CITY OF
BAINBRIDGE ISLAND

CITY OF BAINBRIDGE ISLAND
PLANNING COMMISSION MEETING
THURSDAY, MARCH 10, 2016
6:00 PM - 8:00 PM
CITY COUNCIL CHAMBER
280 MADISON AVE N
BAINBRIDGE ISLAND, WASHINGTON

6:00 PM CALL TO ORDER
Call to Order, Agenda Review, Conflict Disclosure

6:05 PM PUBLIC COMMENT
Accept public comment on off agenda items

6:20 PM 2016 LOW IMPACT DEVELOPMENT WORK
Briefing

7:00 PM PUBLIC COMMENT ON COMPREHENSIVE PLAN UPDATE

7:10 PM 2016 COMPREHENSIVE PLAN UPDATE
- *Water Resources Element*

7:45 PM PUBLIC COMMENT ON COMPREHENSIVE PLAN UPDATE

7:55 PM NEW/OLD BUSINESS

8:00 PM ADJOURN

*****TIMES ARE ESTIMATES****

Public comment time at meeting may be limited to allow time for Commissioners to deliberate. To provide additional comment to the City outside of this meeting, e-mail us at pcd@bainbridgewa.gov or write us at Planning and Community Development, 280 Madison Avenue, Bainbridge Island, WA 98110

For special accommodations, please contact Jane Rasely, Planning & Community Development 206-780-3758 or at jrasely@bainbridgewa.gov

AWC Association of Washington Cities
Washington State Association of Counties
May 2013
Talking points

Why are we doing Low Impact Development?

1. LID is the preferred method for stormwater management

LID techniques for managing stormwater in new development and redevelopment are coming to many Washington State municipalities, however with a different emphasis for the east and west sides of the state.

The Washington Department of Ecology (Ecology) will require municipalities covered by the Phase I or Phase II municipal stormwater permit in Western Washington to integrate LID requirements into their stormwater and broader development codes in the next two to five years.

Timeline

Western WA municipalities must implement the new permit requirements by:

- June 30, 2015: Phase I cities and counties
- Dec. 31, 2016: Most Phase II Western WA Municipalities
- June 30, 2017: Phase II permit holders in Lewis and Cowlitz Counties
- June 30, 2018: City of Aberdeen

Ecology's Phase II Eastern Washington permit requires cities and counties to introduce LID techniques and begin to identify what works for local conditions. Cities and counties will need to allow LID projects and develop local feasibility criteria for infiltrating stormwater runoff.

Eastern WA municipalities must implement the new permit requirements by Dec. 31, 2017

2. LID infiltrates and treats stormwater runoff on-site

LID refers to a suite of stormwater management and site design approaches that mimic natural drainage processes to retain vegetation, limit impervious surfaces, and infiltrate and treat runoff on-site. While traditional stormwater practices focus on collecting stormwater in piped networks and transporting it off-site as quickly as possible, LID manages stormwater on-site by using multiple approaches including:

- "Disconnecting" impervious surfaces by directing roof runoff to disperse or infiltrate in a bioretention facility
- Reducing impervious surfaces using techniques like minimizing the length and width of roads
- Conserving and retaining areas of vegetation, such as forested and natural areas as open space
- Amending soils by adding components like compost and mulch
- Installing bioretention facilities or raingardens that capture, infiltrate, and treat stormwater runoff
- Using permeable pavements which are a range of materials that allow stormwater runoff to move into underlying soils
- Rainwater collection and reuse, such as rain barrels and cisterns
- Vegetated roofs that capture and delay stormwater runoff in soils and plants that cover the roof area

Timeline for new LID Requirements in Washington State

August 1, 2013
New Phase I & Phase II Permits take effect

June 30, 2015
Phase I's must implement LID Requirements

Dec. 31, 2016
Most Western Washington Phase IIs must implement LID Requirements

Dec. 31, 2017
Cowlitz County, Kelso, Longview & Centralia must implement LID Requirements

Dec. 31, 2017
Eastern Washington Phase IIs must update their codes to allow LID and identify local infeasibility criteria

Dec. 31, 2018
Aberdeen must implement LID Requirements

3. LID is an effective approach for managing stormwater

LID has been widely demonstrated as an effective approach for managing stormwater. Here's how it works:

- **Slows it down.** LID reduces the quantity and speed of stormwater flowing into water bodies. Seattle's SEA Streets LID project reduced the volume of water flowing to municipal drainage infrastructure by 98% and the Meadow on the Hylebos LID project in Tacoma was able to retain 99% of precipitation falling on that area.
- **Spreads it out.** Because LID approaches, such as permeable pavements, can be installed over larger areas than traditional stormwater drywells or retention ponds, their effectiveness amplifies when implemented at the landscape-level. LID facilities are often small and more dispersed across the development than the traditional facilities.
- **Soaks it in.** LID filters pollutants picked up by stormwater runoff, such as oil, bacteria, sediments, and metals, before the pollutants enter surface water bodies. A six-year study by University of Washington found that permeable pavements were much more effective than traditional pavements at reducing zinc, copper, and motor oil concentrations to in stormwater runoff.

4. LID has multiple economic, environmental, and community benefits

In addition to water quality improvements, LID provides a multitude of economic, environmental, and community benefits that go beyond traditional stormwater infrastructure. Some of these benefits include:

- **Cost effectiveness** through lower operations and maintenance costs as well as reduced infrastructure costs because LID reduces water flow into our stormwater systems
- **Aesthetic benefits** as LID features can be part of attractive landscaping throughout communities and streetscapes
- **Multiple ecological benefits** including: preserved fish and wildlife habitat, improved air quality from retaining vegetation, reduced building water or energy use (where rainwater is collected or vegetated roofs provide insulation), and carbon sequestration by retaining or planting vegetation

Economic benefits

The effectiveness and multiple benefits provided by LID as a stormwater approach can help stretch scarce local government dollars and provide your jurisdiction with the biggest "bang for its buck." Here's how LID may provide economic benefits:

- May lower long-term operations and maintenance costs for LID facilities
- Avoids expensive retrofits of existing infrastructure because there is less runoff from new development
- May provide more usable land area for development because LID reduces the need for stormwater retention ponds and can free up land area for other uses
- Reduces pollution in stormwater runoff from new development resulting in lower clean up costs for rivers and streams
- Leads to fewer costly urban flooding events as LID holds water on-site, reducing the amount of runoff generated during rain events
- Increases property values by creating attractive landscaping and streetscapes
- Contributes toward other regulatory goals, such as comprehensive plans, critical areas ordinances, salmon recovery plans, and watershed plans
- Cleaner water means healthier fisheries and shellfish throughout the state

Environmental and community benefits

LID uses a variety of site design and pollution prevention techniques that create a hydrologically functional and environmentally sensitive landscape. Because LID strategies are, by design, environmentally-focused, their ecological and community benefits are many. Some are shown here:

- All LID strategies help clean our rivers, lakes, streams, and marine waters
- A rain garden or green roof can provide habitat for wildlife
- A green roof can help insulate a building, reducing energy use
- Improve air quality by decreased impervious surfaces and increased vegetation
- Provide communities with landscape enhancements
- Improve walkability and pedestrian safety
- Provide an opportunity for residents and businesses to help manage stormwater through actions
- Provide new small-business opportunities in the green jobs sector

5. LID works on many sites and under many conditions

LID has been successfully implemented on many types of sites, depending on site conditions and with careful planning. LID can be implemented in a wide variety of land uses including:

- Urban redevelopment (rain gardens, green roofs, rainwater harvesting for indoor use)
- Lower density urban development (reducing street width and building bioretention in parking lots)
- Infrastructure projects (integrate into planning of roads, parking areas)
- Rural commercial and residential areas (bioretention in the right-of-way and permeable pavement parking lots)

CITY OF BAINBRIDGE ISLAND

PLANNING & COMMUNITY DEVELOPMENT

MEMORANDUM

TO: Planning Commission

FROM: Jennifer Sutton, AICP
Senior Planner

DATE: March 10, 2016

RE: Study Session on *Water Resources Element*

I. REVIEW *WATER RESOURCES ELEMENT*

On February 25, the Commission recommending moving the *Environmental Element* goals and policies related to aquatic natural resources (e.g. wetlands and streams) into the *Water Resources Element.* The drafting committee met on March 1 to discuss the additions to the Element. Commissioner Quitslund proposed the new *Vision* at the drafting committee meeting, the *Vision* is included in the DRAFT *Water Resources Element* at the end of the Introduction.

The *Existing Conditions and Future Needs* section of the *Water Resources Element* is partially updated, as shown in the attached DRAFT.

At the second Community Conversation on Water on January 12, 2016 the community heard a presentation from City staff and Aspect Consulting about recharge areas for deep and shallow aquifers on Bainbridge Island (see attached map). Staff suggests that the groundwater management goals and policies in the DRAFT *Water Resources Element* recognize that recharge happens Island-wide, and that the conservation of the aquifers shall take place Island-wide. Staff recommends that the 2016 Low Impact Development (LID) regulations be strictly applied to development and redevelopment, and that the City consider promoting stormwater LID retrofits for existing development.

