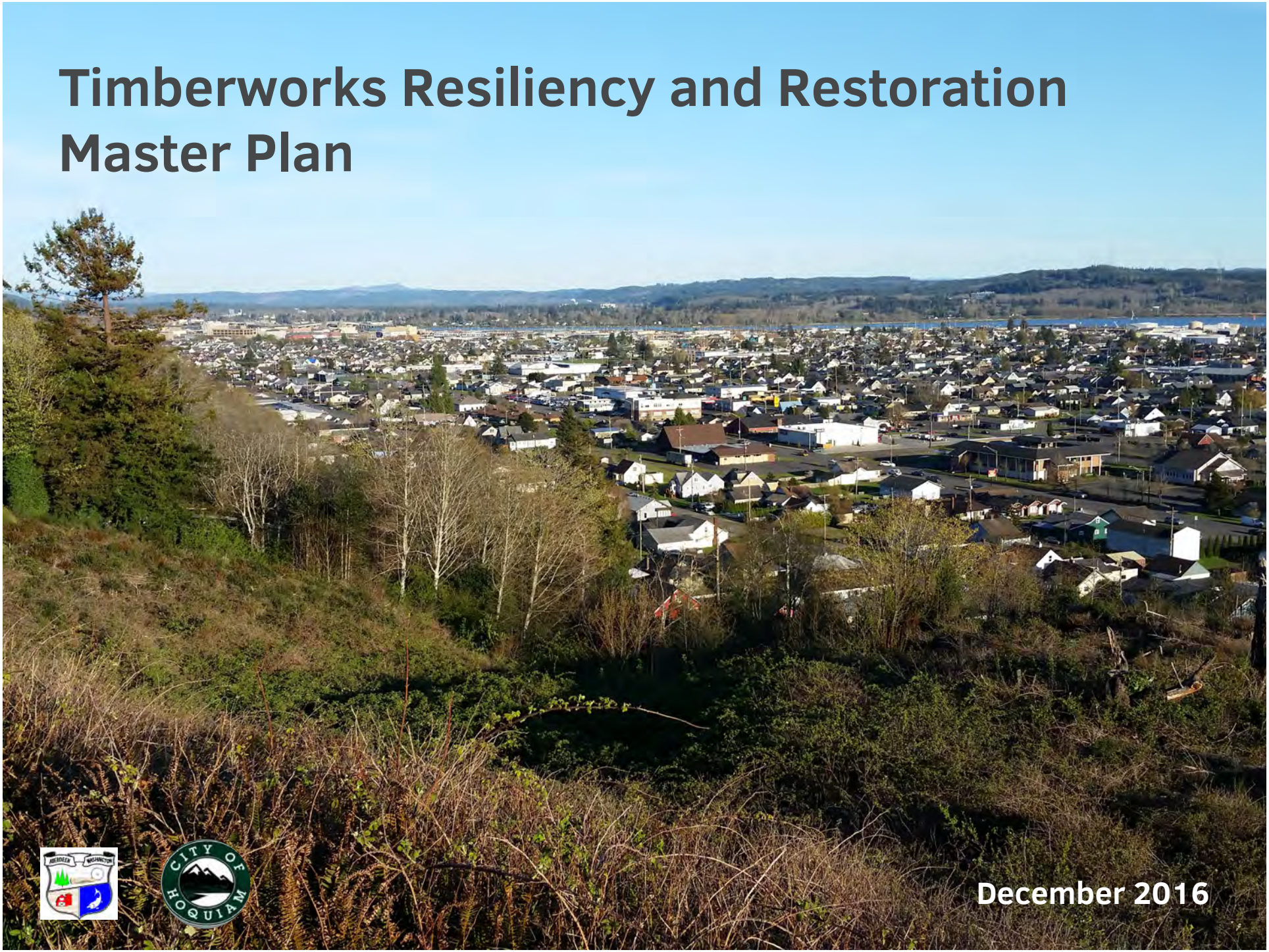
Timberworks Resiliency and Restoration Master Plan



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EXECUTIVE SUMMARY

The cities of Aberdeen and Hoquiam have established a partnership to create a plan for reducing the risk of flooding in their communities. Through the TimberWorks planning process, they have taken a multiple benefits approach to reducing flood risk while also enhancing fish habitat, increasing recreation and open space opportunities, and promoting economic development. This planning process complements and supports the ongoing economic revitalization efforts for the community, including the Vision 2020 effort and the Downtown Aberdeen Revitalization effort as well as land use plans such as the cities' comprehensive plans and shoreline master programs. Protecting properties from water damage, reducing the financial costs of flooding, and enhancing the physical character of the community are foundational to economic and community development.

IMPACTS OF FLOODING

Flooding in the fall and winter months has long been a part of living in the cities of Aberdeen and Hoquiam. As low-lying coastal communities set between the foothills of the Olympic Mountains and Grays Harbor, they experience heavy rainfall, snowmelt, and tidal fluctuation. As far back as the 1930s, an earthen levee was constructed around downtown Hoquiam. Since then Aberdeen and Hoquiam have made a number of significant public infrastructure investments to reduce flood risk, including constructing a series of flood-control structures, most recently the South Aberdeen levee; and converting old sanitary sewer system pipes into a stormwater system to convey runoff to the Wishkah, Hoquiam, and Chehalis rivers. Private-property owners and businesses have also made investments, such as elevating structures, operating pumps, and building floodwalls to protect their assets.

Residents and businesses have accepted and dealt with nuisance flooding for decades. However, in the last few years the physical and financial impacts of flooding have increased to a higher level that demands a proactive response. On January 4 and 5, 2015, over 8 inches of rain fell in Aberdeen and Hoquiam in a 24-hour period. This intense rain event overwhelmed the stormwater drainage system. Standing water was reported to be over 2 feet deep in some streets. The heavy rain led to landslides on steep bluffs along Queets Avenue and other locations. Grays Harbor County and the cities of Aberdeen and Hoquiam unsuccessfully applied for federal disaster declaration following the event. The Coastal Community Action Program worked with over 420 families impacted by the flood and the ensuing mudslides.[1]

[1]City of Aberdeen press release: http://www.aberdeenwa.gov/continuing-flood-recovery/.

The National Flood Insurance Program has undergone a fundamental change since 2012. A series of laws have directed the Federal Emergency Management Agency (FEMA) to increase flood insurance premiums to reflect full risk rates. For some property owners in Aberdeen and Hoquiam, these policy changes have led to monthly flood insurance premiums as large as their mortgage payments. They have also made it difficult to buy and sell property in the community. Property owners in the two cities will pay approximately $2.3 million in flood insurance premiums in 2016. This one year total of premiums represents nearly half of the approximately $5.5 million of losses paid on flood insurance claims over the 30+ years since the inception of the programs in Hoquiam (1979) and Aberdeen (1984).

The extensive damage caused by the January 2015 storm and the financial hardship created by the increase in flood insurance rates have changed flooding from a nuisance that the community had come to terms with to one of the highest priorities for public safety and economic development.

DRIVERS OF FLOODING

There are two distinct types of flooding events in Aberdeen and Hoquiam: coastal floods and localized floods. Coastal floods are driven by extreme high tides, low-pressure systems, wind, and waves that cause the waters of Grays Harbor to push upstream and above the riverbanks. Even though water may be pouring into the communities from the Wishkah and Hoquiam rivers during coastal flood events, the rivers are flowing upstream at that time and the driver of the high water is coastal conditions. The 100-year floodplain established by FEMA is based primarily on the coastal flood.

Localized flooding is caused by high-intensity rain events that overwhelm the stormwater drainage network. These localized floods are exacerbated by high groundwater during the fall and winter months. During these events, stormwater drain pipes are surcharged and water can sometimes be seen rising up out of catch basins. The January 2015 event is a prime example of localized flooding. Soil erosion and landslides worsen these flood events. Sediments eroded from the foothills is carried by stormwater runoff downhill and into streams and catch basins. The sediment then settles out in the catch basin and stormwater conveyance pipes and clogs the system, reducing the capacity to drain stormwater toward the rivers.

These two types of flood events can interact to create complex conditions. For example, high-intensity rain events can occur during high tides. The stormwater drainage system may not be able to pump water out of the

conveyance pipes against the pressure of the tides. The pipes are then surcharged and stormwater runoff has no way to drain.

MULTIPLE BENEFITS APPROACH

The TimberWorks plan takes a multiple-benefits approach to projects. The intent is to explore opportunities to leverage investments in flood-risk-reduction efforts to achieve other benefits such as water quality improvements and habitat enhancement, as well as community and economic development.

ACTION PLAN

A set of recommended programs and projects has been developed based on the assessment of causes of flooding, opportunities for habitat enhancement, public benefits, and the concerns and ideas expressed by community members. Because flooding impacts so many parts of the community and is driven by multiple factors, there is no single silver bullet solution to the challenge facing the community. This plan proposes a set of interrelated programs and projects that can be implemented in multiple locations across the community and that, collectively, will contribute to reducing flood risk while also providing other benefits. While some projects are large-scale public works projects, a number of small-scale, low-cost actions are also recommended that can be implemented by individual property owners or city staff without external funding or technical assistance.

The projects have been organized based on geographic areas to address the varied challenges and opportunities of different sections of the cities. Four recommendations apply across both cities:

Maintenance: Continuing regular maintenance of the stormwater drainage system

Rainwater Storage and Reuse: Providing small scale distributed storage of rain water through cisterns

Urban Forest Canopy: Increasing the tree canopy in the developed area of the cities to intercept precipitation and draw down groundwater

Conveyance System Analysis: Computer modeling analysis of the Aberdeen storm drain system to pinpoint constraints in conveyance pipes

Proposed projects for specific sections of the cities are identified in the following figures. They include a combination of types of projects, including:

Protection of Forested Lands—Keeping land in the upper end of drainage basins in forest cover reduces stormwater runoff and erosion of sediments that clog the storm drain system in the lowlands.

3-1 4-1 5-5

Storage—Flood control parks and green stormwater management techniques that provide storage of floodwaters in basins that also serve as public parks spaces, such as Franklin Field.

1-2 2-3 4-2 4-3

Reconnection of Creeks to Floodplains—Urban creeks in the cities have generally been straightened and constrained by undersized culverts. Habitat-enhancement projects are envisioned that connect creeks to a limited floodplain "bench," add native vegetation, and increase the size of culverts. These changes can increase the conveyance of high flows through these creeks, provide lands where floodwaters can overflow and settle out sediments, and increase habitat function for fish and wildlife. Creek enhancements can also include public trails and open space.

3-2 4-7 5-2 6-1 6-2

Increased Capacity of Built Storm Drain System—The aging storm drain system is generally undersized to convey the volume of runoff from large storms The system also has limited capacity to drain when high tides prevent water from flowing out of the outfall pipes. Increasing pipe size in key areas, as well as the size and configuration of outfall pumps, will increase the capacity of the system. These infrastructure projects are inherently costly, so this report recommends targeting projects in areas that have recurring flooding problems, such as around Ramer and K Streets in Hoquiam and the outfall pump for the basin that includes Cherry Street.

1-5 2-4 2-6 4-4

Levee System—A system of levees and floodwalls appears to be the only feasible way to protect the low-lying areas from coastal floods. Since the coastal flood is the driver for the flood insurance rate maps, construction and accreditation of these levees will have the economic benefit of removing the requirement for property owners to obtain flood insurance.

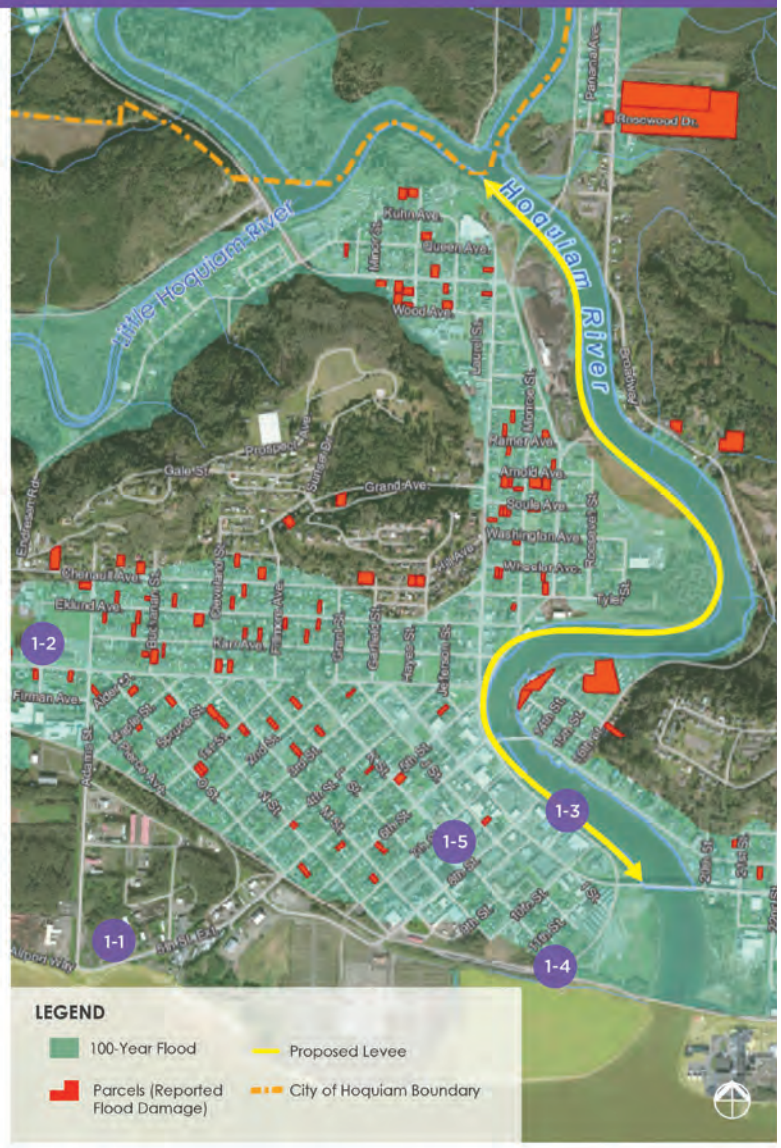
1-4 2-5 5-4

The Advisory Committee and the community provided recommendations for priority projects to initiate in the short term. The cities of Aberdeen and Hoquiam have already successfully obtained funding to move several of these projects forward:

- North Shore Levee—the design process is under way and grant funding for completing the design and permitting has been identified by the Chehalis River Basin Flood Authority.
- Fry Creek—the City of Aberdeen has obtained $500,000 in grant funds for engineering design from the Chehalis River Basin Flood Authority and Washington Coastal Restoration Initiative.
- Drain System Conveyance and Pump Upgrades—the City of Hoquiam has received a grant for $1.3 million from the Chehalis River Basin Flood Authority to upgrade the Ramer Street storm drain lines and pump station.
- Flood Control Parks and Rainwater Capture and Reuse—Rain barrels and cisterns can be installed on private and public properties and stormwater storage basins can be incorporated into public spaces in multiple locations to provide cost effective flood storage without extended design and permitting timelines.

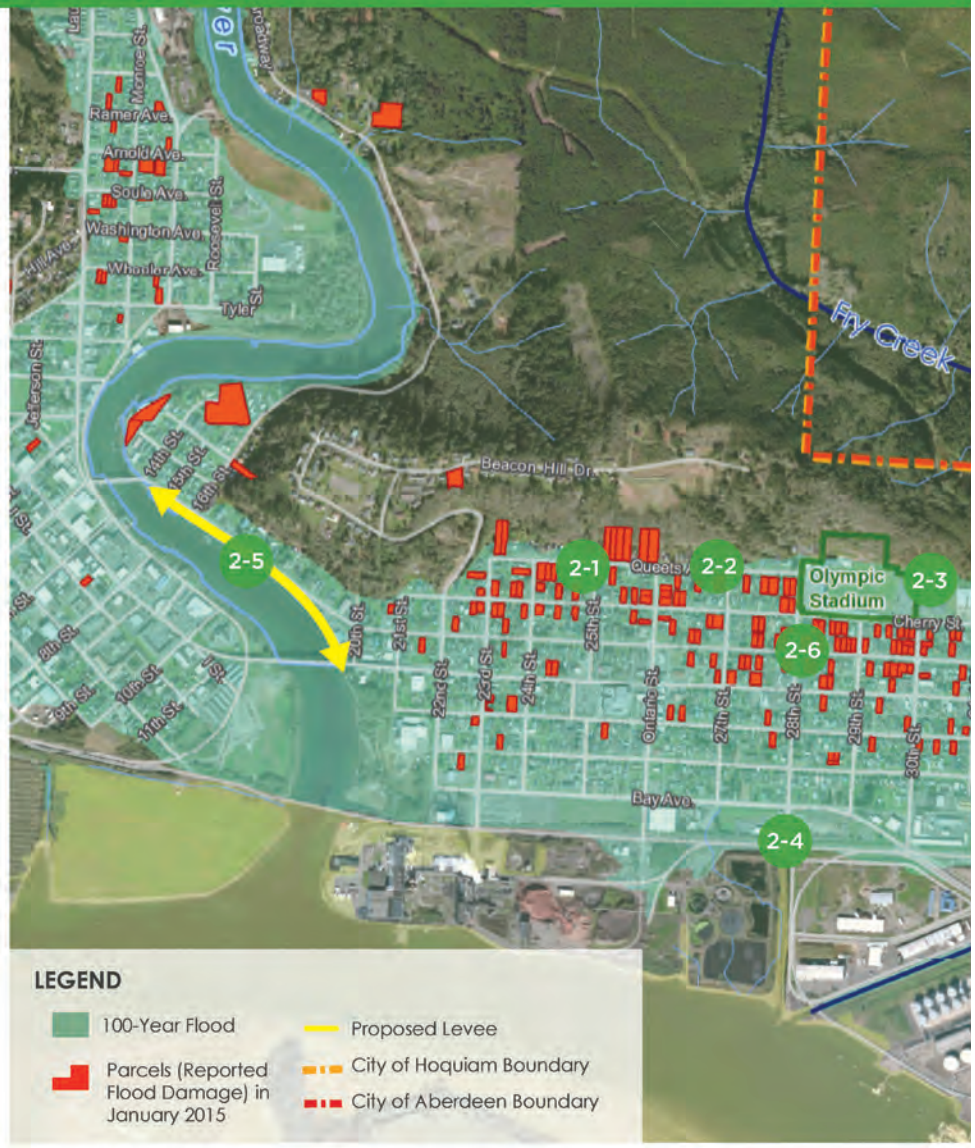
Focus Area 1: West Hoquiam

Project		Cost
1-1	**Moon Road** Shoreline restoration and floodwall	**MED**
1-2	**Bioretention Retrofits** Hoquiam Middle School and Emerson Avenue Triangle Parks	**MED**
1-3	**Enhance and Certify Levee**	**MED**
1-4	**Upgrade Outfall Pumps** Priority: K, Ramer, & 10th Street pumps	**HIGH**
1-5	**Upgrade Storm Drain** Priority: K Street and Ramer Avenue	**HIGH**



