STORM AND SURFACE WATER MASTER PLAN

Prepared for
City of Sequim

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

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STORM AND SURFACE WATER MASTER PLAN

Prepared for
City of Sequim
152 West Cedar Street
Sequim, Washington 98382

Prepared by
Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206.441.9080

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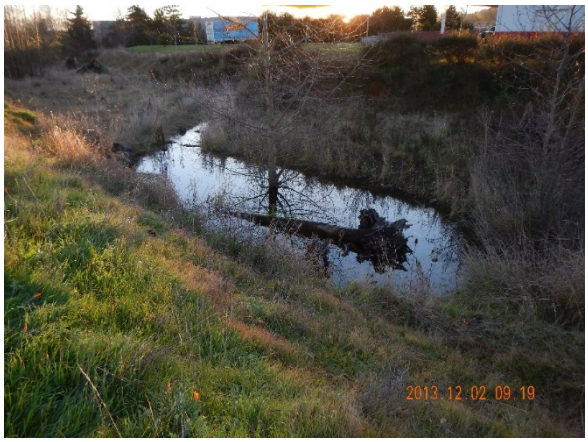
EXECUTIVE SUMMARY

INTRODUCTION

This Storm and Surface Water Master Plan is intended to serve as Sequim's first comprehensive and strategic guide to managing stormwater and surface water as important resources in the city of Sequim. This plan includes:

Typical ponding along West Sequim Bay Road at Fairweather subdivision after a moderate rain event.

- Identification of, and proposed solutions to, drainage and water quality issues
- Actions necessary to ensure compliance with applicable federal, state, and local requirements
- Actions recommended for improving and expanding the City of Sequim's (City) existing stormwater program
- Staffing and resource needs to implement the plan recommendations
- Discussion of future growth and climate change strategies
- Discussion of opportunities for interdepartmental and interagency collaboration



Bell Creek restoration project behind Les Schwab, was completed years ago, when irrigation water was conveyed in the channel all summer.

This plan is necessary because urban development typically results in an increase in the volume of stormwater runoff generated and a decline in water quality downstream. Through better management of stormwater with flow control and water quality treatment facilities, the following benefits can be attained:

- Reduced localized flooding or ponding causing street and other property damage
- Reduced level of pollutants carried by stormwater (sediments, nutrients, metals, oils, and other contaminants)
- Protected fish and wildlife habitat provided by city streams
- Preservation and protection of drinking water supply (i.e., drought resilience)

There are several federal and state regulations and strategic planning efforts that apply to the City's storm and surface water program:

- State surface water quality standards (WAC 173-201A)
- Groundwater quality standards (WAC 173-200)
- Underground Injection Control (UIC) requirements
- Puget Sound Partnership (PSP) Action Agenda
- Dungeness Water Rule (WAC 173-518)
- National Flood Insurance Program (NFIP)
- Species and habitat protection

Oil sheen contributing pollutants to a catch basin connected to the stormwater system. In areas with heavy traffic, catch basins are required to have a filter that removes pollutants.

The goals of this Storm and Surface Water Master Plan are to:

- Demonstrate that stormwater is an important source of water that can be reused if controlled and managed effectively
- Lay out a plan for protecting and enhancing the quality of the City's groundwater and surface water resources
- Outline a practical, user-friendly plan for future stormwater program implementation supported by the public and City Council that will be followed by a financial analysis to determine the most appropriate funding strategy

Groundwater is the main source of drinking water for City and area residents, so it is important to keep it free of stormwater contaminants.

The objectives of this Storm and Surface Water Master Plan are to:

- Document the City's current stormwater program and funding sources and analyze existing stormwater issues and identify capital facility, maintenance, management, and public education solutions to these issues
- Reduce the potential for pollutants associated with stormwater to enter groundwater and surface water resources; incorporate water quality monitoring; and encouraging green stormwater infrastructure (GSI), infiltration, and stormwater re-use
- Anticipate impacts to water resources from growth, climate change, and future regulatory drivers
- Enhance relationships with water management partners and neighboring entities, identify the type and nature of practical management agreements needed, and promote public education and outreach and stewardship opportunities
- Align with goals of the City's Comprehensive Plan, and reclaimed water goals in the Water System Plan and General Sewer Plan
- Establish Sequim as a leader in responsible water quality and resource stewardship for the Dungeness watershed

BACKGROUND

The City currently does not have a formal stormwater management program, and is not currently bound by regulatory requirements such as the National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit. However, in recent years and with the increased focus on the importance of managing water in an area of limited water resources, the City has come to recognize that stormwater should be treated as an important resource rather than a liability. The City is in a unique position to evaluate priorities and articulate goals for a future stormwater management program because it can do this without the regulatory confines of the NPDES program.

"Only rain in the drain" is the message on this typical storm drain in the City of Sequim. Continual outreach and education are key components of a program that effectively protects water quality and the environment.

This plan provides the City with a parallel alternative to the plan requirements imposed on NPDES Phase II-regulated communities. While it covers the elements of regulatory program plans, it is customized to Sequim's unique environment, population, and needs as identified in the City's Stormwater Management Needs Assessment completed in 2014 (Sequim 2014).

The city is located in the Dungeness watershed on the North Olympic Peninsula, in the rain shadow of the Olympic Mountains, averaging just over 16 inches of precipitation per year.

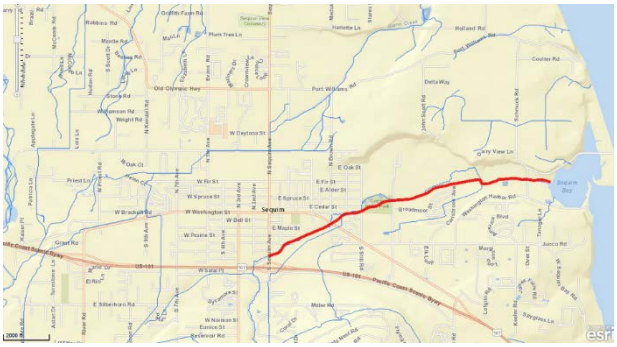
Average monthly precipitation in Sequim. Source: Washington Regional Climate Center.

The city encompasses approximately 6.5 square miles in area, including 5,359 linear feet of marine shoreline. The Urban Growth Area encompasses 8.4 square miles in area. The current city population is 6,606 (2010 census). The population of Sequim has grown by over 80 percent since 1990 and is expected to continue to grow at rates as high as 2 or 3 percent each year, which would increase the city's population to 10,000 to 13,000 by 2035.

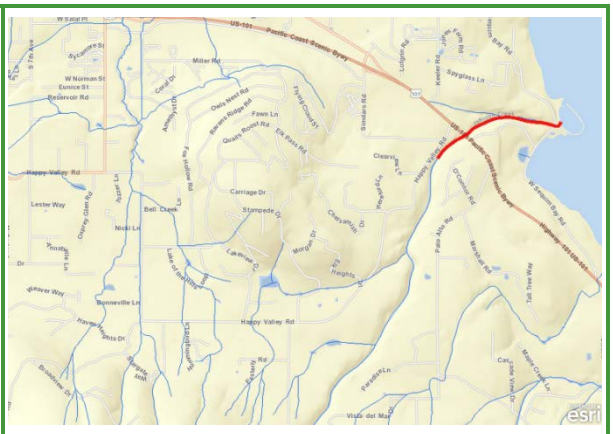
Projected annual population growth in Sequim. Source: City of Sequim DCD.

The city extends over three main drainage basins: Bell Creek Basin, Johnson Creek Basin, and Gierin Creek Basin. Small portions of the city also include areas in the Cassalery Creek Basin and the Dungeness River Basins. Ecology has included the following waterbodies on the 2012 303(d) list of impaired waters (Category 5) for the following parameters:

- The lower reaches of Bell Creek: fecal coliform bacteria, dissolved oxygen, and Benthic Index of Biological Integrity (B-IBI)
- Lower reaches of Johnson Creek: fecal coliform bacteria
- Sequim Bay: fecal coliform bacteria and dissolved oxygen



303(d) listings along Bell Creek.



303(d) listings along Johnson Creek.

In general, stormwater in the city includes runoff from private property and City-owned property within the city, as well as runoff from County property in the upland areas north and south of the city. Irrigation ditches that convey water from the Dungeness River for irrigation and stock water during summer also provide conveyance for stormwater during the wet season. In the city, privately-owned irrigation pipes and ditches converge with creeks and stormwater ditches, carrying stormwater and irrigation water across drainage basin boundaries. The City's stormwater system is composed primarily of short segments of open

ditches, pipes, and drywells/perforated pipes receiving runoff from City-owned streets, alleys, parks, and parking lots through catch basins and inlets.

Farmers in the arid and flat land in the upper portion of the Gierin Creek Basin (an area known as the Sequim Prairie) depend on water from the Dungeness River during the irrigation season (April 15 through September 15). Much of the agricultural land in the city is served either by an irrigation district or by an irrigation company. The irrigation districts and companies in the city include the Highland Irrigation District and the Sequim Prairie Tri-Irrigation Association, composed of the Independent Irrigation Company, Eureka Ditch Company, and Sequim Prairie Ditch Company.

Runoff absorbed by permeable pavement on 3rd Avenue trail near Gerhardt Park.	Typical drywell with perforations to allow street runoff to infiltrate into the ground.

The City's reclaimed water system includes the Water Reclamation Facility, approximately 4 miles of reclaimed water distribution piping, and a 28-acre Reuse Demonstration Site north of Carrie Blake Park. The reclaimed water produced at the Water Reclamation Facility is primarily used at the City Shop for truck filling, the Reuse Demonstration Site at Carrie Blake Park, irrigation of the landscaping in medians and rights-of-way (ROWs) for a portion of the downtown area, and for maintenance of Bell Creek flows.

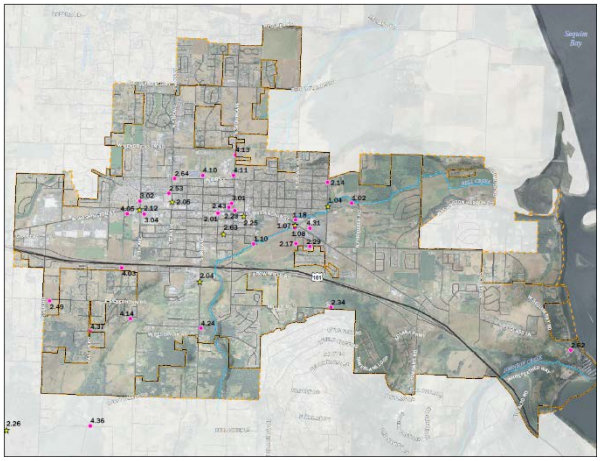
Reclaimed water spigot at the Water Reuse Park.

The City's Water Reclamation Facility off Schmuck Road adjacent to lower Bell Creek. Reclaimed water is piped back to town for irrigation and other non-potable uses.

Known Stormwater Problems and Recommended Capital Solutions

Stormwater flooding and water quality problems in the city are caused by multiple local and regional factors, including:

- Flow from upland development
- Misconnected street drains
- Flooded irrigation infrastructure
- Aging stormwater infrastructure
- Inadequate maintenance due to limited staffing and funding
- Unmanaged runoff from non-City-owned properties
- Direct stormwater discharge to surface water bodies



High priority stormwater problems and proposed capital improvement project locations within the City. Refer to Figure 6 for additional details.

Using input from the public and institutional knowledge, the City documented and mapped problem areas and identified 84 specific runoff and flooding problems in the Stormwater Management Needs Assessment. The development of the City's stormwater CIP project list builds on the stormwater problem identification and prioritization conducted for the Stormwater Management Needs Assessment. These 84 original runoff and flooding problems were placed in the following categories:

- Creek related runoff and flooding problems (17 sites)
- City-owned property runoff and flooding problems (60 sites)
- Misconnected street drain runoff and flooding problems (7 sites)

A fourth group (Non-City-Owned Properties) was added after the completion of the Stormwater Management Needs Assessment.

The higher priority problems identified by the City were further evaluated by conducting interviews with City staff and by performing field reconnaissance. Potential engineering solutions were identified to address these problems, and implementation of the solutions was prioritized based on several criteria. Project summary sheets and itemized planning level cost estimates were developed for ten projects.

This chapter is focused on resolution of flooding and water quality issues through capital project solutions rather than programmatic, or management, solutions.

STORMWATER PROGRAM EVALUATION AND RECOMMENDATIONS

Recommendations and improvements for the City's stormwater program include recommendations from the City's Stormwater Management Needs Assessment (Sequim 2014), as well as additional needs identified during the workshop and document review. Based on this assessment, the Plan makes the following high priority recommendations:

- **Capital Facilities:** Initiate a stormwater Capital Facility Program to address flooding and water quality issues within the city. The City should add stormwater projects to the City's overall CIP; Table 6 in this plan identifies priority capital projects.
- **Inspection Program**: Institute a private stormwater facility inspection program and develop and enforce maintenance standards for non-City-owned stormwater facilities. The inspection program may include development of inspection logs and plat language and private-owner education, coordination with school districts to clarify maintenance responsibilities, and improved coordination with homeowner associations and commercial landowners on shared maintenance responsibilities. Criteria and protocols for enforcement should also be developed.
- **Water Quality Compliance:** Develop and implement a pollution control plan for water bodies currently on the 303(d) list of impaired waters, surface water flow monitoring program (currently underway), and a plan to assess drywells classified as underground injection control wells (UICs). Consider monitoring to assess water quality and measure improvements over the long term resulting from stormwater management and water quality treatment of typical stormwater pollutants.
- **Species and Habitat Protection**: Participate in routine meetings of the Dungeness River Management Team (DRMT) and Water Rule implementation groups, and request smolt outmigration data from Bell Creek (and others as available) measured by the Jamestown S'Klallam Tribe (Tribe) or others.
- **Stormwater Design Guidance and Plan Review to control runoff from development during construction and post-construction:**
    - Review the 2012 Storm Water Management Manual for Western Washington (SWMMWW) (and 2014 modifications) and consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City, which may include BMPs that are most effective in protecting groundwater quality while preserving recharge.
    - Develop a consistent stormwater plan review process, which may include handouts that summarize on-site stormwater management, treatment, and flow control thresholds for when the SWMMWW applies for single-family and commercial development projects.

Outside contractor conducting a storm drain manhole inspection.	The City vactor truck and crews performing annual maintenance such as cleaning debris and jetting infiltration lines.

- **Asset Management:** Continue to update the storm system map and database as needed.
- **Stormwater System Operations and Maintenance:** Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for maintenance, add maintenance and inspection information to the storm system map in GIS, and consider hiring a seasonal worker/additional support for the catch basin inspection crew and inspecting and cleaning stormwater pipes and drywells.
- **Pollution Source Detection and Elimination:** Develop and implement a pollution source tracking program, obtain field equipment for illicit discharge tracking and source tracing, develop a system for tracking illicit discharges, develop a basic training program for City field staff, and develop a spill reporting hotline.
- **Public Education and Outreach:**
  - Develop outreach materials for residents, landscapers, and property managers/landowners, including additional guidance (e.g., fact sheets or brochures) for developers and builders on meeting the City's stormwater facility maintenance and construction requirements.
  - Attend regional meetings and conferences and participate in regional forums such as the West Sound Stormwater Managers' Coordination Group, the Sequim-Dungeness Clean Water Work Group, and the Association of Washington Cities (AWC). Continue to work toward coordination/leadership/agreements with other parties that may be necessary to achieve stormwater management/conservation goals (this may include reclaimed water and other supplies).

City of Sequim Interpretive Center at the Water Reuse Park (500 N Blake Ave).

Examining the drainage features map at the City's Stormwater Stewardship booth at the 2015 Irrigation Festival.

PLAN IMPLEMENTATION

Three tiers were evaluated for staffing, funding, and equipment needs:

A. Needed to meet minimum standards

B. Likely to be mandated

C. Proactively anticipating and reducing risk

The 2014 City budget included 1.75 full time equivalent (FTE) personnel designated to supporting stormwater activities: 0.75 FTE Operations and 1.0 FTE Capital (a temporary position). These numbers are used as the basis for the staffing recommendations presented in this plan, but may change in subsequent City budgets.

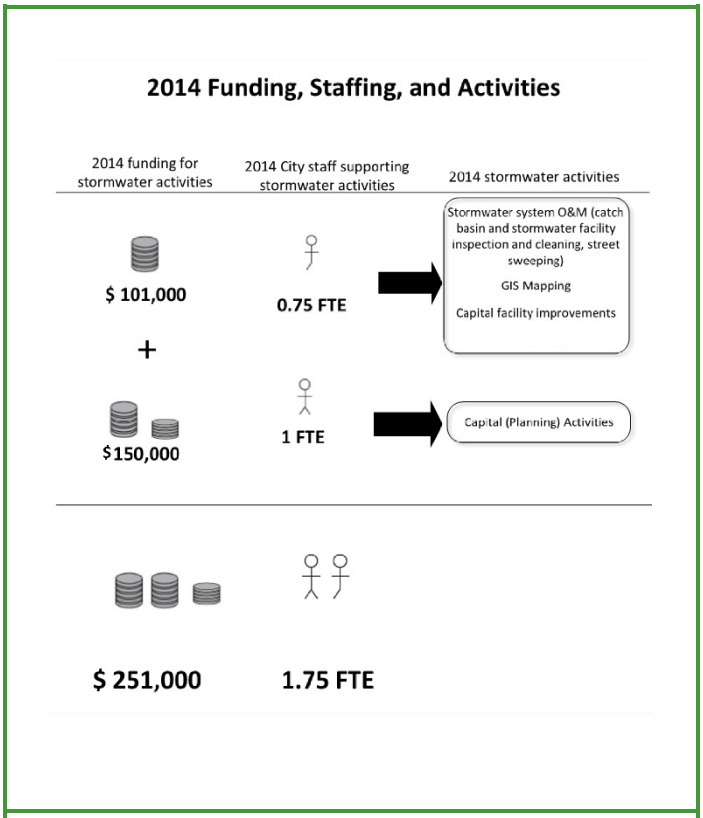
The estimated staff support indicated to be needed for each category includes the following:

- **Tier A:** 2.51 FTE permanent staff (0.75 FTE existing and 1.76 FTE additional staff)
- **Tier B:** 3.93 FTE permanent staff (0.75 FTE existing and 3.18 FTE additional staff)
- **Tier C:** 4.16 FTE permanent staff (0.75 FTE existing and 3.41 FTE additional staff)

The 2014 budget for stormwater as described above includes normal, ongoing operational activities such as stormwater system maintenance, GIS mapping, and minor capital facility improvements. An additional $75,000 was in the 2014 Capital budget for expenses related to development of a master plan. A $250,000 grant from Ecology for the Stormwater Stewardship project covers the period from July 2014 through March 2016. ($250,000 grant = 75 percent grant reimbursement of the $333,000 project cost.)

The estimated funding support needed for each category includes the following for operational as well as capital costs (note that grants will be needed for large capital expenses):

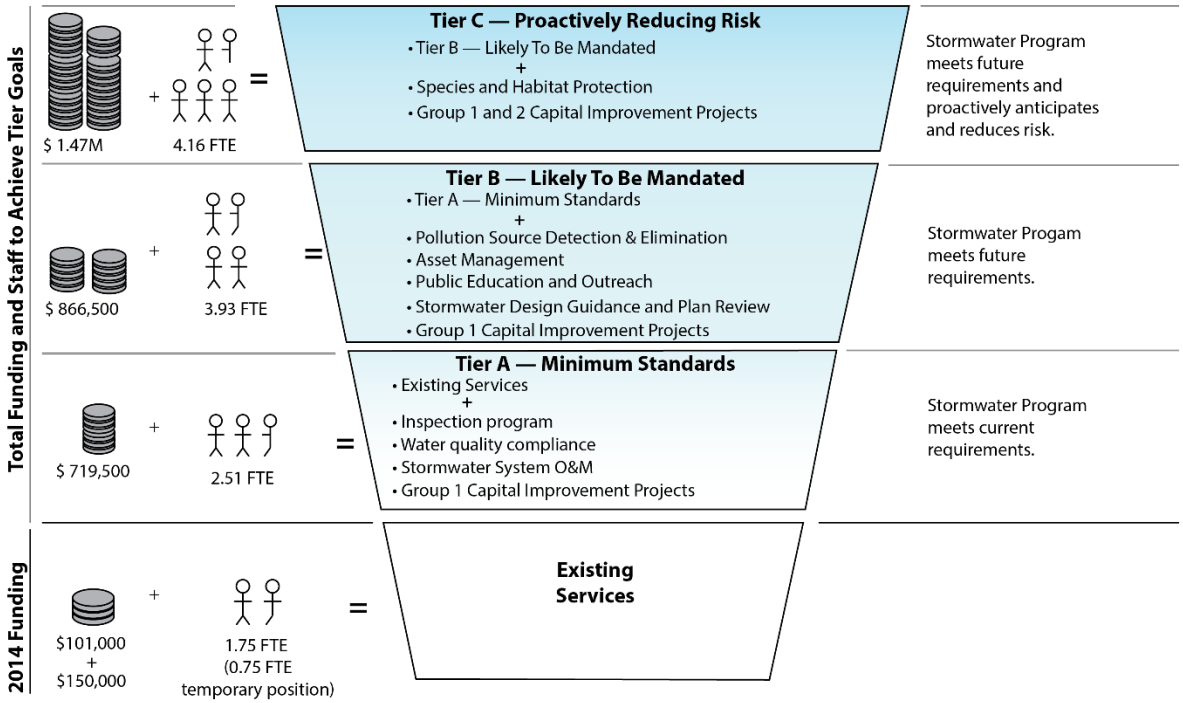
- **Tier A:** $719,500 ($101,000 existing and $618,500 additional funding)
- **Tier B:** $866,500 ($101,000 existing and $765,500 additional funding)
- **Tier C:** $1,472,500 ($101,000 existing and $1,371,500 additional funding)



Summary of 2014 Sequim stormwater program funding, staffing and activities.

Additional equipment that could be useful for maintenance, asset management, and pollution source detection inspections includes the following:

- **Tier A:** No new equipment needed
- **Tier B:** Pollution source field screening and source tracing equipment and field tablets for asset management data collection
- **Tier C:** Pollution source field screening and source tracing equipment, bioretention maintenance equipment, permeable pavement maintenance equipment



Summary of 2014 and proposed Tier A, Tier B, and Tier C Stormwater Program funding, staffing, and activities.

