering Committee agreed to meet monthly as needed throughout the course of the plan's development. The planning team facilitated each Steering Committee meeting, which addressed a set of objectives based on an established work plan. The Steering Committee met four times from April through October. Meeting agendas, notes and attendance logs are available for review upon request. All Steering Committee meetings were open to the public and advertised as such on the flood plan website (see Section 2.6.1). The agendas and meeting notes were posted to the flood hazard mitigation plan website.

2.4 COORDINATION WITH OTHER AGENCIES

Opportunities for involvement in the planning process were provided to neighboring communities, local and regional agencies involved in flood hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (CRS Step 3). This task was accomplished by the planning team as follows:

- **Steering Committee Involvement**—Agency representatives were invited to participate on the Steering Committee.
- **Agency Notification**—The following agencies were invited to participate in the plan development from the beginning and were kept apprised of plan development milestones:
  - The Chehalis River Council
  - The Thurston Regional Planning Council
  - The Thurston County Surface Water Advisory Board (SWAB)
  - FEMA Region X
  - Washington Department of Ecology
  - The Chehalis Tribe
  - The Nisqually Tribe
  - The Nisqually Land Trust
  - Pierce County
  - Lewis County.

  These agencies received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process. These agencies supported the effort by attending meetings or providing feedback on issues.
- **Pre-Adoption Review**—All the agencies listed above were provided an opportunity to review and comment on this plan, primarily through the plan website (see Section 2.6). Each agency was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the Insurance Services Office, FEMA's CRS contractor, for a pre-adoption review to ensure CRS program compliance.

2.5 REVIEW OF EXISTING PROGRAMS

The planning effort included review and incorporation, if appropriate, of existing plans, studies, reports and technical information. Chapter 4 of this plan provides a review of laws and ordinances in effect within the planning area that can affect mitigation initiatives, including an assessment of all Thurston County regulatory, technical and financial capabilities to implement flood hazard mitigation initiatives. In addition, the following programs can affect mitigation within the planning area:

- Natural Hazards Mitigation Plan for the Thurston Region
- 1999 Thurston County Flood Hazard Management Plan
- Thurston County Comprehensive Plan
- Thurston County Critical Areas Ordinance
- Shoreline Master Program for the Thurston Region
- Chehalis Watershed Cooperative
- Basin Plans
- Water Resource Inventory Area (WRIA) Planning.

2.6 PUBLIC INVOLVEMENT

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. CRS credits are available for providing opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval, as well as for optional public involvement activities (CRS Step 2).

2.6.1 Strategy

The strategy for involving the public in this plan emphasized the following elements:

- Include members of the public on the Steering Committee.
- Use a questionnaire to determine the public's perception of flood risk and support of mitigation initiatives.
- Attempt to reach as many planning area citizens as possible using multiple media.
- Identify and involve planning area stakeholders.

Stakeholders and the Steering Committee

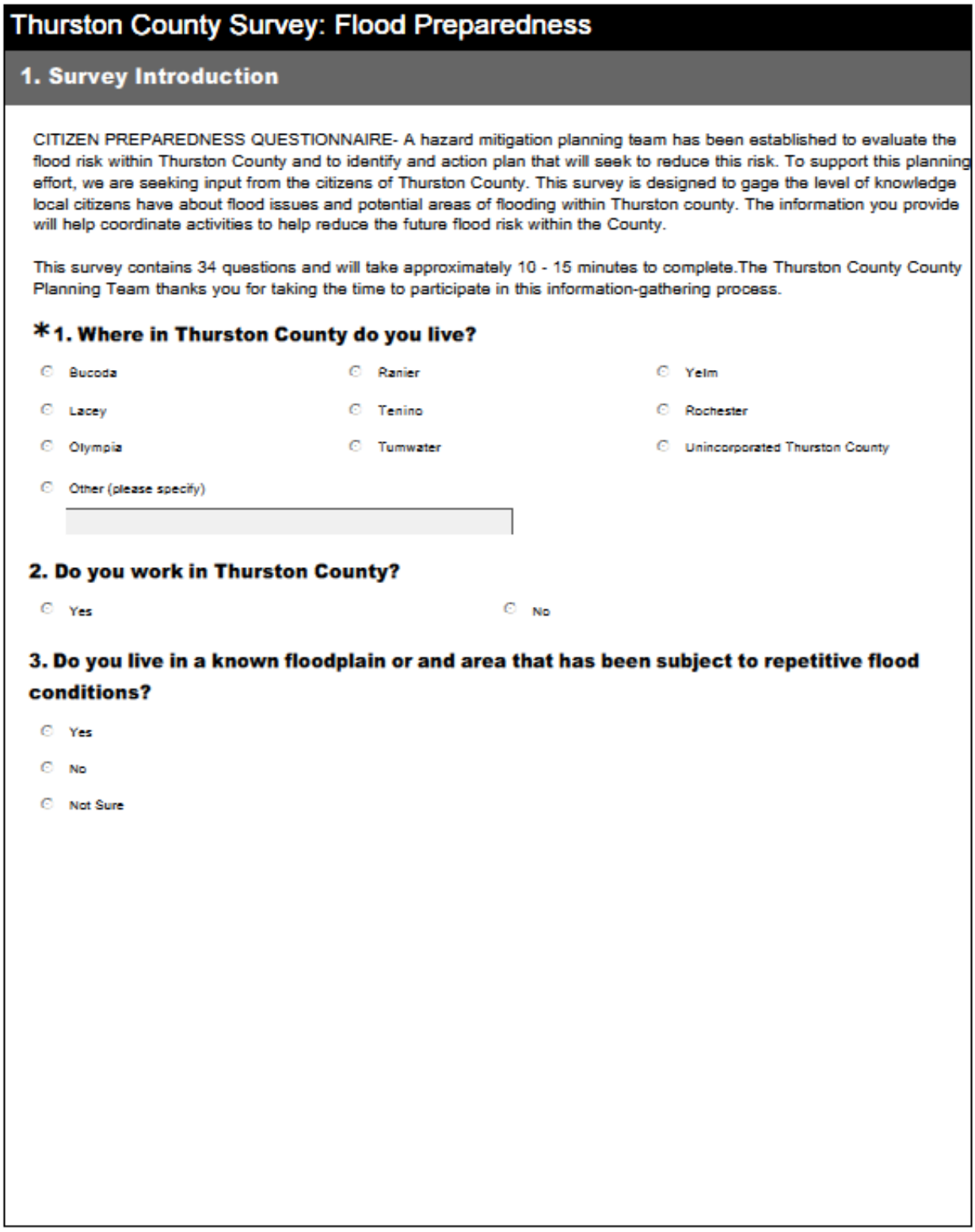
Stakeholders are the individuals, agencies and jurisdictions that have a vested interest in the recommendations of this plan. The effort to include stakeholders in this process included stakeholder participation on the Steering Committee. Stakeholders targeted for this process included:

- Owners/operators of businesses within the floodplain
- Academia
- Tribes
- Environmental advocacy groups
- Neighboring counties.

Questionnaire

A questionnaire (see Figure 2-1) was developed by the planning team with guidance from the Steering Committee. The questionnaire was used to gauge household preparedness for the flood hazard and the level of knowledge of tools and techniques that assist in reducing risk and loss from flooding. This questionnaire was designed to help identify areas vulnerable to floods. The answers to its 34 questions helped guide the Steering Committee in selecting goals, objectives and mitigation initiatives. All floodplain residents were notified about the survey by a postcard mailing advertising the public open houses. All attendees at the public open houses were asked to complete a survey. In addition, the survey and the plan information website was advertised in the "flood bulletin" that is sent annually to all floodplain residents in October (see Figure 2-2 and Figure 2-3). Hard copies of the questionnaires were made available at the public open houses. A web-based version of the questionnaire was made available on the plan website.

Over 50 questionnaires were completed during the course of this planning process. This number is not sufficient to establish trends, but the responses did provide the Steering Committee and planning team with feedback to use throughout the planning process. The Steering Committee used survey results to support the selection of guiding principles, goals and objectives discussed in Chapter 8. The survey results were also used in the review of alternatives and selection of mitigation initiatives as discussed in Chapter 9. The complete questionnaire and a summary of its findings can be found in Appendix C.



Thurston County Survey: Flood Preparedness

1. Survey Introduction

CITIZEN PREPAREDNESS QUESTIONNAIRE- A hazard mitigation planning team has been established to evaluate the flood risk within Thurston County and to identify and action plan that will seek to reduce this risk. To support this planning effort, we are seeking input from the citizens of Thurston County. This survey is designed to gage the level of knowledge local citizens have about flood issues and potential areas of flooding within Thurston county. The information you provide will help coordinate activities to help reduce the future flood risk within the County.

This survey contains 34 questions and will take approximately 10 - 15 minutes to complete.The Thurston County County Planning Team thanks you for taking the time to participate in this information-gathering process.

***1. Where in Thurston County do you live?**

- Bucoda
- Lacey
- Olympia
- Ranier
- Tenino
- Tumwater
- Yelm
- Rochester
- Unincorporated Thurston County
- Other (please specify)

2. Do you work in Thurston County?

- Yes
- No

3. Do you live in a known floodplain or and area that has been subject to repetitive flood conditions?

- Yes
- No
- Not Sure

Figure 2-1. Sample Page from Questionnaire Distributed to the Public

Thurston County Flood Bulletin

Fall 2012 **Preparedness Information**

Dear Neighbor,

If you've received this bulletin in the mail it's because you have property in the 100-year floodplain or in a groundwater flooding area. Even though we've had a dry summer, it only takes a few weeks of heavy rain to raise rivers and groundwater to flood levels.

Disasters can be so overwhelming that demand often exceeds available resources, leaving people on their own sometimes for days before outside help arrives.

The 2012 Flood Bulletin contains information on preparedness tips for your home, vehicle and family. Thank you for taking the time to be prepared.

Kathy Estes

Kathy Estes
Emergency Manager

THURSTON COUNTY

Phone Alert Test: October 22-26, 2012

Subscribers to the Thurston County telephone alert system will receive a test call between 9 a.m. and 5 p.m. during the week of October 22-26.

You don't have to be home during the test. If you have any questions or do not receive a test call that week, please contact us at (360) **867-2800.**

Please Note: If you are not a subscriber, you will **not** receive a test call. See article on next page to find out how to subscribe. It's free!

Sample Message

This is Thurston County Emergency Management with an important message about the Deschutes River. Today is Monday, April 30 at 1 p.m. The gage near Rainier registered nine feet at noon. It's expected to reach flood stage, 11 feet, by 6 p.m. Residents should take steps to protect life and property on short notice.

Photo: 2007 Flood, Highway 12 at Anderson Rd; photo by Paul Henderson

Figure 2-2. Thurston County Flood Bulletin, Fall 2012

6 Ways to Protect Your Home

1. **Elevate** or relocate furnaces, water heaters, appliances and electrical panels. Better yet, elevate your home above possible flood levels on a new foundation.
2. **Install** back-flow valves or plugs for drains, toilets and other connections to prevent floodwaters from entering your home.
3. **Make openings** in foundation walls to allow water to flow in and out. This can help prevent collapse of the walls.
4. **Build and install** flood shields for doors and other openings to prevent the entrance of floodwaters.
5. **Store hazardous materials** like paint, pesticides and fertilizers inside plastic buckets off the floor. Take unwanted hazardous materials to the HazoHouse, Friday through Tuesday. Details at 754-3354.
6. **Install** sump pumps with backup power in crawl spaces or basements.

Questions? Call the county's Resource Stewardship office at **754-3355, ext 6647**.

Building? Be Safe, not Sorry!

The county regulates floodplain development to protect the public and minimize flood losses. We require that homes vulnerable to floods include flood protection when built. We also restrict building new structures within the 100-year floodplain with limited exceptions. Regulations control filling, treecutting, grading and other development which may increase flood damage.

Information on development affecting individual lots in floodplains or in high groundwater areas is available at the county's Resource Stewardship office.

Staff can visit your property to answer questions specific to your site. The county also has limited historical data regarding flooding in unincorporated Thurston County. Call **754-3355, ext. 6647** for complete details.

Your Input Needed!
Flood Mitigation Plan

The county is updating its Comprehensive Flood Mitigation Plan. There were two public meetings in August. Another public meeting will be scheduled in the future. For more information, including a citizen survey, please visit **www.co.thurston.wa.us/planning/natural-res/natural-floodplan-update.htm** or call 709-3079.

10.

Figure 2-3. Flood Hazard Survey Advertisement in Flood Bulletin

Public Meetings

Open-house public meetings were held on August 20, 2012 at the Thurston County Courthouse and on August 21, 2012 at the Thurston County Emergency Management facilities. Each ran from 5:30 to 7:30 p.m. Postcards advertising the public meetings were sent to all addresses intersecting the floodplain within the planning area (see Figure 2-4). This amounted to over 8,500 mailings.

Figure 2-4. Postcard Mailed to All Floodplain Residents Advertising the Public Open Houses

The public meeting format allowed attendees to examine maps and handouts and have direct conversations with project staff. Reasons for planning and information generated for the risk assessment were shared with attendees via a PowerPoint presentation. A computer mapping workstation loaded with output from the HAZUS modeling allowed citizens to see information on their property, including exposure and damage estimates for flood hazard events (see Figure 2-5). Participating property owners were provided printouts of this information for their properties. This tool was effective in illustrating risk to the public. Planning team members were present to answer questions. Each citizen attending the open houses was asked to complete a questionnaire, and each was given an opportunity to provide written comments to the Steering Committee. Local media outlets were informed of the open houses by a press release from the planning team. Example meeting activities are shown in Figure 2-6 through Figure 2-9

A final public meeting to present the draft plan was held on Wednesday, November 14, 2012 at the Thurston County Emergency Management facilities. This meeting was advertised via a press release sent to all media outlets (see Figure 2-10 and Figure 2-11). This meeting was held at the beginning of the published public comment period, which ran until December 11, 2012.

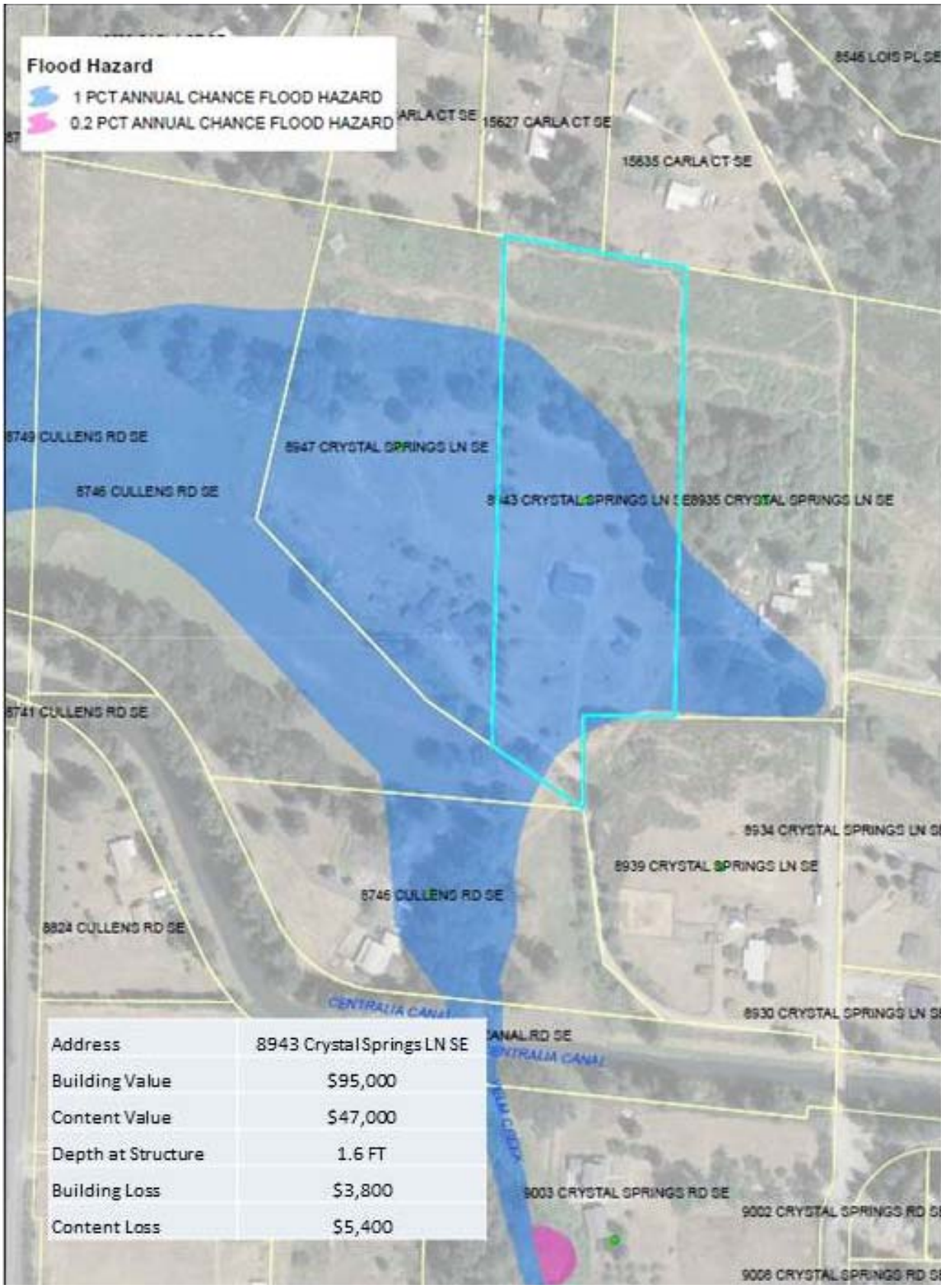


Figure 2-5. Example Printout from HAZUS Workstation

Figure 2-6. Public Meeting #1, August 20, 2012

Figure 2-7. Public Meeting #1, August 20, 2012

Figure 2-8. Public Meeting #2, HAZUS Workstation, August 21, 2012

Figure 2-9. Public Meeting # 2, Hazard Mapping, August 21, 2012

HOME NEWS SPORTS WEATHER LOCAL BUSINESS ENTERTAINMENT ABOUT KMAS NEWSRADIO

Public Invited to Comment on County Flood Mitigation Plan

Thurston County invites citizens to comment on a draft of the Thurston County Flood Hazard Mitigation Plan, which takes a "macro" view of countywide flood issues and identifies 32 actions through a facilitated process that focuses on meeting these objectives. With completion of this plan, the county can become one of the top-rated counties in the nation as determined by the federal Community Rating System (CRS). Currently, Thurston County has earned a 25% discount for flood insurance rates through discounts awarded for mitigation and preparedness actions.
The plan reduces the risk for flooding through floodplain management and mitigation activities with specific tasks, assignments and deadlines. The plan, which fulfils requirements for obtaining state or federal assistance, also promotes education for floodplain residents about flood hazards, loss reduction measures and beneficial functions of floodplains.

The draft plan and instructions on submitting comments is available on the county's website at:
http://www.co.thurston.wa.us/planning/natural-res/natural-floodplain-update.htm
The public can also comment on the plan at a public meeting on **Wednesday, November 14, from 5:30 to 7:00 p.m.** at the Emergency Coordination Center at 9521 Tilley Rd. SW.

Recent floods have shown that floods need to be addressed on a countywide basis. The floods of 2007-2009 cost county residents more than $10 million in uninsured property losses. Even through drainage basin plans and flood plans have been adopted for some watersheds, these plans do not cover all unincorporated areas.

Comments on the draft flood mitigation plan will be accepted until the close of a Public Hearing on the subject held on **Tuesday, December 11 at 3:00 p.m.** at the Thurston County Courthouse, 2000 Lakeridge Dr. SW, Building #1, Room 280.

Please direct comments and questions on the Draft Flood Plan to Mark Swartout, Natural Resources Program Manager, Thurston County Planning Department, swartom@co.thurston.wa.us

Figure 2-10. Online Announcement of Final Public Meeting

LOCAL | theolympian.com/southsound

IN BRIEF

THURSTON COUNTY

County seeks comment on flood plan

Thurston County will seek public comment on a proposed flood-mitigation plan during a hearing set for 5:30-7 p.m. today at the county's new Emergency Coordination Center, 9521 Tilley Road SW.

According to a news release:

If approved, the draft plan would put Thurston among the top-rated counties nationwide under the federal Community Rating System, earning it a 25 percent discount for flood insurance rates because of steps taken toward flood mitigation and preparedness. The draft plan addresses several issues, including education for and benefits of floodplains, and which steps would need to be taken to get state or federal assistance in the case of a flood.

The draft plan is at www.co.thurston.wa.us.

Public comments will be accepted through the close of a final public hearing at 3 p.m. Dec. 11 at the Thurston County Courthouse.

ckrotzer@theolympian.com

Figure 2-11. Newspaper Announcement of Final Public Meeting

Internet

At the beginning of the plan development process, a website was created to keep the public posted on plan development milestones and to solicit relevant input (see Figure 2-12):

http://www.co.thurston.wa.us/planning/natural-res/natural-floodplan-update.htm

The site's address was publicized in all press releases, mailings, questionnaires and public meetings. Information on the plan development process, the Steering Committee, the questionnaire and phased drafts of the plan was made available to the public on the site throughout the process. Thurston County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

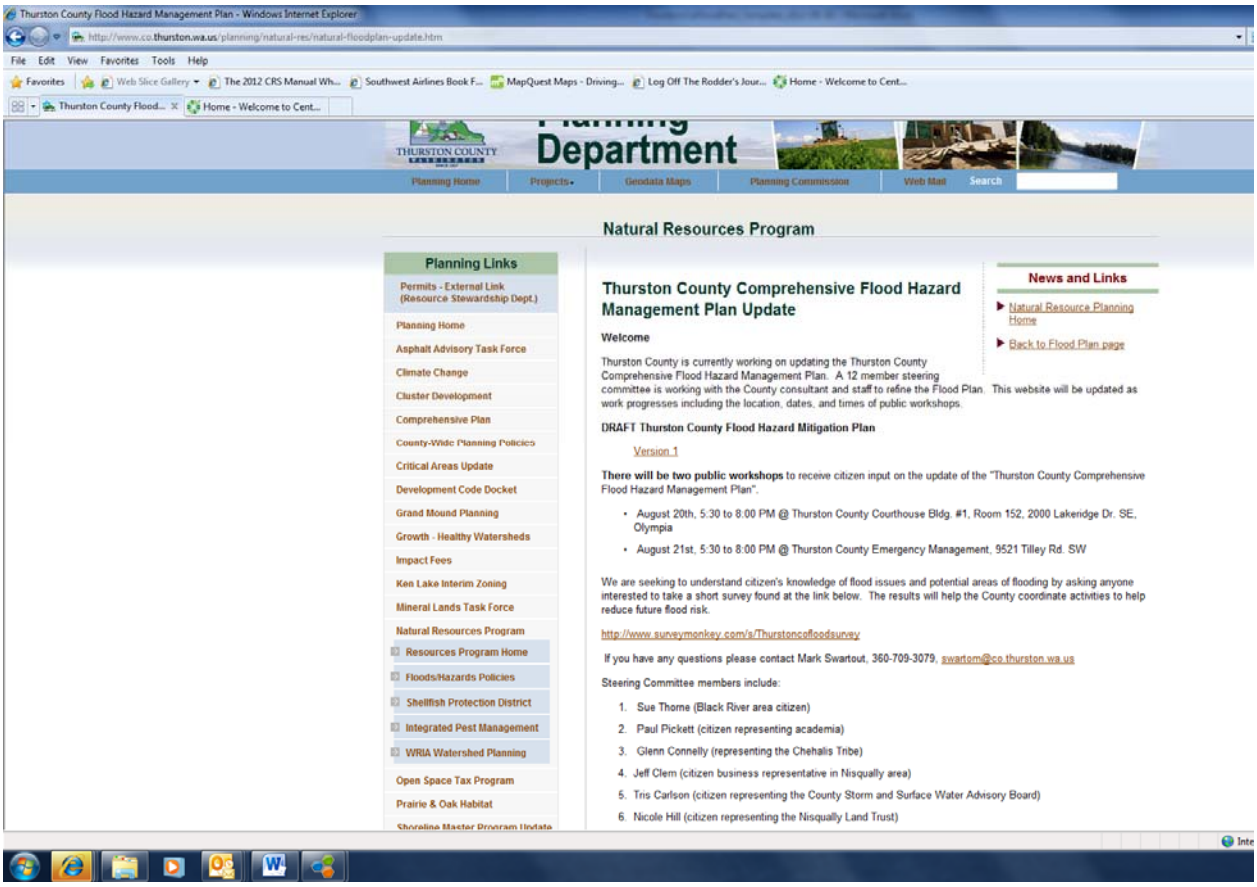


Figure 2-12. Sample Page from Flood Hazard Mitigation Plan Web Site

2.6.2 Public Involvement Results

By engaging the public through the public involvement strategy, the concept of mitigation was introduced to the public, and the Steering Committee received feedback that was used in developing components of the plan. Details of attendance and comments received are summarized in Table 2-2.

2.7 PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

Table 2-3 summarizes important milestones in the development of the plan.

TABLE 2-2.
SUMMARY OF PUBLIC MEETINGS

Date	Location	Number of Citizens in Attendance	Number of Comments Received	Number of Questionnaires Received
8/20/2012	Thurston County Courthouse	41	Numerous	5
8/21/2012	Thurston County Emergency Management	35	Numerous	6
11/14/2012	Thurston County Emergency Management	2	None	N/A
Total		**78**	**Numerous**	**11**

TABLE 2-3.
PLAN DEVELOPMENT MILESTONES

Date	Event	Description	Attendance
2/8/2012	Initiate consultant procurement	Seek a planning expert to facilitate the process	N/A
3/16/2012	Select Tetra Tech to facilitate plan development	Facilitation contractor secured	N/A
4/3/2012	Identify planning team	Formation of the planning team	N/A
4/16/2012	Steering Committee Meeting #1	• Review purposes for update • Organize Steering Committee • Goal setting • Public involvement strategy	13
4/20/2012	Public Outreach strategy	Website set up for posting information related to plan development.	N/A
6/8/2012	Steering Committee Meeting #2	• Approve final goals and guiding principles • Establish objectives • Identify critical facilities • Finalize public meeting strategy	12
7/25/2012	Steering Committee Meeting #3	• Risk assessment preview • Approve final objectives • Alternative review strategy • Finalize public meeting strategy	13
8/20/2012	Public Meeting #1	Public open house to present risk assessment to the public	41
8/21/2012	Public Meeting # 2	Public open house to present risk assessment to the public	35
10/1/2012	Strengths, Weaknesses, Obstacles and Opportunities Meeting	Meeting with County staff to identify strengths, weaknesses, obstacles and opportunities within the planning area. Alternatives review and development of action plan	19
10/1/2012	Steering Committee Meeting #4	• Risk assessment update • Review public involvement results • Alternatives review/action plan status • Plan maintenance strategy • What's next	9

TABLE 2-3.
PLAN DEVELOPMENT MILESTONES

Date	Event	Description	Attendance
11/1/2012	Draft Plan	Internal review draft provided by planning team to Steering Committee	N/A
11/12/2012	Public Comment Period	Initial public comment period of draft plan opens. Draft plan posted on plan website with press release notifying public of plan availability	N/A
11/13/2012	Public Comment Period	Public notice published advertising the 12/11 public hearing by the Board of County Commissioners where they will adopt the plan.	N/A
11/14/2012	Public Outreach	Final public meeting on draft plan	2
12/11/2012	Adoption	Board of County Commissioners adopt plan during public hearing.	30
12/28/2012	Plan Approval	Final draft plan submitted to Insurance Services Office (ISO) for review and approval	N/A

CHAPTER 3.
THURSTON COUNTY PROFILE

Thurston County is located in Western Washington at the south end of Puget Sound (see Figure 3-1). With an area of 736 square miles, it is the 32nd largest of Washington's 39 counties. There are seven incorporated municipalities in the county, including the City of Olympia, which is the county seat and the Washington state capital. The county also includes portions of the Chehalis and Nisqually Indian Reservations.

3.1 HISTORICAL OVERVIEW

The following historical overview is summarized from the Thurston Regional Planning Council's 2011 report, *The Profile*.

Salish Indian groups from the tribes now known as Nisqually, Squaxin, and Chehalis gathered shellfish and frequented the inlets and prairies of Puget Sound for centuries before Euro-American exploration and settlement. The first Europeans to visit Thurston County were part of the British Vancouver Expedition, which explored the southernmost tip of Puget Sound in 1792. An expedition led by James McMillan visited the area in 1824. The first American expedition of the region, led by Lt. Commander Charles Wilke in 1841, mapped and named landmarks throughout the region. The Simmons/ Bush Party, the first American settlers, settled in Thurston County in 1845 near the falls of the Deschutes River, in what is now Tumwater. These settlers set up a gristmill and a sawmill that utilized the water power from the Deschutes River falls. Thurston County was created on January 12, 1852 in what was then the Oregon Territory. The county was named for Samuel Thurston, the first delegate to Congress from the Oregon Territory. Washington became a separate territory in November 1853. Olympia became the permanent capital of the Washington Territory in 1855.

In the l870s, the coming of the transcontinental Northern Pacific Railroad and the Prairie Line between Puget Sound and the Columbia River encouraged significant growth in a number of Thurston County communities. The line passed through Bucoda, Tenino, Rainier and Yelm. Also at this time, Tumwater developed along the falls of the Deschutes River. Local industries included a sawmill, two gristmills, a tannery, a wooden pipe company, two sash and door manufacturers, and a furniture maker. New logging operations and areas of settlement grew in other areas during the 1880s. By 1889, 40 logging camps operated around Thurston County. The sandstone quarrying industry began in Tenino in 1889.

In the early years of the 20th century, growth in natural resource industries continued. New rail lines continued to encourage the creation of new communities. By 1922 the concrete Pacific Highway (State Route 1) had been constructed from the Canadian border, through Thurston County, to the Oregon border, transforming communities along its route. State government employment increased in Thurston County during the 1950s. A court decision during the decade mandated that the headquarters of state agencies be located in the capital city. This decision was later interpreted to mean that the headquarters should be located in the larger Olympia, Lacey and Tumwater area, spurring state employment growth in the three communities. During the 1960s, Thurston County was the site of a tribal effort to re-assert fishing rights granted by the Medicine Creek Treaty of 1854. These rights were guaranteed in a decision by federal Judge George Boldt, which was upheld by the U.S. Supreme Court in 1973. In 1967, the Washington State Legislature passed legislation authorizing the creation of The Evergreen State College. The school, located on approximately 1,000 acres on southern Cooper Point, opened to students in 1971.