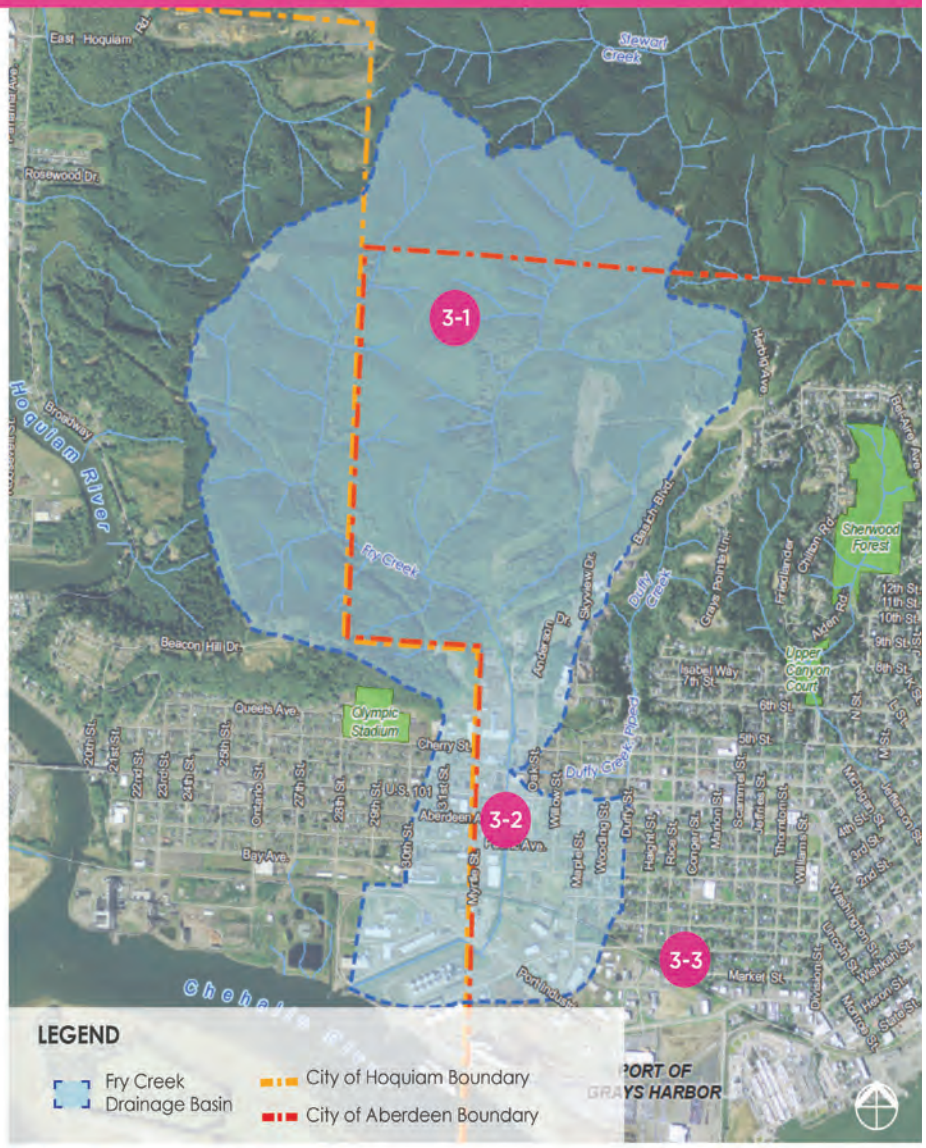
Focus Area 2: East Hoquiam

Project		Cost
2-1	**Cherry and Queets Streets** Green streets	**HIGH**
2-2	**Property Acquisition** Queets Street: landslide-prone homes	**MED**
2-3	**Flood Control Park** Adjacent to Olympic Stadium	**MED**
2-4	**Upgrade Stormwater Outfall Pumps**	**HIGH**
2-5	**North Shore Levee** Along Hoquiam and Chehalis Rivers	**HIGH**
2-6	**Upgrade Storm Drain Capacity**	**HIGH**



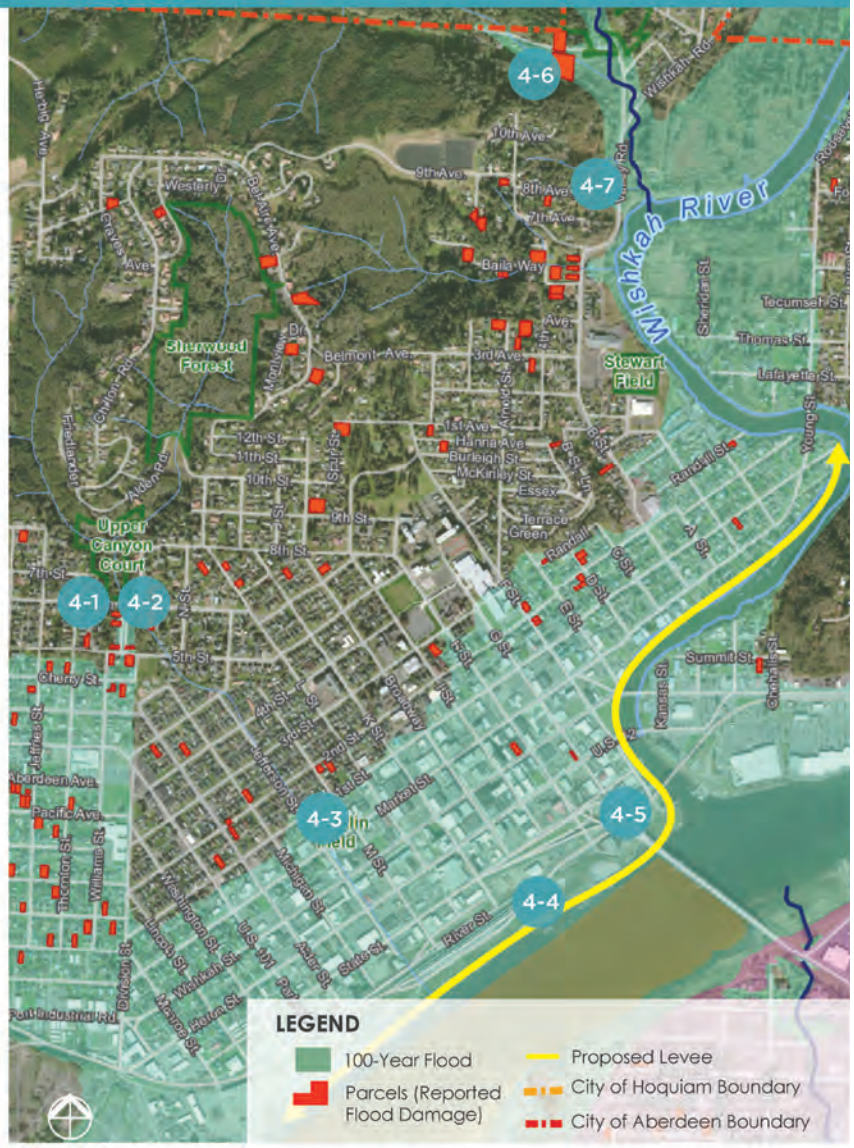
Focus Area 3: Fry Creek

Project		Cost
3-1	**Land Conservation in Upper Watershed**	**MED**
3-2	**Fry Creek Restoration and Flood Reduction**	**MED**
3-3	**West End Play Field** Flood control feature	**MED**



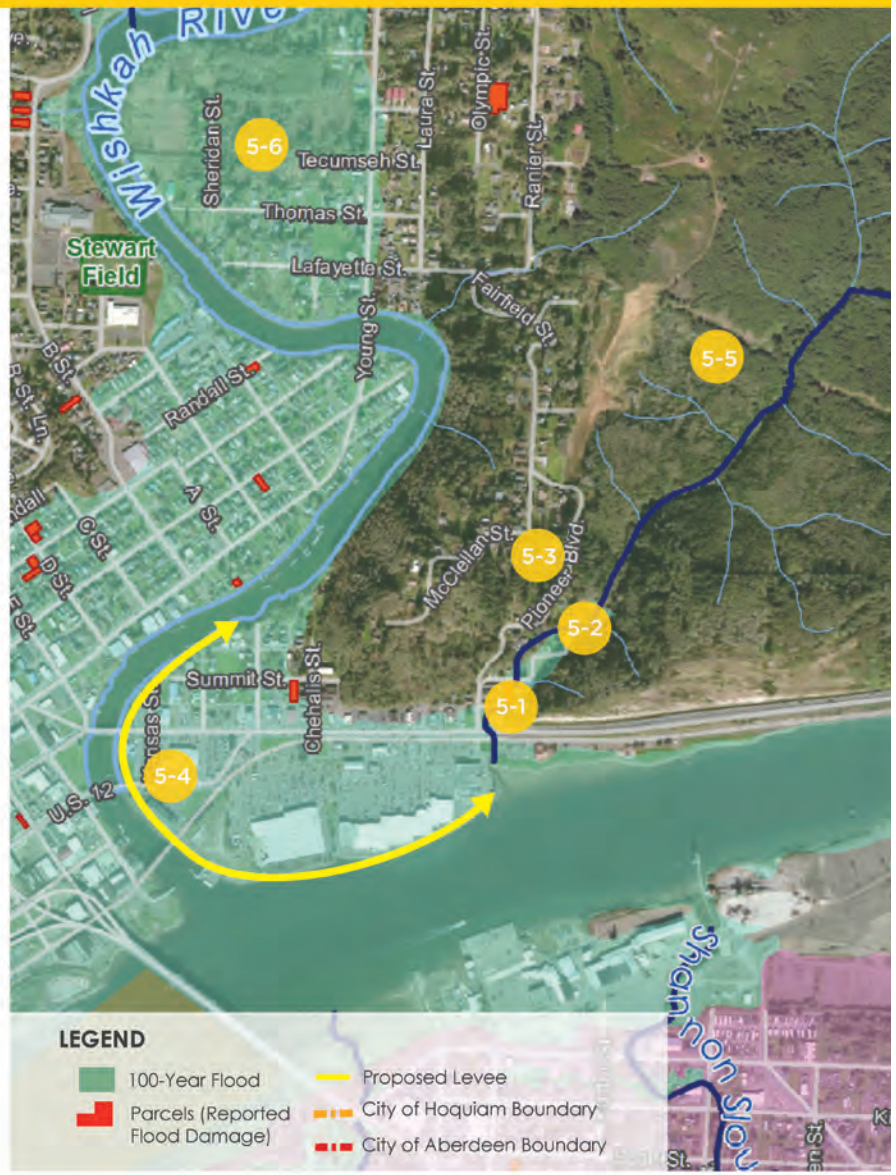
Focus Area 4: West Aberdeen

Project		Cost
4-1	Targeted Land Protection	LOW
4-2	Finch Playfield Flood Control Park	MED
4-3	Franklin Field Upgrade	MED
4-4	Upgrade Outfall Pumps	HIGH
4-5	North Shore Levee	HIGH
4-6	Stewart Creek Culvert Replacement	LOW
4-7	Stewart Creek Confluence Floodplain Reconnection	MED



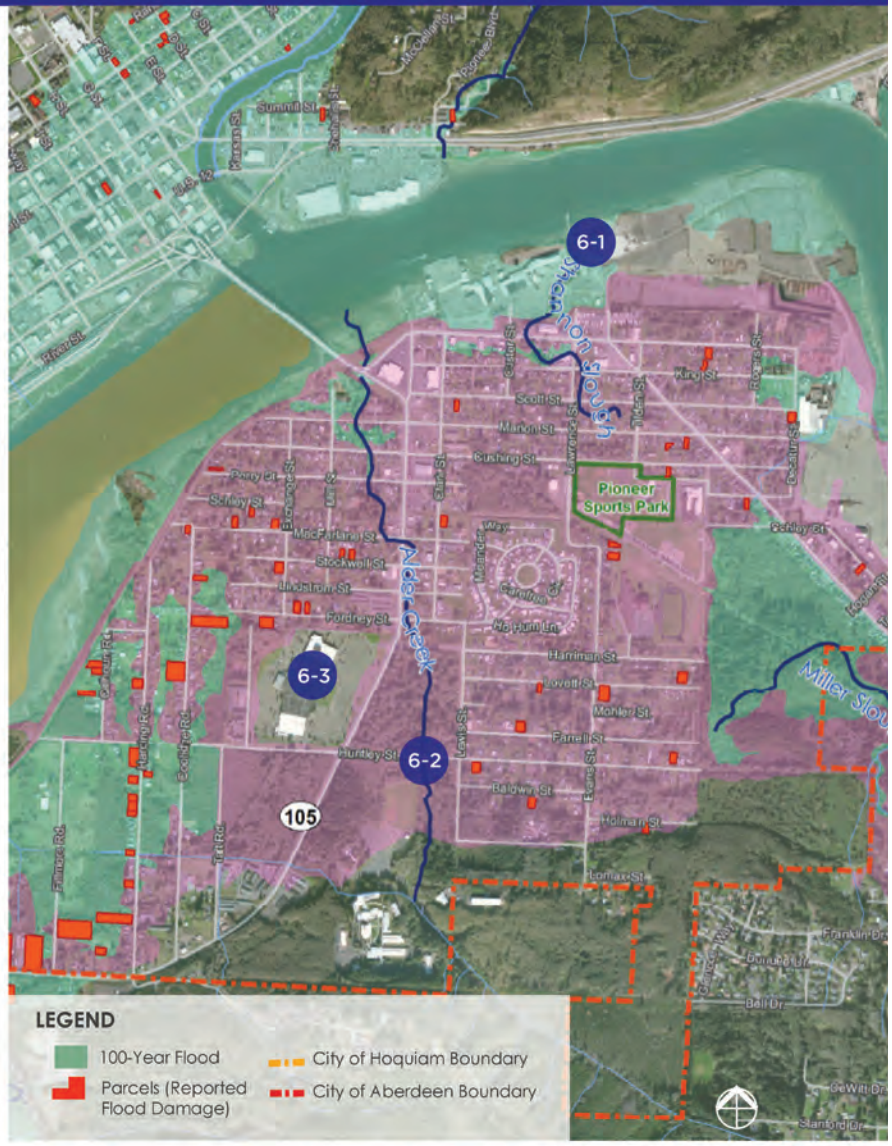
Focus Area 5: East Aberdeen

Project		Cost
5-1	**Wilson Creek Fish Passage Study**	**LOW**
5-2	**Wilson Creek Floodplain Park / Reconnection**	**MED**
5-3	**Pioneer Boulevard** Stormwater retrofit design	**MED**
5-4	**Levee Expansion and Certification**	**HIGH**
5-5	**Land Protections in Upper Watershed**	**MED**
5-6	**North Aberdeen Feasibility Study** Evaluate options to reduce flood risk	**MED**

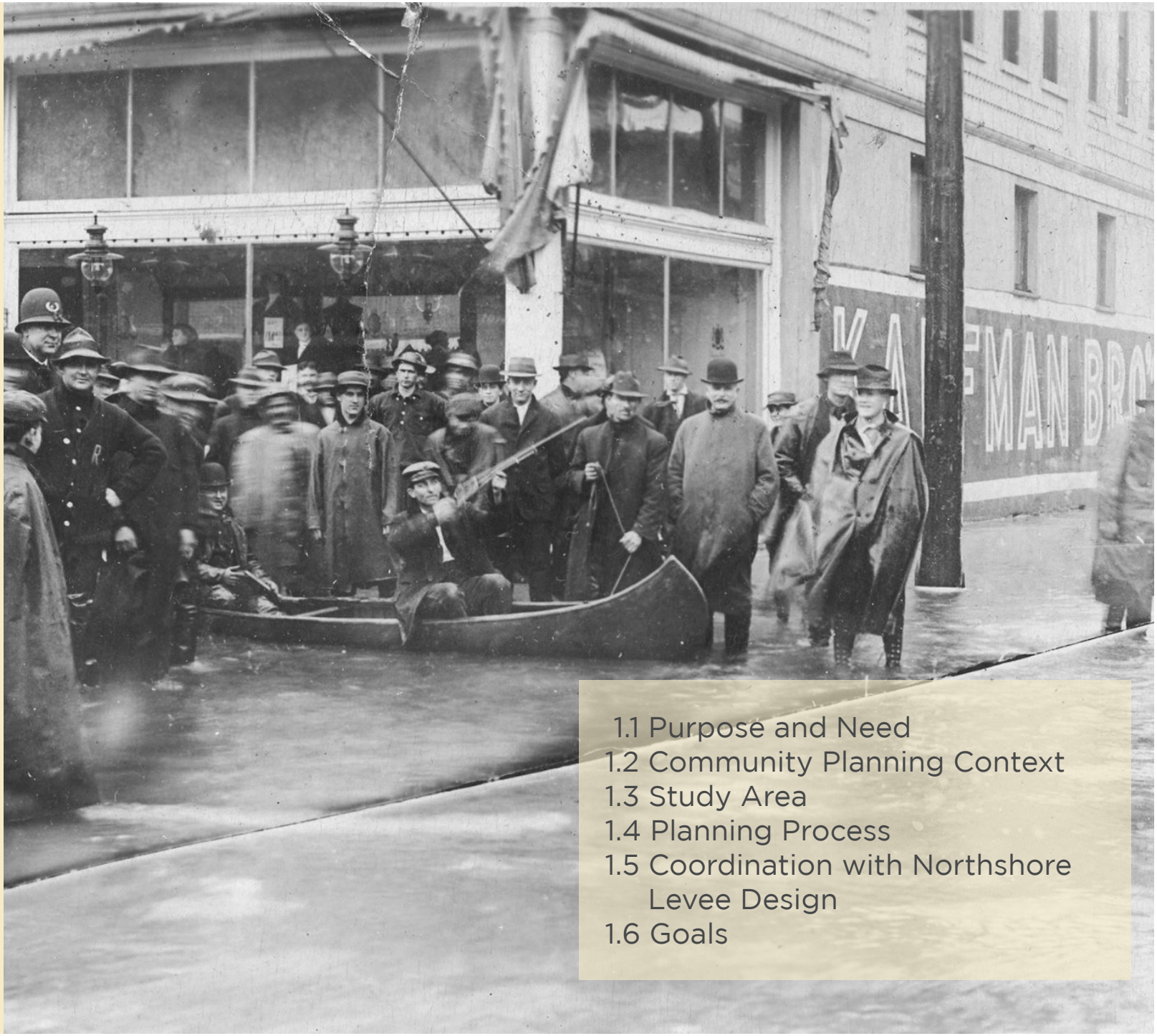


Focus Area 6: South Aberdeen

Project		Cost
6-1	**Shannon Slough Habitat Enhancement**	**MED**
6-2	**Alder Creek Feasibility Study**	**LOW**
6-3	**Shopping Center** LID retrofits	**MED**



1. INTRODUCTION



1.1 Purpose and Need
1.2 Community Planning Context
1.3 Study Area
1.4 Planning Process
1.5 Coordination with Northshore Levee Design
1.6 Goals

The cities of Aberdeen and Hoquiam have established a partnership to create a plan for addressing flood impacts. Through the TimberWorks planning process, they have taken a multiple-benefits approach to reducing flood risk while also enhancing fish habitat, increasing recreation and open space opportunities, and promoting economic development. Integrating the concerns of people, floods, and fish will lead to solutions that can generate broad public support and enhance community and economic development through protection of property and improvement of quality of life.