CONCLUSIONS

Based on discussions with City staff, Planning Commission, and City Council, the preferred approach for storm and surface water management is implementing the Tier A recommendations over the next one to three years (2016–2018) using existing resources without adding any new revenue. CIP projects will be implemented as grant and loan funding become available. City staff will report back to the City Council at the end of each year to provide an update on the activities performed during that year, activities that are planned for the upcoming year, and any changes that need to be made to increase success in terms of achievement of Tier A objectives, and impacts, if any, on other City programs. Staff will continue to seek grant and other outside funding to supplement these activities and CIP projects, while ultimately aiming toward Tier B levels of service.

CHAPTER 1 – INTRODUCTION

This section provides information on the following:

- Purpose of this Storm and Surface Water Master Plan, including the importance of managing stormwater, regulatory framework, and goals and objectives of the plan
- Overall document organization

PURPOSE OF THIS PLAN

This Storm and Surface Water Master Plan is intended to serve as a comprehensive and strategic guide to managing stormwater and surface water in the city of Sequim. This plan addresses needs identified in the Stormwater Management Needs Assessment (Sequim 2014) and includes:

- Identification of, and proposed solutions to, drainage and water quality issues
- Actions necessary to ensure compliance with applicable federal, state, and local requirements
- Actions recommended for improving and expanding capital and operational elements of the City's existing stormwater program
- Staffing and resource needs to implement the plan recommendations
- Discussion of future growth and climate change strategies
- Discussion of opportunities for interdepartmental and interagency collaboration

Importance of Managing Stormwater

Urban development typically results in an increase in the volume of stormwater runoff generated and a decline in water quality downstream. Within the City of Sequim, the native soils can handle and treat most of this stormwater runoff through the natural process of infiltration, if stormwater facilities are designed appropriately. There are some areas of the city with localized flooding or capacity issues (described in the *Known Stormwater Problems and Recommended Solutions* section of this plan), but overall, the drainage issues within the city do not create major public safety hazards. However, water quality in the city's streams, bays, and aquifers is impacted by stormwater runoff.

Through better management of stormwater with flow control and water quality treatment facilities such as ponds, wetlands, biofiltration swales, drywells, and infiltration trenches, the following benefits can be attained:

- Reduced localized flooding or ponding causing damage to streets and other property
- Reduced level of pollutants carried by stormwater (sediments, nutrients, metals, oils, and other contaminants)

- Protected fish and wildlife habitat provided by city streams
- Preservation and protection of drinking water supply (i.e., drought resilience)

Most of the stormwater in the city is managed through infiltration and therefore serves as a source of groundwater recharge. While this is a convenient and inexpensive way to manage stormwater, it does present a potential concern for protecting the quality of the city's groundwater supply. The city is unique when compared to most other cities in western Washington because of the relatively dry climate; therefore, City staff are especially concerned with conserving water resources and water resource management in the Dungeness watershed is an important focus in the area.

If stormwater structures (e.g., catch basins, ditches) and facilities (e.g., ponds, wetlands, biofiltration swales, drywells, and infiltration trenches) are not operated and maintained properly, they will fill with sediment and not perform or treat the runoff as designed. Without maintenance, the stormwater that enters these structures and facilities would bypass the facilities and cause ponding or flooding on roadways and parking lots throughout the city. Some of this water may even flow directly into city creeks, potentially resulting in water quality violations and harm to local aquatic species. Without stormwater site plan review, the City may also have facilities installed that are not sized correctly and overflows from these facilities could result in additional flow and water quality impacts.

Regulatory Framework

There are several federal and state regulations and strategic planning efforts that apply to the City's storm and surface water program. Each are summarized in detail in Appendix C including:

- State surface water quality standards (WAC 173-201A)
- Groundwater quality standards (WAC 173-200)
- Underground Injection Control (UIC) requirements
- Puget Sound Partnership (PSP) Action Agenda
- Dungeness Water Rule (WAC 173-518)
- National Flood Insurance Program (NFIP)
- Various species and habitat protection requirements (such as the Endangered Species Act, Watershed Planning Act, and Growth Management Act)
- The Sequim Municipal Code (SMC) (as it applies to the requirements listed above)

Appendix C also references evolving regulations and policies which include recent changes to the state surface water quality standards (not yet finalized) and the National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit. The City is not currently a municipal stormwater permittee; however, many stormwater program elements highlighted in the NPDES permit are beneficial for the City to consider as part of implementing its current stormwater program—and have been included in this plan as appropriate to fill Sequim's unique needs.

Master Plan Goals and Objectives

The goals of this Storm and Surface Water Master Plan are to:

- Demonstrate that stormwater is an important source of water which can be reused if controlled and managed effectively
- Lay out a plan for protecting and enhancing the quality of the City's groundwater and surface water resources
- Outline a practical, user-friendly plan for future stormwater program implementation supported by the public and City Council that will be followed by a financial analysis to determine the most appropriate funding strategy

The objectives of this Storm and Surface Water Master Plan are to:

- Document the City's current stormwater program and funding sources
- Analyze existing stormwater issues and identify capital facility, maintenance, management, enforcement, and public education solutions to these issues
- Reduce the potential for pollutants associated with stormwater to enter groundwater and surface water resources
- Encourage green stormwater infrastructure (GSI), infiltration, and stormwater re-use
- Incorporate water quality monitoring
- Anticipate impacts to water resources from growth, climate change, and future regulatory drivers
- Enhance relationships with water management partners and neighboring entities, and identify the type and nature of practical management agreements needed
- Promote public education and outreach and stewardship opportunities
- Align with goals of the City's Comprehensive Plan, and reclaimed water goals in the Water System Plan and General Sewer Plan
- Establish Sequim as a leader in responsible water quality and resource stewardship for the Dungeness watershed

A summary of goals and policies in the Citywide Comprehensive Plan related to stormwater and surface water is included in the City's Stormwater Management Needs Assessment (Sequim 2014). These goals and policies are currently being updated through the Sequim 120 Comprehensive Plan update process (Sequim 2015).

PLAN ORGANIZATION

This Master Plan includes the following chapters:

- **Chapter 2 – Background:** A discussion of background material that is relevant to the stormwater program including study area characteristics, drainage basins, existing

stormwater system, irrigation system, and reclaimed water system. This section also includes a short section on future growth, climate change, and applicable regulations.

- **Chapter 3 – Known Stormwater Problems and Recommended Solutions:** A description of citywide and site-specific stormwater problems and recommended solutions.
- **Chapter 4 – Stormwater Problem Evaluation and Recommendations:** A description of the stormwater program current activities and recommendations to meet regulatory and City code requirements as well as programmatic goals.
- **Chapter 5 – Plan Implementation:** A plan for implementation of the recommended capital improvement projects and stormwater program activities that takes into account staffing needs, resource needs, future growth, climate change, interdepartmental collaboration, and interagency collaboration.
- **Chapter 6 – Conclusions:** An abbreviated summary of the information contained in this plan.

The Master Plan appendices provide more detailed background information, calculations, and data related to the plan's recommendations:

- **Appendix A** provides a list of definitions, acronyms, and abbreviations for terminology included in the Master Plan.
- **Appendix B** describes the methods used and the people involved in development of the Master Plan. It also includes a summary of public outreach efforts conducted related to the Master Plan.
- **Appendix C** includes a summary of Underground Injection Control (UIC) regulations, water quality standards, and other applicable regulations that guide the stormwater program. It also includes a summary of the NPDES Phase II Permit requirements (for future City planning).
- **Appendix D** includes a table that summarizes all of the identified stormwater problems in the city and outlines potential solutions for these problems.
- **Appendix E** provides a quantitative CIP project prioritization table.
- **Appendix F** provides summary sheets and conceptual cost estimates for ten of the CIP projects included in the Master Plan.
- **Appendix G** contains the Regulatory Gap Analysis and Compliance Strategy Report that was developed as part of this project and which provided the basis for the information summarized in the *Stormwater Program Evaluation and Recommendations* section of the Master Plan.
- **Appendix H** contains the Water Quality Data Analysis Report that was developed as part of this project.
- **Appendix I** contains the funding strategies memorandum.

CHAPTER 2 – BACKGROUND

This section provides background information on:

- The City's current approach to stormwater management
- The physical environment in the city that affects stormwater management
- Waterbodies within the city limits
- Stormwater, irrigation, and reclaimed water systems in the city
- Climate change considerations
- A list of applicable regulations

CURRENT STORMWATER PROGRAM

The City currently does not have a formal stormwater management program, and is not currently bound by regulatory requirements such as the NPDES municipal stormwater permit. However, in recent years and with the increased focus on the importance of managing water in an area of limited water resources, the City has come to recognize that stormwater should be treated as an important resource rather than a liability. The City is in a unique position to evaluate priorities and articulate goals for a future stormwater management program because it can do this without the regulatory confines of the NPDES program.

Currently, funding for the City's limited stormwater program operations is equally shared by the City Sewer Utility and Water Utility. These utilities are restricted in the types of activities they can fund, limiting the City's ability to perform certain operational activities needed to meet stormwater program goals. The current funding approach as well as alternative funding options will be evaluated as part of the financial analysis.

Capital facility improvements are sometimes partly or fully subsidized with grant funding and new development fees. A small amount of stormwater-related communications, monitoring, and enforcement activities have been funded as needed by various other City funds (Sequim 2014).

STUDY AREA CHARACTERISTICS

The city is located in the Dungeness watershed on the North Olympic Peninsula, in the rain shadow of the Olympic Mountains, averaging just over 16 inches of precipitation per year. The city encompasses approximately 6.5 square miles in area, including 5,359 linear feet of marine shoreline (Sequim 2013a). The Urban Growth Area (UGA) encompasses 8.4 square miles in area. The current city population is 6,606 (2010 census). (Note: This plan only addresses stormwater issues within the city limits, but the UGA is included in text and figures when the UGA is relevant to stormwater management issues within the city limits.)

The City's land uses reflect blend of its small, farm town heritage and more recent influx of residential and commercial development. The city has been known as a retirement community due to its location in the rain shadow. The median age in the city is expected to remain around 60 (Sequim 2015). Single family residential development dominates the southern portion of the city south of Highway 101, while mixed use, multi-family residential, medical and professional, and commercial buildings dominate the north side of Highway 101. Parks and open space areas are found throughout the city, with the largest on the southwest and northeast corners of the city. Figure 1 depicts existing land uses in the city.

The soils in the city consist of floodplain soils, intermixed zones of glacial till, and wetland bogs (Figure 2). The majority of the city is dominated by Sequim (37 percent), Sequim-Carlsborg (19 percent), and Hoypus (3 percent) soils; these are floodplain soils that formed in coarse textured alluvium or glacial outwash that have high infiltration capacities. These soils are generally most suitable for stormwater infiltration applications. The remainder of the mapped soils in the city include, Yeary (21 percent), Clallam (17 percent), Catla (2 percent), and Beaches (1 percent); these are sandy or silty soils characterized by low permeability and relatively high runoff potential. These are less suitable for stormwater infiltration applications.

Sensitive groundwater areas in the city include Wellhead Protection Areas (WHPAs) and Critical Aquifer Recharge Areas (CARAs). The City Water System Plan (Sequim 2013b) defines a WHPA as the surface and subsurface area surrounding a groundwater source through which potential contamination can travel and eventually reach the source. WHPAs are based on Zones of Contribution (ZOCs) derived from the time of travel required for a contaminant to move from the point of introduction into the water bearing formation to the drinking water source, and are used to identify the area of influence around each drinking water well, and where land use management can help to reduce the risk of contamination. CARAs are defined as "areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge" (WAC 365-190-030). Because WHPAs identify areas where land use is carefully regulated to avoid contamination of drinking water, groundwater in these areas should already be protected. Future development in WHPAs and CARAs through land use and activity regulation is defined and enforced through SMC 18.80. A majority of the city is designated as a High Aquifer Recharge Area. These protected areas constitute the following percentage of the city and are shown in Figure 3:

- **Wellhead Protection Areas (WHPAs)** – 27 percent
- **Critical Aquifer Recharge Areas (CARAs)** – 58 percent

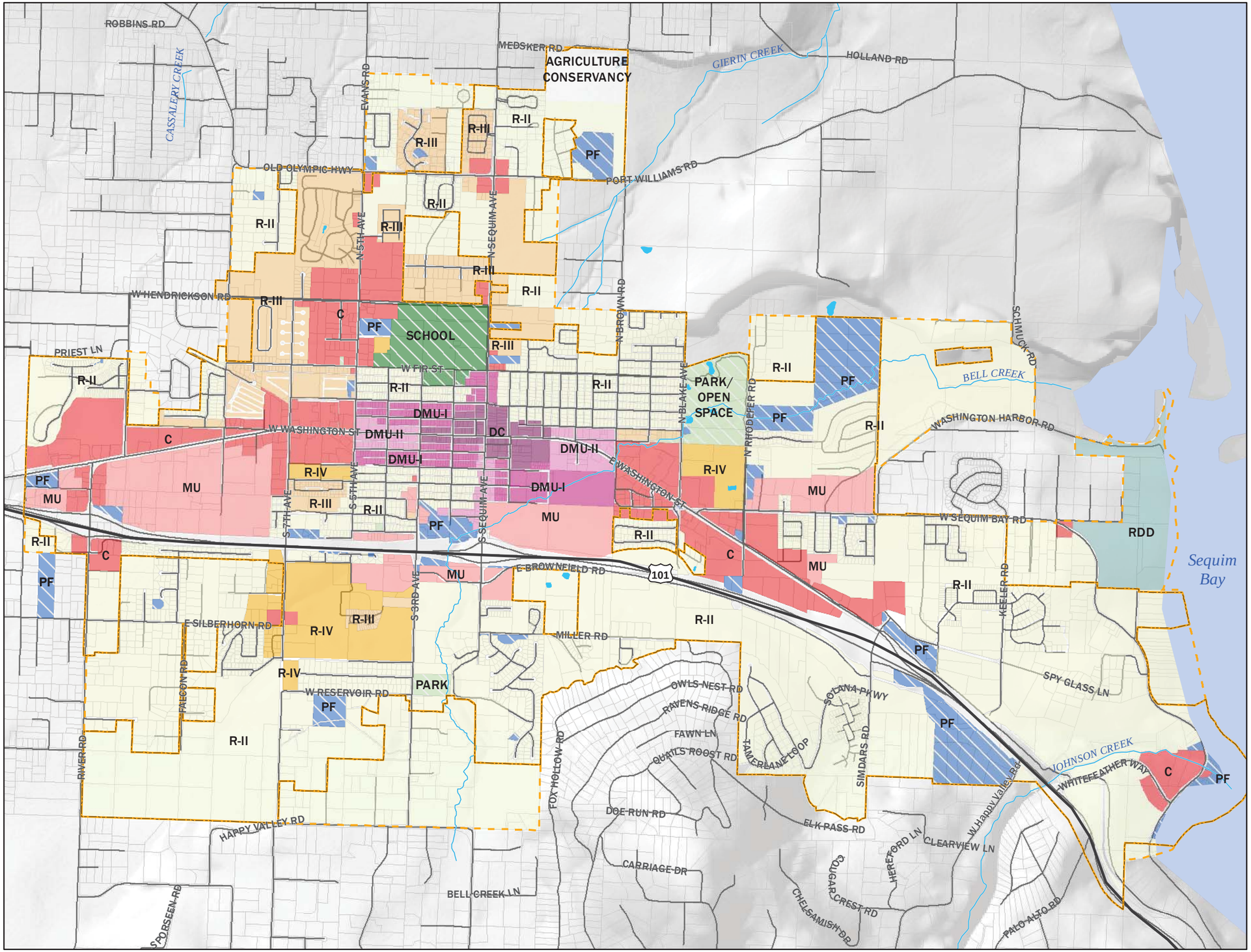


Figure 1.
Existing Land Use
in the City of Sequim.

Legend

- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Pond
- Highway
- Road

Land Use

- DC - Downtown Core
- DMU-I - Downtown Mixed Use I
- DMU-II - Downtown Mixed Use II
- C - Commercial
- MU - Mixed Use
- RDP - Research and Development Park
- PF - Public Facility/ Government Owned Parcel
- School
- Park/Open Space
- R-II - Residential
- R-III - Residential
- R-IV - Residential

Note: Land use data from the 2006 City of Sequim Comprehensive Plan.

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HERRERA

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Washington State Plane North FIPS 4601 Feet

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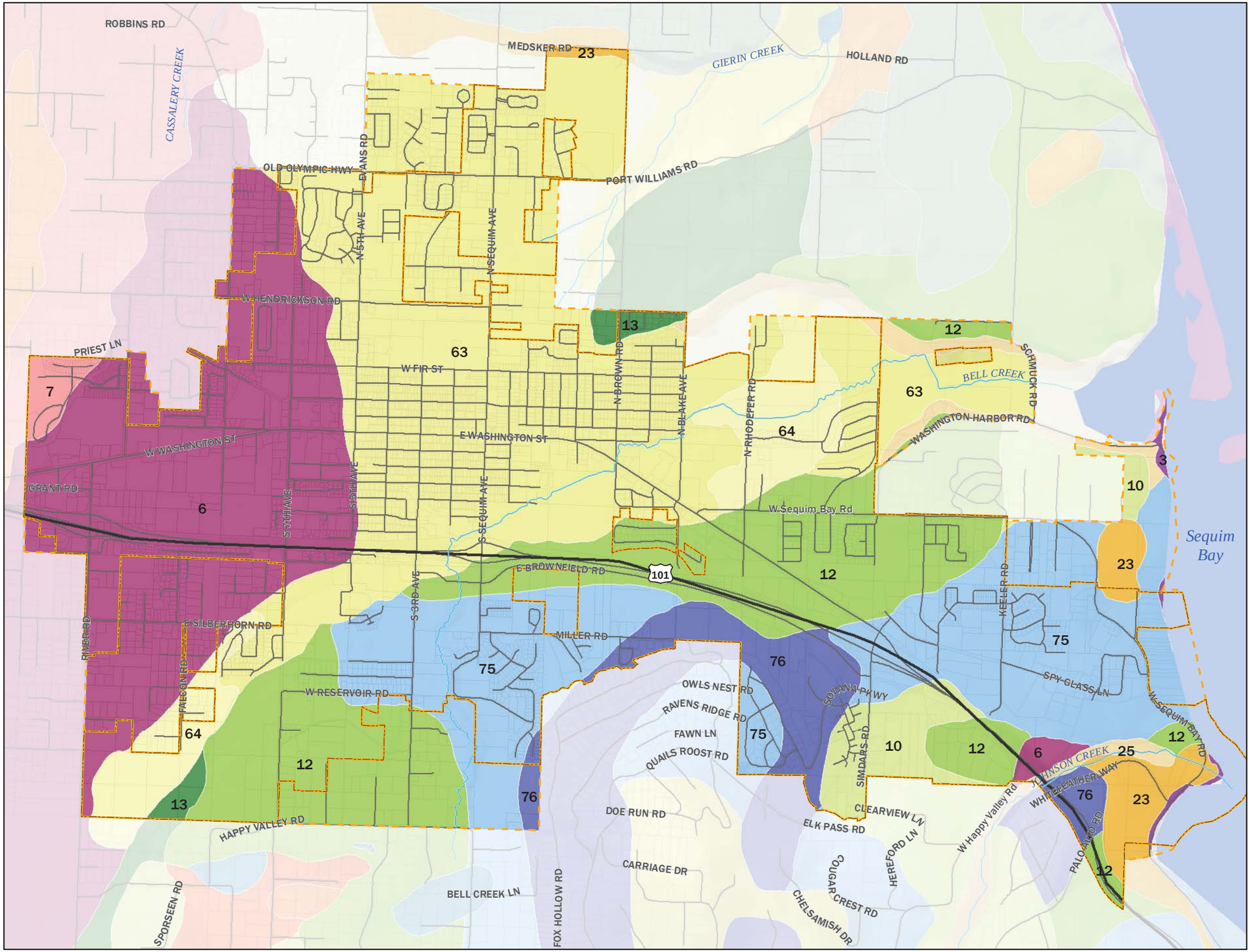

Figure 2.
Hydrologic Soil Groups
in the City of Sequim and UGA.