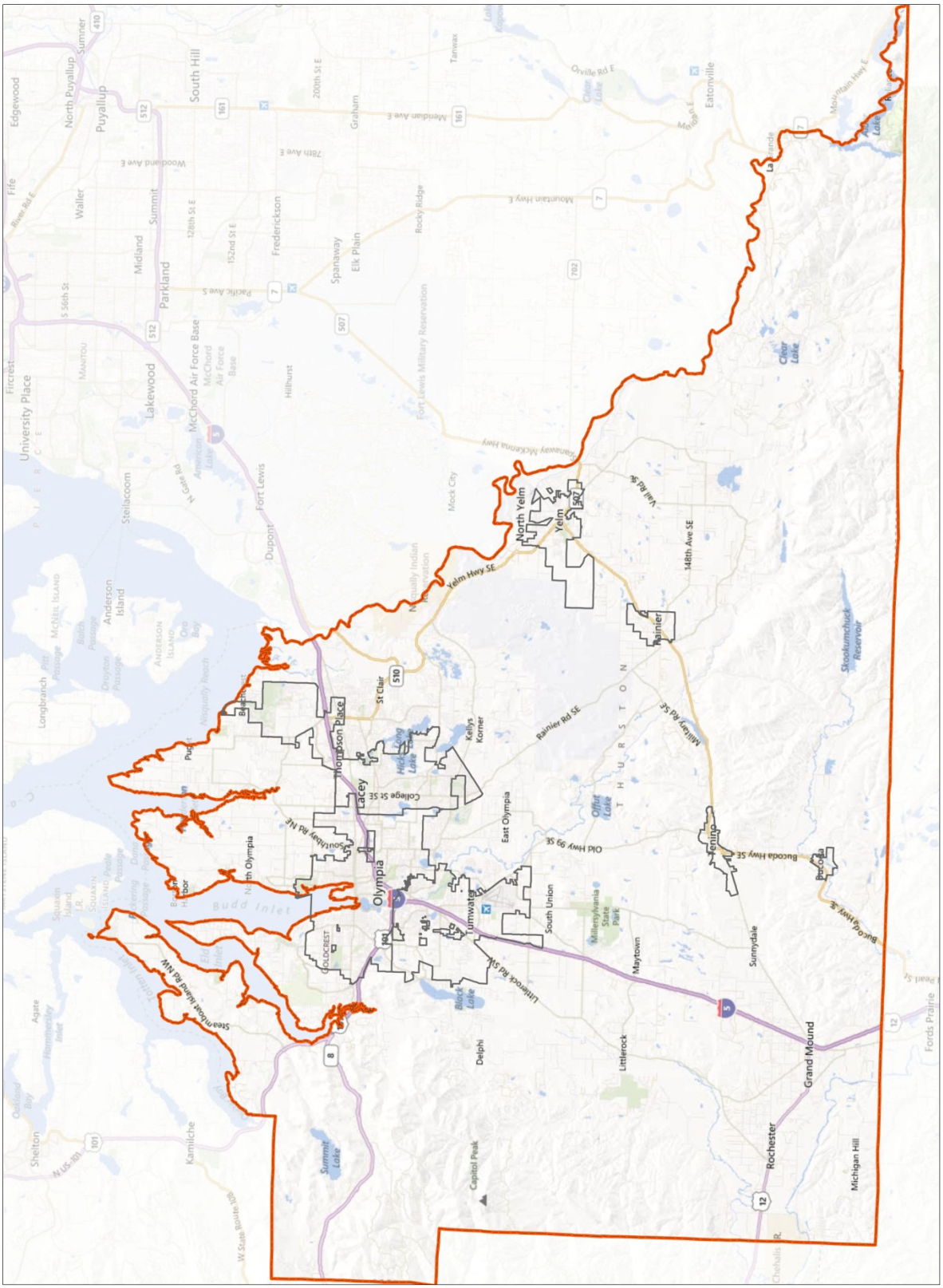


Figure 3-1. Main Features of Planning Area

Between 1960 and 1980, the county population more than doubled (from 55,059 to 124,624). Residential growth has continued since the 1970s, though at not as great of a rate countywide. Major development in certain areas however has occurred. Since the mid-1990s, Yelm has developed significantly through the influx of population related to the installation of a sewer system, and the City of Lacey has seen significant residential development.

3.2 PHYSICAL SETTING

3.2.1 Topography

Topography in the Thurston County area ranges from coastal lowlands to prairie flatlands and the foothills of the Cascades, with numerous lakes and ponds formed by glacial activity in the geologic past. The northern boundary of the county is defined by the shoreline of Puget Sound, including Budd, Henderson, and Eld Inlets. Totten Inlet divides Thurston and Mason Counties, and the Nisqually River separates Thurston from Pierce County (TRPC, 2011).

Peaks ranging from 1,700 to 3,000 feet in elevation mark the northwest and southeast corners of the county. Larch Mountain and Capitol Peak (both over 2,650 feet) are in the 92,000-acre Capitol State Forest in the northwest portion of the county. Quiemuth Peak, the highest point in Thurston County at 2,922 feet, rises in the extreme southeast corner near Alder Lake (TRPC, 2011).

3.2.2 Geology and Soils

Primary geological layers in Thurston County are as follows (Wallace and Molenaar, 1961):

- The oldest rocks known in Thurston County are of Tertiary age (2.6 to 65 million years ago). These rocks are chiefly marine and non-marine siltstone, claystone, and sandstone interbedded with rocks of volcanic origin. They are generally moderately hard and compact, but the siltstone and claystone may be locally soft and susceptible to sliding and slumping. These rocks generally have a low permeability and are very poor aquifers. Where they have been deeply weathered, dug wells usually supply enough water for household use.
- The earliest known deposits of Pleistocene age (12,000 to 2.6 million years ago) in Thurston County are a part of the Logan Hill formation in Lewis County. This formation crops out chiefly as rusty, cemented gravel that is greatly decayed and stained. The gravel particles are so soft they can be cut with a pocket knife. The formation, as it has been observed in Thurston County, is relatively impermeable and unimportant as an aquifer. In Lewis County, the lower portion of the Logan Hill formation yields a moderate amount of groundwater, although it is usually somewhat high in iron content.
- Most of the surface deposits in Thurston County consist of sand, gravel and till of the latest glaciation. The materials are relatively fresh and unaltered. A distinctive feature is the presence of a considerable quantity of pebbles, cobbles, and boulders that have a composition that is either uncommon or entirely foreign to the surrounding area. These deposits are named the Vashon drift, and they mantle much of the Puget Sound lowland from the Canadian border to Centralia. The Vashon drift was deposited both by ice and as outwash from a great tongue of ice extending south from ice fields in Canada and northern Washington. The deposits are of the following types:
  - **Advance** Outwash—As ice moved south, large quantities of sand and gravel were deposited by meltwater at the front and sides of the ice mass. These deposits consist typically of poorly sorted to moderately well-sorted, well-rounded gravel in a sandy matrix, interbedded with lenses of sand. The materials have a fresh, unweathered appearance and are generally moderately to very permeable. The advance outwash, which

is composed predominantly of permeable sand and gravel, is one of the most productive aquifers in the county.

- **Till**—Till, deposited directly by the ice, covers more of the Puget Sound lowland than does any other unit. Till is readily recognizable by its characteristic appearance. Unweathered, it is a grey to light bluish-grey concrete-like mixture of clay, silt, sand, pebbles, cobbles and boulders. Typically, silt predominates, and the spacing of pebbles and cobbles is similar to that of raisins in raisin bread. The whole aspect is one of toughness and compactness. Although the till is of low permeability and restricts or greatly impedes the downward percolation of water, small supplies of perched groundwater can sometimes be obtained from it under favorable conditions. Water is yielded mostly from cracks or permeable sandy streaks and zones within the till.
- **Recessional Outwash**—Sand and gravel that were deposited by glacial meltwater streams during the recession of the glacier to the north are referred to as recessional outwash. At a few places, sand and silt were deposited where water was ponded by irregularities of topography or by blocking of the drainage with ice. Except for these silt and sand deposits, the recessional outwash materials generally were laid down rapidly by swift, overloaded streams. Hence, the degree of sorting is variable and great lateral variation is common. Although poorly sorted, the outwash is moderately permeable. The recessional outwash is a productive aquifer in Thurston County.

3.2.3 Drainage

Thurston County is drained by five major rivers, described below in order from east to west (Wallace and Molenaar, 1961):

- The Nisqually River bounds the county on the east and is fed by glaciers on the south flank of Mount Rainier. It flows into Puget Sound at a point about 10 miles northeast of Olympia.
- The Deschutes River, rising in the hills southeast of Yelm, roughly parallels and is 5 to 10 miles southwest of the Nisqually River. It flows into Puget Sound through Budd Inlet at Olympia.
- The Skookumchuck River, which begins in the Bald Hills of Thurston and Lewis Counties, drains most of the hills in the south-central portion of the county south of the Deschutes drainage area. After its entrance into Thurston County, the Skookumchuck flows west along a circuitous route to Bucoda and then turns sharply to flow southwest to its confluence with the Chehalis River just west of Centralia in Lewis County.
- The Chehalis River flows northwest from Centralia and crosses the southwestern corner of Thurston County, where it drains the Michigan Hill area and receives water from Prairie Creek and Scatter Creek. The Chehalis discharges into the Pacific Ocean at Grays Harbor.
- The Black River drains a large portion of the easternmost Black Hills and much of the prairie area east of the river. The fall of the Black River is not great enough for effective drainage, so marshy areas occur through most of its course. Its confluence with the Chehalis is about one and a half miles southeast of Oakville in Grays Harbor County.

In addition to these major rivers, a portion of the northwest corner of Thurston County drains to Puget Sound through smaller streams flowing to Eld Inlet and Totten Inlet. Another separate drainage area discharges to Henderson Inlet, between the Nisqually and Deschutes River basins. The planning area's eight river and inlet basins, as shown on Figure 3-2, were used in the risk assessment performed for this plan.

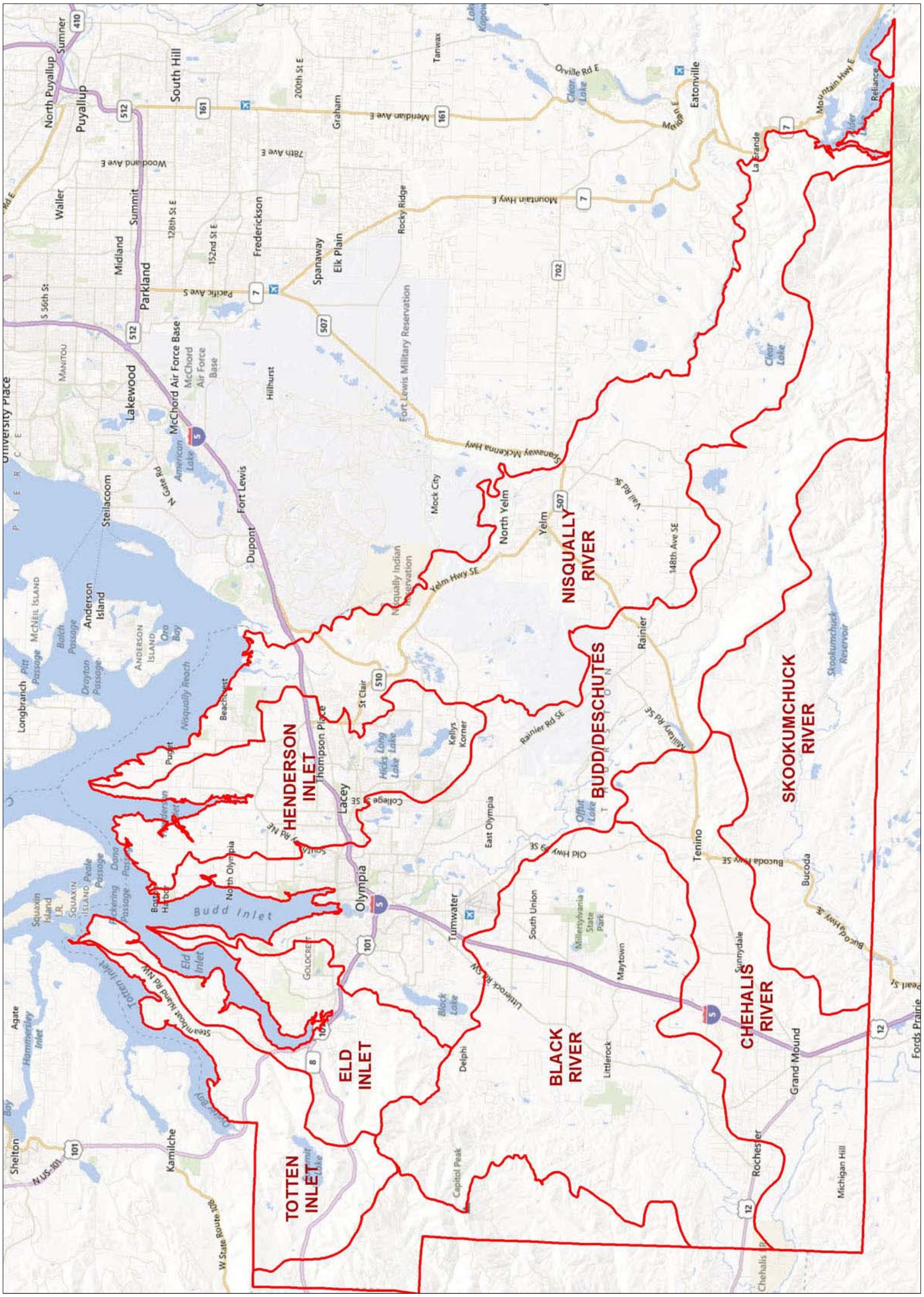


Figure 3-2. Planning Area River and Inlet Drainage Basins

3.2.4 Climate

Like most of Western Washington, Thurston County's weather is characterized by sunny summers and wet winters. The county has a marine climate with mild temperatures year-round. In summer, the average high temperature ranges between 70ºF and 80ºF. In winter, high temperatures are around 45ºF. Olympia receives 50 inches of rainfall annually, spread out over a large number of days. With about 52 clear days out of every 365, Thurston County residents live under some form of cloud cover 86 percent of the year, with more than a trace of rain falling on almost half of the days of the year. Table 3-1 summarizes key climate data for the county (TRPC, 2011).

TABLE 3-1.
AVERAGE THURSTON COUNTY CLIMATE DATA

	Average Temperature (ºF)		Average Precipitation (inches)	
	High	Low	Rainfall	Snowfall
Jan	44.6	31.7	8.0	7.3
Feb	49.2	32.4	5.6	3.7
Mar	53.3	33.8	5.1	1.9
Apr	58.9	36.5	3.3	0.1
May	65.7	41.6	2.0	0.0
Jun	70.9	46.7	1.5	0.0
Jul	77.2	49.5	0.7	0.0
Aug	77.0	49.5	1.1	0.0
Sep	71.5	45.3	2.0	0.0
Oct	60.5	39.7	4.7	0.0
Nov	50.4	35.6	8.2	1.3
Dec	44.8	32.6	8.1	3.9
Average	***60.3***	***39.6***	**—**	**—**
Total	**—**	**—**	**50.3**	**18.2**

Source: TRPC, 2011

3.3 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities and infrastructure are those that are essential to the health and welfare of the population. These become especially important after a hazard event. Critical facilities typically include police and fire stations, schools and emergency operations centers. Critical infrastructure can include the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need, and the utilities that provide water, electricity and communication services to the community. Also included are "Tier II" facilities and railroads, which hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event. Through a facilitated process, the Steering Committee established a definition of critical facilities for this flood hazard mitigation plan that includes but is not limited to the following:

> A critical facility is one that is deemed vital to the Thurston County planning area's ability to provide essential services while protecting life and property. A critical facility may be a system or an asset, either physical or virtual, the loss of which would have a profound impact across the planning area on security, the economy, public health or safety, the environment,

or any combination thereof. The following types of systems and assets are defined as critical facilities:

- Police stations, fire stations, paramedic stations, emergency vehicle and equipment storage facilities, and emergency operations and communications centers needed for disaster response before, during and after hazard events.
- Public and private utilities and infrastructure vital to maintaining or restoring normal services to areas damaged by hazard events. These include water (potable, wastewater, stormwater, drainage and irrigation), utilities (transmission and distribution facilities for natural gas, power and geothermal) and communications (land-based telephone, cell phone, the internet, emergency broadcast facilities and emergency radios).
- Public gathering places that could be used as evacuation centers during large-scale disasters.
- Hospitals, extended care facilities, urgent care facilities and housing that may contain occupants not sufficiently mobile to avoid death or injury during a hazard event
- Transportation systems that convey vital supplies and services to, through and throughout the community. These include roads, bridges, railways, airports and pipelines
- Government and educational facilities central to governance and quality of life, along with response and recovery actions during and after a hazard event.
- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic, or water-reactive materials.
- Infrastructure designed to help safely convey high water events from the event source to the perimeter of the planning area including but not limited to dams, revetments and stormwater drainage facilities.
- Debris management and solid waste facilities.

An inventory of facilities that meet this definition was created and input to the HAZUS Comprehensive Data Management System. Two principle sources of information were used for this inventory:

- The HAZUS default entries contained in the Comprehensive Data Management System (HAZUS version 2.2)
- The inventory of critical facilities and infrastructure maintained by Thurston County Emergency Management to support the Critical Infrastructure/Key Resource initiative.

Figure 3-3 shows the location of critical facilities in the planning area. Due to the sensitivity of this information, a detailed list of facilities is not provided. The list is on file with Thurston County. Table 3-2 and Table 3-3 provide summaries of the general types of critical facilities and infrastructure in the planning area. All critical facilities and infrastructure were analyzed to help identify the flood risk and mitigation initiatives. Chapter 7 assesses facilities that are exposed and vulnerable to the flood hazard.

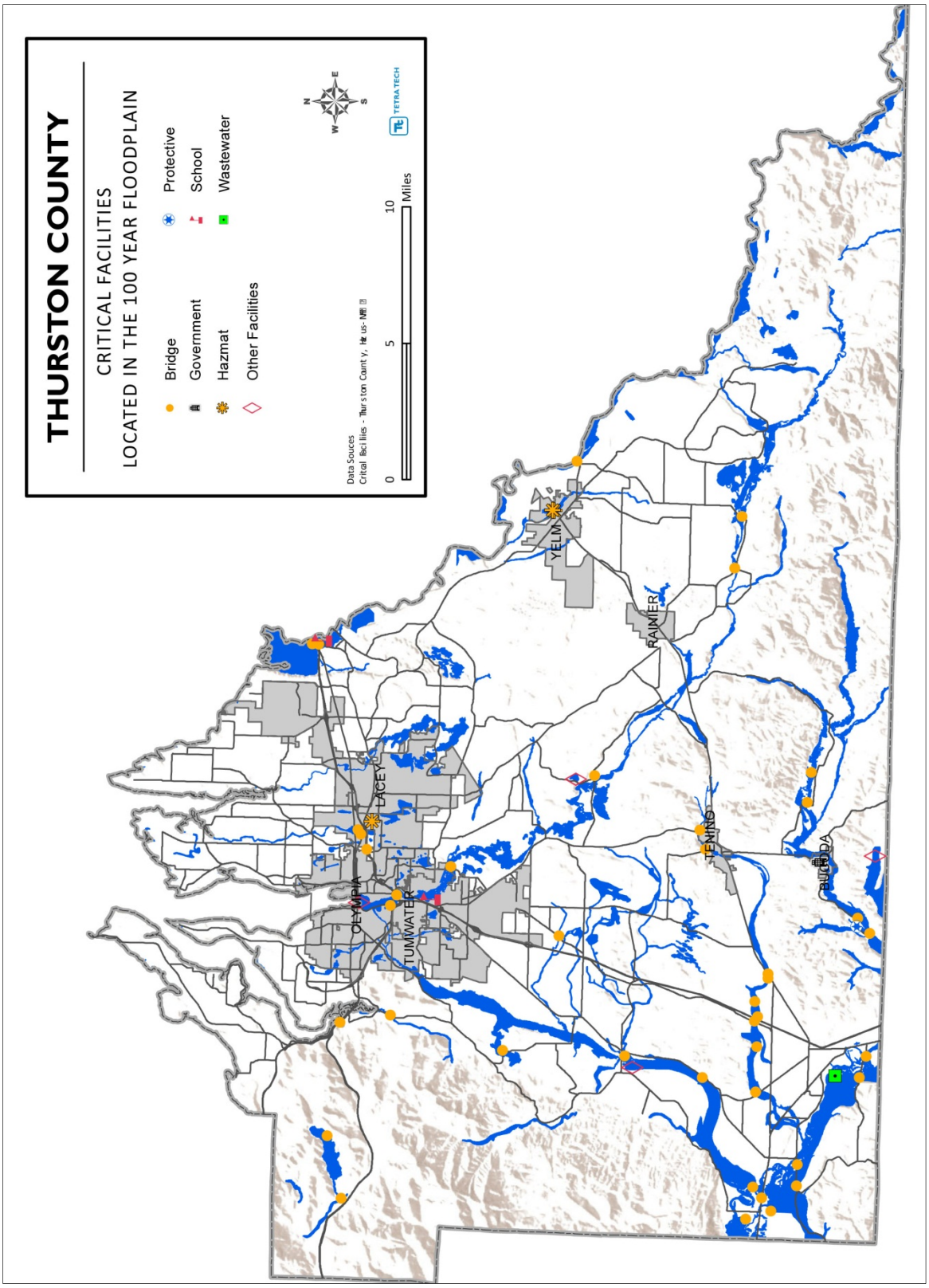


Figure 3-3. Identified Critical Facilities in the Planning Area

TABLE 3-2.
PLANNING AREA CRITICAL FACILITIES

Facility Type	Number in Planning Area
Medical and Health	84
Government Functions	83
Protective Functions	52
Schools	94
Hazmat	10
Other Critical Functions	57
Total	**380**

TABLE 3-3.
PLANNING AREA CRITICAL INFRASTRUCTURE

Infrastructure Type	Number in Planning Area
Bridges	187
Water Supply	10
Wastewater	6
Power	4
Communications	12
Other	23
Total	**242**

3.4 DEMOGRAPHICS

Some populations are at greater risk from hazard events such as floods because of decreased resources or physical abilities. Elderly people, for example, may be more likely to require additional assistance. Research has shown that people living near or below the poverty line, the elderly (especially older single men), the disabled, women, children, ethnic minorities and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap spatially and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would help to extend focused public outreach and education to these most vulnerable citizens.

3.4.1 Population Characteristics

Knowledge of the composition of the population and how it has changed in the past and how it may change in the future is needed for making informed decisions about the future. Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. The Washington State Office of Financial Management estimated Thurston County's population at 254,100 as of 2011, making it the sixth largest county by population in the state (OFM, 2012).

Population changes are useful socio-economic indicators. A growing population generally indicates a growing economy, while a decreasing population signifies economic decline. Figure 3-4 shows the planning area population change from 1900 to 2010 compared to that of the State of Washington (OFM, 2012). For most of its history, Thurston County has grown faster than the statewide average. The County and the state have both seen reduced population growth rates since a peak in the 1970s, but both continue to grow. Thurston County's population increased an average of 2 percent per year between 2000 and 2010, a total of 21.7 percent over that period. Table 3-4 shows the county population from 1995 to 2011.

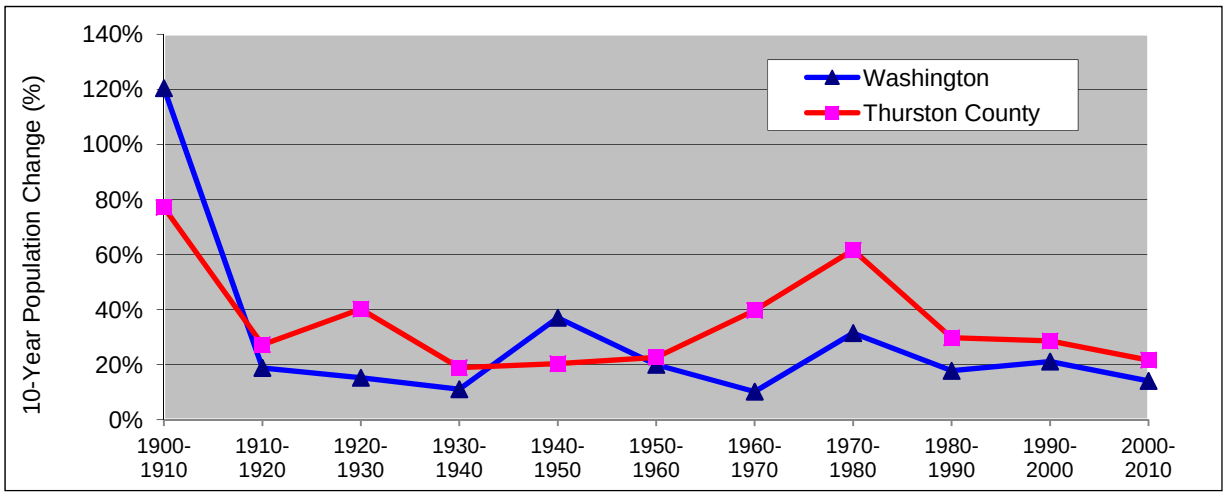


Figure 3-4. Washington and Thurston County Population Growth

TABLE 3-4.
RECENT COUNTY POPULATION GROWTH

	Thurston County Population
1995	186,400
2000	207,355
2005	224,100
2010	252,264
2011	254,100

Source: TRPC, 2011

The Thurston Regional Planning Council has developed forecasts of future population as shown in Table 3-5. The projections estimate a population of 426,993 in Thurston County by 2040.

TABLE 3-5.
PROJECTED FUTURE COUNTY POPULATION GROWTH

	Thurston County Population
2015	274,892
2020	309,438
2025	340,136
2030	369,866
2035	398,039
2040	426,993

Source: TRPC, 2011

3.4.2 Income

In the United States, individual households are expected to use private resources to prepare for, respond to and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards such as flooding. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on the most recent 5-year estimates (2006 – 2010) from the U.S. Census Bureau's American Community Survey, per capita income in the planning area was $29,707 and the median household income was $60,930. It is estimated that about 15.7 percent of households receive an income between $100,000 and $149,999 per year and 4.6 percent of household incomes are above $150,000 annually. The Census Bureau estimates that 10.3 percent of the population in the planning area lives below the poverty level (U.S. Census, 2012).

3.4.3 Age Distribution

As a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from the flood hazard.

The overall age distribution for the planning area is illustrated in Figure 3-5. Based on the most recent 5-year estimates (2006 – 2010) from the U.S. Census Bureau's American Community Survey, 12.5 percent of the planning area's population is 65 or older, compared to the state average of 12.3 percent. According to U.S. Census data, 36.6 percent of the over-65 population has disabilities of some kind and 5.9 percent have incomes below the poverty line. Children under 18 account for 13 percent of individuals who are below the poverty line. The county's population includes 18.9 percent who are 14 or younger, compared to the state average of 19.5 percent. (U.S. Census, 2012)

2010 U.S. Census

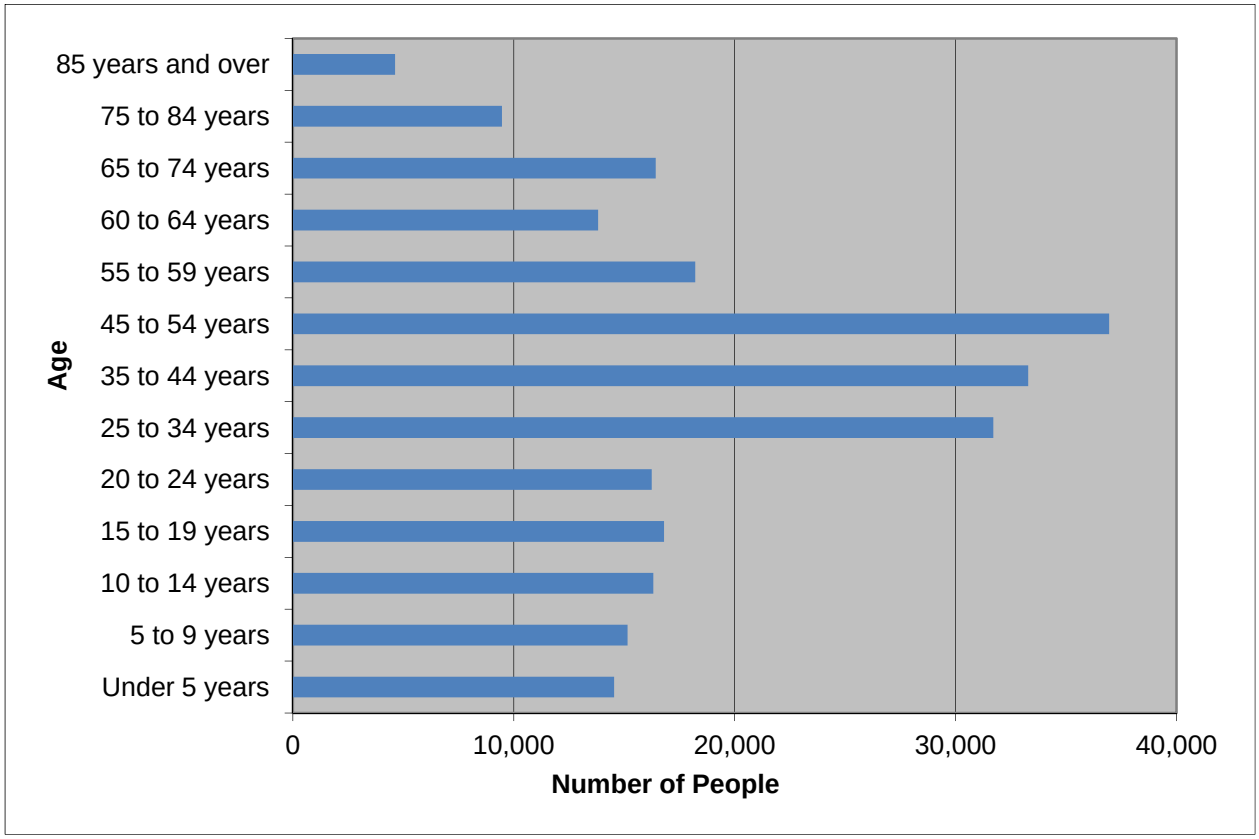


Figure 3-5. Planning Area Age Distribution

3.4.4 Race, Ethnicity and Language

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability. According to the most recent 5-year estimates (2006 – 2010) from the U.S. Census Bureau's American Community Survey, the racial composition of the planning area is predominantly white, at 83.4 percent. The largest minority populations are Asian at 5.3 percent and two or more races at 4.4 percent. Figure 3-6 shows the racial distribution in the planning area. (U.S. Census, 2012)

2010 U.S. Census

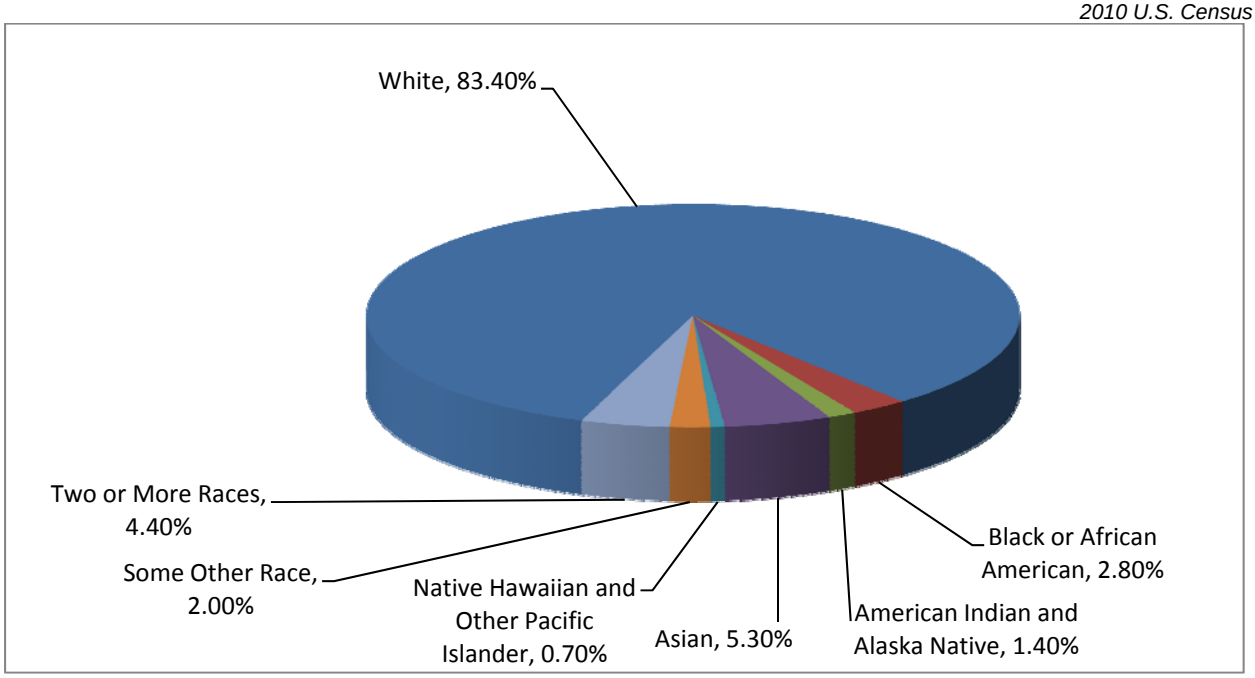


Figure 3-6. Planning Area Race Distribution

The planning area has a 7.1-percent foreign-born population. Other than English, the most commonly spoken languages in the planning area are Asian and Pacific Islander languages at 4.1 percent and Spanish at 3.6 percent. The census estimates that 3.5 percent of the residents speak English "less than very well." (U.S. Census, 2012).