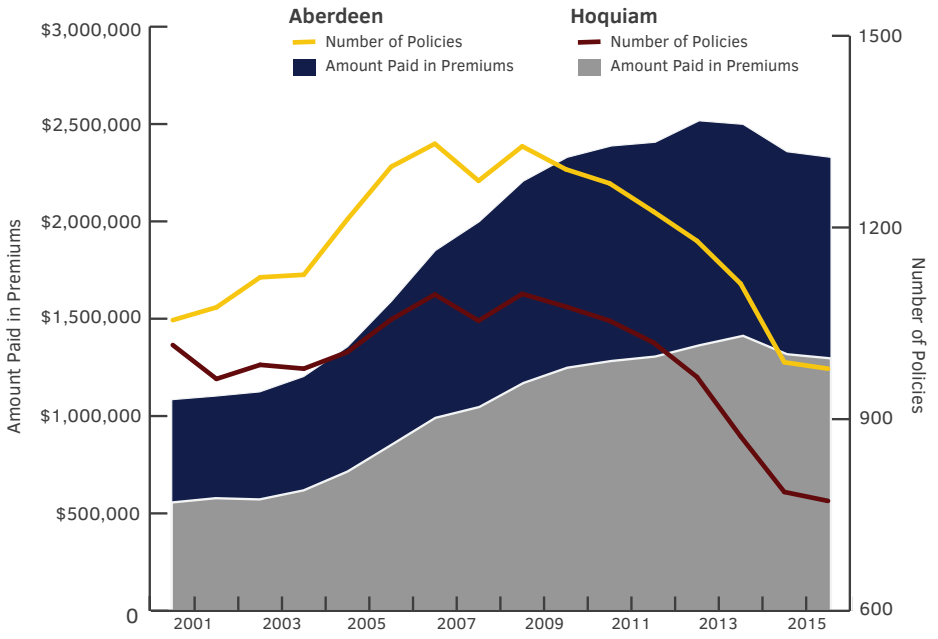
Flooding in the fall and winter months has long been a part of living in the cities of Aberdeen and Hoquiam. As low-lying coastal communities set between the foothills of the Olympic Mountains and Grays Harbor, they experience heavy rainfall, snowmelt, and tidal fluctuation. As far back as the 1930s, the U.S. Army Corps constructed an earthen levee around downtown Hoquiam. Since then, Aberdeen and Hoquiam have made a number of significant public infrastructure investments to reduce flood risk, including constructing a series of flood control structures, most recently the South Aberdeen levee, and converting old sanitary sewer system pipes into a stormwater system to convey runoff to the Wishkah, Hoquiam, and Chehalis rivers. Private-property owners and businesses have also made investments, such as elevating structures, operating pumps, and building floodwalls to protect their assets.

Residents and businesses have accepted and dealt with nuisance flooding for years. However, several recent events have created a sense of urgency and the need for a comprehensive, proactive plan for reducing flood risk. On January 4 and 5, 2015, over 8 inches of rain fell in Aberdeen and Hoquiam in a 24-hour period, overwhelming the stormwater drainage system. Standing water was reported to be over 2 feet deep in some streets. The heavy rain led to landslides on steep bluffs along Queets Avenue and other locations. Grays Harbor County and the cities of Aberdeen and Hoquiam unsuccessfully applied for federal disaster declaration following the event. The Coastal Community Action Program worked with over 420 families impacted by the flood and the ensuing mudslides.[2]

The National Flood Insurance Program (NFIP) has undergone a fundamental change since 2012. The Biggert-Waters Flood Insurance Reform Act mandated that flood insurance premiums increase to reflect full risk rates. These premiums could increase by 25 percent or more each year until they reached the full risk rate. Subsequent legislation repealed portions of the Biggert-Waters Act and put lower limits on annual rate increases. These policy changes have had a significant financial impact on the communities of Aberdeen and Hoquiam. Property owners in the two cities will pay approximately $2.3 million in flood insurance premiums in 2016 (see Figure 1). This one year total of premiums represents nearly half of the approximately $5.5 million of losses paid on flood insurance claims over the 30+ years since the inception of the programs in Hoquiam (1979) and Aberdeen (1984).

The extensive damage caused by the January 2015 storm and the financial hardship created by the increase in flood insurance rates have changed flooding from a nuisance the community had come to terms with to one of the highest priorities for public safety and economic development.

FIGURE 1. FLOOD INSURANCE PREMIUMS AND POLICIES IN ABERDEEN AND HOQUIAM



NOTE: Amount paid in premiums are stacked and shown cumulatively in Aberdeen and Hoquiam.

[2]City of Aberdeen press release: http://www.aberdeenwa.gov/continuing-flood-recovery/.

Grays Harbor County is one of the most economically disadvantaged counties in Washington State. The area has experienced persistently high unemployment rates and low median per capita income. Unemployment in the county hovers at approximately 9.3 percent, compared to 5.4 percent statewide (See Table 1). Median household income is approximately $43,000, well below the statewide level of approximately $60,000.

There is growing momentum for redevelopment efforts in Aberdeen and Hoquiam. Grassroots community efforts, such as the Grays Harbor Vision 2020, have developed strategies and action plans that are being implemented to improve quality of life and the economy. Vision 2020 has brought together over 30 local organizations and has initiated or completed 85 of 120 planned actions in just three years. Vision 2020 recently received the Governor's Smart Communities Award for its accomplishments.

This revitalization effort is based on a paradigm shift in economic development in Aberdeen and the surrounding Grays Harbor County. The community is transitioning away from an economy based on natural resource extraction and heavy industry. Strategies are being developed for building a more diversified and resilient economy in which natural resources are used sustainably, downtowns and local businesses are revitalized, and quality of life draws businesses and tourists.

As part of this larger effort, the City of Aberdeen has initiated the Downtown Aberdeen Revitalization project. This effort focuses on implementing high-priority public projects, including constructing the Gateway Center (currently in design), improving downtown streetscapes (under way), and establishing waterfront parks.

On the south side of the Chehalis River, the Grays Harbor Historical Seaport Authority is transforming a former sawmill property into a maritime heritage center that will provide education and waterfront access opportunities for tourists and local residents.

In addition to these planning efforts, there are numerous investments by large organizations—including the Port of Grays Harbor and the Quinault Indian Nation, as well as small business and nonprofit organizations, including Coastal Community Action Program and NeighborWorks—that are working toward increasing employment opportunities, economic activity, and quality of life around Grays Harbor.

The TimberWorks plan complements these efforts by establishing a framework to protect properties from flooding, create and enhance public open space amenities, and restore fish and wildlife habitat.

TABLE 1. DEMOGRAPHICS OF GRAYS HARBOR COUNTY AND WASHINGTON STATE

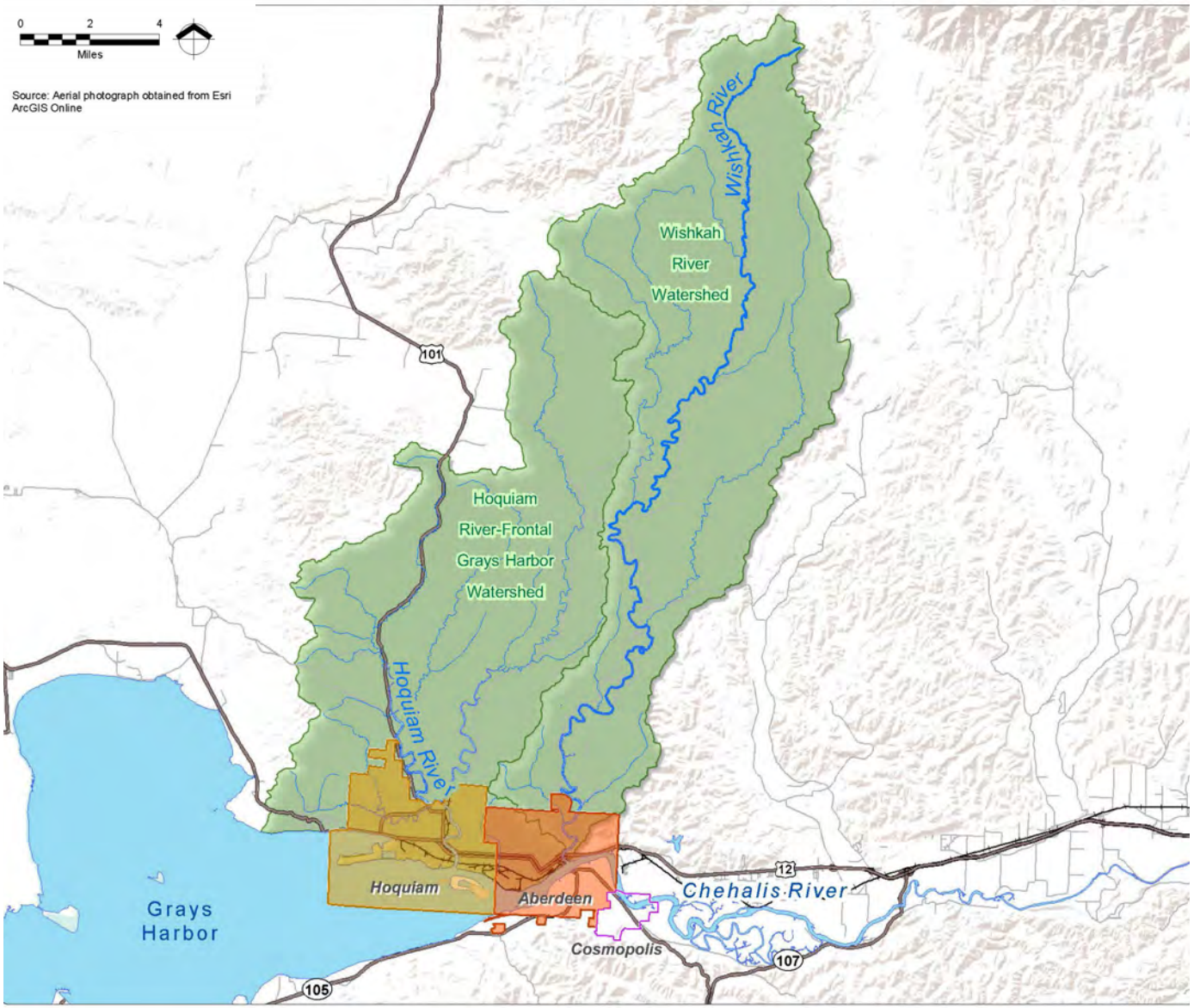
	POPULATION	MEDIAN HOUSEHOLD INCOME	UNEMPLOYMENT	POVERTY RATE
GRAYS HARBOR COUNTY 1854	71,734	$43,379	9.3%	18.8%
	6,899,123	$60,294	5.4%	13.6%

Sources: U.S. Census Bureau. "Total Population, Median Household Income, Ratio of Income to Poverty (Summarized), 2009-2014." Social Explorer. Web. Dec 1, 2016.

Bureau of Labor Statistics, U.S. Department of Labor, Occupational Employment Statistics, [Dec 1, 2016] [www.bls.gov/oes/].

Issues of water drainage and flooding are most effectively addressed through a watershed lens that encompasses the basins where water flows. The TimberWorks Resiliency and Restoration Master Plan study area was based on the watersheds of the Wishkah and Hoquiam rivers and the Chehalis River/Grays Harbor Estuary shoreline (see Figure 2). As this is a plan created by the cities, specific project recommendations are limited to the municipal boundaries of Aberdeen and Hoquiam.

FIGURE 2. STUDY AREA



The TimberWorks planning process integrated technical and local knowledge, built on previous studies and plans, and synthesized different perspectives to identify solutions that reduce flood risk, enhance fish habitat, and increase recreation and open space opportunities in the area. The Master Plan should be understood as the first of four major steps in moving this initiative forward:

1. **Master Plan**—Articulates a vision, goals, and objectives, along with a set of potential projects to address challenges related to flooding, fish habitat, and community open space. The Master Plan will include an implementation strategy that prioritizes projects, recommends phasing, identifies potential funding sources, and outlines the roles and responsibilities of local partners. Projects defined as concepts or typologies at 10 percent design level.
2. **Feasibility Analysis**—Evaluates the potential benefits, costs, and risks associated with projects identified as priorities in the Master Plan. Provides conceptual designs of specific projects at 30 percent design level.
3. **Design & Permitting**—Specific to each project that is identified as a priority to be moved forward. Detailed analysis will be conducted to create design plans and specifications suitable for permitting and a competitive public bid process.
4. **Construction**—Implementation of specific projects that have been developed through the previous steps.

The cities established an Advisory Group to guide development of the TimberWorks Master Plan. The Advisory Group included representatives of the cities, Grays Harbor County, Grays Harbor Council of Governments, and the Port of Grays Harbor. The Advisory Group met four times during the planning process to share information, discuss causes of flooding, and review potential solutions.

The Master Planning process included three major tasks (see Figure 3).

1. **Defining the Problem**—The objective of this task was to develop a robust understanding of recreation and open space needs in the communities and the causes of flooding and fish habitat degradation. This effort involved engagement with community stakeholders to integrate local knowledge with the findings of previous studies and new research.
2. **Exploring the Universe of Opportunities**—This task included identifying the potential types of projects that could be implemented and evaluating their potential benefits for flood risk reduction, habitat and water quality enhancement, and public recreation and open space.
3. **Action Plan**—The focus of this task is to synthesize the work of the previous tasks to create a plan, and to develop an implementation strategy that defines the roles and responsibilities of partner agencies and provides a schedule and a funding strategy.

The desired outcomes of the master planning process are to build community understanding, support, and capacity; recommend a set of priority programs and projects; and outline a clear funding and implementation strategy.

COMMUNITY INVOLVEMENT

Engagement of the local community was a priority in the development of the Master Plan. Community members are directly affected by flooding, have tremendous knowledge of local conditions and history, and will be critical to implementation of any solutions. The planning process employed multiple methods, including personal interviews, walking tours, questionnaires, and open house workshops, to involve community members. Key themes from community member comments are presented in Section 3 with more detailed meeting summaries in Appendix A.

CONSULTATION WITH QUINAULT INDIAN NATION

The cities have established government to government relations with the Quinault Indian Nation in recognition of the Tribe's rights under an 1856 federal treaty. The treaty provided the Quinault Indian Nation with rights to fishing and hunting in their usual and accustomed areas, which include Grays Harbor and its tributaries. At the request of the Quinault Indian Nation, the cities have provided briefings to the Tribal Council during the planning process. The cities invited representatives of the Quinault Indian Nation to participate in the Advisory Group and provided notice of community meetings. Consultation with the Quinault Indian Nation will continue as the recommended projects in this master plan proceed through design, permitting, and implementation.

FIGURE 3. PLANNING PROCESS

Task 1: Research-Defining the Problem

1.1 Stakeholder Interviews & "Walkshops"

Walking tours of problem areas to discuss needs and opportunities

March 2016

1.2 Flood Risk Assessment

Flood modeling; Identify areas of risk and levels of inundation

1.3 Infrastructure Assessment

Evaluation of existing stormwater system

1.4 Fish Habitat Needs and Opportunities

Review existing documents to identify areas of floodplain connectivity issues, culvert passage limitations, and restoration opportunities

1.5 Community Spaces Evaluation

Review existing land use, parks and open space plans to identify needs and opportunities

Task 2: Exploring Opportunities

2.1 Identify Universe of Opportunities

Approaches: Structural and Non-structural
Locations and Conceptual Project Typologies

2.2 Community Workshop

Open house meeting to discuss potential projects and specific locations for improvements

April 2016

Task 3: Action Plan

3.1 Priority Project List and Implementation Strategy

Tiered List of Potential Projects – Conceptual Approaches Typologies

3.2 Community Open House

To solicit community input on priorities

October 2016

3.3 Master Plan with Implementation Strategy

COORDINATION WITH NORTH SHORE LEVEE DESIGN

The TimberWorks Master Plan has been developed in coordination with the preliminary design of the North Shore Levee. Before initiating the TimberWorks planning process, the City of Aberdeen evaluated options for constructing a levee to protect properties along the Wishkah River and in downtown Aberdeen. As the cities of Aberdeen and Hoquiam initiated a more comprehensive assessment of flooding concerns, they decided to collaborate and design a levee that would protect properties between the Wishkah and Hoquiam rivers (see Figure 4). This larger effort has been named the North Shore Levee. The preliminary design phase of the project has been conducted in parallel with the TimberWorks planning process. Because of the urgent need for the levee and the availability of funding through the Chehalis River Basin Flood Authority, the cities decided that the levee design should not be delayed by the TimberWorks planning process.

The levee design and the master planning process have mutually informed and benefited each other. The technical studies conducted to support the levee design have provided a strong scientific basis for the planning process. These studies have included hydraulic and hydrologic analysis, assessment of stormwater infrastructure, geotechnical analysis, and topographic and bathymetric surveys. The public planning process and broad perspective of the master planning process have provided critical input and insight for the levee design.

FIGURE 4. PROPOSED ALIGNMENT OF NORTH SHORE LEVEE

GOALS

A set of goals was defined by the Advisory Group and was reviewed and confirmed through community meetings at the beginning of the master planning process. The goals articulate what the community intends to achieve through the master plan and provides guidelines for developing recommendations.

GOALS

- Reduce flood risk in Aberdeen and Hoquiam
- Enhance habitat for fish and wildlife and improve water quality
- Create attractive and active public spaces
- Support economic and community development
- Maximize cost efficiency and build community support through meeting multiple goals
- Foster partnerships and collaboration among public and private parties

Earthworks in Kent, WA is an example of a public park that also provides floodwater storage.

Bioretention facilities incorporated into a playground environment.

2. EXISTING CONDITIONS

2.1 Landscape Setting
2.2 Climate and Tides
2.3 Climate Change
2.4 Fish and Wildlife Habitat
2.5 Existing Stormwater Management System
2.6 Existing Levees
2.7 Drivers of Flooding in Community
2.8 Major Flood Events
2.9 Floodplain Management Framework

In order to develop a set of effective programs and projects to reduce flood risk in the two cities, it is fundamentally important to understand the factors that contribute to flooding. This analysis was conducted through review of previous studies of flood risk and stormwater management, hydraulic and hydrologic modeling, research interviews with city public works staff and key stakeholders, and solicitation of information from community members through open house workshops and questionnaires.

The following sections describe the characteristics of the natural and built systems that control water flow in Aberdeen and Hoquiam.

