CITY OF
BAINBRIDGE ISLAND

PLANNING COMMISSION SPECIAL MEETING
THURSDAY, APRIL 08, 2021

THE PLANNING COMMISSION WILL HOLD THIS MEETING USING A VIRTUAL ZOOM WEBINAR PLATFORM PER GOVERNOR INSLEE'S "STAY HOME, STAY HEALTHY" ORDERS. MEMBERS OF THE PUBLIC WHO DO NOT WISH TO VIEW THE MEETING VIA THE CITY'S WEBSITE STREAMING WILL BE ABLE TO CALL IN TO THE ZOOM MEETING.
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AGENDA

1. **CALL TO ORDER/LAND ACKNOWLEDGEMENT/COFLICT DISCLOSURE - 6:00 PM**
We would like to begin by acknowledging that the land on which we gather is within the aboriginal territory of the Suquamish, "People of Clear Salt Water." Expert fishermen, canoe builders and basket weavers, the Suquamish live in harmony with the lands and waterways along Washington's Central Salish Sea as they have for thousands of years. Here, the Suquamish live and protect the land and waters of their ancestors for future generations as promised by the Point Elliot Treaty of 1855.

2. **PLANNING COMMISSION MEETING MINUTES - 6:05 PM**

2.a **Review and Approve March 25, 2021 Meeting Minutes** 5 Minutes
Planning Commission Meeting Minutes DRAFT 032521.pdf

3. **PUBLIC COMMENT - 6:10 PM**
Public Comment on off-agenda items.

4. **UNFINISHED BUSINESS - 6:20 PM**

4.a **(6:20 PM) - SMP Periodic Review - Policy Workshop (2 of 2)** 3 Hours
Flooding from Sea Level Rise White Paper

Aquaculture Survey Results
Flooding from Sea Level Rise Survey Results
Aquaculture Amendment Options Outline DRAFT

5. **PLANNING DIRECTOR'S REPORT - 9:20 PM**

6. **FOR THE GOOD OF THE ORDER - 9:25 PM**

7. **ADJOURNMENT - 9:30 PM**

GUIDING PRINCIPLES

Guiding Principle #1 - Preserve the special character of the Island, which includes downtown Winslow's small town atmosphere and function, historic buildings, extensive forested areas, meadows, farms, marine views and access, and scenic and winding roads supporting all forms of transportation.

Guiding Principle #2 - Manage the water resources of the Island to protect, restore and maintain their ecological and hydrological functions and to ensure clean and sufficient groundwater for future generations.

Guiding Principle #3 - Foster diversity with a holistic approach to meeting the needs of the Island and the human needs of its residents consistent with the stewardship of our finite environmental resources.

Guiding Principle #4 - Consider the costs and benefits to Island residents and property owners in making land use decisions.

Guiding Principle #5 - The use of land on the Island should be based on the principle that the Island's environmental resources are finite and must be maintained at a sustainable level.

Guiding Principle #6 - Nurture Bainbridge Island as a sustainable community by meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Guiding Principle #7 - Reduce greenhouse gas emissions and increase the Island's climate resilience.

Guiding Principle #8 - Support the Island's Guiding Principles and Policies through the City's organizational and operating budget decisions.

Planning Commission meetings are wheelchair accessible. Assisted listening devices are available in Council Chambers. If you require additional ADA accommodations, please contact the Planning & Community Development Department at (206) 780-3750 or pcd@bainbridgewa.gov by noon on the day preceding the meeting.

Public comment may be limited to allow time for the Commissioners to deliberate. To provide additional public comment, email your comment to pcd@bainbridgewa.gov or mail it to Planning and Community Development, 280 Madison Avenue North, Bainbridge Island, WA 98110.

CITY OF BAINBRIDGE ISLAND

Planning Commission Special Meeting Agenda Bill

MEETING DATE: April 8, 2021 **ESTIMATED TIME:** 5 Minutes

AGENDA ITEM: Review and Approve March 25, 2021 Meeting Minutes

AGENDA CATEGORY: Minutes **PROPOSED BY:** Jane Rasely

PREVIOUS PLANNING COMMISSION REVIEW DATE(S):

PREVIOUS COUCIL REVIEW DATE(S):

RECOMMENDED MOTION:
I move approval of the March 25, 2021 meeting minutes.

SUMMARY:

BACKGROUND:

ATTACHMENTS:

CITY OF
BAINBRIDGE ISLAND

Planning Commission Special Meeting
March 25, 2021

Meeting Minutes

1) CALL TO ORDER/LAND ACKNOWLEDGEMENT/AGENDA REVIEW/CONFLICT DISCLOSURE

Chair McCormick Osmond called the meeting to order at 6:01 PM. Commissioners in attendance were Vice-chair Joe Paar, Jon Quitslund, Lisa Macchio, Sarah Blossom and Ashley Mathews. William Chester was absent and excused. City Staff present were Planning Director Heather Wright, Senior Planners Kelly Tayara and Peter Best, and Administrative Specialist Jane Rasely who monitored recording and prepared minutes.

The land acknowledgement was read and the agenda reviewed.

2) PUBLIC PARTICIPATION MEETING

2.a Public Participation Meeting for Wyatt and Madison Apartments

Cover Page
Wyatt & Madison Apartments Summary.pdf
Wyatt & Madison Public Meeting.pdf
12MAR2021 Preapplication Summary Letter.pdf

Chair McCormick Osmond provided an overview of the public participation meeting process and introduced Senior Planner Kelly Tayara. Architect Bruce Anderson represented project owner Michael Burns and presented the project to the public.

3) PLANNING COMMISSION MEETING MINUTES

3.a Review and approve meeting minutes from March 11, 2021.

Cover Page
Planning Commission Meeting Minutes DRAFT 031121.pdf

Motion: I move approval of the minutes from the March 11, 2021 meeting.
Quitslund/Paar: Passed Unanimously

4) PUBLIC COMMENT

None.

5) UNFINISHED BUSINESS

5.a SMP Periodic Review - Policy Workshop (1 of 2)

Cover Page
SMP Periodic Review Staff Memo
Attachment 1 - Project Log
Attachment 2 - Public Participation Plan & Work Plan
Attachment 3 - Summary of Periodic Review Rule
Attachment 4 - Aquaculture Policy White Paper
Attachment 6 - Baseline SMP Improvement Examples

Peter Best led the workshop.

Planning and Community Development Director Heather Wright provided information on conflict disclosures specifically regarding shoreline property owners. Vice-chair Joe Paar and Commissioner Ashley Mathews both disclosed they were shoreline property owners, but felt they could set that aside and make decisions as a Planning Commissioner when it came to the shoreline discussion.

6) PLANNING DIRECTOR'S REPORT

Director Heather Wright provided updates on topics of interest to the Planning Commission.

7) FOR THE GOOD OF THE ORDER

Commissioner Quitslund asked when the process for finding his replacement as a Commissioner would begin.

8) ADJOURNMENT

Meeting adjourned at 9:05 PM.