3.4.5 Disabled Populations

The 2010 U.S. Census estimates that 54 million non-institutionalized Americans with disabilities live in the U.S. This equates to about one-in-five persons. People with disabilities are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs.

According to the 2008-2010 3-year Census estimates, there are 31,289 individuals with some form of disability within the planning area, representing 12.9 percent of the county total. (U.S. Census, 2012)

3.5 ECONOMY

3.5.1 Industry, Businesses and Institutions

The planning area's economy is strongly based in the education/health care/social service industry (21 percent of employment), followed by public administration (18 percent) and retail trade (11 percent). Information (1 percent), wholesale trade (2 percent) and natural resources industries (2 percent) make up the smallest source of the local economy. Figure 3-7 shows the breakdown of industry types in the planning area. (U.S. Census, 2012)

2010 U.S. Census

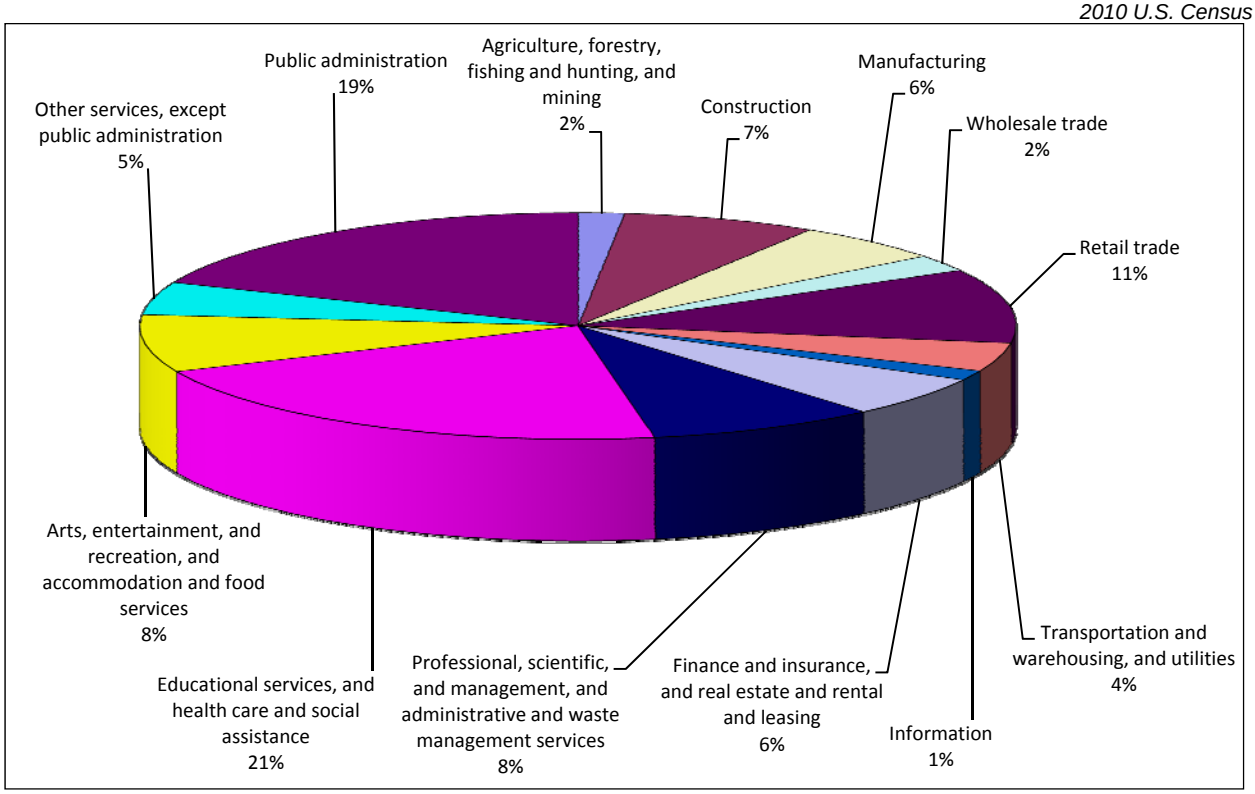


Figure 3-7. Industry in the Planning Area

The Thurston Regional Planning Council identifies the following large employers in Thurston County (TRPC, 2011):

- The State of Washington is the largest employer in the county, accounting for about 19,500 full- and part-time jobs in the county.
- Providence St. Peter Hospital is the largest private employer in Thurston County, employing an estimated 2,400 workers.
- With 1,498 employees, the Chehalis Tribe is one of the largest employers in the area.
- The Nisqually Tribe is also a major employer for the region. The tribe employs approximately 900 people.
- Resident active duty military personnel total 3,435 individuals, many of them employed at Joint Base Lewis-McChord, 9 miles north of Lacey along I-5.

3.5.2 Employment Trends and Occupations

According to the 2006-2010 5-year American Community Survey, 65.4 percent of the planning area's population 16 years old or older is in the labor force, including 62 percent of women in that age range and 71 percent of men (U.S. Census, 2012).

Figure 3-8 compares Washington's and Thurston County's unemployment trends from 1990 through 2010, based on data from the state Employment Security Department (ESD, 2012). Thurston County's unemployment rate was lowest in 1998 at 4.2 percent and in 2007 at 4.3 percent. The rate peaked at 8.2 percent in 2010, and has declined slightly since then. The county unemployment rate has been consistently lower than the statewide rate.

Washington Office of Financial Management

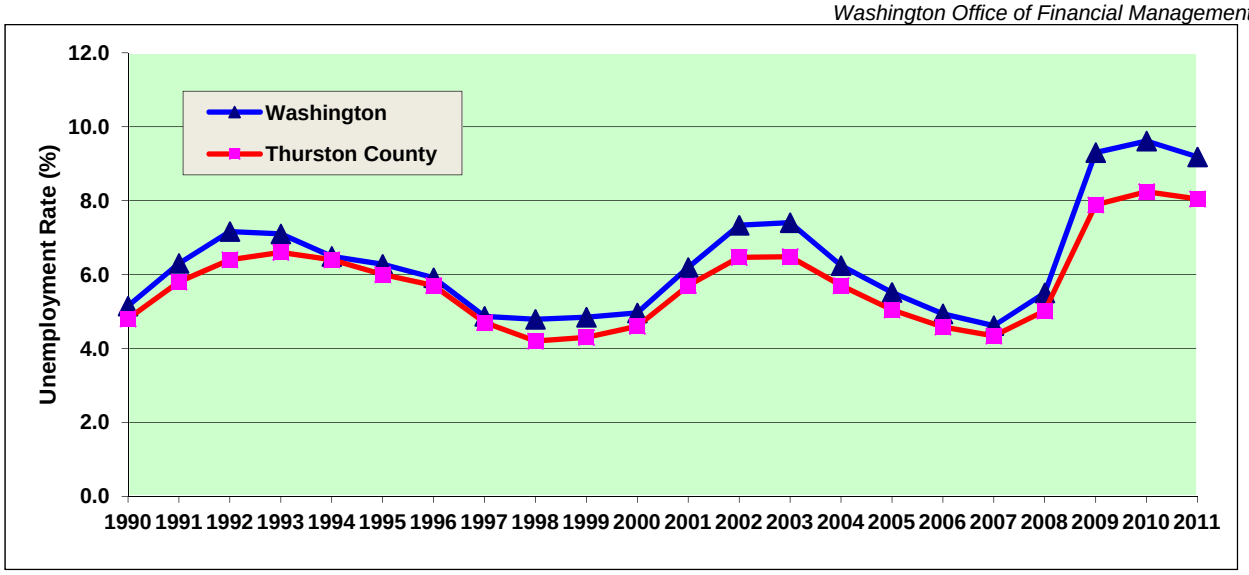


Figure 3-8. Washington and Thurston County Unemployment Rate

Figure 3-9 shows Census Bureau estimates of employment distribution by occupation category (U.S. Census, 2012). Management, business, science and arts occupations make up 41 percent of the jobs in the planning area. Sales and office occupations make up 25 percent of the local working population.

2010 U.S. Census

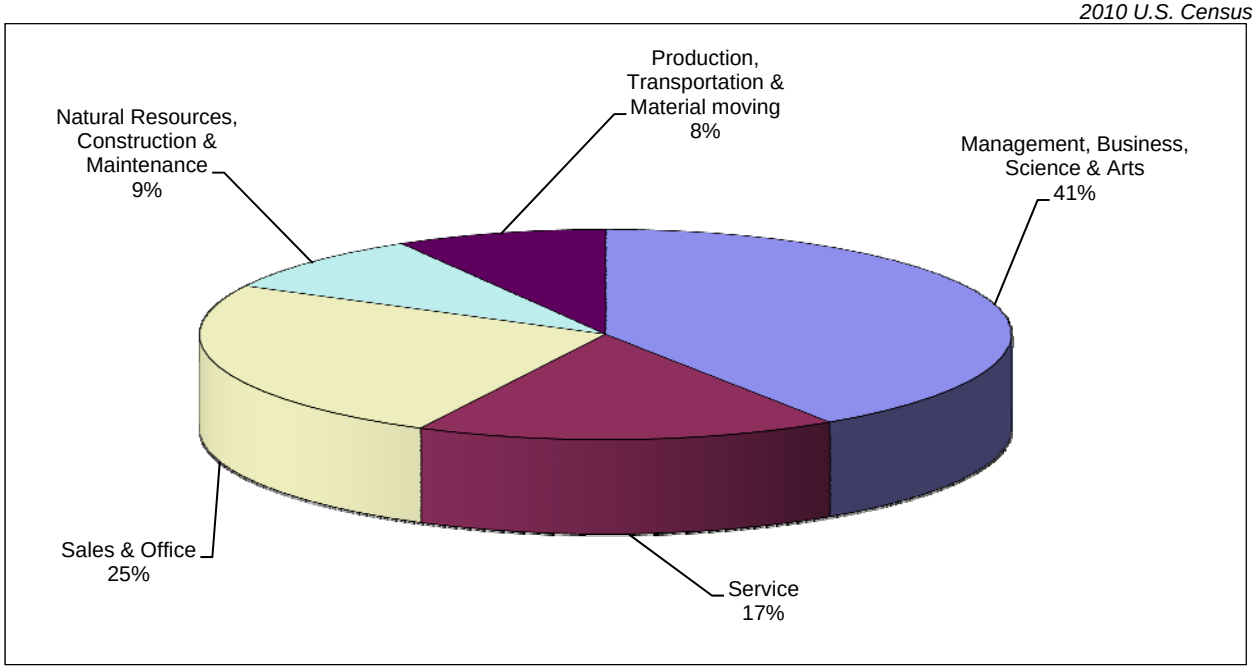


Figure 3-9. Occupations in the Planning Area

The U.S. Census estimates that 77 percent of workers in the planning area commute alone (by car, truck or van) to work, and mean travel time to work is 24.9 minutes (the state average is 25.1 minutes) (U.S. Census, 2012).

CHAPTER 4.
RELEVANT PROGRAMS AND REGULATIONS

Existing laws, ordinances and plans at the federal, state and local level can support or impact mitigation initiatives identified in this plan. Development of this plan included a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process. Pertinent federal, state and local laws are described below.

4.1 FEDERAL

4.1.1 Disaster Mitigation Act of 2000

The federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) provides the legal basis for FEMA mitigation planning requirements for state, local and Indian tribal governments as a condition of mitigation grant assistance. The DMA amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by replacing previous mitigation planning provisions with new requirements that emphasize the need for planning entities to coordinate mitigation planning and implementation efforts. The law added incentives for increased coordination and integration of mitigation activities at the state level by establishing two levels of state plans. The DMA also established a new requirement for local mitigation plans and authorized up to 7 percent of Hazard Mitigation Grant Program funds to be available for development of state, local, and Indian tribal mitigation plans.

4.1.2 National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities in exchange for communities enacting floodplain regulations. For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood (100-year flood) and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Thurston County participates in the NFIP and has adopted regulations that meet the NFIP requirements. The County entered the NFIP in 1982, and the first Thurston County FIRM was issued December 1, 1982. Structures permitted or built in the planning area before then are called “pre-FIRM” structures, and

structures built afterwards are called "post-FIRM." The insurance rate is different for the two types of structures. The effective date for the current FIRM is October 16, 2012. Thurston County is currently in good standing with the provisions of the NFIP.

4.1.3 The Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions to meet the CRS goals of reducing flood losses, facilitating accurate insurance rating and promoting awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The CRS classes for local communities are based on 18 creditable activities in the following categories:

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

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Thurston County has participated in the CRS program since 2000. The County has a Class 5 rating (out of 10), so citizens who live in a 100-year floodplain can receive a 25-percent discount on their flood insurance; outside the 100-year floodplain they receive a 10-percent discount. This equates to a savings ranging from $92 to $180 per policy, for a total countywide premium savings of a little over $50,953.

As of October 2011, out of 1,189 communities in the U.S. participating in the CRS program, only 66 were rated Class 5 and only nine were rated higher (see Figure 4-1). The County received this rating because of its floodplain management program and critical areas ordinance. Together these regulatory programs reduce damage caused by flooding, which results in a reduction in insurance premiums. To maintain this rating, the County goes through an annual recertification and a re-verification every 3 years.

4.1.4 Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

FEMA

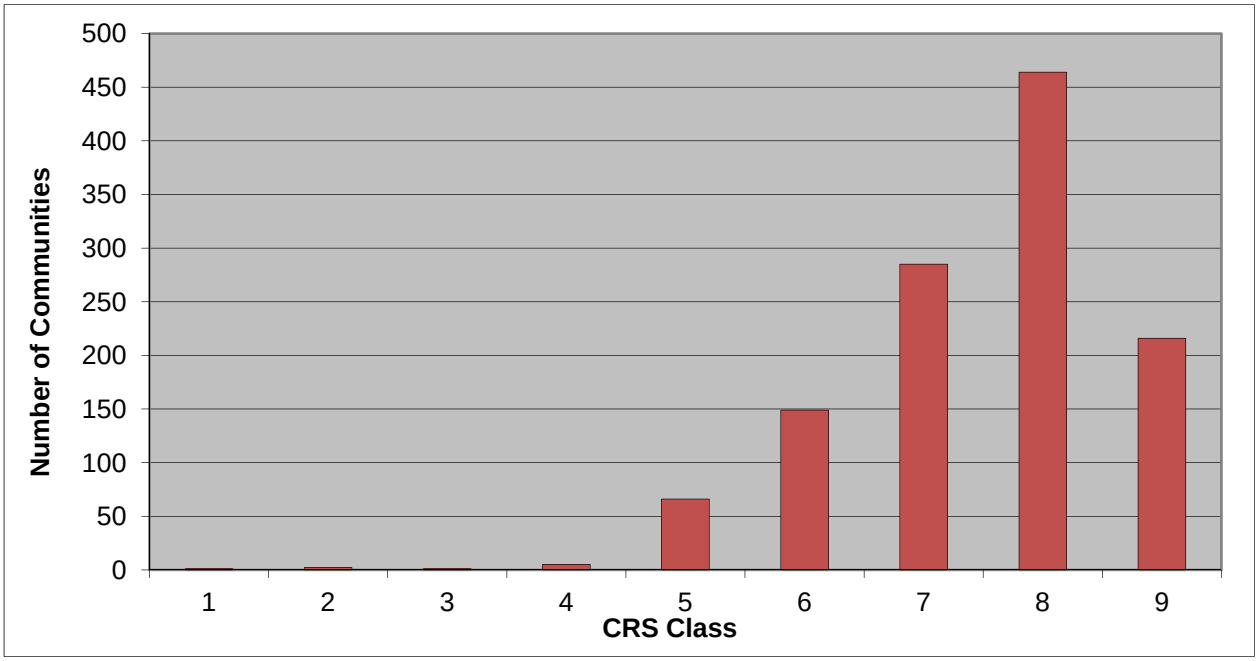


Figure 4-1. CRS Communities by Class Nationwide as of October 2011

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- **Endangered** means that a species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- **Threatened** means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- **Critical habitat** means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- **Section 4: Listing of a Species**—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or citizens may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- **Section 7: Consultation**—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a

species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.

- **Section 9: Prohibition of Take—**It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- **Section 10: Permitted Take**—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- **Section 11: Citizen Lawsuits**—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

With the listing of salmon and trout species as threatened or endangered, the ESA has impacted most of the Pacific Coast states. Although some of these areas have been more impacted by the ESA than others due to the known presence of listed species, the entire region has been impacted by mandates, programs and policies based on the presumption of the presence of listed species. Most West Coast jurisdictions must now take into account the impact of their programs on habitat.

4.1.5 The Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

4.2 STATE

4.2.1 Washington State Floodplain Management Law

Washington's floodplain management law (Revised Code of Washington (RCW) 86.16, implemented through Washington Administrative Code (WAC) 173-158) states that prevention of flood damage is a matter of statewide public concern and places regulatory control with the Department of Ecology. RCW 86.16 is cited in floodplain management literature, including FEMA's national assessment, as one of the first and strongest in the nation. A 1978 major challenge to the law—Maple Leaf Investors Inc. v. Department of Ecology—is cited in legal references to floodplain management issues. The court upheld the law, declaring that denial of a permit to build residential structures in the floodway is a valid exercise of police power and did not constitute a taking. RCW Chapter 86.12 (Flood Control by Counties) authorizes county governments to levy taxes, condemn properties and undertake flood control activities directed toward a public purpose.

4.2.2 Flood Control Assistance Account Program

Washington's first flood control maintenance program was passed in 1951, and was called the Flood Control Maintenance Program. In 1984, RCW 86.26 (State Participation in Flood Control Maintenance) established the Flood Control Assistance Account Program (FCAAP), which provides funding for local flood hazard management. FCAAP rules are found in WAC 173-145. Ecology distributes FCAAP matching grants to cities, counties and other special districts responsible for flood control. This is one of the few state programs in the U.S. that provides grant funding to local governments for floodplain management. The program has been funded for $4 million per biennium since its establishment, with additional amounts provided after severe flooding events.

To be eligible for FCAAP assistance, flood hazard management activities must be approved by Ecology in consultation with the Washington Department of Fish and Wildlife. A comprehensive flood hazard management plan must have been completed and adopted by the appropriate local authority or be in the process of being prepared in order to receive FCAAP flood damage reduction project funds. This policy evolved through years of the Flood Control Maintenance Program and early years of FCAAP in response to the observation that poor management in one part of a watershed may cause flooding problems in another part.

Local jurisdictions must participate in the NFIP and be a member in good standing to qualify for an FCAAP grant. Grants up to 75 percent of total project cost are available for comprehensive flood hazard management planning. Flood damage reduction projects can receive grants up to 50 percent of total project cost, and must be consistent with the comprehensive flood hazard management plan. Emergency grants are available to respond to unusual flood conditions. FCAAP can also be used for the purchase of flood prone properties, for limited flood mapping and for flood warning systems. Funding currently is running about 60 percent for planning and 40 percent for projects.

Thurston County is currently in compliance and good standing with the FCAAP program. The June 1999 Thurston County Flood Hazard Management Plan was approved by the Washington Department of Ecology as the FCAAP plan of record for Thurston County. This Flood Hazard Mitigation Plan will be viewed as a supplement to the 1999 plan. The mitigation initiatives identified in this plan may be eligible for funding under FCAAP. FCAAP funds can be used as matching funds for some types of mitigation projects funded under the FEMA Hazard Mitigation Grant Program.

4.2.3 Shoreline Management Act

The 1971 Shoreline Management Act (RCW 90.58) was enacted to manage and protect the shorelines of the state by regulating development in the shoreline area. A major goal of the act is to prevent the "inherent harm in an uncoordinated and piecemeal development of the state's shorelines." Its jurisdiction includes the Pacific Ocean shoreline and the shorelines of Puget Sound, the Strait of Juan de Fuca, and rivers, streams and lakes above a certain size. It also regulates wetlands associated with these shorelines.

4.2.4 Growth Management Act

The 1990 Washington State Growth Management Act (RCW Chapter 36.70A) mandates that local jurisdictions adopt land use ordinances protect the following critical areas:

- Wetlands
- Critical aquifer recharge areas
- Fish and wildlife habitat conservation areas
- Frequently flooded areas

- Geologically hazardous areas.

The Growth Management Act regulates development in these areas, and therefore has the potential to affect hazard vulnerability and exposure at the local level.

4.2.5 Washington State Building Code

The Washington State Building Code Council adopted the 2006 editions of national model codes, with some amendments. The Council also adopted changes to the Washington State Energy Code and Ventilation and Indoor Air Quality Code. Washington's state-developed codes are mandatory statewide for residential and commercial buildings. The residential code exceeds the 2006 International Energy Conservation Code standards for most homes, and the commercial code meets or exceeds standards of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE 90.1-2004). For residential construction covered by ASHRAE 90.1-2007 (buildings with four or more stories), the state code is more stringent. The 2009 IBC went into effect as the Washington model code on July 1, 2010.

4.2.6 Comprehensive Emergency Management Planning

Washington's Comprehensive Emergency Management Planning law (RCW 38.52) establishes parameters to ensure that preparations of the state will be adequate to deal with disasters, to ensure the administration of state and federal programs providing disaster relief to individuals, to ensure adequate support for search and rescue operations, to protect the public peace, health and safety, and to preserve the lives and property of the people of the state. It achieves the following:

- Provides for emergency management by the state, and authorizes the creation of local organizations for emergency management in political subdivisions of the state.
- Confers emergency powers upon the governor and upon the executive heads of political subdivisions of the state.
- Provides for the rendering of mutual aid among political subdivisions of the state and with other states and for cooperation with the federal government with respect to the carrying out of emergency management functions.
- Provides a means of compensating emergency management workers who may suffer any injury or death, who suffer economic harm including personal property damage or loss, or who incur expenses for transportation, telephone or other methods of communication, and the use of personal supplies as a result of participation in emergency management activities.
- Provides programs, with intergovernmental cooperation, to educate and train the public to be prepared for emergencies.

It is policy under this law that emergency management functions of the state and its political subdivisions be coordinated to the maximum extent with comparable functions of the federal government and agencies of other states and localities, and of private agencies of every type, to the end that the most effective preparation and use may be made of manpower, resources, and facilities for dealing with disasters.

WAC 118-30-060(1) requires each political subdivision to base its comprehensive emergency management plan on a hazard analysis, and makes the following definitions related to hazards:

- Hazards are conditions that can threaten human life as the result of three main factors:
  - Natural conditions, such as weather and seismic activity
  - Human interference with natural processes, such as a levee that displaces the natural flow of floodwaters

  - Human activity and its products, such as homes on a floodplain.
- The definitions for hazard, hazard event, hazard identification, and flood hazard include related concepts:
  - A hazard may be connected to human activity.
  - Hazards are extreme events.

Hazards generally pose a risk of damage, loss, or harm to people and/or their property

4.2.7 Watershed Management Act

Washington's Watershed Management Act of 1998 encourages local communities to develop plans for protecting local water resources and habitat. Lawmakers wanted local governments and citizens to develop plans since they know their own regions best. WRIA is an acronym for "Water Resource Inventory Area." WRIAs are watershed planning areas established by the Department of Ecology. Washington State is divided into 62 WRIAs, each loosely drawn around a natural watershed or group of watersheds. A watershed is an area of land that drains into a common river, lake or the ocean

4.3 LOCAL

4.3.1 Comprehensive Plans

Several comprehensive plans guide development of lands in unincorporated parts of Thurston County. Comprehensive Plans guide the county's physical development and identify transportation and other public facilities needed to meet the needs of population growth. These plans are the framework for zoning and other development regulations, which must be consistent with comprehensive plans.

The Thurston County Comprehensive Plan deals mainly with rural areas of the county (land outside of urban growth areas that surround cities). The County also has subarea plans for the communities of the Nisqually Valley, Rochester and Grand Mound. Joint plans with cities guide land use in the unincorporated county areas between urban growth area boundaries and the city limits of Bucoda, Olympia, Lacey, Tumwater, Yelm, Tenino, and Rainier. These joint plans are jointly adopted by both the applicable city and Thurston County

4.3.2 Emergency Management Plan

The Comprehensive Emergency Management Plan is Thurston County's framework for response to a disaster or emergency. The current version is a working draft that the County currently operates under; it is due for formal adoption in 2012. Several emergency support function documents are functional annexes to the basic plan, which outline general guidelines by which County organizations will carry out the responsibilities assigned in the plan. These emergency support function documents are being reorganized to be consistent with FEMA's *National Response Framework* (FEMA, 20008).

4.3.3 Critical Areas Ordinance

Washington's Growth Management Act requires local governments to protect five types of critical areas: important fish and wildlife habitat areas, wetlands, critical aquifer recharge areas, frequently flooded areas, and geologically hazardous areas, such as bluffs. Thurston County's critical areas regulations are a response to that law; they regulate how development and redevelopment can safely occur on lands that contain critical areas. On July 24, 2012, the Board of County Commissioners adopted Ordinance No. 14773 amending the Thurston County Critical Areas Ordinance and other related chapters of the Thurston County Code.

4.3.4 Shoreline Master Program

Thurston County's Shoreline Master Program is a combined planning and regulatory document that contains policies, goals and specific land-use regulations for shorelines. The master program balances development, public access and shoreline protection. The most recent Shoreline Master Program update includes marine shorelines, rivers with a flow greater than 20 cubic feet per second, lakes larger than 20 acres, upland areas within 200 feet of these water bodies and the floodplains and wetlands associated with these shorelines. Thurston County's Shoreline Master Program was last updated in 1990, before new state guidelines were approved in 2003. Thurston County must update its Shoreline Master Program by 2011 in order to be consistent with the latest state requirements.

4.3.5 WRIA Planning

Although Washington's Watershed Management Act does not require planning, Thurston County and local governments have undertaken related planning activities. The Washington Department of Ecology is providing technical and financial support for the effort. Thurston County has participated in watershed planning for four WRIAs (see Figure 4-2):

- The Nisqually River Watershed (WRIA 11)—This consists solely of the Nisqually River basin, which is a single drainage basin used for analysis in this Flood Hazard Mitigation Plan.
- The Deschutes Watershed (WRIA 13)—This consists of the entire Nisqually River and Henderson Inlet basins used for analysis in this Flood Hazard Mitigation Plan, as well as the eastern portion of the Eld Inlet basin.
- The Kennedy-Goldsborough Watershed (WRIA 14)—Most of this WRIA is outside the planning area of this Flood Hazard Mitigation Plan, but it includes the Totten Inlet basin and the western portion of the Eld Inlet basin used for analysis in this plan.
- The Upper and Lower Chehalis River Watershed (WRIAs 22 and 23)—These two WRIAs include the Chehalis, Skookumchuck and Black River basins used in the analysis for this Flood Hazard Mitigation Plan.

4.3.6 Capability Assessment

The planning team performed an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of an agency's mission, programs and policies, and evaluates its capacity to carry them out. Table 4-1 summarizes the legal and regulatory capability of Thurston County. Table 4-2 summarizes the administrative and technical capability. Table 4-3 summarizes fiscal capability.