Legend

- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Road
- Highway

Soil Type

Rapid Infiltration-Floodplains Soils

- Carlsborg gravelly sandy loam, 0 to 5 percent slopes (6)
- Carlsborg-Dungeness complex, 0 to 5 percent slopes (7)
- Hoypus gravelly sandy loam, 0 to 15 percent slopes (25)
- Hoypus gravelly loamy sand, 30 to 65 percent slopes (23)
- Sequim very gravelly sandy loam (63)
- Sequim-McKenna-Mukilteo complex (64)

High Runoff-Glacial Till, Clay Soils

- Catla gravelly sandy loam, 2 to 15 percent slopes (10)
- Clallam gravelly sandy loam, 0 to 15 percent slopes (12)
- Clallam gravelly sandy loam, 15 to 30 percent slopes (13)
- Yeary gravelly loam, 0 to 15 percent slopes (75)
- Yeary gravelly loam, 15 to 35 percent slopes (76)

Others

- Beaches (3)

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USDA, Soils (2013)

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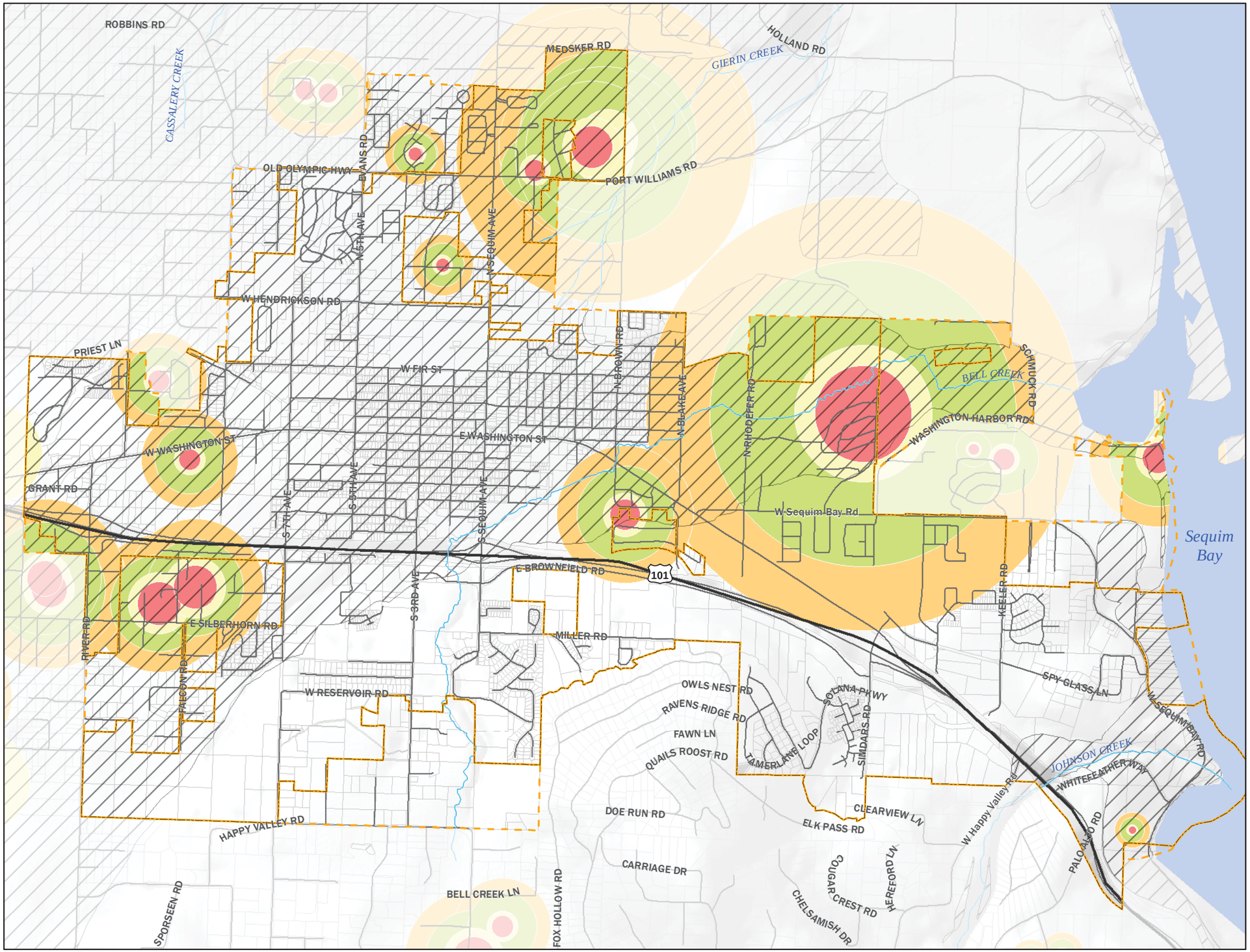

Figure 3.
Critical Aquifer Recharge Areas (CARA) and Well-head Protection Areas (WHPA) in the City of Sequim and Clallam County.

Legend

- Critical Aquifer Recharge Area (as defined by Clallam County)

WHPA

- 6 months
- 1 year
- 5 year
- 10 year
- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Road
- Highway

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Washington State Plane North FIPS 4601 Feet
Clallam County, CARA (2004)

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DRAINAGE BASINS

Sequim extends over three main drainage basins: Bell Creek Basin, Johnson Creek Basin, and Gierin Creek Basin. Small portions of the city also include areas in the Cassalery Creek Basin and the Dungeness River Basins. The drainage basin size and land cover composition based on data from the National Land Cover Database (NLCD) are summarized in Table 1 (NLCD 2011). The drainage basin boundaries are depicted on Figure 4.

Table 1. Drainage Basin Size and Land Cover for Basins Located Within the City of Sequim.

	Bell Creek	Johnson Creek	Gierin Creek	Cassalery Creek	Dungeness River
Total Area (square miles)	7.4	6.3	5.3	3.5	48.9
Basin Area Within City Limits	40%	14%	35%	4%	0.37%
City Area Within Basin[a]	46%	15%	29%	2.4%	2.9%
Land Cover (% of total basin)					
Developed, high intensity and medium intensity	16%	5%	26%	27%	8%
Developed, low intensity and open space	16%	7%	21%	16%	5%
Barren[c]	0%	1%	1%	0%	0%
Forest[d]	23%	43%	12%	4%	55%
Shrub/scrub[e]	2%	16%	0%	0%	10%
Herbacious[f]	1%	3%	2%	0%	2%
Planted/Cultivated[g]	39%	22%	29%	51%	14%
Wetlands[h]	2%	1%	6%	1%	4%
Water[i]	0%	2%	0%	0%	0%

Land cover category descriptions:

[a] The remaining 4.7 percent of the city drains to two unnamed basins (2.5 percent) and the West Happy Valley sub-watershed (2.2 percent).

[b] Developed areas category includes low intensity, medium intensity, and high intensity development.

[c] Barren areas are characterized by bare rock, gravel, sand, silt, clay, or other earthen material, with little or no vegetation present.

[d] Forest areas are characterized by tree cover where the tree canopy accounts for 25% to 100% of the cover. This category includes deciduous, evergreen, and mixed forest.

[e] Shrub/scrub areas are characterized by natural or semi-natural woody vegetation with aerial stems.

[f] Herbaceous areas are characterized by natural or semi-natural herbaceous vegetation. This category includes grassland/herbaceous and sedge/herbaceous.

[g] Planted/Cultivated areas are characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber. This category includes pasture/hay and cultivated crops.

[h] Wetlands are areas that are characterized by soil or substrate that is periodically saturated with or covered with water. This category includes woody wetlands and emergent herbaceous wetlands.

[i] Water includes open water and perennial ice/snow cover.

Multiple locations within the Bell Creek, Johnson Creek, and Gierin Creek drainage basins have been monitored for water quality in recent years (Appendix H). Some of this water quality data has been used as part of the state's official water quality assessment submitted

to EPA. For this process Ecology groups waterbodies into five categories according to their level of impairment. These categories are:

- Category 1 (meets tested standards for clean waters)
- Category 2 (waters of concern)
- Category 3 (insufficient data)
- Category 4:
  - Category 4a (has a water cleanup plan, or TMDL)
  - Category 4b (has a pollution control program)
  - Category 4c (is impaired by a non-pollutant)
- Category 5 waterbodies have known water quality impairments and have exceeded water quality standards for one or more pollutants. All Category 5 waterbodies are included on the State's 303(d) list and the list is submitted to EPA. Total Maximum Daily Load (TMDLs) or water cleanup plans are required for all waterbodies identified on the 303(d) list. The most recent 303(d) list was approved by the EPA in 2012; however, the list is revised periodically and Ecology is currently finalizing the new list.

Bell Creek Drainage Basin

The Bell Creek drainage basin is bordered on the north by the Gierin Creek drainage basin and on the south by the Johnson Creek drainage basin (Figure 4). Bell Creek flows a total of 3.8 miles from the uplands of Happy Valley, where it receives runoff from Bell Hill and Burnt Hill, through the eastern portion of the City, and discharges to Washington Harbor at the north end of Sequim Bay (Elwha-Dungeness Planning Unit 2005). The total drainage basin area for Bell Creek is approximately 7.4 square miles, 40 percent of which is located within the city limits. Approximately 32 percent of the drainage basin is comprised of urban and rural development based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (39 percent), forest (23 percent), and shrub/scrub (2 percent).

Until recently, the middle and lower reaches of Bell Creek were supplemented with irrigation water from the Dungeness River for the Highland Irrigation District for the duration of the irrigation season through a spillway near Bell Creek's canyon and ditches in the west Happy Valley drainage area (also referred to as the West Fork of Bell Creek) (Sequim 2014). Now, Bell Creek is considered an ephemeral stream fed primarily by groundwater and by stormwater. Without supplementation with Dungeness River flow, the middle reaches of Bell Creek are dry during the summer months. The Highland Irrigation District maintains a separate irrigation system that, in the summer, conveys Dungeness River water as far east as Sequim Bay in both open ditch and piped segments, which cross or discharge to Bell Creek at multiple locations, with tail water discharging to Johnson Creek. In the winter, the irrigation system conveys a relatively small amount of Dungeness River water during dry weather, and intercepts runoff from west of the Bell Creek drainage basin into Bell Creek or Johnson Creek during wet weather (when the head gate at the Dungeness River is shut). The Sequim Prairie Tri-Irrigation Association also maintains a separate irrigation system of pipes and ditches, some of which discharge runoff and/or irrigation tail water to Bell, Gierin, and Cassalery Creeks.

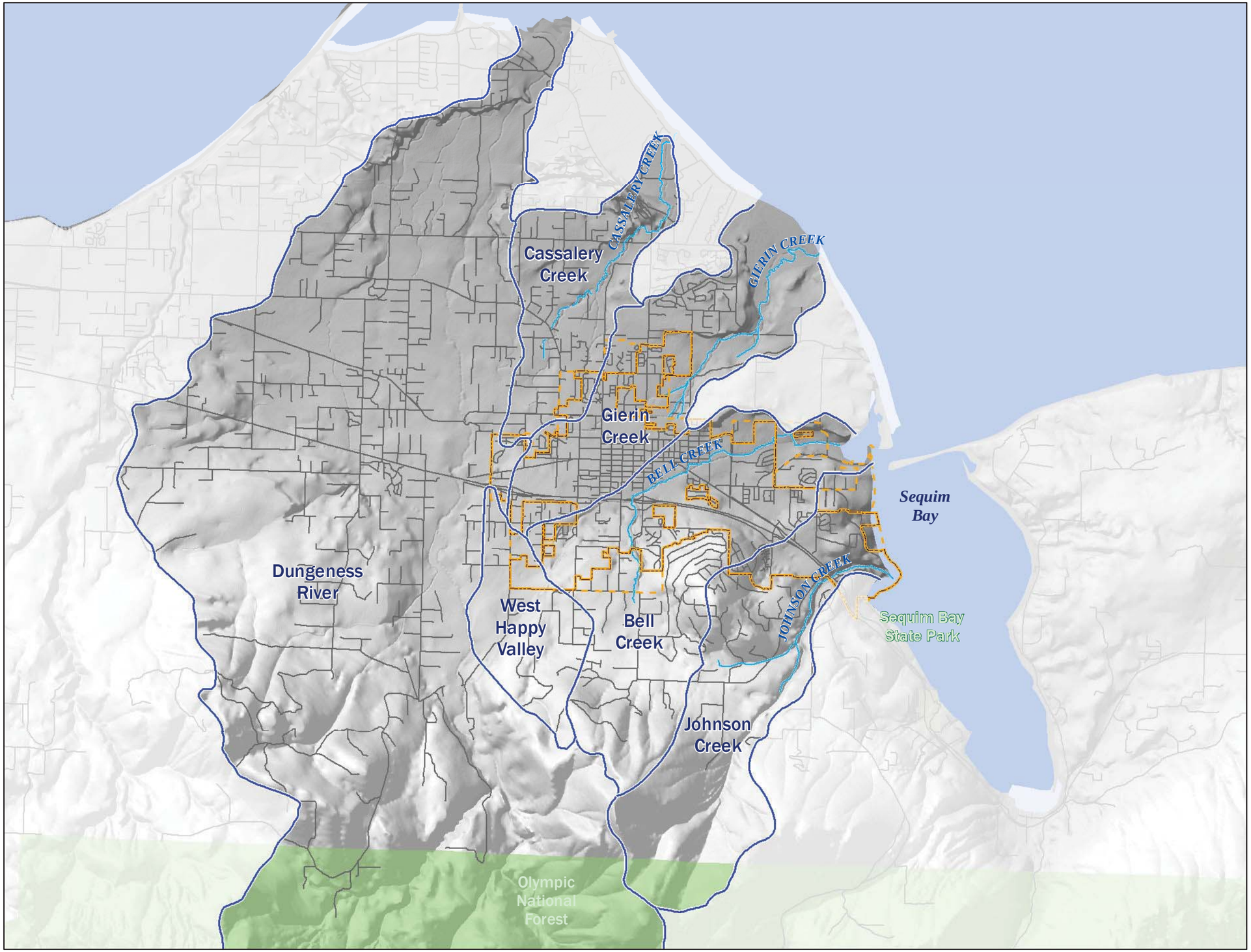

Figure 4.
Drainage Basins
Surrounding the City of Sequim.

Legend

- Subbasin
- City limit
- Urban Growth Area (UGA)
- Stream
- Road
- National Park
- State Park

Note: Dungeness River subbasin is approximate.

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The Jamestown S'Klallam Tribe monitors Coho, steelhead, and cutthroat salmon outmigration in Bell Creek, and federal assessments designate most of Bell Creek from the mouth to the crossing of the Highland Irrigation canal as critical habitat for threatened/endangered bull trout (USFWS 2010). A critical habitat designation is also proposed for Puget Sound steelhead in Bell Creek (NOAA 2013). Ecology has included the lower reaches of Bell Creek on the 303(d) list of impaired waters (Category 5) for fecal coliform bacteria, dissolved oxygen, and Benthic Index of Biological Integrity (B-IBI).

The data analyzed in the Water Quality Data Analysis Report (Appendix H) shows a documented declining trend in B-IBI scores in Bell Creek over time as well as distance downstream, presenting evidence of poor water quality. There is also some evidence of elevated nutrient concentrations (e.g., dissolved nitrate+nitrite nitrogen and total phosphorus), elevated dissolved copper concentrations, and likely sources of fecal coliform bacteria. Insufficient data were available to make a meaningful assessment for temperature, total arsenic, total chromium, dissolved lead, or sediment quality. Recommendations for additional monitoring in the Bell Creek drainage basin are summarized in the *Plan Implementation* section.

Johnson Creek Drainage Basin

The Johnson Creek drainage basin is bordered on the northwest by Bell Creek basin and on the southeast by an unnamed drainage basin in Clallam County (Figure 4). Johnson Creek drains eastern portions of Bell Hill, Happy Valley, Burnt Hill, and county areas that drain directly to the Highland Irrigation canal (which empties into Johnson Creek at RM 1.5). The stream enters the city just upstream of SR 101, runs along the eastern edge of the city, and discharges into Sequim Bay just south of Pitship Point (John Wayne Marina). The total drainage basin area for Johnson Creek is approximately 6.3 square miles, 14 percent of which is located within the city limits. Approximately 11 percent of the drainage basin is developed based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (22 percent) and forest (44 percent).

Johnson Creek is considered suitable habitat for salmonids and is designated critical habitat for bull trout by the United States Fish and Wildlife Service (USFWS 2010). A critical habitat designation is also proposed for Puget Sound steelhead in Johnson Creek (NOAA 2013). Ecology has included the lower reaches of Johnson Creek on the 303(d) list of impaired waters (Category 5) for fecal coliform bacteria.

The data analyzed in the Water Quality Data Analysis Report (Appendix H) shows a documented declining trend in B-IBI scores in Johnson Creek with distance downstream; however, it is not as notable as what has been observed in Bell Creek. Limited fecal coliform bacteria sampling performed in Johnson Creek in 2010 did not show any exceedances of the single event criterion. Recommendations for additional monitoring in the Johnson Creek drainage basin are summarized in the *Plan Implementation* section.

Gierin Creek Drainage Basin

Gierin Creek basin is a small drainage basin, bordered on the south by Bell Creek basin and in the northwest by the Cassalery Creek basin (Figure 4). A large portion of what is known as

Sequim Prairie comprises the upper Gierin Creek Basin. Sequim Prairie is characterized by flat topography, gravelly soils, and arid climate. Gierin Creek's natural channel rarely has base flow within the city limits. The total drainage basin area is approximately 5.3 square miles, 35 percent of which is located within the city limits where drainage either infiltrates or is controlled by irrigation and SR 101 infrastructure. Approximately 49 percent of the drainage basin is developed based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (29 percent), forest (13 percent), and wetlands (6 percent).

Gierin Creek is supplemented directly by Dungeness River water conveyed through the city in irrigation ditches during the summer, and receives stormwater (through sheet flow and stormwater roadside ditches) carried in these irrigation ditches during the winter. Groundwater recharge in this basin is of particular importance, since a portion of the basin (6 percent) is comprised of wetlands that are fed by groundwater (Sequim 2014). Gierin Creek is not included on the 303(d) list of impaired waters (Category 5). No fish habitat has been identified in the Gierin Creek basin within the city or its UGA; however, fish utilization of the channel within the city limits has been reported (Stocker testimony, July 7, 2015).

In-stream monitoring data were not available for the main stem of Gierin Creek; however, there is some fecal coliform data for Eureka Ditch (tributary to Gierin Creek). As summarized in the Water Quality Data Analysis Report (Appendix H), this ditch has elevated fecal coliform concentrations during storm events.

Cassalery Creek Drainage Basin

Cassalery Creek is small independent drainage in the northwest portion of the Sequim Prairie that enters saltwater between Sequim Bay and the Dungeness River (Figure 4). Cassalery Creek is primarily fed by groundwater discharge from the north slopes of the Olympic Mountains (Pacific Groundwater Group 2008). The total drainage basin area for the Cassalery Creek is approximately 3.5 square miles, 4 percent of which is located within the city limits. Approximately 51 percent of the drainage basin is planted/cultivated areas based on data from the NLCD with the remainder of the drainage basin comprised of developed areas (43 percent), forest (4 percent), and wetlands (1 percent). Cassalery Creek may receive upland runoff from the county and city, but irrigation ditches run parallel and likely intercept any runoff, carrying it further east (Sequim 2014).

Dungeness River Drainage Basin

The Dungeness River drains a watershed of 270 square miles into the Strait of Juan de Fuca. Streams and tributaries that make up the watershed come to a total of 546 miles, the largest of which are the Grey Wolf River and Canyon Creek. The Dungeness River watershed cuts steeply through the high mountains of the Olympics, largely protected in National Park and Forest lands, emerging to the north in a flatter, broad lowland plain in the lower Sequim-Dungeness valley, and emptying into the Dungeness Bay (Elwha-Dungeness Planning Unit 2005). The total drainage basin area for the Dungeness River is approximately 48.9 square miles, 0.37 percent of which is located within the city limits. Approximately 55 percent of the drainage basin is comprised of forest, based on data from the NLCD, with the remainder of the drainage basin primarily comprised of planted/cultivated areas (14 percent), developed areas (13 percent), and shrub/scrub (10 percent). The Dungeness River would receive upland

runoff from the county and city except that it mostly infiltrates; in addition, several irrigation ditches run parallel and likely intercept runoff, carrying it north and east (Sequim 2014).

West Happy Valley Drainage

The west Happy Valley drainage area flows into what was once referred to as the West Fork of Bell Creek. The west Happy Valley area drains the north slope of Burnt Hill and west Happy Valley, elevated areas just south of the city. Runoff from these areas flows east into Bell and Johnson Creek basins and north to Gierin Creek basin through irrigation ditches and some roadside ditches. Irrigation ditches managed by the Highland Irrigation District (HID) or the Sequim Prairie Tri-Irrigation Association (SPT) run north and north-east across the drainage area. Irrigation ditch water historically entered Bell Creek just south of Highway 101; however, currently no continuous channel connects the irrigation ditches to Bell Creek at this location (Sequim 2014).

This area was subjected to flood irrigation historically, but over time has become more developed, with several ranches and large lots in the county and moderate-density subdivisions within the city limits. The uppermost layer of soil in this area is highly porous and has rapid infiltration, but is underlain by a shallow till or non-porous material (Sequim 2014). During the summer, the irrigation ditches convey irrigation water from the Dungeness River through the city. During the winter, when tendency for flooding in the area is high, runoff flows from West Happy Valley and Burnt Hill through roadside ditches and into the irrigation ditches. The irrigation ditches convey the stormwater flows efficiently until reaching the urban city area, where excess flows overwhelm the capacity of the downstream culverts and stormwater system (Sequim 2014).

EXISTING STORMWATER SYSTEM

In general, stormwater in the city includes runoff from private property and City-owned-property, as well as runoff from County property in the upland areas surrounding the city. Stormwater runoff from these areas is conveyed through the city in irrigation ditches, and through stormwater roadside ditches. The City's stormwater system is composed primarily of short segments of open ditches, pipes, and drywells/perforated pipes (Table 2) receiving runoff from City-owned streets, alleys, parks, and parking lots through catch basins and inlets.

There are also large sections of the city that have no curbs, gutters, or drains. Rainfall infiltrates in the right-of-way (ROW) or on private property, and then flows downhill to the nearest catch basin or inlet. Infiltration facilities primarily discharge to the ground instead of as discrete outfalls to streams, rivers, and lakes. This is distinctly different from most of the urban stormwater conveyance networks in western Washington that largely rely on a combination of underground stormwater pipes, catch basins, and conveyance ditches leading to stormwater outfalls that discharge to surface waters. The Sequim's stormwater system is more similar to a majority of eastern Washington cities. The City also has several publicly owned and operated water quality treatment and flow control facilities including biofiltration swales, detention/retention ponds, and stormwater vaults. Stormwater ponds are maintained as a stormwater facility not a wetland, based on City code, even if they have the characteristics of a wetland. Public and private stormwater facilities are summarized in Table 2 (as documented to date).

Stormwater that is not infiltrated, either due to the lack of stormwater management facilities or poorly infiltrating soils, discharges through irrigation ditch, sheet flow, or interflow (i.e., subsurface groundwater flow) into Bell Creek, Johnson Creek, or Gierin Creek (described in the *Drainage Basins* section). A map showing the current documentation of the City's stormwater system, including irrigation conveyances, is provided in Figure 5.

Table 2. Summary of the City of Sequim Stormwater System.