_____
Kimberly McCormick Osmond, Chair

_____
Jane Rasely, Administrative Specialist

CITY OF BAINBRIDGE ISLAND

Planning Commission Special Meeting Agenda Bill

MEETING DATE: April 8, 2021 **ESTIMATED TIME:** 3 Hours

AGENDA ITEM: (6:20 PM) - SMP Periodic Review - Policy Workshop (2 of 2)

AGENDA CATEGORY: Discussion **PROPOSED BY:** Peter Best

PREVIOUS PLANNING COMMISSION REVIEW DATE(S): 1/28/2021 - Planning Commission was briefed on the updated Public Participation Plan and Work Schedule, including the upcoming role of the Planning Commission during an early policy input phase (i.e. these current workshops) and how the optional SMP joint review process selected by the City creates a different legislative process than typically used by the City.
3/25/2021 - Planning Commission participated in the first of these two workshops.

PREVIOUS COUCIL REVIEW DATE(S): 9/1/2020 - City Council adopted an updated Public Participation Plan and Work Schedule.

RECOMMENDED MOTION:
Workshop (2 of 2) regarding early policy input on aquaculture and future flooding from sea level rise.

SUMMARY:
This workshop will continue the informal policy discussions between the planning department and the Planning Commission during the early input phase of the SMP Periodic Review. The first two hours will be focused on the topic of flooding from sea level rise (see attached policy white paper). We will then have an hour for follow-up discussion regarding aquaculture.

Also attached are the results of the public surveys on the topics of aquaculture and flooding from sea level rise.

BACKGROUND: See packet from the first workshop on 3/25/2021.

ATTACHMENTS:

CITY OF BAINBRIDGE ISLAND

SMP Periodic Review

Policy White Paper
on
Flooding from Sea Level Rise

3/28/2021

Prepared by:
Peter Best, MMA
Senior Planner
City of Bainbridge Island
pbest@bainbridgewa.gov
206-780-3719

Note Regarding the Scope of this Policy White Paper
This policy white paper is not intended to be an exhaustive summary on the complex issue of flooding from sea level rise, but rather a concise summary relevant to supporting policy-level discussions within the scope of authority the City of Bainbridge Island has under the Washington State Shoreline Management Act, Growth Management Act, and other authorities.

Contents

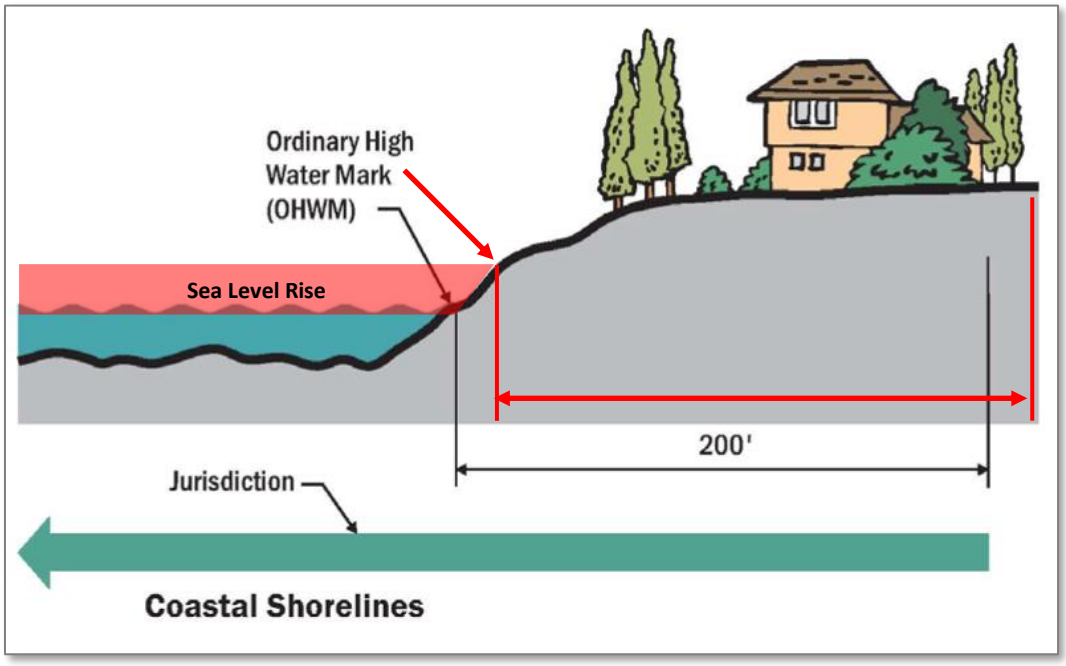
Introduction

The City of Bainbridge Island has been very proactive in understanding and planning for the likely impacts of climate change. In 2016 the City completed a Climate Impact Assessment and updated to the Comprehensive Plan with significant changes related to climate change. In 2019 the City prepared an updated assessment of Sea Level Rise on Bainbridge Island (Attachment B) and in 2020 the City adopted a Climate Action Plan. Through this work, the City has made it official policy to adapt to projected sea level rise (See Attachment A). Therefore, the policy discussion associated with this amendment is not about the causes of sea level rise, but rather the discussion is about when and how the community of Bainbridge Island will implement existing policy, using the most recent sea level rise projections for Washington State, to adapt to the rising seas around us. The City has intentionally chosen to address flooding from sea level rise in this amendment and to address bluff erosion from sea level rise in a future amendment currently anticipated in 2-3 years.

Shoreline Jurisdiction

The SMP manages an area commonly referred to as "shoreline jurisdiction" which extends from the City boundary half-way between Bainbridge Island and the opposite shoreline to approximately 200-feet inland from the ordinary high water mark (see Figure 1). The ordinary high water mark is a key regulatory line from which setbacks and buffers are measured. The ordinary high water mark is a bio-physical line that, by law, moves as the shape of the shoreline changes (e.g. from erosion or development) and with sea level rise, which means setbacks, buffers, and shoreline jurisdiction will move with it over time.

Figure 1. Shoreline Jurisdiction



(Source: WA Dept of Ecology Shoreline Master Programs Handbook, Dec 2017)