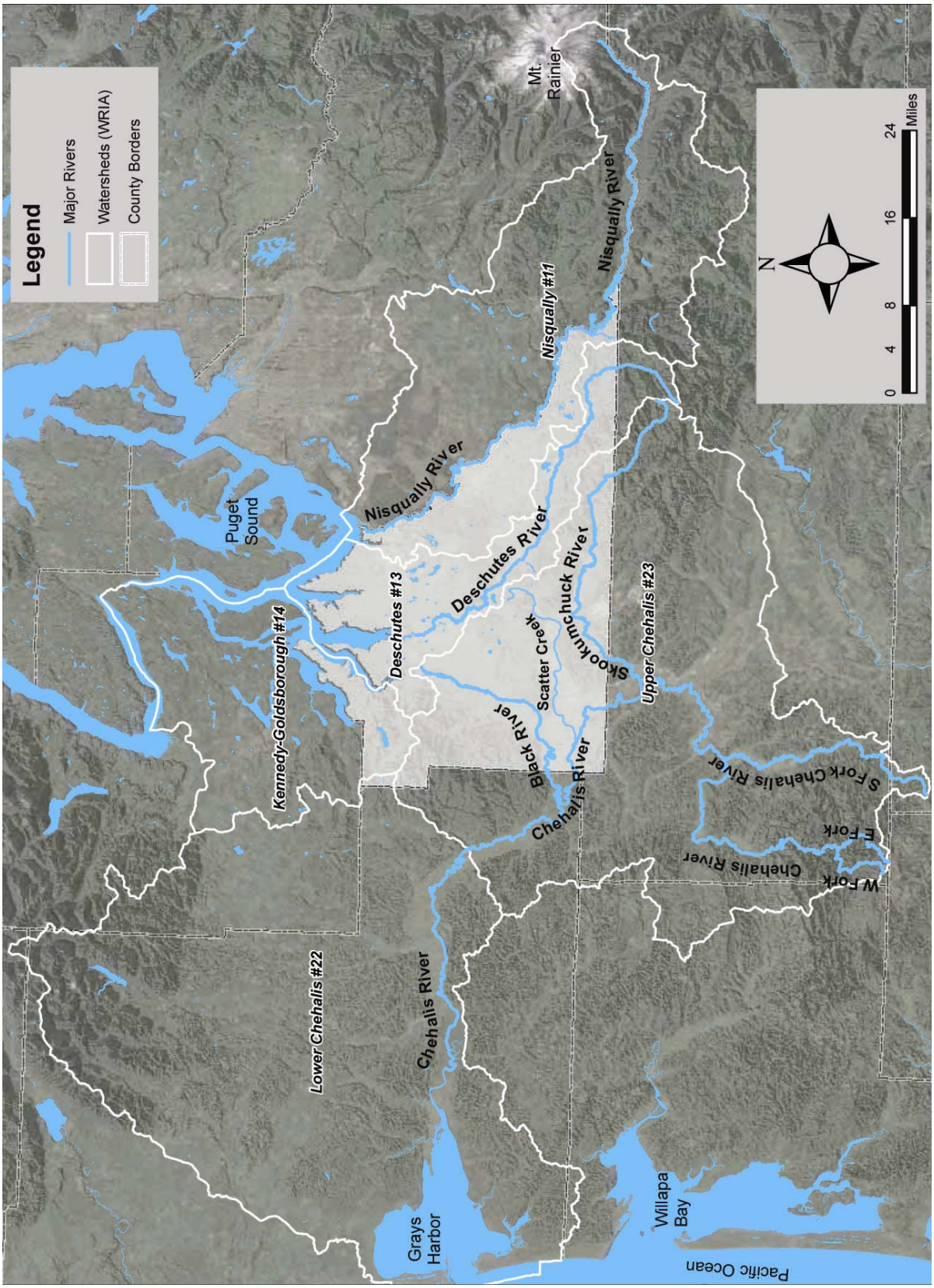


Figure 4-2. Rivers and WRIA Boundaries Within the Planning Area

TABLE 4-1.
LEGAL AND REGULATORY CAPABILITY

	Local Authority	State or Federal Prohibitions	Other Jurisdictional Authority	State Mandated	Comments
Codes, Ordinances & Requirements					
Building Code	Y	N	N	Y	Thurston County Code 14.17.010 adopts State Building code (IBC). 8/3/2010
Zoning Code	Y	N	N	Y	Thurston County Code, Title 20, 1997
Subdivisions	Y	N	N	N	Thurston County Code, Title 18, 1997
Post-Disaster Recovery	N	N	N	N	
Real Estate Disclosure	N	N	N	N	
Growth Management	Y	N	N	Y	County Comprehensive Plan , 2010
Site Plan Review	Y	N	N	N	Thurston County Code, Title 18, 1997
Special Purpose (flood management, critical areas)	Y	N	N	Y	Thurston County Code, Title 15, Chapter 17.15, 7/24/2012
Planning Documents					
Comprehensive Plan	Y	N	N	Y	County Comprehensive Plan , 2010
Capital Improvement Plan	Y	N	N	N	The County has a 6-year CIP for roads, water, drainage and sewer that is updated annually.
Economic Development Plan	Y	N	N	N	County Comprehensive Plan includes an economic development chapter. Countywide planning policies for economic development and employment, 1992
Floodplain or Basin Plan	Y	N	N	N	This plan will become the floodplain management plan of record for the County
Stormwater Plan	Y	N	N	Y	Washington Department of Ecology, Stormwater Management Manual for Western Washington, 2012
Habitat Conservation Plan	Y	N	N	N	Thurston County Natural Resources Program-Planning Department
Shoreline Management Plan	Y	N	N	N	1990 Shoreline Master Program, to be updated
Emergency Response Plan	Y	N	N	N	2012 Comprehensive Emergency Management Plan
Continuity of Operations Plan	N	N	N	N	
Post Disaster Recovery Plan	N	N	N	N	
Terrorism Plan	Y	N	N	N	2012

TABLE 4-2.
ADMINISTRATIVE AND TECHNICAL CAPABILITY

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Planning, Public Works
Engineers or professionals trained in building or infrastructure construction practices	Yes	Public Works, Permit Assistance Center
Planners or engineers with an understanding of flooding hazards	Yes	Planning, Public Works
Staff with training in benefit/cost analysis	Yes	Planning, Emergency Management
Floodplain manager	Yes	Permit Assistance Center
Surveyors	Yes	Public Works
Personnel skilled or trained in GIS applications	Yes	Emergency Management, Geo Data Center
Scientist familiar with flooding hazards in local area	Yes	Planning Natural Resources Division
Emergency manager	Yes	Emergency Management
Grant writers	Yes	Emergency Management, Planning, Thurston Regional Planning Council

TABLE 4-3.
FISCAL CAPABILITY

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes

PART 2 —
RISK ASSESSMENT

CHAPTER 5.
RISK ASSESSMENT METHODOLOGY

5.1 PURPOSE OF RISK ASSESSMENT

This part of the flood hazard mitigation plan evaluates the risk of the flood hazard in the planning area (CRS Step 5). Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards such as flooding. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- Exposure identification—Determine the extent of people, property, environment and economy exposed to the effects of the natural hazard.
- Vulnerability evaluation—Estimate potential damage from the natural hazard and associated costs.

The risk assessment describes the flooding hazard, the planning area's vulnerabilities, and probable event scenarios. The following steps were used to define the risk:

- Identify and profile the flooding hazard—The following information is given:
  - Principal sources of flooding in the planning area
  - Major past flood events
  - Geographic areas most affected by floods
  - Estimated flood event frequency
  - Estimates of flood severity
  - Warning time likely to be available for response
  - Secondary hazards associated with the flood hazard
  - Potential impacts of climate change on flooding
  - Expected future trends that could affect the flood hazard
  - Scenario of potential worst-case flood event.
- Determine exposure to the flood hazard—Exposure was determined by overlaying flood maps with an inventory of structures, facilities, and systems to determine which of them would be exposed to flood events.
- Assess the vulnerability of exposed facilities—Vulnerability of exposed structures and infrastructure was determined by interpreting the probability of occurrence of each flood event and assessing structures, facilities, and systems that are exposed.

5.2 RISK ASSESSMENT APPROACH

5.2.1 FEMA's HAZUS-MH Software

In 1997, FEMA developed the standardized Hazards U.S. (HAZUS) model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. HAZUS was later

expanded into a multi-hazard methodology, HAZUS-MH, with new models for estimating potential losses from hurricanes and floods.

HAZUS-MH is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates FEMA review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

HAZUS-MH provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

5.2.2 Application for This Plan

To assess the flood hazard for this plan, a Level 2, user-defined analysis was performed for both general building stock and critical facilities. GIS building and assessor data (replacement cost values and detailed structure information) were loaded into HAZUS-MH. Finished floor elevations were established within the model using the following data:

- Available FEMA elevation certificates
- Date of construction of the structure.

An updated inventory was used in place of the HAZUS-MH defaults for essential facilities, transportation and utilities in the floodplain. Current planning area digital Flood Insurance Rate Maps were used to delineate flood hazard areas and estimate potential losses from the 100-year event flood. County flood-of-record data was also incorporated where available, and used to model flood-of-record events. Using the

digital Flood Insurance Rate Map floodplain boundaries and LIDAR data from a 2011 Thurston County project, flood depth grids were generated and integrated into the model.

At the request of the Steering Committee, risk assessment results for this plan were divided by incorporated city within the planning area as well as by drainage basin boundary. The drainage basin GIS layer of information was provided by the Natural Resources Division of the Thurston County Planning Department, using boundaries defined within the local WRIA planning processes. This system defines the following drainage basins:

- Black River
- Budd Inlet/Deschutes River
- Chehalis River
- Eld Inlet
- Henderson Inlet
- Nisqually River
- Skookumchuck River
- Totten Inlet.

Table 5-1 provides HAZUS model data documentation for this project.

5.2.3 Limitations

Loss estimates, exposure assessments and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent and severity of the flood hazard
- Mitigation initiatives already employed
- The amount of advance notice residents have to prepare for a flood event.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. The results do not predict precise results and should be used only to understand relative risk.

TABLE 5-1.
HAZUS MODEL DATA DOCUMENTATION

Data	Source	Date	Format
Building information such as area, occupancy, date of construction, foundation type, stories	Thurston County Assessor	2012	Digital (GIS) format
Finished floor elevations	Thurston County Permit Assistance Center	2012	FEMA elevation certificates in CRS access data base. (Note: this data was available for only some of the structures in the floodplain)
Building replacement cost	RS Means	2012	Paper format. Updated RS means Values imported into HAZUS Model
Population data	Washington Office of Financial Management	5/1/2012	Digital (GIS) format
Flood hazard data	FEMA	10/16/2012	Digital (GIS) format
Flood hazard data	Thurston County Planning Department Natural Resources Division	2012	Surveyed high-water mark data converted to digital (GIS) depth grid
Drainage basin data	Thurston County Planning Department Natural Resources Division	2012	Eight basin boundaries in digital (GIS) format
Critical facilities and infrastructure	FEMA-HAZUS	2012	Comprehensive Data Management System default, HAZUS version 2.2, digital (GIS) format
Critical facilities and infrastructure	Thurston County Emergency Management	2012	Digital (Excel) format

CHAPTER 6.
THURSTON COUNTY FLOOD HAZARD PROFILE

6.1 GENERAL CONCEPTS

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

DEFINITIONS

Flood—The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Floodplain—The land area along the sides of a river that becomes inundated with water during a flood.

100-Year Floodplain—The area flooded by a flood that has a 1-percent chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1-percent annual chance flood is the standard used by most federal and state agencies.

Return Period—The average number of years between occurrences of a hazard (equal to the inverse of the annual likelihood of occurrence).

Riparian Zone—The area along the banks of a natural watercourse.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

6.1.1 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The “annual flood” is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

6.1.2 Floodplain Ecosystems

Floodplains can support ecosystems that are rich in plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

6.1.3 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

6.2 PRINCIPAL FLOODING SOURCES IN THURSTON COUNTY

Of all natural hazards that affect Thurston County, floods are the most common and, on an annual average basis, the most costly. The following types of flooding occur in unincorporated Thurston County:

- River or stream (riverine) flooding
- Groundwater flooding
- Tidal flooding
- Flash flooding
- Urban flooding.

6.2.1 Riverine Flooding

River and stream floods occur because of prolonged heavy rainfall, a rapidly melting snow pack or a combination of these. Historically, Thurston County must experience two or three days of rainfall averaging 2 to 5 inches per day for this type of flooding to occur. The actual duration and rainfall amount needed to cause flooding depends on the initial condition of the river or stream, groundwater conditions, and runoff conditions. The county is also vulnerable to events beyond its borders. Both the Nisqually River and the Chehalis River have flooded in Thurston County because of events in their watersheds outside the county. The following sections describe the five river basins in the planning area that are sources of riverine flooding. Figure 3-2 and

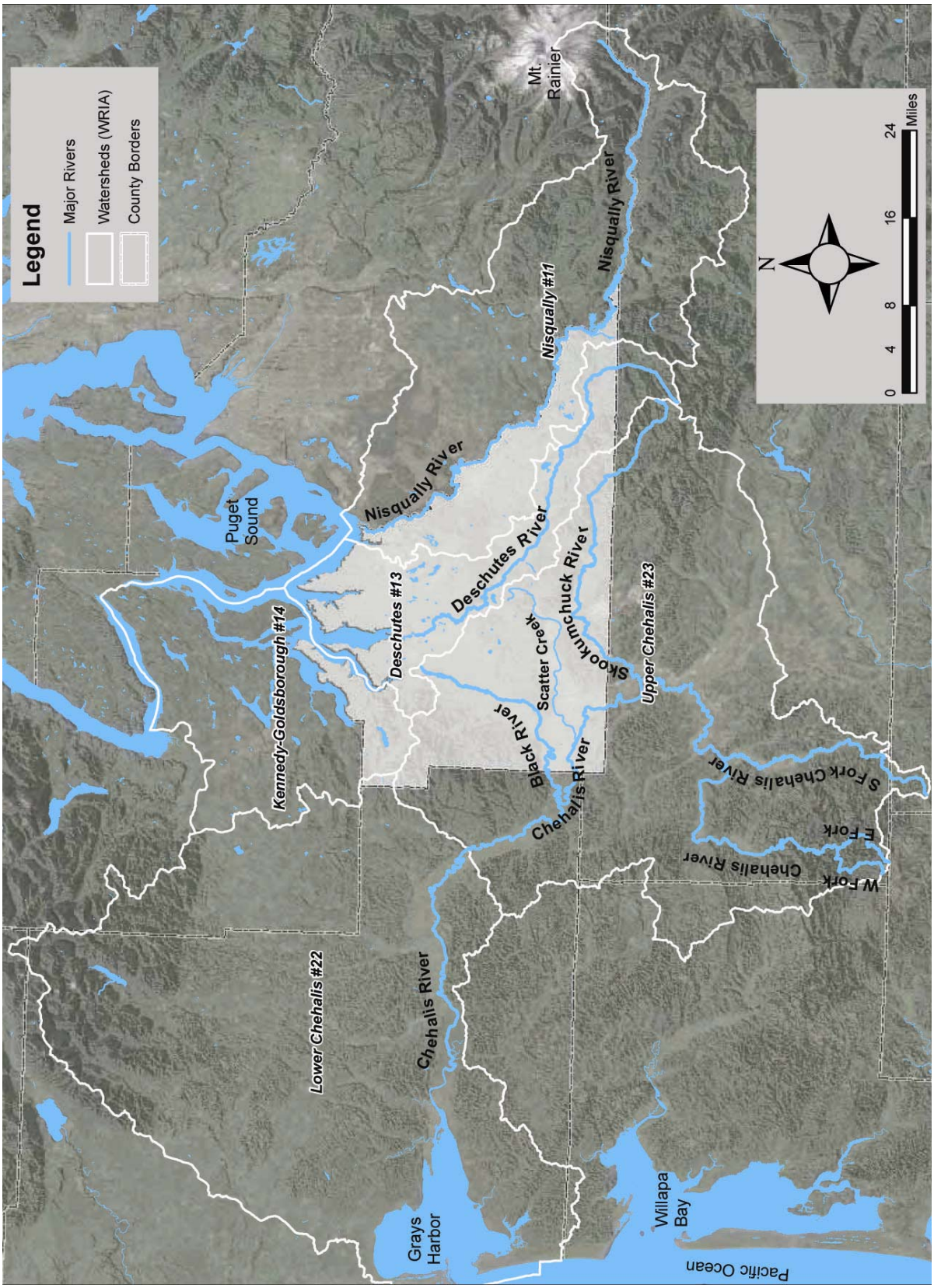


Figure 4-2. Rivers and WRIA Boundaries Within the Planning Area

show the rivers, drainage basins and WRIA planning areas within Thurston County.

Nisqually River Basin

The Nisqually River is the eastern boundary of Thurston County and flows into Puget Sound about 10 miles northeast of Olympia. Flooding on the Nisqually River is related largely to the amount of water released from LaGrande Dam in Pierce County near the southeast corner of Thurston County. This, in turn, is related to how much water enters Alder Lake and is released from Alder Dam. Feeder streams such as Ohop, Yelm, and Tanwax Creeks also influence flooding, as does high tide in the Nisqually Delta. Feeder streams only significantly exacerbate flooding when fed by lowland heavy snow that is melting rapidly due to a change from cold to warm weather. This kind of event is rare and can be mitigated by moderately lowering the level of Alder Lake prior to the arrival of a warm weather system when there is significant existing lowland snow.

The National Weather Service issues a flood warning for the Nisqually River when forecasting indicates that the river will reach a stage of 12 feet or higher at the McKenna gage. The County has defined the following impacts based on Nisqually River stage at the McKenna gage (Thurston County EM, 2012):

- **Action Stage—**At a stage of 8 feet, residents should be aware that the river is likely to flood.
- **Flood Stage—**At a stage of 10 feet, the Nisqually River will flood at the lower end near the mouth. High tide levels on Puget Sound may increase the amount of flooding. The Nisqually River will also spill over its banks between LaGrande and McKenna.
- **Moderate Flood Stage—**At a stage of 13 feet, the Nisqually River will flood from LaGrande downstream through McKenna to the mouth. Swift waters will flood roads, farms and some residential areas, including the residential care facility in McKenna. Erosion will likely damage properties along river banks.
- **Major Flood Stage—**At a stage of 14 feet, the Nisqually River will cause major flooding from LaGrande downstream through McKenna to the mouth. Deep and swift waters will flood roads, farms and residential areas, including the residential care facility in McKenna. Erosion may cause severe damage. Flooding will occur all along the river, including headwaters, tributaries and other streams within and near the Nisqually River Basin.

Recently, work was done in the Nisqually Delta to restore the natural estuary habitat. It is unknown how this reclamation will affect anticipated flooding impact levels.

For WRIA planning, the Nisqually River basin is a single planning area: WRIA 11. The portion of the basin within the planning area was used in the HAZUS modeling for this report.

Deschutes River Basin

The Deschutes River roughly parallels and is 5 to 10 miles southwest of the Nisqually River. It flows into Puget Sound at Olympia. The Deschutes is the fastest rising (and falling) river in Thurston County, responding quickly to local rainfall and runoff. The County has defined the following impacts based on Deschutes River stage at the Rainier Vail Loop Bridge gage (Thurston County EM, 2012):

- **Action Stage—**At a stage of 9 feet, the Deschutes River locally spills over its banks into low fields and forested lands, mainly along Vail Cutoff Road and Reichel Road (east of Vail).
- **Flood Stage—**At a stage of 11 feet, the Deschutes River will flood downstream in Tumwater Valley, including the golf course. Minor flooding will also occur in several residential areas, mainly Cougar Mountain and Driftwood Valley. Many roads and farm lands will also be flooded.

- **Moderate Flood Stage—**At a stage of 13.5 feet, the Deschutes River will flood residential areas, especially Cougar Mountain, Driftwood Valley and Falling Horseshoe. Downstream flooding will occur in areas of Tumwater Valley, including the golf course. Many roads and farm lands will also be flooded.
- **Major Flood Stage—**At a stage of 15 feet, the Deschutes River will cause major flooding, with swift and deep water flooding roads, farmlands and the residential areas of Cougar Mountain, Driftwood Valley, Falling Horseshoe and areas downstream in the Tumwater Valley. Flooding will occur all along the river including headwaters, tributaries and other streams within and near the Deschutes River Basin.

For WRIA planning, the Deschutes River basin is a part of WRIA 13, along with the Henderson Inlet basin. The HAZUS modeling for this report used the portion of this basin within the planning area, designated as the Budd Inlet/Deschutes River basin.

Skookumchuck River Basin

The Skookumchuck River drains most of the hills in the south-central portion of the county south of the Deschutes drainage area. The Skookumchuck flows west from the eastern county line to Bucoda and then turns sharply to flow southwest to its confluence with the Chehalis River near Centralia. The National Weather Service issues a flood warning for the Skookumchuck River when forecasts indicate that the river will reach a stage of 13.5 feet at the gage near Bucoda. The County has defined the following impacts based on Skookumchuck River stage at the Bucoda gage (Thurston County EM, 2012):

- **Action Stage—**At a stage of 11.5 feet, residents should be aware that the river is likely to flood.
- **Flood Stage—**At a stage of 13.5 feet, the Skookumchuck River will flood a few roads and low pasture lands near Bucoda.
- **Moderate Flood Stage—**At a stage of 15 feet, the Skookumchuck River will flood several residential and business areas around Bucoda. Flood waters will cover many roads.
- **Major Flood Stage—**At a stage of 17 feet, the Skookumchuck River will cause major flooding in the Bucoda area, with deep and swift flood waters inundating residential and business areas and numerous roads. Flooding will occur all along the river, including headwaters, tributaries and other streams within and near the Skookumchuck River Basin.

For WRIA planning, the Skookumchuck River basin is a portion of the Upper Chehalis planning area: WRIA 23. The portion of the Skookumchuck basin within the planning area was used in the HAZUS modeling for this report.

Chehalis River Basin

The Chehalis River flows northwest from Centralia and crosses the southwestern corner of Thurston County, where it drains the Michigan Hill area and receives water from Prairie Creek and Scatter Creek. The Chehalis discharges into the Pacific Ocean at Grays Harbor.

Due to its large drainage area, the Chehalis River tends to rise and fall slowly over a long period of time. The most predictable scenario for the Chehalis occurs when rains fall over all of southwestern Washington and all regional rivers and streams rise. However, the Chehalis can also experience flooding when there is little or no rain in Thurston or Grays Harbor Counties, but heavy rain in Lewis and Pacific Counties. This causes flooding to occur later than normal. A third scenario occurs when heavy rain falls in Grays Harbor County, but not in Thurston or Lewis counties. Feeder streams can fill the Chehalis and

cause water to back up into Thurston County. The County has defined the following impacts based on Chehalis River stage at the gage near Grand Mound (Thurston County EM, 2012):

- **Action Stage—**At a stage of 12.2 feet, the Chehalis River will locally spill out of its banks into nearby fields and over a few roads.
- **Flood Stage—**At a stage of 14 feet, the Chehalis River will flood several roads in Independence Valley, including James Road, Independence Road and Moon Road. Flood waters will also cover nearby farm lands.
- **Moderate Flood Stage—**At a stage of 15.5 feet, the Chehalis River will flood several roads in Independence Valley with swiftly moving water, including SR-12 and James, Independence, Moon and Anderson Roads. Floodwaters will cut off access to and from the Chehalis Reservation and inundate nearby farm lands. Some residential structures may be threatened
- **Major Flood Stage—**At a stage of 17 feet, the Chehalis River will cause major flooding, inundating roads and farm lands in Independence Valley. Deep and swift floodwaters will cover SR-12 and James, Independence and Moon Roads. Flooding will occur all along the river, including headwaters, tributaries and other streams within and near the Chehalis River Basin.

For WRIA planning, the Chehalis River basin covers two planning areas: the Upper Chehalis is WRIA 23 and the Lower Chehalis is WRIA 22. The portion of the Chehalis basin within the planning area, excluding the Black and Skookumchuck River basins, was used in the HAZUS modeling for this report.

Black River Basin

The Black River drains southwest from the south end of Black Lake into the Chehalis River near Oakville in Grays Harbor County. The Black River drainage is approximately 144 square miles, with 105 square miles in Thurston County. In general, the Black River is a slow flowing river with a broad floodplain. Most flooding along the main stem of the river is inundation flooding with low-velocity floodwater.

The west side of the Black River drainage drains the Capitol Forest area. Main tributaries in this part of the basin are Dempsey, Waddell, and Mima Creeks. This area ranges in elevation from 2,659 feet at Capitol Peak to 200 feet at the Black River valley floor. It is subject to high-intensity, short-duration rain events that can produce flash flooding in these creeks. This flooding can be compounded by snow in the watershed. In general, snowmelt alone does not cause flooding in this area.

The east side of the Black River basin drains the relatively flat area south of Tumwater, west of Offutt Lake and north of Tenino. The elevation difference of this area is approximately 200 feet. The main streams draining this area are Salmon and Beaver Creeks and Bloom Ditch. These are very slow-flowing water systems that tend to cause inundation flooding with no velocity. This side of the basin is susceptible to high-groundwater flooding during periods of extended rain.

Because of its flat topography, the Black River is also susceptible to flooding by waters backing up from the Chehalis River. This is especially true when flooding on the Chehalis River is concurrent with high tides along the coast.

In April 2005, the Washington State Department of Ecology established a river gauging station on the Black River where it crosses U.S. Highway 12. Unlike the gauging stations on the Chehalis at Prather Road Bridge and at Porter, this site has not been rated and is not modeled to forecast flood levels. However, the County has defined the following impacts based on Black River stage at the Highway 12 gage (Thurston County EM, 2012):

- **Action Stage**—At a stage of 6 feet, residents should be aware that the river is likely to flood.
- **Flood Stage**—At a stage height of 8 feet, the Black River has reached flood stage; the river will spill out of its banks into nearby fields and woods with limited water over a few spots on local roads.
- **Moderate Flood Stage**—At 10 feet, moderate flooding will occur. This stage corresponds to 15.5 feet at the Prather Road Bridge on the Chehalis River. At this level, the Chehalis River in Thurston County will flood several roads in Independence Valley with swiftly moving water, including U.S. Highway 12 and James, Independence, Moon and Anderson Roads. Floodwaters will cut off access to and from the Chehalis Reservation and inundate nearby farmlands. Some residential structures may be threatened.
- **Major Flood Stage**—Major flooding occurs when the Black River reaches a stage of 12 feet. During the December 2007 flood, the gauge on the Black River recorded a stage of 14.5 feet.

For WRIA planning, the Black River basin is a portion of the Upper Chehalis planning area: WRIA 23. The portion of Black River basin within the planning area was used in HAZUS modeling for this report.

6.2.2 Groundwater Flooding

Groundwater flooding occurs whenever there is a high water table and persistent heavy rains. The situation is caused in areas where an upper, thin layer of permeable soils overlays an impermeable layer of hard pan. As the ground absorbs more and more rain water, the groundwater table rises and causes flooding where it is higher than the land surface. The condition has historically been most severe in the second and subsequent years of consecutive wet years.

According to a U.S. Army Corps of Engineers' post-event report on the winter storm of 1996-1997, the frequency of a groundwater flooding disaster is probably on the order of 25 years. The 1996-1997 event was the first widespread groundwater flooding since 1972 and the worst on record until the winter of 1998-1999 which is now the "event of record." Statistically, the Corps estimates that there is approximately a 70-percent chance that the 1996-1997 flooding will be equaled or exceeded at least once during a 30-year cycle.

Thurston County data and historical data provided by the National Oceanic and Atmospheric Administration identify two types of weather patterns that trigger groundwater flooding events:

- **Type 1: Intense, Short-Duration Storms in Succession—**Type 1 storms are characterized by a weather system called the "Pineapple Express." This weather pattern draws tropical moisture from an area near Hawaii and conveys it directly to Western Washington and Oregon. These systems tend to deliver a wet-weather pattern that results in warm temperatures and heavy rainfall for up to a week at a time. They rapidly melt any snow that may have accumulated and produce rainfall that generally exceeds 6 inches per event. The groundwater system in Thurston County can typically handle one of these events without much flooding if it occurs early in the season. Groundwater flooding generally occurs when more than one of these systems impacts the region within a month, or if an event happens later in the season after normal winter rains have raised groundwater levels to within a few feet of the surface. Normal high groundwater levels occur in mid to late March; if a large storm coincides with this groundwater peak, the capacity of the system is exceeded and groundwater flooding can occur. These events are the driving factors of urban riverine flooding and landslides as well as groundwater flooding. This pattern has been increasing in frequency over the past decade and the overall intensity of the events is increasing.
- **Type 2: Persistent Low-Intensity Precipitation Pattern—**The Type 2 weather pattern is less common than the Type l pattern but it produces similar flooding. It is characterized by

some measurable low-intensity rainfall (generally less than 1 inch) every day for several weeks. These events gradually overwhelm the groundwater system by saturating the soil column. This pattern causes more widespread flooding throughout the county, both in areas that routinely flood and in areas that are generally not susceptible to groundwater flooding. Only two occurrences of this weather pattern have been identified in the last decade. It was first identified in the winter of 2006–2007. Later review of groundwater and precipitation records identified an occurrence in the winter of 2002–2003 that was less extreme but resulted in similar groundwater flooding. In both cases, groundwater flooding occurred in areas not previously identified as susceptible to such flooding. This suggests that a Type 2 event may represent a more widespread groundwater problem than the more common Type l event. The Type 2 pattern does not appear to cause riverine flooding or landslides, but data is insufficient at this time to be certain of this conclusion.

6.2.3 Tidal Flooding

Spring tides, the highest tides during any month, occur with each full and new moon. When these coincide with a northerly wind piling water in south Puget Sound, tidal flooding can occur. The tides can also enhance flooding in delta areas when rivers or creeks are at or near flood stage. The area at greatest risk to tidal flooding is the Olympia waterfront, but such flooding is also a threat to low-lying farmlands in the Nisqually Valley and along McLane Creek near Mud Bay. Tidal impact is of most concern in delta areas when rivers are at flood stage and high tide exacerbates the situation. Concerns about tidal flooding are anticipated to increase due to the impacts of global climate change and sea level rise. See Section 6.9 for further discussion of this issue.

6.2.4 Flash Flooding

Flash flooding is flooding characterized by a quick rise and fall of water level. Flash floods generally result from intense storms dropping large amounts of rain within a short period of time onto watersheds that cannot absorb or slow the flow. The natural terrain and vegetation in Thurston County helps to reduce the potential for flash floods. However, the Deschutes River and many smaller streams can experience flash floods due to their rapid response to rainfall, which can be difficult to forecast. This rapid response can be attributed to factors such as location within the watershed, channel capacity, contributory impacts and urbanization.

6.2.5 Urban Flooding

Thurston County has experienced rapid change due to urban development in once rural areas. Drainage facilities in recently urbanized areas are a series of pipes, roadside ditches and channels. Urban drainage flooding occurs when these conveyance systems lack the capacity to convey runoff to nearby creeks, streams and rivers. As drainage facilities are overwhelmed, roads and transportation corridors become conveyance facilities. The key factors that contribute to urban drainage flooding are rainfall intensity and duration. Topography, soil conditions, urbanization and groundcover also play an important role.

6.3 MAJOR FLOOD EVENTS

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses and public entities. Some of the programs are matched by state programs. Thurston County has experienced 16 flooding events since 1972 for which presidential disaster declarations were issued, as summarized in Table 6-1.

TABLE 6-1.
HISTORY OF THURSTON COUNTY FLOOD EVENTS WITH PRESIDENTIAL DISASTER DECLARATIONS

Event Dates	Declaration #	Type of event	Estimated Damage[a]
2/1/1972 – 2/1/1972	DR-322	Severe storms & flooding	N/A
3/24/1972 – 3/24/1972	DR-328	Heavy rains & flooding	N/A
1/25/1974 – 1/25/1974	DR-414	Severe storms, snowmelt & flooding	$50,000
12/13/1975 – 12/13/1975	DR-492	Severe storms & flooding	$38,461,538
12/10/1977 – 12/10/1977	DR-545	Severe storms, mudslides, & flooding	$159,300
1/6/1990 – 1/14/1990	DR-852	Severe storms & flooding	$3,846,153
11/9/1990 – 12/20/1990	DR-883	Severe storms & flooding	$7,738,098
11/7/1995 – 12/18/1995	DR-1079	Severe storms, high wind, and flooding	$556,575
1/26/1996 – 2/23/1996	DR-1100	High winds, severe storms and flooding	$22,000,000
12/26/1996 – 2/10/1997	DR-1159	Severe winter storms, land & mudslides, flooding	$2,840,000
3/18/1997 – 3/28/1997	DR-1172	Heavy rains, snow melt, flooding, land & mud slides	$133,333
10/15/2003 – 10/23/2003	DR-1499	Severe storms and flooding	$863,636
11/2/2006 – 11/11/2006	DR-1671	Severe storms, flooding, landslides, and mudslides	$100,000
12/1/2007 – 12/17/2007	DR-1734	Severe storms, flooding, landslides, and mudslides	$4,600,000
1/6/2009 – 1/16/2009	DR-1817	Severe winter storm, landslides, mudslides, and flooding	$3,200,000
1/14/2012 – 1/23/2012	DR-4056	Severe winter storm, flooding, landslides, and mudslides	N/A

a. Data obtained from Spatial Hazard Events and Losses Database for the United States

Review of these events helps identify targets for risk reduction and ways to increase a community's capability to avoid large-scale events in the future. Still, many flood events do not trigger federal disaster declaration protocol but have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for flooding. The following sections provide an overview of some of the more significant floods in the county.