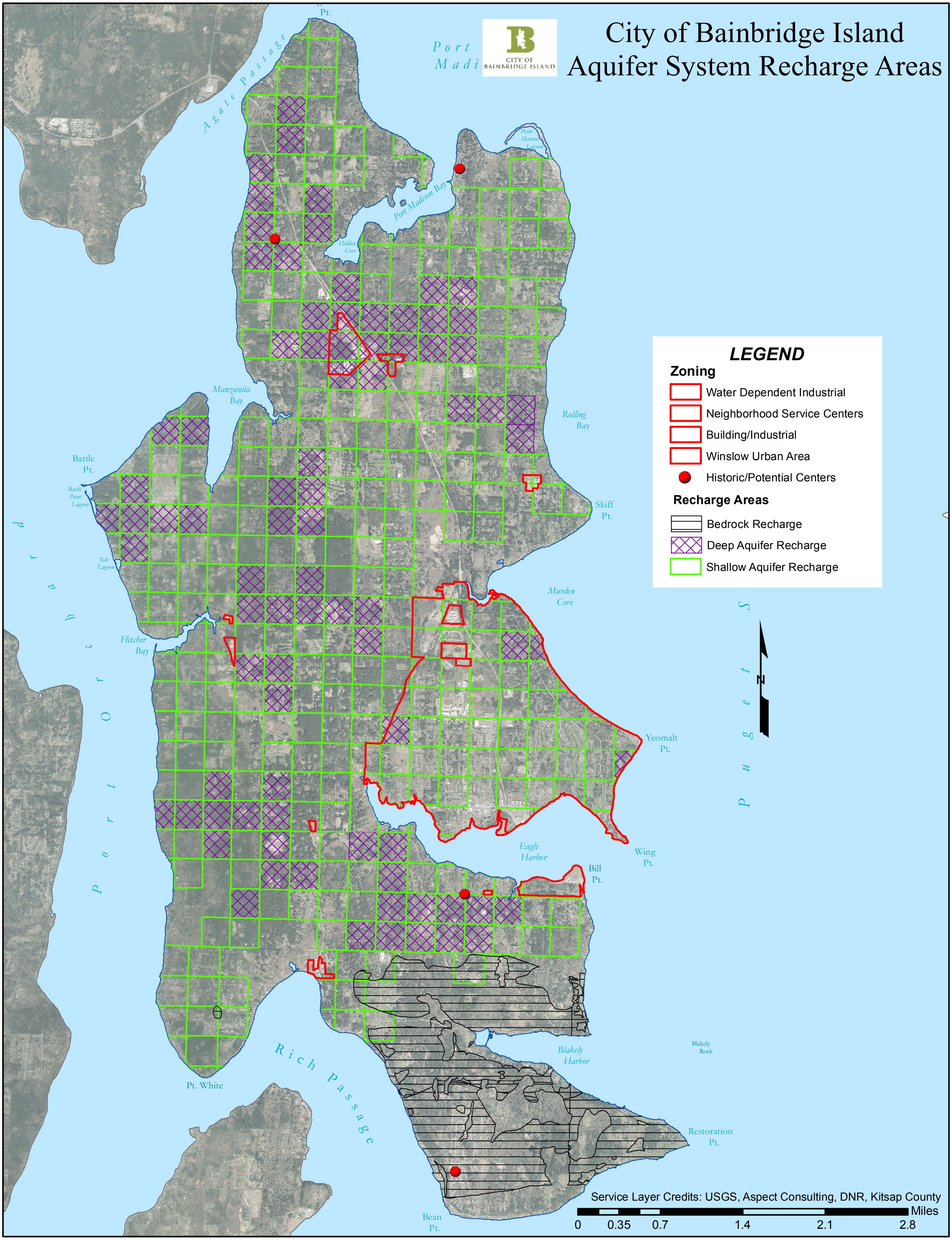
The existing 2004 Plan Water Resources Element was provided to the Planning Commission and can be viewed on the City's website.

Planning Commission Action: Review and confirm amendments and reorganization of the DRAFT *Water Resources Element.* The Commission should ask questions of staff about the information presented

II. NEXT STEPS

The third (and last) of the Community Conversation on Water is scheduled for Thursday, March 17 at 6:00 PM. Aspect Consulting will present information on the concept of a “Water Budget” for Bainbridge Island.

The Planning Commission will hold a special extra meeting, immediately following the March 17 water workshop, beginning at 7:40 PM. The Commission will continue review of the DRAFT *Water Resources Element* at that meeting.



City of Bainbridge Island
Aquifer System Recharge Areas
CITY OF BAINBRIDGE ISLAND
LEGEND
Zoning
Water Dependent Industrial
Neighborhood Service Centers
Building/Industrial
Winslow Urban Area
Historic/Potential Centers
Recharge Areas
Bedrock Recharge
Deep Aquifer Recharge
Shallow Aquifer Recharge
Agate Passage
Port Madison
Port Madison Bay
Hidden Cove
Point Monroe Lagoon
Manzanita Bay
Rolling Bay
Battle Pt.
Battle Point Lagoon
Skiff Pt.
Port Orchard
Tolo Lagoon
Murden Cove
Fletcher Bay
Puget Sound
Yeomalt Pt.
Eagle Harbor
Wing Pt.
Bill Pt.
Blakely Harbor
Blakely Rock
Rich Passage
Pt. White
Restoration Pt.
Bean Pt.
Service Layer Credits: USGS, Aspect Consulting, DNR, Kitsap County
Miles
0
0.35
0.7
1.4
2.1
2.8
N

WATER RESOURCES ELEMENT

TABLE OF CONTENTS

NOTE: HIGHLIGHTED GOALS ARE RECOMMENDED TO BE MOVED TO UTILITIES ELEMENT

EXISTING CONDITIONS & FIGURES ONLY PARTIALLY UPDATED; TO BE COMPLETED IN APRIL ONCE AQUIFER CARRYING CAPACITY ASSESSMENT DONE

WATER RESOURCES ELEMENT

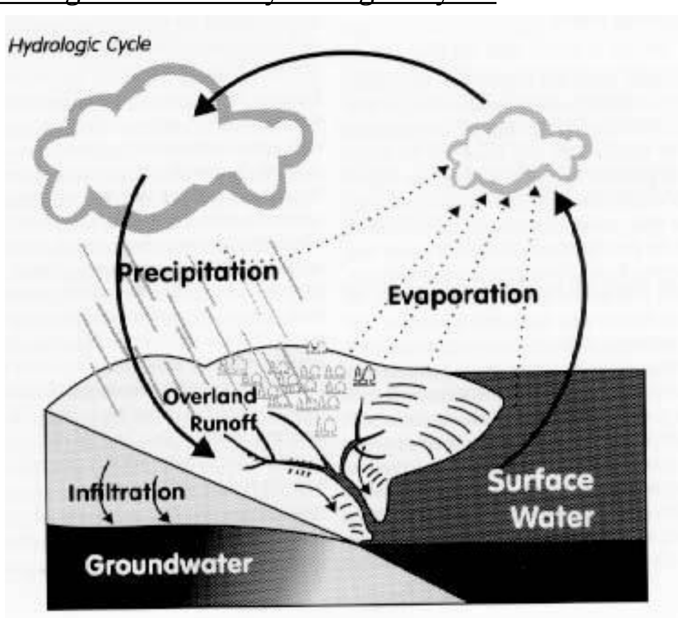
INTRODUCTION

Bainbridge Island is a quasi-enclosed environment that requires a holistic perspective to understand the interdependence among the Island's three primary water resources: groundwater, surface water, and stormwater. Although these waters are typically regulated and managed independently, they are, in nature, intimately connected. In fact, it is all the same water, simply given a different name and managed according to where it resides in the hydrologic cycle at any given time (see Figure 1).

When rain falls, rainwater that is not evaporated or taken up by plants, will take one of three paths. It may infiltrate into the ground where it is called groundwater. It may drain directly into streams and harbors where it is called surface water, or it may be captured by manmade infrastructure such as street drains, ditches, or detention/retention ponds where it is called stormwater.

Rainwater that infiltrates into the ground (groundwater) may be pumped from wells to provide drinking water or irrigation or seep out of the ground into streams, springs, and harbors where it is, again, called surface water. Likewise, stormwater may discharge into a nearby stream or harbor and become surface water or infiltrate into the ground and become groundwater.

Figure 1. The Hydrologic Cycle



In order to successfully protect and manage any one of these waters, one must protect and manage all three. To address these interrelationships, a separate Water Resources Element has been developed as follows:

- General water resources management policies
- Groundwater management and protection policies
- Surface water management and protection policies
- Stormwater management and protection policies
- Residential on-site sewage system policies
- Contaminated sites policies

Land Use Connection

In the development of policies related to the management of our Island water resources, it is important to understand the links between water resources quality and quality and land use. Most water quality and habitat integrity impacts are caused by the way land was or is used. Developed land allows for rapid runoff and inundation of natural conveyance systems such as wetlands and streams. Rapid runoff can cause damage through flooding, erosion, and water-borne contamination.

In addition, households create sewage which needs disposal either by a wastewater treatment plant or by residential on-site sewage systems. Wastewater treatment plants are very effective at cleaning wastewater, but do not at present provide complete removal of nitrogen nor treat for contaminants of emerging concern which include, but are not limited to, byproducts of medications, health and beauty products, and caffeine.

Residential on-site sewage systems can fail and cause contaminants to enter the surface water and/or groundwater. Even functioning systems, depending upon density and proximity to surface water and groundwater, can contribute to accumulations of nitrogen and contaminants of emerging concern in these waters.

Use of fertilizers, pesticides, and other chemicals for cropland, lawns and gardens, and vehicle and household cleaning and maintenance as well as improper pet and livestock waste management can add significant contamination to surface water and/or groundwater.

Commerical and industrial uses, past and present, leave behind pollutants in our soils. In particular, historic land uses such as large row crop agriculture, lumber, petroleum, and others have left behind legacy pollutants in sediments both on upland properties and in the sediments along the bottoms of our streams, harbors, and nearshore areas.

Without proper coordination of the regulations that will implement policy statements, conflicting signals may be given when dealing with water resources issues. For example, a surface water problem may be resolved by efficiently collecting and removing all water from the area, whereas a groundwater recharge issue may require that the water be kept on-site to allow for infiltration. Another conflict arises when infiltration of stormwater competes for space with on-site sewage system drainfields. There are physical limitations to the rates of infiltration and absorption based on soil types, which may make it impossible to have both of those facilities on the same site. Where development occurs in important aquifer recharge areas, special consideration is needed to preserve the volume of recharge available to the aquifer and to protect the ground water from contamination.

A key component of the water resources protection strategy is adequate monitoring and assessment, and the overriding theme that runs through all of the policies and goals is the preservation of water quality, water quantity, and ecological and hydrologic function.

Water Resources Vision

Our vision is of water resources – in precipitation, on the Island's surfaces, and in the ground – that remain adequate indefinitely, for all forms of life on the Island, with supply and demand fluctuating but resilient. Achieving this vision will require monitoring, conservation, protection of aquifer recharge, and careful maintenance of the quantity and quality of the Island's waters, recognizing that the Island's carrying capacity is limited.

GOALS AND POLICIES

GOAL 1 General Water Resources

Protection of water resources is of primary importance to the Island. Therefore, the goal is to manage the water resources of the Island in ways that restore, enhance, and preserve their ecological and hydrologic function. ~~for present and projected land uses, recognizing that they are are the sole water supply and that:~~

- **Degradation of ~~groundwater~~ ~~quality and quantity~~ water resources is not allowed.**
- **~~Water supplies and systems are efficiently utilized.~~**
- **The long-term sustainability of the Island's water resources is maintained.**
- **~~The w~~Water resources needs ~~of new development approved under the Comprehensive Plan~~ ~~are adequately~~ can be met for the indefinite future. ~~by the existing resources.~~**
- **Groundwater, surface water, and stormwater monitoring, data assessment, and reporting ~~Adequate data~~ ~~of the water resource~~ are current and available to inform current and long-range planning and land use decisions.**

General Water Resources Policies

Policy WR 1.1

~~The City shall coordinate with other major private water purveyors, government agencies and citizens to ensure protection and preservation of water resources and to provide efficient high quality Island-wide water service.~~ Groundwater, surface water, and stormwater are resources to be protected and managed to preserve water quality and quantity and to retain or mimic ecological and hydrologic function to the maximum extent practicable.

Policy WR 1.2

~~To foster sustainable water resources, planning, protection, management, monitoring and on-going education outreach that is based on watersheds and natural systems should be provided by the City in coordination with appropriate agencies.~~ To foster sustainable water resources, planning, protection, management, monitoring and on-going education and outreach should be provided by the City in coordination with Tribes, government agencies at all levels, drinking water purveyors, watershed management groups, land trusts, health organizations, conservation and restoration groups, local integrating organizations for regional recovery and protection, and citizens.