King Tides

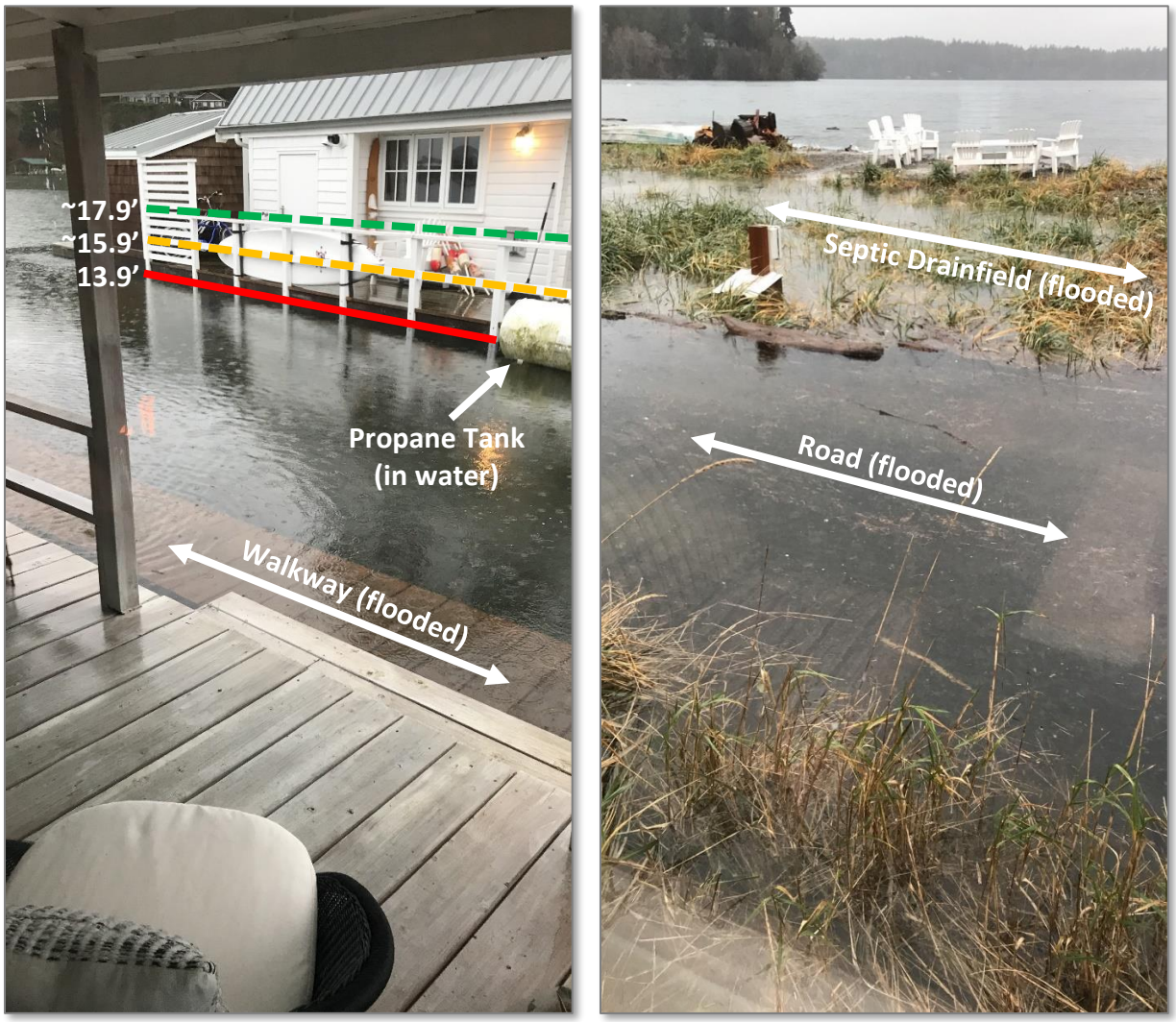
"King Tide" is the term used to describe the highest tide of the year. These are "still water" levels that may include storm surge caused by low atmospheric pressure and winds, but no additional wave height is included in the tidal elevation. King Tides today help us imagine what regular high tides will look like in the future. Figure 2 shows a still water "sunny day" flood event (i.e. when there is no storm and little to no wind generated waves) on Point Monroe during the January 4, 2021 King Tide. Using Risk Profile 4 (Low Risk of Future Flooding) in Attachment C:

Note: Attachment C has more info on tides and water levels.

EHW = Extreme High Water
MHHW = Mean Higher High Water
MLLW = Mean Lower Low Water

- This King Tide (red line) is projected to be the approximate ordinary high water mark by 2040 and our future MHHW (i.e. average daily high tide) by the 2080s.
- Approximate future base flood elevations (BFE) for the flood zone at this location will be the yellow dash line by 2030 and the green dash line by the 2080s.

Figure 2. January 4, 2021 "King Tide" Flooding on Bainbridge Island



(Annotation by COBI with water levels in MLLW. Photo Credit: Pat McCabe. 9am 1/4/2021)

In contrast, the February 4, 2006 King Tide was at a similar tidal elevation but occurred during a significant storm event with winds up to 50 MPH and high waves. The combination of extreme tide and strong winds caused widespread flooding and property damage (see Figure 3), including lifting the decks of some piers off the top of their piling on Bainbridge Island.

Figure 3. February 4, 2006 King Tide Flooding and Damage

(Source: WA Department of Ecology. 2016. Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State; *Double Bluff Park, Whidbey Island;* Credit: Hugh Shipman)

On December 17, 2012, the King Tide reached the extreme high water (EHW) level (i.e. the highest tide ever recorded in Seattle) during a significant storm event resulting in widespread flooding and property damage (see Figures 4 and 5).

- Accounting for the waves, this storm likely represents an event quite close to the 1% annual chance flood event (FKA 100-year flood event) used to map current flood zones.
- Under the "very low risk of future flooding" risk profiles in Attachment C, we would project that this 14.48' MLLW tide could be our future MHHW (i.e. average daily high tide) by the 2070s. Under the "moderate risk of future flooding" risk profile, we would project that it would be our future MHHW by the 2130s.

Figure 4. Headline Following December 17, 2012 Extreme High Water Storm Event

Originally published Tuesday, December 18, 2012 at 9:17 PM

Record-high tides wash in prospects for more in future

Damage done by Monday's storm-driven high tide could be a preview of what climate change could cause on a regular basis.

Figure 5. Photo of the December 17, 2012 Extreme High Water Storm Event

(Figure 4 & 5 Source: Cliff Mass Weather Blog. 12/19/2012. "Record Water Levels in Seattle: Why did it occur and is global warming important?"; Headline Credit: The Seattle Times; Photo Credit: West Seattle Blog)

Sea Level Rise Projections

Sea level rise projections have evolved over time and will continue to improve. As with any forecasting effort, there is always *uncertainty*, and of course projections never precisely predict the future. However, there is:

- *Certainty* about the trend: sea levels are rising, and the pace of change is accelerating.
- *High confidence* that the amount of sea level rise will not be small or easy to manage.

For an example of a sea level rise impact assessment from another Puget Sound island, see the Squaxin Island Sea Level Rise Story Map.

Washington is fortunate to have what may be the best sea level rise projections in the United States because they account for localized vertical land movement and provide a range of risk profiles on a decade-by-decade basis (see Attachment B). This provides us with localized projections that can be applied in a context-sensitive way.

Attachment C contains the sea level rise projections for Bainbridge Island following the guidance provided by the City's Climate Change Advisory Committee in Attachment B to use only the high (RCP 8.5) greenhouse gas scenario in the Washington Coastal Resilience Project model (Miller, et al 2018). Five risk profiles are presented using charts and data tables to:

- Visualize sea level rise curves
- Compare current datums to future elevations (i.e. today's EHW elevation will become the future MHHW elevation by the year-x and will go from a 2% chance per year event to a near daily occurrence)
- Compare data points from the projections to real world tidal and land elevations for buildings, infrastructure, and habitats.
- Visualize different water levels on a map using the NOAA Sea Level Rise Viewer.

The risk profiles are presented in a way that is intended to simplify the very complex topic of future probabilities. See Attachment C for more information and examples for using the risk profiles.