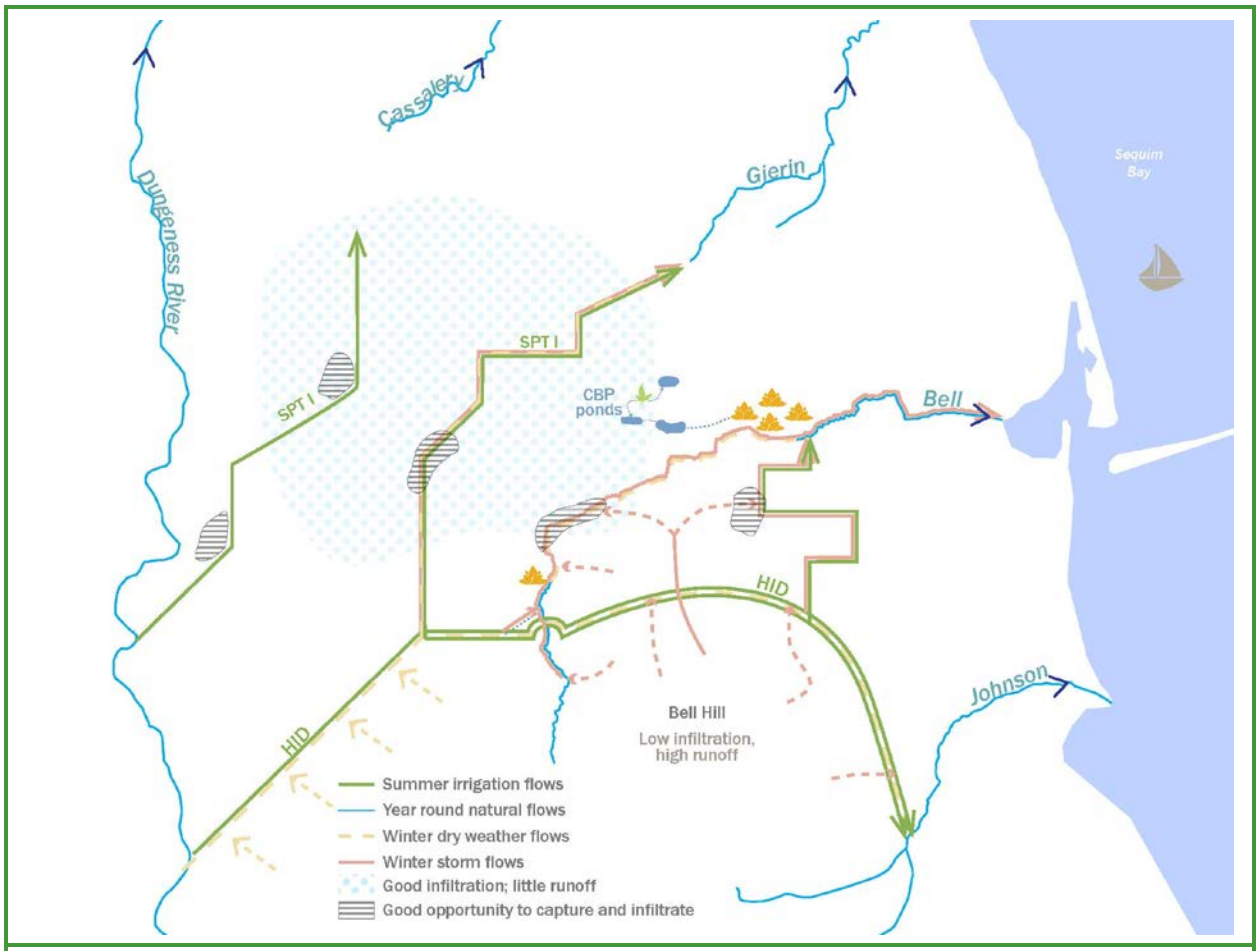
Item	Quantity	Units	Notes
Catch basin or inlet	1,018	each	
Drywell	153	each	Class V UIC
Oil-water separator	NA	each	113 installed for sewer system
Filter	2	Each	Private facilities
City stormwater perforated pipe drain field	169	sites	
City stormwater culvert ditch or stream	66	miles	
Pervious pavement	5	sites	
Biofiltration swale	18	each	
Detention/Retention Pond	43	each	
Flow Control	11	each	Usually overflow from a pond
Roadside ditch	~50	miles	
Stormwater curb and gutter	~80	miles	

Source: Sequim 2014

Irrigation System

Farmers in the arid and flat land in the upper portion of the Gierin Creek Basin (an area known as the Sequim Prairie) depend on water from the Dungeness River during the irrigation season (April 15 through September 15). Much of the agricultural land in the city is served either by an irrigation district or by an irrigation company. In fact, irrigation is so important to the city that it is celebrated during the annual Irrigation Festival in May that marks the lifting of the first head gate on the Dungeness River in 1896.

The irrigation districts and companies in the city include the Highland Irrigation District and the Sequim Prairie Tri-Irrigation Association, composed of the Independent Irrigation Company, Eureka Ditch Company, and Sequim Prairie Ditch Company. The Highland Irrigation District occupies the southern portion of the city and carries approximately 4 to 10 cubic feet per second (cfs) of water from the Dungeness River during the irrigation season, while the Sequim Prairie Tri-Irrigation Association occupies the northern portion of the city (refer to Figure 5 for the irrigation district basins within the city).



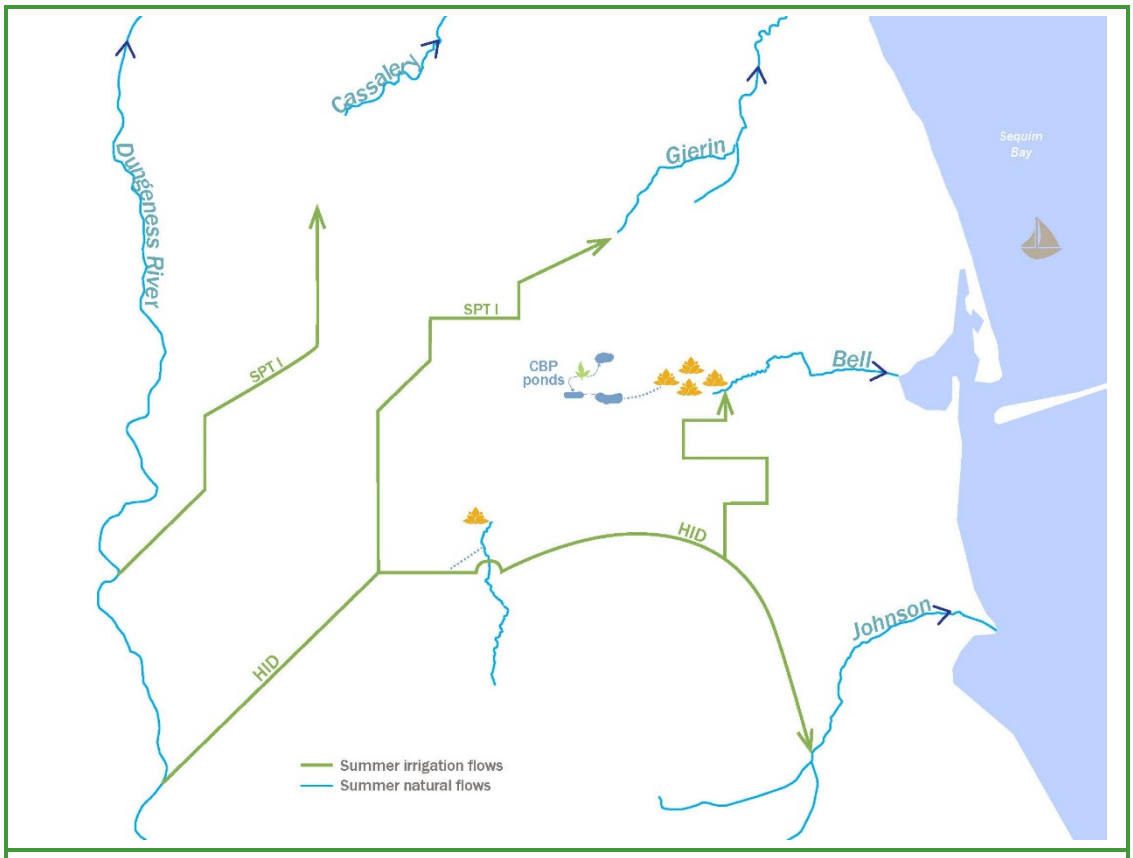
Stormwater, irrigation, and creek flows and groundwater recharge opportunities.

Irrigation ditches that convey water from the Dungeness River for irrigation and stock water during summer also provide conveyance for stormwater during the wet season. In the city, privately-owned irrigation pipes and ditches converge with creeks and stormwater ditches, carrying stormwater and irrigation water across drainage basin boundaries. The Highland Irrigation main canal intercepts subsurface groundwater flows and stormwater in the Bell Creek Basin and conveys these flows east to the Johnson Creek Basin. The Highland Irrigation system supplements the middle reach of Bell Creek intermittently with irrigation flows (Dungeness River water) throughout the irrigation season, and with stormwater during the rainy season. The Sequim Prairie irrigation ditches supplement flows in Gierin Creek in a similar manner. The Highland Irrigation main canal empties into Johnson Creek outside of the city limits (Sequim 2014). The irrigation system within the city is summarized in Table 3.

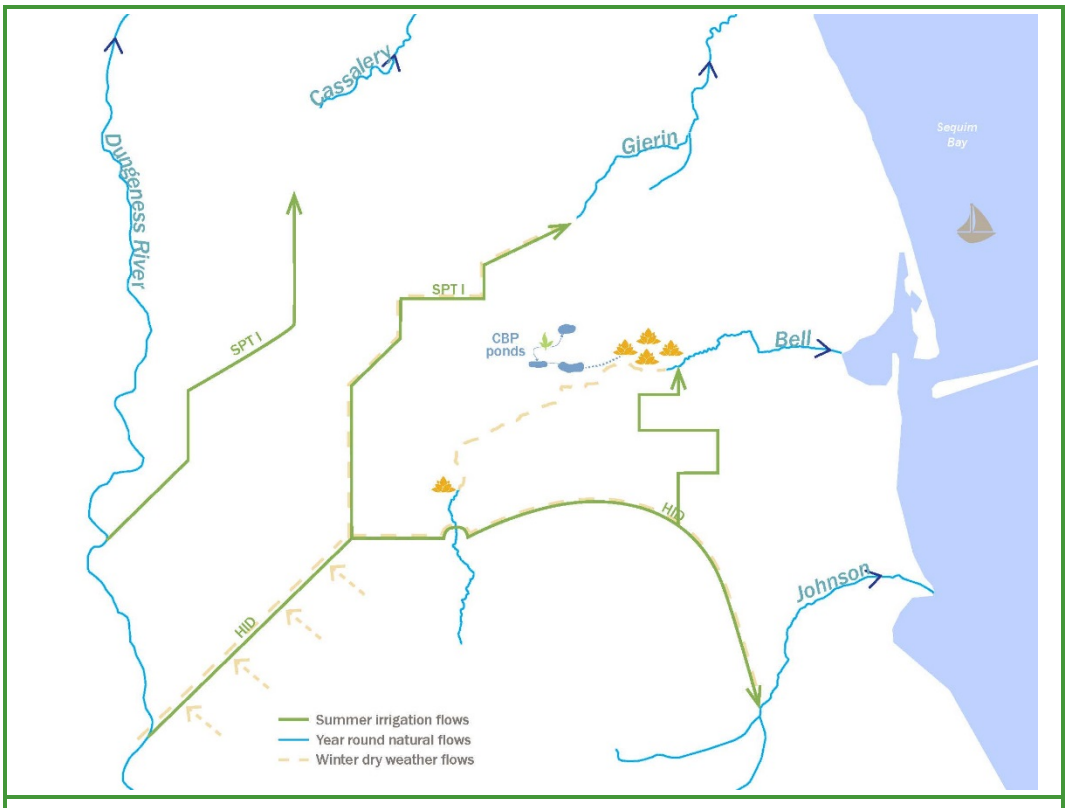
Table 3. Summary of the Irrigation System in the City of Sequim.

Item	Quantity	Units
Irrigation ditch (open, mostly unlined)	18.1	miles
Irrigation pipe[a]	17.4	miles
Total	**35.5**	**miles**

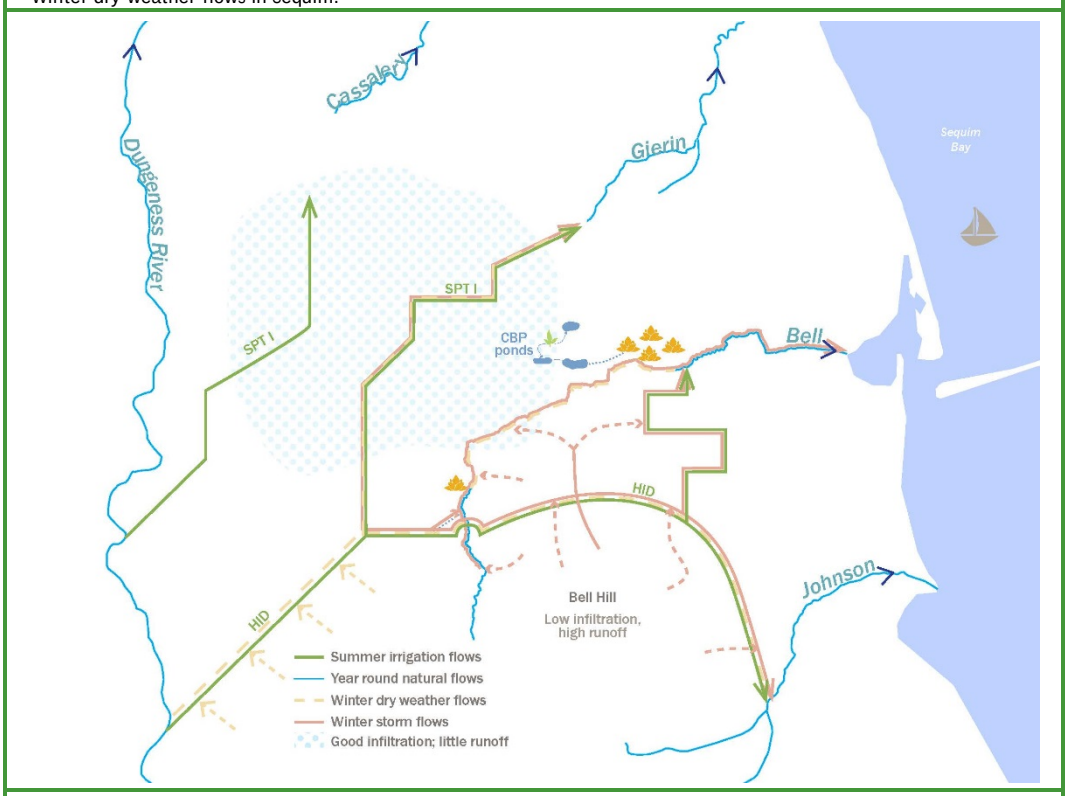
[a] Source: GIS data from City and Conservation District.



Summer irrigation and creek flows in the city of Sequim.



Winter dry-weather flows in Sequim.



Winter storm flows in Sequim.

RECLAIMED WATER SYSTEM

Most of the stormwater in the city is managed through infiltration and therefore serves as a source of groundwater recharge. While this is a convenient and inexpensive way to manage stormwater, it does present a potential concern for protecting the quality of the city's groundwater and drinking water supply. While the city's Port Williams well field is very deep and well protected from surface contamination, hundreds of private and smaller public wells are potentially at risk for contamination. City staff are especially concerned with conserving water resources due to the relatively dry climate and the focus on resource management in the Dungeness watershed.

The City's water conservation program has developed over time in response to updated State regulations. In 1995, the City developed a water conservation program based on the 1994 Conservation Planning Requirements, which was documented in the City's Water System Plan (Sequim 2013b). In 1997, the City received $3.4 million from the Washington State Legislature to implement its reclaimed water program (Sequim 2013c). Between 1997 and 1998, the City upgraded its secondary wastewater treatment facility to a Water Reclamation Facility (WRF) that produces Class A reclaimed water and Class A biosolids from the wastewater.

Today, the City's reclaimed water system includes the Water Reclamation Facility, approximately 4 miles of reclaimed water distribution piping, and a 28-acre Reuse Demonstration Site north of Carrie Blake Park (Sequim 2013c). The reclaimed water produced at the Water Reclamation Facility is primarily used at the City Shop for water truck filling, at the Reuse Demonstration Site at Carrie Blake Park, irrigation of the landscaping in medians and ROWs for a portion of downtown area, and for maintenance of Bell Creek flows.

The 2000 Water System Plan set a 20-year goal of reducing average yearly water demand by 15 percent, and reducing peak day demand by 15 percent. By 2006, the City was using approximately 20 percent of its reclaimed water for City projects. In the 2008 Water System Plan, the water conservation plan was revised to address the implementation of the Municipal Water Law. The 2008 Plan set a goal of reducing the water systems water use per equivalent residential unit (ERU) by 10 percent over a 10-year period, by increasing utilization of the reclaimed water produced at the Water Reclamation Facility. In the 2013 Water System Plan, the City retained the 2008 goal of reducing the water use per ERU value by 10 percent over the next 10 years, and added a goal of reducing the distribution system leakage (DSL) by 10 percent over the next 6 years, as required by the Department of Health (DOH) (Sequim 2013b).

Today, the City has goals of maximizing reuse of the reclaimed water, a reduction in potable water use for irrigation, and overall improvement to the Dungeness River Watershed (Sequim 2013c). Future uses for reclaimed water that will help the City achieve their reclaimed water program goals include supplementation of aquifer recharge areas, landscape irrigation, additional expansion of existing commercial use, additional City non-potable water use, and additional augmentation of Bell and Gierin Creeks and the Dungeness River (Sequim 2013c).

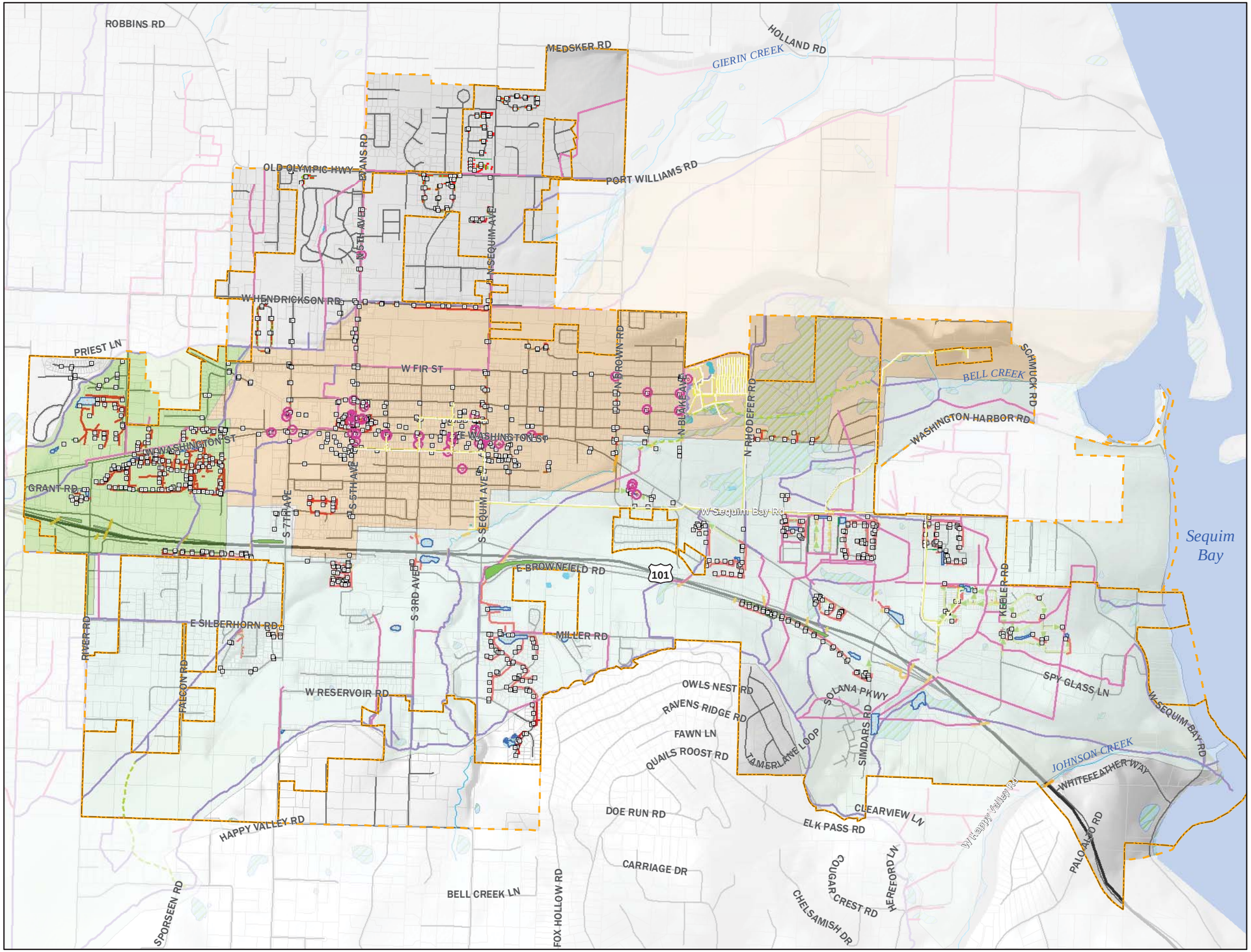


Figure 5.
Stormwater, Irrigation, and Reclaimed Water Systems and Facilities in the City of Sequim.

Legend

- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Road
- Highway
- Pond
- Wetland
- Reclaimed water system

Irrigation System

- Pipe
- Open ditch
- Ditch in creek
- Shared ditch

Stormwater System

- Culvert
- Storm drain pipe
- Perforated pipe
- Roadside ditch
- Bioswale
- Detention pond
- Retention pond
- Drywell
- Catchbasin
- Highland Irrigation District
- Independent Irrigation
- Eureka Irrigation District

N

0 1,000 2,000 4,000 ft

HERRERA

NAD 1983 HARN
Washington State Plane North FIPS 4601 Feet

Project: K:\Projects\Y2014-14-05826-000\Project\Master_Plan\stormwater_irrigation.mxd (5/20/2015)

FUTURE GROWTH

The population of Sequim has grown by over 80 percent since 1990 and is expected to continue to grow at rates as high as 2 or 3 percent each year, which would increase the city's population to 10,000 to 13,000 by 2035 (Sequim 2015). For the past 30 years, the population in the Sequim-Dungeness Valley outside the city limits has grown twice as fast as the city. Growth and associated development in the city and the Sequim-Dungeness Valley will put additional pressure on the City's stormwater system. Strategies to address these predicted future growth impacts are discussed in the *Plan Implementation* section.

CLIMATE CHANGE

Currently Sequim averages just over 16 inches of precipitation per year; snow is relatively rare and does not occur at all in some years. According to climate change prediction models, while changes in overall annual precipitation amounts are not projected to be significant, the timing and character of precipitation is projected to change which can affect stormwater infrastructure (Mote and Salathé 2010, Littell 2011, Muschinski and Katz 2013, Abatzoglou et al. 2014).

Given current climate change predictions, the city can expect more extreme precipitation events in the winter months. Winter precipitation on the Olympic Peninsula is expected to increase by 4.5 to 5 percent on average and depending on location (Littell 2011); although average projected winter increases in precipitation are not large relative to interannual variability (Littell et al. 2009). Projections of extreme precipitation events also vary significantly, but indicate future increases in extreme rainfall magnitudes throughout the state (Littell et al. 2009).