Policy WR 1.3

The policies in this element will work in tandem with the protective measures set by the City's Shoreline Management Master Program, Critical Areas Ordinance, and any other environmental or water resources management ordinance established by the City.

GOAL WR-2 Groundwater Management and Protection ~~Policies~~

Policy WR 2.1

To protect groundwater resources, areas identified as high aquifer recharge areas should be maintained in low impact uses.

~~**Discussion:**~~ Low impact uses and low impact development are appropriate for areas with high aquifer recharge. Low impact uses includes development for buildings, roads or parking that has a reduced area of impact on the land. Low impact uses do not depend on regular applications of fertilizers or pesticides. Low impact development is an environmentally-friendly approach to site development and stormwater management, emphasizing the integration of site design and planning techniques that conserve and protect the natural systems and hydrologic functions of a site.

Policy WR 2.2

To protect Island groundwater resources, the City shall encourage the development and expansion of public and private water systems, rather than encouraging shallow or individual residential wells.

Policy WR 2.3

The City shall assess the impacts of proposed activities and development on the flow of springs and streams and levels of wetlands that are either sustained by groundwater discharge or contribute recharge to groundwater by requiring a hydrologic assessment report, and restricting the activities or development based on the report, and/or mitigating impacts.

Policy WR 2.4

The City, in cooperation with the appropriate regulatory agencies (e.g., Washington State Department of Health and the Kitsap County Health District) should institute new wellhead protection procedures.

~~Policy WR 2.5~~

~~For the purpose of protecting surface and groundwater quality, the City Parks Department and School District shall develop plans to eliminate the use of biocides on their properties through the use of integrated pest management techniques.~~ (

Policy WR 2.6

The City shall promote the use of integrated pest management techniques and the reduction of pesticide and herbicide use within the City boundaries. .**NOTE:** potential cross over with surface and stormwater protection policies)

Policy WR 2.7

Establish a stakeholder group to develop an Islandwide Groundwater Management Plan.

Policy WR 2.8

Encourage exempt well owners to regularly monitoring the quality of their well water and self-report to the Kitsap Public Health District.

Policy WR 2.8

Recognizing that the Island aquifer system is a Sole Source Aquifer as designated by EPA, institute an added level of development and re-development permit review to prevent or mitigate potential pollutant-generating activities associated with proposed land use.

NOTE: GOALS 3 AND 4 HAVE BEEN BROUGHT OVER FROM THE ENVIRONMENTAL ELEMENT WHERE THEY WERE LABELED "AQUATIC RESOURCES (GOALS 6 & 7)"

~~Aquatic Resources~~ GOAL ~~1~~ WR-3 Surface Water Management and Protection

~~Preserve and protect the Island's remaining aquatic resources.~~ Achieve no net loss of ecological functions and processes necessary to sustain aquatic resources[1] including loss that may result from cumulative impacts over time.

~~**Discussion**: Aquatic resources include marine nearshore, wetlands, streams, lakes, creeks, and associated vegetated areas.~~

Over ~~the past~~ recent decades, awareness has grown of the importance of preserving and protecting aquatic resources ~~particularly wetlands, in our natural and built environment~~. Aquatic resources have a number of important ecological functions, processes and values. These functions vary ~~from wetland to wetland, stream to stream~~, but include providing water quality protection, flood plain control, shoreline stabilization, contributions to groundwater and stream flows and wildlife and fisheries habitat. ~~Wetlands and streams~~ Aquatic resources also have values as natural areas providing aesthetic, recreational and educational opportunities that ~~need to~~ should be preserved for future generations

AQ 1.1

~~Achieve no overall net loss of the City's remaining, regulated, aquatic resources.~~

AQ 1.2 Policy WR 3.1

~~Development shall not be approved in regulated wetlands, streams, or buffer areas, unless a property owner would be denied all reasonable use of property.~~

Development should not be approved in regulated aquatic critical areas or their associated water quality buffer unless the subject property is encumbered to such an extent that application of development regulations would deny all reasonable use of property.

~~**Discussion**: In some cases, buffer configurations and widths can be modified to allow normal usage of legally established lots. In other cases, the development and implementation of a habitat management plan may provide resource protection to allow development. A variance process should be available to accommodate development in buffer areas. Reasonable use exception should be reserved for development in the critical area if no other process will allow for a reasonable use of the property. A Reasonable Use Exception (RUE) is a form of variance from regulations that allows some use of a legally established lot. A reasonable use must minimize the impact to critical areas. The RUE process is included in~~

[1] *Aquatic resources* – Marine nearshore, wetlands, streams, lakes, creeks and associated vegetated areas.

the critical areas regulations of the Bainbridge Island Municipal Code, which implements policies of this document.

AQ 1.3 Policy WR 3.2

Require that vegetated buffers be maintained between proposed development and the aquatic resource in order to protect the functions and values of such systems. Degraded buffers should be restored to enhance their function. Allow Rreductions in vegetated buffers shall be allowed only in areas where such reductions, if consistently applied, would not result in significant cumulative impacts to aquatic resources and fish and wildlife habitat.

AQ 1.4 Policy WR 3.3

Require that buffers be retained in their natural condition wherever possible, while allowing for appropriate maintenance. Where buffer disturbance has occurred, require revegetation with appropriate species, with a preference for native species, to restore the buffers' protective values.

Discussion: Vegetated buffers facilitate infiltration and maintenance of stable water temperatures, provide the biological functions of flood storage, water quality protection and groundwater recharge, reduce amount and velocity of run-off, and provide for wildlife habitat.

AQ 1.5 Policy WR 3.4

Ensure that development activities are conducted so that aquatic resources and natural drainage systems are maintained and water quality is protected.

AQ 1.6 Policy WR 3.5

Prior to any clearing, grading, or construction on a site, all wetlands, streams, and buffer areas should be specifically identified and accurately located in the field in order to protect these areas during development. After construction, permanent visual markers should be placed around the buffer areas.

Discussion: The purpose of this policy is to educate future home owners and users of aquatic resources (i.e., trail users) of the boundary of the aquatic resources.

AQ 1.7

New development using flexible lot design should include any wetlands, streams, or required buffers in separate tracts or easements to remain in common ownership.

AQ 1.8 Policy WR 3.6

Herbicides and pesticides should shall not be used in aquatic resource areas wetlands, streams, and buffers areas, and should be discouraged in the areas that drain into them.

Discussion: Encourage alternatives to the use of herbicide and pesticide in areas adjacent to buffer areas by providing technical information and educational programs including the use of native vegetation.

AQ 1.9 MOVE TO GOAL 4

~~Develop a community-wide program to educate Island residents about alternatives to using and disposing of herbicides, pesticides, and other household chemicals to reduce impacts to marine shoreline areas, wetlands, streams, and other environmentally sensitive areas.~~

AQ 1.10 Policy WR 3.7

Prohibit ~~A~~access to ~~regulated wetlands~~ aquatic critical areas by farm animals ~~should be discouraged~~. Agricultural activities within proximity of aquatic resources should complete a farm management plan addressing water quality and other natural resource protection ~~must be in conformance with Best Management Practices~~.

AQ 1.11 Policy WR 3.8

Mitigation shall be required to compensate for unavoidable impacts to aquatic critical areas. Mitigation should be designed to achieve no net loss in functions and processes of aquatic resources. ~~Restoration, creation or enhancement of wetlands, streams, and their buffers shall be required in order to offset the impacts of alteration of a wetland/stream or buffer area. Compensation for loss of aquatic resources should be determined according to function, acreage, type, location, time factors, and an ability to be self-sustaining.~~

Policy WR 3.9

Promote watershed-based mitigation to meet federal regulations, improve mitigation success and better address the ecological priorities of the island's watersheds.

Policy WR 3.10

Identify the areas of the Island that are the most vulnerable to pollution from concentrations of fecal coliforms and nitrates (for example, from septic fields, agricultural activities, or fertilizers), and monitor those areas to determine if and when preventative or restorative measures are warranted.

Policy WR 3.11

Evaluate the merits of new technologies such as greywater capture, package treatment plants and composting toilets, as alternatives to traditional septic and sewer systems and determine which of those systems should be allowed and/or encouraged to better protect the quality and capacity of the Island's groundwater, surface water and nearshore environment.

Policy WR 3.12

The City will consider the implications of climate change, acidification, and their impacts when developing regulations or approving capital projects related to aquatic resources, including marine nearshore, wetlands, streams, lakes, creeks, associated vegetated areas and frequently flooded areas.

~~Wetlands~~

AQ 1.12

~~Maintain the Island's wetlands in their natural state by:~~

- ~~Preservation of native vegetation in and next to the wetlands.~~
- ~~Restoration of areas that have already been degraded.~~
- ~~Protection of areas that have not been disturbed.~~

AQ 1.13 MOVED TO GOAL 4

~~The City should make every effort to purchase or obtain conservation easements for significant wetlands and areas of the shoreline critical to natural habitat.~~

~~Streams~~

AQ 1.14

~~Maintain the Island's streams and creeks in their natural state by:~~

- ~~Preservation of their courses, their banks, and the vegetation next to them.~~
- ~~Restoration of areas that have already been degraded.~~
- ~~Protection of areas that have not been disturbed.~~

AQ 1.15 Policy WR 3.13

Allow stream relocation only where relocation would result in improved stream habitat ~~and~~ or when a property owner would otherwise be denied all reasonable use of the property.

AQ 1.16 Policy WR 3.14

Degraded channels and banks should be rehabilitated by various methods (e.g., culvert replacement, volunteer efforts, public programs or as offsetting mitigation for new development) to restore the natural function of the riparian habitat for fish and wildlife.

AQ 1.17 Policy WR 3.15

Anadromous fish streams and adjacent land should be preserved and enhanced to ensure a sustainable fishery ~~the propagation of salmonid fish~~.

AQ 1.18 Policy WR 3.16

Require the construction of public facilities ~~necessary roads and utility corridors~~ to avoid ~~wetland and stream crossings and~~ encroachment into and disturbance~~s~~ of aquatic resources.

GOAL WR-4

Promote the maintenance, restoration and enhancement of aquatic resources.

AQ 1.9 Policy WR 4.1

~~Develop a~~ Support community-wide program to educate Island residents about alternatives to using and disposing of herbicides, pesticides, and other household chemicals to reduce impacts to marine shoreline areas, wetlands, streams, and other environmentally sensitive areas.

Policy WR 4.2

Promote and support volunteer or community driven restoration projects.

~~AQ 1.13~~ Policy WR 4.3

The City should make every effort to purchase or obtain conservation easements for significant wetlands and areas of the shoreline critical to natural habitat.

Policy WR 4.4

After construction, permanent visual markers should be placed around the buffer areas of protected aquatic resources.

THIS GOAL MOVED TO UTILITIES ELEMENT
~~**Drinking Water Service Policies**~~

GOAL WR-5 TO BE DRAFTED
GOAL WR-5 Stormwater Management and Protection

Policy WR 5.1

GOAL WR-6 ~~Sanitary Sewer~~ Residential On-Site Sewage Systems

Ensure that sewage is collected, treated, and disposed of properly to prevent public health hazards and pollution of groundwater, and surface water, including waters of the Puget Sound, and to promote recharge of the waters of Puget Sound.