Impacts of Sea Level Rise (SLR)

Sea levels have fallen and risen many times over geologic time scales and have reshaped coastal landscapes through flooding and erosion processes. The period of rapidly increasing sea level rise we are now beginning to experience will reshape the shorelines around Bainbridge Island within a human lifetime, not only physically, but also economically, socially, and ecologically. While these impacts will affect our entire community, the greatest personal impacts will materialize for the next generations who live and work closest to our shorelines. The following is a summary of anticipated impacts.

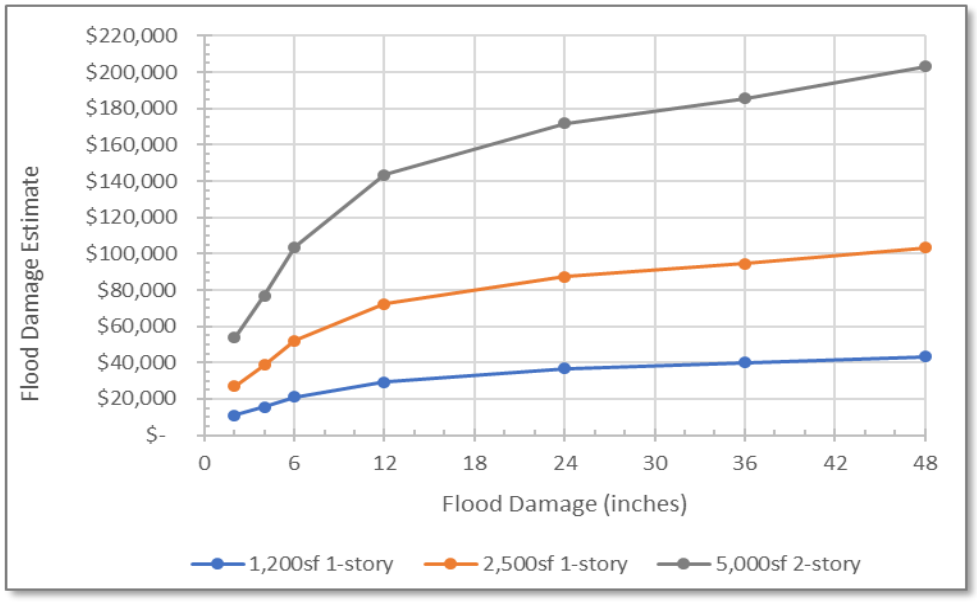
Economic Impacts

- Decreasing property values in the SLR risk area
- Increasing property values outside of the SLR risk area
- Decreasing tax revenues
- Increasing infrastructure costs
- Increasing flood damage costs (see Figure 6)
- Increasing private costs to adapt existing development
- Increasing public costs to assist with adaptation

Social Impacts

- Increasing road closures and detours
- Decreasing access for emergency services, residents, employees, and customers
- Increasing displacement of community members who will need housing elsewhere in the community or will leave the community
- Decreasing shoreline access and park uses (although this could increase if some shoreline property is acquired and opened for public use)
- Increasing saltwater intrusion into aquifers
- Higher groundwater levels will alter conditions for building foundations, septic systems, vegetation, and stormwater infiltration

Figure 6. Estimated Flood Damage Costs for Single-family Residence



(Source: FEMA Flood Damage Cost Calculator)

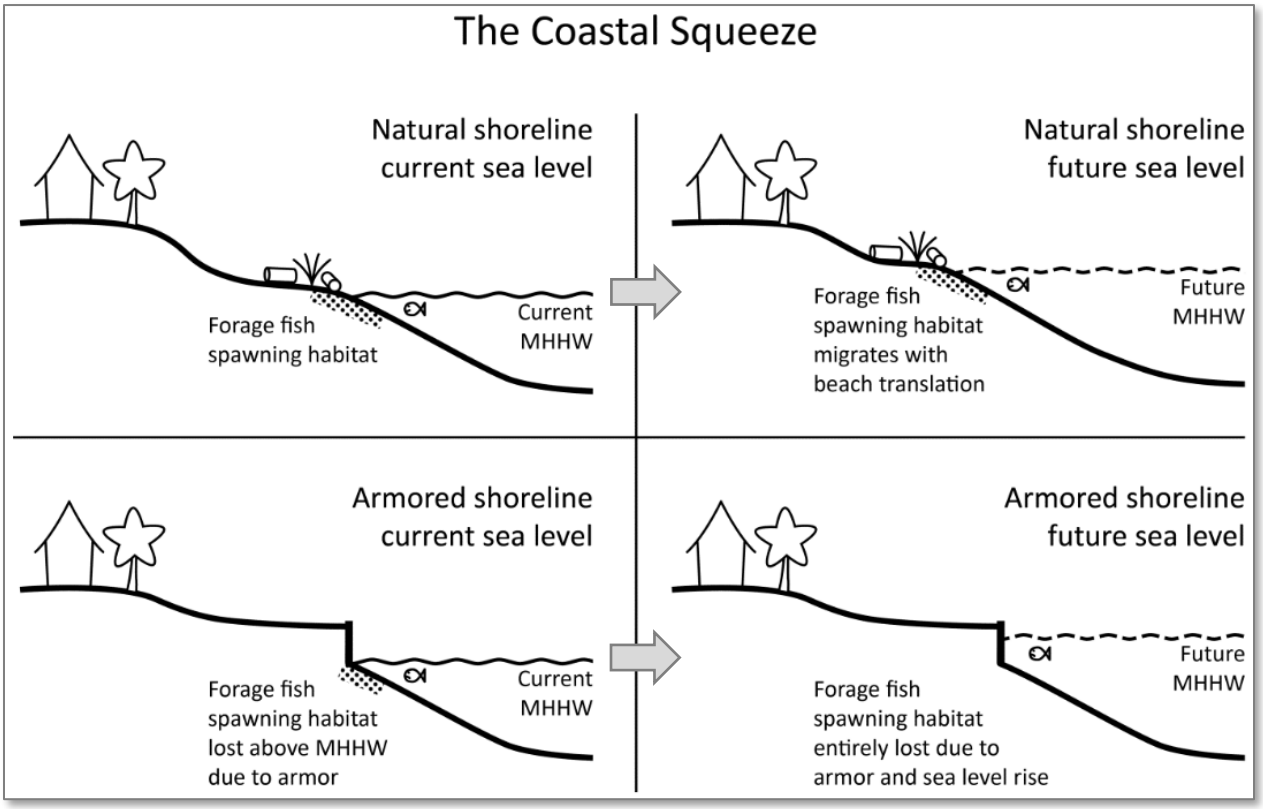
Ecological Impacts

- Designated critical areas in the sea level rise risk area include:
  - Submerged aquatic vegetation (eelgrass, kelp, etc)
  - Shellfish beds
  - Forage fish spawning habitat
  - Coastal wetlands
  - Other fish and wildlife habitat areas associated with listed species and species of local important, including salmon
  - Marine riparian areas (shoreline buffers)
  - Aquifer recharge areas
- Most of these critical areas are dependent on certain water depth gradients, salinity gradients, proximity to tidal water, and/or the long-term movement and sorting of sediments, which are all impacted by not just the rising water level but also the pace at which it rises.
- Some types of critical areas can "migrate" landward as water levels rise, but this is largely dependent on having suitable substrate and hydraulic conditions. If they cannot migrate at the same pace as water levels rise, they will essentially be "drowned" out.
- If there is no available area for elevation-dependent critical areas to migrate due to shoreline armoring or natural banks, then these critical areas will be "squeezed" out (see Figure 7).
- Restoration and enhancement efforts, including the intentional retreat of certain development, will be needed in order to maintain as much of the valuable ecological functions and values as possible provided by these critical areas and will need to be designed to accommodate sea level rise and habitat migration. A net loss of at least certain ecological functions and values is expected to be inevitable in the long-term.