6.3.1 January 6-16, 2009, Federal Disaster 1817: Severe Winter Storms, Landslides, Mudslides, and Flooding

In January 2009, a Pineapple Express system raised temperatures and dropped heavy rains throughout western Washington following one of the heaviest Pacific Northwest snow storms in decades. Severe flooding occurred throughout western Washington. The Chehalis, Skookumchuck, Deschutes, Nisqually, and Black Rivers all experienced major flooding. The Skookumchuck River crested at 17.72 feet on January 8, making it the second worst flood level in the river's recorded history. The Chehalis River crested at 18.18 feet near Grand Mound, causing major flooding in the Chehalis River Basin.

Interstate 5 was closed for 20 miles for nearly two days. State Route 12, State Route 8 and Highway 101 were also closed for varying durations, some for multiple days. During the height of the flood event, 49 county roads were closed. Over 200 homes were isolated in the Bald Hill Road/Clearwood area, over 100 homes in the Rochester, Grand Mound and Gate areas, and another 50 homes in the Bucoda vicinity.

Damage to homes throughout Thurston County was estimated at $3 million. Damage was concentrated in and around the town of Bucoda, the Rochester community, and along the Deschutes River outside of Yelm. Damage to public facilities and roads around Thurston County and the overtime cost for city and county officials to respond to the flooding cost $2.5 million.

6.3.2 December 1-7, 2007, Federal Disaster 1734: Severe Winter Storms, Flooding, Landslides, and Mudslides

Snow followed by a Pineapple Express on December 2 and 3 caused major flooding throughout southwest Washington. Heavy rainfall and melting snow resulted in record flooding on the Chehalis River. The Chehalis River crested at 20.23 feet, 6 feet over flood stage at the Grand Mound gage. Some sites in the Willapa Hills collected 14 to 18 inches of rain over the two-day period. Widespread flooding occurred in southwest Thurston County, heavily impacting the Rochester community, Grand Mound, and the Independence Valley area. Lewis County was especially hard hit, particularly around the more densely populated cities of Centralia and Chehalis and the farms around Adna and the Boisfort Valley.

The Deschutes and Black rivers also rose above their banks. The Deschutes River crested 2.75 feet above flood stage near Rainier and flooded residential areas and the Tumwater Valley. The region also experienced stream and urban flooding and flash flood conditions off of the hills of Capital Forest, resulting in washouts and landslides.

On December 4, Rochester Fire Department developed a command post for evacuation and rescue. The Rochester Fire District, the Thurston County Sheriff's Office Dive Team, local search and rescue volunteer groups, and the Washington State National Guard rescued 63 people—17 by helicopter. Nearly 300 people were rescued or forced to evacuate in Lewis County. Numerous people were forced from their homes to seek refuge in local area shelters. Thurston County opened a flood relief center at the Rochester Community Center to assist affected residents.

Thurston County documented 44 County roads and bridges that closed from storm and flood damage. Round-the-clock road repair and maintenance was carried out by the County and cities. Over 400 homes in southwest Thurston County were affected by road closures due to Chehalis River flooding. Interstate 5 closed for 20 miles between Chehalis and Grand Mound for five days. Some portions of Interstate 5 were covered with 10 feet of water. The Washington State Department of Transportation estimated that the closure resulted in $47 million in lost of economic output statewide. Additional closures along Highway 101 and Highway 8 disrupted commute patterns for thousands of people who travel through or live or work in Thurston County. A railroad bridge over the Nisqually River suffered significant damage due to debris collection against the bridge, resulting in a disruption of statewide rail traffic. West coast rail traffic was also shut down for several days due to flooding.

Nearly 10 inches of rain resulted in the worst urban flooding ever experienced on the City of Olympia's west side. On the morning of December 3, 2007 during the peak commute period, the west side of Olympia experienced major traffic backups for hours due to road closures. One of the highest traffic volume intersections in the region, Cooper Point Road and Black Lake Boulevard off Highway 101, experienced major flooding resulting in permanent damage to the signal controller. Several motorists attempted to drive through the water only to become stranded and forced to abandon their vehicles. Some vehicles were eventually completely submerged. The Percival Creek Bridge on Cooper Point Road also experienced inundation forcing its closure. Several businesses on Olympia's west side were affected by floodwaters and power outages. Puget Sound Energy turned off power as a safety precaution requiring businesses to temporarily close their doors. The Woodshed, a furniture retailer, lost its entire inventory to 3 feet of water. Replacement cost was estimated at $250,000.

On December 3, the Budd Inlet Sewer Treatment Plant was forced to discharge untreated wastewater into Budd Inlet due to the enormous volume of rainfall and runoff. At its peak, an estimated 1 million gallons per hour bypassed treatment processes and was sent through the emergency outfall near Fiddlehead Marina. After the flooding, many wells and water supplies were contaminated and non-functional in the unincorporated areas of the county. Public health advisories were issued to flood affected areas to inform the public to boil their water or consume only bottled water.

Preliminary cost estimates for response, preventive measures, and damage to public facilities throughout Thurston County exceeded $4.6 million. Many of the local fire districts' response personnel were volunteer firefighters. The reported response costs reflect only a fraction of the actual costs to local governments. Damage to Thurston County roads and bridges for non-Federal Highway Administration system roads was $2.7 million. Three sites of federal system roads incurred over $32,000 in damage.

For this disaster, nearly 267 Thurston County residents applied to FEMA for assistance, with over $6 million claims in property damage. FEMA awarded $544,928 in aid and the Small Business Administration granted $1.7 million to 30 homeowners and 2 businesses.

6.3.3 December 1996 (Federal Disaster 1159) to February 1997 Winter Storm and Flooding

1996 was the third wettest year of the 20th century and December was especially wet, receiving over twice its normal monthly rainfall. During this time period, flood-related damage included the following:

- 200 homes countywide were inundated.
- 200 drinking water wells became contaminated.
- Septic system failures occurred throughout the county.
- Response and recovery efforts cost Thurston County government over $340,000.
- Response, recovery, and repair costs for other government entities and utilities exceeded $750,000.
- Private property owners lost over $1.75 million in uninsured losses.

6.3.4 February 1996, Federal Disaster 1100: Flooding

The February 1996 flood was one of the most devastating floods on record for Thurston County. Every major river and stream crested its banks. Record flooding occurred on the Nisqually River near McKenna when the river crested at 17.13 feet, 7 feet over flood stage on February 8, 1996. Record flooding also occurred on the Skookumchuck River near Bucoda when the river crested at 17.87 feet, 4 feet over flood stage. Major flooding also occurred on the Deschutes and Chehalis Rivers. The 1996 flood resulted in the following impacts:

- Over 350 homes were inspected, 190 were declared uninhabitable.
- 47 homes were destroyed in the Nisqually Valley.
- Over two dozen homes were destroyed elsewhere.
- Nearly 1,000 people evacuated their homes.
- 300 people required rescuing.
- More than 300 sections of the County road system were damaged.

- Wa He Lut, a contract U.S. Bureau of Indian Affairs School, was destroyed by the Nisqually River.
- I-5 was closed at the Lewis County line.
- The main north-south railroad line at the Pierce County line was closed due to the Nisqually River diverting part of its flow through a road tunnel that runs under the tracks, almost destroying the tunnel and weakening the rail support above.
- Response and recovery efforts cost Thurston County government over $2 million.
- Response, recovery and repair costs for other government entities and utilities exceeded $20 million.
- Private property owners experienced over $22 million in uninsured losses.

One of the reasons that the Nisqually basin was the worst hit during this event is that Tacoma Power raised the level of the Alder Lake Dam to capacity during the first two days of the storm. The reservoir was over 17 feet below capacity at the start of the storm, as verified by historical records. Tacoma Power could have completely mitigated the effects of the event. This was a repeat of what happened in November 1995.

6.3.5 January 1990, Federal Disaster 852: Severe Storm and Flooding

The Deschutes River at Rainier crested at 17.01 feet, 6 feet over flood stage, setting the flood record. Major flooding also occurred on the Nisqually, Deschutes, Skookumchuck, and Chehalis Rivers. The Thurston region experienced the following impacts:

- I-5 closed for several days between Chehalis and Thurston County.
- Two people were killed by floodwaters in Lewis County.
- 83 elderly residents from the Nisqually Valley Care Center in McKenna were evacuated to a Red Cross Shelter at Yelm High School gymnasium.
- Floodwaters reached 4 feet deep on Bucoda streets and prompted nearly 600 residents to evacuate; one elderly man died from natural causes during the evacuation.
- Lowland Nisqually Valley residents were urged to evacuate their homes.
- Portions of downtown Olympia experienced urban flooding.

6.4 LOCATION

The major floods in the planning area have resulted from intense weather rainstorms between November and March. Flooding in portions of the planning area has been extensively documented by gage records, high water marks, damage surveys and personal accounts. This documentation was the basis for the June 16, 2009 FIRMs generated by FEMA for the planning area. To map the extent and location of the flood hazard for this plan, two sources of data were used (see Figure 6-1):

- The 2009 Flood Insurance Study (special flood hazard area only)
- Historical flood high-water mark data set maintained by Thurston County.

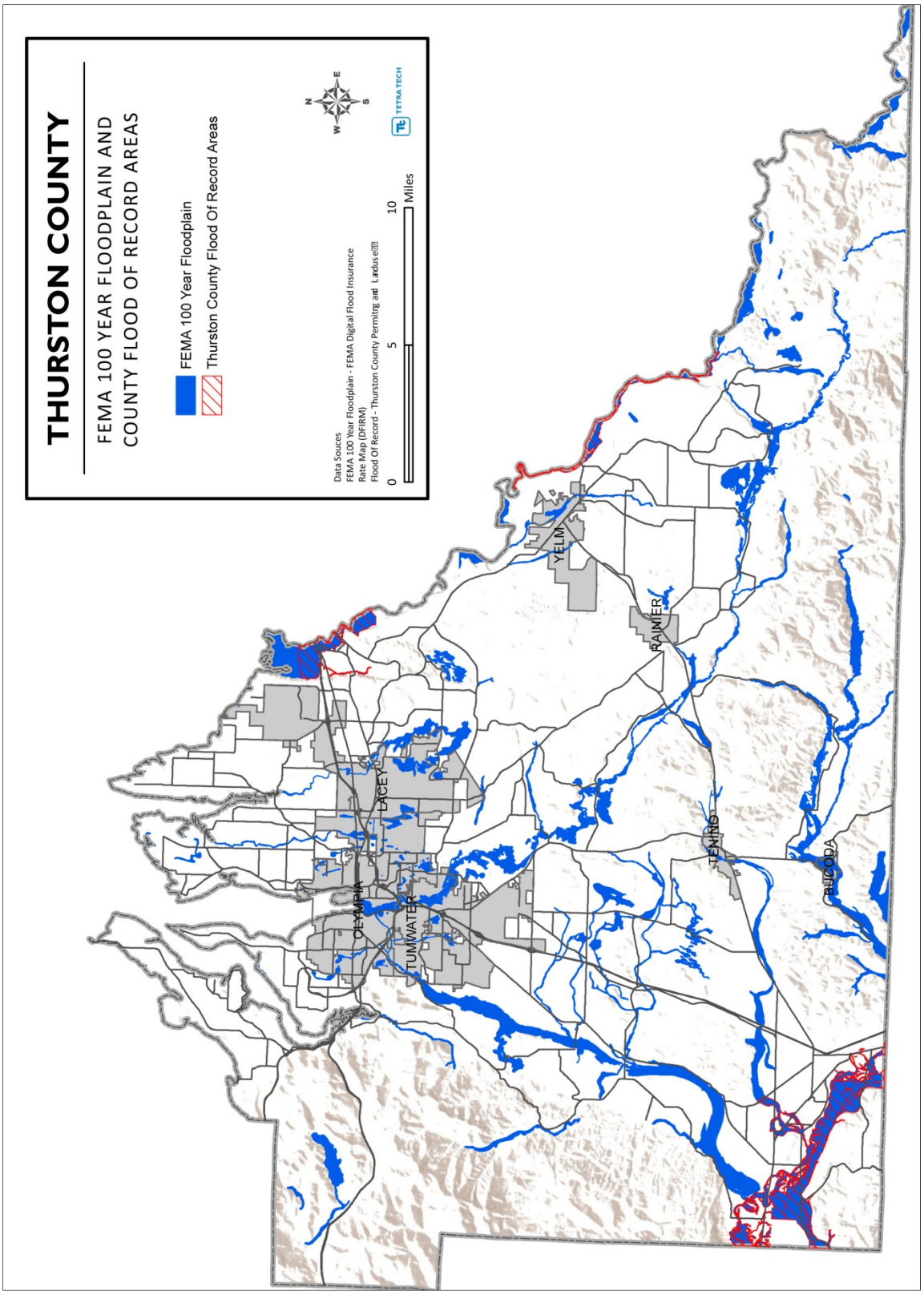


Figure 6-1. Mapped Flood Hazard Areas in Thurston County

6.5 FREQUENCY

Floods are commonly described as having a 10-, 50-, 100-, and 500-year recurrence interval, meaning that floods of these magnitudes have (respectively) a 10-, 2-, 1-, or 0.2-percent chance of occurring in any given year. These measurements reflect statistical averages only; it is possible for two or more rare floods (with a 100-year or higher recurrence interval) to occur within a short time period. Assigning recurrence intervals to historical floods on different rivers can help indicate the intensity of a storm over a large area. For example, the 1996 flood event exceeded the flood with 100-year recurrence interval on the Chehalis River, while the recurrence interval of that event for tributaries to the Chehalis such as the Skookumchuck River was determined to be 75 years.

Recent history has shown that Thurston County can expect an average of one episode of minor river flooding each winter. Large, damaging floods typically occur every 2 to 5 years. Urban portions of the county annually experience nuisance flooding related to drainage issues.

6.6 SEVERITY

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges; Table 6-2 lists peak flows used by FEMA to map the floodplains of the planning area.

6.7 WARNING TIME

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

Each watershed has unique qualities that affect its response to rainfall. A hydrograph, which is a graph or chart illustrating stream flow in relation to time (see Figure 6-2), is a useful tool for examining a stream's response to rainfall. Once rainfall starts falling over a watershed, runoff begins and the stream begins to rise. Water depth in the stream channel (stage of flow) will continue to rise in response to runoff even after rainfall ends. Eventually, the runoff will reach a peak and the stage of flow will crest. It is at this point that the stream stage will remain the most stable, exhibiting little change over time until it begins to fall and eventually subside to a level below flooding stage.

The potential warning time a community has to respond to a flooding threat is a function of the time between the first measurable rainfall and the first occurrence of flooding. The time it takes to recognize a flooding threat reduces the potential warning time to the time that a community has to take actions to protect lives and property. Another element that characterizes a community's flood threat is the length of time floodwaters remain above flood stage.

The Thurston County flood threat system consists of a network of precipitation gages throughout the watershed and stream gages at strategic locations in the county that constantly monitor and report stream levels. This information is fed into a U.S. Geological Survey forecasting program, which assesses the flood threat based on the amount of flow in the stream (measured in cubic feet per second). In addition to this program, data and flood warning information is provided by the National Weather Service (NWS). All of this information is analyzed to evaluate the flood threat and possible evacuation needs.

TABLE 6-2.
SUMMARY OF PEAK DISCHARGES WITHIN THE PLANNING AREA

Source/Location	Drainage area (sq. mi.)	Discharge (cubic feet/second) 10-Year	50-Year	100-Year	500-Year
Deschutes River					
Downstream of Henderson Blvd.	160	5,990	7,960	8,800	10,800
Upstream of confluence with Spurgeon Creek	127	5,630	7,450	8,230	10,100
At Vail Loop Rd, Crossing	89.8	4,950	6,500	7,150	8,690
Upstream of confluence with Mitchell Creek	44.1	2,690	3,590	3,980	4,900
Upstream of limit of detailed study	33.3	2,120	2,860	3,180	3,930
Skookumchuck River					
At State Route 507	113	6,990	9,100	9,980	12,100
Upstream of Bucoda	90.2	6,400	8,290	9,060	10,900
Upstream of confluence with Thompson Creek	65.9	5,790	7,440	8,110	9,700
Scatter Creek					
At downstream limit of detailed study	15.5	403	561	633	803
At confluence with Scatter Creek tributary	11.0	314	436	492	622
Upstream confluence with Scatter Creek tributary	4.6	167	230	258	324
Scatter Creek Tributary					
At confluence with Scatter Creek	6.4	212	293	330	415
At State Route 507	10.3	66	90	102	126
Chehalis River					
U.S. Geological Survey Gauge #12027500 near Grand Mound	895	38,600	50,100	55,000	66,600
Black River					
At County limits	124	2,820[a]	4,100[a]	4,940[a]	6,790
Downstream of confluence with Beaver Creek	99	1,550	2,220	2,490	3,200
Downstream of confluence with Waddell Creek	58.7	1,250	1,770	2,000	2,560
Outlet of Black Lake					
At Black Lake	5.0	219	303	342	431
Percival Creek					
At Sapp Rd., SW	1.8	94	128	145	180
At 54th Ave., SW	0.5	33	45	50	62
Woodland Creek					
At Pleasant Grade Rd., NE	24.6	151	205	228	284
Nisqually River					
At Mouth	711	21,500	29,000	33,000	45,000
Upstream of confluence with Horn Creek	488	21,000	28,000	32,000	44,000
Upstream of Confluence with Tanwax Creek	446	20,500	27,000	31,000	43,000
Yelm Creek					
From 1st St. to Centralia Canal	11.2	220	310	350	445
From 103rd Ave. to 1st St.	9.8	200	285	325	410
Upstream end of study reach, to 103rd Ave.	9.3	185	265	300	375

a. Includes effect of overflow from Chehalis River

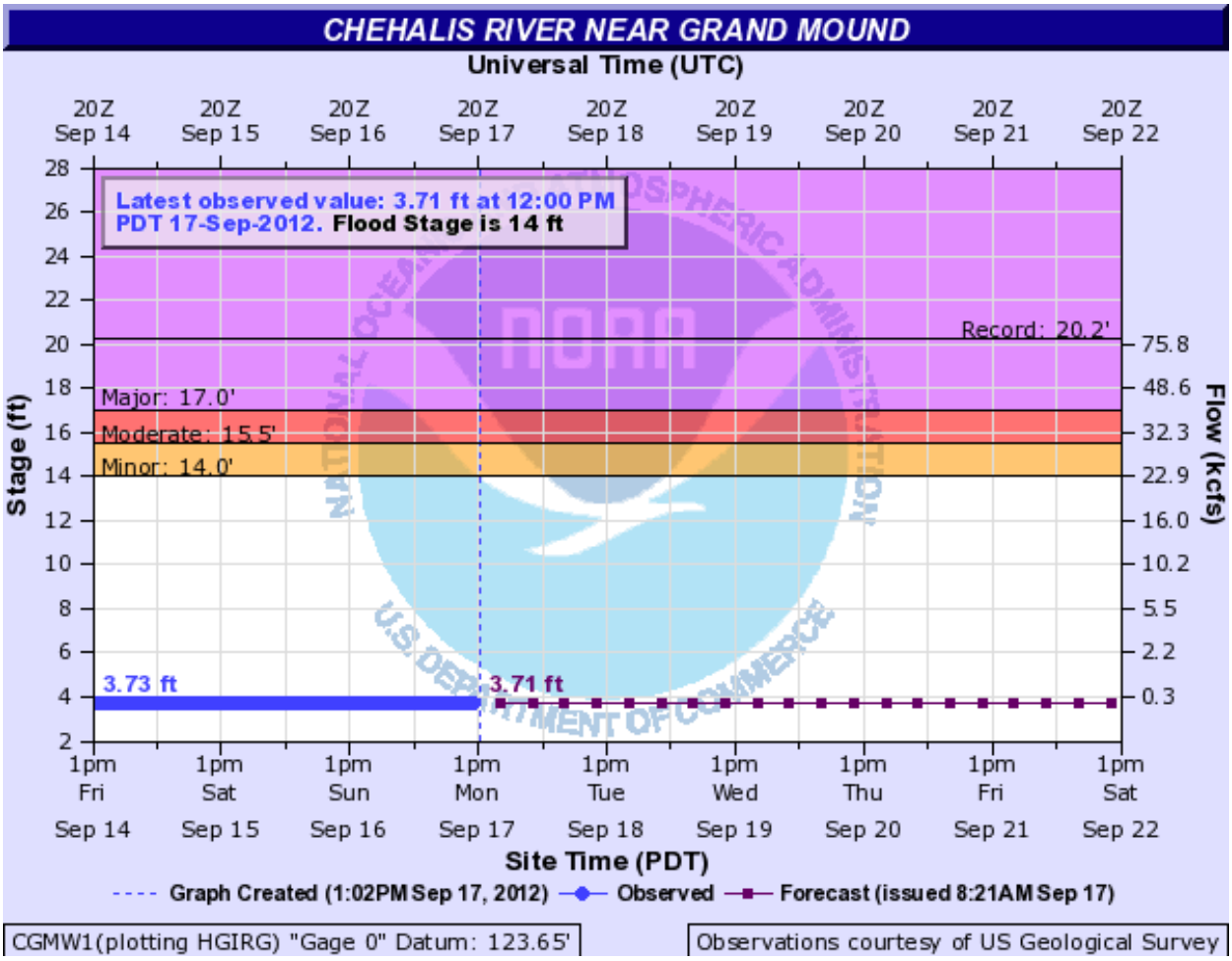


Figure 6-2. Chehalis River Hydrograph at Grand Mound

The NWS issues watches and warnings when forecasts indicate rivers may approach bank-full levels. When a watch is issued, the public should prepare for the possibility of a flood. When a warning is issued, the public is advised to stay tuned to a local radio station for further information and be prepared to take quick action if needed. A warning means a flood is imminent, generally within 12 hours, or is occurring. Local media broadcast NWS warnings. Thresholds for flood warnings have been established on the major rivers within Thurston county as follows:

- Nisqually River—Forecasted river stage of 12 feet or higher at the McKenna gage.
- Skookumchuck River—Forecasted river stage of 13.5 at the Bucoda gage. Low-lying flooding in Thurston County occurs at a height of 15 feet; major flooding at 17 feet.
- Chehalis River—Forecasted river stage of 14 feet at the Grand Mound gage. Major flooding occurs when the gage reaches 17.5 feet.
- Deschutes River—Forecasted river stage at 11 feet at the Vail Loop Bridge. Major flooding occurs when the height exceeds 13.5 feet. This river rises and falls at a faster rate than any other county river.

6.8 SECONDARY HAZARDS

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers or storm sewers.

6.9 CLIMATE CHANGE

"Climate change" refers to changes over a long period of time in patterns of temperature, precipitation, humidity, wind and seasons. Climate change is expected to have significant impacts on the Pacific Northwest by mid-21st century. Climate plays a fundamental role in shaping ecosystems and the human economies and cultures that depend on them. It is generally perceived that climate change will have a measurable impact on the occurrence and severity of flooding. As hydrology changes, what is currently considered a 100-year flood may strike more often, leaving many communities at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, floodways, bypass channels and levees, as well as the design of local sewers and storm drains.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood events in particular (e.g. 10-year floods) will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding.

Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

For the Thurston County planning area, climate change is anticipated to impact flood conditions on two fronts—hydrology and sea level rise—as described in the following sections. While many models are currently being developed to assess the potential impacts of climate change, there are currently none available to support flood hazard mitigation planning. As these models are developed in the future, this risk assessment may be enhanced to better measure these impacts.

6.9.1 Hydrology

Changes in temperature and precipitation will continue to decrease snow pack, affecting stream flow and water quality throughout the Pacific Northwest. Warmer temperatures will result in more winter precipitation falling as rain rather than snow, particularly in mid-elevation basins where average winter temperatures are near freezing. This change will result in less winter snow accumulation and higher winter stream flows. Earlier peak spring stream flow and lower summer stream flows are likely in rivers that depend on snowmelt, which includes most rivers in the Pacific Northwest.

The decline of the region's snowpack is predicted to be greatest at low and middle elevations due to increases in air temperature and less precipitation falling as snow. The average decline in snowpack in the

Cascade Mountains, for example, was about 25 percent over the last 40 to 70 years, with most of the decline due to the 2.5ºF increase in cool season air temperatures over that period. As a result, seasonal stream flow timing will likely shift significantly in sensitive watersheds.

Thurston County's rivers are not as impacted by snowpack as other rivers in western Washington, and therefore would not feel the impacts from changes to snowpack as much as others. However, any change in hydrograph associated with more concentrated, intense rainfall would have a great deal of impact on Thurston County's rivers.

Rivers with dams operating as flood control facilities could experience significant impacts from a changed hydrograph. Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased flows earlier in a storm cycle in order to maintain required margins of safety. Such early releases of flow can increase flood potential downstream. Throughout the western United States, communities downstream of dams are already experiencing increases in stream flows caused by earlier releases from dams.

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted. Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection and emergency response.

6.9.2 Sea Level Rise

Local sea level rise is produced by the combined effects of global sea level rise and local factors such as the following:

- Vertical land deformation, caused by phenomena such as:
  - Tectonic movement
  - Isostatic rebound (the rising of compressed earth after removal of a load such as glaciers)
- Seasonal ocean elevation changes due to atmospheric effects.

The melting of mountain glaciers and the Greenland and Antarctic ice sheets, along with the thermal expansion of the oceans, will likely continue to increase sea level for many hundreds of years into the future. The fourth Assessment Report of the Intergovernmental Panel on Climate Change projects global sea level rise over the course of this century to be between 7 and 15 inches for the lowest emissions scenario, and between 10 and 23 inches for the highest emissions scenario. Based on current science, the

"medium" estimate of 21st century sea level rise in Washington is that local sea level rise in Puget Sound will closely match global sea level rise. On the northwest Olympic Peninsula, very little relative sea level rise will be apparent, due to rates of local tectonic uplift that currently exceed projected rates of global sea level rise. On the central and southern Washington coast, the number of continuous monitoring sites with sufficiently long data records is small, adding to the uncertainty of sea level rise estimates for this region. Available data points suggest that uplift is occurring in this region, but at rates lower than those observed on the northwest Olympic Peninsula.

As a result of sea level rise, low-lying coastal areas will eventually be inundated by seawater or periodically over-washed by waves and storm surges. Coastal wetlands will become increasingly brackish as seawater inundates freshwater wetlands. New brackish and freshwater wetland areas will be created as seawater inundates low-lying inland areas or as the freshwater table is pushed upward by the higher stand of seawater.

6.10 FUTURE TRENDS

In 1983, Thurston County, together with the cities of Lacey, Olympia and Tumwater, initiated growth management in Washington State under an inter-local agreement called the Urban Growth Management Agreement. This agreement established an urban growth area boundary around the three cities large enough to accommodate growth for 20 years. Revisions to the agreement in 1988 generally reduced the boundary. In 1990, Washington State adopted the Growth Management Act, which among other things required Thurston County to establish urban growth boundaries, rural areas and natural resource lands. This was basically and extension of what the County had already been doing since 1983. The County and all of the cities and towns have adopted plans and development regulations that are currently in compliance with the Growth Management Act. These plans and regulations will dictate how floodplains, watersheds and critical areas are impacted by all future development and redevelopment activities.

Several comprehensive plans guide development in unincorporated parts of Thurston County, as described in Section 4.3.1. The County's Comprehensive Plan has adopted goals, objectives, policies and actions with regards to frequently flooded areas. The county has developed several plans and initiatives to promote healthy watersheds and to manage stormwater runoff. These plan components strive to steer future trends in development away from increasing flood risks in Thurston County. Thurston County's critical areas regulations regulate how development and redevelopment can safely occur on lands that contain critical areas, as described in Section 4.3.3. Additionally, Thurston County participates in the NFIP and has adopted flood damage prevention regulations in response to its requirements. Thurston County has committed to maintaining its good standing under the NFIP through initiatives identified in this plan.

Thurston County's population increased an average of 2 percent per year between 2000 and 2010, a total of 21.7 percent over that period. It is estimated that Thurston County's population will increase by 66% by the year 2040 (see section 3.4.1). The cumulative implementation of these plans and regulations will reduce the impacts of this future growth on the floodplains and critical areas of Thurston County, as well as lessen the impacts of flooding on future development. State mandated growth management, stormwater management and critical areas regulation has proven to be highly effective in limiting an increase in flood risk within the state of Washington. There is no reason to think that this effectiveness can't continue through the performance period of this plan.

6.11 SCENARIO

The primary water courses in the planning area have the potential to flood at regular intervals (2 to 5 years on the average), generally in response to a succession of intense winter rainstorms. Storm patterns of warm, moist air usually occur between early November and late March. A series of such weather events can cause severe flooding in the planning area. The worst-case scenario is a series of storms that flood numerous drainage basins in a short time. This could overwhelm response and floodplain management capabilities within the planning area. Major roads could be blocked, preventing critical access for many residents and critical functions. High in-channel flows could cause water courses to scour, possibly washing out roads and creating more isolation problems. In the case of multi-basin flooding, Thurston County would not be able to make repairs quickly enough to restore critical facilities and infrastructure. The floodplains mapped and identified by Thurston County will continue to take the brunt of these floods. Additionally, as the grounds become saturated, groundwater flooding issues typical for the planning area would be significantly enhanced.

6.12 ISSUES

Important issues associated with flood hazards in the planning area include but are not limited to the following issues identified by the planning team:

- There needs to be a sustained effort to gather historical damage data, such as high water marks on structures and damage reports, to measure the cost-effectiveness of future mitigation projects.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- Existing floodplain-compatible uses such as agricultural and open space need to be maintained. There is constant pressure to convert these existing uses to more intense uses within the planning area during times of moderate to high growth.
- There needs to be a coordinated hazard mitigation effort between jurisdictions affected by flood hazards in the county.
- Floodplain residents need to continue to be educated about flood preparedness and the resources available during and after floods.
- The potential impact of climate change on flood conditions in the planning area needs to be better understood.
- The capability for prediction forecast modeling needs to be enhanced.
- Flood warning capability should be tied to flood phases.
- There needs to be enhanced modeling to better understand the true flood risk.
- Floodplain restoration/reconnection opportunities should be identified as a means to reduce flood risk.
- Post-flood disaster response and recovery actions need to be solidified.
- Staff capacity is required to maintain the existing level of floodplain management within the planning area.
- Floodplain management actions require interagency coordination.

CHAPTER 7.
RISK ASSESSMENT

7.1 FLOOD HAZARD EXPOSURE

The Level 2 HAZUS-MH protocol was used to assess the risk and vulnerability to flooding in the planning area. The model used census data at the block level and FEMA floodplain data, which has a level of accuracy acceptable for planning purposes. Where possible, the HAZUS-MH default data was enhanced using local GIS data from local, state and federal sources. Data outputs were generated by various geographical areas to support other planning initiatives such as the Natural Hazards Mitigation Plan, Comprehensive Plan and WRIA plans. These areas include cities, urban growth areas (UGA), unincorporated county outside the UGAs, total unincorporated area (inside and outside the UGAs), and the portions of drainage basins within the planning area (see Section 5.2.2 for the list of drainage basins used).