~~**Sanitary Sewer On-Site Systems Policies**~~

Policy WR 6.1 ~~SSP 1.1~~

Properly designed and maintained on-site wastewater disposal systems that are approved by the Kitsap County Health District or the State Department of Health are a long-range solution to sewage disposal in most areas of the Island. However, there may be areas of the Island determined by the Kitsap County Health District to be unsuitable for on-site wastewater disposal systems due to site conditions (such as steep slopes, geological or soil conditions, lot size, or proximity to sensitive bodies of water).

Policy WR 6.2 ~~SSP 1.2~~

Regulations and procedures of the Washington State Department of Health and the Kitsap County Health District shall apply to all on-site disposal systems. The City shall work with these agencies to assure regular maintenance and repair of all sanitary sewer and on-site systems located on the Island.

Policy WR 6.3 ~~SSP 1.3~~

Certification of adequate design and proper operation of septic systems shall be required prior to issuance of permits for remodeling of existing buildings.

Policy WR 6.4 ~~SSP 1.4~~

Prior to issuance of a building permit, on-site drainfield and reserve areas should be identified and marked, and a protection plan should be approved for any building lot.

Policy WR 6.5 ~~SSP 1.5~~

The City shall request notification of all waivers or variances of Kitsap County Health Department requirements, such as modification of setbacks, vertical separation, minimum lot size, reserve drainfield, etc., prior to issuance and subsequent modifications by the Health District of an approved Building Site Application.

Policy WR 6.6 ~~SSP 1.6~~

Kitsap County Health District approved alternative systems, such as sand filters, aerobic treatment, composting toilets, living-systems, etc., should be encouraged for sites where conventional on-site systems are not suitable or feasible.

Policy WR 6.7 ~~SSP 1.7~~

Regulations shall require coordination between the on-site septic and storm drainage disposal systems designs to ensure the proper functioning of both systems.

Policy WR 6.8 ~~SSP 1.8~~

The City shall assist the Kitsap County Health District in developing a program to require proper maintenance of all on-site waste disposal systems in order to reduce public health hazards and pollution. This program shall include periodic system inspection and pumping when necessary.

Policy WR 6.9 ~~SSP 1.9~~

The City and the Kitsap County Health District should work together on a collaborative program to fund and pursue grants or low-cost loans for low and moderate-income households to repair failed septic systems.

Policy WR 6.10 ~~SSP 1.10~~

On-site waste disposal systems serving more than one household should be allowed only with assurance of proper design, operation, management and approval from the Health District.

Policy WR 6.11 ~~SSP 1.11~~

The City may provide the service of operation and maintenance management for approved large on-site sanitary sewer systems (LOSS) or community sanitary sewer systems in coordination with the Kitsap County Health District.

Policy WR 6.12 ~~SSP 1.12~~

The City should support the Kitsap County Health District in establishing a public education program to foster proper construction, operation, and maintenance of on-site septic systems.

Policy WR 6.13 ~~SSP 1.13~~

The City should support the Kitsap County Health District in developing and maintaining an ongoing inventory of existing on-site disposal systems to provide needed information for future studies.

THIS GOAL MOVED TO UTILITIES ELEMENT
~~**Public Sanitary Sewer Policies**~~

THIS GOAL MOVED TO UTILITIES ELEMENT
~~**Stormwater Management and Protection**~~

GOAL WR-7 Monitoring ~~Policies~~(may incorporate these in each of the sections above)

Policy WR 7.1 ~~M 1.1~~

~~The City should~~ Maintain ~~institute~~ a comprehensive program of water resource data gathering and analysis. The ~~Such a~~ program shall include geologic studies and monitoring of static water levels, water use, water quality, surface water flows, and acquisition of other data as necessary.

Policy WR 7.2 ~~M 1.2~~

Periodic monitoring and reporting of water quality and quantity of public water systems[2] is required by the Kitsap County Health District. Single units shall be encouraged by the City to provide well data to the Kitsap Public Utility District and the Department of Health regarding water level recordings, quality degradation, etc.

Policy WR 7.3 ~~M 1.3~~

~~The City should~~ S~~s~~upport the Kitsap County Health District in developing a program for proper maintenance of on-site waste disposal systems in order to reduce public health hazards and pollution. This program should include periodic system inspection and pumping when necessary.

Policy WR 7.4 ~~M 1.4~~

~~The City should~~ S~~s~~upport the Kitsap County Health District in developing and maintaining an ongoing inventory of existing on-site disposal systems to provide needed information for future studies.

GOAL WR-8 Public Education (may incorporates these in each of the sections above)

Policy WR 8.1 ~~PE 1.1~~

The City, special districts, and water purveyors will develop and implement a comprehensive public education program in water resource management and protection. The program should address all aspects of water conservation and groundwater protection, including septic system maintenance, spill management and non-point pollution impacts from farm animal/agricultural activities, and homeowner maintenance practices.

[2] A public water system is defined as a system with two or more hookups.

Policy WR 8.2 ~~PE 1.2~~

Water conservation should be aggressively pursued by the City to promote the efficient use of water and to protect the resource. Water conservation programs should encourage the use of vegetation that prevents soil erosion, protects habitat for wildlife, retains surface water for recharge, and which does not require additional water during normally dry months.

Policy WR 8.3 ~~PE 1.3~~

Water re-use and reclamation will be encouraged to serve as a supplementary source for high-water users such as industry, parks, schools, and golf courses, as approved by the Washington State Department of Health.

Policy WR 8.4 ~~PE 1.4~~

~~The City should~~ D~~d~~evelop a program that encourages homeowners to reduce impervious surface area and explore innovative methods for recapturing and reusing surface water runoff and grey water, as approved by the Washington State Department of Health and the Kitsap County Health District.

Policy WR 8.5 ~~PE 1.5~~

~~The City should~~ S~~s~~upport the Kitsap County Health District in maintaining ~~establishing~~ a public education program to foster proper construction, operation, and maintenance of on-site septic systems.

WATER RESOURCES ELEMENT
EXISTING CONDITIONS AND FUTURE NEEDS

PRESENTED HERE ARE PARTIAL UPDATES ONLY; UPDATE COMPLETION ANCITIPATED IN APRIL 2016

The following outlines the present conditions and understanding of the water resources of the Island and the future needs for restoration, enhancement, and protection of these resources.

Groundwater To be completed after Aquifer System Carrying Capacity Model Run complete.

~~*Groundwater*~~

Groundwater is the sole source of drinking water on Bainbridge Island. It is found in underground reservoirs called aquifers. An aquifer is defined as a permeable sand and/or gravel formation that is capable of yielding a significant amount of water to a well. Wells on Bainbridge Island penetrate several distinct aquifers to allow withdrawal of drinking water by individual homeowners and municipal water purveyors. Most individual household wells penetrate to depths of less than 300 feet. Some residents are still using hand-dug wells less than 40 feet deep, completed in the permeable sediments known as the Vashon Recessional Outwash. Groundwater found at this level also feeds the base flow (summer flow) for Island streams. High capacity wells have been drilled as deep as 1,200 feet to find adequate marketable quantities of water for public and private water purveyors. While few in number, these wells produce a large portion of the Island's potable water. The Blakely Formation, a sedimentary bedrock formation, dominates the geology on the southern end of the Island and limits groundwater production in this area.

Aquifer systems on the Island have been mapped where there is sufficient geologic and hydrologic data available to define them. Our understanding of the Island's water resources has been enhanced through the *City of Bainbridge Island, Level II Assessment*[4] prepared by Kato & Warren and Robinson Noble. The following information on existing conditions was drawn from the Level II Assessment by Hydrogeologists and Bainbridge Island residents Doug Dow, Russ Prior, and Mark Shaffer and is subject to change with further study. These aquifers are described in detail in the *Kitsap County Groundwater Management Plan,* Volumes I II, dated April 1991, and more recently in the Level II Assessment. Brief descriptions of each aquifer system identified are as follows:

Perched Aquifer (PA)

The Perched Aquifer is a sand and gravel aquifer system under the major upland areas. It is found above 200 feet elevation and averages 90 feet in thickness. This aquifer underlies nine square miles (33%) of the Island's land surface and serves a number of domestic wells, with yields averaging 16 gpm. It is recharged from leakage through overlying sediments and discharges through underlying sediments into deeper aquifers or through springs where the aquifer intercepts land surface.

[4] Subtitled *An Element of the Water Resource Study, dated December 2000*.

Semi-Perched Aquifer (SPA)

The Semi-Perched Aquifer is found under approximately 20 square miles (73%) of the land surface and averages about 30 feet in thickness. Where identified, it is found between 20 feet below and 100 feet above sea level. Approximately 25% of the domestic wells on the Island obtain an average of 19 gpm from this aquifer. However, uncharacteristically high yields from wells completed for Meadowmeer provide local yields over 300 gpm. The aquifer is recharged from leakage through overlying sediments and discharges into deep cut stream valleys, deeper aquifers, or to Puget Sound.

Sea Level Aquifer (SLA)

The Sea Level Aquifer underlies 85% (23.5 square miles) of the Island's land surface but is noticeably absent south of Blakely Harbor where bedrock is found above sea level. The aquifer's average thickness is 110 feet. It is found from 40 feet above to 230 feet below sea level. The Sea Level Aquifer is the Island's primary aquifer system, supplying water to approximately 53% of Island wells. Several of the Island's larger water purveyors obtain yields of more than 300 gpm from this aquifer. The average yield to the majority of (domestic) wells is 20 gpm. The aquifer accepts recharge from leakage through overlying sediment with natural discharge into Puget Sound. The City's wells at the head of Eagle Harbor are completed in the SLA.

Glaciomarine Aquifer (GMA)

The Glaciomarine Aquifer is the shallower of the two deep aquifer systems present below Bainbridge Island. The data available confirms estimates of a depth of 400 to 760 feet below sea level under approximately 9.5 square miles (35%) of the Island and an average thickness of 120 feet. This aquifer may exist under a greater portion of the Island but lack of exploration precludes a definitive analysis. Only 2% of Island wells penetrate this fine-grained aquifer which yields an average of 18 gpm. Notable wells completed in the GMA are the City's Taylor Avenue well and the old and new wells completed at the former creosote plant site at Bill Point. Recharge to the aquifer is obtained through leakage from overlying sediments. Discharge is likely to deeper areas in Puget Sound.

Fletcher Bay Aquifer (FBA)

The Fletcher Bay Aquifer is named for a pair of wells drilled into the deep aquifer system near Fletcher Bay. Several other wells are also completed in this permeable sand and gravel formation found from 690 to 1,280 feet below sea level. Because very few wells penetrate to this depth, the extent of the aquifer is not well defined. The aquifer is believed to underlie 55% (15 square miles) of the Island, mainly in the north central area. The City obtains the majority of the drinking water for the Winslow water system from the FBA through its Fletcher Bay and Sands Road wells. Yields from this aquifer average 330 gpm. Because of the depth of this aquifer, it has been theorized that it is connected to a similar aquifer identified at this depth on the Kitsap Peninsula. However, this connection has not been proven and recharge to the FBA can only have been assumed to originate on the Island through leakage from overlying sediments.