Read more about "coastal squeeze" in the Salish Sea:

- San Juan Islands
- Fraser River Delta, British Columbia

Figure 7. Example of Coastal Squeeze



(Source: Encyclopedia of Puget Sound. Credit: Coastal Geologic Services)

What Development is vulnerable to flooding from sea level rise?

Several risk assessments have been completed for Bainbridge Island, all of which have generally described the risk and vulnerability to sea level rise, including:

- 2012 Bainbridge Island Hazard Identification and Vulnerability Assessment
- 2015 FEMA Risk Report for Kitsap County
- 2019 Sea Level Rise on Bainbridge Island: A Preliminary Assessment (Attachment B)

In order to complete a more detailed vulnerability assessment and draft code amendments necessary to facilitate adaptation to sea level rise, we need to know the risk profile(s) to which we are going to be managing (see Attachment C).

For comparison, current special flood hazard zones are based on the historic 1% annual chance of flooding (formerly known as the 100-year flood event). Based on this risk profile, we know that Bainbridge Island is more vulnerable to current flood risks than most other parts of Kitsap County (see Table 1).

Table 1. Special Flood Area Assessment

Community	Total Estimated Building Value	Percentage of Buildings in the Special Flood Hazard Area	Building Dollar Loss for a 1% Annual Chance Flood Event	Loss Ratio (Dollar Losses/Total Building Value)	Number of Buildings in Zones AE, A	Number of Buildings in Zone VE
Bainbridge	$2.6 Billion	1.5%	$3.6 Million	1.4%	136	8
Bremerton*	$1.7 Billion	<1%	$404,000	<1%	21	0
Port Gamble S'Klallam Tribe**	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Suquamish Tribe	$474 Million	<1%	$175,000	<1%	3	0
Port Orchard	$966 Million	<1%	$579,000	<1%	24	0
Poulsbo	$865 Million	<1%	$3.4 Million	<1%	7	0
Unincorporated County	$9.7 Billion	<1%	$5.2 Million	<1%	164	175
Total	**$16.3 Billion**	**<1%**	**$13.4 Million**	**<1%**	**355**	**183**

Note: Loss information is included for communities in the coastal floodplain. The table includes both dollar losses and a loss ratio, which is calculated as total losses/total building value. Also included is a count of the buildings in Zone VE, which is the 1-percent-annual-chance coastal flood zone with wave action, and in Zones A and AE, which are riverine or coastal 1-percent-annual-chance floodplains. The loss information for the county is only for coastal SFHAs; the rest of the county's SFHAs are identified as Zones AE or A.
*Information from the military base was not included in the assessment for the City of Bremerton.
**No building data was available from Kitsap County for the Port Gamble S'Klallam Indian Reservation, so the results are listed as unknown.

(Source: 2015 FEMA Risk Report for Kitsap County)

The following tables summarize the potential vulnerability of various areas and assets on Bainbridge Island and maps indicating these areas are provided in Attachment D. These are preliminary vulnerability assessments based on the EHW curve on the sea level rise projections for Risk Profile 3 (Moderate Risk of Future Flooding) in Attachment C and based on a visual assessment using the NOAA Sea Level Rise Viewer. Vulnerability will be greater where a lower risk profile is more appropriate and vulnerability will be less where a higher risk profile is more appropriate. Keep in mind that current flood risk will get worse and those areas impacted by 2050 will be more impacted by 2120.

Table 2. Sea Level Rise Visualization Parameters

Visualize flooding risk from sea level rise for yourself using the following parameters for water level above MHHW in the NOAA Sea Level Rise Viewer				
	Risk Profile	**Currently**	**By 2050**	**By 2120**
1	Very High Risk of Future Flooding (99% chance)	+3.1'	+3.2'	+3.8'
2	High Risk of Future Flooding (90% chance)	+3.1'	+3.5'	+4.7'
3	Moderate Risk of Future Flooding (50% chance)	+3.1'	+3.9'	+5.9'
4	Low Risk of Future Flooding (10% chance)	+3.1'	+4.3'	+7.4'
5	Very Low Risk of Future Flooding (1% chance)	+3.1'	+4.7'	+10'

Once the City has identified which risk profile(s) will be used to manage future flooding risk from sea level rise, this vulnerability assessment should be refined in the future utilizing more detailed topographic mapping on an Island-wide basis, neighborhood basis, or during site planning for specific projects.

Table 3. Commercial and Industrial Development Vulnerable to Coastal Flooding

Coastal Flooding Risk	Commercial	Industrial
Currently	Auto shop (head of Eagle Harbor)	WSF Maintenance Facility Wyckoff Superfund Site
By 2050	Lower Parfitt Way	
By 2120	Lynwood Center^	

^ Potential flooding through stormwater system

Table 4. Residential Areas Vulnerable to Coastal Flooding

Coastal Flooding Risk	Higher Density	Lower Density
Currently	Pt Monroe Rolling Bay Walk Yeomalt Pt Lower Hawley neighborhood Lower Lynwood Center	Various parcels and small areas Manitou Beach Area south of Fay Bainbridge Park Inner Eagle Harbor (varies) Pleasant Beach Pt White (varies) Tolo Lagoon West Port Madison (varies)
By 2050	Eagle Harbor Condos Rockaway Beach	Various parcels and small areas Crystal Springs (varies)
By 2120	Place 18 Condos	Various parcels and small areas Wing Pt Lagoon Lower Skinner Rd neighborhood Rich Passage Estates (by Ft Ward Park)

Table 5. Roads and Neighborhood Access Vulnerable to Coastal Flooding

Coastal Flooding Risk	Flooded Roads	Neighborhoods with no Road Access during Floods	Neighborhoods with Detoured Road Access during Floods
Currently	Euclid Ave* Pt Monroe Drive* Rolling Bay Walk* Manitou Beach Drive* Yeomalt Pt Dr* Pt White Drive* (*by Schel Chelb*)	Pt Monroe Manitou Beach Rolling Bay Walk Yeomalt Pt	
By 2050	Eagle Harbor Drive* Crystal Springs Dr*	Pt White/Crystal Springs	South Shore Eagle Harbor Rockaway Beach
By 2120			

(*) Documented presence of critical fish and wildlife habitat areas, saltwater habitat areas, shoreline associated wetlands that will be vulnerable to "coastal squeeze"

Table 6. Utilities Vulnerable to Coastal Flooding

Coastal Flooding Risk	City	TBD
Currently	Yeomalt Stormwater	Winslow Sewer Treatment Plant Facilities co-located with at risk roads Urban Stormwater Sewer Water (private wells) Power
By 2050	Eagle Harbor sewer main Lynwood Center stormwater (likely)	
By 2120		

Table 7. Parks and Shoreline Access Vulnerable to Coastal Flooding

Coastal Flooding Risk	Shoreline Parks	Other Shoreline Access
Currently	Fay Bainbridge Park Manitou Beach Park Hawley Cove Park Pritchard Park Strawberry Plant Park Blakely Harbor Park	Waterfront Trail (Winslow Way to Shepard Way) Lytle Road End Dock Street Road End Other Road Ends (TBD)
By 2050	Waterfront Park Schel-Chelb Park Pt White Dock	Other Road Ends (TBD)
By 2120		Other Road Ends (TBD)

How is flood risk managed?