7.1.1 Population

Population counts of those living in the floodplain in the planning area were generated by analyzing census blocks that intersect with the 100-year floodplain identified on FIRMs. Census blocks do not follow the boundaries of the floodplain. Therefore, the methodology used to generate these estimates counted census block groups whose centers are in the floodplain or where the majority of the population most likely lives in or near the floodplain. HAZUS-MH estimated the number of buildings within the floodplain in each block, and then estimated the total population by multiplying the number of residential structures by the average Thurston County household size of 2.46 persons per household (based on the 2010 census). This methodology may underestimate the population at risk to flooding by as much as half. However, it is preferable to the census block approach, which can overstate risk by as much as 10 times.

Using this approach, it was estimated that the population within the 100-year floodplain in the planning area is 6,310 (2.46 percent of the total planning area population). Of this population, it is estimated that the exposed population in the unincorporated portions of the county is 4,643. This represents approximately 3.40 percent of the total population for the unincorporated portions of the county.

7.1.2 Property

Structures in the Floodplain

Table 7-1 summarizes the total area and number of structures in the floodplain. The HAZUS-MH model determined that there are 2,039 structures within the 100-year floodplain. In the 100-year floodplain, about 89 percent are residential, and 8.4 percent are commercial, industrial or agricultural. Structure exposure was also analyzed by drainage basin as shown in Table 7-2. It should be noted that are no buildings owned or operated by Thurston County located within the floodplain.

Exposed Value

Table 7-3 summarizes the estimated value of exposed buildings. The analysis estimated $511.8 million of building-and-contents exposure to the 100-year flood, representing 1.35 percent of the total assessed value of the planning area. Table 7-4 breaks down the value by drainage basin.

TABLE 7-1.
AREA AND STRUCTURES WITHIN THE 100-YEAR FLOODPLAIN BY JURISDICTION

	Area	Number of Structures							
	(Acres)	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	**Total**
Bucoda	182	164	4	0	3	3	4	0	**178**
Grand Mound UGA	11	1	0	0	0	0	0	0	**1**
Lacey	517	10	0	0	0	0	1	0	**11**
Lacey UGA	798	27	0	0	0	0	1	0	**28**
Olympia	876	146	27	0	0	0	4	0	**177**
Olympia UGA	137	16	0	0	0	0	0	0	**16**
Rainer UGA	4	3	1	0	0	0	0	0	**4**
Tenino	34	2	0	0	0	0	0	0	**2**
Tenino UGA	9	2	0	0	0	0	0	0	**2**
Tumwater	480	28	1	2	0	0	10	0	**41**
Tumwater UGA	503	39	1	0	2	0	0	0	**42**
Yelm	145	15	3	1	0	1	1	0	**21**
Yelm UGA	75	6	0	0	0	0	0	0	**6**
Unincorporated outside UGA	28,694	1365	16	0	116	0	12	1	**1,510**
Total	**32,465**	**1,824**	**53**	**3**	**121**	**4**	**33**	**1**	**2,039**
Total Cities	**2,235**	**365**	**35**	**3**	**3**	**4**	**20**	**0**	**430**
Total UGA	**1,537**	**94**	**2**	**0**	**2**	**0**	**1**	**0**	**99**
Total Unincorporated	**30,231**	**1459**	**18**	**0**	**118**	**0**	**13**	**1**	**1,609**

TABLE 7-2.
AREA AND STRUCTURES WITHIN THE 100-YEAR FLOODPLAIN BY DRAINAGE BASIN

	Area	Number of Structures							
Drainage Basin	(Acres)	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	**Total**
Black River	7,142	194	6	0	20	0	3	0	**223**
Budd/Deschutes	6,970	453	30	2	20	0	14	0	**519**
Chehalis River	5,280	253	0	0	51	0	1	0	**305**
Eld Inlet	642	193	1	0	1	0	0	1	**196**
Henderson Inlet	1,808	116	3	0	2	0	2	0	**123**
Nisqually River	5,612	330	9	1	10	1	5	0	**356**
Skookumchuck R.	4,138	249	4	0	16	3	6	0	**278**
Totten Inlet	873	36	0	0	1	0	2	0	**39**
Total	**32,465**	**1,824**	**53**	**3**	**121**	**4**	**33**	**1**	**2,039**

TABLE 7-3.
VALUE OF EXPOSED BUILDINGS WITHIN 100-YEAR FLOODPLAIN BY JURISDICTION

	Estimated Flood Exposure			% of Total
	Structure	Contents	**Total**	Assessed Value
Bucoda	$8,524,700	$5,549,840	**$14,074,540**	54.04
Grand Mound UGA	$76,400	$45,840	**$122,240**	—
Lacey	$1,762,300	$1,062,100	**$2,824,400**	0.04
Lacey UGA	$4,843,800	$3,381,600	**$8,225,400**	—
Olympia	$41,351,200	$28,954,000	**$70,305,200**	0.59
Olympia UGA	$2,266,500	$1,359,900	**$3,626,400**	—
Rainer UGA	$332,500	$213,980	**$546,480**	—
Tenino	$106,700	$64,020	**$170,720**	0.10
Tenino UGA	$155,800	$93,480	**$249,280**	—
Tumwater	$10,020,750	$8,967,755	**$18,988,505**	0.62
Tumwater UGA	$7,871,100	$5,337,420	**$13,208,520**	—
Yelm	$5,661,000	$4,490,710	**$10,151,710**	1.26
Yelm UGA	$487,100	$292,260	**$779,360**	—
Unincorporated outside UGA	$217,120,150	$151,436,930	**$368,557,080**	2.54
Total	**$300,580,000**	**$211,249,835**	**$511,829,835**	**1.35**
Total Cities	**$67,426,650**	**$49,088,425**	**$116,515,075**	**0.52**
Total UGA	**$16,033,200**	**$10,724,480**	**$26,757,680**	**—**
Total Unincorporated	**$233,153,350**	**$162,161,410**	**$395,314,760**	**2.54**

TABLE 7-4.
VALUE OF EXPOSED BUILDINGS WITHIN 100-YEAR FLOODPLAIN BY DRAINAGE BASIN

	Estimated Flood Exposure			% of Total
	Structure	Contents	**Total**	Assessed Value
Black River	$29,956,400	$21,936,680	$51,893,080	3.41%
Budd/Deschutes	$86,915,000	$60,916,285	$147,831,285	0.79%
Chehalis River	$54,399,500	$44,275,540	$98,675,040	9.01%
Eld Inlet	$40,042,800	$24,169,780	$64,212,580	2.04%
Henderson Inlet	$20,803,200	$13,091,880	$33,895,080	0.42%
Nisqually River	$43,158,400	$29,850,550	$73,008,950	1.51%
Skookumchuck River	$17,385,700	$12,116,840	$29,502,540	20.28%
Totten Inlet	$7,919,000	$4,892,280	$12,811,280	2.45
Total	**$300,580,000**	**$211,249,835**	**$511,829,835**	**1.34**

Land Use in the Floodplain

Some land uses are more vulnerable to flooding, such as single-family homes, while others are less vulnerable, such as agricultural land or parks. Table 7-5 shows the existing land use of all parcels in the 100-year floodplain in the planning area, including vacant parcels and those in public/open space uses. About 76 percent of the parcels in the 100-year floodplain are zoned for agricultural or low-density uses. Approximately 10 percent of area is zoned for an open space use. These are favorable, lower-risk uses for the floodplain. The amount of the floodplain that contains vacant, developable land is not known. This would be valuable information for gauging the future development potential of the floodplain.

TABLE 7-5.
LAND USE WITHIN THE FLOODPLAIN

	100-Year Floodplain	
Land Use	Area (acres)	% of total
Arterial Commercial	1.78	0.0055%
Green Belt	183.94	0.5666%
Heavy Commercial	0.00	0.0000%
High Density Corridor 4	0.00	0.0000%
Highway Commercial	10.27	0.0316%
Lake	588.70	1.8133%
Light Industrial	19.23	0.0592%
Light Industrial Commercial	20.55	0.0633%
Long Term Agriculture	5923.38	18.2454%
Long Term Forestry	2809.88	8.6551%
Low Density Residential	0.08	0.0003%
Low Density Residential 0-4	111.35	0.3430%
McAllister Geologically Sensitive Area	427.32	1.3162%
Military Reservation	327.62	1.0091%
Mixed Use Moderate Density	0.02	0.0000%
Moderate Density Residential	0.39	0.0012%
Multifamily Medium Density Residential 9-15 Units Per Acre	2.58	0.0079%
Neighborhood Convenience Commercial	1.78	0.0055%
Neighborhood Village	0.00	0.0000%
Nisqually Agriculture	45.73	0.1409%
Open Space	402.82	1.2408%
Open Space Institutional	7.97	0.0246%
Open Space Park	0.72	0.0022%
Open Space School	0.00	0.0000%
Planned Industrial Park	9.26	0.0285%
Public Parks Trails And Preserves	2863.17	8.8193%
Public/Semi-Public	0.00	0.0000%
Residential 1 Unit Per 5 Acre	0.39	0.0012%
Residential 4-8	504.05	1.5526%
Residential 6-12	10.88	0.0335%

TABLE 7-5.
LAND USE WITHIN THE FLOODPLAIN

Land Use	100-Year Floodplain Area (acres)	100-Year Floodplain % of total
Residential Lamird 1/1	380.63	1.1724%
Residential Lamird 1/2	66.53	0.2049%
Residential Lamird 2/1	1535.90	4.7309%
Residential Low Impact 2-4 Units Per Acre	0.36	0.0011%
Residential Sensitive Resource 2-4 Units Per Acre	1.84	0.0057%
Rural 1/10	199.13	0.6134%
Rural 1/20	3417.49	10.5267%
Rural Commercial	9.17	0.0282%
Rural Residential 1/5	326.08	1.0044%
Rural Residential Resource 1/5	11912.90	36.6945%
Rural Resource Industrial	23.47	0.0723%
Single Family Environmentally Sensitive	0.05	0.0001%
Single Family Low Density Residential 4-7 Units Per Acre	200.52	0.6176%
Single Family Medium Density Residential 6-9 Units Per Acre	15.84	0.0488%
Single Family Residential 4	50.54	0.1557%
Two Family Residential 6-12	0.00	0.0000%
Urban Reserve 1/5	50.69	0.1561
Total	**32465**	**100**

7.1.3 Critical Facilities and Infrastructure

Table 7-6 and Table 7-7 summarize the planning area critical facilities and infrastructure in the 100-year floodplain. Details are provided in the following sections.

Tier II Facilities

Tier II facilities are those that use or store materials that can harm the environment if damaged by a flood. Six businesses in the 100-year floodplain report having Tier II hazardous materials. During a flood event, containers holding these materials can rupture and leak into the surrounding area, having a disastrous effect on the environment as well as residents.

Utilities and Infrastructure

It is important to determine who may be at risk if infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the planning area, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Dikes can fail or be overtopped, inundating the land that they protect. The following sections describe specific types of critical infrastructure.

TABLE 7-6.
CRITICAL FACILITIES IN THE FLOODPLAIN

	Number of Facilities in 100-Year Floodplain
Medical and Health Services	0
Government Function	2
Protective	2
Hazardous Materials	6
Schools	3
Other	0
Total	**13**

TABLE 7-7.
CRITICAL INFRASTRUCTURE IN THE FLOODPLAIN

	Number of Facilities in 100-Year Floodplain
Bridges	45
Water Supply	0
Wastewater	1
Power	0
Communications	0
Other	4
Total	**50**

Roads

The following major roads in the planning area pass through the 100-year floodplain and thus are exposed to flooding:

- Interstate 5
- U.S. Highway 101
- State Route 507
- State Route 510
- State Route 12
- Old Highway 99 SW
- Old Highway 99 SE
- Little Rock Road SW

Some of these roads are built above the flood level, and others function as levees to prevent flooding. Still, in severe flood events these roads can be blocked or damaged, preventing access to some areas.

Bridges

Flooding events can significantly impact road bridges, which provide the only ingress and egress to some neighborhoods. There are 45 bridges that are in or cross over the 100-year floodplain in the planning area.

Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban

flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers and streams.

Dams

There are 33 dams in or adjacent to Thurston County. Many of them serve more than one purpose, such as hydroelectric power generation, irrigation and recreation. Dam failures can be caused by nature, such as flooding or an earthquake, but mostly they are caused by human error such as poor construction, operation, maintenance or repair. The effects of a dam failure are highly variable, depending on the dam, the amount of water stored behind the dam, the current stream flow, and the size and proximity of the downstream population. There are many effects of a major dam failure: loss of life, destruction of homes and property, damage to roads, bridges, power lines and other infrastructure, loss of power generation and flood control capabilities, disruption of fish stock and spawning beds, and the erosion of stream and river banks. Many dam failures have occurred in Washington State over the last 40 years, but none have been in or affected Thurston County.

Washington State's Downstream Hazard Classification system for dams assigns a hazard rating of "Low," "Significant" or "High" for areas at risk of economic loss and environmental damage should a dam fail. In Thurston County, most dams are rated low, a few are rated significant and three are rated high. The high hazard dams are Alder and La Grande Dams on the Nisqually River and the Skookumchuck Dam on the Skookumchuck River (see Table 7-8). Failure of any of these dams could affect a population of 300 or more, inundate major transportation routes and industries, and have long-term effects on water quality and wildlife. The high hazard dams in Thurston County are primarily for electrical power generation and are licensed by the Federal Energy Regulatory Commission. Accordingly, they are inspected regularly and staffed 24 hours a day.

TABLE 7-8.
HIGH HAZARD DAMS IN THURSTON COUNTY

Name of Dam	River or Stream	Storage (acre-feet)	Hazard Class
Alder Dam	Nisqually River (Alder Lake)	231,936	1A
La Grande Dam	Nisqually River (La Grande Reservoir)	2,676	1B
Skookumchuck Dam	Skookumchuck River (Skookumchuck Reservoir)	35,000	1A

Of the high-hazard dams, only the Skookumchuck is an earthen dam; La Grande and Alder are both concrete structures. All three are well-maintained and comply with current dam safety regulations. Therefore, barring a natural disaster or terrorist action, the 1998 Thurston County Hazard Identification and Vulnerability Analysis assigned a low risk rating to all three dams.

The failure of a high hazard dam would threaten a small but important segment of Thurston County, suggesting moderate vulnerability. As high hazard dams, dam inundation mapping for these facilities does exist as part of their emergency action plans. However, this data is not readily available to local governments in a format that can support planning due to security interest.

Levees

There are no FEMA accredited levees within the planning area. There is a non-certified levee along the Nisqually River that provides minor flood protection to developed properties.

7.1.4 Environment

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees, and logjams from timber harvesting can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Many species of mammals, birds, reptiles, amphibians and fish live in Thurston County in plant communities that are dependent upon streams, wetlands and floodplains. Changes in hydrologic conditions can result in a change in the plant community. Wildlife and fish are impacted when plant communities are eliminated or fundamentally altered to reduce habitat. Wildlife populations are limited by shelter, space, food and water. Since water supply is a major limiting factor for many animals, riparian communities are of special importance. Riparian areas are the zones along the edge of a river or stream that are influenced by or are an influence upon the water body. Human disturbance to riparian areas can limit wildlife's access to water, remove breeding or nesting sites, and eliminate suitable areas for rearing young. Wildlife rely on riparian areas and are associated with the flood hazard in the following ways:

- Mammals depend upon a supply of water for their existence. Riparian communities have a greater diversity and structure of vegetation than other upland areas. Beavers and muskrats are now recolonizing streams, wetlands and fallow farm fields, which are converted wetlands. As residences are built in rural areas, there is an increasing concern with beaver dams causing flooding of low-lying areas and abandoned farm ditches being filled in, which can lead to localized flooding.
- A great number of birds are associated with riparian areas. They swim, dive, feed along the shoreline, or snatch food from above. Puget Sound, rivers, lakes and wetlands are important feeding and resting areas for migratory and resident waterfowl. Other threatened or endangered species (such as the bald eagle or the peregrine falcon) eat prey from these riparian areas. Some species have become adapted to changes to shoreline environments. For example, resident populations of Canada geese, which do not leave the Olympia area, have increased 600 percent over the past decade, according to the Black Hills Audubon Society.
- Amphibians and reptiles are some of the least common forms of wildlife in riparian areas. However, some state threatened species, such as the western pond turtle and the spotted frog, are known to inhabit the waterways and wetlands of Thurston County.
- Fish habitat throughout the county varies widely based on natural conditions and human influence. Many ditches were dug throughout the county to make low, wet ground better for farming. As the water drained away and the wetlands were converted to farm fields, natural stream conditions were altered throughout the county. Agriculture along many rivers extends to the water's edge and smaller side channels have been tiled to drain better. Within developing areas, small streams were placed in pipes and wetland filled in to support urban development. While salmonids prefer clear, free-flowing streams, other species like the Olympic mud-minnow inhabit the calm, backwater areas of sloughs and wetlands.

Protection of these biological resources within the floodplains of the planning area is very important to Thurston County. Equipped with planning tools such as WRIA planning, comprehensive planning, critical areas ordinances, open space planning and participation in regional planning initiatives such as the Chehalis Watershed Cooperative, Thurston County has been able to establish a diverse inventory of preserve areas that maintain the natural and beneficial functions of the floodplain. This has been

established through proactive land use regulations, and property acquisitions that have identified critical habitat to be preserved. The combination of these two tools has resulted in a floodplain that is predominantly free of high-density development as shown in Table 7-5. Parks and preserve areas that promote the natural and beneficial functions of floodplains include the following:

- Woodland Creek Wetlands Preserve
- Black River-Mima Prairie Glacial Heritage Preserve
- Johnson Point Wetlands Preserve
- Black River Natural Area.

7.2 FLOOD HAZARD VULNERABILITY

Many areas exposed to flooding may not experience serious flooding or flood damage. This section describes vulnerabilities in terms of population, property, infrastructure and environment. Two areas of the regulated floodplain within the planning area have been focused on for this analysis:

- The special flood hazard area (SFHA) depicted on the current Flood Insurance Rate Map (FIRM) for Thurston County.
- The portions of the planning area for which the County has maintained flood-of-record data from past flood events. Thurston County Code considers this to be the best available data when flood-of-record data shows more flood risk than shown on the FIRM.

The County does not currently have flood-of-record data for all of the mapped SFHA, and the extent of the floods of record has not been mapped. Therefore, the vulnerability analysis focuses on the difference in flood depths where flood-of-record data is available. It provides two sets of data output that should be interpreted separately, not cumulatively. For example, loss values shown for flood-of-record areas are not in addition to those reflected in the SFHA; they represent the total damage estimated for the flood event that generated the flood depths.

7.2.1 Population

Vulnerable Populations

A geographic analysis of demographics using the HAZUS-MH model identified populations vulnerable to the flood hazard as follows:

- **Economically Disadvantaged Populations**—It is estimated that 16 percent of the people within the 100-year floodplain are economically disadvantaged, defined as having household incomes of $15,000 or less.
- **Population over 65 Years Old**—It is estimated that 2 percent of the population in the census blocks that intersect the 100-year floodplain are over 65 years old. Approximately 20 percent of the over-65 population in the floodplain also have incomes considered to be economically disadvantaged and are considered to be extremely vulnerable.
- **Population under 16 Years Old**—It is estimated that 11.5 percent of the population within census blocks located in or near the 100-year floodplain are under 16 years of age.

Impacts of the 100-year flood on persons and households in the planning area were estimated as follows through the Level 2 HAZUS-MH analysis:

- Number of Displaced Households: 8,156
- Number of Persons Requiring Short-Term Shelter: 4,274

Public Health and Safety

Floods and their aftermath present threats to public health and safety. Floodwater is generally contaminated by pollutants such as sewage, human and animal feces, pesticides and insecticides, fertilizers, oil, asbestos, and rusting building materials. This was evidenced by health and environmental tests carried out on floodwaters in New Orleans during and after Hurricane Katrina. The tests revealed bacteria and lead hazards to human health, and the public was warned to avoid exposure to the contaminated water. The following health and safety risks are commonly associated with flood events:

- **Unsafe food—**Floodwaters contain disease-causing bacteria, dirt, oil, human and animal wastes, and farm and industrial chemicals. They carry away whatever lies on the ground and upstream. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat and hazardous to human health. Power failures caused by floods damage stored food. Refrigerated and frozen foods are affected during the outage periods, and thus must be carefully monitored and examined prior to consumption. Foods kept inside cardboard, plastic bags, jars, bottles, and paper packaging are subject to disposal if contaminated by floodwaters. Even though the packages do not appear to be wet, they may be unhygienic with mold contamination and deteriorate rapidly.
- **Contaminated drinking and washing water and poor sanitation—**Flooding impairs clean water sources with pollutants and affects sanitary toilets. Direct and indirect contact with the contaminants—whether through direct food intake, vector insects such as flies, unclean hands, or dirty plates and utensils—can result in waterborne illnesses and life-threatening infectious disease. The pollutants also saturate into the groundwater or can infiltrate into sanitary sewer lines through the ground. Wastewater treatment plants, if flooded and caused to malfunction, can be overloaded with polluted runoff waters and sewage beyond their disposal capacity, resulting in backflows of raw sewage to homes and low-lying grounds. Private wells can be contaminated or damaged severely by floodwaters, while private sewage disposal systems can become a cause of infection and illnesses if they are broken or overflow. In this manner, unclean drinking and washing water and sanitation, coupled with lack of adequate sewage treatment, can lead to disease outbreaks, including life-threatening cholera, typhoid, dysentery and some forms of hepatitis. The key to preventing a health catastrophe is basic hygiene available from clean and safe water and toilets.
- **Mosquitoes and animals—**Prolonged rainfall and floods provide new breeding grounds for mosquitoes—wet areas and stagnant pools—and can lead to an increase in the number of mosquito-borne diseases such as malaria and dengue and West Nile fevers. Rats and other rodents and wild animals also can carry viruses and diseases. The public should avoid such animals and should dispose of dead animals in accordance with guidelines issued by local animal control authorities. Leptospirosis—a bacterial disease associated predominantly with rats—often accompanies floods in developing countries (Leptospirosis Information Center), although the risk is very low in industrialized regions unless cuts or wounds have direct contact with disease-contaminated floodwaters or animals.
- **Molds and mildews—**Excessive exposure to molds and mildews can cause flood victims—especially those with allergies and asthma—to contract upper respiratory diseases and to trigger cold-like symptoms such as sore throat, watery eyes, wheezing and dizziness. Molds grow in as short a period as 24 to 48 hours in wet and damp areas of buildings and homes that have not been cleaned after flooding, such as water-infiltrated walls, floors, carpets, toilets and bathrooms. Very small mold spores can be easily inhaled by human bodies and, in large enough quantities, cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, elderly people and pregnant women are considered most vulnerable to mold-induced health problems.

- **Carbon monoxide poisoning—**Carbon monoxide poisoning is as a potential hazard after major floods. Carbon monoxide can be found in combustion fumes, such as those generated by small gasoline engines, stoves, generators, lanterns and gas ranges, or by burning charcoal or wood. In the event of power outages following floods, flood victims tend to use alternative sources of fuels for heating, cooling, or cooking inside enclosed or partly enclosed houses, garages or buildings without an adequate level of air ventilation. Carbon monoxide builds up from these sources and poisons the people and animals inside.
- **Hazards when reentering and cleaning flooded homes and buildings—**Flooded buildings can pose significant health hazards after floodwaters recede. Electrical power systems, including fallen power lines, can become hazardous. People should avoid turning on or off the main power while standing in remaining floodwater. Gas leaks that from pipelines or propane tanks can trigger fire and explosion when entering and cleaning damaged buildings or working to restore utility service. Flood debris—such as broken bottles, wood, stones and walls—may cause wounds and injuries when removing contaminated mud and cleaning damaged buildings. Extreme caution must be used with possible chemical hazards during flood recovery. Containers of hazardous chemicals, including pesticides, insecticides, fertilizers, car batteries, propane tanks and other industrial chemicals, may be hidden or buried under flood debris. A health hazard can also occur when hazardous dust and mold in ducts, fans and ventilators of air-conditioning and heating equipment are circulated through a building and inhaled by those engaged in cleanup and restoration.
- **Mental stress and fatigue—**Various reports identify a major health hazard of floods as mental stress or psychological distress due to exposure to extreme disaster events. Having experienced a devastating flood, seen loved ones lost or injured, and homes damaged or destroyed, flood victims can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on the people affected, in particular the unprepared and uninsured. Post-flood recovery—especially when it becomes prolonged—can cause mental disorders, anxiety, anger, depression, lethargy, hyperactivity, sleeplessness, and, in an extreme case, suicide. Behavior changes may also occur in children such as an increase in bed-wetting and aggression. There is also a long-term concern among the affected that their homes can be flooded again in the future.

Documentation of these types of impacts within the planning area is limited. Current loss estimation models such as HAZUS are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

7.2.2 Property

HAZUS-MH calculates losses to structures from flooding by looking at depth of flooding and type of structure. Using historical flood insurance claim data, HAZUS-MH estimates the percentage of damage to structures and their contents using damage functions based on historical averages. For this analysis, local data on facilities was used instead of the default building-and-inventory data provided with HAZUS-MH. The results are summarized in Table 7-9 through Table 7-11 for the 100-year and flood-of-record events. Up to $70.9 million of flood loss is estimated for a 100-year flood event in the planning area. This represents 13.9 percent of the total exposure to the 100-year flood and 0.19 percent of the total assessed value of the planning area. It is estimated that there would be $49.6 million of flood loss from a flood-of-record comparable event, representing 42.1 percent of the total exposure in the areas for which flood-of-record information is available and 0.67 percent of the total assessed value in those areas.

TABLE 7-9.
LOSS ESTIMATES FOR 100-YEAR FLOOD BY JURISDICTION

	Structures Impacted[a]	Estimated Loss Associated with Flood			% of Total Assessed Value
		Structure	Contents	**Total**	
Bucoda	148	$1,195,159	$692,137	**$1,887,444**	7.25
Grand Mound UGA	0	$0	$0	**$ 0**	0
Lacey	2	$25,254	$11,132	**$36,388**	0.00056
Lacey UGA	9	$159,861	$54,905	**$214,775**	--
Olympia	170	$5,074,344	$3,214,311	**$8,288,825**	0.07
Olympia UGA	9	$173,981	$59,712	**$233,702**	--
Rainer UGA	4	$56,592	$27,190	**$83,786**	--
Tenino	2	$17,755	$9,441	**$27,198**	0.02
Tenino UGA	0	$0	$0	**$ 0**	0
Tumwater	39	$971,698	$1,890,583	**$2,862,320**	0.09
Tumwater UGA	30	$701,093	$565,461	**$1,266,584**	--
Yelm	13	$349,662	$266,023	**$615,698**	0.08
Yelm UGA	4	$57,798	$19,266	**$77,068**	--
Unincorporated outside UGA	1,153	$25,353,009	$29,997,475	**$55,351,637**	0.36
Total	**1,583**	**$34,136,206**	**$36,807,636**	**$70,945,425**	**0.19**
Total Cities		**$7,633,872**	**$6,083,627**	**$13,717,499**	**0.06**
Total UGA		**$1,149,324**	**$726,534**	**$1,875,858**	--
Total Unincorporated		**$26,502,334**	**$30,724,009**	**$57,226,343**	**0.15**

a. Impacted structures are those structures with finished floor elevations below the flood event water surface elevation. These structures are the most likely to receive significant damage in a flood event.

TABLE 7-10.
LOSS ESTIMATES FOR 100-YEAR FLOOD BY DRAINAGE BASIN

Drainage Basin	Structures Impacted[a]	Estimated Loss Associated with Flood			% of Total Assessed Value
		Structure	Contents	**Total**	
Black River	200	$4,111,821	$4,049,638	**$8,161,459**	0.54
Budd/Deschutes	426	$9,425,345	$7,700,491	**$17,125,836**	0.09
Chehalis River	280	$8,604,108	$16,763,122	**$25,367,729**	2.32
Eld Inlet	105	$3,380,548	$1,737,566	**$5,118,104**	0.16
Henderson Inlet	71	$1,620,200	$684,209	**$2,304,409**	0.03
Nisqually River	248	$4,168,350	$3,463,367	**$7,631,716**	0.16
Skookumchuck River	235	$2,376,185	$2,075,114	**$4,451,299**	0.05
Totten Inlet	18	$449,650	$333,640	**$783,290**	0.15
Total	**1,583**	**$34,136,206**	**$36,807,147**	**$70,943,842**	**0.19**

a. Impacted structures are those structures with finished floor elevations below the flood event water surface elevation. These structures are the most likely to receive significant damage in a flood event.

TABLE 7-11.
LOSS ESTIMATES FOR FLOOD OF RECORD BY DRAINAGE BASIN

Planning area	Structures Impacted[a]	Estimated Loss Associated with Flood			% of Total Assessed Value
		Structure	Contents	**Total**	
Black River	60	$1,299,065	$1,288,207	$2,587,272	0.17%
Chehalis River	123	$14,872,675	$25,436,280	$40,308,955	3.68%
Nisqually River	139	$2,851,311	$3,865,567	**$6,716,878**	0.14
Total	**322**	**$19,023,051**	**$30,590,054**	**$49,613,105**	**0.67**

a. Impacted structures are those structures with finished floor elevations below the flood event water surface elevation. These structures are the most likely to receive significant damage in a flood event.

National Flood Insurance Program

Table 7-12 lists flood insurance statistics that help identify vulnerability in the planning area. Eight planning area communities participate in the NFIP, with 998 flood insurance policies providing $231.1 million in coverage. According to FEMA statistics, 295 flood insurance claims were paid between January 1, 1978 and August 31, 2012, for a total of $4.2 million, an average of $14,266 per claim.

TABLE 7-12.
FLOOD INSURANCE STATISTICS FOR THURSTON COUNTY

Jurisdiction	Date of Entry Initial FIRM Effective Date	# of Flood Insurance Policies as of 8/31/2012	Insurance In Force	Total Annual Premium	Claims, 11/1978 to 8/31/2012	Value of Claims paid, 11/1978 to 8/31/2012
Bucoda	9/20/1981	72	$10,843,100	$62,509	43	$257,010.48
Lacey	7/16/1980	15	$3,678,000	$$4,660	3	$8,088.08
Olympia	2/17/1982	94	$30,714,000	$99,308	20	$369,197.88
Rainer	10/16/2012	2	$630,000	$708	0	$0
Tenino	6/4/1980	7	$1,411,100	$2,524	7	$105,231.94
Tumwater	8/01/1980	12	$3,025,000	$5,336	2	$12,514.40
Yelm	6/16/1999	33	$7,617,200	$23,718	2	$7,602.70
Unincorporated	12/01/1982	763	$173,194,400	$389,521	218	$3,448,798.39
Total		**998**	**$231,112,800**	**$521,115**	**295**	**$4,208,444**

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRMs in the planning area were available in 1980.