Hydrologic Cycle and the Water Budget

Understanding the Island's water budget requires a look at the components of the water system. These components are defined as:

- Precipitation (rain or snow);
- Evapotranspiration: the combined amount of water that evaporates directly from the surface plus the amount that is taken up by vegetation and transpired back into the air;
- Runoff: the amount of water that flows directly off the Island via streams;
- Recharge: the amount of water that infiltrates into the aquifer; and
- Discharge: well pumpage, springs, streams and direct discharge into Puget Sound.

Although the variability of the natural system is great, educated assessments of the individual components are commonly used to predict sustainable use of the groundwater.

All water entering the Island's natural water system originates as precipitation. Only a portion of the precipitation is available for recharge because some of it exits the system before it percolates into the ground. Water exits the system through evapotranspiration, surface runoff and discharge. The quantity of groundwater available for use is a function of the water balance: water entering the system is equal to water flowing out of the system, plus or minus the change in storage of water within the aquifer.

Precipitation on Bainbridge Island averages about 35 inches per year. In the absence of more precise water budget data it is generally thought that one-half to one-third of all precipitation is lost through evaporation from surface water and evapotranspiration from trees, plants and grass. It is estimated that approximately one-quarter to one-third of the precipitation is discharged to springs and stream flow or directly to Puget Sound.

The remaining precipitation infiltrates the surface sediments through direct absorption, supplemented to some extent through on-site stormwater infiltration, to recharge the Island aquifers. An unknown quantity of recharge is discharged from the Perched and Semi-Perched Aquifer, and to a lesser extent the Sea Level Aquifer providing (base) stream flow for fish and other wildlife. However, only a portion of the remaining recharge that reaches the major aquifers is available for use without serious disruption of the hydrologic system. Withdrawing too much water will cause aquifer water levels to decline and may cause seawater intrusion into the Sea Level Aquifer and deeper aquifers.

Hypothetical groundwater (aquifer) yield

A simplistic approach for determining the "hypothetical groundwater yield" is the product of the general recharge rate times the recharge area (27.5 square miles or 17,600 acres) producing a volume of water in acre feet per year. The Level II study provided a hypothetical groundwater recharge of 19,000 acre feet per year (afy). However, it is recognized that the sustainable yield of an aquifer can be more accurately determined by monitoring aquifer water levels for many years. Such monitoring would include: flow metering of typical wells for water use or measurement of surface water diversions; well water monitoring; and stream flow monitoring. Management of the groundwater resources of Bainbridge Island will require balancing withdrawals from specific aquifers to sustainable water levels. Actual sustainable withdrawal rates are unknown.

Aquifer Recharge Areas

Springs and streams reflect a natural system of discharge for Island groundwater. All of the remaining land surface (except for portions of the southern end of the Island) serves as aquifer recharge area. Soil type, slopes, vegetative cover and impervious surfaces significantly affect the distribution of recharge. The identification of aquifer recharge areas is important both from the standpoint of groundwater quantity and quality. Aquifer recharge areas have geologic and soil conditions which allow high rates of surface water infiltration, which also means they are particularly susceptible to contamination. Increasing impervious surfaces through development reduces the amount of recharge available to the Island's aquifers. At the same time, runoff from impervious surfaces in developed areas contains increased contaminants. Efforts to protect and preserve the Island's natural water supply are warranted, as the resources that would be required to clean up after contamination or to secure a new source would be prohibitive.

Where development overlays aquifer recharge areas, special considerations need to be made to preserve the volume of recharge available to the aquifer and to protect the groundwater from contaminates such as nitrates, biocides and heavy metals found in septic systems and stormwater runoff. The most extensively used aquifer underlies 85% of the Island and occurs under all zoning classifications.

The Recharge Areas Map (Figure 5) was developed by Russ Prior with assistance from Mark Shaffer, Doug Dow and Kitsap County PUD. This recharge map is based on a spreadsheet model produced by Robinson and Noble for the Level II Assessment (December 2000). Figure 5 identifies high, moderate and low aquifer recharge areas on Bainbridge Island. Generally recharge depends on the ease with which precipitation can move from the land surface to the aquifer based on the types of conditions in the area. The elements used in the Level II spreadsheet model include: amount of rainfall, surficial soil types (based on USDA Soil Survey of Kitsap County), slope, ground cover and water holding capacity.

Aquifer recharge areas have been mapped for the Island using available assessment information described in the Level II Assessment. The mapping identifies high, moderate, and low aquifer recharge areas in accordance with the following definitions:

Susceptibility	**Characteristics**
High	Greater than 20 inches of infiltration into the groundwater system per year – generally areas with high recharge have permeable surficial soils and shallow slopes.
Moderate	Between 10 and 20 inches per year of infiltration into the groundwater system – includes many areas underlain by Vashon till which allows significant quantities of infiltration.
Low	Less than 10 inches per year of infiltration into the groundwater system – generally areas with low recharge have surficial soils of low permeability and steep slopes.

Source: 2000 Bainbridge Island Level II Assessment

Aquifer Concerns

The Island has many shallow and deep aquifers, some of which may be connected vertically as well as horizontally. No data has been developed to date to determine how much water can be withdrawn from any of the Island aquifers without causing over-drafting. Monitoring is important to further our understanding of the Island's aquifer systems.

Based on current water quality data, the 2000 *Bainbridge Island Level II Assessment* concluded there was no evidence of extensive seawater intrusion on the Island nor was there evidence of increasing salinity

Surface Water

The surface waters of Bainbridge Island provide aesthetic, recreational, economic, and ecological benefits to Island citizens. Boating, fishing, and shellfish harvest are important recreational and economic activities, and the Island's streams, lake, harbors, shorelines, and wetlands provide habitat for a diversity of fish and wildlife species.

The harbors and numerous coves around the Island host anchorage, moorage, marinas, boat launches, waterfront access, and swimming beaches. Eagle Harbor, specifically, hosts marinas which provide permanent moorage for live-aboards and an open water mooring and anchoring area for the Island's live-aboard community.

In addition to providing forage and habitat for salmon, otter, sea lions, and waterfowl and swimming, boating, and fishing areas for people, the majority of the Island's shorelines and adjacent nearshore areas are commercial shellfish growing and harvest areas. Many shoreline residents recreationally harvest shellfish such as clam and geoduck as well.

Watersheds

Surface water flows from high geographic points to lower elevations collecting in streams and wetland systems within the watersheds of the Island. Watershed boundaries are determined by Island topography where ridgelines define the boundaries.

Bainbridge Island contains twelve distinct watersheds with 59 seasonal and perennial streams that contribute fresh water to Puget Sound (see Figure 2.1 below excerpted from the Water Quality and Flow Monitoring Program Final Monitoring Plan, 2008). Five harbors, twelve estuarine wetlands, one lake, 1,242 acres of wetland, and 53 miles of shoreline comprise the remainder of the surface water system.