The City has adopted policies regarding flood management and aquatic resources (see Attachment A and BIMC 15.16.010) and several codes related to flood management, which include the following. One management challenge is that none of the following codes apply to the entire area at risk of flooding from sea level rise (see Figure 8), so some type of jurisdictional adjustment will most likely be necessary to ensure effective management of future flood risk from sea level rise.

BIMC 15.16 (Flood Damage Prevention)

This code satisfies the National Flood Insurance Program and is the City's primary flood management code. This code currently applies only in the flood zones mapped by FEMA and contains standards for construction, such as:

- Anchoring of the building and accessories
- Building the lowest floor at least 1' above the base flood elevation
- Nonconforming standards which require the entire structure to conform to the existing regulations when any repair, reconstruction, or improvement to a structure is equal to or greater than 50% of the structures market value
- A habitat assessment may also be required under the Endangered Species Act

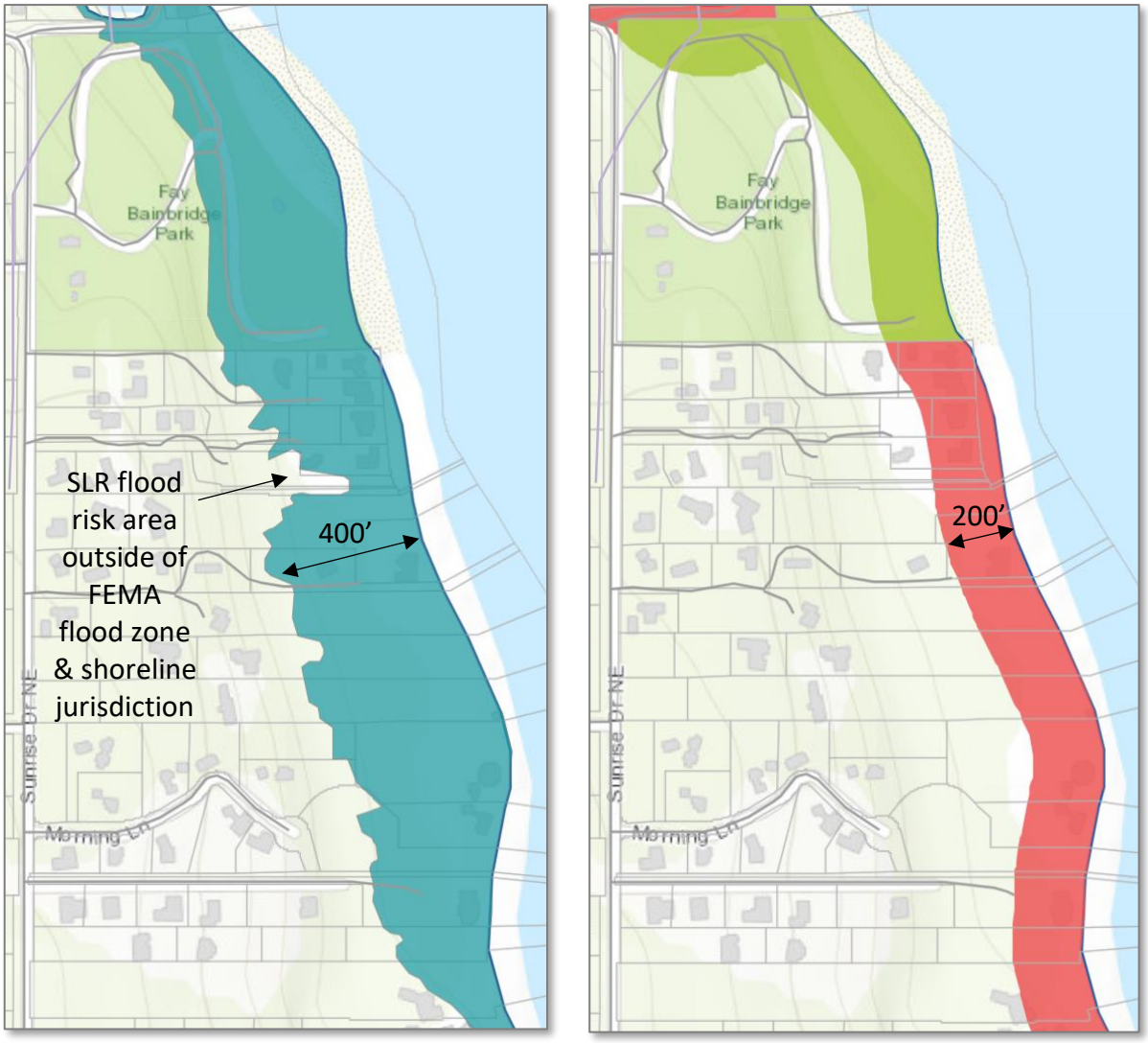
The City could expand the area where BIMC 15.16 applies. One example of this was adopted by King County in 2020 by which they created a Sea Level Rise (SLR) Risk Area and updated some of the flood-related development standards. This approach did not address issues related to coastal squeeze.

Frequently Flooded Areas (SMP 4.1.5 and BIMC 16.20)

The City is mandated by state law to regulate "frequently flooded areas" as one type of "critical area". City critical area regulations are in both the Critical Areas Ordinance (BIMC 16.20) and the SMP (4.1.5), however the SMP and BIMC 16.20 both regulate frequently flooded areas through direct reference to BIMC 15.16. Under the SMP, the City is required to ensure no net loss of ecological functions and values associated with frequently flooded areas and other critical areas, as discussed under the impacts section of this paper.

Frequently flooded areas are currently defined as the FEMA flood zone, which is designated based on historic flooding rather than future flood risk from sea level rise. The City is allowed by WAC 365-190-110 to expand the definition of frequently flooded areas to include a future flood risk from sea level rise. This expanded "frequently flooded area" could be managed without fragmented jurisdiction either through BIMC 16.20 or by expanding SMP shoreline jurisdiction (discussed below).

Figure 8. FEMA Flood Hazard Area (left) can Extend Beyond Shoreline Jurisdiction (right)



(Source: COBI Critical Areas Online GIS Map)

SMP

Beyond frequently flooded requirements, the SMP also is required to address flood hazard reduction (SMP 4.1.7), shoreline stabilization (SMP 6.2), fill (SMP 6.5), and dredging (6.4) consistent with the state guidelines in WAC 173-26 adopted under the Shoreline Management Act. Flood control projects could be allowed by the SMP under some circumstances and is less restrictive in Pt Monroe than elsewhere on the Island. Shoreline stabilization projects could also be allowed by the SMP under some circumstances, however new development must ensure that shoreline stabilization will not be required for the life of the structure and stabilization proposals for pre-existing structures must rule out alternatives, including elevation or relocation of the structure. No net loss of ecological functions must be achieved in all development actions.