LANDSCAPE SETTING

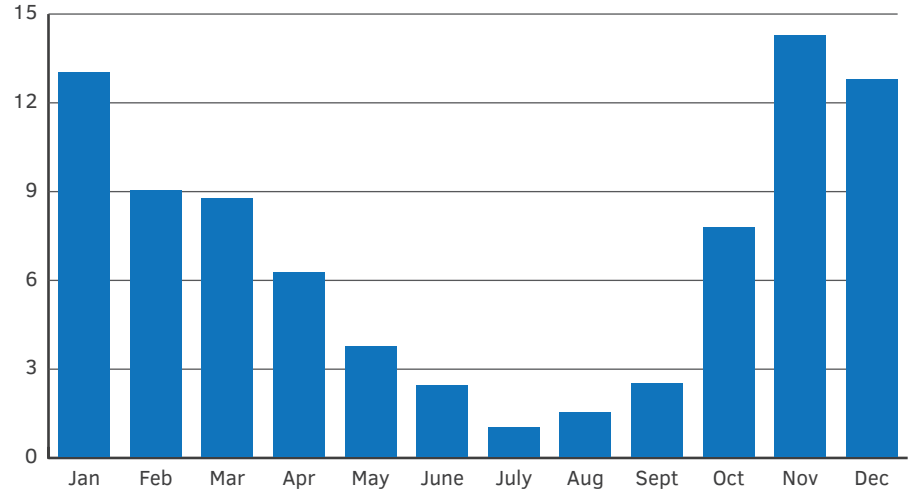
The drainage basin through which water flows down to larger rivers is called a watershed. With their location near the mouth of the Chehalis River, the cities of Aberdeen and Hoquiam are at the bottom of a network of hierarchical watersheds. The Chehalis River watershed encompasses over 2,100 square miles,[3] stretching to the east, past Centralia. The Wishkah and Hoquiam river watersheds extend north into the Olympic Mountains, encompassing approximately 102 square miles and 90 square miles,[4] respectively (see Figure 2).

The downtown areas both Aberdeen and Hoquiam are situated in low-lying, flat areas with steep hills and bluffs to the north and south. These small, urbanized drainage basins typically have a more significant contribution to localized flooding events than the larger watersheds of the Chehalis, Wishkah, and Hoquiam rivers. Soils in this area are predominantly unconsolidated sandy or silty loam. These soils are highly erodible on steep slopes. Before the development of the cities, these areas were active portions of the floodplain dominated by shrub-scrub wetlands with multiple small streams flowing from the foothills to the Chehalis, Wishkah, and Hoquiam rivers. Over the past 100 years, large areas have been filled to raise their elevation; streams such as Duffy Creek and Division Creek have been routed through underground pipes. Development has created a landscape where stormwater runoff quickly flows down from the foothills into the low-lying, flat parts of the city, and there is little gradient to cause the water to continue to flow toward the rivers. The historical floodplains and wetlands that slowed and absorbed floodwaters have largely been filled and developed.

[3]Draft Report—Chehalis River Hydraulic Model Development Project.
[4]Hoquiam-Wishkah Management Unit, Hoquiam River: http://www.co.grays-harbor.wa.us/info.

Weather along the Washington coast and in Grays Harbor County is characterized by mild and wet winters and cool and dry summers.[5] Grays Harbor County averages annual precipitation of 65 to 75 inches at the coast, and 80 to 90 inches near the mountain foothills. Average monthly precipitation for the City of Aberdeen is depicted in the figure below. The heavy rainfall period typically begins in November and lasts until at least February and often into March.[6]

FIGURE 5. AVERAGE MONTHLY RAINFALL IN ABERDEEN



While light rain events occur frequently, intense periods of precipitation also occur. The frequency probability of high intensity storms is referred to as the recurrence interval and is used as a design parameter for stormwater management and flood control structures (see Table 2). The January 2015 rain event exceeded the 100-year recurrence interval storm. Between 1990 and 2005, seven distinct flooding events in Grays Harbor County were declared as Federal Emergency Management Agency (FEMA) flood disasters.[7] All of these flood events featured heavy rainfall.

[5]Grays Harbor County Hazard Mitigation Plan and the City of Hoquiam Comprehensive Plan.
[6]Grays Harbor County Hazard Mitigation Plan.
[7]Same as above.

TABLE 2. DESIGN STORM EVENTS

Recurrence Interval	Rainfall in 24-Hour Storm (INCHES)
2-Year	3.5
10-Year	4.5
50-Year	5.5
100-Year	6.0

Water elevations differ an average of 10.1 feet between the daily high tide and low tide in the Chehalis River near Aberdeen.[8] Typical tidal fluctuation data for Aberdeen are presented in Table 3 below. Notably, mean higher high water (MHHW) (the higher of the two daily high tides) is 8.47 feet North American Vertical Datum of 1988 ($NAVD_{88}$). Modeling for the North Shore Levee indicates that the tidal elevation for the 100-year event is 13.2 feet $NAVD_{88}$. Note that the effective FEMA mapping for Grays Harbor shows elevations in an older datum, $NGVD_{29}$. The conversion factor between $NGVD_{29}$ and $NAVD_{88}$ is 3.5 feet, so the 100-year high tide elevation of 13.2 feet $NAVD_{88}$ is 9.7 feet $NGVD_{29}$.

TABLE 3. TIDAL ELEVATIONS

Events	Tidal Elevation ($NAVD_{88}$)
Mean Higher High Water (MHHW)	8.47 feet
Mean Lower Low Water	-1.64 feet
100-year High Tide	13.2 feet
500-year High Tide	14.1 feet

[2]National Oceanic and Atmospheric Agency (https://tidesandcurrents.noaa.gov/stationhome.html?id=9441187).

The effects of climate change are becoming apparent in precipitation patterns and sea level rise throughout the Pacific Northwest. Several studies have recently been conducted to forecast likely impacts of climate change along the Washington coast and around Grays Harbor. These reports include a summary of sea level rise and coastal flood risk for Grays Harbor County, issued by Climate Central; a report on climate change in the Chehalis River and Grays Harbor Estuary, issued by the Wild Fish Conservancy; and a 2015 update by the University of Washington's Climate Impacts Group on the state of knowledge of climate change impacts in the Puget Sound. Key findings of these reports are summarized below.

PRECIPITATION

Increased warming of the Puget Sound region over the twentieth and twenty-first centuries is expected to be a key driver of precipitation change in Washington State, particularly surrounding the Washington coast.[9] According to the University of Washington report, warming for the twenty-first century is expected to be double that experienced in the twentieth century. Regional warming is expected to cause increased variation in long-term annual precipitation throughout the same period, as well as an increase in severity and frequency of heavy rainfall events in a given year. The University of Washington report estimates that there could be up to a 13 percent increase in projected annual precipitation in the Puget Sound by 2050.

Warmer regional temperatures will additionally cause an increased proportion of precipitation to fall as rainfall versus snow.[10] The University of Washington report predicts that increased rainfall and decreased snowfall will lead to a decreased snowpack of at least 42 percent by the year 2080. Increased wintertime rainfall (as well as decreased snowpack) in the Puget Sound region will contribute to an increased risk of landslides in Washington's coastal communities.[11]

Increased warming is forecasted to have profound impacts on Washington coastal communities, including Grays Harbor County. Landslide risk likely will increase because of a combination of heavier snowmelt runoff and increasingly frequent, heavier rainfall events. Additionally, more intensified, severe rainfall events will increase flood risk in the Puget Sound region as

[9]State of Knowledge: Climate Change in Puget Sound, University of Washington College of the Environment, November 2015.
[10]Same as above.

a whole.[12] Coastal communities, such as those in Grays Harbor County, will have more heightened flood risk because of continued sea level rise (see subsection below), which will increase the reach of storm surges.[13]

SEA LEVEL RISE

An increase in the ambient temperature of the oceans causes the water volume to expand, leading to higher sea levels. The relative amount of sea level rise varies geographically in Washington State because of tectonic activity. The northern portions of the state, such as the northern tip of the Olympic Peninsula, are actually rising, as the ground surface is still rebounding from the receding of the glaciers. In South Puget Sound, the land is subsiding, exacerbating sea level rise.

From 1900 to 2008, sea level rose by 8.6 inches in Seattle, as measured by the Seattle tide gauge.[14] This is on par with the recorded global sea level rise of 8 inches during the same period. The variance between the recorded amounts of sea level rise in Seattle and global sea level rise is due primarily to geologic processes, such as tectonic activity, as well as to local atmosphere and ocean dynamics.

Forecasts for sea level rise in the future vary, based on assumptions related to different amounts of future greenhouse gas emissions and probability. A summary of sea level rise projections from recent studies is presented in Table 4. As sea level continues to rise, the risk increases of greater extent and depth of coastal floods impacting coastal communities such Aberdeen and Hoquiam. Forecasts of sea level rise are being taken into consideration in the design of the North Shore Levee to determine the appropriate height for the structure and the potential for adaptation (i.e., increasing the height) in the future.

TABLE 4. SEA LEVEL RISE PROJECTIONS

Domain	2030	2050	2100
Washington State[15]	+3 inches (-2 to +8 inches)	+7 inches (-1 to +19 inches)	+24 inches (+4 to +56 inches)
Central & Southern WA Coast[16]	---	+5 inches (+1 to +18 inches)	+11 inches (+2 to +43 inches)

Values presented are for median projections, with highest probability. The ranges presented include lower probability projections.

Coastal flooding along F Street during extreme high tide in December 2016.

[12]State of Knowledge: Climate Change in Puget Sound, University of Washington College of the Environment, November 2015.
[13]Same as above.
[14]Same as above.

[15]NRC. Sea Level Rise for the Coasts of California, Oregon and Washington: Past, present and future. 2012.
[16]Mote, Philip, Alexander Petersen, Spencer Reeder, Hugh Shipman, and Laura Whitely-Binder. 2008. Sea Level Rise in the Coastal Waters of Washington State.

The cities of Aberdeen and Hoquiam are adjacent to extensive areas of high-quality, protected forests, mountains, wetlands, and estuarine habitats. As these cities developed over more than 100 years and were largely built out by the 1950s, fish and wildlife habitat within the city boundaries has been highly modified and urbanized. Many of the small streams have been straightened and riparian areas have been developed. Several streams, such as Duffy Creek and Division Creek, have been placed into underground pipes. The shorelines of the Hoquiam, Wishkah, and Chehalis rivers within the city boundaries are highly developed, with industrial, commercial, and residential uses. The characterization study conducted as part of the Shoreline Master Program Update process found that the habitat, hydrologic, and water quality functions of the Hoquiam, Wishkah, and Chehalis rivers were moderate to low because of impacts from historical fill, bank hardening, and structures such as pilings, piers, and levees.[17]

Salmon and trout species migrate through Grays Harbor and the Chehalis River and use tributary streams for foraging, rearing, and spawning habitat.[18] Chinook salmon, coho salmon, chum salmon, and steelhead trout all occur in the Chehalis River and have the potential to be present in tributary streams. All of the streams and estuarine waters that support Chinook or coho salmon are considered "essential fish habitat" protected by the Magnuson-Stevens Fishery Conservation and Management Act. The Chehalis and Wishkah rivers and Grays Harbor are designated under the Endangered Species Act as critical habitat for bull trout (75 CFR 63898).

Fry Creek.

Wilson Creek.

[17]Herrera 2014. Shoreline Inventory and Characterization for the Cities of Aberdeen, Cosmopolis, and Hoquiam.
[18]Washington State Conservation Commission 2001. Salmon and Steelhead Limiting Factors: Chehalis Basin and Nearby Drainages Water Resource Inventory Areas 22 and 23.

EXISTING STORMWATER MANAGEMENT SYSTEM

The cities of Aberdeen and Hoquiam both have stormwater drainage systems that include catch basins, pipes, and drainage ditches that convey stormwater runoff to natural waterways or pump stations that collect and discharge water to the Hoquiam River, Wishkah River, Chehalis River or Grays Harbor. Much of the existing pipe system in the lowlands of Aberdeen and Hoquiam was initially constructed as a combined sanitary and storm system. In the 1950s, the cities began to construct a separate system to convey sanitary wastewater to treatment plants. The older pipe system has been dedicated to stormwater use. Because of the age of the storm system pipes, their condition is degrading and it is assumed that there is significant intrusion of groundwater into the drainage system. This reduces the capacity of the drainage system to convey water, especially in winter months when the ground is saturated and groundwater levels rise closer to the surface.

Stormwater runoff flows downhill, following natural topography, and if it enters catch basins is conveyed through a network of underground pipes that form a manmade drainage basin (see Figure 6). The drainage system is designed for gravity flow to outfalls. Most of the drainage basins discharge to pump stations that pump stormwater when high tides rise above the elevation of the outfalls and prevent gravity flow. Because of the flat topography of the cities' lowlands, there is little hydraulic gradient to drain water in the pipe system. Many, but not all, of the pumps have variable drives that turn on when the level of water in wet wells reaches a threshold. The pumps increase drainage capacity of the system, creating a greater hydraulic gradient that draws water through the pipes. Most of the pumps are decades old and are undersized relative to the capacity needed to drain large rain events. The City of Hoquiam Surface Water Master Plan identified the need to replace five pump stations to provide sufficient capacity to pump the volume of runoff generated by the ten year rain event.[19] The Interior Drainage Analysis for the proposed Northside Levee also calculated that the six pump stations in that project area lacked the capacity to pump the runoff volume from the 100 year storm.[20]

[19]City of Hoquiam Comprehensive Surface Water Management Plan. Prepared by Tetra Tech. July 2000.
[20]Northside Levee: Interior drainage analysis for the 60% design. Prepared by KPFF. August 21, 2015.

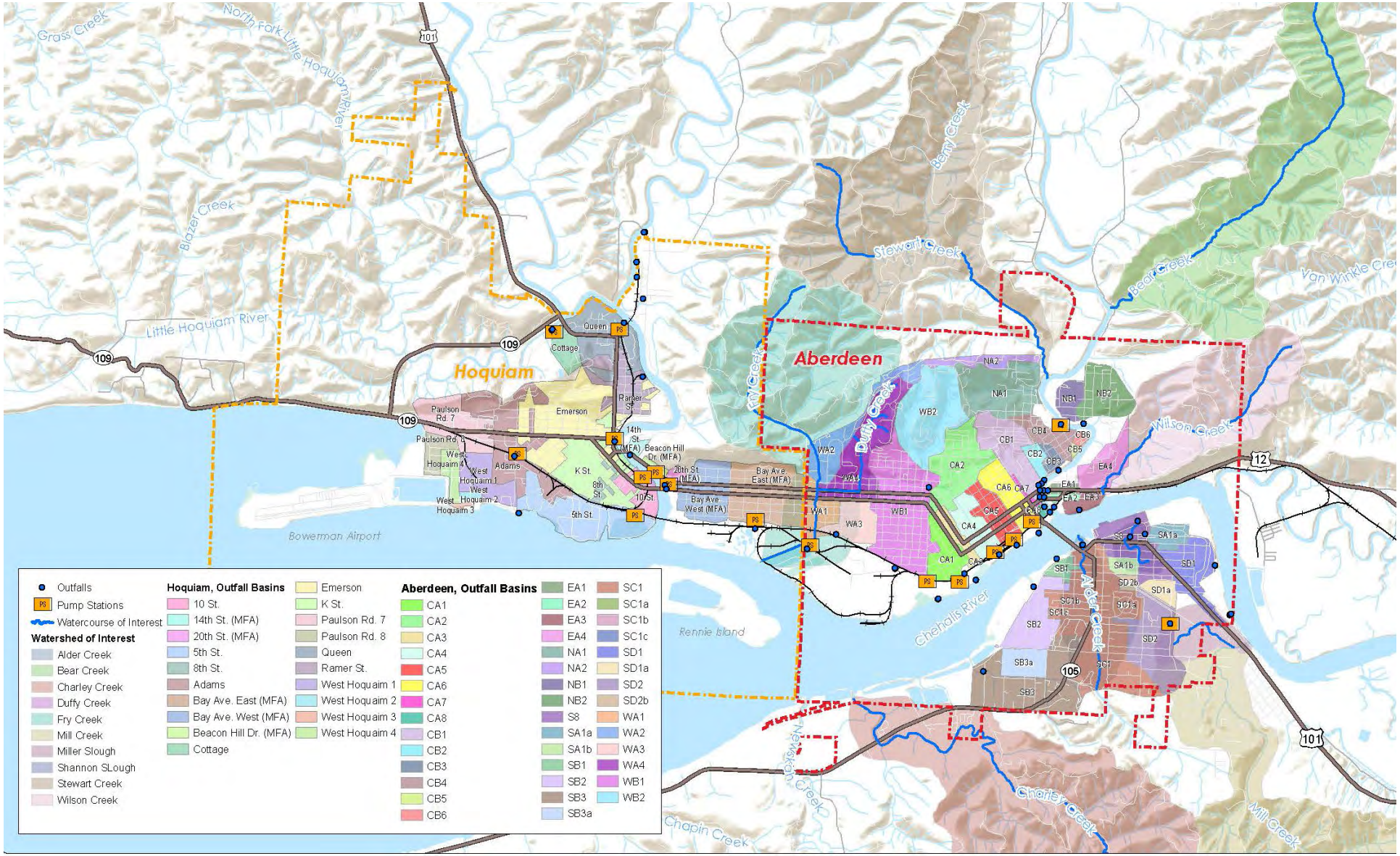
EXISTING LEVEES

A series of levees has been constructed in Aberdeen and Hoquiam over time to provide protection from coastal flooding (see Figure 7). There are approximately 6.7 miles of levees in Hoquiam and approximately 5 miles in Aberdeen.[21] Records indicate that the earthen levee on the west bank of the Hoquiam River near downtown Hoquiam was constructed in the 1930s as an Emergency Relief Administration project after a severe flooding event in December 1933.[22] The levee continues to provide flood-protection benefits but has not been taken through the modern process for certification by FEMA and likely would not meet the standards of protection against the 100-year flood event. Similarly, sections of levees have been constructed over time on the left bank of the Hoquiam River and the right and left banks of the Wishkah River, and along the right bank of the Chehalis River. The South Aberdeen Levee constructed by the City of Aberdeen in the 1990s runs along the left bank of the Chehalis River from Cosmopolis to State Route 105 in Aberdeen. The levee is a combination of earthen dike and floodwalls. The drainage basin upland of the levee covers approximately 5 square miles. The levee is crossed by several creeks, including Alder Creek, Shannon Slough, and Mill Creek. The South Aberdeen Levee has been certified by FEMA, so property protected by the levee is designated on the Flood Insurance Rate Map (FIRM) as Zone X.

South Aberdeen Levee.

[21]Herrera 2014. Shoreline Inventory and Characterization for the Cities of Aberdeen, Cosmopolis, and Hoquiam.
[22]City of Hoquiam Comprehensive Surface Water Management Plan. Prepared by Tetra Tech. July 2000.