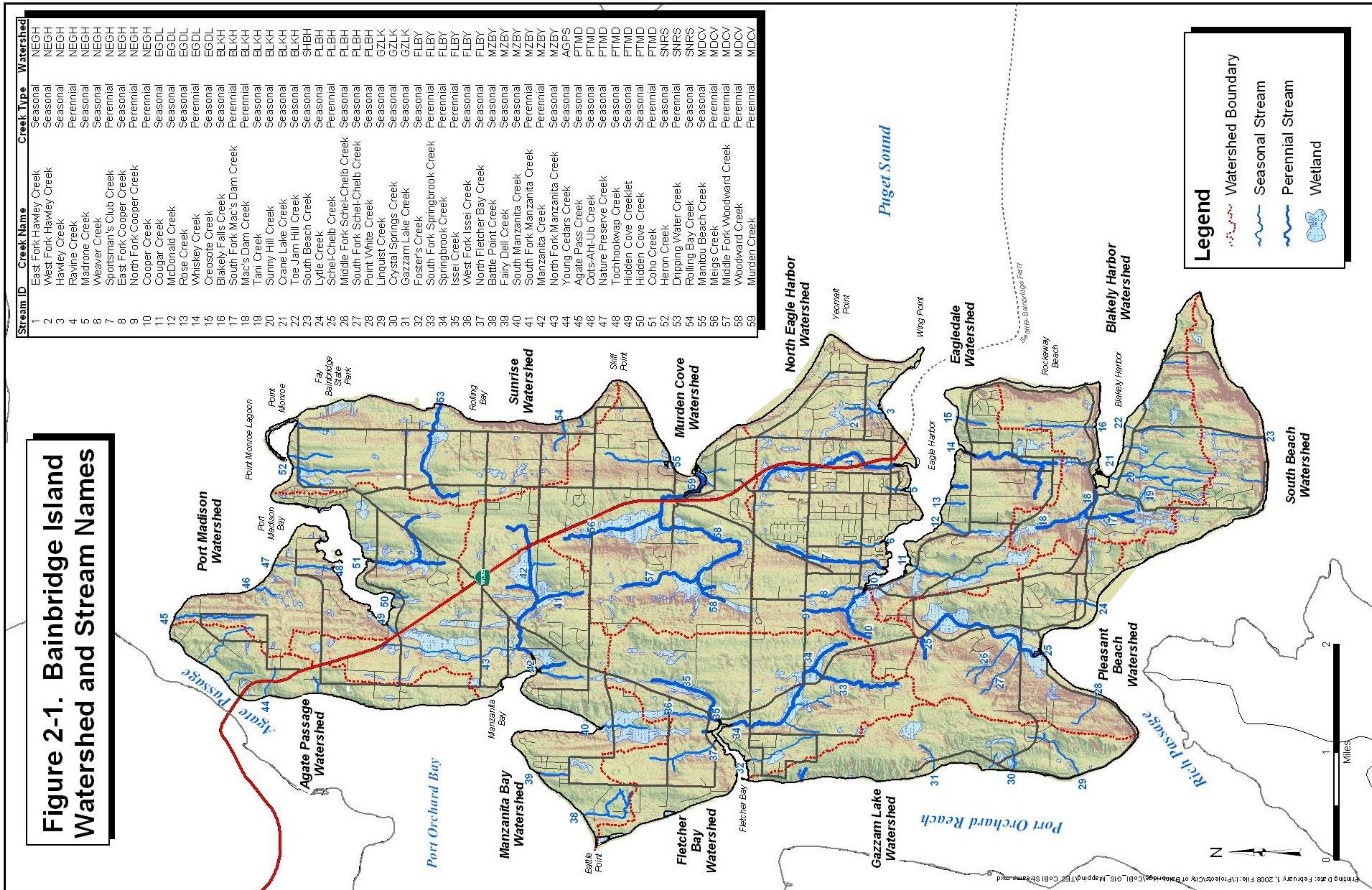


Figure 2-1. Bainbridge Island Watershed and Stream Names

Stream ID	Creek Name	Creek Type	Watershed
1	East Fork Hawley Creek	Seasonal	NEGH
2	West Fork Hawley Creek	Seasonal	NEGH
3	Hawley Creek	Seasonal	NEGH
4	Ravine Creek	Perennial	NEGH
5	Madrone Creek	Seasonal	NEGH
6	Weaver Creek	Seasonal	NEGH
7	Sportsman's Club Creek	Perennial	NEGH
8	East Fork Cooper Creek	Seasonal	NEGH
9	North Fork Cooper Creek	Perennial	NEGH
10	Cooper Creek	Perennial	NEGH
11	Cougar Creek	Seasonal	EGDL
12	McDonald Creek	Seasonal	EGDL
13	Rose Creek	Seasonal	EGDL
14	Whiskey Creek	Perennial	EGDL
15	Creosote Creek	Seasonal	EGDL
16	Blakely Falls Creek	Seasonal	BLKH
17	South Fork Mac's Dam Creek	Perennial	BLKH
18	Mac's Dam Creek	Perennial	BLKH
19	Tani Creek	Seasonal	BLKH
20	Sunny Hill Creek	Seasonal	BLKH
21	Crane Lake Creek	Seasonal	BLKH
22	Toe Jam Hill Creek	Seasonal	BLKH
23	South Beach Creek	Seasonal	SHBH
24	Lytle Creek	Seasonal	PLBH
25	Schel-Chelb Creek	Perennial	PLBH
26	Middle Fork Schel-Chelb Creek	Seasonal	PLBH
27	South Fork Schel-Chelb Creek	Seasonal	PLBH
28	Point White Creek	Seasonal	PLBH
29	Linquist Creek	Seasonal	GZLK
30	Crystal Springs Creek	Seasonal	GZLK
31	Gazzam Lake Creek	Seasonal	GZLK
32	Foster's Creek	Seasonal	FLBY
33	South Fork Springbrook Creek	Perennial	FLBY
34	Springbrook Creek	Perennial	FLBY
35	Issei Creek	Perennial	FLBY
36	West Fork Issei Creek	Seasonal	FLBY
37	North Fletcher Bay Creek	Seasonal	FLBY
38	Battle Point Creek	Seasonal	MZBY
39	Fairy Dell Creek	Seasonal	MZBY
40	South Manzanita Creek	Seasonal	MZBY
41	South Fork Manzanita Creek	Perennial	MZBY
42	Manzanita Creek	Perennial	MZBY
43	North Fork Manzanita Creek	Seasonal	MZBY
44	Young Cedars Creek	Seasonal	AGPS
45	Agate Pass Creek	Seasonal	PTMD
46	Oots-Aht-Ub Creek	Seasonal	PTMD
47	Nature Preserve Creek	Seasonal	PTMD
48	Tochhookwap Creek	Seasonal	PTMD
49	Hidden Cove Creeklet	Seasonal	PTMD
50	Hidden Cove Creek	Seasonal	PTMD
51	Coho Creek	Perennial	PTMD
52	Heron Creek	Seasonal	SNRS
53	Dripping Water Creek	Perennial	SNRS
54	Rolling Bay Creek	Seasonal	SNRS
55	Manitou Beach Creek	Seasonal	MDCV
56	Meigs Creek	Perennial	MDCV
57	Middle Fork Woodward Creek	Perennial	MDCV
58	Woodward Creek	Perennial	MDCV
59	Murden Creek	Perennial	MDCV

Land cover

Bainbridge Island encompasses an area of 17,471 acres, or approximately 28 square miles. The primary land cover is tree-cover at 73%, or 12,760 acres. Grass/scrub lands, developed areas with impervious surfaces and other coverages comprise 15%, 11% and 1%, respectively, with combined coverage of 4,712 acres (Table 1 next page).

Land use type does not vary widely by any great degree across the island due to a low percentage of industrial or commercial land development and the lack of available or developed farm/range land. The island's land use is consequently dominated by residential uses (75%). Other land uses such as recreation land (7%), agricultural (6%), transportation corridors (6%), commercial/light manufacturing (2%), forest land-use (2%) and public facilities (2%), make up the remainder of the land use as a percentage of the total acreage on the island. With a total overall population of 23,630 the greatest population density occurs at the towns of Winslow, Island Center, Lynwood Center and around the coastline of the island. Outside of urbanized areas, the Island is generally characterized by scattered, small communities, homes on acreage, and large parcels of undeveloped land.

Stream type

In 2014, the Wild Fish Conservancy (WFC) completed stream typing for Bainbridge Island as part of the West Sound Watersheds, Kitsap Peninsula (WRIA 15) Stream Typing Project.

WFC's website states, "Water typing is the state-sanctioned process of mapping the distribution of fish and fish habitat. Regulatory water type maps are used to regulate land use decisions adjacent to streams, ponds, and wetlands. Because existing (modeled) regulatory maps often significantly misrepresent the presence, location, and extent of fish habitat, the effectiveness of state and local government fish habitat protection regulations is compromised. More information about the water typing process and its significance is available at: http://wildfishconservancy.org/resources/maps/what-is-water-typing."

WFC classified fish and fish habitat in Island streams and ground-truthed regulatory maps of stream presence and location, identifying an additional # previously unknown/unmapped miles of stream on Bainbridge Island. The City is currently using WFC's updated stream data.

Table 1. CoBI Watershed Land Cover Statistics

Watershed Name /Code	Watershed Area (Acres)	Watershed Size Ranking	Breakdown of Total Watershed Landcover (% of Total Area)								
			Forest	Wetlands	**Natural**	Grass & Turf	Bare Ground	% Total Impervious Area	**Developed**	**Surface Water**	**Other**
Agate Passage / AGPS	599.96	12	79.52	2.75	**82.28**	4.25	3.08	9.17	**16.51**	**0.17**	1.04
Blakely Harbor / BLKH	1,369.73	7	87.04	1.08	**88.13**	2.25	3.62	5.75	**11.62**	**0.22**	0.04
Eagledale / EGDL	1,094.12	9	65.10	2.95	**68.04**	8.83	4.36	18.45	**31.63**	**0.33**	0.00
Fletcher Bay / FLBY	2,114.01	3	75.83	1.09	**76.92**	8.60	6.04	7.89	**22.52**	**0.56**	0.00
Gazzam Lake / GZLK	886.45	10	83.96	0.79	**84.74**	3.96	1.86	7.82	**13.64**	**1.62**	0.00
Manzanita Bay / MZBY	2,296.34	1	72.25	1.92	**74.18**	9.76	6.76	8.85	**25.37**	**0.46**	0.00
Murden Cove / MDCV	2,046.36	4	73.65	2.34	**75.99**	7.65	6.46	9.48	**23.58**	**0.43**	0.00
North Eagle Harbor / NEGH	2,184.91	2	50.64	2.46	**53.11**	8.30	10.57	26.95	**45.82**	**0.44**	0.63
Pleasant Beach / PLBH	1,437.63	5	70.66	3.00	**73.66**	6.01	6.64	13.56	**26.21**	**0.13**	0.00
Port Madison / PTMD	1,388.31	6	81.85	1.18	**83.03**	6.26	3.75	6.36	**16.37**	**0.30**	0.31
South Beach / SHBH	711.89	11	76.59	1.20	**77.79**	4.16	10.88	6.54	**21.58**	**0.63**	0.00
Sunrise / SNRS	1,342.24	8	79.08	1.92	**81.00**	4.49	6.41	7.97	**18.87**	**0.13**	0.00
TOTAL ACREAGE	**17,471.95**	-	12,760.44	333.49	**13,093.92**	1,194.76	1,089.27	1,994.28	**4,278.31**	**74.84**	**24.88**

Notes:
** Statistical sources include: Battelle GIS database, CoBI GIS data, and CoBI Level II Assessment (Kato & Warren, 2000)

(Water Quality and Flow Monitoring Program – Final Monitoring Plan, COBI, 2008)

Stormwater

Stormwater is generated when the ground becomes saturated and rainwater drains overland to the nearest surface water body or rainfall encounters hard or impervious surfaces.

The amount of stormwater runoff generated from road, roof, parking lot, and other impervious surfaces ~~created by urban developments~~ can be of a higher volume than what existed in the natural state. Peak flows that follow immediately after a storm can be much greater than existed when the land was in a natural state with vegetative cover.

The volume of stormwater generated by impervious surfaces has tremendous force and can cause erosion if allowed to flow into natural drainage systems provided by streams and wetlands. Stormwater can loosen soil and stream banks in the natural drainage way causing suspended particulates to flow into other bodies of water.

Excessive stormwater runoff may cause streams to expand and overflow, creating flooding conditions on adjacent lands. Any sedimentation will eventually drop as the water slows down and loses its force, causing siltation and the degradation of wetlands, particularly of salmon spawning habitat.

Stormwater runoff from driveways and parking lots also transports pollutants such as gas and oil as well as residues from pesticides, fertilizers, and other chemicals used in lawn care, as well as animal waste in agricultural areas. Non-point source pollution accumulates as water runs over hard surfaces and is carried to the nearest body of water.

(more to come; will speak to permit requirements related to monitoring, illicit discharege detection and elimination, and education and outreach; and low impact development requirements)

Observed Surface and Stormwater Conditions

Department of Ecology Surface Water Quality Assessment

Every two years the State Department of Ecology (Ecology) identifies polluted water bodies and submits a list of impaired water bodies, called a 303(d) list, to the Environmental Protection Agency (EPA) for approval in accordance with the federal Clean Water Act. This assessment is based on the assumption that each water body should support certain designated uses. Some of these uses are swimming and boating, fish and shellfish rearing and harvest, and wildlife habitat.

Ecology designates water bodies that frequently or consistently fail to meet standards or criteria as *Impaired*. Water bodies that only infrequently fail to meet standards are classified as *Waters of Concern* or *Sediments of Concern* if the sampled matrix was sediment. These assessments use water, fish/shellfish tissue, habitat, and sediment data.

Ecology's *2012 Water Quality Assessment* determined that one stream, one harbor, two coves, one lagoon, and three Island-adjacent nearshore marine areas on Bainbridge Island were *Impaired* by one or more pollutants and were not able to provide the full recreational, habitat, and aesthetic benefits they once offered.

An additional one bay, one harbor, and 28 other Island-adjacent nearshore marine areas were identified as *Waters of Concern* and/or *Sediments of Concern* for periodic excursions beyond the allowable standard or criteria for one or more pollutants.

Ecology's proposed *2014 Water Quality Assessment* (under review by the EPA at the time of this printing), designated an additional two streams as *Impaired* by at least one pollutant.

Tables 2-5 on the following pages detail those water bodies classified as *Impaired* or *of Concern* according to the analyzed matrix (water, tissue, habitat, and sediment, respectively).