Other Regulatory Programs

Other regulatory programs that could require adjustments due to flood risks include:

- Septic and well requirements administered by the Kitsap Public Health District to address flood proofing and public health
- Fire code requirements administered by the Bainbridge Island Fire Department to address emergency service access and public safety
- Critical aquifer recharge area requirements administered by the City to address saltwater intrusion issues
- City design standards for roads and other public infrastructure to address design elevations, culvert or bridge sizing, and flood proofing

What are adaptive actions?

Because of observable changes and the quality of the available science, communities around the world have made the shift to planning and investing for ongoing and significant changes in their coastal areas knowing that adaptation to rising seas will continue to be an evolving process for a long time to come.

Adaptative actions to sea level rise are typically grouped into three broad strategies:

1. **Protect** – Usually involves building walls but can also include "soft approaches" and restoration of habitats that help reduce flooding. This approach generally creates the greatest long-term risk of losing ecological functions and values to coastal squeeze.
2. **Accommodate** – Usually involves raising structures and finding ways to live with increasing flooding. This approach is likely to result in a mix of losing, protecting, and restoring ecological functions and values.
3. **Retreat** – Usually involves an extended and coordinated period of phasing out structures and infrastructure as well as habitat restoration. This approach will generally minimize the loss of ecological functions and values.

Existing City policies in Attachment A and in BIMC 15.16.010 do not prohibit but also do not prioritize the use of protection strategies.

Different communities seem to adopt different solutions largely based on risks and timeframes. Some high-density urban areas feel they have no choice but to invest in protection measures whatever the cost. Some communities may prioritize the "now", which emphasizes investment in protection actions in the near term, likely increasing the long-term costs to the community, and as time passes the community may find they have fewer options because some adaptive actions are no longer feasible. Other communities may prioritize the "future" and adopt plans to relocate their entire community. Other communities may take a "context-sensitive" approach that includes protection of high-consequence facilities/areas, accommodating flood waters in areas where that is feasible (at least for a while), and retreating over time in areas as risks increase. Some communities have accommodated flooding to the extent that households

have gutted first floors and retreated to their second floor. Sea level rise planning may be controversial, but elected leaders and citizens are increasingly recognizing that action is necessary.

Island County has completed a sea level rise strategy study that includes a summary table of adaptive actions along with examples of where they are being implemented (see Attachment E). King County has a buyout and building elevation assistance program and recently adopted zoning rules expanding accommodation actions to a "SLR risk area". One creative idea from Virginia worth noting includes using some type of buyout, transfer of development right, or conservation easement with the owner retaining life use of the property (or at least until a specified safety threshold is triggered).

This paper will not go into further detail regarding adaptive actions at this time because a higher-level policy discussion needs to happen first regarding risk profiles and general policy direction regarding the three broad adaptation strategies.

Policy Issues for Consideration

The following are questions that build off the content presented in this policy white paper which are intended to frame a high-level policy discussion that will inform the planning department's proposed amendments.

1. **When should actions be taken to adapt PRIVATE development in low-lying areas to sea level rise?**
    a. Well before any flooding occurs
    b. Not too early, but before flooding occurs
    c. Only after flooding has become a problem

2. **When should actions be taken to adapt PUBLIC infrastructure in low-lying areas to sea level rise?**
    a. Well before any flooding occurs
    b. Not too early, but before flooding occurs
    c. Only after flooding has become a problem

3. **What level of risks (i.e. risk profiles) should we be planning for? Should the management of flood risk from sea level rise be more context-sensitive or should we generally apply the same standards in all situations?**
    - For example:
        - Should there be (1) standard risk profiles for different types of structures and uses (e.g. 90% chance for accessory building vs. 50% chance for SFR vs. 10% chance for multi-family vs. 1% chance for critical infrastructure) or (2) one risk profile for all development and uses (e.g. 50% chance)?
        - Should landowners be (1) allowed to develop to their own custom risk profile and prepare a plan for how and when the property would adapt in the future to comply with a standard risk profile or (2) required to develop to a standardized risk profile to provide equal protection to current and future owners?
        - Should (1) neighborhood adaptation plans be developed so that adaptive actions (i.e. protect, accommodate, or retreat) for public infrastructure and private development can be coordinated or (2) should the City and other public service providers coordinate only regarding the adaptation of public infrastructure.

4. **How should the costs of adaptive actions be allocated between at-risk landowners and the community at large (i.e. through public expenditures and infrastructure projects)? Should some sort of financial incentive or compensation be considered to encourage adaptive actions where there is existing development or the potential for new development? What incentives or compensation tools seem appropriate?**
    - Adaptation technical assistance
    - Adaptation grants

- Transferable Development Rights (TDR)
- Bonus TDRs
- Buyout (i.e. voluntary sale of property to the government at market rate or program-specific prices that are usually below market rate)
- Life use (i.e. after the sale or transfer of a property, the seller retains the right to use the property for the remainder of one's life or until some sort of risk threshold is triggered)

Attachment A – City Policies Regarding Sea Level Rise and Flooding

2020 Climate Action Plan Goals, Targets, & Actions

Goal 5.B. Establish procedures to ensure buildings and infrastructure are resilient to climate change impacts (e.g., higher precipitation, sea level rise, wildfire risk and temperatures).

Target 5.B.1. By 2025, COBI will complete an analysis, develop a plan, and design a process for regularly updating the plan to ensure all City-owned assets will be resilient from sea level rise over the lifespan of the infrastructure.

> **Action 5.B.1.a.** (By 2022) As recommended by the 2019 CCAC Report on Sea Level Rise, conduct a systematic, high-resolution analysis of exposure of City assets to sea level rise
>
> **Action 5.B.1.b.** (By 2023) As recommended by the 2019 CCAC Report on Sea Level Rise create a prioritized list for addressing COBI assets at high risk of sea level rise (e.g., roadways that are expected in the coming decades to be sufficiently flooded that they will not be functional for motorized transit.)
>
> **Action 5.B.1.c.** (By 2024) As recommended by the 2019 CCAC Report on Sea Level Rise integrate sea level rise analysis into all City planning to identify and avoid or minimize risk to planned infrastructure and development.

Target 5.B.1. By 2025, COBI will complete an analysis, conduct public outreach activities, and identify those properties at highest risk from sea level rise impacts over the next 50 years.

> **Action 5.B.2.a.** (By 2025-2030) Conduct a high-resolution analysis of all shoreline properties to inform landowners of exposure to sea level rises, make this information widely available for property owners to use in decision-making, and provide guidance on possible solutions and regulatory requirements.
>
> **Action 5.B.2.a.** (By 2025-2030) COBI integrates sea-level rise analysis into all City permitting to help applicants identify and avoid or minimize risk to existing infrastructure and land uses and planned infrastructure and development from sea level rise or other climate impacts.
>
> **Action 5.B.2.c.** (By 2023) COBI hosts community workshops on climate impacts, how they might impact buildings, and how to prepare buildings for these impacts.