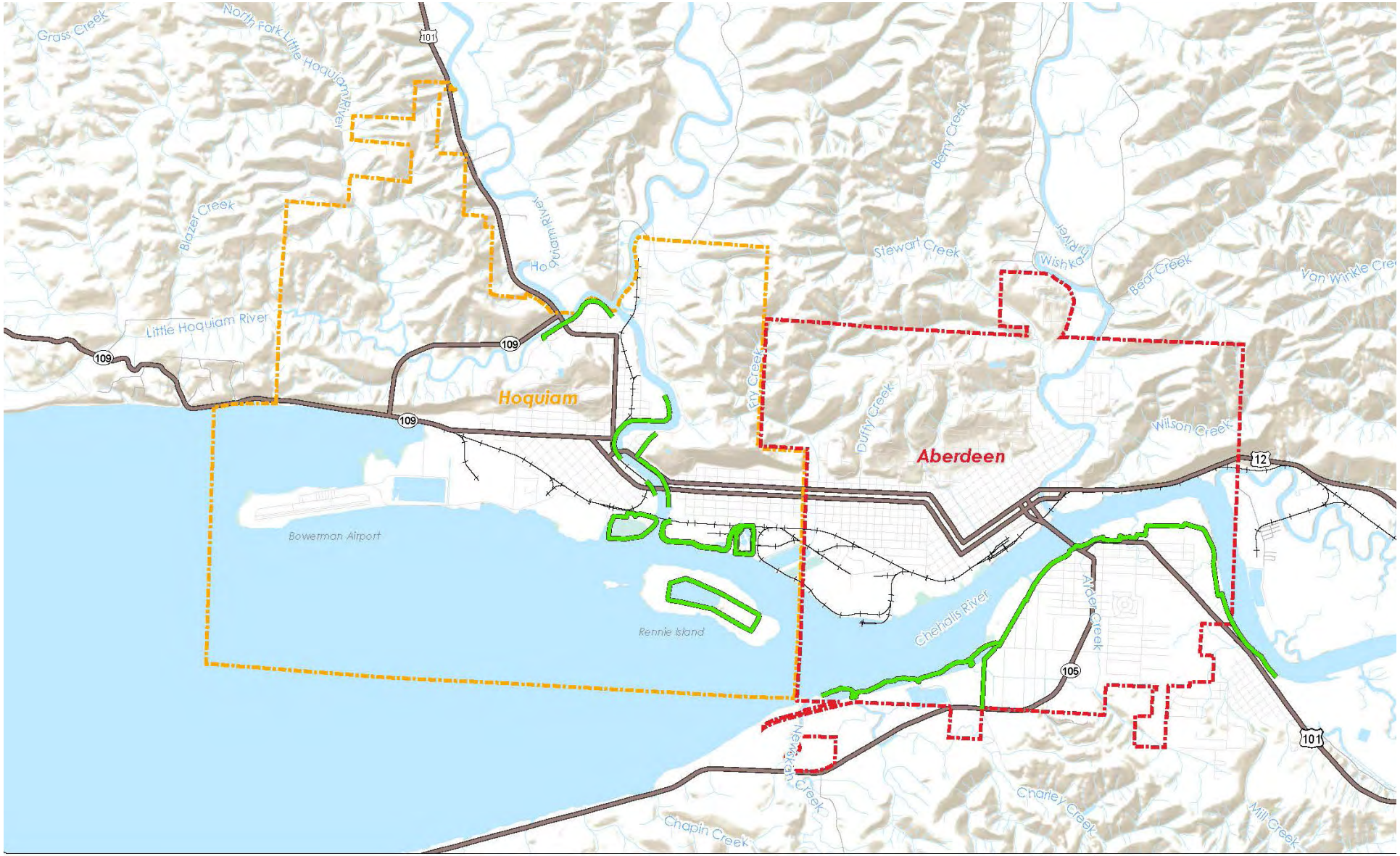
FIGURE 6. STORM DRAINAGE BASINS



0 2,000 4,000
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online

FIGURE 7. EXISTING LEVEES



Source: Aerial photograph obtained from Esri ArcGIS Online

NOTE: This figure is based on best available information and has not been field verified or surveyed, so some existing levees may not be shown.

There are two distinct types of flooding events in Aberdeen and Hoquiam: coastal floods and localized floods. Coastal floods are driven by extreme high tides, low-pressure systems, wind, and waves that cause the waters of Grays Harbor to push upstream and above the riverbanks. Even though water may be pouring into the communities from the Wishkah and Hoquiam rivers during coastal flood events, the rivers are flowing upstream at that time and the driver of the high water is coastal conditions. The 100-year floodplain established by FEMA is based primarily on the coastal flood. The FIRM generally designates land below the 100-year flood elevation of 13.5 feet NAVD88 as being in the floodplain (see Figure 8).

Localized flooding is caused by high-intensity rain events that overwhelm the stormwater drainage network. These localized floods are exacerbated by high groundwater during the rainy winter months. During these events, stormwater drain pipes are surcharged and water can sometimes be seen rising up out of catch basins. The January 2015 event is a prime example of localized flooding. Soil erosion and landslides worsen these flood events. Sediments eroded from the foothills is carried by stormwater runoff downhill and into streams and catch basins. The sediment then settles out in the catch basin and stormwater conveyance pipes and clogs the system, reducing the capacity to drain stormwater toward the rivers.

These two types of flood events also interact to create complex conditions. For example, high-intensity rain events can occur during high tides. The stormwater outfall pump system effectiveness is reduced when pumping water out against the pressure of the tides. The pipes are then surcharged and stormwater runoff has no way to drain.

There has been no formal, systematic mapping of areas impacted by localized flooding over time. As part of the TimberWorks planning process, local residents and Public Works staff from both cities were asked to identify areas of localized flooding. Following the January 2015 flood, Grays Harbor County compiled information to seek a federal disaster designation (see Figure 8). A map of properties that were reported as impacted during that flood event aligns well with areas that local residents and city staff identified as impacted by chronic flooding. These areas are widespread, but generally include:

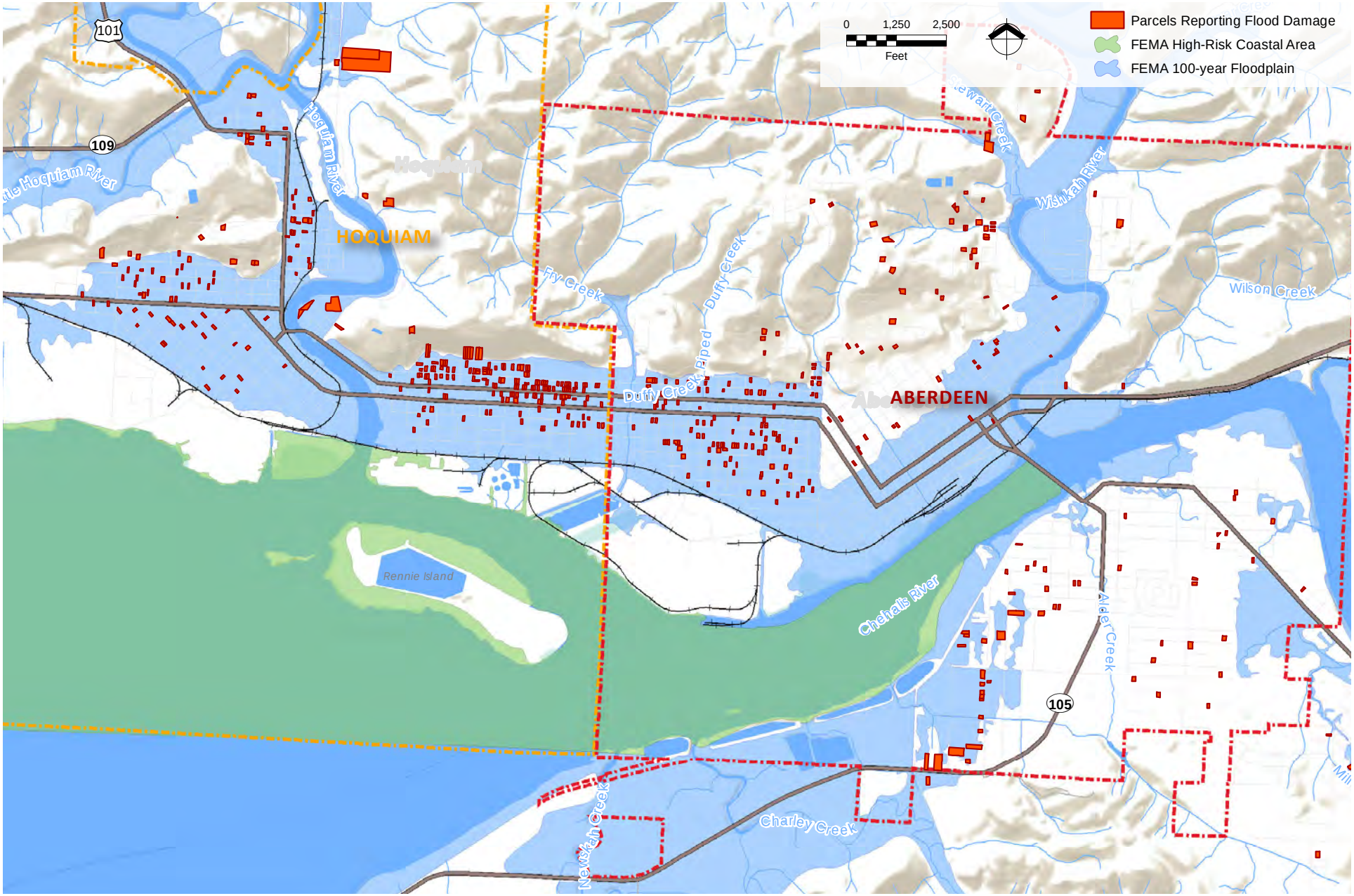
- Cherry Street and surrounding area north to Queets Avenue and south to Aberdeen Avenue
- Area around K Street in downtown Hoquiam
- Area around Queen Avenue and the mouth of the Little Hoquiam River
- Drainages where the creeks, including Duffy Creek, Division Creek, Stewart Creek, and Wilson Creek, come down from the foothills and meet the lowlands
- Area around East 2nd and East Market Streets

Current flood infrastructure leading to flooding from the river and due to system backflow. Note sediment coming down from hills, filling catchbasins, and high tide preventing conveyance from drainage pipes.

Future condition. Flood control parks and sediment traps prevent sediment from clogging catch basins. Upgraded pumps provide capacity to drain conveyance pipes even at high tide.

FIGURE 8. 100-YEAR FLOODPLAIN

This figure shows flood damaged properties impacted by an exceptionally heavy rain event in January 2015.



The communities of Aberdeen and Hoquiam deal with nuisance flooding on a seasonal basis. Nuisance flooding is generally characterized by short periods of time when water seeps into crawl spaces and basements or backs up out of catch basins to flood streets. There is a history of major flood events in the communities as well. The Washington State Hazard Mitigation Plan identified Grays Harbor County as being "most at-risk and vulnerable" to flooding, with an estimated three-year flooding recurrence rate.[23] The table below presents the dates of all declared federal flood disasters in Grays Harbor between 1960 and May 2010.[24]

The damage caused by major flood events can be quantified in terms of impacts to property and infrastructure, as well as lost business revenues. The December 2007 flood event alone caused nearly $8 million in reported flood losses across the entire county.[25]

TABLE 5. FEDERALLY DECLARED FLOOD DISASTERS IN GRAYS HARBOR COUNTY

Month	Year
December	1964
January	1971
January	1972
December	1975
December	1977
December	1979
January	1990
November	1990
November/December	1995
January/February	1996
March	1997
October	2003
January/February	2006
November	2006
December	2007
December/January	2008–2009
January	2009

Downtown Hoquiam after the 1933 floods.

Aerial of Aberdeen and Hoquiam after flooding from the January 2015 rainfall event.

[23]Grays Harbor County 2011-2016 Hazard Mitigation Plan.
[24]Same as above.
[25]Same as above.

There is an interrelated set of regulatory and financial controls related to property development in floodplains. Generally, these controls regulate rather than prohibit development in the floodplain and are designed to minimize health, safety, and financial risks related to the development of the floodplain.

The three primary controls are the NFIP, Federal Executive Orders (EOs) 11988 and13690, and local government development regulations.

- The NFIP is a program that provides federally subsidized insurance for existing and new construction in the 100-year floodplain (referred to as the Special Flood Hazard Area [SFHA]). Federal regulations pertaining to lending institutions require flood insurance for commercial or home loans. To make properties eligible for this program, local governments must adopt regulations that meet federal standards for development in the floodplain.
- EO 11988 establishes policy for federal agencies to avoid direct and indirect support of floodplain development where there is a practicable alternative. EO 13690 amends the previous order and establishes a framework to support resiliency and consider the impacts of sea level rise before permits are issued or funding is awarded.
- The cities of Aberdeen and Hoquiam have both adopted development regulations that meet the requirements of the NFIP. The key provisions of these regulations are listed in Table 5.

Additional detail on each of these programs is provided below.

NATIONAL FLOOD INSURANCE PROGRAM

The purpose of the NFIP is to reduce the impacts of flooding on communities by providing flood insurance to property owners, as well as encouraging communities to adopt floodplain management programs.[26] Federally regulated lending institutions require flood insurance when lending to properties in the SFHA. Calculation of flood insurance premiums are based primarily on a property's location on the FIRM.[27] The FIRM is established by FEMA and delineates flood hazard zones with different levels of flood risk in a particular community.[28] A FIRM update is in process for the cities of Aberdeen and Hoquiam, with a target future effective date of February 2017.[29] Two key designations on the FIRM are floodway and floodplain.

- Floodway: The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.[30]
- Floodplain: The area that will be inundated by the flood event having a 1 percent chance of being equaled or exceeded in any given year. The 1 percent-annual-chance flood is also referred to as the base flood or the 100-year flood.

Recent federal policy changes are driving significant changes in federal flood insurance rates. Historically, flood insurance rates were effectively subsidized by the federal government. The Biggert-Waters Flood Insurance Reform Act of 2012 changed the flood insurance rate calculations to make flood insurance rates more reflective of the true flood risk for a property.[31] Following this guidance, FEMA began to systematically increase flood insurance premiums. The rate changes sparked a great level of concern that led Congress to pass the Homeowner Flood Insurance Affordability Act of 2014. This act modified provisions of the Biggert-Waters Act to lower rate increases on some policies, prevent some future rate increases, and provided refunds to some policyholders to offset rate increases.

[26]FEMA NFIP Frequently Asked Questions: https://www.fema.gov/media-library-data/20130726-1438-20490-1905/f084_atq_11aug11.pdf.
[27]Same as above.
[28]Same as above.
[29]https://www.floodsmart.gov/floodsmart/pages/understanding_flood_maps/mapScheduleSearch.action;jsessionid=E5E14F124C1B33BEE44C6B644AF52D1F?zipCode=98520.
[30]FEMA NFIP Frequently Asked Questions: https://www.fema.gov/media-library-data/20130726-1438-20490-1905/f084_atq_11aug11.pdf.
[31]Biggert-Waters Act: https://www.fema.gov/media-library-data/20130726-1912-25045-9380/bw12_qa_04_2013.pdf.

EXECUTIVE ORDERS 11988 AND 13690

When EO 11988 was enacted in 1977, its primary purpose was to "avoid short and long term adverse impacts associated with the occupancy and modification of floodplains."[32] This includes avoiding direct or indirect assistance with floodplain development, to the extent practicable.[33] EO 11988 does not expressly prohibit federal funding for development projects in 100-year floodplains. Federal agencies may be required to make the determination that there are no reasonable practicable alternative locations and that appropriate mitigation measures will be implemented to minimize adverse impacts. Federal agencies are required to establish their own guidelines for implementing EO 11988 within their authorized programs.

EO 13690 amended EO 11988 when it was enacted in 2015. EO 13690 established a Federal Flood Risk Management Standard (FFRMS) meant to increase resilience against flooding.[34] The FFRMS applies to any and all FEMA grants if they fund construction activities in or affecting a floodplain. It is designed to be a flexible framework to ensure that agencies integrate the most recent science and understanding of floodplains, climate change, and natural ecosystems. The FFRMS gives agencies the flexibility to select one of three approaches for establishing the flood elevation and hazard area they use in siting, design, and construction. They can:

- Use data and methods informed by best available, actionable climate science;
- Build 2 feet above the 100-year (1 percent-annual-chance) flood elevation for standard projects, and 3 feet above for critical buildings such as hospitals and evacuation centers; or
- Build to the 500-year (0.2 percent-annual-chance) flood elevation.

LOCAL REGULATIONS

Washington State law (Title 86 Revised Code of Washington [RCW], supported by Washington Administrative Code 173-158 and 173-145) requires that all communities adopt local ordinances that comply with the minimum NFIP requirements. The state law additionally prohibits the construction of new residences in the designated floodway. While local ordinance must meet the NFIP minimum requirements, they are authorized to impose more stringent regulation if determined necessary for public safety.

Development is not prohibited in the floodplain in the cities of Aberdeen and Hoquiam. However, Aberdeen's and Hoquiam's development regulations require special measures for development and building renovation, as summarized in the following table. Both cities are considering updating their floodplain development regulations.

TABLE 6. LOCAL FLOODPLAIN DEVELOPMENT REGULATIONS

Factor	City of Aberdeen	City of Hoquiam
Net rise analysis required?	Yes. All construction in the floodplain requires net rise analysis. (AMC 15.52.040.A.2)	Yes. Must demonstrate no net rise for development to be allowed within 100-year floodplain. (HMC 11.16.250.7)
Elevation	In floodplain, 1.1 feet above base flood elevation in most cases. Between 0.5 and 1.6 feet above adjacent street centerline. (AMC 15.52.100 A & B)	Permitted development in the floodplain ground floor elevation must be one foot above base flood elevation. (HMC 11.16.260.1)
Flood-proofing	Flood proofing and hydrostatic equalization required for structure/utilities /etc. that are below minimum elevation point in floodplain. (AMC 15.52.090.F, 15.52.100 B & C)	Flood-proofing required at base flood elevation and below. (HMC 11.16.260.2)
Development in Floodway	New residential prohibited in floodways. All construction in floodways requires net rise analysis. (AMC 15.52.110)	Residential development prohibited in the floodway. Structures within coastal high-hazard must be on piles to elevate up to one foot above base elevation. (HMC 11.16.250.8)

[32]FEMA EO 11988: https://www.fema.gov/executive-order-11988-floodplain-management.
[33]Same as above.
[34]FEMA 2015. Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Risk Management Standard. October 8.

3. COMMUNITY INPUT

3.1 Key Themes

Engaging the community was a key element of the TimberWorks planning process. A series of community involvement activities was designed and implemented to gather local knowledge, suggestions for multiple benefit projects, and comments on proposed recommendations. This section summarizes the key findings of the community involvement effort. More detailed summaries of meetings is provided in Appendix A. Community engagement activities included:

- Research interviews with key stakeholders: The planning team conducted personal interviews with property owners; business owners; planning and public works staff from both cities; and representatives of interested organizations, including the Chehalis River Basin Land Trust, Grays Harbor Conservation District, and Grays Harbor College.
- "Walkshops": Informational workshops and walking tours of areas with perennial flooding impacts were conducted in March 2016. During these workshops, the planning team shared findings from preliminary assessment of flooding impacts, infrastructure conditions, fish habitat needs, and public open space plans. Participants were asked to provide information on their personal experience and their observations of flooding in the community.
- Open house workshops: Open house events were hosted in April and October 2016. During the April workshop, information was presented on the analysis of conditions that cause flooding in the community and potential projects that could be implemented to reduce flood risk and create additional economic and community benefits. Participants were asked to identify locations on maps where different types of projects could be implemented to reduce flood risk. In the October meeting, participants reviewed the proposed Action Plan and participated in a funding exercise to prioritize projects.
- Survey: Meeting participants were asked to fill out a questionnaire, which was also posted on the project Web site.