This will increase the city's susceptibility to flash floods as a secondary hazard from severe summer rainstorms as well as saturated soil hazards such as landslides and falling trees. These predicted changes will also increase flood risk potential in the city, which is currently relatively low except during large storm events. Increased flooding and reduced snow and ice cover in the Olympic Mountains are projected to increase sediment and flood debris carried by rivers and streams. Increases in saturated conditions and flooding can increase infiltration and inflow to the stormwater system, increasing the cost of protecting and maintaining infrastructure as well as strain current stormwater collection systems as they reach capacity. In addition, water quality may be affected by increasing sediment and nutrient loads (Snover et al. 2013). There may also be an increased need for emergency response to repair facilities from damage caused by extreme events.

Extreme events are more likely to affect stormwater infrastructure than are changes in average conditions (Hamlet 2011; WSDOT 2011). Also, vulnerability to extreme events varies by location. For example, stormwater infrastructure located above or below steep slopes, in low-lying areas subject to flooding, or along streams that are aggrading would be more vulnerable to calamity.

Summers in the city are also predicted to be warmer and drier. Increased average air temperature will produce increased average annual and summer surface water temperatures

as well as higher evapotranspiration. Higher water temperatures will increase the frequency and duration of incidents of low dissolved oxygen and could further impair city streams such as Bell Creek, which has reaches already on Ecology's 303(d) list of impaired waters as a Category 5 for fecal coliform bacteria, dissolved oxygen, and B-IBI. Warming waters within the city can affect the viability of many native aquatic plant and animal species, especially cold-water fish such as coho salmon, steelhead, and cutthroat trout found in some portions of city streams. Climate changes increase the importance of providing adequate water quality treatment for new and redevelopment projects, as well as retrofits of the City's existing stormwater system.

Table 4 outlines the stormwater elements that would be most affected by climate change in the city, and the resultant physical and biological responses.

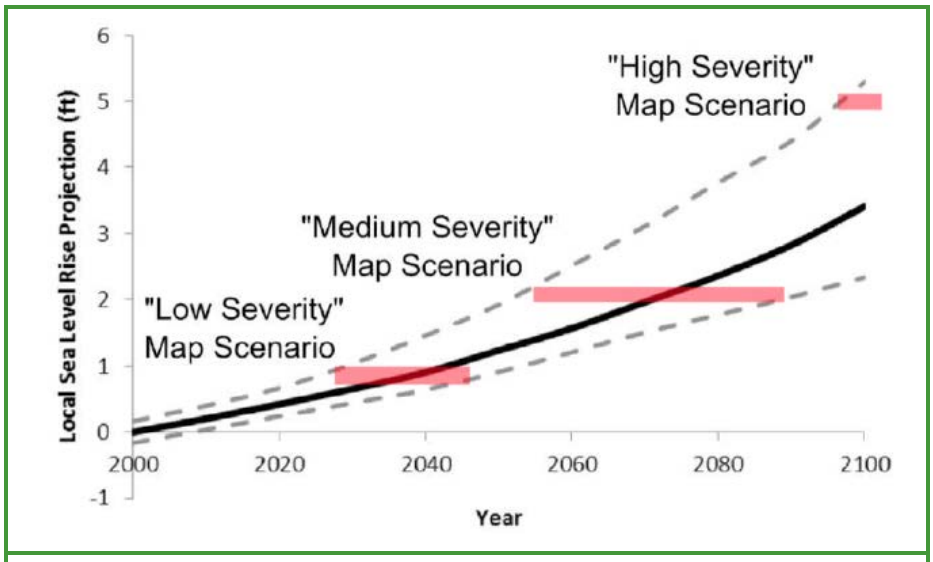
Table 4. Predicted Climate Change Effects on Stormwater Flows.

Stormwater Element	Predicted Response to Climate Change
Storm intensity	• Increased magnitude and frequency of peak flows
Annual precipitation amount and seasonal distribution	• Moderate increase in winter precipitation • Moderate decrease in summer precipitation • Increased average runoff in winter and spring • Decreased summer base flow
Flood risk	• Increased flood risk from increased peak flow magnitudes • Increased flood risk from channel migration • Increased flood risk from more frequent saturated conditions • Increased strain on stormwater infrastructure
Marine flooding risk due to sea level rise	• Reduced capacity for low lying stormwater infrastructure • Increase in elevation of receiving waters • Potential saline intrusion of shallow groundwater near marine shorelines • Increase in erosion along the marine shoreline at higher elevations than in the past
Water temperature	• Increased average and summer water temperature • Lower dissolved oxygen • Increased algal blooms
Evapotranspiration	• Increased evapotranspiration • Lower soil moisture • Reduced summer base flow in creeks • Reduced groundwater recharge • Wetland conversion from perennial to seasonal

The potential hydrologic changes associated with climate change increase the importance of stormwater management practices that control flows, promote infiltration, and preserve and enhance water quality. Because the city's water resources are largely precipitation-driven and much of the city's water supply is from groundwater, ensuring deep infiltration of stormwater through groundwater recharge will become increasingly important as groundwater demands increase (due to higher temperatures and greater population), and especially if water resources become more scarce (due to altered precipitation patterns and higher temperatures).

Sea level rise is also a documented consequence of climate change. Sequim has a small part of its city limits within marine influence, including Pitship Estuary and John Wayne Marina. Although most of the city's marine shoreline is on a bluff, these low-lying coastal areas are somewhat vulnerable to sea level rise. Due to a gradient in tectonic uplift along the Strait of Juan de Fuca (Verdonck 2006), observed sea level rise over the twentieth century can be assumed to be an average of the rate observed at Port Angeles (approximately zero: NOAA 2015a) and Port Townsend (0.06 inches per year: NOAA 2015b). This equates to an estimated current rate of 0.03 inches rise in sea level per year for the city's marine shoreline. This is a lower rate than most other locations in western Washington due to tectonic uplift of the northwest corner of the Olympic Peninsula.

Recent work completed by the Jamestown S'Klallam Tribe planned for sea level rise using three "severity" levels that were based on a combination of eustatic sea level rise estimates from the Intergovernmental Panel on Climate Change and tectonic uplift measured by Central Washington University, including locations along Sequim Bay. Low severity assumed a rise of 0.8 feet, medium severity assumed 2.0 feet of rise, and high severity assumed 5.1 feet of rise by 2,100 (Adaptation International 2013). These estimates are significantly greater than those provided by the US Army Corps of Engineers (USACE). USACE guidance suggests designing for sea level rises of between 1.5 and 3 feet, depending on the criticality of the infrastructure affected, and assuming a 50-year design life (USACE 2013). A 100-year design life sea level rise estimate for the USACE would be between 3 and 8 feet depending on the criticality of the infrastructure. Given the modest sea level rise in the Olympic Peninsula region observed in the twentieth century due to tectonic uplift, the USACE guidance provides a more realistic estimate for planning and design of stormwater infrastructure within the city for areas that may be affected.



Average sea level rise trend line (dark black line) and sea level rise range (high and low dashed lines). Projections are based off the linear vertical land movement trend combined with the projected rates of sea level rise for the West Coast. "Low Severity" = 0.8 feet, "Medium severity" = 2.0 feet, and "High Severity" = 5.1 feet above the current sea level. Source: Adaptation International 2013.

Strategies to addressing these predicted climate change impacts are discussed in the *Plan Implementation* section.

APPLICABLE REGULATIONS

Federal and state regulations and strategic planning efforts that apply to the city's storm and surface water program and are summarized in detail in Appendix C include:

- State surface water quality standards (WAC 173-201A)
- Ecology's 303(d) list
- Groundwater quality standards (WAC 173-200)
- Model Toxics Control Act [MTCA]
- Federal Safe Drinking Water Act
- Underground Injection Control (UIC) requirements
- Puget Sound Partnership (PSP) Action Agenda
- Dungeness Water Rule (WAC 173-518)
- National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Act (FEMA)
- Federal Endangered Species Act (ESA)
- State Salmon Recovery Planning Act
- Watershed Planning Act
- Growth Management Act (GMA)
- State Environmental Policy Act (SEPA)
- Shoreline Management Act (SMA)
- The SMC (as it applies to the requirements listed above)

Appendix C also references evolving regulations and policies which include recent changes to the state surface water quality standards (not yet finalized) and the NPDES municipal stormwater permit. The City is not currently a municipal stormwater permittee; however, many stormwater program elements highlighted in the NPDES permit are beneficial for the City to consider as part of implementing its current stormwater program.

CHAPTER 3 – KNOWN STORMWATER PROBLEMS AND RECOMMENDED CAPITAL SOLUTIONS

Stormwater flooding and water quality problems in the city are caused by multiple local and regional factors, including:

- Flow from upland development
- Misconnected street drains
- Flooded irrigation infrastructure
- Aging stormwater infrastructure
- Inadequate maintenance due to limited staffing and funding
- Unmanaged runoff from non-City-owned properties inside and outside city limits
- Direct stormwater discharge to surface water bodies

In 2013, the City asked the general public to report where they observed problems with runoff, ponding, and pollution. Using input from the public and institutional knowledge, the City documented and mapped the problem areas, and identified 84 specific runoff and flooding problems in the Stormwater Management Needs Assessment (Sequim 2014). The development of the City's stormwater CIP project list builds on the 2014 stormwater problem identification and prioritization in the Stormwater Management Needs Assessment and is described in the sections below.

This chapter focuses on capital project solutions to flooding and water quality problems. Chapter 4 is focused on programmatic, management-related solutions.

DOCUMENT REVIEW, WORKSHOP, AND SITE VISITS

The City evaluated several site-specific problems to develop planning level solutions and cost estimates for use in establishing the City's stormwater CIP plan and for scheduling non-CIP project implementation. A total of 84 runoff and flooding problems were originally identified in the Stormwater Management Needs Assessment and were placed in the following categories:

- Creek related runoff and flooding problems (17 sites)
- City-owned property runoff and flooding problems (60 sites)
- Misconnected street drain runoff and flooding problems (7 sites)

A fourth group (Non-City-owned Properties) was added after the completion of the Stormwater Management Needs Assessment. A workshop was held with City staff on November 18, 2014 (Appendix B), to discuss capital facility improvement needs and to identify the highest priority problems for field evaluation.

The higher priority problems identified by the City were further evaluated by conducting interviews with City staff and by performing field reconnaissance. Potential engineering solutions were identified to address these problems and implementation of the solutions was prioritized based on several criteria (described below). Project summary sheets and itemized planning level cost estimates were developed for ten projects that were considered to be higher priorities. This section of the plan identifies the problems, solutions, and prioritization process. Project summary sheets and itemized planning level cost estimates for the ten selected projects and proposed solutions are provided in Appendix F.

IDENTIFIED STORMWATER PROBLEMS AND SOLUTIONS

A complete list of runoff and flooding problems identified in the Stormwater Management Needs Assessment, through the workshop and interviews with City staff, is provided in Appendix D. Some of these problems are better addressed with capital project-type solutions, and others with management or programmatic solutions. Table 5 describes problems and proposed solutions for the higher priority problems related to capital facilities identified by the City. These problems were further evaluated and solutions were refined by performing field reconnaissance and through discussions with City staff. Figure 6 shows the locations of the higher priority capital projects as well as the ten selected CIP projects.

It should be noted that City staff and other local stakeholder knowledge of potential solutions may not be represented in Table 5. For example, abandoned irrigation pipes or other facilities discovered in the City ROW could possibly be utilized for storage or conveyance of stormwater. In addition, parks and other parcels with undeveloped open space could be utilized for stormwater management (storage, conveyance, infiltration, etc.).

Table 5. Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
1.00 (see CIP)	Sequim Area Stormwater-Watershed Plan	Long history of flooding problems along the Bell Creek Corridor and in western Sequim. Stormwater input via active and abandoned irrigation conveyances adds to flooding across city, and future development may increase flooding in already flooded/problem areas. It is an opportune time to implement a watershed wide solution while there is still available space to implement projects that will address water quantity and quality. The Plan would address problems 1.02, 1.04, 1.06, 1.07, 1.08, 1.09, 1.10, 2.17, 4.04, and 4.31.	Develop a Sequim Area Stormwater- Watershed Plan to identify a strategy to provide adequate surface water system capacity for future growth and habitat improvements. Project will include an assessment of existing conditions and will develop a plan for maintaining and improving stormwater conveyance, infiltration, and resource protection. A surface water and shallow groundwater system model would be used to better understand the causes of flooding in the stormwater system and develop effective long term solutions.
1.02	Bell Creek Overflow Channel Upgrade at Rhodefer Road (RM 1.4)	Channel very overgrown and culvert backs up, causing flooding of Carrie Blake Park as well as north to the Reuse Park.	Maintain or abandon overflow channel to north as part of Sequim Area Stormwater -Watershed Plan implementation.
1.04 (see CIP)	Bell Creek Culvert Upgrade at Blake Avenue, Park entrance (RM 1.5)	Two culverts along Bell Creek used to convey creek flows under driveway to Carrie Blake Park (off of North Blake Avenue) do not have adequate hydraulic capacity to handle high flows. Flooding has been observed in the park entry and road. High flows often spill onto private property to the east as well, adjacent to City Park, rather than staying in channel.	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. Replace existing 42" wide x 26" high and 40" wide x 28" high culvert with fish passable culvert, unless evaluation indicates runoff can be re-routed or infiltrated upstream. Creek is channelized upstream of this site, with no floodplain. Flow comes out of channel and floods park and adjacent private property. Riparian restoration would benefit habitat and flood management aspects of site.
1.06	Bell Creek Culvert Upgrade at Blake Avenue (RM 1.6)	Culvert backs up and causes flooding of Gebhardt-Zwicker Park and spills onto Blake Ave. and private property to the north).	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. Culvert may need to be resized unless runoff is re-routed or infiltrated upstream.
1.07 (see CIP)	Bell Creek Culvert Upgrade at Washington (RM 1.8)	Existing culvert downstream of Culvert 1.08 along Bell Creek does not have adequate capacity and the roadway at intersection of South Brown and East Washington Streets floods during high flow events. Culvert starts out heading north, angles northeast under East Washington and South Brown Intersection, then joins and 11-foot wide x 6-foot high culvert under Les Schwab driveway.	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. Replace existing 48" dia. culvert with fish passable culvert, unless evaluation indicates runoff can be re-routed or infiltrated upstream.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
1.08	Bell Creek Culvert Upgrade at RM 1.85 (driveway from S Brown into Bell Creek Café and Evergreen Collision)	Bell Creek and culvert under driveway along South Brown Rd flood during high flows. Flooding extends into roadway and driveway of business, but does not reach business parking lot to the north. Floodplain to the south receives some of the excess flows and also floods. Undeveloped area is lower in elevation than the adjacent parking lot to the north of Bell creek along this corridor, so excess flows will flood this area before flooding parking lot.	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. May need to be resized unless runoff is re-routed or infiltrated upstream. Related site is 4.44, with parking lot storm drains discharging to Bell Creek at driveway.
1.09 (see CIP)	Middle Reach Bell Creek Corridor Planning	Bell Creek, Highland irrigation ditch, and stormwater culverts along Bell Creek corridor receive stormwater runoff from upland areas during storm events, causing facilities to back up and flood undeveloped property along the Creek during high flows. Would address problems 2.17/2.29 and 1.02, 1.04, 1.06, 1.07, 1.08, 1.10.	1 – Implement 1.00 (Sequim Area Stormwater -Watershed Plan). 2 – If 1.00 is not implemented, develop a plan for future development and resource protection in the undeveloped floodplain property along Bell Creek. Project will include an assessment of existing conditions and will develop a plan for maintaining and improving stormwater conveyance, infiltration, and resource protection.
1.10	Bell Creek Culvert Upgrade at Hammond (RM 2.2)	Bell Creek Culvert backs up onto private property on south side of East Hammond Road due to overgrown vegetation and possibly lack of capacity.	Maintain vegetation around culvert, inspect and repair if damaged. Evaluate culvert as part of 1.00 (Sequim Area Stormwater -Watershed Plan) implementation. May require maintenance agreement.
1.18	N Brown Road Drainage Improvements at Washington	Stormwater pipe along N Brown Road discharges untreated stormwater into Bell Creek downstream of culvert under Les Schwab driveway.	Install treatment BMP or infiltration system, or tie to existing facility.
2.01	S 2nd at Washington	Runoff from the east on Washington floods this intersection and erodes the ROW landscaping, which clogs other storm drains.	Need additional capacity in nearby stormwater facilities; possibly cut the curb in places so runoff can enter planted ROW (if grade allows).