It should be noted that much of the sediment data were collected prior to 2003, some as early as the 1990's. These may not be representative of current conditions. Further, many of the identified pollutants are legacy pollutants resulting from historic land use such as large-scale, row-crop farming and the active lumber industry at the turn of twentieth century. The City's sediment sampling data collected in 2008 and 2013 may be more representative of current inputs to these water bodies. These data are summarized in the next section, *City Surface Water Quality Assessment*.

One example of legacy pollution is the former Wyckoff Creosote Facility located at the mouth of Eagle Harbor. Sites where sediments are contaminated by hazardous waste are regulated and managed through the Model Toxics Control Act (MTCA). Sites such as the former Wyckoff Creosote Facility, due to the complexity and size, are normally addressed through EPA's Superfund program.

However, water bodies listed on the 303(d) list require TMDLs (Total Maximum Daily Loads) where identified sources of the pollutant of concern are allocated a pollutant load reduction in order for that water body to meet criteria. Currently, the City is a stakeholder in the *Sinclair and Dyes Inlets Fecal Coliform Bacteria Total Maximum Daily Load (TMDL)*. Four of the Island's watersheds are captured within the TMDL drainage basin boundaries (Fletcher Bay, Gazzam Lake, Pleasant Beach, and South Beach Watersheds).

Table 2. Ecology Approved 2012 and Proposed 2014 Water Quality Assessment - Water

Waterbody	Parameter or Pollutant	2012	2014 (Proposed)
Eagle Harbor (Middle)	Bacteria	Impaired	Impaired
	Copper	Waters of Concern	Waters of Concern
Eagle Harbor (Inner)	Dissolved Oxygen	Waters of Concern	Waters of Concern
	Temperature		
Agate Passage - Bridge	Dissolved Oxygen	Waters of Concern	Waters of Concern
Agate Passage - Agate Point	Dissolved Oxygen	Waters of Concern	Waters of Concern
	Temperature		
Rich Passage - Pleasant Beach Cove/Pleasant Beach	Bacteria	Impaired	Impaired
	Dissolved Oxygen		
	pH	Waters of Concern	Waters of Concern
Rich Passage - Point White	Dissolved Oxygen	Waters of Concern	Waters of Concern
Rich Passage - Fort Ward	Bacteria	Waters of Concern	Waters of Concern
	Dissolved Oxygen		
	pH		
Port Orchard Passage - Lower Crystal Springs	Dissolved Oxygen	Impaired	Impaired
	Bacteria		
	Temperature	Waters of Concern	Waters of Concern
Port Orchard Passage - Upper Crystal Springs	Bacteria	Waters of Concern	Waters of Concern
Port Orchard Passage - Fletcher Bay	Bacteria	Waters of Concern	Waters of Concern
Port Orchard Passage - Battle Point	Bacteria	Waters of Concern	Waters of Concern
Port Orchard Passage - South of Rolston	Bacteria	Waters of Concern	Waters of Concern
Puget Sound (Central) - Blakely Harbor (Mouth)	Bacteria	Waters of Concern	Waters of Concern
Puget Sound (Central) - Blakely Harbor (Middle)	Bacteria	Waters of Concern	Waters of Concern
Puget Sound (Central) - Blakely Harbor (Inner)	Bacteria	Waters of Concern	Waters of Concern
Puget Sound (Central) - Murden Cove	Bacteria	Impaired	Impaired
Puget Sound (Central) - Rolling Bay	Bacteria	Waters of Concern	Waters of Concern
Port Madison Bay - Point Monroe	Bacteria	Waters of Concern	Waters of Concern
Port Madison Bay - Mouth	Bacteria	Waters of Concern	Waters of Concern
Springbrook Creek	Bacteria	Impaired	Impaired
Ravine Creek	Bacteria	---	Impaired
Murden Creek	Bacteria	---	Impaired

Table 3. Ecology Approved 2012 and Proposed 2014 Water Quality Assessment - Tissue

Waterbody	Parameter or Pollutant	2012	2014 (Proposed)
Eagle Harbor (Outer)	Benzo(a)pyrene	Impaired	Impaired
	Benzo(a)anthracene		
	Benzo[b]fluoranthene		
	Benzo[k]fluoranthene		
	Chrysene		
	Dibenzo[a,h]anthracene		
	Indeno(1,2,3-cd)pyrene		
	PCB		
Puget Sound (Central) - Rockaway	Chrysene	Impaired	Impaired

Table 4. Ecology Approved 2012 and Proposed 2014 Water Quality Assessment - Habitat

Waterbody	Parameter or Pollutant	2012	2014 (Proposed)
Puget Sound (Central) - Murden Cove	Habitat	Impaired	Impaired
Port Madison - Point Monroe Lagoon	Habitat	Impaired	Impaired

Table 5. Ecology Approved 2012 and Proposed 2014 Water Quality Assessment - Sediment

Waterbody	Parameter or Pollutant	2012	2014 (Proposed)
Eagle Harbor (Outer)	1,2,4-Trichlorobenzene 1,2-Dichlorobenzene 1,4-Dichlorobenzene 2,4-Dimethylphenol 2-Methylnaphthalene 2-Methylphenol 4-Methylphenol Acenaphthene Acenaphthylene Anthracene Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(g,h,i)perylene Benzofluoranthenes (b+k+j), Total Benzoic Acid Benzyl Alcohol Bis (2-Ethylhexyl) Phthalate Bioassay Butyl Benzl Phthalate Cadmium Chromium Chrysene Copper Dibenzo(a,h)anthracene Dibenzofuran Diethyl Phthalate Dimethyl Phthalate Di-n-butyl Phthalate Di-n-octyl Phthalate Fluoranthene Fluorene Hexachlorobenzene Hexachlorobutadiene HPAH Indeno(1,2,3-c,d) Pyrene Lead LPAH Mercury Naphthalene N-Nitrosodiphenylamine PCB Pentachlorophenol Phenanthrene Phenol Pyrene Silver Zinc	Impaired	Impaired
Rich Passage - Pleasant Beach	Benzoic Acid	Sediments of Concern	Sediments of Concern
Rich Passage - Pleasant Beach Cove	Benzoic Acid	Sediments of Concern	Sediments of Concern
Port Orchard Passage - Upper Crystal Springs	Benzoic Acid	Sediments of Concern	Sediments of Concern
Port Orchard Passage - South of Rolston	1,2,4-Trichlorobenzene 1,2-Dichlorobenzene Benzyl Alcohol	Sediments of Concern	Sediments of Concern
Port Orchard Passage - Manzanita Bay	1,2,4-Trichlorobenzene 1,2-Dichlorobenzene	Sediments of Concern	Sediments of Concern
Puget Sound (Central) - Wing Point	1,2-Dichlorobenzene 1,2,4-Trichlorobenzene 1,4-Dichlorobenzene 2,4-Dimethylphenol Hexachlorobenzene Pentachlorophenol	Sediments of Concern	Sediments of Concern
Puget Sound (Central) - Rockaway	1,2-Dichlorobenzene 1,2,4-Trichlorobenzene 1,4-Dichlorobenzene 2,4-Dimethylphenol Hexachlorobenzene Hexachlorobutadiene Naphthalene N-Nitrosodiphenylamine	Sediments of Concern	Sediments of Concern
Puget Sound (Central) - Blakely Harbor (Middle)	1,2-Dichlorobenzene 1,2,4-Trichlorobenzene 1,4-Dichlorobenzene 2,4-Dimethylphenol Dibenzo(a,h) anthracene Hexachlorobenzene Hexachlorobutadiene N-Nitrosodiphenylamine Pentachlorophenol	Sediments of Concern	Sediments of Concern

Commercial Shellfish Growing Area and Recreational Harvest Area Assessment

Department of Health (DOH) routine bacterial and biotoxin assessments of recreational shellfish harvest areas and commercial shellfish growing and harvest areas demonstrate a significant loss of designated uses. The entire east, north, and west shorelines are closed to recreational butter and varnish clam harvest, and the southern shoreline is closed to recreational varnish clam harvest. Only one small area around Point White is open to recreational harvest.

Most commercial shellfish growing area around the Island is open to harvest. However, two segments of commercial shellfish growing areas along Agate Passage and Crystal Springs are currently closed due to bacterial contamination in shoreline drainages to include private drains, stormwater outfalls, and streams. Point Monroe Lagoon is restricted for commercial harvest, requiring that shellfish be transplanted to approved growing area waters for a specified amount of time in order to naturally cleanse themselves of contaminates before they are harvested for market. Commercial Geoduck Tract 07850 at Restoration Point was closed four times in 2012-2013 for biotoxin. Commercial Geoduck Tract 07000 at the mouth of Manzanita Bay has been closed 14 times in the last five years for biotoxin, and is currently closed at the time of this printing.

In addition to annual commercial growing area reports, DOH publishes an annual threatened areas report to bring attention to monitoring sites where bacteria concentrations are close to exceeding the criteria. The 2015 report (based upon 2014 data) identified one monitoring site (#457) immediate outside of the north side of the mouth of Fletcher Bay as a threatened site and one site (#418) along the southern shore of Blakely Harbor as a site of concern.

Swimming Beach Assessment

The Departments of Ecology and Health's BEACH Program conducts swimming beach monitoring for bacteria during the swimming season (Memorial Day through Labor Day). Typically, bacteria levels in marine waters tends to be fairly low in the summertime. In fact, most beach closures on the Island have been associated with sanitary sewer spills such as the Kitsap Sewer District #7 Fort Ward spill in 2012, and the City's sewer main breaks along the north side of Eagle Harbor in 2014.

In 2015, three of the Island's swimming beaches (Fay Bainbridge Park, Joel Pritchard Park, and Eagle Harbor Waterfront Park) were monitored. Bacterial concentrations in 2015 were acceptable, and there were no beach closures in 2015.

City Surface Water Quality Assessment

In 2007, the City received a Centennial Clean Water Fund Grant from Ecology to design and implement a long-term monitoring program to assess the ecological health of the Island's freshwater (streams and lakes), marine water (harbors, bays, and nearshore areas), and stormwater discharge.

The Water Quality and Flow Monitoring Program (WQFMP) was pilot-tested in 2007-2008 and expanded to Island wide long-term status and trends monitoring in 2010. The program currently conducts routine monitoring for stream and stormwater chemistry, stream and nearshore sediment chemistry, rainfall, stream and stormwater flow, and stream biodiversity (benthic macroinvertebrates). Every five years, the program also conducts targeted storm event monitoring to assess stormwater runoff impacts in streams and nearshore marine waters.

Although the program's Final Monitoring Plan is comprehensive, staffing and funding are limited. Current monitoring gaps are stormwater best management practice effectiveness monitoring, lake monitoring, marine biological assessments (fish, aquatic macrophytes, phytoplankton, and benthic invertebrates), routine marine water chemistry, and freshwater and marine habitat assessments.

The program released its first edition *State of the Island's Waters* report in 2012 which summarized findings from data collected through Water Year 2011 (September 2011). Program staff are currently assessing data collected through Water Year 2015 (September 2015) and working on a second edition of the report. The following summary reflects assessments completed at the time of this printing.