"We can't wait years to fix this problem"

Community members take a walking tour along Wilson Creek.

Community members discuss flooding issues at open house.

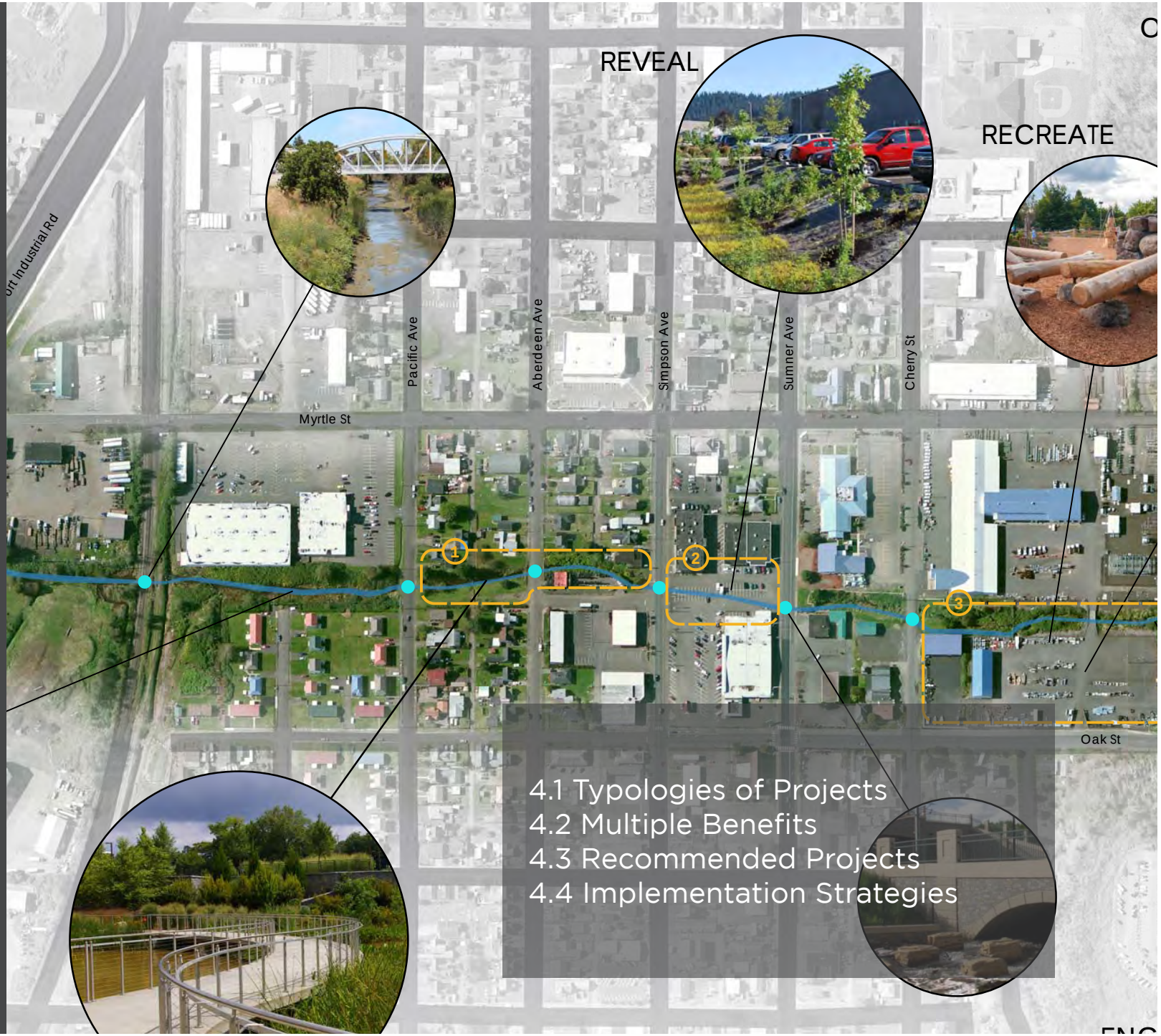
There was broad consensus on a number of key themes related to flooding in the cities of Aberdeen and Hoquiam.

- Flooding is a major concern for both communities. There are significant personal, physical, and financial impacts to flooding. There is growing frustration among many community members that flooding is recurring and a sense of urgency to take proactive actions to manage the problem.
- The increases in flood insurance rates following the passage of the Biggert-Waters Reform Act have significantly impacted household finances. Some property owners stated that their insurance rates had increased to the point of exceeding their mortgage payments and that the high cost of flood insurance making it very difficult to buy, sell, and renovate properties.
- Community members identified numerous broad areas where flooding occurs. Areas of particular concern based on the frequency and depth of flooding include Cherry Street and Queets Avenue in the vicinity of Fry Creek, Downtown Aberdeen, K Street in Downtown Hoquiam, the west side of Hoquiam, and Stewart Park. Some community members perceive that flooding has become more frequent and more serious in recent years.
- There is broad support for the cities implementing projects to reduce flood risk. One hundred percent of the survey respondents indicated that they would like to see investments made to improve floodplain management. Seventy-six percent of survey respondents also stated that they would be willing to pay more toward stormwater fees or property taxes to reduce flooding and flood insurance rates. This statement of willingness to pay was followed by many respondents with a statement that the support for increased taxes would depend on the effectiveness of the proposed projects and the magnitude of the costs.
- There is broad recognition that the stormwater drainage system is aging and is insufficient to address current flood-management needs.
- Many community members expressed support for projects that would create new open spaces or use existing parks for detention of floodwaters, especially if the parks could be used for recreation when the facilities were dry.
- There was strong interest in developing projects that would combine flood protection benefits with open space, habitat, and community development benefits.
- Many community members also strongly urged the cities to move quickly to reduce flood risk. While long-term, comprehensive solutions are needed, the cities should also implement effective flood-reduction projects in the short term.

"No one will invest in a property that's going to flood."

Community member and project staff meet to take a walking tour of flood prone areas.

4. ACTION PLAN



4.1 Typologies of Projects
4.2 Multiple Benefits
4.3 Recommended Projects
4.4 Implementation Strategies

A set of recommended programs and projects has been developed based on the assessment of causes of flooding, opportunities for habitat enhancement and public benefits, and the concerns and ideas expressed by community members. Because flooding impacts so many parts of the community and is driven by the combination of a multiple factors, there is no single, silver bullet solution to the challenge facing the community. This plan proposes a set of interrelated programs and projects that can be implemented in multiple locations across the community and that, collectively, will contribute to reducing flood risk while also providing other benefits. While some projects are large-scale public works, a number of small-scale, lower cost actions are also recommended that can be implemented by individual property owners or city staff without external funding or technical assistance. The recommended actions are based on a review of research studies and leading-edge planning in the Pacific Northwest region and across the country. These examples have been combined with local experience and tailored to the challenges and opportunities of the cities of Aberdeen and Hoquiam.

Rendering of a typical flood wall inland of the Hoquiam River at 14th Street and Bridge.

There are five basic types of projects that communities can implement to reduce flood risk:

- Structural approaches include physical modifications or facilities that can be constructed to convey or store floodwaters.
  - Conveyance—The traditional approach to managing stormwater runoff is to collect the water and convey it through a pipe system away from structures and into streams or rivers. The results of the assessment of the stormwater infrastructure in Aberdeen and Hoquiam indicate that the aging pipes lack sufficient capacity to convey the volume of water generated by high-intensity rain events, especially at high tidal elevations when the water must be pumped. Additionally, culverts at road crossings for streams such as Fry Creek, Wilson Creek, and Alder Creek are undersized and cause water to back up and flood as well as creating barriers to fish passage.
  - Storage—Stormwater and floodwaters can be detained in basins or cisterns and then drained by gravity or pumps after flooding conditions have receded. The regrading of Franklin Field presents an effective local example of this approach. Stormwater drainage pipes convey runoff to Franklin Field during high-intensity rain events and the water is stored temporarily in the park rather than taking up capacity of drainpipes.
  - Barriers—Levees and floodwalls provide a physical barrier that prevents water from the rivers or Grays Harbor from encroaching into the communities.

Franklin Field currently serves as a way to store stormwater when it overflows.

- Nonstructural approaches may include restoration projects that reconnect streams with floodplain habitat in the upper watershed, land use policies, and programs to enhance community resiliency to flood events.
  - Floodplain connectivity—In natural conditions, rivers regularly overtop their banks and water flows through the adjacent floodplain. Ecological systems have adapted to this regular flooding in a number of ways. Floodplains are generally flat areas with trees, vegetation, and a physical structure that slows and stores flood waters. By slowing and storing floodwaters, naturally functioning floodplains can actually reduce flooding in downstream areas. The historical floodplains in Aberdeen and Hoquiam have been largely developed. Restoration of some of this habitat can be implemented in targeted areas to manage floodwaters before they reach urban development.
  - Policies and programs—Local governments can institute policies and programs to protect the hydrologic functions of watersheds in order to reduce stormwater runoff and land use practices that exacerbate flooding. The cities of Aberdeen and Hoquiam both participate in the NFIP and have adopted floodplain management ordinances in compliance with national standards. The cities have also adopted critical areas ordinances to limit development impacting wetlands, streams, steep slopes, and geologic hazard areas.

Fry Creek at Aberdeen Avenue: current condition.

Fry Creek: illustrated future condition including larger culvert, larger floodplain, and public access.

The TimberWorks plan takes a multiple-benefits approach to projects. The intent is to explore opportunities to leverage investments in flood-risk-reduction efforts to achieve other benefits such as water quality improvements, habitat enhancement, and community and economic development.

Water Quality Improvements—The existing public stormwater drainage system was not designed to provide water quality treatment. Recent private development projects, such as the residential subdivision on Basich Boulevard, have included stormwater management facilities that control stormwater runoff volume and provide treatment. There are opportunities to integrate water quality treatment technologies into flood-control projects to reduce pollutant loadings into local waterways. These improvements can include using constructed wetlands, settlement ponds, and low-impact development technologies such as bioretention and pervious pavements.

Habitat Enhancement—As described in previous studies, such as the Salmon Recovery Limiting Factors Report and Shoreline Conditions Inventory for the Shoreline Master Program Update, the habitat quality of many of the streams and wetlands in the cities of Aberdeen and Hoquiam has been degraded by decades of development. There is an opportunity to restore stream and floodplain habitat in ways that will also reduce flood risk.

Community and Economic Development—Reducing flood impacts has a financial value in reduced costs associated with recovery and repair after flood events. Flood-control projects can also be designed to improve the aesthetics and function of city streets, walkways, and public spaces in order to enhance the community and attract investment. These improvements can include increasing or enhancing public open spaces, using landscaping to improve streetscapes, and providing education opportunities.

Illustration of 'green street' retrofits to Cherry Street including bioretention facilities and pervious pavement

A set of recommended programs projects has been developed through technical analysis, discussion with the Advisory Group, and review with community members. The projects have been organized based on geographic areas to address the varied challenges and opportunities of different sections of the cities (see Table 6). More detailed information on the projects is provided in Appendix B.

NOTES:

Funding Source:

ALEA—Aquatic Lands Enhancement Account

CDBG—Community Development Block Grant

CRBFA—Chehalis River Basin Flood Authority

Ecology Integrated Stormwater Grants—Centennial Fund, 319 Grants, Stormwater Funding Assistance Program, and Clean Water State Revolving Loan Fund

FbD—Floodplains by Design

FEMA—Federal Emergency Management Agency: Pre-disaster Mitigation Grant, Flood Mitigation Assistance Program

LWCF—Land and Water Conservation Fund

SRFB—Salmon Recovery Funding Board

USDA—Water and Waste Disposal Loans, Business and Industry Guaranteed Loan Program

WCRI—Washington Coastal Restoration Initiative

WWRP—Washington Wildlife and Recreation Program

[1]To the extent possible, total cost includes planning, design/permitting, and construction. See Appendix B for further detail.

No.	Project Name	Coastal Flooding	Local Flooding	Flood Reduction Benefit	Habitat Benefit	Open Space/ Recreation Benefit
Community-Wide						
0-1	**Maintenance Programs**	**Yes**	**Yes**	Maximizes capacity of storm drain system.	N/A	N/A
0-2	**Rainwater Capture and Reuse**	No	**Yes**	Provides storage of rainwater. Potential significant cumulative benefit.	N/A	N/A
0-3	**Urban Forest Program**	No	**Yes**	Intercepts and stores rain. Draws down groundwater.	Bird and wildlife habitat.	Aesthetic benefit.
0-4	**Stormwater System Capacity Analysis**—City of Aberdeen	No	**Yes**	Computer modeling of constriction points.	N/A	N/A
1. West Hoquiam						
1-1	**Moon Road**—shoreline restoration and floodwall	**Yes**	No	Higher elevation would provide protection for adjacent roads, infrastructure and properties.	2,300 linear feet of shoreline habitat for Moon Road, and 500 linear feet for Adams Street.	Public access opportunity.
1-2	**Bioretention Retrofits**—Hoquiam Middle School and Emerson Avenue Triangle Parks	No	**Yes**	Depends on size of facility	Bird and wildlife habitat.	Educational opportunity and aesthetic enhancement.
1-3	**Enhance and Certify Levee**	**Yes**	**Yes**	Provides protection from coastal flood.	Potential for native plantings.	Potential for public walkway.
1-4	**Upgrade Outfall Pumps**— High priorities: K Street, Ramer Street, and 10th Street pumps	**Yes**	**Yes**	Increases capacity of storm drain system.	N/A	N/A
1-5	**Upgrade Storm Drain Capacity**—Priority K Street and Ramer Avenue	No	**Yes**	Increases storm drain capacity.	N/A	N/A
2. East Hoquiam						
2-1	**Cherry and Queets Streets**—Green streets	No	**Yes**	Provides 1.5–2 acre-feet of storage.	Provides water quality treatment.	Enhance street aesthetic and pedestrian / bike connectivity.

Description	Cost Forecast	Timing	Funding Opportunities	Special Notes
Cleaning and maintenance of existing storm drainage system are fundamentally important to flood control.	Based on annual budget.	Ongoing	Stormwater Utility	Public Works crews from both City of Hoquiam and City of Aberdeen actively maintain the system, clearing catch basins and culverts and maintaining existing levees.
Focus on key areas such as Cherry Street and Basich Drive.	$150–$1,500 per site	Short Term	Stormwater Utility; Private Foundations	Build community knowledge and support. Immediate action that can be grass roots.
Private Foundations	Build community knowledge and support. Immediate action that can be grass roots.		DNR Urban Forestry Grant; Private Foundations; Corporate Donations; Stormwater Utility	Build community knowledge and support. Immediate action that can be grass roots.
Program to plant and maintain trees on public and private property in lowlands.	No cost—$150 / tree	Short Term	Ecology Integrated Stormwater Grant	May require extensive surveying to confirm.
Habitat restoration with bank / road protection. Moon Drive and Adams Street.	$335,000–$620,000[1]	Short Term	WCRI; SRFB; ALEA; WWRP	Project identified in Shoreline Master Program.
Bioretention swale for treatment of stormwater runoff roads, high school parking lot, and middle school.	$36/Square Foot[1]	Mid Term	Ecology Integrated Stormwater Grants; Private Foundations	Educational opportunity. Location proximate to downtown.
Builds on existing levee to consolidate, elevate, and extend.	$300,000–$600,000 for design	Mid Term	CRBFA	Design and certification process to obtain FEMA accreditation of levee.
Nearly every outfall pump station in need of upgrade or replacement.	$3,184,000[1]	Short Term	CRBFA; Ecology integrated Stormwater Grants; USDA	Needed to support levee accreditation by FEMA. Expected to have immediate benefit to increase capacity of storm drain system.
Double diameter of main storm drain trunk line on K Street.	$1,700,000	Phase project from south to north.	Ecology integrated Stormwater Grants; USDA	Recommended in Hoquiam Comprehensive Surface Water Plan.
Reduce paved width and integrate bioretention swales.	$1,380,000–$2,580,000[1]	Mid Term	Ecology Integrated Stormwater Grants	Pilot test, then increase in scale if effective.