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.04 (see CIP)	S 3rd Avenue (west ROW south of Bypass) Drainage Improvements	Storm water runoff from S 3rd Avenue just downstream of the Hideaway Homes Mobile Home Park and from the park itself flows down the steep slope on the west side of S 3rd Avenue and onto the Sequim School District Transportation Facility property, intermittently causing localized flooding. A poorly defined ditch runs along the base of the road fill slope to a culvert under the entry drive into the transportation facility; this ditch is filled with silt, sand, and gravel eroded from the S 3rd Avenue fill slope. Discharge from entry drive culvert flows to a catch basin approximately 10 feet north of the outlet end of the culvert; the catch basin is covered with silt, sand, and gravel eroded from the S 3rd Avenue fill slope.	Install an 18" diameter culvert under the Hideaway Homes Mobile Home Park driveway and a catch basin at the discharge end of the culvert. Install an outfall pipe down the steep slope with an energy dissipater at the outlet. Construct a new ditch line along the base of the fill slope (this ditch with be on School District property; an easement will be needed for these improvements). Construct a short ditch section from the end of the culvert under the Transportation Facility entry drive to the catch basin at the base of the roadway fill. Stabilize the fill slopes with quarry spall slope protection to prevent further erosion of the fill.
2.05 (see CIP)	N 5th Avenue and Cedar Street Structure Upgrade	Drywell at south east corner of West Cedar and North 5th Avenue intersection floods at inlet. Flooding extends along cross walk and up ramp, imposing risk to pedestrians (especially when icy). Maintenance was recently performed but the structure still does not provide adequate drainage.	Rehabilitate infiltration facility (drywell) to restore capacity. Empty drywell to clean and inspect facility. If drywell is compromised, install an infiltration trench and stormwater treatment unit.
2.12 (see CIP)	7th Avenue and Washington Upgrade	Flooding at south west inlet at intersection of S 7th Avenue and W Washington Street. Structure is full of sediment. Maintenance was recently performed but the structure still does not drain fast enough.	Install Filterra bio-filtration unit for treatment of runoff and protection of the infiltration facility, tie existing catch basins into Filterra, install extended infiltration trench for infiltration of runoff.
2.14	N Blake and E Fir Drainage Improvements	Flooding on south west corner of intersection. Four existing catch basins on corners are located at higher elevations than the surrounding grade and infiltration capacity may be inadequate. Catch basin piped to a drywell structure under the sidewalk. Maintenance was recently performed on the drywell structure, but ponding persists.	Rehabilitate infiltration facility to restore capacity; adjust grade of street surface to improve flow to drains. Overflow from this site affects ponding at entrance to Reuse Park across street (see 2.70).
2.17 (2.29 added) (see CIP)	S Brown and Hammond Drainage Improvements	Flooding at private property located on corner of E Hammond Street and S Brown Road.	Widen existing ditch and culvert system to convey runoff away from private property near the intersection of S Brown Road and E Hammond Street. Evaluate as part of 1.00 (Sequim Area Stormwater – Watershed Plan) for possible re-routing or infiltration of runoff upstream.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.23 (see CIP)	Centennial Place Infiltration and Inflow Investigation	Stormwater runoff from parking lot flows to sanitary sewer.	Re-route stormwater to bioretention cells to the north east, perform maintenance on bioretention cells to improve performance.
2.25 (see CIP)	Etta Street Infiltration and Inflow Investigation	Surface runoff from alley drains to two existing catch basins and it is unclear where the catch basins drain (infiltration trench, drywell, or sanitary sewer). It appears that most of the runoff flows into a catch basin located out of the City ROW. Downspout connection appears to tie into sanitary sewer (actual connections to be confirmed).	Perform testing and investigations to confirm discharge locations of downspouts and catch basins. Divert downspouts and catch basins to Contech StormFilter. Re-grade parts of the alley to direct the stormwater to the existing catch basins or the Stormfilter. Install infiltration trench to dispose of surface runoff.
2.26 (see CIP)	River Road Storage Project	Flooding of private property within the City and UGA caused by runoff from west Happy Valley (outside of the UGA in the county) entering Eureka ditch near Mockingbird Lane. Would address problems 4.11, 4.14, and 4.36.	Construct a large storage facility to provide stormwater detention by storing water during high flows for use by the Dungeness Water Users Association during the low flow period. To provide stormwater benefits during the wet season, the facility would need to be operated in a manner that would reduce flow to downstream irrigation conveyance through the city of Sequim during storm events. The storage facility is one option under consideration by the Dungeness River Flow Enhancement Project. Project should consider stormwater conveyance for future developments as well as the potential to provide flow control to offset increased runoff from existing and future development.
2.28	W Fir between N 5th and Sequim Avenue	Major surface damage on W Fir from water ponding, runoff due to lack of adequate stormwater facilities. Reconstruction including stormwater facilities expected in 2016–18.	Check pervious pavement installations. Street is scheduled for reconstruction. Stormwater treatment and infiltration will be designed into street project; funding sources still being identified.
2.34 (see CIP)	Clara Crest Way/ Highland Hills Runoff Abatement	Detention ponds discharge large volumes of runoff downslope, into city roadside ditches along Miller Road and Clara Crest.	Re-evaluate problem and continue to work with HOA and local landowners to perform retrofits and/or ditch maintenance/ repair as needed. Retrofit detention pond(s) as needed. Evaluate runoff problem as part of 1.00 or 1.09. Also see 4.25.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.49	Silberhorn and River Road Drainage Improvements	East side of intersection floods, no good drainage or facilities.	Add street and drainage improvements and facilities.
2.53	W Spruce Street Structure Upgrade	Catch basin and perforated pipe are causing flooding of roadway and nearby basement. Update Fall 2015: City recently cleaned structure, jetted perforated pipe, extended perf pipe, and added capacity.	Continue to monitor location for flooding. If flooding continues, upgrade the infiltration system again or add structure on north side of Spruce.
2.62	Roadside ditch along West Sequim Bay Road uphill from Marina	Ditch overflows when driveway culverts clog, washing out road.	Establish responsibilities of driveway property owners and irrigation providers (check whether this is an irrigation conveyance in season) relative to culvert maintenance/repair.
2.63 (see CIP)	W Prairie Street Green Street Upgrade (between Sequim Avenue and 2nd Avenue)	Typical of this area and type of development, no storm water management infrastructure exists. The streets have typically been paved to a nominal width of 24 feet and storm water runoff from the roadway flows to the roadside area and infiltrates into the porous subsoil. During periods of intense rainfall intermittent flooding can occur. In addition, oils and grease contained in the runoff can infiltrate into the porous subsoil and potentially enter the groundwater untreated.	Provide a demonstration facility using green infrastructure for the management of stormwater runoff from fully developed residential streets. The final street configuration would consist of 32 feet of pavement with curb and gutter and porous pavement sidewalks on both sides. Bioretention cells would be constructed between the back of the curb and the sidewalk at intervals along the roadway. For each city block, a total bioretention cell length of 120 feet would be required on each side of the street. Small cells, approximately 30 feet in length, would be constructed at several points along the roadway to avoid driveways and minimize roadway grading.
2.64	W Fir between 5th Avenue and Sequim Avenue Drainage Improvements	Street runoff enters school district property and ponds against Admin building; in largest storms, runoff continues east across yard and exits on Sequim Avenue.	Improve/upgrade storm drainage on W Fir as street is reconstructed in 2016-18. Also see 2.28 regarding W Fir street upgrade.
2.67	E Cedar south side east of Dunlap	Runoff from the west flows to private property (storage units) and continues to front yard of apartment complex down street.	Improve/upgrade drainage facilities on E Cedar between Dunlap and Ryser. Update Fall 2015: Streets crew added berm to direct drainage around storage units. Monitor drainage further down street.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.68 (see CIP)	Emerald Highlands ponds	North and South detention ponds overgrown and silted in. Need maintenance. North pond overflows to Bell Creek at 101 off ramp. South pond drains to Bell Creek to the west.	Remove brush; check valves and outlets; restore capacity if needed. Update Fall 2015: North pond outlet valves cleared, ponds drained. City will monitor silt and water levels. South pond still needs maintenance.
2.74	Washington and Sequim intersection	CB fills and flows north across street to another CB connected to drywell. May lack sufficient capacity for infiltration.	Add capacity to drainage facilities in upstream area; if new facilities installed, add runoff treatment capability.
2.75	9th Avenue and Honeycomb	Drainage flows to Helen Court area; street surface degraded on north side where water sits.	Improve/upgrade drainage facilities on 9th Ave.
3.01 (also see 2.43, Appendix D)	Seal Street Drainage Improvements	Flooding of private and public parking lots at intersection of W Cedar Street and Seal Street due to limited capacity of infiltration system. Runoff originates in alley and drains into nearby apartments.	1 – Divert street runoff and alley/downspout runoff to existing underutilized (deep) drywells on Seal St. (may also require easement). 2- Divert street and alley runoff to new or existing underutilized storm drain on Cedar Street in City ROW. 3 – Extend capacity of infiltration line under parking lot.
3.02	N 7th Avenue Structure Maintenance/ Upgrade	City street drainage at the west gutter of N 7th Avenue is connected to private drywell in parking lot of flooring business along N 7th Avenue. Infiltration facility is very full of sediment and standing water and is causing flooding in parking lot. Update 12/2015: checked and found drywell connected inside ROW to west of drain.	Conduct maintenance and inspect system draining the street (catalog information in GIS database). Disconnect street drainage from private system or upgrade drywell/street drainage to restore capacity as necessary. Update 12/2015: existing drywell should handle infiltration well; if not, drains north and east down W Spruce St.
3.04	S 7th Avenue Drainage Improvements	Stormwater runoff from private parking lot on the west side of S 7th Avenue is piped under S 7th Avenue and potentially into irrigation vault/network on the east side of S 7th Avenue. (Based on field observations the stormwater may actually be piped into a perforated pipe under the planter or parking lot).	Inspect system and catalog information in GIS database. Re-route stormwater runoff from private parking lot to stormwater system (i.e., infiltration or conveyance to existing system) if it is entering irrigation pipe.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
4.10	School Property Drainage and I/I Improvements	Runoff from school property flows to city streets, sewer and/or irrigation conveyances.	Confirm school district stormwater system connections, if any. Inspect system and catalog information in GIS database. Upgrade school system to infiltrate stormwater on-site.
4.11	N Sequim Avenue, N 5th Avenue and Fir Drainage Improvements	Flooding of roadway at the northeast corner of N Sequim Avenue and W Fir Street. Irrigation pipes reduce from 18 inches to 12 inches along W Fir Street and then make a 90 degree bend at the northeast corner of the intersection (high flows blow the lid off the catch basin). At N 5th Avenue and Fir, the D-box control mechanism is problematic; results in more stormwater going east along Fir than north on 5th Avenue.	Would be addressed by 2.26. Site specific option: Install a locking lid on the structure and install infrastructure on N 5th Avenue and W Fir Street to split the flow into the north and east irrigation pipes during the winter (using capacity of both pipes may eliminate problem). Would likely require downstream impact assessment.
4.14	East Silberhorn Road (east of Petal Lane) Drainage Improvements	Flooding on east end Silberhorn Road caused by unmitigated runoff from distant south and under-sized ditch and culvert (between S 7th Avenue and Petal Lane). New development to south would exacerbate. Existing ditch receives piped runoff from SW under Comfort Way, currently flows through undeveloped area and ends at Silberhorn Road. Private property on corner, north side of culvert under Silberhorn also floods.	Would probably be addressed by 2.26. Solution may be possible with appropriate future development plans 1 – Ensure that new development plans provide appropriate conveyance. 2 – Upstream detention/infiltration. (Requires coordination with upstream properties and future development.)
4.24	S 3rd Ditch Drainage Improvements	Flooding in irrigation ditch along S 3rd Avenue caused by runoff from county area on Bell Hill and partially collapsed concrete Highland irrigation pipe installed by original landowner (at Gerhardt Park).	Repair culvert (installed by former landowner, not irrigators; City is now owner; HID has easement).
4.31	E Washington at QFC complex Drainage Improvements	Irrigation ditch enters culvert pipe on west end of parking lot (former Staples), discharges to Bell Creek. Clogged culvert floods parking lot. Runoff from parking lot enters Bell Creek.	Implement 1.00 (Sequim Area Stormwater – Watershed Plan) to avoid future problems. Not a recurring problem except in extreme events. Impacts Bell Creek water quality.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
4.36	West Happy Valley and Sporseen Ditch Improvements	Runoff overwhelms roadside ditch and culvert over Highland canal at West Happy Valley Road; also washes out hillslope to south side of West Happy Valley Road near River Rd intersection (irrigation canal also spills into roadside ditch east of Sporseen, adding to the volume) (all in county). Runoff eventually ends up in Eureka ditch as well as private property draining to Comfort Way/Silberhorn Road area and continues to overwhelm culverts and ditches in city.	Would be addressed by 2.26. Site specific option: Improve drainage in ditches and add storage and/or infiltration.
4.37	Highland Irrigation Canal breaches	Stormwater fills and over-tops canal wall, spilling runoff to downhill properties (esp. uphill from Jara and Falcon Road areas) and Eureka ditch. If canal wall blows out, it's a big emergency in the city.	Would partially be addressed by 2.26. Site specific option: develop a maintenance policy with the Irrigation District, and maintain canals accordingly.
4.38	Various single-family residential inflow investigation and elimination	Inflow evident from smoke testing.	Redirect sewer inflow to drainage solution. Project would include components for planning, outreach, and general design, as well as costs for drain and downspout disconnection and drainage upgrades to improve downstream detention, infiltration, or conveyance.
4.44	Bell Creek Café/ Evergreen Collision	Infiltration storm drain backs up into driveway and discharges to Bell Creek. Also see 1.08, culvert-caused flooding of Bell Creek.	Re-evaluate problem and contact landowner/ facility manager as needed. Need inspection program and enforcement.

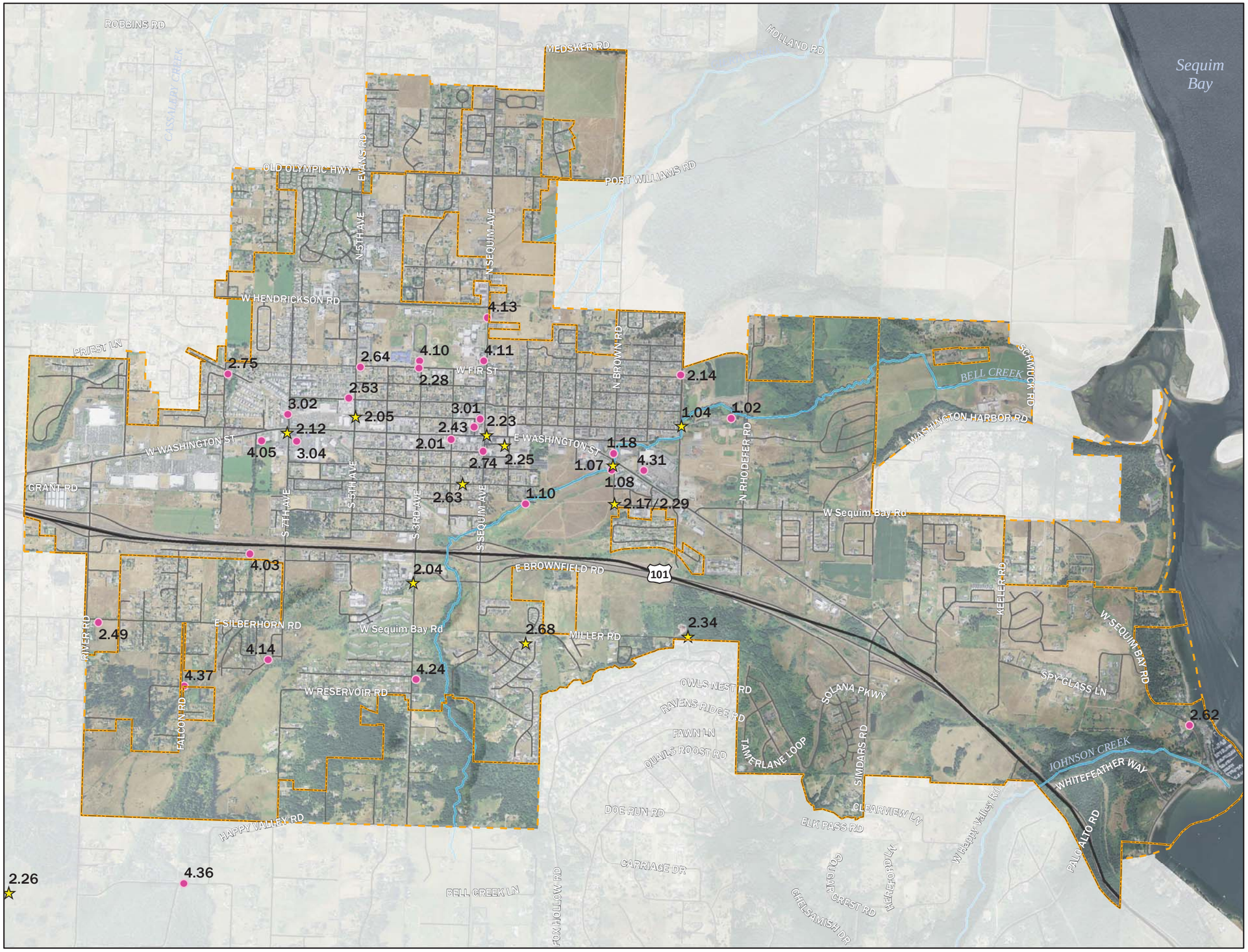


Figure 6.
Identified High Priority Stormwater Problems and CIP Project Locations.

Legend

- CIP project location
- High priority stormwater problem location
- City limit
- Urban Growth Area (UGA)
- Stream
- Road
- Highway

Note:
Projects 1.00, 1.09, and 4.38 are programmatic or occur in multiple locations in the City, and are therefore not included in this figure.

N

0 1,000 2,000 4,000 ft

HERRERA

NAD 1983 HARN
Washington State Plane North FIPS 4601 Feet
USDA, Aerial (2013)

Project: K:\Projects\Y2014\14-05826-000\Project\Master_Plan\stormwater_problems.mxd (2/24/2016)

Stormwater CIP Project Prioritization

The stormwater CIP problems and solutions were prioritized based on the results of a qualitative evaluation that considered multiple criteria. The prioritization process input data is provided in Appendix E, Table E-1, and include findings from field reconnaissance, input from City staff, and review of background documentation such as GIS data.

The objective of the prioritization process was to identify the most important projects and develop a schedule for project implementation. Based on the cumulative input shown in Table E-1, a project implementation schedule was developed (Table E-1); in general, high priority projects were scheduled to occur sooner than low priority projects.

During the prioritization process, each project was assigned a classification category (e.g., maintenance, replacement, upgrade, expansion of the current system, or stormwater planning), and the following prioritization factors were evaluated as high, moderate, or low:

- Problem Risk
- Project Efficiency
- Funding Potential
- Public Sentiment
- Data Quality

Each of these prioritization factors is described in more detail below.

Following CIP project identification and development, a subset of projects were further analyzed and grouped into three distinct categories based on urgency, risk, and level of effort required:

- Group 1 projects represent projects that are most urgent, higher liability, and are compliance related or are on the critical path
- Group 2 projects represent projects that are less urgent, lower risk, and may require coordination with other entities
- Group 3 projects requires study or planning and are not urgent

Table 6. CIP Project Implementation Schedule (in 2015 dollars).

ID	Project Name	Priority[a]	Group	Total Cost[e]	Est. External Funding (%)	Total Cost to City[e]	2016	2017	2018	2019	2020	2021
Group 1 Projects												
1.09	Middle Reach Bell Creek Floodplain Planning[b, c]	High	1	$365,000	50%	$182,500[c]		$12,500	$75,000	$80,000	$15,000	
2.04	South 3rd Avenue (west ROW south of Bypass) Drainage Improvements	High	1	$70,000	0%	$70,000		$14,220	$55,780			
2.12	7th Avenue and Washington Upgrade	High-Moderate	1	$180,000	0%	$180,000				$180,000		
2.23	Centennial Place Inflow and Infiltration Repair	High-Moderate	1	$22,000	0%	$22,000		$22,000				
2.26	River Road Storage Project[d]	High	1	Unknown	100%	$24,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
2.68	Emerald Highlands Detention Pond Repair/Maintenance	High-Moderate	1	$40,000	0%	$40,000	$40,000					
			Subtotal (Group 1)	**$677,000**	**NA**	**$518,500**	**$44,000**	**$52,720**	**$134,780**	**$264,000**	**$19,000**	**$4,000**
Group 2 Projects												
2.05	North 5th Avenue and Cedar Street Structure Upgrade	High-Moderate	2	$120,000	0%	$120,000						$120,000
2.34	Clara Crest Way /Highland Hills Runoff Abatement	High-Moderate	2	$55,000	0%	$55,000						$55,000
2.63	West Prairie Street Green Street Upgrade (between Sequim Avenue and 2nd Avenue)	High	2	$130,000	0%	$130,000					$20,760	$109,240
			Subtotal (Group 2)	**$305,000**	**NA**	**$305,000**	**$0**	**$0**	**$0**	**$0**	**$20,760**	**$284,240**
			Total (Groups 1 and 2)	**$982,000**	**NA**	**$823,500**	**$44,000**	**$52,720**	**$134,780**	**$264,000**	**$39,760**	**$288,240**
Group 3 Projects												
1.00	Sequim Area Stormwater-Watershed Plan[b, c]	High	3	$742,000	50%	$371,000[c]						
1.04	Bell Creek Culvert Upgrade at RM 1.5	High	3	$350,000	0%	$350,000						
1.07	Bell Creek Culvert Upgrade at RM 1.8	High-Moderate	3	$980,000	0%	$980,000						
2.17/ 2.29	S Brown & Hammond Drainage Improvements	High-Moderate	3	$30,000	0%	$30,000						
2.XX	Annual Stormwater System Rehabilitation	High-Moderate	3	$300,000	0%	$300,000						
			Subtotal (Group 3)	**$2,402,000**	**NA**	**$2,031,000**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
			Total (Groups 1, 2, 3)	**$3,384,000**	**NA**	**$2,830,500**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

[a] Project priority based on the results of a qualitative evaluation that considered multiple criteria. The prioritization process input data is provided in Appendix E.

[b] Total cost to the City assumes that 50 percent of the total project cost would be externally funded by grants as well as possible cost-sharing with Clallam County and Irrigators, etc.

[c] 1.00 Sequim-Area Stormwater-Watershed Planning (covers entire City) will be implemented as an alternative to 1.09 Middle Reach Bell Creek Floodplain Planning if additional grant funding and cost sharing are available.

[d] Implementation of this High-priority irrigation/stormwater storage reservoir requires external sources of funding and cost-sharing with project partners such as irrigation purveyors, Clallam County, and others. In-kind costs to the City are roughly estimated at $4,000/year.

[e] Includes a 30 to 40 percent contingency due to preliminary nature of project and estimate.

Problem Risk

The assessment of risk includes consideration of problem probability (i.e., frequency) and the potential losses resulting from the problem. Problems that occur frequently and have major potential losses associated with them, have higher risk, and thus are typically assigned a higher priority. Problems that occur infrequently with minor potential losses have less risk, and thus are typically assigned a lower priority. Probability and potential losses are summarized below.

- **Probability (i.e., frequency):** Probability of the problem occurring was evaluated qualitatively, based on the perceptions of City staff. Problems that occur more frequently were assigned a higher priority.
- **Potential Losses:** The potential losses associated with surface water problems can vary greatly. The highest potential losses were assigned to problems that cause a significant public safety hazard or extreme property damage, such as flooding of a major intersection that creates hazardous conditions. Problems with moderate potential losses could damage property, but pose a limited hazard to public safety. Problems with minor potential losses result in only a minor loss of use, such as flooding in the parking lane of a residential street (i.e., nuisance issues).

Project Efficiency

There are often opportunities to reduce costs or increase project efficiency by implementing multiple projects at once. For example, a storm drain replacement or extension project can be scheduled to coincide with other right- of- way improvements performed by the transportation department, such as an asphalt overlay, or construction of other utilities, such as replacement of a sewer main. Significant cost savings can be realized in these cases because the cost of surface removal or repair may be minimized or performed at a larger scale (i.e., economies of scale). Combining projects can also minimize the disruption in service, such as reducing the amount of time that a road is out of service.

Funding Potential

Project funding opportunities also play a role in project prioritization. Projects with likely cost sharing or grant opportunities were assigned a higher priority. For example, grant funding is regularly available for water quality improvement projects and some flood improvement projects have potential to share costs with the irrigation districts and the County.

Public Sentiment

Public sentiment and political will are often difficult to quantify, but can play an important role in prioritizing one project over another. For example, the visibility of a flooding problem to the general public and perceived impact on commerce could affect the priority level.

Data Quality

The quality of data used to understand the cause of the problem and assess the above factors, especially problem risk, is also important to consider during prioritization. For example, if the cause of a problem is not well understood, then it may also be difficult to identify a reliable solution; or if the frequency of occurrence is not known, then the impact of the problem is also not well known. Projects with low data quality are assigned a lower priority and data collection needs are identified.

STORMWATER CIP PRIORITIZATION SUMMARY

A qualitative assessment of the factors listed above for all high and moderate priority projects identified by staff is provided in Appendix E. The overall priority of each project was assigned based on consideration of all the factors. Risk was considered the primary factor during this evaluation, and other factors were considered secondary in importance.

The CIP project implementation schedule shown in Table 6 was generated based upon the overall priority shown in the right hand column of Table E-1. In general, higher priority projects are scheduled to occur earlier.

Refer to Appendix F for CIP Project Summary Sheets and conceptual cost estimates for ten CIP projects. Note that three additional CIP projects (2.23, 2.34, and 2.68) were identified after CIP project development, and are therefore not included in Appendix F.

CHAPTER 4 – STORMWATER PROGRAM EVALUATION AND RECOMMENDATIONS

This section summarizes the City's stormwater program. A summary of the status of the program element and recommendations is included for the following stormwater program categories:

1. Inspection Program
2. Water Quality Compliance
3. Species and Habitat Protection
4. Stormwater Design Guidance and Plan Review
5. Asset Management
6. Stormwater System Operations and Maintenance
7. Pollution Source Detection and Elimination
8. Public Education and Involvement

Each section includes a table with the proposed priority (high, medium, low) for each recommendation. The proposed priority was determined based on City input and professional judgment of risk associated with no action and benefit of action.

Additional detail regarding these accomplishments and recommendations is included in the Regulatory Gap Analysis and Compliance Strategy Report (Appendix G). Capital facilities are discussed in the previous section (*Known Stormwater Problems and Recommended Solutions*), thus are not included here.

INSPECTION PROGRAM

The SMC includes stormwater inspection requirements; however, the City does not currently have sufficient staff to conduct or enforce inspections.

Status

The City has established the legal authority to inspect and enforce construction and maintenance standards (SMC 13.104.370). SMC 13.108 sets minimum standards for the inspection and maintenance of all stormwater facilities within the city. Provisions include monthly and annual inspections of different types of facilities, waste disposal, compliance, and inspection authority.

Recommendations

The high priority recommendations summarized in Table 7 are necessary to meet the City's inspection program requirements as outlined in the City code. Moderate and low priority recommendations would result in a more robust inspection program.

Table 7. Inspection Program Recommendations.

Recommendation	Prioritization
Institute a stormwater facility inspection program and develop maintenance standards for non-City-owned stormwater facilities (drains, drywells, infiltration lines, retention/detention ponds, etc.). Develop inspection logs and plat language, and consider providing owner education. Maintain records of private stormwater facility as-builts, covenants, and inspection logs.	High
Improve coordination with homeowner associations, commercial landowners, and School Districts on shared maintenance responsibilities	High
Develop enforcement procedures for private stormwater facility maintenance, such as notification letters, required maintenance standards, maintenance tracking procedures, and a restitution process.	Medium

Water Quality Compliance

The City is faced with several water quality compliance requirements related to 303(d) listings and Underground Injection Control (UIC) wells.

Status

The City does not currently have an active water quality protection program or dedicated staff.