The following information from flood insurance statistics is relevant to reducing flood risk:

- The use of flood insurance in the planning area is below the national average. Only 19.1 percent of insurable buildings in the planning area are covered by flood insurance. According to an NFIP study, about 49 percent of single-family homes in special flood hazard areas are covered by flood insurance nationwide.
- The amount of insurance in force represents approximately 45 percent of the total value of the assets exposed within the SFHA.
- The average claim paid in the planning area represents about 5.7 percent of the 2012 average assessed value of structures in the floodplain.
- The percentage of policies and claims outside a mapped floodplain suggests that not all of the flood risk in the planning area is reflected in current mapping. Based on information from the NFIP, 41 percent of policies in the planning area are on structures within an identified SFHA, and 59 percent are for structures outside such areas. It may be that a high number of these policies are in areas with groundwater flood issues, which are not reflected on the FIRM.

Repetitive Loss

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced any of the following since 1978, regardless of any changes in ownership:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property.

Repetitive loss properties make up only 1 to 2 percent of flood insurance policies in force nationally, yet they account for 40 percent of the nation's flood insurance claim payments. In 1998, FEMA reported that the NFIP's 75,000 repetitive loss structures have already cost $2.8 billion in flood insurance payments and that numerous other flood-prone structures remain in the floodplain at high risk. The government has instituted programs encouraging communities to identify and mitigate the causes of repetitive losses. A recent report on repetitive losses by the National Wildlife Federation found that 20 percent of these properties are outside any mapped 100-year floodplain. The key identifiers for repetitive loss properties are the existence of flood insurance policies and claims paid by the policies.

FEMA-sponsored programs, such as the CRS, require participating communities to identify repetitive loss areas. A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as meeting the definition of repetitive loss. Identifying repetitive loss areas helps to identify structures that are at risk but are not on FEMA's list of repetitive loss structures because no flood insurance policy was in force at the time of loss. Figure 7-1 shows the repetitive loss areas in the planning area. FEMA's list of repetitive loss properties identifies 42 such properties in the planning area as of July 12, 2012. The breakdown of the properties by jurisdiction is presented in Table 7-13.

A review of repetitive loss properties was performed for the unincorporated county only, because the County is currently the only community in the planning area participating in the CRS program, for which the repetitive loss area review is a requirement. The review identified that all but two of the identified repetitive loss properties are within a mapped special flood hazard area. The lone properties outside the SFHA are within county-mapped groundwater flooding areas that are zone B on the FIRM.

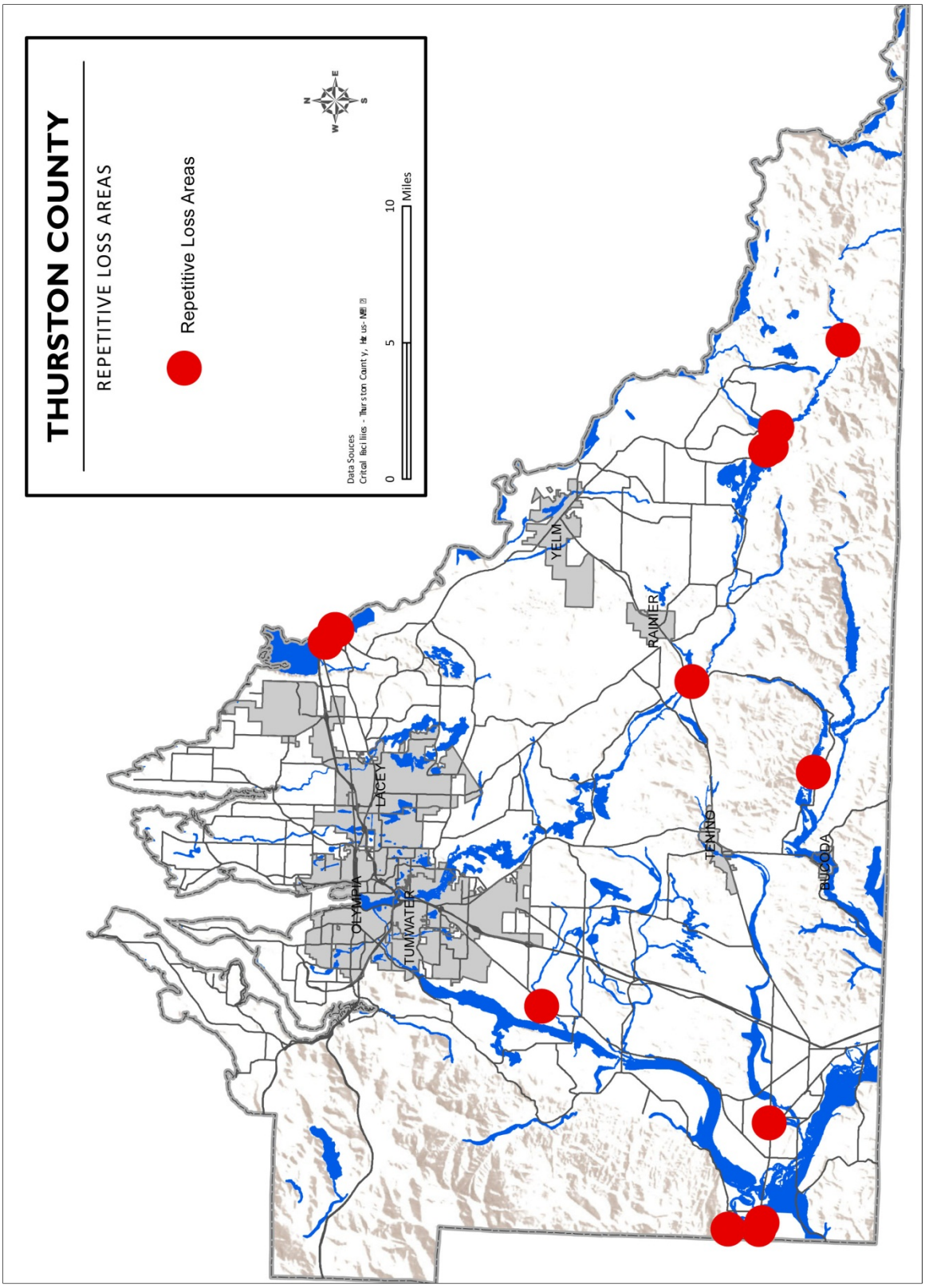


Figure 7-1. Repetitive Loss Areas in Thurston County

TABLE 7-13.
REPETITIVE LOSS PROPERTIES IN THURSTON COUNTY

Jurisdiction	Repetitive Loss Properties	Properties That Have Been Mitigated	Number of Corrections	Corrected Number of Repetitive Loss Properties
Bucoda	6	0	0	6
Lacey	0	0	0	0
Olympia	10	0	0	10
Rainer	0	0	0	0
Tenino	6	0	0	6
Tumwater	0	0	0	0
Yelm	0	0	0	0
Unincorporated	20	6	0	14
Total	**42**	**6**	**0**	**36**

Based on FEMA Report of Repetitive Losses, 07/12/2012

A further review of the repetitive loss data found that all dates of repetitive losses coincide with dates of known flooding in the county. Therefore, it can be concluded that the overall cause of repetitive flooding is the same as has been profiled in this plan and is covered by available mapping. With the potential for flood events every three to seven years, Thurston County considers all of the mapped floodplain areas as susceptible to repetitive flooding. These areas are subject to provisions of the Thurston County flood damage prevention ordinance. Additionally, as required under the CRS program, Thurston County disseminates flood protection information to these areas annually, identified for the river basins in which each repetitive loss area is found.

7.2.3 Critical Facilities and Infrastructure

HAZUS-MH estimates the loss potential of critical facilities exposed to the flood risk using depth/damage function curves to estimate the percent of damage to critical facility buildings and contents and the functional down-time of the facilities (the time to restore a facility to 100 percent of its functionality). This helps to gauge how long the planning area could have limited usage of critical facilities. The analysis estimated the following losses to critical facilities for the 100-year flood event:

- 4.8 percent damage to structures
- 39.2 percent damage to contents
- An estimated 135 days to restore these facilities to full functionality.

7.2.4 Environment

The environment vulnerable to flood hazard is the same as the environment exposed to the hazard. Loss estimation platforms such as HAZUS-MH are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

PART 3 —
MITIGATION STRATEGY

CHAPTER 8.
GUIDING PRINCIPLE, GOALS AND OBJECTIVES

This chapter identifies goals for reducing long-term vulnerabilities to flooding (CRS Step 6). The Natural Hazards Mitigation Plan for the Thurston Region identifies six guiding principles and eight goals. It was the Steering Committee's decision to adopt a derivation of the guiding principles and goals established for the Natural Hazards Mitigation Plan to set the course for eventual integration of the two plans. From the guiding principles and goals, objectives were identified, and the objectives were used in the selection and prioritization of recommended mitigation initiatives. These planning components all directly support one another. Goals were selected that met multiple guiding principles. Objectives were selected that met multiple goals. Mitigation initiatives were prioritized based on meeting multiple objectives.

8.1 GUIDING PRINCIPLES

The Natural Hazards Mitigation Plan's guiding principles were adapted for the flood plan as follows:

1. Provide a methodical approach to flood hazard planning that can integrate with other planning mechanisms that enhance or support floodplain management.
2. Enhance the public's awareness and understanding of the flood hazard.
3. Create a decision-making tool for policy and decision makers.
4. Promote compliance with state and federal program requirements.
5. Ensure inter-jurisdictional coordination on all floodplain management activities.

8.2 GOALS

The Natural Hazards Mitigation Plan's goals were adapted for the flood plan as follows:

1. Foster all sectors of the community working together to create a flood-hazard-resilient community.
2. Ensure that local and state government entities have the capabilities to develop, implement and maintain effective floodplain management programs in the Thurston region.
3. Ensure that the communities in the Thurston region collectively maintain the capacity to initiate and sustain emergency operations during and after a flood disaster.
4. Ensure that local government operations are not significantly disrupted by flood hazard events.
5. Reduce the vulnerability to flood hazards in order to protect the life, health, safety and welfare of the community's residents and visitors.
6. Reduce the adverse impact on critical facilities and infrastructure from flood hazard events within the Thurston region.
7. Increase public awareness of vulnerability to flood hazards and preparation for floods.
8. Maintain, enhance, and restore the natural environment's capacity to deal with the impacts of flood hazard events.

The effectiveness of a mitigation strategy is assessed by determining how well these goals are achieved.

8.3 OBJECTIVES

The following objectives were selected that meet multiple goals:

1. Eliminate or minimize disruption of local government operations caused by flood hazard events.
2. Maintain a regionally coordinated warning and emergency response program that can detect the flood threat and provide timely warning.
3. Utilizing best available data and science, continually improve understanding of the location and potential impacts of flood hazards, the vulnerability of building types and community development patterns, and the measures needed to protect life safety.
4. Continually provide state, county and local agencies with updated information about flood hazards, vulnerabilities and mitigation initiatives.
5. Establish partnerships among all levels of government and the business community to improve and implement regionally consistent floodplain management practices (such as prevention, property protection, public education and awareness, natural resource protection, emergency services, and capital improvements).
6. Develop or improve early warning emergency response systems and evacuation procedures for flood hazard events.
7. Work to lower emergency service response times, including through improvement to transportation facilities.
8. Consider the impacts of flood hazards in all planning processes that address current and future land uses within the planning area.
9. Evaluate the risks to public safety and existing development (e.g., critical facilities, infrastructure, and structures) in flood hazard areas.
10. Sponsor and support public outreach and education activities to improve awareness of flood hazards, and recommend roles that property owners can take to prepare, respond, recover and protect themselves from the impacts of these events.
11. Consider the impacts that future development will have on the environment's capacity to withstand the impacts of flood events and the opportunities this development may create for environmental restoration.

CHAPTER 9.
MITIGATION INITIATIVES

9.1 MITIGATION ALTERNATIVES

The planning team developed a catalog of flood hazard mitigation alternatives through a facilitated process with County staff involved in floodplain management. A session held October 1, 2012 to look at local strengths, weaknesses, obstacles and opportunities was the basis for the alternatives considered as well as the mitigation initiatives selected for implementation. The catalog represents the comprehensive range of alternatives considered for complying with Step 7 of the CRS 10-step process. The Steering Committee reviewed this catalog in conjunction with the findings of public outreach efforts, the risk assessment results and the Natural Hazards Mitigation Plan for the Thurston Region. The catalog was enhanced based on this review and then used by County staff to select hazard mitigation initiatives.

Catalogs of flood hazard mitigation alternatives were developed that present a broad range of alternatives to be considered for use in the planning area (CRS Step 7). The catalogs are listed in Table 9-1 through Table 9-4. The catalogs present alternatives that are categorized in two ways:

- By what the alternative would do:
  - Manipulate a hazard
  - Reduce exposure to a hazard
  - Reduce vulnerability to a hazard
  - Increase the ability to respond to or be prepared for a hazard
- By who would have responsibility for implementation:
  - Individuals
  - Businesses
  - Government.

Flood hazard mitigation initiatives recommended in this plan were selected from among the alternatives presented in the catalogs. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the goals and objectives, and are within the capabilities of Thurston County to implement. It should be noted that some of these actions may not be feasible based on the County's selection criteria. The purpose of the catalog was to equip the Steering Committee with a list of what could be considered to reduce risk of the flood hazard within the planning area. All actions identified in table 9-5 of this plan were selected based on the selection criteria identified in this chapter. Initiatives included in the catalog not selected by the County in the action plan were not selected based on the following:

- The action is not feasible
- The action is already being implemented
- There was an apparently more cost-effective alternative
- The action did not have public or political support

9.2 SELECTED MITIGATION INITIATIVES

The Steering Committee determined that some initiatives from the flood hazard mitigation catalog could be implemented to provide flood hazard mitigation benefits. Table 9-5 lists the recommended initiatives, the lead agency for each, and the proposed timeline. The parameters for the timeline are as follows:

- Short Term = to be completed in 1 to 5 years
- Long Term = to be completed in greater than 5 years
- Ongoing = currently being funded and implemented under existing programs.

TABLE 9-1.
MITIGATION ALTERNATIVES TO MANIPULATE THE FLOOD HAZARD

Personal Scale	Corporate Scale	Government Scale
1. Clear stormwater drains and culverts 2. Institute low-impact development techniques on property	1. Clear stormwater drains and culverts 2. Institute low-impact development techniques on property	1. Maintain drainage system 2. Institute low-impact development techniques on property 3. Dredging, levee construction, and providing regional retention areas 4. Structural flood control, levees, channelization, or revetments. 5. Stormwater management regulations and master planning 6. Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff 7. Maintain/restore natural floodplain functions

TABLE 9-2.
MITIGATION ALTERNATIVES TO REDUCE EXPOSURE TO THE FLOOD HAZARD

Personal Scale	Corporate Scale	Government Scale
1. Locate outside of hazard area 2. Elevate utilities above base flood elevation 3. Institute low impact development techniques on property	1. Locate business critical facilities or functions outside hazard area 2. Institute low impact development techniques on property	1. Locate or relocate critical facilities outside of hazard area 2. Acquire or relocate identified repetitive loss properties 3. Promote open space uses in identified high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks. 4. Adopt land development criteria such as planned unit developments, density transfers, clustering 5. Institute low impact development techniques on property 6. Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff

TABLE 9-3.
MITIGATION ALTERNATIVES TO REDUCE VULNERABILITY TO THE FLOOD HAZARD

Personal Scale	Corporate Scale	Government Scale
1. Retrofit structures (elevate structures above base flood elevation) 2. Elevate items within house above base flood elevation 3. Build new homes above base flood elevation 4. Flood-proof existing structures	1. Build redundancy for critical functions or retrofit critical buildings 2. Provide flood-proofing measures when new critical infrastructure must be located in floodplains	1. Harden infrastructure, bridge replacement program 2. Provide redundancy for critical functions and infrastructure 3 Adopt appropriate regulatory standards, such as: increased freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold; compensatory storage, non-conversion deed restrictions. 4. Augment existing regulations to account for the impacts of Climate Change 5. Stormwater management regulations and master planning. 6. Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on downstream communities.

TABLE 9-4.
MITIGATION ALTERNATIVES TO INCREASE PREPARATION OR RESPONSE CAPABILITY

Personal Scale	Corporate Scale	Government Scale
1. Buy flood insurance 2. Develop household mitigation plan, such as retrofit savings, communication capability with outside, 72-hour self-sufficiency during and after an event	1. Keep cash reserves for reconstruction 2. Support and implement hazard disclosure for the sale/re-sale of property in identified risk zones. 3. Solicit cost-sharing through partnerships with other stakeholders on projects with multiple benefits. 4. Develop a flood response plan	1. Produce better hazard maps 2. Provide technical information and guidance 3. Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) 4. Incorporate retrofitting or replacement of critical system elements in capital improvement plan 5. Develop strategy to take advantage of post-disaster opportunities 6. Warehouse critical infrastructure components 7. Develop and adopt a continuity of operations plan 8. Consider participation in the Community Rating System 9. Maintain existing data and gather new data needed to define risks and vulnerability 10. Train emergency responders 11. Identify critical facilities/infrastructure that require early notification during flood responses 12. Create a dam/levee failure response plan 13. Enhance flood threat recognition capability 14. Create a building and elevation inventory of structures in the floodplain 15. Develop and implement a public information strategy 16. Charge a hazard mitigation fee 17. Integrate floodplain management policies into other planning mechanisms within the planning area. 18. Consider the probable impacts of climate change on the risk associated with the flood hazard 19. Consider the residual risk associated with structural flood control in future land use decisions 20. Enforce National Flood Insurance Program 21. Adopt a Stormwater Management Master Plan 22. Create flood hazard identification maps that reflect future conditions including the probable impacts from climate change.

TABLE 9-5.
ACTION PLAN—FLOOD MITIGATION INITIATIVES (FMI)

Lead Department	Possible Funding Sources or Resources	Estimated Project Cost	Time Line	Objectives	Covered in previous plan (Yes or No), Initiative #
FMI-1—Identify properties that are potential candidates for elevation, relocation or buyout based on an evaluation of flood risks, project feasibility, and planned flood risk reduction capital projects. A list of targeted high-priority acquisitions should be prepared and annually updated. An example of a high-priority project would be a property identified by FEMA as a repetitive loss property. Once the list is established, pursue funding opportunities to implement the projects.					
Resource Stewardship / Planning / Central Services—	Community Development Block Grant / Federal Grants	High	Short-term, Ongoing	5, 9, 10	Yes, TC-FH-15
FMI-2—Using the best available data on flood risk, conduct outreach to property owners to alert them to the risks and ways to deal with them, to inform them about potential opportunities to mitigate the risks, and to assess their interest in participation should funding be available. Property owners who are interested in participating in one of these programs should be informed that having flood insurance might help qualify them for funding assistance.					
Emergency Management / Resource Stewardship / Planning	Department Budgets	Low	Ongoing	3, 4, 10	No
FMI-3—Continue a conservative approach to woody debris management and maintenance, using state- or County-established best management practices.					
Resource Stewardship / Emergency Management / Planning	Department Budgets	Low	Ongoing	1, 5, 9	No
FMI-4—Continue to maintain compliance and good standing with the programmatic requirements of the National Flood Insurance Program.					
Resource Stewardship / Planning	Department budgets	Low	Ongoing	3, 4, 5, 8, 9, 10, 11	No
FMI-5—Strive to maintain Thurston County's Community Rating System classification of no higher than Class 5, as a primary measure of successful flood risk reduction.					
Planning	Department Budget	Low	Ongoing	3, 4, 5, 8, 9, 10, 11	Yes, TC-FH-1
FMI-6—Expand multi-jurisdictional and multi-stakeholder coordination efforts and seek inter-local agreements or other contractual relationships in support of achieving long-term comprehensive flood risk reduction solutions, potentially in conjunction with salmon recovery efforts and regional flood risk reduction efforts.					
Emergency Management / Resource Stewardship / Planning	Department Budgets	Low	Ongoing	1, 2, 4, 5	No

TABLE 9-5.
ACTION PLAN—FLOOD MITIGATION INITIATIVES (FMI)

Lead Department	Possible Funding Sources or Resources	Estimated Project Cost	Time Line	Objectives	Covered in previous plan (Yes or No), Initiative #
FMI-7—Undertake a feasibility study on the formation of a countywide flood control zone district. This study should focus on the following: • What are the capital costs of flood risk reduction projects within the county? • What would be the costs to the constituents of Thurston County to implement a flood control zone district? • How would this affect other Thurston County programs? • What would be the benefit to the constituents of Thurston County? • Recommendations for structure and organization of the district.					
Planning / Resource Stewardship / Commissioners	County funding sources	High	2014-2018 short term	All objectives	No
FMI-8—Analyze the findings of the flood control zone district feasibility report and determine if its recommendations should be adopted. Create a prioritized list of flood risk reduction projects and programs throughout the county that could be funded under this mechanism.					
Planning / Resource Stewardship / Commissioners	County funding sources	High	2018 – 2022 long term	All objectives	No
FMI-9—Invest in flood prediction and forecast modeling to support all facets of the Thurston County floodplain management program, including but not limited to flood hazard identification, flood threat recognition in support of flood notification programs, climate change adaptation, and risk assessment.					
Resource Stewardship / Emergency Management	Department Budgets / Grants	Medium	2013 – 2015 (Short-term)	3, 4, 5, 6, 10, 11	Yes, TC-FH-23
FMI-10—Complete an inventory of all publicly maintained stormwater facilities.					
Resource Stewardship / Public Works	Department budget	Medium	2013 – 2014 short term	3, 4, 5, 8, 9	No
FMI-11—Create an inventory and establish a priority list for culvert replacement that takes into account fish passage, flood depth reduction and future losses avoided.					
Public Works / Resource Stewardship / Central Services – Geo Data	Department Budget	Low	2012 – 2013 short term	3, 4, 5, 8, 9	No
FMI-12—Utilizing the best available data, science and technology, enhance the existing flood notification program, striving to identify a notification protocol within systems that have real-time flood threat recognition capability.					
Emergency Management	Department Budget / Grants	Medium	2013 – 2014 short term	2, 3, 6, 9, 10	Yes, TC-MH-4
FMI-13—Update the County emergency response plan to reflect any changes to flood notification protocol within the county.					
Emergency Management	Department Budget / Grant	Medium	2013 – 2015 short term	1, 2, 3, 5, 6	Yes, TC-MH-4

TABLE 9-5.
ACTION PLAN—FLOOD MITIGATION INITIATIVES (FMI)

Lead Department	Possible Funding Sources or Resources	Estimated Project Cost	Time Line	Objectives	Covered in previous plan (Yes or No), Initiative #
FMI-14—Utilizing the best available data, science and technology, maintain and enhance as data becomes available the Level 2, user-defined HAZUS-MH model that was constructed to support this planning effort.					
Emergency Management / Central Services – Geo Data	Department Budgets	Medium	2013-2014 short term	3, 4, 5, 8, 9, 10, 11	No
FMI-15—Develop a post-flood disaster action plan that establishes protocols for the County such as substantial damage determination, the recording of perishable data (such as high water marks), grant support, staffing, continuity of operations, and recovery.					
Emergency Management / Public Works / Resource Stewardship	Department Budgets / Grant	Low	2013-2014 short term	1, 5, 9	No
FMI-16—Perform a comprehensive assessment of floodplain restoration, reconnection and enhancement of floodplain storage opportunities in the county.					
Planning / Resource Stewardship	Grants	Medium	2013-2015 short term	3, 5, 8, 11	No
FMI-17—Work with the County departments responsible for implementation and maintenance of the County's capital improvements programs to identify flood hazard mitigation projects that are eligible for hazard mitigation grants. Once projects are identified, pursue grant funding for those projects shown to be cost-effective.					
Public Works / Resource Stewardship	Department Budgets	Low	2013 short term	1, 3, 9	No
FMI-18—Collaborate with Pierce County and Tacoma Power to identify appropriate operational procedures of Alder Lake Dam that will minimize the flood risk on the Nisqually River.					
Emergency Management	Department Budget	Low	2013 – 2014 short term	1, 3, 5, 9, 10	Yes, TC-FH-25
FMI-19—Continue to develop and implement an annual public outreach strategy that seeks to leverage public information resources and capabilities within the county.					
Emergency Management / Planning	Department Budget	Low	Ongoing	3, 5, 10	No
FMI-20—Continue to pursue/ maintain Thurston County floodplain management program compliance with the National Marine Fisheries Service biological opinion regarding the National Flood Insurance Program.					
Planning / Resource Stewardship	Department Budget	Low	Ongoing	3, 4, 5, 8, 11	No

TABLE 9-5.
ACTION PLAN—FLOOD MITIGATION INITIATIVES (FMI)

Lead Department	Possible Funding Sources or Resources	Estimated Project Cost	Time Line	Objectives	Covered in previous plan (Yes or No), Initiative #
FMI-21—Establish a link between the Thurston County Flood Hazard Mitigation Plan and the Natural Hazards Mitigation Plan for the Thurston Region. The Flood Hazard Mitigation Plan will become the flood hazard component of the Natural Hazards Mitigation Plan upon its next update. All future updates to the two plans will occur on the same planning cycle upon plan integration.					
Emergency Management, Thurston Regional Planning Council	Department Budgets, Grants, Thurston Regional Planning Council funds	Medium	2014 short term	1, 3, 5, 10	No
FMI-22—Obtain digital data and create GIS maps of the flood inundation from possible failures of the Skookumchuck Dam on the Skookumchuck River and the Alder and LaGrande Dams on the Nisqually River. Using this data, assess the risk associated with these facilities utilizing the best available date and science.					
Emergency Management / Central Services – Geo Data	Grant	Medium	2014 – 2015 short term	1, 3, 4, 5, 9, 10	No
FMI-23—Develop evacuation plans for communities and residents downstream from the Nisqually and Skookumchuck River dams.					
Emergency Management / Resource Stewardship / Public Works/ County Sheriff / Central Services – Geo Data	Grant and Local Match	Low	2013 – 2015 short term	1, 2, 6, 10	Yes, TC-FH-25
FMI-24—Draft a prioritized list of road segments and bridges that should be elevated above the 100-year floodplain and culverts that will fail under flood flow. Upgrade these structures if state or federal funds become available.					
Public Works / Resource Stewardship / Central Services – Geo Data	Thurston County CIP, Grants	Low	2013 – 2015 short term	1, 3, 9	Yes, TC-FH-22
FMI-25—Develop a southeast flood detour plan for the Thurston County Comprehensive Emergency Management Plan.					
Emergency Management / Public Works / Central Services – Geo Data	Emergency Management funds/Grants	Low	2013 – 2015 short term	6, 7, 9, 10	Yes, TC-FH-24
FMI-26—Map the channel migration zones for all rivers in the region and the extent of high quality riparian habitat.					
Resource Stewardship / Central Services – Geo Data	Department Budgets/Grants	High	2013 – 2015 short-term, depends on funding	3, 4, 8, 11	Yes, TC-FH-8

TABLE 9-5.
ACTION PLAN—FLOOD MITIGATION INITIATIVES (FMI)

Lead Department	Possible Funding Sources or Resources	Estimated Project Cost	Time Line	Objectives	Covered in previous plan (Yes or No), Initiative #
FMI-27—To support initiative # FMI-1, undertake a study of identified repetitive flood loss areas to determine the following: • Repetitive losses not captured by flood insurance data • Causes of the repetitive flooding • Assets impacted by the repetitive flooding (this would include assets such as livestock, out-buildings and rescue costs not already identified by FEMA) • Possible alternatives to remediate the repetitive flooding					
Resource Stewardship / Planning	Department Budgets, Grants	Medium	2013 – 2018 long term, depends on funding	3, 4, 8, 9, 10, 11	Yes, TC-FH-21
FMI-28—Revise shoreline regulations to encourage shoreline protective structures to be bioengineered.					
Resource Stewardship / Planning	Department Budgets, Grants	Low	2013-2015	3, 8, 11	Yes, TC-FH-11
FMI-29—Review the recommendations of adopted stormwater drainage basin plans to determine which ones are still relevant for implementation.					
Resource Stewardship	Stormwater impact Fees and Grants	Medium	Ongoing	1, 4, 9, 11	Yes, TC-FH-20
FMI-30—Prepare new drainage basin plans for the high groundwater areas.					
Resource Stewardship – Salmon Creek drainage basin is completed	Fees and Grants	Medium	2014 – 2018	3, 4, 9, 11	Yes, TC-FH-14
FMI-31—To support implementation of the Thurston County Critical Areas Ordinance, encourage research that establishes best management practices for bioengineering and other techniques that provide streambank protection and improve fisheries through the use of large woody debris. Support local demonstration projects that could support such research.					
Resource Stewardship / Public Works / Thurston Conservation District / South Sound Salmon Enhancement Group	Grants	High	2013 – 2018 long term	3, 4, 9, 11	Yes, TC-FH-18
FMI-32—Where feasible, consider the adoption of appropriate higher regulatory standards (including but not limited to freeboard, comp storage, lower substantial damage thresholds, setbacks and fill restrictions) as means to reduce future flood risk and support a no-adverse-impact philosophy of floodplain management.					
Resource Stewardship / Thurston County Board of Commissioners	Department Budgets	Low	Long-term	8, 9, 11	No

9.3 BENEFIT/COST REVIEW

The action plan is prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (CRS Step 8). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

Cost ratings were defined as follows:

- **High**—Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
- **Medium**—The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- **Low**—The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Benefit ratings were defined as follows:

- **High—**Project will provide an immediate reduction of risk exposure for life and property.
- **Medium—**Project will have a long-term impact on the reduction of risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
- **Low—**Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

For many of the strategies identified in this action plan, Thurston County may seek financial assistance under the FEMA HMGP or Hazard Mitigation Assistance programs, both of which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For projects not seeking financial assistance from grant programs that require detailed analysis, Thurston County reserves the right to define “benefits” according to parameters that meet the goals and objectives of this plan.

9.4 ACTION PLAN PRIORITIZATION

Table 9-6 lists the priority of each initiative as assigned by the planning team, using the same parameters used in selecting the initiatives. A qualitative benefit-cost review was performed for each of these initiatives. The priorities are defined as follows:

- **High Priority**—A project that meets multiple objectives, has benefits that exceed cost, has funding secured or is an ongoing project and meets eligibility requirements for a grant program. High priority projects can be completed in the short term (1 to 5 years). The key factors for high priority projects are that they have funding secured and can be completed in the short term.