No.	Project Name	Coastal Flooding	Local Flooding	Flood Reduction Benefit	Habitat Benefit	Open Space/ Recreation Benefit
2. East Hoquiam (cont.)						
2-2	**Property Acquisition**—Queets Street—landslide-prone homes	No	**Yes**	Potential to create stormwater swales.	Increases green space.	Potential to create a greenway pedestrian / bike corridor.
2-3	**Flood Control Park Adjacent to Olympic Stadium**	No	**Yes**	Provides up to 5.3 acre-feet of storage.	Provides water quality treatment.	Continued open space use.
2-4	**Upgrade Stormwater Outfall Pumps**	Yes	**Yes**	Increases capacity of storm drain system.	N/A	N/A
2-5	**North Shore Levee**	Yes	**Yes**	Provides protection from coastal flood to over 2,700 properties.	Potential for native plantings.	Potential for public walkway.
2-6	**Upgrade Storm Drain Capacity**	No	**Yes**	Increases storm drain capacity.	N/A	N/A
3. Fry Creek						
3-1	**Land Conservation in Upper Watershed**	No	**Yes**	Reduces runoff and erosion.	Protects high-quality habitat.	Potential for public access and trails.
3-2	**Fry Creek Restoration and Flood Reduction**	No	**Yes**	Increases flood storage and conveyance. Approx. 5.5 acre-feet of storage.	Enhances habitat in salmon stream.	Potential for public access and trails.
3-3	**West End Playfield**—flood-control feature	No	**Yes**	Increases flood storage.	Potential for water quality treatment.	Continued public recreation use.
4. West Aberdeen						
4-1	**Targeted Land Protection**	No	**Yes**	Reduces runoff and erosion.	Protects forested habitat.	Potential for public access and trails.
4-2	**Finch Playfield Flood Control Park**	No	**Yes**	Provides approx. 2.0–2.3 acre-feet of storage.	Potential for water quality treatment.	Continued public recreation use.
4-3	**Franklin Field**—Upgrade	No	**Yes**	Increases flood storage.	Allows for sediment settling.	Continued public recreation use.
4-4	**Upgrade Outfall Pumps**	**Yes**	**Yes**	Increases capacity of storm drain system.	N/A	N/A

Description	Cost Forecast	Timing	Funding Opportunities	Special Notes
Acquire properties at risk of landslide. Clear properties and create swales to trap sediment.	$44,000–$157,000	Mid Term	CDBG	Public health, geohazard risk reduction as well as flood benefit.
Shallow, broad swale near base of bluff to collect and store storm and flood waters.	$370,000–$695,000[1]	Short Term	Ecology Integrated Stormwater Grants	Limit depth to avoid encountering potentially shallow groundwater.
Bay Avenue outfall.	$6,900,000	Short-term, immediate impact	Ecology Integrated Stormwater Grants; USDA	Needed to support levee approval by FEMA.
East Hoquiam to Downtown Aberdeen.	Design in process	Mid-Term, immediate impact	CRBFA; FEMA	Removes protected area from FEMA flood insurance requirements.
Increase diameter of storm drain trunk lines on Bay Avenue, 24th and 28th Streets.	$3,400,000	Mid-Term. Phase project from south to north.	Ecology Integrated Stormwater Grants; USDA	Recommended in Hoquiam Comprehensive Surface Water Plan.
Land acquisition or conservation easements to keep land forested.	$375,000–$450,000	Short Term	LWCF; WWRP; CRBFA	Future phases of Aberdeen Highlands development already platted.
Opportunities to restore floodplain connectivity, replace culverts, and create park spaces.	$4,085,000–$7,985,000[1]	Mid Term	WCRI; FbD; CRBFA; Ecology Integrated Stormwater Grants	Projects along the creek corridor can be phased over time.
Lower grade, like Franklin Field. Bay Avenue and Oak Street.	$550,000–$1,030,000[1]	Mid Term	Ecology Integrated Stormwater Grants	Potential to encounter historical landfill waste material.
Acquisition or conservation easements to keep land forested and connect trails. North of West 6th Street, between Thornton and Division.	$7,500–$15,000	Short Term	LWCF; WWRP	Potential to connect to Sherwood Forest trail. Also creates opportunity for floodplain restoration.
Lower grade, like Franklin Field. West 5th Street, east of Canyon Court.	$190,000–$360,000[1]	Mid Term	Ecology Integrated Stormwater Grants	Canyon Creek is in 42” pipe on west side of the park.
Add pump to increase capacity of Franklin Field to store water.	$275,000–$505,000[1]	Mid Term	Ecology Integrated Stormwater Grants	Improvement to existing facility.
Nearly every outfall pump station in need of upgrade or replacement.	TBD as part of North Shore Levee design process	Short-term, immediate impact	Ecology Integrated Stormwater Grants; CRBFA; FEMA	Needed to support North Shore levee accreditation by FEMA.

No.	Project Name	Coastal Flooding	Local Flooding	Flood Reduction Benefit	Habitat Benefit	Open Space/ Recreation Benefit
4. West Aberdeen (cont.)						
4-5	**North Shore Levee**	**Yes**	**Yes**	Provides protection from coastal flood to over 2,700 properties.	Potential for vegetated levee banks.	Opportunity for trail / path on earthen levee.
4-6	**Stewart Creek Culvert Replacement**	No	**Yes**	Increases conveyance.	Removes fish passage barrier.	Reduces flooding impacts to properties.
4-7	**Stewart Creek Confluence Floodplain Reconnection**	No	**Yes**	Provides storage capacity.	Enhances floodplain and wetland habitat.	Potential for public access.
5. East Aberdeen						
5-1	**Wilson Creek Fish Passage Study**	No	**Yes**	Increases conveyance.	Removes fish passage barrier.	Reduces flooding impacts to properties.
5-2	**Wilson Creek Floodplain Park / Reconnection**	No	**Yes**	Increases flood storage and conveyance.	Enhances habitat in salmon stream.	Potential for public access and trails.
5-3	**Pioneer Boulevard—** Stormwater Retrofit Design	No	**Yes**	Provides storage and conveyance.	Reduces risk of steep slope erosion.	Protects steep slope.
5-4	**Levee Expansion and Certification**	**Yes**	No	Provides protection from coastal flood for up to 120 properties.	Potential for native plantings.	Potential for public walkway.
5-5	**Land Protections in Wilson Creek Watershed**	No	**Yes**	Reduces runoff and erosion.	Protects high-quality habitat.	Potential for public access and trails.
5-6	**North Aberdeen Feasiblity Study**	No	**Yes**	Flood reduction-study will identify specific projects to reduce flood risk.	Potential to enhance functions of existing wetlands and streams.	Potential for public access and trails.
6. South Aberdeen						
6-1	**Shannon Slough Habitat Enhancement**	No	**Yes**	Potential to design project to provide flood protection to Seaport Landing.	Enhances stream habitat.	Potential for public access and trails.
6-2	**Alder Creek Feasibility Study**	No	**Yes**	Potential to increase flood storage.	Enhances stream habitat.	Potential for public access and trails.
6-3	**Shopping Center**—LID Retrofits	No	**Yes**	Provides up to 2 acre-feet of storage.	Provides water quality treatment.	Enhanced aesthetics. Continued commercial use.

Description	Cost Forecast	Timing	Funding Opportunities	Special Notes
East Hoquiam to Downtown Aberdeen.	Design in process	Mid-term, immediate impact	CRBFA; FEMA	Removes protected area from FEMA flood insurance requirements.
Fish passage survey indicates partial barrier on southern branch of Stewart Creek.	$75,000–$100,000	Mid Term	SRFB	Identified in Conservation District assessment of fish passage barriers.
Design for replacement culvert to allow for greater flow connectivity.	$25,000–$50,000	Mid Term	WCRI; FbD	Listed as project in Shoreline Master Program Restoration Plan.
Evaluate culverts for fish passage; recommend upgrades as needed.	$10,000–$15,000	Mid Term	SRFB; WCRI	Listed as project in Shoreline Master Program Restoration Plan.
Re-meander stream and create floodplain bench within city-owned property at corner of Summit and Fairfield.	$115,000–$210,000[1]	Mid Term	SRFB; WCRI; FrD; CRBFA	Significant constraints from property ownership and development to restoration of lower reach of Wilson Creek.
Design for improved conveyance and management of runoff from street.	$25,000–$50,000	Mid-Term	Ecology Integrated Stormwater Grants	Runoff from Pioneer appears to be contributing to slope erosion on bluff on southern edge of road.
Builds on existing levees to consolidate, elevate, and extend.	$300,000–$600,000 for design	Long-Term	CRBFA	Design and certification process to obtain FEMA accreditation of proposed levee.
Land acquisition or conservation easements to keep land forested.	TBD	Mid-Term	LWCF; WWRP	Potential for coordinated land conservation with subdivision development.
Study of causes of flooding and cost effectiveness of potential solutions.	$50,000-$100,000	Mid-Term	CRBFA; WCRI; FbD	Potential to build on Wishkah Road Comprehensive Flood Study.
Habitat improvements and stormwater management in riparian zone. Include earthen berm to reduce flood risk to Seaport Landing.	$50,000–$75,000	Short-Term	SRFB; WCRI; Private Foundations	Aligns with plans for redevelopment of Seaport Landing.
Assess conveyance constraints and sources of water quality and habitat impacts.	$25,000–$50,000	Mid Term	CRBFA; WCRI	Potential partnership with Grays Harbor College.
Parking lot retrofits for stormwater infiltration.	$660,000–$960,000	Mid-Term	Ecology Integrated Stormwater Grants	Educational opportunity in high-traffic area.

FIGURE 9. TIMBERWORKS FOCUS AREA MAP

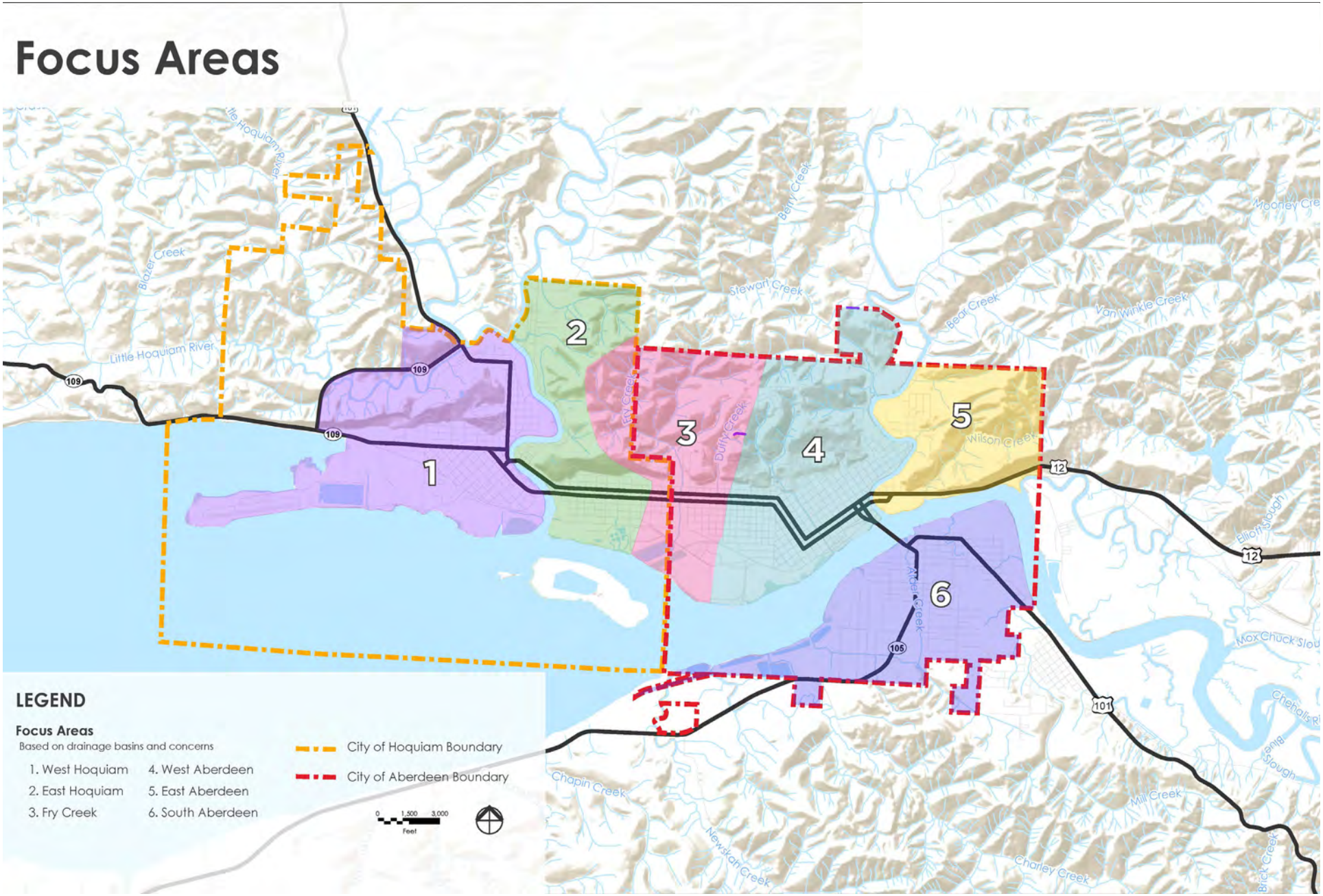


FIGURE 10. FOCUS AREA 1

Focus Area 1: West Hoquiam

Project		Cost
1-1	**Moon Road** Shoreline restoration and floodwall	**MED**
1-2	**Bioretention Retrofits** Hoquiam Middle School and Emerson Avenue Triangle Parks	**MED**
1-3	**Enhance and Certify Levee**	**MED**
1-4	**Upgrade Outfall Pumps** Priority: K, Ramer, & 10th Street pumps	**HIGH**
1-5	**Upgrade Storm Drain** Priority: K Street and Ramer Avenue	**HIGH**

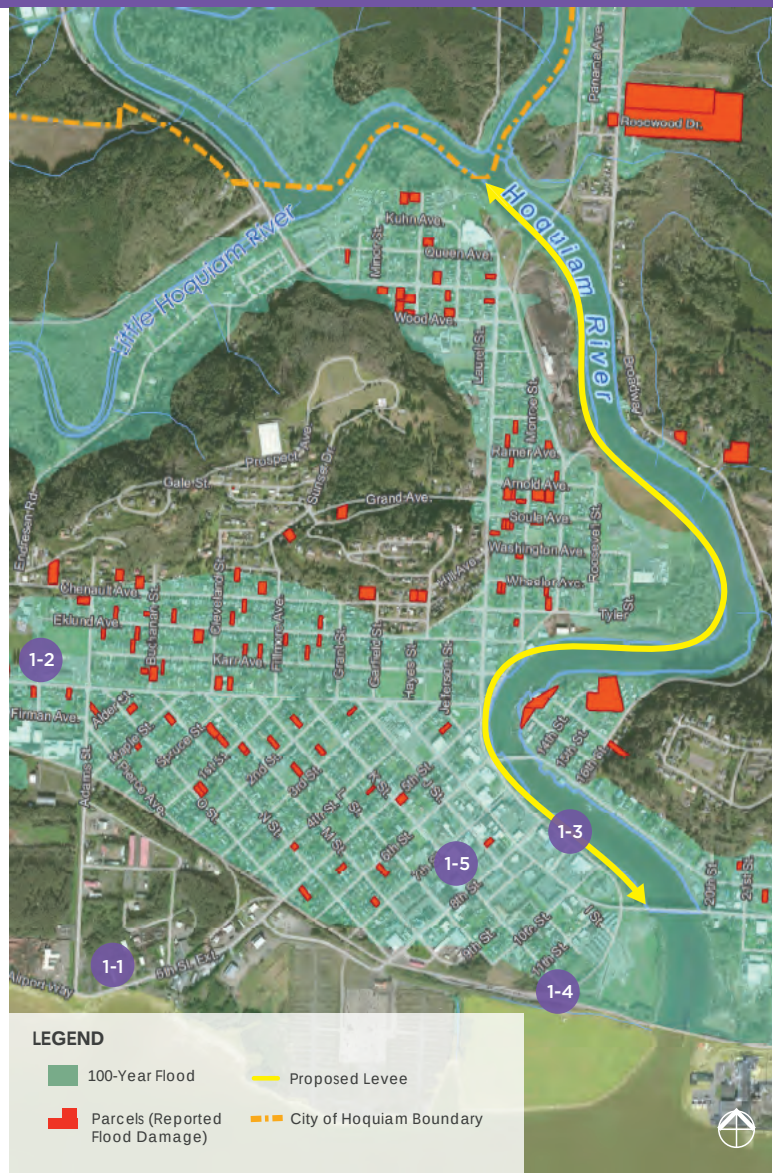


FIGURE 11. FOCUS AREA 2

Focus Area 2: East Hoquiam

Project		Cost
2-1	**Cherry and Queets Streets** Green streets	**HIGH**
2-2	**Property Acquisition** Queets Street: landslide-prone homes	**MED**
2-3	**Flood Control Park** Adjacent to Olympic Stadium	**MED**
2-4	**Upgrade Stormwater Outfall Pumps**	**HIGH**
2-5	**North Shore Levee** Along Hoquiam and Chehalis Rivers	**HIGH**
2-6	**Upgrade Storm Drain Capacity**	**HIGH**

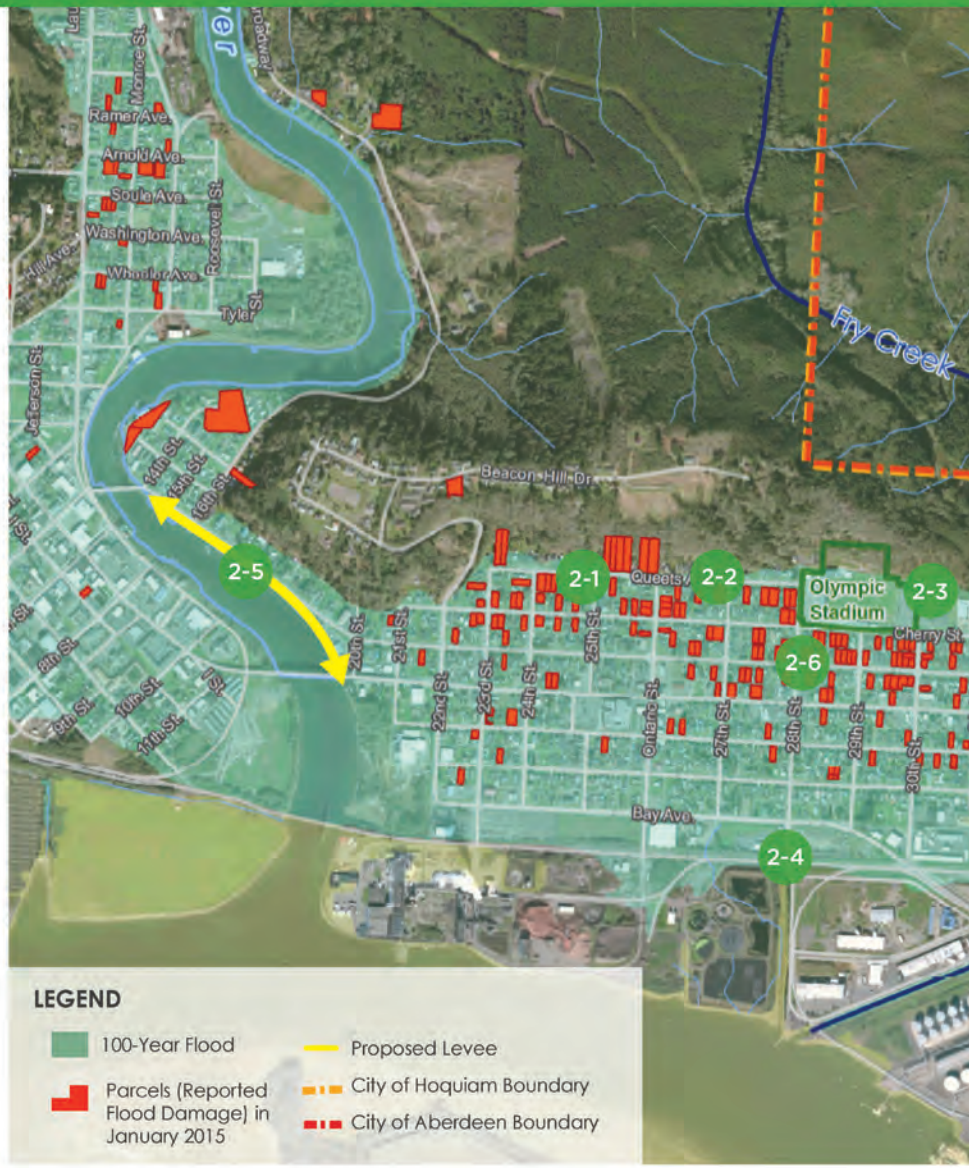


FIGURE 12. FOCUS AREA 3

Focus Area 3: Fry Creek

Project		Cost
3-1	**Land Conservation in Upper Watershed**	**MED**
3-2	**Fry Creek Restoration and Flood Reduction**	**MED**
3-3	**West End Play Field** Flood control feature	**MED**