Recommendations

Recommendations of the Water Quality Data Analysis Report (Appendix H) include additional monitoring of Bell Creek and Johnson Creek for dissolved metals, fecal coliform, and nutrients. Fecal coliform monitoring should be focused at key upstream stations (Bell 0.2, Bell 0.6, Bell 1.0, Bell 1.6, Johnson 0.0, Johnson 0.6, Johnson 1.4, and Johnson 2.0) for evaluating background sources and effects of source control activities. Nutrients should also be monitored at Johnson 0.6. These monitoring recommendations, in addition to other water quality compliance recommendations, are summarized in Table 8.

The City should continue to coordinate with local/regional water quality partners through the Sequim-Dungeness Clean Water Work Group and its members, which are often involved in monitoring water quality in and around the City and UGA. Also see Public Education and Involvement recommendations.

Water quality monitoring is beneficial to both assess current status and measure improvements over the long term resulting from stormwater management and water quality treatment of typical stormwater pollutants.

Table 8. Water Quality Compliance Recommendations.	
Recommendations	**Prioritization**
Develop and implement a pollution control program for water bodies currently on the 303(d) list of impaired waters	High
Develop and implement surface water flow monitoring program	High
Coordinate with the Sequim-Dungeness Clean Water Work Group (CWWG) on monitoring activities, especially for city creeks, Washington Harbor, and Sequim Bay.	High
Use GIS to identify UIC wells that need to be registered with Ecology	High
Use online form to register UIC wells	High
Develop and implement a plan to assess drywells classified as UICs	High
Consider implementing additional water quality monitoring recommendations included in the Water Quality Data Analysis Report: • 12 samples per year (6 during wet weather and 6 during dry weather) at 6 monitoring stations in Bell and Johnson Creek • Continuous monitoring of dissolved oxygen and temperature in Bell Creek during the summer months • Fecal source tracing in Bell Creek	Medium
Develop and implement a groundwater monitoring plan for stormwater constituents of concern	Medium
Develop and implement a nitrate groundwater monitoring plan	Low
Develop and implement a stormwater facility monitoring plan (including private facilities)	Low

Species and Habitat Protection

Status

The City does not currently have a species and habitat protection program, other than membership and participation in the Dungeness River Management Team (DRMT) and Water Management Rule Implementation committees. The following activities have recently been completed that have resulted in a benefit to species and habitat protection:

- Pitship Estuary Bridge on West Sequim Bay Road that reconnects tidal functions to the Pitship Pocket Estuary.
- Reclaimed water is used north of the Reuse Demonstration Park to irrigate Garry Oaks Park managed by the Washington Department of Fish and Wildlife and to augment ponds that benefit migratory waterfowl.
- Bell Creek flow is continuously augmented year-round with reclaimed water at a rate of 0.1 cfs.

The City also cooperated with the Jamestown S'Klallam Tribe on the Washington Harbor Estuary Bridge project to replace a causeway that supported the City's outfall pipe and blocked potential fish habitat.

Shellfish habitat within or just downstream of City jurisdiction in Sequim Bay can be impacted by urban runoff, and is important to protect. For example, Washington Harbor is now a target location for native Olympia oyster restoration by local organizations.

Recommendations

The high priority activity listed in Table 9 is recommended to meet the City's species and habitat protection requirements. Medium and low priority stormwater program recommendations are also summarized in this table.

Table 9. Species and Habitat Protection Recommendations.

Recommendation	Prioritization
The City should participate in Dungeness River Management Team (DRMT) routine meetings and with Water Rule implementation groups. The City should also request smolt outmigration data from Bell Creek measured by the Jamestown S'Klallam Tribe, and water quality information for Washington Harbor and Sequim Bay.	High
Ensure habitat access by examining and replacing all culverts if they pose barriers to fish passage.	Medium
Maintain riparian buffers to control water temperature and provide forage material	Medium
Utilize soft bank stabilization methods, levee setbacks, and limit the use of riprap and other bank hardening methods to allow natural stream migration and off-channel habitat formation.	Medium
Determine whether the City needs to update floodplain mapping within city limits to be in compliance with the National Floodplain Insurance Program (NFIP) and restrict development within the floodplain.	Low

Stormwater Design Guidance and Plan Review

Status

The City implements a variety of activities and programs for stormwater design guidance and plan review (for runoff control from development during construction and post-construction) that include the following:

- **Stormwater management design guidance:** The SMC requires use of "the latest edition" of Ecology's Stormwater Management Manual for Western Washington (SWMMWW) for designing stormwater systems. The latest edition was published in 2012 and revised in 2014 (Ecology 2012b).
- **Stormwater site plan review:** The City (Senior Planner, Department of Community Development) currently conducts drainage reviews for smaller developments, and contracts out the drainage review for larger developments within the city. The City does not typically use modeling software for plan review of residential projects.
- **LID code update/integration**: In 2009**,** City code recommendations related to incorporating the Low Impact Development (LID) principles and practices (BMPs) were developed (AHBL 2009). The code recommendations have not yet been adopted. The City code sections that were reviewed and a brief summary of the recommendations are provided in Appendix G.
- **Stormwater management ordinance and enforceable mechanisms:**
    - SMC 13.104.100 adopts the most recent version of Ecology's SWMMWW.

- **Recordkeeping and enforcement:**
  - As-built drawings are kept on file with the City.

The City has established the authority to enforce the stormwater management ordinance and issue a stop work order if needed (SMC 13.104.390).

Recommendations

Recommendations regarding the City's stormwater design guidance and plan review process to control runoff from development during construction and post-construction are provided in Table 10.

Table 10. Stormwater Design Guidance and Plan Review Recommendations.

Recommendation	Prioritization
Review the 2012 SWMMWW (and 2014 modifications) and consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City.	High
Determine which BMPs are most effective in protecting groundwater quality while preserving recharge as part of the Master Plan and consider including these BMPs in an additional guidance document or amendment to the 2012 SWMMWW.	High
Develop handouts that summarize on-site stormwater management, treatment, and flow control thresholds for when the SWMMWW applies for single-family and commercial development projects. Update in the SMC as needed.	High
Improve/develop a consistent stormwater plan review process in consultation with the development industry, that includes checklists, sizing table tools, and plant lists for site plan review to increase efficiency.	High
Look for opportunities to partner with Clallam County in a watershed-scale planning effort	High
Review AHBL's Code Revision recommendations regarding LID, review additional sections of the SMC identified in the Stormwater Management Needs Assessment (Sequim 2014), update as needed, develop a brief summary report, and coordinate with City Council to review and approve proposed changes to SMC.	Medium
Promote upcoming training opportunities for designers (specifically on the 2012 SWMMWW)	Medium
Coordinate with the Clallam Conservation District and WSU Extension for additional training opportunities for staff.	Medium
Consider promoting or incentivizing secondary uses for stormwater such as rainwater collection (e.g., cisterns) and reuse for irrigation and toilet flushing.	Medium
Train staff when updates occur to planning, development, inspection, and enforcement of stormwater runoff controls.	Low

Asset Management

Status

The City has mapped the majority of stormwater facilities and structures in its geographic information system (GIS) software, but does not have a formal asset management program for their stormwater infrastructure.

Recommendations

Asset management is a system for maintaining the desired level of service while minimizing the life cycle cost of stormwater assets. An effective asset management program ensures that assets continue to function over the long term and can significantly reduce the potential for system failure. An asset management program typically includes an inventory of assets, an assessment of their condition (updated with periodic maintenance checks), implementation of a GIS-based asset management data information tracking system, and prioritization of maintenance or capital repair projects based on assessing the likelihood of failure and consequences of failure for each asset. Table 11 summarizes the recommendations for the City related to Asset Management.

Table 11. Asset Management Recommendations.

Recommendation	Prioritization
Continue to update the storm system map and database as needed.	High
Develop a system to ensure that new development projects with stormwater components are incorporated into GIS.	Medium
Improve the existing asset inventory by updating stormwater system components in GIS with current conditions.	Medium

Stormwater System Operations and Maintenance

Status

The City currently implements a variety of stormwater system operations and maintenance (O&M) activities that include the following:

- **Inspections and O&M:**
  - City-owned catch basins and stormwater facilities (e.g., drywells, perforated pipes, detention ponds, retention ponds) inspections are conducted every 1 to 3 years, according to need
  - Street sweeping, most streets several times/year
  - Stormwater facility cleaning and maintenance, repair/replacement as needed
  - Flooding and storm response and repair, including checking/cleaning irrigation system trash racks

- **Spill Response:**
    - Spill control materials (i.e., sand bags, kitty litter, straw wattles, catch basin filters, etc.) are kept on hand in case of spills, including firefighting water.

The Streets crews also implement the following activities that may impact stormwater:

- **Snow and Ice Management:** Crews have used magnesium chloride since the winter of 2011-2012 as a de-icing agent on main arterials, overpasses, hills, and roundabouts. Magnesium chloride has been more cost-effective for the City than road salt or sand and is more environmentally friendly than most other de-icers. The use of magnesium chloride also does not require additional street sweeping (as required with sand) to pick up material after each storm event. De-icing materials are stored outdoors in storage tanks (8,000-gallon maximum capacity) on an uncovered impervious area.
- **Weed Management:** City crews occasionally use EPA-approved herbicides during the summer and early fall to keep sidewalks and street gutters free of weeds. Any herbicides used are applied to the minimum extent practicable and are applied by Washington State Department of Agriculture Pesticide licensed Public Works crew members. Herbicides are stored in the breezeway in containers or inside on a concrete pad. The City does not currently have an Integrated Pest Management Plan (IPMP).
- **Vactor Waste Disposal:** The City collects vactor waste from cleaning and maintenance of catch basins, detention facilities, and treatment structures or facilities. The vactor waste is transported to the City Shop facility and dumped at the decant facility. The decant liquids are sent to the sanitary sewer system. Clean solids are disposed of at the County gravel pit or land-applied to City-owned property next to the Shop. If a hot load is suspected, materials are tested prior to dumping and transported to the Port Angeles Landfill.
- **Street Sweeping Waste Disposal:** Street sweeping waste is transported to the City Shop facility and dumped on a dewatering slab where the liquids are decanted from the solids. The decant liquids are sent to the sanitary sewer system. Clean solids are disposed of at the County gravel pit or land-applied to City-owned property next to the Shop. If a hot load is suspected, materials are tested prior to dumping and transported to the Port Angeles Landfill.

Recommendations

The high priority stormwater program modifications summarized in Table 12 are recommended to improve the City's stormwater system O&M program. Medium and low priority stormwater program recommendations are also summarized in this table.

Table 12. Stormwater System Operations and Maintenance Recommendations.	
Recommendation	**Prioritization**
Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for annual and storm-related maintenance.	High
Add maintenance and inspection information to the storm system map and database in GIS.	High
Ensure compliance with SMC requirements for regular inspection and maintenance.	High
Consider hiring seasonal workers to work on inspection/maintenance crew.	High
Increase staff support (permanent or seasonal) for inspecting and cleaning stormwater facilities including irrigation system track racks.	High
Evaluate street sweeping routine to determine if changes need to be made.	Medium
Develop a policy for City inheritance of private stormwater facilities that specifies the condition that a private stormwater facility should be in prior to being inherited by the City. Consider coordinating this policy with the inheritance of private streets.	Medium
Improve internal communications within Public Works to facilitate O&M activities.	Medium
Develop SOPs for O&M staff.	Medium
Review SWPPPs developed for other Cities and Counties to determine if a similar plan should be developed for the City Shop.	Medium
Require City O&M staff attendance at trainings, especially those related to maintenance of LID BMPs. Invite Irrigation District O&M staff to attend trainings.	Medium
Include the stormwater pond that drains part of the Shop parking lot in regular inspection and maintenance routines.	Medium
Develop an Integrated Pest Management Plan (IPMP) for ROW vegetation and stormwater facility maintenance.	Medium
Obtain additional tools and equipment to inspect, maintain, and repair LID facilities.	Low
Remove trash and litter from problem areas, set up a notification system and response, or implement a program for volunteer trash clean ups that prioritizes problem areas.	Low
Invite vendors to present on how to maintain their technologies.	Low

Pollution Source Detection and Elimination

Status

Pollution Source Detection and Elimination refers to the detection and elimination of "illicit discharges," defined in SMC 13.104.040 as non-stormwater discharges to the storm drainage system that cause or contribute to a violation of state water quality, sediment quality or ground water quality standards. These discharges can include, but are not limited sanitary sewer connections, industrial process water, interior floor drains, car washing, and greywater systems. The City's activities related to pollution source identification and elimination include the following:

- **Stormwater system map updates:** Ongoing mapping of the City's stormwater facilities and pipes (both City and non-City-owned) is described under Asset Management.
- **Illicit discharge ordinance:** Adopted an illicit discharge ordinance prohibiting illicit discharges to stormwater drainage systems (SMC 13.104.120).
- **Enforcement:** Ecology and the EPA have enforced several past illicit discharges within the city.

Recommendations

The recommendations for establishing a proactive pollution source detection and elimination program are summarized in Table 13.

Table 13. Pollution Source Detection and Elimination Recommendations.

Recommendation	Prioritization
Develop and implement a pollution source tracking program that includes obtaining field equipment that can be used for illicit discharge field screening and source tracing, developing of a basic training program for City field staff, and developing of a system for tracking all illicit discharges reported and investigated.	High
Establish a policy for how charity car wash drainage should be handled.	High
Develop a spill reporting hotline or web form.	High
Update illicit discharge ordinance, or provide policy direction for interpreting it.	Medium
Provide pollution source detection and elimination education as part of the City's ongoing public education program to the general public and businesses.	Medium
Require staff involved in illicit discharge response to review the Illicit Connection/Illicit Discharge Field Screening and Source Tracing Guidance Manual that was developed for the State of Washington (Ecology 2013).	Medium
Develop and implement a pollution source field screening program for the City's stormwater system.	Low

Public Education and Involvement

Status

The City's stormwater public education and involvement currently includes the following activities, *all* directly related to the 2013-2015 Master Plan project, partially funded by a Centennial Clean Water grant from Ecology:

- **Education:**
  - Dungeness River Fest (September 2014)
  - Interpretive Center at Water Reuse Demonstration Park (grand opening in October 2014; open 2 hours every Wednesday morning and Thursday afternoon)
  - Public presentations to Chamber of Commerce, Dungeness River Management Team, Science Café, Sequim Association of Realtors, North Peninsula Builders Association, and others
  - Stormwater Stewardship flyer, Bell Creek poster, LID resource table and other elements displayed at the Interpretive Center
  - Website on surface water management, including a page on the Stormwater Stewardship project, and a virtual tour of local water resources
  - Creek sign installation (Bell, Johnson, and Gierin Creeks)

- **Opportunities provided for public involvement:**
  - Website for the Stormwater Management Needs Assessment (Sequim 2014) project to solicit reports of flooding and problem areas within the city
  - Volunteer program, including storm drain inventory, flow monitoring, data entry, watershed education, and other activities
  - Bell Creek Discovery Tour online or on-the-ground educational tour of sites from headwaters to mouth (prizes for those completing tour April-May 2015)
  - Monthly Stormwater Stewardship project updates offered by email to subscribers via website
- **Coordination with stakeholders:** Directly consults with stakeholder groups (e.g., irrigators, Clallam Conservation District, WSU Extension, Clallam County, homeowner groups, tribes, Olympic Region Clean Air Agency [ORCAA], and others) regarding stormwater management, water quality, habitat, and regional water supplies including water conservation.

Recommendations

The high priority stormwater program modifications summarized in Table 14 are recommended to improve the City's stormwater public education programs. Medium and low priority stormwater program recommendations are also summarized in this table.

Table 14. Public Education and Involvement Recommendations.

Recommendation	Prioritization
Provide additional guidance (e.g., factsheets, brochures, checklists) for developers and builders on meeting the City's stormwater facility design, maintenance, and construction requirements.	High
Develop outreach materials for residents, landscapers, and property managers/landowners, the general public, and businesses.	High
Attend regional conferences and meetings on stormwater and surface water management.	High
Continue to coordinate and create agreements with other parties as necessary to achieve stormwater management goals, water quality goals, and water resource management for the Dungeness watershed.	High
Utilize resources available from partner agencies including Clallam Conservation District, WSU Extension, Ecology, and Association of Washington Cities (AWC).	High
Attend regional meetings and participate in regional forums and such as the West Sound Stormwater Managers' Coordination Group, the Sequim-Dungeness Clean Water Work Group, and the Association of Washington Cities (AWC).	High
Identify opportunities for public participation throughout Master Plan implementation.	Medium
Create a hotline and system for logging and responding to general stormwater-related complaints.	Medium
Promote rain barrels and cisterns for storing roof runoff for future irrigation.	Medium
Re-establish storm drain marking program—using storm drain markers, for example.	Low
Measure adoption of targeted behaviors and adapt program to best meet goals.	Low
Continue to develop a Communications Plan.	Low
Evaluate the costs and benefits of having a stormwater public education and outreach program.	Low

CHAPTER 5 – PLAN IMPLEMENTATION

This section describes a plan for implementation of the recommended CIP projects and stormwater program activities that takes into account staffing needs, funding needs, equipment needs, future growth, climate change, interdepartmental collaboration, interagency collaboration, and concurrent planning.

SUMMARY OF RECOMMENDATIONS

Three tiers were evaluated for staffing, funding, and equipment needs:

A. Needed to meet minimum standards

B. Likely to be mandated

C. Proactively anticipating and reducing risk

Table 15 identifies the Stormwater Program elements that fall into each tier.

Table 15. Stormwater Program Element Priorities Included in Tier A, B and C.

Stormwater Program Element	Tier A	Tier B	Tier C
Capital Facilities	Group 1	Group 1	Group 1 and 2
Inspection Program	H, M	H, M	H, M (no L priorities)
Water Quality Compliance	H	H, M	H, M, L
Species and Habitat Protection			H (no M or L priorities)
Stormwater Design and Plan Review		H, M	H, M, L
Asset Management		H, M	H, M (no L priorities)
Stormwater System O&M	H	H, M	H, M, L
Pollution Source Detection and Elimination		H	H, M, L
Public Education and Involvement		H	H, M, L

A summary of the work items and costs required to implement the recommendations of this plan is provided in Table 16.

Table 16. Stormwater Program and CIP Recommendations.			
Stormwater Program Element	**Summary of Tier A Recommendations**	**Additional Funding**	**Additional Staff Support (FTE)**
Capital Facilities	Implement Group 1 and 2 CIP Projects (see Chapter 3 – Known Stormwater Problems and Recommended Solutions section).	Tier A – $518,500 Tier B – $518,500 Tier C – $823,500	Not applicable (additional funding includes design and construction management costs)
Inspection Program	• Institute a stormwater facility inspection program • Develop maintenance standards, inspection logs, and plat language • Coordinate with School Districts • Improve coordination with homeowner associations and commercial landowners • Develop enforcement procedures for maintenance of private stormwater facilities	$0	Tier A – 0.17 FTE Tier B – 0.17 FTE Tier C – 0.17 FTE
Water Quality Compliance	• Develop and implement a pollution control plan for waterbodies currently on the 303(d) list of impaired waters • Develop and implement surface water flow monitoring program • Coordinate with CWWG on monitoring activities • Use GIS to identify UIC wells that need to be registered • Use online form to register wells • Develop and implement a plan to assess drywells classified as UICs	Tier A – $100,000 Tier B – $148,000 Tier C – $158,000	Tier A – 0.20 FTE Tier B – 0.27 FTE Tier C – 0.29 FTE
Species and Habitat Protection	• No Tier A recommendations	$0	Tier C – 0.04 FTE
Stormwater Design Guidance and Plan Review	• No Tier A recommendations	Tier B – $40,000 Tier C – $40,000	Tier B – 0.23 FTE Tier C – 0.27 FTE
Asset Management	• No Tier A recommendations	Tier B – $6,000 Tier C – $6,000	Tier B – 0.61 FTE Tier C – 0.61 FTE
Stormwater System O&M	• Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for annual vs. storm-related maintenance. • Add maintenance and inspection information to the storm system map and database in GIS. • Consider hiring seasonal workers to work on inspection/maintenance crew • Increase staff support for inspecting and cleaning stormwater facilities including irrigation system trash racks.	Tier A – $0 Tier B – $15,000 Tier C – $281,000	Tier A – 1.39 FTE Tier B – 1.54 FTE Tier C – 1.54 FTE

Table 16 (continued). Stormwater Program and CIP Recommendations.			
Stormwater Program Element	**Summary of Tier A Recommendations**	**Additional Funding**	**Additional Staff Support (FTE)**
Pollution Source Detection and Elimination	• No Tier A recommendations	Tier B – $14,000 Tier C – $24,000	Tier B– 0.11 FTE Tier C – 0.19 FTE
Public Education and Involvement	• No Tier A recommendations	Tier B – $24,000 Tier C – $39,000	Tier B – 0.24 FTE Tier C – 0.29 FTE
Total Additional Funding and Staff Support Needed		Tier A – $618,500 Tier B – $765,500 Tier C – $1,371,500	Tier A – 1.76 FTE Tier B – 3.18 FTE Tier C – 3.41 FTE

Staffing Needs

When this Plan was developed (mid-2015), the City budgeted 1.75 full time equivalent (FTE) personnel designated to supporting stormwater activities: 0.75 FTE Operations and 1.0 FTE Capital (a temporary position largely reimbursed with grant funds).

The estimated staff support needed for each category includes the following:

- **Tier A:** 2.51 FTE permanent staff (0.75 FTE existing and 1.76 FTE additional staff)
- **Tier B:** 3.93 FTE permanent staff (0.75 FTE existing and 3.18 FTE additional staff)
- **Tier C:** 4.16 FTE permanent staff (0.75 FTE existing and 3.41 FTE additional staff)

A detailed staffing breakdown by position is included in the Regulatory Gap Analysis and Compliance Strategy Report (Appendix G). Note that temporary and/or part-time staff may be used to fulfill FTE needs, and supplementary grant funds will most likely be needed.

Funding Needs

The 2014 budget for stormwater was $251,000. Of this, $101,000 is used for stormwater system maintenance, GIS mapping, capital facility improvements, and education and outreach activities (refer to Appendix G for details) and $150,000 is used for capital (planning grant).