Bacteria

All of the seven nearshore marine waters monitored during WY2014 targeted storm event monitoring failed to meet the state criteria for fecal coliform bacteria, while 13 (86%) of the 15 streams monitored on a monthly basis failed to meet the state criteria in WY2015. Given these results and the number of state listings for bacterial impairment (see Table 2 above), bacteria has proven to be the most prevalent pollutant in freshwater and marine water resources Island wide.

As described above in *Commercial Shellfish Growing Area and Recreational Shellfish Harvest Area Assessment*, commercial shellfish harvest areas along approximately twelve miles of shoreline are currently closed due to elevated bacteria in shoreline drainages, and nearly the entire Island is closed to recreational harvest of varnish and butter clams due to the biotoxins usually associated with bacteria.

Bacterial contamination is common to every season and every watershed, urban or rural, and its sources are as varied as the landscape itself. In rural watersheds, the most common sources of bacteria are failing septic systems, improperly-managed pet and livestock wastes, and wildlife. In urban watersheds, the most common sources are improperly-managed pet waste, improper food handling, poorly-maintained food waste receptacles, failing septic systems, poorly-maintained or failing stormwater drainage infrastructure (private and public), failing sanitary sewer infrastructure, and illicit cross-connections between the sanitary sewer and the stormwater drainage systems.

In marine environments, common sources of bacteria aside from discharges from upland sources are improper boat waste disposal, failing sanitary sewer infrastructure, and wildlife.

Nutrients

Although they are essential to all plant, human, and aquatic life, phosphorus and nitrogen concentrations, if excessive, can overstimulate growth of aquatic vegetation and algal blooms. Applying Ecology's Water Quality Index using the ratio of total nitrogen to total phosphorus, Island streams generally rate of low to moderate concern during the wet season and moderate to high concern during the dry season relative to other Puget Lowland streams. In 2013, a year of below average rainfall, most streams rated of moderate concern even in the wet season, and 3 streams reached a high level of concern. During the drought in the summer of 2015, 7 streams climbed to a level of high concern.

Nuisance algal blooms have increased along eastern shorelines and harbors (see Ecology's Eyes Over Puget Sound). These blooms are not only aesthetically unpleasant, but dying and decomposing algae use up aquatic life-sustaining oxygen and render aquatic habitat unusable such as in Murden Cove and Point Monroe Lagoon which are covered year-round with ulvoid macroalgae (see Table 4 above).

Though more study is needed to establish natural background levels for Island streams and it is well-understood that a significant amount of nitrogen-loading in Puget Sound comes from the ocean through the Strait of Juan de Fuca via tidal action, ecosystems with naturally high background levels are particularly sensitive to any additional loading from human sources.

Aside from the natural sources of nutrients from forests and wetlands, human inputs include agricultural and residential fertilizers, phosphate-based laundry detergents and commercial washing agents, yard waste such as grass clippings and other vegetation dumped along shorelines and streams, failing residential septic systems (in some cases even functioning systems), failing municipal sewer infrastructure, and improperly handled pet and livestock waste.

Ammonia

Ammonia is considered a priority pollutant by the EPA, since it is deadly to both humans and aquatic life. Therefore, there are established acute and chronic criteria for ammonia in surface waters. Acute criterion is the concentration of a substance at which injury or death to an organism can occur as a result of short-term exposure. Chronic criterion is the concentration of a substance at which injury or death to an organism can occur as a result of repeated or constant exposure.

Out of the 11 fish-bearing streams monitored on a routine basis, 8 (73%) consistently exceeded the chronic criteria, while the remaining 3 had seasonal exceedances only. During WY2014 targeted storm event monitoring, all 7 streams and corresponding nearshore areas monitored exceeded the chronic criteria. Murden Cove frequently exceeded the acute criteria. The cove exceeded acute criteria 14 times during the 3-year Murden Cove Watershed Nutrient and Bacteria Reduction Project (see project highlight below).

Sediment and Metals

During rain events, sediment-laden stormwater runoff is a prominent pollutant on the Island. Not only does sediment cause excessive scouring and erosion, de-stabilizing slopes and stream banks and threatening property, but subsequent downstream deposition clogs stream bottoms, smothers fish eggs, and increases siltation rates in the Island's harbors and bays. Sediment also reduces fish's ability to find food and damages their gills as well.

Sediment-intolerant macroinvertebrate species (an important food source for fish) have diminished, some entirely, from half of the Island streams monitored, especially Ravine and Murden Creeks. (King County work here!) Sensitive to fine grains – what does % fines in sediment sampling tell us?

Equally concerning are the pollutants that sediment carries with it such as heavy metals. Monitoring results have shown significant increases in concentrations of metals in both streams and nearshore marine waters and stormwater outfall discharge during rain events.

Anywhere soil is exposed to rain there is a risk of sediment-laden runoff. Construction sites, croplands, sand and gravel pits or accumulations, and any other cleared or grubbed land surfaces are all potential sources of sediment. Likewise, poorly-maintained parking lots, stormwater drainage systems, and roadways become significant sources of sediment, particularly sediment laden with heavy metals.

Metals are also carried to streams from uncontrolled discharges from auto washing washwater.

In-situ Physical Chemistry

Several Island streams and nearshore areas experience periodic excursions in pH, temperature, and dissolved oxygen. Weaver, Hawley, Murden, Schel Chelb, and Mac's Dam Creeks and Murden Cove suffer chronically low levels of dissolved oxygen, significantly impairing their ability to support aquatic life. While not as prevalent, two nearshore areas (Eagle Harbor at Ravine Creek, and Murden Cove) frequently exceed temperature criteria as well. MCWP…habitat driven, lack of canopy cover, low base flows, and stream flow flashiness due to stormwater runoff (reference KC work).

Flow and Impacts on the Biological Community

In 2015, the City contracted with King County Department of Natural Resources and Parks, Water and Land Resources Division to conduct a stream benthos and hydrologic evaluation of the City's stream benthic macroinvertebrate data and continuous flow gauging data.

Project Highlight – Murden Cove Watershed Nutrient and Bacteria Reduction

In 2013 – 2015, the City brought together and led a partnership of agencies, schools, business….sampling, training volunteers, what each partner brought to the project, targeted shoreline and upland stream side properties – Health District visits. Monitoring identified habitat-driven temperature and dissolved oxygen impairments (shows in King county's assessment bio)Though remaining work needs to be done to address land cover/land use impacts such as sediment, nitrate, and ammonia watershed-wide, significant reductions in phosphorous and bacteria concentrations in the watershed were achieved. Critical to retain and protect riparian buffers and reduce stormwater runoff.

The 2016 stormwater discharge permit-required low impact development requirements for new and re-development should help alleviate some of the stressors, sediment, flow, over time.

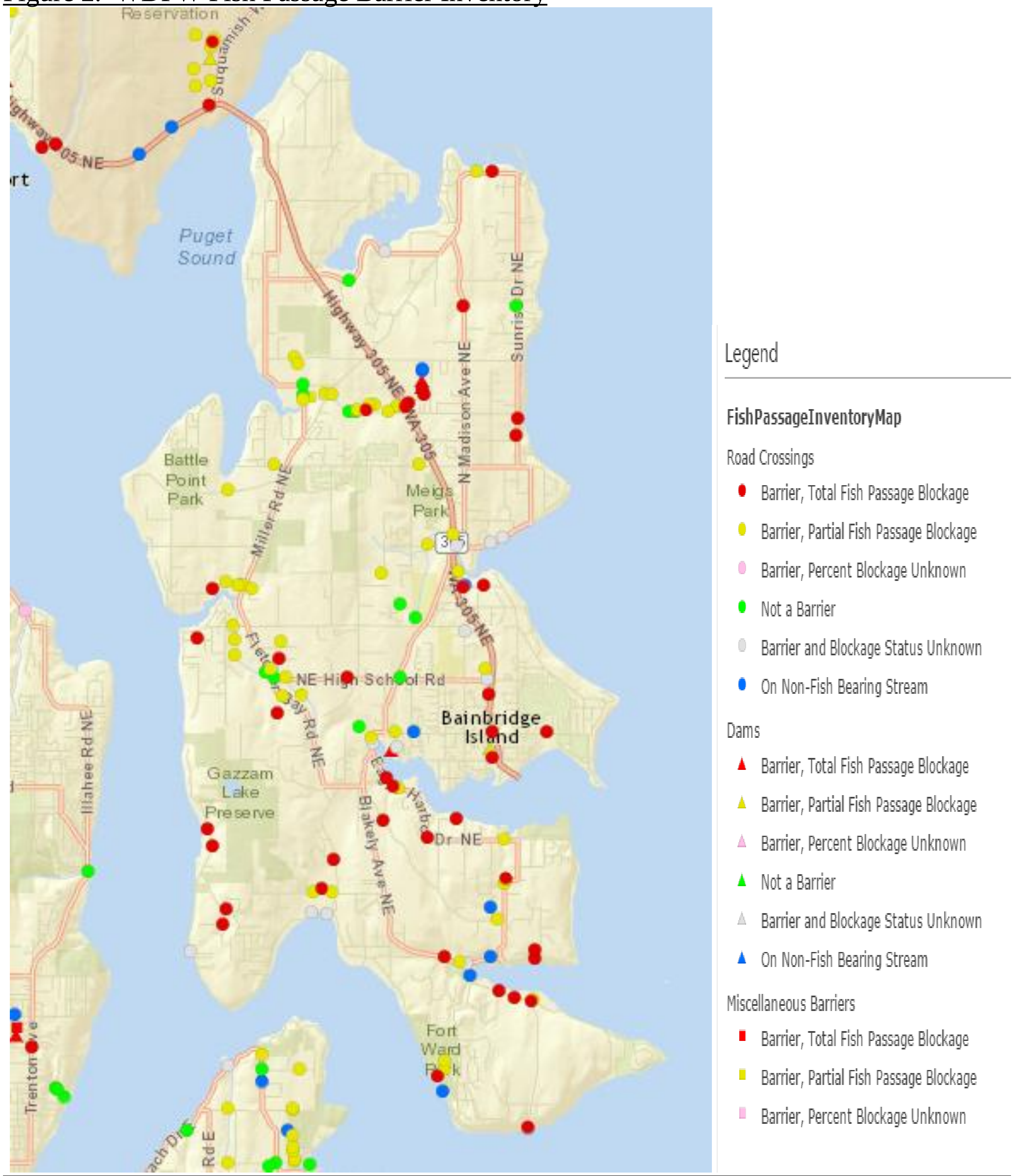
Freshwater and Marine Water Habitat

(to come)

Fish Passage Barrier Inventory

In 2014 the Washington Department of Fish and Wildlife (WDFW) completed fish passage assessments on Bainbridge Island streams. As part of this assessment, WDFW identified 43 total passage barriers (40 road crossings and 3 dams) and 45 partial passage barriers (43 road crossings, 1 dam, and 1 miscellaneous) (see Figure 2).

Figure 2. WDFW Fish Passage Barrier Inventory



(http://wdfw.maps.arcgis.com/home/webmap/viewer.html)