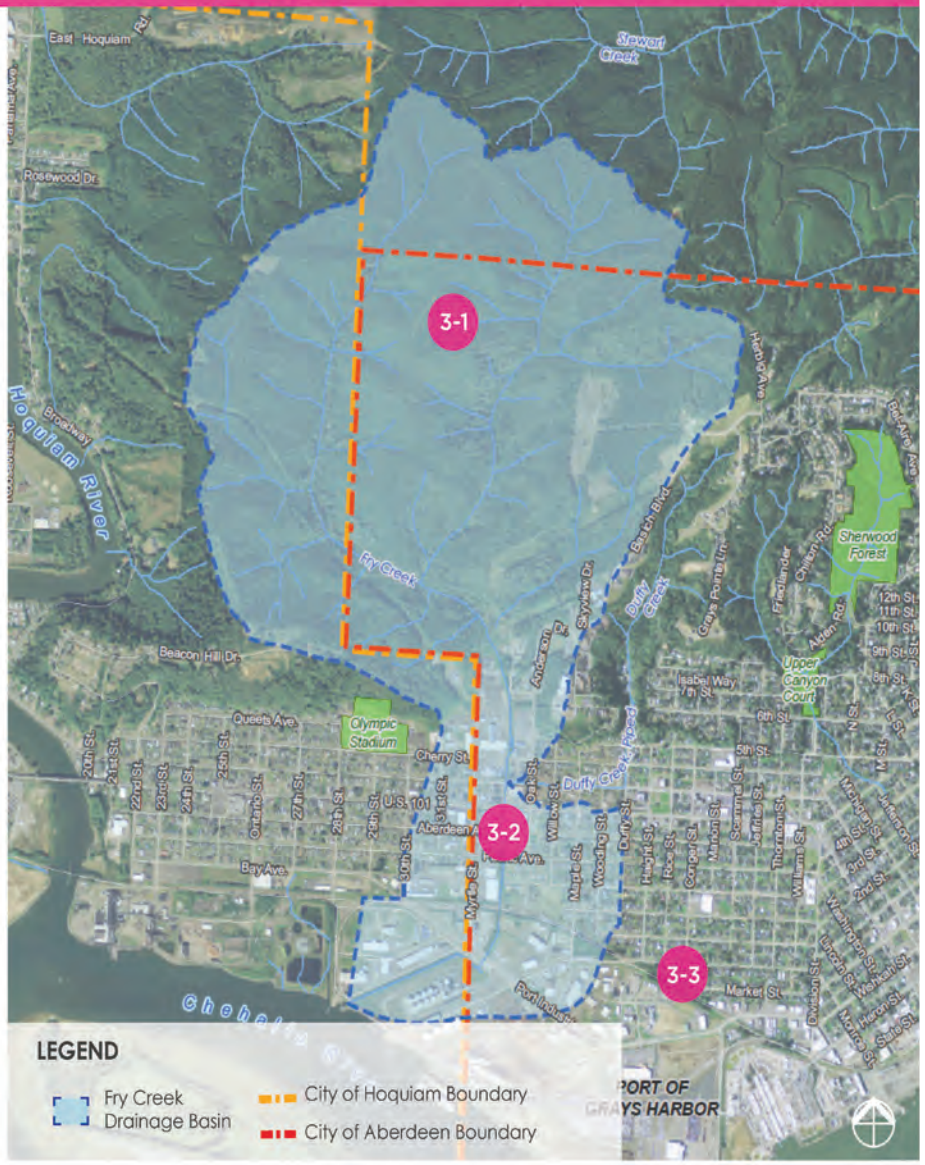


FIGURE 13. FOCUS AREA 4

Focus Area 4: West Aberdeen

Project		Cost
4-1	Targeted Land Protection	LOW
4-2	Finch Playfield Flood Control Park	MED
4-3	Franklin Field Upgrade	MED
4-4	Upgrade Outfall Pumps	HIGH
4-5	North Shore Levee	HIGH
4-6	Stewart Creek Culvert Replacement	LOW
4-7	Stewart Creek Confluence Floodplain Reconnection	MED

FIGURE 14. FOCUS AREA 5

Focus Area 5: East Aberdeen

Project		Cost
5-1	**Wilson Creek Fish Passage Study**	**LOW**
5-2	**Wilson Creek Floodplain Park / Reconnection**	**MED**
5-3	**Pioneer Boulevard** Stormwater retrofit design	**MED**
5-4	**Levee Expansion and Certification**	**HIGH**
5-5	**Land Protections in Upper Watershed**	**MED**
5-6	**North Aberdeen Feasibility Study** Evaluate options to reduce flood risk	**MED**

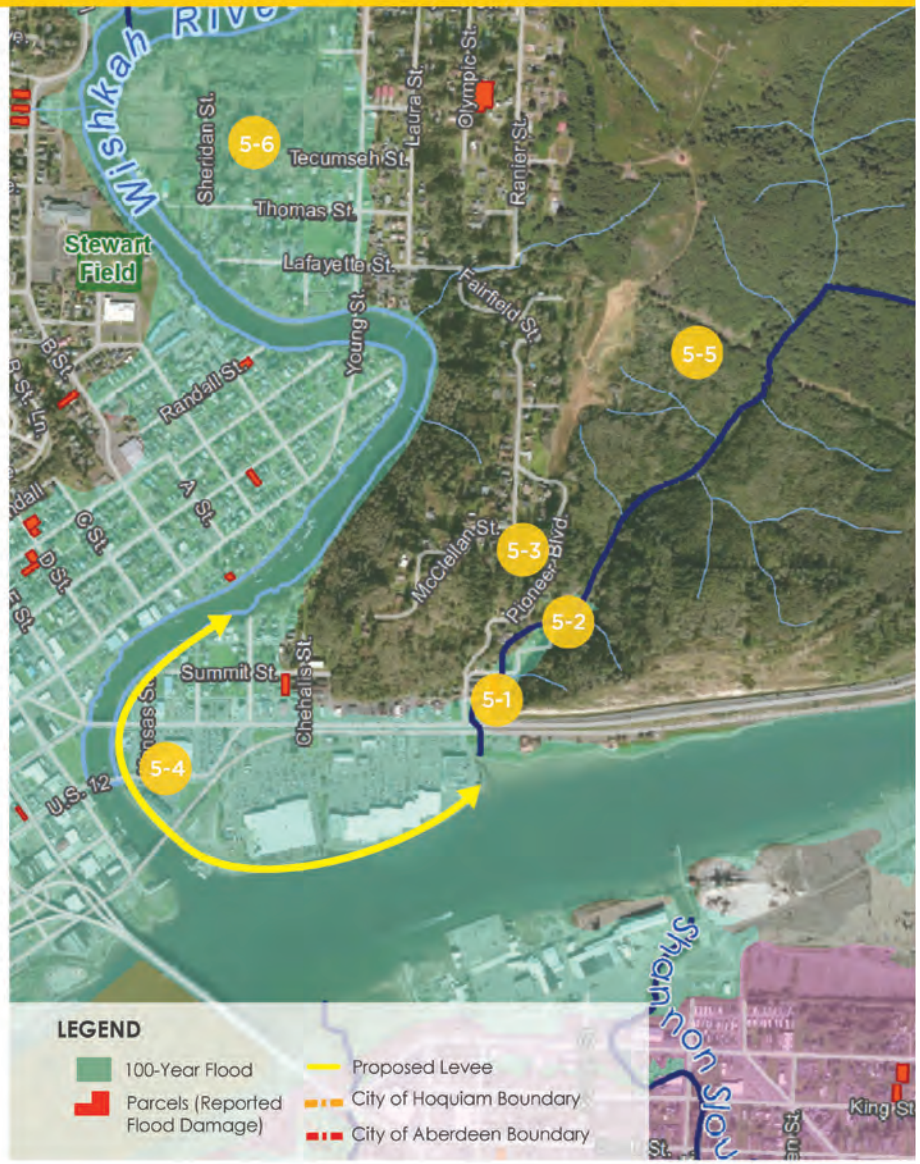
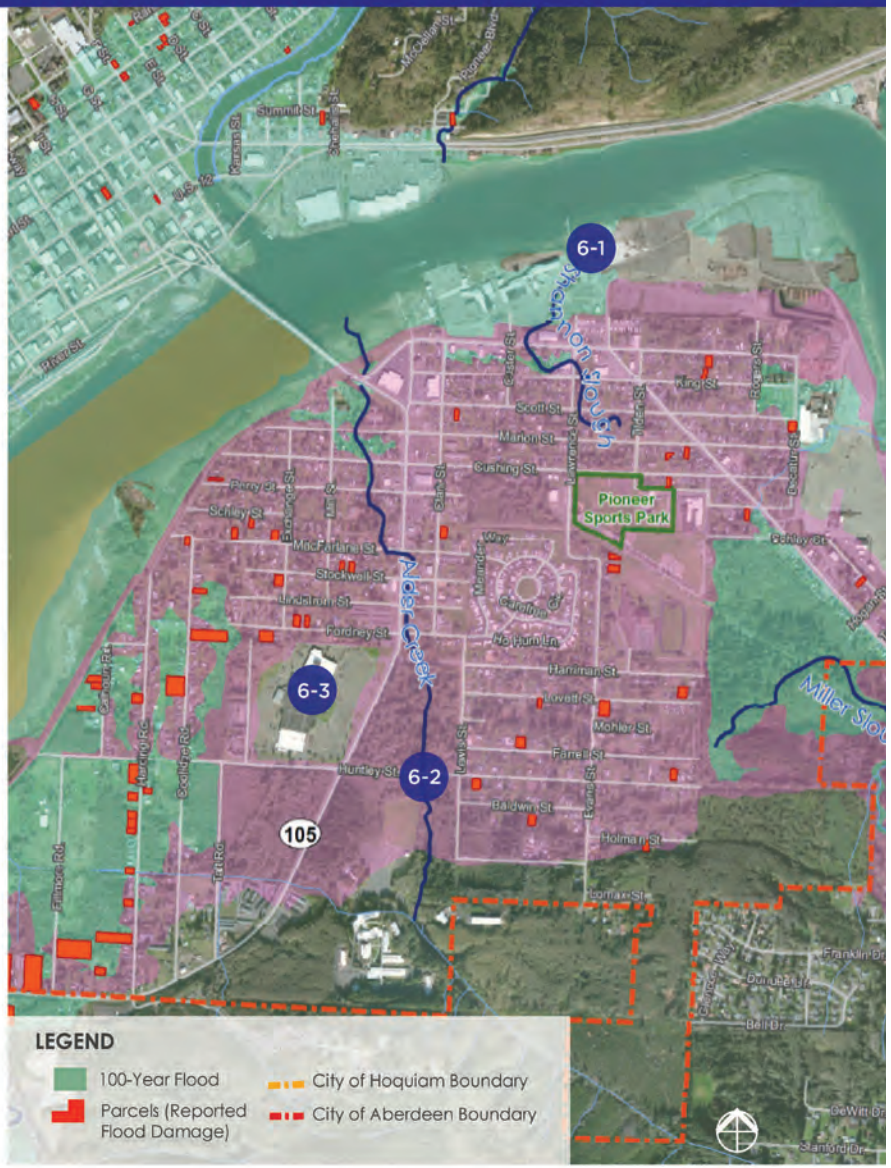


FIGURE 15. FOCUS AREA 6

Focus Area 6: South Aberdeen

Project		Cost
6-1	**Shannon Slough Habitat Enhancement**	**MED**
6-2	**Alder Creek Feasibility Study**	**LOW**
6-3	**Shopping Center** LID retrofits	**MED**



Implementation of the proposed projects and programs will be led by the cities of Aberdeen and Hoquiam with support from partners, and take place in phases over time. The timeline for implementation will be driven by the availability of staff resources and funding. The physical projects, including stormwater pipe replacements, pump station upgrades, and construction of levees, will require incorporation into the cities' capital improvement programs. Each of these projects is important and they collectively contribute to reducing flood risk and improving the community. The Advisory Committee and the community provided recommendations for priority projects to initiate in the short term. The cities of Aberdeen and Hoquiam have already successfully obtained funding to move several of these projects forward:

- North Shore Levee—the design process is under way and grant funding for completing the design and permitting has been identified by the Chehalis River Basin Flood Authority.
- Fry Creek—the City of Aberdeen has obtained $500,000 in grant funds for engineering design from the Chehalis River Basin Flood Authority and Washington Coastal Restoration Initiative.
- Drain System Conveyance and Pump Upgrades—the City of Hoquiam has received a grant for $1.3 million from the Chehalis River Basin Flood Authority to upgrade the Ramer Street storm drain lines and pump station.
- Flood Control Parks and Rainwater Capture—Rain barrels and cisterns can be installed on private and public properties and stormwater storage basins can be incorporated into public spaces in multiple locations to provide cost effective flood storage without extended design and permitting timelines.

PARTNERSHIPS

Successful implementation of the TimberWorks plan will require strong partnerships between the cities of Aberdeen and Hoquiam and other public and private parties. The cities have been building a strong foundation for partnerships through this planning process and ongoing community revitalization efforts such as Grays Harbor Vision 2020 and the Downtown Aberdeen Revitalization movement. Recommendations for key partners to implement specific projects are provided in the project sheets in Appendix B. Property owners will be critical partners in these projects. Most of the proposed projects are located on public lands, including properties owned by the school districts and Grays Harbor Public Utility District. In general, great opportunities for partnerships to leverage resources include:

- Community Outreach Efforts such as Rainwater Capture and Reuse (Project 0-2) and Tree Planting on private properties (Project 0-3)—Nonprofit organizations such as the Chehalis River Basin Land Trust, Grays Harbor Historical Seaport Authority, and Friends of Grays Harbor are well positioned to assist the cities in engaging with private-property owners and in seeking private foundation grants to support these efforts.
- Conservation of Natural Lands (Projects 2-2, 3-1, and 4-1)—The Chehalis River Basin Land Trust and Forterra are actively working with property owners to protect natural lands for habitat and watershed functions. The cities should coordinate with these organizations to develop a plan for acquisition of key properties and identify the most effective lead organization to negotiate with property owners and manage lands.
- Floodplain Reconnection, Fish Passage, and Steam Habitat Restoration Projects (Projects 1-1, 3-2, 4-7, 5-1, 5-2, 6-1, and 6-2)—Grays Harbor County, the Grays Harbor Conservation District, the Quinault Indian Nation, and Forterra all have technical expertise and experience in implementing these types of projects and could potentially support the cities in fundraising, design, and implementation. It may be appropriate for these partner organizations to take the lead on some of these projects, with the cities playing a supporting role.

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FUNDING STRATEGIES

There is a large need for improvements to reduce flooding and enhance the communities of Aberdeen and Hoquiam. The overall funding strategy for implementing these projects is based on capitalizing on state and federal grants and loans to leverage local funds and to phase projects over time.

State and Federal Funding Opportunities

The long-range framework of the TimberWorks Master Plan and the multiple-benefit approach create opportunities for the cities to obtain funding from a number of different federal and state programs related to flood control, economic development, habitat restoration, and recreation and open space. A guide to potential state and federal funding sources is provided in Appendix C. Funding opportunities for specific projects are identified in Table 6 and Appendix B.

Local Funding Mechanisms

One of the primary purposes of the TimberWorks Master Plan is to alleviate the financial impacts to the community caused by flooding, so there is great sensitivity to the prospect of increasing local taxes to fund projects. An important consideration for local funding is that, currently, flood insurance premiums effectively flow out of the community with little return. In contrast, local funds invested in projects identified in the TimberWorks plan will be applied directly to projects to benefit the community. There are four primary mechanisms for local funding that could be considered for implementation of this plan: stormwater utilities, municipal bonds, a flood-control zone district, and a metropolitan parks district (MPD).

Stormwater Utility

The cities of Aberdeen and Hoquiam both currently charge property owners a stormwater utility rate under the authority of RCW 35.67. The purpose of the utility rate is to generate revenues to support stormwater management operations, maintenance, and capital projects. The rate is charged to properties that contribute to an increase in surface water runoff or that benefit from any stormwater-control facilities. Tax-exempt properties, including publicly owned properties, are subject to the same rates as private properties. In Aberdeen, the rate is $6.69 per equivalent residential unit per month, generating approximately $ 490,000 per year. In Hoquiam, the rate is $10.83 per equivalent residential unit per month, generating approximately $575,000 per year. The projects proposed in this plan can be incorporated into the cities' capital improvement plans over time and funded in part with these stormwater utility fees.

Municipal Bonds

Capital improvements are often funded through municipalities issuing debt. The amount of debt that a local government can incur is limited by the Washington State Constitution, the type of debt, and local government policy. Since it is expected that the proposed projects in this plan will not generate revenue to repay debt, the cities' options for debt issuance would be general obligation bonds or special assessment debt. General obligation bonds issued by local governments are secured by a pledge of the taxing district's property tax authority. General obligation bonds have been the traditional form of financing for capital projects such as land acquisition, park development, and transportation projects that are owned and operated by government. There are two types of general obligation bonds: limited tax general obligation bonds, which can be issued by vote of the city council, and unlimited tax general obligation bonds, which must be approved by voters. Special-assessment debt is repaid from assessments charged to those who directly benefit from a project.

Flood Control Zone Districts

Flood-control zone districts are special-purpose governments that can be established by a county to fund flood-protection projects and programs under the authority of RCW 86.15. Although cities may participate in the formation and operation of the districts, flood-control districts are under county control. Flood-control zone districts can be established by vote of the county commission following a resolution or petition from voters and a public hearing. State law identifies the county commission as the governing Board of Supervisors of the district. The Board of Supervisors provides policy direction for the district activities and selects projects to be funded. Through interlocal agreements, the Public Works and Utilities Department could design and build the approved projects. State law identifies the county engineer as the administrator of the district.

Flood-control zone districts have the authority generate revenue through several different funding mechanisms. The district can collect a property tax

of up to 50 cents per $1,000 of assessed value. It can charge those who receive flood-control benefits a service rate similar to that charged by the stormwater utility. It can also authorize an excess levy with approval from voters.

Metropolitan Parks District

Cities and counties may create an MPD for the "management, control, improvement, maintenance, and acquisition of parks, parkways, boulevards, and recreational facilities" under the authority of RCW 35.61. MPDs may levy property taxes or issue bonds for this work. Formation of a district must be approved by a majority of voters at a general or special election following a resolution of the City Council or a petition signed by at least 15 percent of registered voters. It would be governed by a board, which can be either the City Council or separately elected officials. The maximum levy rate that can be charged by an MPD is 75 cents per $1,000 of assessed value of a property. An MPD tax levy is subject to tax levy lid rules that apply to junior taxing districts. A tax lid can be invoked if a geographic area's cumulative property tax rate exceeds the maximum allowed by state law. An MPD also has authority to issue bonds without voter approval for up to 0.25 percent of the value of taxable property in the district. With approval of at least 60 percent of district voters, the MPD could issue up to 2.5 percent of the value of taxable property in the district. Local funds such as those derived through a district levy or bond are particularly useful in leveraging state and federal grants that often require a local match.

Flooding and landslides caused by the January 2015 rain events.

Community members work to prioritize flood control projects at an open house.


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