The estimated funding support needed for each category includes the following for operational as well as capital costs (note that grants and/or loans will be needed to help cover these needs, especially for large capital projects):

- **Tier A:** $719,500 ($101,000 existing and $618,500 additional funding)
- **Tier B:** $866,500 ($101,000 existing and $765,500 additional funding)
- **Tier C:** $1,472,500($101,000 existing and $1,371,500 additional funding)

Equipment Needs

The primary City equipment currently used for the stormwater program includes two vactor trucks (one new in Fall 2014), a street sweeper, a motorized camera, a "push" camera, and equipment that is used for jetting infiltration lines.

Additional equipment that could be useful for maintenance, asset management, and pollution source detection inspections include the following:

- **Tier A:** No new equipment needed
- **Tier B:** Pollution source field screening and source tracing equipment and asset management software and field tools
- **Tier C:** Pollution source field screening and source tracing equipment, bioretention maintenance equipment, permeable pavement maintenance equipment

A more detailed equipment breakdown is included in the Regulatory Gap Analysis and Compliance Strategy Report (Appendix G). Grant funds are sometimes available for equipment needs.

FUNDING STRATEGIES

The City currently funds stormwater activities (primarily street sweeping, catch basin cleaning, and capital expenses) with about $100,000 from Water and Sewer Utility funds supplemented with an Ecology grant. The state allows sewer funds to be used for stormwater activities (RCW 35.92.020). The 2013 budget for stormwater was $141,000. The 2014 budget for stormwater was $251,000 (refer to Appendix G for details).

A financial analysis was performed in late 2015. The Funding Strategies Memorandum is attached as Appendix I.

The projected annual cost of the three tiers through 2022 is compared with existing stormwater expenses as follows:

- No Change annual cost: $110,000
- Tier A annual cost: $565,000
- Tier B annual cost: $675,000
- Tier C annual cost: $825,000

The financial analysis assessed the following five potential funding options for programmatic stormwater activities (grant funding is expected to be needed for many capital projects):

1. Continuing to pay from water and sewer utility revenues
2. Ad valorem property tax assessment
3. Establishing a stormwater fee
4. Forming a special purpose district
5. Combination of the above funding sources

Under Alternative 1 (the City's current approach), the Water Utility and Sewer Utility pay for stormwater services. The financial impact varies depending on total water use and winter water use, but is projected to be $1.60 to $2.10 per month for most single-family residential customers. With the implementation of the Tier A recommendations, that financial impact would increase to $8.60 to $11 per month.

Alternative 2 (Ad valorem property tax assessment) results in a projected cost of $0.686 per $1,000 of assessed valuation, or $10.58 of new property taxes per month, for implementation of the Tier A recommendations. P

Alternative 3 (Establishing a stormwater fee) results in a projected cost of $12 to $18 per month, for implementation of the Tier A recommendations.

Projected costs for Tier B and Tier C, a discussion of equity considerations, and administrative and implementation considerations are included in Appendix I.

Alternatives 4 and 5 were also evaluated; however, financial impacts were not developed for either alternative. Additional detail regarding these two alternatives can be found in Appendix I.

FUTURE GROWTH STRATEGIES

This section identifies programmatic and capital project strategies for handling future growth. The needs will evolve with growth, which means these strategies will need to be revisited on a regular basis.

Stormwater Program Strategies

Future growth will increase the need for resources in all stormwater program elements, in particular, growth is expected to increase the effort required for providing stormwater design guidance and plan review, construction inspection, stormwater system O&M, and public education and involvement. Providing adequate resources for education, design guidance, and inspection will help ensure that development projects occur in accordance with applicable stormwater regulations and minimize the increased burden on the storm and surface water system. Future development will expand the transportation and stormwater systems, and lead to additional effort required for O&M, including inspection and cleaning the stormwater system and street sweeping. During future years, the City will need to consider whether staffing and equipment resources need to be increased to address the needs of growth.

Capital Project Strategies

This plan includes stormwater CIP projects that will lay the groundwork for future development of the storm and surface water system. In particular, three CIP projects focus largely on planning for future development:

- 1.00 Sequim Area Stormwater-Watershed Plan
- 1.09 Middle Reach Bell Creek Floodplain Planning
- 2.26 River Road Storage Project

Projects 1.00 and 1.09 are needed to address several important growth considerations:

- Balance the City's development density goals with natural resource protection, including managing stormwater in ways that ensure adequate groundwater recharge and protect groundwater quality.
- Include a watershed-based approach for stormwater management that may include development of regional stormwater infrastructure plans for conveyance, flow control, and water quality treatment, as well as resource protection projects; watershed-specific regulations may also be indicated. Typical regional plans are aimed at constructing natural (streams and wetlands) or built (pipes and pond) elements to convey, detain, treat, and infiltrate stormwater from developed properties without causing erosion of streams or degradation of water quality that would be harmful to fish and wildlife.
- Outline funding strategies that may include fee-in-lieu approaches where regional stormwater projects may be funded through fees on future development.
- Be adaptable to future land use plan changes.
- Address the City's goals for reclaimed water. As an example, projects focused on stormwater treatment and infiltration may be designed to receive reclaimed water during the dry season to further increase aquifer recharge and could also create wildlife habitat.
- Consider land use planning elements, such as reduced lot size and increased open space, in order to minimize the stormwater impacts of future development.

Project 2.26, as described in this plan, would include construction of a large reservoir outside of the city limits that could benefit the City by detaining flow in irrigation canals during the wet season and by alleviating existing flooding problems in the city. As this project concept is developed, the City should consider whether the reservoir can also be used to provide to offset stormwater management needs of future growth. If the wet season detention benefits of the reservoir are great enough, the City may be able to establish credits by which future developments could discharge treated stormwater into the irrigation canals. These credits could help reimburse the reservoir construction. Secondary benefits of a large reservoir could include wildlife habitat and possible recreation opportunities.

Climate Change Strategies

Stormwater management adaptation is less costly and disruptive if necessary measures are undertaken in advance of anticipated changes. Sequim is working to identify stormwater infrastructure vulnerable to climate risks and implement adaptation strategies to maintain public safety and working stormwater infrastructure. A primary adaptation strategy will be to consider climate risks in the planning, funding, design, and construction of new or replaced stormwater infrastructure. Second, the City will promote improvements in the most vulnerable areas. Many infrastructure improvements made for other reasons, such as seismic retrofits, fish passage improvements, and culvert replacements, also make infrastructure more resistant to climate change impacts. The City will also strengthen contingency plans to prepare for and respond to more frequent and severe weather, as well as water shortages.

Given climate change risk factors, the City may want to consider modeling its stormwater system to determine what areas are at or near flow capacity and thus prone to increased flood risk in the future; particularly in neighborhoods where redevelopment is expected to occur, or where large capital improvement projects are planned. But aside from modeling, flood-prone problem areas reported in the City's Stormwater Management Needs Assessment (Sequim 2014) and further defined in this plan, are a good place to start to understand the potentially vulnerable links in the City's stormwater system.

As identified in Table 4, declining water quality is expected as a result of increasing summer and average temperatures leading to lower levels of dissolved oxygen and increased frequency of algal blooms. The City could reduce its vulnerability to expected continued decline in water quality by retrofitting existing stormwater facilities for better treatment performance, or constructing new stormwater infrastructure, such as constructed wetlands, or LID facilities, that more effectively treat water quality in areas that have surface runoff. LID and GSI could be implemented as cost-effective methods of dealing with potential increases in precipitation intensity. The City has identified basin-specific studies that would provide better data for adapting stormwater system infrastructure. This is important as climate changes could produce varying levels of impact due to differences in topography, watershed size, level of development, and existing infrastructure drainage capacity that vary by basin.

Future changes in climate that alter precipitation intensity or duration would have consequences for urban stormwater discharge, particularly where stormwater detention and conveyance facilities were designed under assumptions that may no longer be correct. Modifications to the defined 'design storm' may be needed to account for future precipitation changes. Design storm frequency predictions for use in stormwater system modeling that account for predicted precipitation changes remains a data gap, but recent research has indicated a 25 percent increase may be sufficient to design for expected larger events (Rosenberg et al. 2010) and provide adequate adaptability when designing stormwater management systems.

Adaptations used in other jurisdictions to address projected flow increases include increasing stormwater detention on public and private property as well as increasing stormwater detention on streets. Rosenberg et al. (2010) recommends increasing stormwater detention on public and private property by 25 cubic yards per impervious acre, and increasing stormwater detention on streets by 20 cubic yards per impervious acre. Retrofits of privately-owned stormwater ponds is another way to add storage capacity. Planned inspections of key drainages during large storm events can identify erosion concerns that need to be addressed and prevent clogging if the debris and sediment is cleared at the same time.

Finally, in the broader picture, Sequim is working with the North Olympic Peninsula Resource Conservation and Development Council (NOPRC&D) in 2015 to plan for climate change on the North Olympic Peninsula. Members of NOPRC&D include Jefferson County, Clallam County, the cities of Port Angeles, Sequim and Port Townsend, Clallam Economic Development Council, Ports of Port Townsend and Port Angeles, Clallam Conservation District, the Clallam PUD, the Jefferson PUD, Jamestown S'Klallam Tribe, Makah Tribe, Elwha Klallam Tribe, and Team Jefferson Economic Development Council.

A region-specific climate assessment that summarizes the observed trends and projected changes in the climate for the North Olympic Peninsula (changes in precipitation, air and water temperatures, etc.) and the projected impacts of climate change on the North Olympic

Peninsula has been completed. In addition, a prioritized risk assessment of climate change and a vulnerability assessment of the North Olympic Peninsula was conducted based on: 1) how the climate is changing; 2) how sensitive key sectors, resources, or areas are to those changes; and 3) the ability of our systems and environment to adapt to those changes. NOPRC&D plans to develop potential solutions and actions for reducing risk and increasing resilience for the prioritized higher risk areas through research and workshops with local experts in 2015.

In September 2015, the NOPRC&D completed a Climate Preparedness Plan for the North Olympic Peninsula, created outreach materials, and presented the plan to municipalities (including planning commissions), watershed planning organizations, and other groups in Jefferson and Clallam Counties. The plan's purpose is to inform decision-making with specific local information and strategies to reduce risks from climate change; key strategies for Sequim are listed under *Concurrent Planning*, below. Currently, the NOPRC&D is tracking implementation of solutions and actions recommended in the Climate Preparedness Plan.

Based on the predicted long-term trends and changing risks, it is recommended that City collaborate with its partners on a long-term, comprehensive water management strategy that institutes adaptive management and water conservation. This strategy will help ensure that regional water supplies, including stormwater, drinking water, irrigation water, reclaimed water (and potentially gray water), streams and other surface waters, will effectively meet the needs of residents, industry, agriculture and the natural environment.

INTERDEPARTMENTAL COLLABORATION

The stormwater program is currently led by the Resource Manager in the Public Works Department. Within the Public Works Department, several divisions assist with stormwater program activities including Utilities, Engineering, and Streets. The Engineering division works with the Department of Community Development (DCD) to implement stormwater program activities. Representatives from these departments and divisions were involved in the development of this Master Plan. These representatives are identified in Appendix B.

As the stormwater program becomes more robust, it is critical to align stormwater CIP project planning with the Transportation, Sewer, and Water Master Plans, the Parks and Recreation Master Plan, and the City's reclaimed water projects. Future opportunities will be sought for managing stormwater along with the City's reclaimed water system, potentially using the same infiltration facilities, to utilize both sources to the greatest extent possible.

There may be opportunities to coordinate stormwater management with land use planning, particularly when undeveloped open spaces (including parks and public right-of-way) could be available for storage, conveyance, or infiltration of stormwater.

INTERAGENCY COLLABORATION

To address ongoing regional coordination needs, the City will continue to work with regional stakeholder groups and other local governments in shared drainage basins to protect groundwater and surface water quality and to manage and treat stormwater effectively. These entities include (among others):

- Clallam County
- Irrigation districts and companies (Highland Irrigation District and Sequim Prairie Tri-Irrigation Association, comprised of Independent Irrigation Company, Eureka Ditch Company, and Sequim Prairie Ditch Company)
- Clallam Conservation District
- Sequim School District
- Jamestown S'Klallam Tribe
- Home Owner Associations

The types of agreements discussed in this plan include the following:

- Maintenance and management agreements addressing type and frequency of maintenance/management activities as well as separate and shared responsibilities
- Information sharing agreements with data collection partners, such as members of the Sequim-Dungeness Clean Water Work Group (a subcommittee of the Dungeness River Management Team) and other water quality, fish habitat/use, stormwater monitoring and management information
- Other agreements necessary to achieve stormwater and long-term regional water management and water conservation goals

State and federal agency coordination will also be important as the Storm and Surface Water Master Plan is implemented, especially to communicate that the City is taking certain actions specifically to prevent the need to have the NPDES permit requirements imposed. Other state-agency drivers include water quality regulations and the Puget Sound Action Plan and its "Puget Sound Vital Signs," several of which would be addressed with Plan implementation.

Key state and federal agencies include:

- Washington Department of Ecology
- Washington Department of Health
- Washington Department of Fish & Wildlife
- Washington Department of Transportation
- Puget Sound Partnership
- US Environmental Protection Agency
- US Fish & Wildlife Service
- National Marine Fisheries Service (with NOAA)
- Federal Emergency Management Agency
- Olympic Region Clean Air Agency (ORCAA)

CONCURRENT PLANNING

After the release of the draft Storm and Surface Water Master Plan in May 2015 and before it was finalized in February 2016, there were several key planning processes that concluded with results relevant to this plan.

First, a 2016 budget was prepared and adopted by City Council that includes stormwater operations and capital elements slightly different from what was current in May 2015. Pertinent sections have been updated in the final version of this plan to reflect these differences. Appendix I contains a funding analysis based on the 2014 and 2015 stormwater budgets; these details were not updated.

Sequim 2015–2035 Comprehensive Plan

On October 26, 2015, the City Council adopted the Comprehensive Plan Update resulting from the Sequim 120 planning process conducted by DCD. When the draft Storm and Surface Water Master Plan was developed, the most current Comprehensive Plan draft was from March 11, 2015 (Sequim 2015). Since then, City staff made several changes to the most pertinent section, Chapter 9/ Energy & Environment, which have improved compatibility with the Storm and Surface Water Master Plan.

Significant themes in the adopted Comprehensive Plan Update include:

- Preserving and protecting water supplies and water quality, both surface water and groundwater
- Protecting and enhancing stream habitat, especially Bell Creek
- Managing long-term risk and costs through sustainable practices and environmental sensitivity when developing
- Working with regional water management partners and utilize reclaimed water resources

Climate Change Preparedness Plan for the North Olympic Peninsula

There are several references in this plan to the multi-stakeholder planning process undertaken in 2014–15 by the North Olympic Peninsula Resource Conservation & Development Council, with funding from the US EPA, to plan for impacts related to climate change. City of Sequim staff and City Council participated at various stages of this process, as mentioned in earlier in this chapter.

The final plan was released in September 2015 and presented to the City Council at a Study Session on November 9, 2015, with a list of “adaptation strategies” especially pertinent to Sequim. In fact, this plan already contains several recommendations that parallel those in the Preparedness Plan. Appendix A of the Climate Change Preparedness Plan contains a comprehensive list of adaptation strategies categorized as follows: Ecosystem (E), Water Supplies (WS), and Critical Infrastructure (CI).

Some of the most relevant strategies in the Climate Change Preparedness Plan include:

- E-5: Increase regional capacity for water storage
- E-16: Develop community climate action plans
- E-34: Replace undersized culverts to anticipate climate-influenced runoff events
- WS-1: Enhance education on drought and water supplies issues for the peninsula
- WS-15: Enhance residential water conservation through incentives and outreach
- WS-21: Explore opportunities for artificial recharge of groundwater aquifers
- CI-1: Update emergency management and response planning to include climate change
- CI-2: Reduce inflow and infiltration (I&I) to wastewater systems
- CI-8: Improve on-site stormwater management practices

CHAPTER 6 – CONCLUSIONS

Adoption and implementation of a Storm and Surface Water Master Plan in Sequim is important to attain the following benefits:

- Compliance with existing requirements for maintenance, inspection and enforcement
- Reduced localized flooding or ponding resulting in less nuisance and property damage
- Reduced level of pollutants carried by stormwater (sediments, nutrients, metals, oils, and other contaminants) resulting in fewer water quality impairments
- Protected fish and wildlife habitat provided by city streams and downstream resources including Washington Harbor
- Preservation and protection of drinking water supply and groundwater quality
- Comprehensive water management/conservation to ensure future water supply resilience

Most of the stormwater in the city is managed through infiltration and therefore serves as a source of groundwater recharge. While this is a convenient and inexpensive way to manage stormwater, it does present a potential concern for protecting the quality of the city's groundwater supply. The city is unique when compared to most other cities in western Washington because of the relatively dry climate; therefore, City staff are especially concerned with conserving water resources and water resource management in the Dungeness watershed is an important focus in the area.

Recommendations and improvements for the City's stormwater program include recommendations from the City's Stormwater Management Needs Assessment (Sequim 2014), as well as additional needs identified during the workshop and document review. Based on this assessment, this Plan makes the following high priority recommendations:

- **Capital Facilities:** Initiate a stormwater Capital Facility Program to address flooding and water quality issues within the city. The City should add stormwater projects to the City's overall CIP; Table 6 in this plan identifies priority capital projects.
- **Inspection Program**: Institute a stormwater facility inspection program and develop and enforce maintenance standards for non-City-owned stormwater facilities. The inspection program may include development of inspection logs and plat language and private-owner education, coordination with school districts to clarify maintenance responsibilities, and improved coordination with homeowner associations and commercial landowners on shared maintenance responsibilities. Criteria and protocols for enforcement should also be developed.
- **Water Quality Compliance:** Develop and implement a pollution control plan for water bodies currently on the 303(d) list of impaired waters, surface water flow monitoring program, and a plan to assess drywells classified as underground injection control wells (UICs).Consider monitoring to assess water quality and measure improvements

over the long term resulting from stormwater management and water quality treatment of typical stormwater pollutants.

- **Species and Habitat Protection**: Participate in routine meetings of the DRMT and Water Rule implementation groups, and request smolt outmigration data from Bell Creek measured by the Tribe and Sequim Bay water quality data.
- **Stormwater Design Guidance and Plan Review to control runoff from development during and post-construction:**
  - Review the 2012 SWMMWW (and 2014 modifications) and consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City, which may include BMPs that are most effective in protecting groundwater quality while preserving recharge.
  - Develop a consistent stormwater plan review process, which may include handouts that summarize on-site stormwater management, treatment, and flow control thresholds for when the SWMMWW applies for single-family and commercial development projects.
- **Asset Management:** Continue to update the storm system map and database as needed.
- **Stormwater System Operations and Maintenance:** Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for maintenance, add maintenance and inspection information to the storm system GIS database, and consider hiring additional support for the inspection/maintenance crew and inspecting and cleaning stormwater pipes and drywells.
- **Pollution Source Detection and Elimination:** Develop and implement a pollution source tracking program, obtain field equipment for illicit discharge tracking and source tracing, develop a system for tracking illicit discharges, develop a basic training program for City field staff, and develop a spill reporting hotline.
- **Public Education and Outreach:**
  - Develop outreach materials for residents, landscapers, and property managers/landowners, including additional guidance (e.g., fact sheets or brochures) for developers and builders on meeting the City's stormwater facility maintenance and construction requirements.
  - Attend regional meetings and conferences and participate in regional forums and such as the West Sound Stormwater Managers' Coordination Group, the Sequim-Dungeness Clean Water Work Group, and the AWC. Continue to work toward coordination/leadership/agreements with other parties that may be necessary to achieve stormwater and overall water resource management/conservation goals (this may include reclaimed water and other supplies).
- **Planning and Collaboration**: Continue to plan and coordinate with local water managers to ensure future water supply resilience.

During development of this plan (in mid-2015), the City's stormwater program included an annual operational budget of $101,000, which funded 0.75 FTE permanent staff (maintenance), and an Ecology grant which funded the capital planning project. With this

budget, the City is struggling to provide basic stormwater services such as stormwater system O&M (complete catch basin and stormwater facility inspection and cleaning, street sweeping), GIS mapping, and minor capital facility improvements. The recommendations and activities outlined in this Master Plan include a three tier approach to providing future stormwater program support—which will need to be supplemented with grant funds.

Tier A includes stormwater program activities necessary to meet minimum standards. This tier includes Group 1 capital projects, a City inspection program (currently in the City code, but unfunded), high priority recommendations to meet water quality compliance, and high priority recommendations for stormwater system O&M. Tier A would include $618,500 additional funding and 1.76 FTE additional staff. This would result in a total of $719,500 funding and 2.51 FTE staff for the City's stormwater program.

Tier B includes stormwater program activities that are likely to be mandated. This tier includes Tier A activities and adds Group 1 capital projects, high priority stormwater design and plan review activities, an asset management program, medium priority recommendations to meet water quality compliance and stormwater system O&M, medium and high priority recommendations for stormwater design and plan review, and high priority recommendations for pollution source detection and elimination and public education and involvement. Tier B would include $765,500 additional funding and 3.18 FTE additional staff. This would result in a total of $866,500 funding and 3.93 FTE staff for the City's stormwater program.

Tier C allows for proactive stormwater program activities to reduce risk. This tier includes Tier B activities and adds Group 2 capital projects, species and habitat protection activities, stormwater design and plan review activities, and all remaining activities (primary medium and low priority recommendations for the remaining stormwater program categories). Tier C would include $1,371,500 additional funding and 3.41 FTE additional staff. This would result in a total of $1,472,500 funding and 4.16 FTE staff for the City's stormwater program.

For all three tiers, grants and/or loans would be needed to supplement the budget, particularly for capital projects.

A financial analysis was performed in late 2015. The Funding Strategies Memorandum is attached as Appendix I. The financial analysis assessed the following five potential funding options:

1. Continuing to pay from water and sewer utility revenues
2. Ad valorem property tax assessment
3. Establishing a stormwater fee
4. Forming a special purpose district
5. Combination of the above funding sources

PREFERRED APPROACH

Based on discussions with City staff, Planning Commission, and City Council, the preferred approach for storm and surface water management is implementing the Tier A recommendations over the next one to three years (2016–2018) using existing resources without adding any new revenue. CIP projects will be implemented as grant and loan funding

become available. City staff will report back to the City Council at the end of each year to provide an update on the activities performed during that year, activities that are planned for the upcoming year, and any changes that need to be made to increase success in terms of achievement of Tier A objectives, and impacts, if any, to other City programs. Staff will continue to seek grant and other outside funding to supplement these activities and CIP projects, while ultimately aiming toward Tier B levels of service.

CHAPTER 7 – REFERENCES

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