TABLE 9-6.
PRIORITIZATION OF MITIGATION INITIATIVES

Initiative	# of Objectives Met	Benefits	Costs	Do Benefits equal or exceed Costs?	Is project Grant eligible?	Can Project be funded under existing programs/ budgets?	Priority (High, Med., Low)
FMI-1	3	High	High	Yes	Yes	No	Medium
FMI-2	3	Low	Low	Yes	No	Yes	High
FMI-3	3	Medium	Low	Yes	No	Yes	High
FMI-4	7	Medium	Low	Yes	No	Yes	High
FMI-5	7	Medium	Low	Yes	No	Yes	High
FMI-6	4	High	Low	Yes	No	Yes	High
FMI-7	11	High	High	Yes	No	No	Medium
FMI-8	11	High	High	Yes	No	No	Medium
FMI-9	6	High	Medium	Yes	Yes	Yes	High
FMI-10	5	Medium	Medium	Yes	No	Yes	High
FMI-11	5	High	Low	Yes	Yes	Yes	High
FMI-12	5	High	Medium	Yes	Yes	Yes	High
FMI-13	5	High	Medium	Yes	Yes	Yes	High
FMI-14	7	Medium	Medium	Yes	Yes	Yes	High
FMI-15	3	Medium	Low	Yes	No	No	Medium
FMI-16	4	Medium	Medium	Yes	No	No	Medium
FMI-17	3	Medium	Low	Yes	No	Yes	High
FMI-18	5	High	Low	Yes	No	Yes	High
FMI-19	3	Low	Low	Yes	No	Yes	High
FMI-20	5	Low	Low	Yes	No	Yes	High
FMI-21	4	Medium	Medium	Yes	Yes	Yes	High
FMI-22	6	High	Medium	Yes	No	Yes	High
FMI-23	4	High	Low	Yes	No	Yes	High
FMI-24	3	Medium	Low	Yes	No	Yes	High
FMI-25	4	High	Low	Yes	No	Yes	High
FMI-26	4	High	High	Yes	No	No	Medium
FMI-27	6	Medium	Medium	Yes	Yes	No	Medium
FMI-28	3	Medium	Low	Yes	No	Yes	High
FMI-29	4	Medium	Medium	Yes	No	Yes	High
FMI-30	4	Medium	Medium	Yes	No	Yes	High
FMI-31	4	High	High	Yes	No	No	Medium
FMI-32	3	High	Low	Yes	No	Yes	Medium

- **Medium Priority**—A project that meets goals and objectives, that has benefits that exceed costs, and for which funding has not been secured but that is grant eligible. Project can be completed in the short term, once funding is secured. Medium priority projects will become high priority projects once funding is secured. The key factors for medium priority projects are that they are eligible for funding, but do not yet have funding secured, and they can be completed within the short term.
- **Low Priority**—A project that will mitigate the risk of a hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for FEMA grant funding, and for which the time line for completion is long term (1 to 10 years). Low priority projects may be eligible for grant funding from other programs. Low priority projects are "blue-sky" projects. How they will be financed is unknown, and they can be completed over a long term.

9.5 ANALYSIS OF MITIGATION INITIATIVES

Each recommended initiatives was classified based on the hazard it addresses and the type of mitigation it involves. Mitigation types used for this categorization are as follows:

- **Prevention**—Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.
- **Public Education and Awareness**—Actions to inform citizens and elected officials about flood hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Resource Protection**—Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Emergency Services**—Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- **Structural Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.

Table 9-7 presents the results of this analysis.

TABLE 9-7.
ANALYSIS OF MITIGATION INITIATIVES

Mitigation Type	Applicable Mitigation Initiatives (FMI #'s)
1. Prevention	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 17, 21, 22, 24, 26, 27, 28, 29, 30, 32
2. Property Protection	4, 5, 7, 8
3. Public Education and Awareness	2, 4, 5, 6, 7, 8, 14, 19
4. Natural Resource Protection	3, 5, 6, 7, 8, 16, 20, 28, 31
5. Emergency Services	5, 6, 7, 8, 9, 12, 13, 14, 15, 18, 22, 23, 25
6. Structural Projects	6, 7, 8, 11, 16, 17, 24

PART 4 —
PLAN MAINTENANCE

CHAPTER 10.
PLAN ADOPTION

This chapter documents formal adoption of the Thurston County Flood Hazard Mitigation Plan by Thurston County's governing body (CRS Step 9). The Thurston County Board of Commissioners adopted the plan on December 11, 2012. Thurston County will formally adopt the plan. A copy of the resolution is provided in Figure 10-1.

RESOLUTION No. 14822

A **RESOLUTION** approving and adopting the Thurston County Comprehensive Flood Hazard Mitigation Plan.

WHEREAS, Thurston County participates in the National Flood Insurance Program; and

WHEREAS, Thurston County participates in the Nation Flood Insurance Program's Community Rating System (CRS); and

WHEREAS, Thurston County currently is rated as a Class 5 community in the CRS program, which results in a 25% reduction in flood insurance premiums for property owners located in the County's floodplains; and

WHEREAS, Thurston County qualifies for a Class 3 rating, which provides a 35% reduction in flood insurance premiums, but is unable to attain it without revising its Comprehensive Flood Hazard Mitigation Plan; and

WHEREAS, the revised Comprehensive Flood Hazard Mitigation Plan meets the CRS program's pre-requisites for an improved rating over Class 5 in the Community Rating System; and

WHEREAS, the revised Comprehensive Flood Hazard Mitigation Plan is intended to reduce private and public property damages due to future floods; and

WHEREAS, the Board of County Commissioners has had an opportunity to review the Comprehensive Flood Hazard Mitigation Plan, and finds that it is in the best interest of Thurston County to adopt the Plan;

NOW, THEREFORE, BE IT RESOLVED that the Board of County Commissioners approves the Comprehensive Flood Hazard Mitigation Plan as shown in attachment A.

ADOPTED: December 11, 2012

ATTEST:

Clerk of the Board

BOARD OF COUNTY COMMISSIONERS
Thurston County, Washington

Chair

Vice-Chair

Commissioner

APPROVED AS TO FORM:

JON TUNHEIM
PROSECUTING ATTORNEY

Jeffrey G. Pancher
Deputy Prosecuting Attorney

Figure 10-1. Resolution Adopting Flood Hazard Mitigation Plan

CHAPTER 11.
PLAN MAINTENANCE STRATEGY

This chapter presents a plan maintenance process that includes the following (CRS Step 10):

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over a 5-year cycle
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate
- A discussion on how the community will continue public participation in the plan maintenance process.

The plan maintenance strategy is the formal process that will ensure that the flood hazard mitigation plan remains an active and relevant document and that Thurston County maintains its eligibility for applicable funding sources. It includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. The strategy also describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan will be incorporated into existing planning mechanisms and programs, such as comprehensive land-use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

11.1.1 Plan Implementation

The effectiveness of the flood hazard mitigation plan depends on its implementation and incorporation of its action items into existing local plans, policies and programs. Together, the action items in the Plan provide a framework for activities that Thurston County can implement over the next 5 years. The planning team and the Steering Committee have established goals and objectives and have prioritized mitigation initiatives that will be implemented through existing plans, policies, and programs.

The Thurston County Planning Department's Natural Resources Program will have lead responsibility for overseeing the plan implementation and maintenance strategy. Plan implementation and evaluation will be a shared responsibility among all agencies identified as lead agencies in the mitigation action plan.

11.1.2 Steering Committee

The Steering Committee is a total volunteer body that oversaw the development of the Plan and made recommendations on key elements of the plan, including the maintenance strategy. It was the Steering Committee's position that an oversight committee with representation similar to that of the Steering Committee should have an active role in the Plan maintenance strategy. Therefore, it is recommended that a steering committee remain a viable body involved in key elements of the Plan maintenance strategy. The new steering committee should include representation from stakeholders in the planning area.

The principal role of a steering committee in this plan maintenance strategy will be to review the annual progress report and provide input to the Thurston County Planning Department on possible enhancements to be considered at the next update. Future plan updates will be overseen by a steering committee similar to the one that participated in this plan development process, so keeping an interim steering committee

intact will provide a head start on future updates. It will be the steering committee's role to review the progress report in an effort to identify issues needing to be addressed by future plan updates.

11.1.3 Annual Progress Report

The minimum task of the ongoing annual steering committee meeting will be the evaluation of the progress of its individual action plan during a 12-month performance period. This review will include the following:

- Summary of any flood hazard events that occurred during the performance period and the impact these events had on the planning area
- Review of mitigation success stories
- Review of continuing public involvement
- Brief discussion about why targeted strategies were not completed
- Re-evaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or initiatives that involve hazard mitigation.

The planning team has created a template for preparing a progress report (see Appendix D). The plan maintenance steering committee will provide feedback to the planning team on items included in the template. The planning team will then prepare a formal annual report on the progress of the plan. This report should be used as follows:

- Posted on the Natural Resources Program website page dedicated to the flood hazard mitigation plan
- Provided to the local media through a press release
- Presented to the Thurston County Commissioners to inform them of the progress of mitigation initiatives implemented during the reporting period
- Provided as part of the CRS annual re-certification package. The CRS requires an annual recertification to be submitted by October 1 of every calendar year for which the community has not received a formal audit. To meet this recertification timeline, the planning team will strive to complete progress reports between June and September each year.

Annual progress reporting is credited under CRS Step 10.

11.1.4 Plan Update

Thurston County intends to update the flood hazard mitigation plan on a 5-year cycle from the date of initial plan adoption (CRS Step 10). This cycle may be accelerated to less than 5 years based on the following triggers:

- A Presidential Disaster Declaration that impacts the planning area
- A hazard event that causes loss of life
- A comprehensive update of Thurston County comprehensive plan.

It will not be the intent of future updates to develop a complete new flood hazard mitigation plan for the planning area. The update will, at a minimum, include the following elements:

- The update process will be convened through a steering committee.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plan will be reviewed and revised to account for any initiatives completed, dropped, or changed and to account for changes in the risk assessment or new policies identified under other planning mechanisms (such as the comprehensive plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- The Thurston County Board of Commissioners will adopt the updated plan.

It is Thurston County's intention to fully integrate this Flood Hazard Mitigation Plan into the Natural Hazards Mitigation Plan for the Thurston Region at some time. This will allow for a uniform update cycle for both plans and eliminate redundant planning.

11.1.5 Continuing Public Involvement

The public will continue to be apprised of the plan's progress through the Natural Resources Program website and by providing copies of annual progress reports to the media. The website will not only house the final plan, it will become the one-stop shop for information regarding the plan and plan implementation. Copies of the plan will be distributed to the Thurston County library system. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new steering committee. This strategy will be based on the needs and capabilities of Thurston County at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

11.1.6 Incorporation into Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The Thurston County Comprehensive Plan is considered to be an integral part of this plan. Thurston County, through adoption of a comprehensive plan and zoning ordinance, has planned for the impact of flooding. The plan development process provided the opportunity to review and expand on policies in these planning mechanisms. The comprehensive plan and the flood hazard mitigation plan are complementary documents that work together to achieve the goal of reducing risk exposure. An update to a comprehensive plan may trigger an update to the flood hazard mitigation plan.

Thurston County will create a linkage between the flood hazard mitigation plan and the comprehensive plan by identifying a mitigation initiative as such and giving that initiative a high priority. Other planning processes and programs to be coordinated with the recommendations of the flood hazard mitigation plan include the following:

- Natural Hazards Mitigation Plan for the Thurston Region
- Emergency response plans
- Capital improvement programs
- Municipal codes

- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

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APPENDIX A.
ACRONYMS AND DEFINITIONS

APPENDIX A.
ACRONYMS AND DEFINITIONS

ACRONYMS

CIP—Capital Improvement Plan

CRS—Community Rating System

DHS—Department of Homeland Security

DMA —Disaster Mitigation Act

EPA—U.S. Environmental Protection Agency

ESA—Endangered Species Act

FEMA—Federal Emergency Management Agency

FIRM—Flood Insurance Rate Map

GIS—Geographic Information System

HAZUS-MH—Hazards, United States-Multi Hazard

HMGP—Hazard Mitigation Grant Program

IBC—International Building Code

IRC—International Residential Code

LIDAR—Light Detection and Ranging

NFIP—National Flood Insurance Program

NOAA—National Oceanic and Atmospheric Administration

NWS—National Weather Service

SFHA—Special Flood Hazard Area

TRPC—Thurston Regional Planning Council

UGA—Urban Growth Area

DEFINITIONS

100-Year Flood: The term "100-year flood" can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1 percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1 percent annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program.

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre

foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1% chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation initiatives, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with flooding. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: A critical facility is one that is deemed vital to the Thurston County planning area's ability to provide essential services while protecting life and property. A critical facility may be a system

or an asset, either physical or virtual, the loss of which would have a profound impact on the security, economy, public health or safety, environment, or any combination of thereof, across the planning area. For the purposes of the Thurston County Flood Hazard Mitigation Plan, the following types of systems and assets are defined as critical facilities:

- Police stations, fire stations, paramedic stations, emergency vehicle and equipment storage facilities, and emergency operations and communications centers needed for disaster response before, during, and after hazard events.
- Public and private utilities and infrastructure vital to maintaining or restoring normal services to areas damaged by hazard events. These include water (potable, wastewater, storm water, drainage and irrigation), utilities (transmission and distribution facilities for natural gas, power, geothermal) and communications (land-based telephone, cell phone, the internet emergency broadcast facilities and emergency radios).
- Public gathering places that could be utilized as evacuation centers during large scale disasters.
- Hospitals, extended care facilities, urgent care facilities and housing that may contain occupants not sufficiently mobile to avoid death or injury during a hazard event
- Transportation systems that convey vital supplies and services to, through and throughout the community. These include roads, bridges, railways, airports and pipelines
- Government and educational facilities central to governance and quality of life along with response and recovery actions taken as a result of a hazard event
- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic, and/or water-reactive materials.
- Infrastructure designed to help safely convey high water events from the event source to the perimeter of the planning area including but not limited to; dams, revetments and stormwater drainage facilities.
- Debris management and solid waste facilities

Drainage Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Economically Disadvantaged Populations: Households with household incomes of $15,000 or less.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area.

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's Flood Insurance rate Map. The study contains such

background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A flood insurance rate map identifies most, but not necessarily all, of a community's floodplain as the Special Flood Hazard Area.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a flood hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people and/or cause property damage.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation initiatives after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (HAZUS-MH) Loss Estimation Program: HAZUS-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The HAZUS-MH software program assesses risk in a quantitative manner to estimate damage and losses associated with natural hazards. HAZUS-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. HAZUS-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Initiatives: Mitigation initiatives are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00; or
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations and zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Stream Bank Erosion: Stream bank erosion is common along rivers, streams and drains where banks have been eroded, sloughed or undercut. However, it is important to remember that a stream is a dynamic and constantly changing system. It is natural for a stream to want to meander, so not all eroding banks are "bad" and in need of repair. Generally, stream bank erosion becomes a problem where development has limited the meandering nature of streams, where streams have been channelized, or where stream bank structures (like bridges, culverts, etc.) are located in places where they can actually cause damage to downstream areas. Stabilizing these areas can help protect watercourses from continued sedimentation, damage to adjacent land uses, control unwanted meander, and improvement of habitat for fish and wildlife.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33%.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damage, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric

substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains down-gradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

APPENDIX B.
CRS AND FCAAP GUIDELINES FOR FLOOD PLANNING

APPENDIX B.
CRS AND FCAAP GUIDELINES FOR FLOOD PLANNING

COMMUNITY RATING SYSTEM PLANNING PROCESS GUIDELINES

A. FLOODPLAIN MANAGEMENT PLANNING

1. Organize to prepare the plan (Maximum credit: 10 points). The credit for this step is the total of the following points, which are based on how the community organizes to prepare its floodplain management plan:

- (a) if the planning process is under the supervision or direction of a professional planner;
- (b) if the planning process is conducted through a committee composed of staff from those community departments that will be implementing the majority of the plan's recommendations;
- (c) if the planning process and/or the committee are formally created or recognized by action of the community's governing board.

The plan document must discuss how it was prepared, who was involved in the planning process, and how the public was involved during the planning process. (REQUIRED) When a multi-jurisdictional plan is prepared, at least one representative from each community seeking CRS credit must be involved on the planning committee that is credited under item (b).

2. Involve the public (Maximum credit: 85 points). The planning process must include an opportunity for the public to comment on the plan during the drafting stage and before plan approval (REQUIRED). The term "public" includes residents, businesses, property owners, and tenants in the floodplain and other known hazard areas as well as other stakeholders in the community, such as business leaders, civic groups, academia, non-profit organizations, and major employers. The credit for this step is the total of the following points based on how the community involves the public during the planning process.

- (a) if the planning process is conducted through a planning committee that includes members of the public. If this is the same planning committee credited under step 1, items (b) and (c), at least one half of the members must be representatives of the public, including residents, businesses, or property owners from the flood-prone areas. The committee must hold a sufficient number of meetings that involve the members in planning steps 4 through 9 (e.g., at least one meeting on each step).
- (b) if one or more public information meetings are held in the affected area(s) at the beginning of the planning process to obtain public input on the natural hazards, problems, and possible solutions. At least one meeting must be held separate from the planning committee meetings in item (a).
- (c) for holding at least one public meeting to obtain input on the draft plan. The meeting must be at the end of the planning process, at least two weeks before submittal of the recommended plan to the community's governing body.
- (d) if questionnaires are distributed asking the public for information on their natural hazards, problems, and possible solutions. The questionnaires must be distributed to at least 90% of the floodplain residents.

- (e) if written comments and recommendations are solicited from neighborhood advisory groups, homeowners' associations, parent-teacher organizations, the Chamber of Commerce, or similar organizations that represent the public in the affected area(s).
- (f) if other public information activities are implemented to explain the planning process and encourage input to the planner or planning committee.

3. Coordinate (Maximum credit: 25 points). Other agencies and organizations must be contacted to see if they are doing anything that may affect the community's program and to see if they could support the community's efforts.

Examples of "other agencies and organizations" include neighboring communities; local, regional, state, and federal agencies; and businesses, academia, and other private and non-profit organizations affected by the hazards or involved in hazard mitigation or floodplain management. The credit for this step is the total of the following points. To receive credit for this step, the coordination must include items (a) and (b).

- (a) if the planning includes a review of existing studies, reports, and technical information and of the community's needs, goals, and plans for the area. (REQUIRED)
- (b) if neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests are given an opportunity to be involved in the planning process. (REQUIRED)
- (c) if neighboring communities, the state NFIP Coordinator, the state water resources agency, the county and state emergency management agency, the FEMA Regional Office, and (where appropriate) the state's coastal zone management agency are contacted at the beginning of the planning process to see if they are doing anything that may affect the community's program and to see how they can support the community's efforts.
- (d) if other governmental and nongovernmental organizations, such as the National Weather Service, Red Cross, homebuilders association, and environmental groups are contacted at the beginning of the planning process to see if they are doing anything that may affect the community's program and to see how they can support the community's efforts.
- (e) if the coordination effort includes holding meetings with representatives of the other agencies and organizations to review common problems, development policies, mitigation strategies, inconsistencies, and conflicts in policies, plans, programs, and regulations.
- (f) for sending the draft action plan to the other agencies and organizations contacted under items (b), (c), (d), and (e) and asking them to comment by a certain date.

4. Assess the hazard (Maximum credit: 20 points). The credit for this step is the total of the following points based on what the community includes in its assessment of the hazard. To receive CRS credit for this step, the assessment must include item (a). If the community wants the plan to also qualify as a FEMA multi-hazard mitigation plan, item (b) must also be completed.

- (a) for including an assessment of the flood hazard in the plan. If the community is a Category B or C repetitive loss community, this step must cover all of its repetitive loss areas (REQUIRED). The assessment must include at least one of the following items:
  - (1) a map of the known flood hazards. "Known flood hazards" means the floodplain shown on the Flood Insurance Rate Map (FIRM), repetitive loss areas, areas not mapped on the FIRM that have flooded in the past, and surface flooding identified in existing studies. No new studies need to be conducted for this assessment.

  - (2) a description of the known flood hazards, including source of water, depth of flooding, velocities, and warning time.
  - (3) a discussion of past floods.
- (b) if the plan includes a map, description of the magnitude or severity, history, and probability of future events for other natural hazards, such as erosion, tsunamis, earthquakes, and hurricanes. The plan should include all natural hazards that affect the community. At a minimum, it should include those hazards identified by the state's hazard mitigation plan. (REQUIRED FOR PLANS TO BE CREDITED UNDER THE DISASTER MITIGATION ACT OF 2000)

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5. Assess the problem (Maximum credit: 35 points) The credit for this step is the total of the following points, based on what is included in the assessment of the vulnerability of the community to the hazards identified in the previous hazard assessment step. To receive credit for this step, the assessment must include item (a) and must evaluate the hazard data in light of their impact on the community. Simply listing data, such as the names of the critical facilities or the number of flood insurance claims, will not suffice for credit.

- (a) if the plan includes an overall summary of the jurisdiction's vulnerability to each hazard identified in the hazard assessment (step 4) and the impact on the community. (required)
- (b) if the plan includes a description of the impact that the hazards identified in the hazard assessment (step 4) have on: (1) life, safety, and health and the need and procedures for warning and evacuating residents and visitors. (5 points) (2) critical facilities and infrastructure. (5 points) (3) the community's economy and tax base. (5 points)
- (c) for including the number and types of buildings subject to the hazards identified in the hazard assessment.
- (d) if the assessment includes a review of all properties that have received flood insurance claims (in addition to the repetitive loss properties) or an estimate of the potential dollar losses to vulnerable structures.
- (e) if the plan describes areas that provide natural and beneficial functions, such as wetlands, riparian areas, sensitive areas, and habitat for rare or endangered species.
- (f) if the plan includes a description of development, redevelopment, and population trends and a discussion of what the future brings for development and redevelopment in the community, the watershed, and natural resource areas.

When a multi-jurisdictional plan is prepared, the critical facilities, building counts, and similar data must be presented for each community.

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6. Set goals (Maximum credit: 2 points). The two credit points for this step are provided if the plan includes a statement of the goals of the community's floodplain management or hazard mitigation program. (REQUIRED)

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7. Review possible activities (Maximum credit: 30 points) The plan must describe those activities that were considered and note why they were or were not recommended (e.g., they were not cost-effective or they did not support the community's goals). (REQUIRED)

If an activity is currently being implemented, the plan must note whether it should be modified. The discussion of each activity needs to be detailed enough to be useful to the lay reader. The credit for this step is the total of the following points based on which floodplain management or hazard mitigation activities are reviewed in the plan.

- (a) if the plan reviews preventive activities, such as zoning, stormwater management regulations, building codes, and preservation of open space and the effectiveness of current regulatory and preventive standards and programs;
- (b) if the plan reviews property protection activities, such as acquisition, retrofitting, and flood insurance;
- (c) if the plan reviews activities to protect the natural and beneficial functions of the floodplain, such as wetlands protection;
- (d) if the plan reviews emergency services activities, such as warning and sandbagging;
- (e) if the plan reviews structural projects, such as reservoirs and channel modifications; and
- (f) if the plan reviews public information activities, such as outreach projects and environmental education programs.

8. Draft an action plan (Maximum credit: 70 points). The action plan specifies those activities appropriate to the community's resources, hazards, and vulnerable properties.

For each recommendation, the action plan must identify who does what, when it will be done, and how it will be financed. The actions must be prioritized and include a review of the benefits of the proposed projects and their associated costs. (REQUIRED) A multi-hazard mitigation plan must identify actions that address both existing and new infrastructure and buildings. The credit for this step is based on what is included in the action plan. Credit is provided for a recommendation on floodplain regulations, provided it recommends a regulatory standard that exceeds the minimum requirements of the NFIP.

- (a) if the action plan includes flood-related recommendations for activities from two of the six categories credited in step 7, Review possible activities.
- (b) if the action plan includes flood-related recommendations for activities from three of the six categories credited in step 7, Review possible activities.
- (c) if the action plan includes flood-related recommendations for activities from four of the six categories credited in step 7, Review possible activities.
- (d) if the action plan includes flood-related recommendations for activities from five of the six categories credited in step 7, Review possible activities.
- (e) additional points are provided if the action plan establishes post-disaster mitigation policies and procedures.
- (f) additional points are provided if the action plan's recommended natural resource protection activities include recommendations from a Regional Habitat Conservation Plan as credited under Section 511.c.
- (g) additional points are provided if the plan includes action items (other than public information activities) to mitigate the effects of the other natural hazards identified in the hazard assessment (step 4, item (b)).

If the plan calls for acquiring properties, there must be a discussion of how the project(s) will be managed and how the land will be reused. When a multi-jurisdictional plan is prepared, it must have action items from at least two of the six categories that directly benefit each community seeking CRS credit.

9. Adopt the plan (Maximum credit: 2 points) The 2 credit points for this step are provided if the plan and later amendments are officially adopted by the community's governing body. (REQUIRED)

When a multi-jurisdictional plan is prepared, it must be adopted by the governing board of each community seeking CRS or multi-hazard mitigation plan credit.

10. Implement, evaluate, and revise (Maximum credit: 15 points) The credit for this step is the total of the following points based on how the community monitors and evaluates its plan.

- (a) if the community has procedures for monitoring implementation, reviewing progress, and recommending revisions to the plan in an annual evaluation report. The report must be submitted to the governing body, released to the media and made available to the public. (REQUIRED)
- (b) if the evaluation report is prepared by the same planning committee that prepared the plan that is credited in step 2(a) or by a successor committee with a similar membership that was created to replace the planning committee and charged with monitoring and evaluating implementation of the plan.

To maintain this credit, the community must submit a copy of its annual evaluation report with its recertification each year and update the plan at least every five years.

B. REPETITIVE LOSS AREA ANALYSIS

Up to 50 points are provided for conducting area analyses of all of the community's repetitive loss areas. An area analysis is prepared according to the following criteria:

- 1. All repetitive loss areas must be mapped as described in Section 503.b. If the community does not conduct an analysis of all the areas, it will be reflected through the impact adjustment in Section 512.
- 2. Data must be collected on each building in the area(s) using the "limited data view" of the National Flood Mitigation Data Collection Tool. The database file created by the National Flood Mitigation Data Collection Tool must be made available to FEMA and the state, upon request.
- 3. A five-step process must be followed. The steps do not have to be done in the order listed.
  - Step 1. Advise all the property owners in the repetitive loss areas that the analysis will be conducted. This must be sent directly to each property owner and cannot be done via a newspaper or newsletter notice or article.
  - Step 2. Collect data on each building and determine the cause(s) of the repetitive damage.
  - Step 3. Review alternative approaches and determine whether any property protection measures or drainage improvements are feasible. The review must look at all of the property protection measures listed in Figure 510-2 that are appropriate for the types of buildings affected.
  - Step 4. Contact agencies or organizations that may have plans that could affect the cause or impacts of the flooding.
  - Step 5. Document the findings, including a map showing all parcels in the area, recommendations, and how the recommendations will be funded.

- 4. Each area analysis document must be approved by the head of the appropriate community department. It does not have to be circulated to or adopted by the community's governing board, but it does have to be made available to any inquirer, including residents of the repetitive loss area(s).
- 5. The community must prepare an annual report on progress toward implementing the recommendations.

C. HABITAT CONSERVATION PLAN

If the community has adopted a regional Habitat Conservation Plan or other plan that explains and recommends actions to protect rare, threatened, or endangered aquatic or riparian species. The plan must have been adopted by the community's governing board and there must be documentation that the plan is being implemented. The plan must identify:

- the species in need of protection,
- the impact of new development on their habitat,
- alternative actions that could be taken to protect that habitat,
- what actions are recommended to protect that habitat and why they were selected from the alternatives, and
- how the recommendations will be funded.

If the plan has also been accepted as a Habitat Conservation Plan by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

FLOOD CONTROL ASSISTANCE ACCOUNT PROGRAM GUIDELINES

(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 problem areas;
- (d) Description of flood damage history;
- (e) Description of potential flood damage;
- (f) Short-term and long-term goals and objectives for the planning area;
- (g) Description of rules that apply within the watershed including, but not limited to, local shoreline management master programs, and zoning, subdivision, and flood hazard ordinances;
- (h) Determination that the in-stream flood control work is consistent with applicable policies and rules.

(2) Alternative flood control work.

- (a) Description of potential measures of in-stream flood control work;
- (b) Description of alternatives to in-stream flood control work.

(3) Identification and consideration of potential impacts of in-stream flood control work on the following in-stream 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;
- (h) Other impacts.

(4) Area of coverage for the comprehensive plan shall include, as a minimum, the area of the one-hundred-year frequency 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. The plan may or may not include an entire watershed. Comprehensive plans shall also include flood hazard areas 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 must be identified on aerial photographs or maps that will be included with the plan.

(5) Conclusion and proposed solution(s). The Comprehensive Flood Control Management Plan must 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 action with proposed impact resolution measures for resource losses; and
- (d) Corrective action priority.

(6) A certification from the state department of community, trade, and economic development that the local emergency management organization is administering an acceptable comprehensive emergency operations plan

APPENDIX C.
PUBLIC OUTREACH MATERIALS

APPENDIX C.
PUBLIC OUTREACH MATERIALS

APPENDIX D.
EXAMPLE PROGRESS REPORT

APPENDIX D.
EXAMPLE PROGRESS REPORT

Thurston County, WA
Flood Hazard Mitigation Plan
Annual Progress Report

Reporting Period: *(Insert reporting period)*

Background: Thurston County developed a flood hazard mitigation plan to reduce risk from flooding by identifying resources, information, and strategies for risk reduction. To prepare the plan, Thurston County organized resources, assessed risks from flooding, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from floods. Stafford Act. The plan can be viewed on-line at:

http://www.co.thurston.wa.us/planning/natural-res/natural-floodplan-update.htm

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2012, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before _____, 2017. As of this reporting period, the performance period for this plan is considered to be __% complete. The Flood Hazard Mitigation Plan has targeted 32 flood hazard mitigation initiatives to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- __ out of __ initiatives (__%) reported ongoing action toward completion.
- __ out of __ initiatives (__%) were reported as being complete.
- __ out of __ initiatives (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the Thurston County Flood Hazard Mitigation Plan. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of Thurston County and stakeholders. This report discusses the following:

- Flood events that have occurred within the last year
- Changes in risk exposure within the planning area (all of Thurston County)
- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement.

The Flood Hazard Mitigation Plan Steering Committee: The Flood Hazard Mitigation Plan Steering Committee, made up of stakeholders within the planning area, reviewed and approved this

progress report at its annual meeting held on _____, 201_. It was determined through the plan's development process that a steering committee would remain in service to oversee maintenance of the plan. At a minimum, the Steering Committee will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Steering Committee membership is as indicated in Table 1.

TABLE 1.
STEERING COMMITTEE MEMBERS

Name	Title	Jurisdiction/Agency

Flood Events within the Planning Area: During the reporting period, there were __ flood events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- _____
- _____

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any flood event in the planning area that changed the probability of occurrence of flooding as presented in the flood hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each initiative. Reviewers of this report should refer to the Flood Hazard Mitigation Plan for more detailed descriptions of each initiative and the prioritization process.

Address the following in the "status" column of the following table:

- *Was any element of the initiative carried out during the reporting period?*
- *If no action was completed, why?*
- *Is the timeline for implementation for the initiative still appropriate?*
- *If the initiative was completed, does it need to be changed or removed from the action plan?*

TABLE 2.
ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Status	Status (X, O,✓)
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				

TABLE 2.
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Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				
Initiative #__ —_____[description]				

Completion status legend:
- ✓= Project Completed
- O = Action ongoing toward completion
- X = No progress at this time

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Plan Steering Committee, the following recommendations will be noted for future updates or revisions to the plan:

- _____
- _____
- _____
- _____
- _____
- _____

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the Thurston County governing board and to local media outlets and the report is posted on the Thurston County Flood Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*

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