Goal 6.C. Steward our Island's shorelines to allow for resilience in the face of climate impacts including sea level rise.

> **Action 6.C.1.a.** (By 2025) Ensure that planning for sea level rise on the timeframe relevant to any proposed action's lifetime impact is explicitly incorporated into the SMP, including incorporating capacity for inundation and change to natural shoreline features, such as planting for shifting vegetative communities, infrastructure movement or abandonment to adapt to habitat loss at shoreline.

2016 Comprehensive Plan Content
Most Relevant to Flooding from Sea Level Rise

ENVIRONMENTAL VISION 2036

It is well understood that the integrity of our environment – the foundation of our quality of life – sets limits on the growth of our population and our economic life. We have faced some distressing events within the changing natural order and have survived as a stronger community.

A culture of stewardship has preserved and even improved the varied landscapes, forests and views that contribute so much to the sense of place that is valued here. Monitoring and regulation of the impacts of human activities on the Island's natural resources has been successful in maintaining their resilience. Public policies and many initiatives of citizens and businesses have been proactive in response to the anticipated effects of climate change, such as sea level rise, adapting where necessary and mitigating impacts to the extent possible.

CAPITAL FACILITIES VISION 2036

Capital facilities planning has kept up with changes in the natural and built environments, meeting the needs of a population that expects a high level of service. The City's *Capital Improvement Plans* were coordinated with the strategic plans and budgets of the special purpose districts (e. g., Schools, Parks and Fire).

Planning and budgeting for facilities has been concurrent with subarea planning for the *designated centers*, and to a large extent, recent population growth and commerce have been concentrated in and near those centers. Planning and budgeting has kept pace with maintenance and expansion of recreational facilities and public lands preserved for agriculture or conservation.

Over the past twenty years, Capital Improvement Plans have responded to anticipated impacts of climate change and sea level rise. New construction and retrofits have made public buildings energy efficient and models of low impact design.

Guiding Policy 2.4
Anticipate and prepare for the consequences of *climate change* on our *aquatic resources.* These changes include sea level rise, altered precipitation patterns, as well as any other changes in climate and community response to climate in order to ensure ample quality, quantity and seasonal integrity of surface water and *groundwater* for the Island's people and ecosystems.

Guiding Policy 7.3
Evaluate the climate vulnerabilities and implications of City actions and identify policies that alleviate those vulnerabilities. Consider the effects of shifting conditions (sea level rise, changing rainfall patterns, increasing temperatures and more extreme weather events) and the effects they cause (altered vegetation, changing water demands, economic shifts).

Policy EN 1.2

Taking into account the present and future need to reduce the potential for personal injury, loss of life, or property damage due to flooding, erosion, landslides, seismic events, *climate change* or soil subsidence, properties adjoining or adjacent to *critical areas* must be developed in observance of the following principles in descending order:

- Avoid the impact if possible.
- Minimize or limit the degree or magnitude of the action and its implementation by using appropriate technology to avoid or reduce impacts.
- Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action.
- Rectify by repair, rehabilitation or restoration of the affected environment.
- Compensate for unavoidable impacts by replacing, enhancing or providing substitute resources or environments.

Critical areas are identified in order to flag concerns during the review process and to make applicants aware of potential hazards or areas where development may be constrained.

Compatible development will be allowed which avoids designated *critical areas*, minimizes the impact or mitigates potential problems through engineering, siting or design. Proposals will be examined on a case-by-case basis to allow for creative solutions and to assure that the special combinations of factors in a particular case are addressed.

FREQUENTLY FLOODED AREAS

GOAL EN-6 - Protect the natural functions of frequently flooded areas.

Policy EN 6.1

Minimize public and private losses due to flood conditions by limiting development in *frequently flooded areas* as shown on the Flood Insurance Rate Maps. Educate property owners and residents in proximity to *frequently flooded areas* about vulnerability over time.

Frequently flooded areas can and do migrate over time. Increased development may affect the level of occurrence and location of *frequently flooded areas.* The Flood Insurance Rate Maps adopted by the City were originally produced in 1975 and updated in 1977, and need to be kept current.

Policy EN 6.2

Limit the alteration of natural floodplains, *stream* channels and natural protective barriers that help accommodate, dissipate, or channel floodwaters.

Policy EN 6.3

Emphasize nonstructural methods such as setbacks and vegetation, to prevent or minimize flood damage.

Policy EN 6.4

Locate public facilities such as sewer and water lines outside of *frequently flooded areas* and with

consideration of future sea level rise in order to minimize damage to both the *public facility* and the natural environment. *Public facilities* may be located within *frequently flooded areas* only if no environmentally preferable alternative exists to mitigate environmental concerns. Additional development is not encouraged in *frequently flooded areas.*

SEA LEVEL RISE

GOAL EN-7 - Anticipate and prepare for the consequences of sea level rise.

Sea level rise may happen as the result of natural or human activity such as geologic subduction or *climate change*. Here in the Puget Sound we experience the effects of both the geologic and climatological forces. Cumulative sea level rise has serious implications for the shorelines and lowland areas of the Island such as beach and bluff erosion and loss of intertidal zones. These areas serve such purposes as nursery habitat, feeding grounds for fish and fowl, stormwater collection and water filtration.

Policy EN 7.1

Consider the implications of sea level rise in all relevant decision-making by using regional sea level rise projections and shoreline instability maps (as provided by the WA Department of Ecology and utilized and interpreted with the Bainbridge Island Climate Impact Assessment).

Policy EN 7.2

Coordinate with Tribal, Federal, State and local agencies to address issues related to sea level rise.

SURFACE WATER PROTECTION AND MANAGEMENT

GOAL WR-3 - Achieve no net loss of ecological functions and processes necessary to sustain aquatic resources including loss that may result from cumulative impacts over time.

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

Policy WR 3.1

Development in regulated aquatic *critical areas* or their associated water quality buffers shall not be allowed unless application of *development regulation*s would deny any reasonable use of property. In such cases, minimize the allowed use and associated impacts, to maximize environmental protection.

Policy WR 3.11

Consider the impacts of *climate change* and ocean acidification when developing regulations or approving capital projects related to *aquatic resources* including marine nearshore, *wetland*s, *streams*, lakes, creeks, associated vegetated areas and *frequently flooded areas*.

CAPITAL FACILITIES

Policy CF 1.3

Evaluate and prioritize proposed *capital improvement* projects using the following long-term financial strategy principles and guidelines:

- Preserve and maintain physical infrastructure.
- Use an asset management approach to the City's capital facilities.
- Use unexpected one-time revenues for one-time costs or reserves.
- Pursue innovative approaches.
- Maintain capacity to respond to emerging community needs.
- Address unfunded mandates.
- Selectively recover costs.
- Recognize the connection between the operating and capital budgets.
- Utilize partnerships wherever possible.
- Remain committed to City *goals* over the long run.
- Anticipate and respond to the impacts of *climate change*, including sea level rise.

ACTIONS

EN Action #3 Consider *climate change* in all relevant City decisions, including capital projects, budgeting, staffing, and program creation.

EN Action #10 Coordinate with organizations and governments at all levels to prepare for and respond to *climate change*.

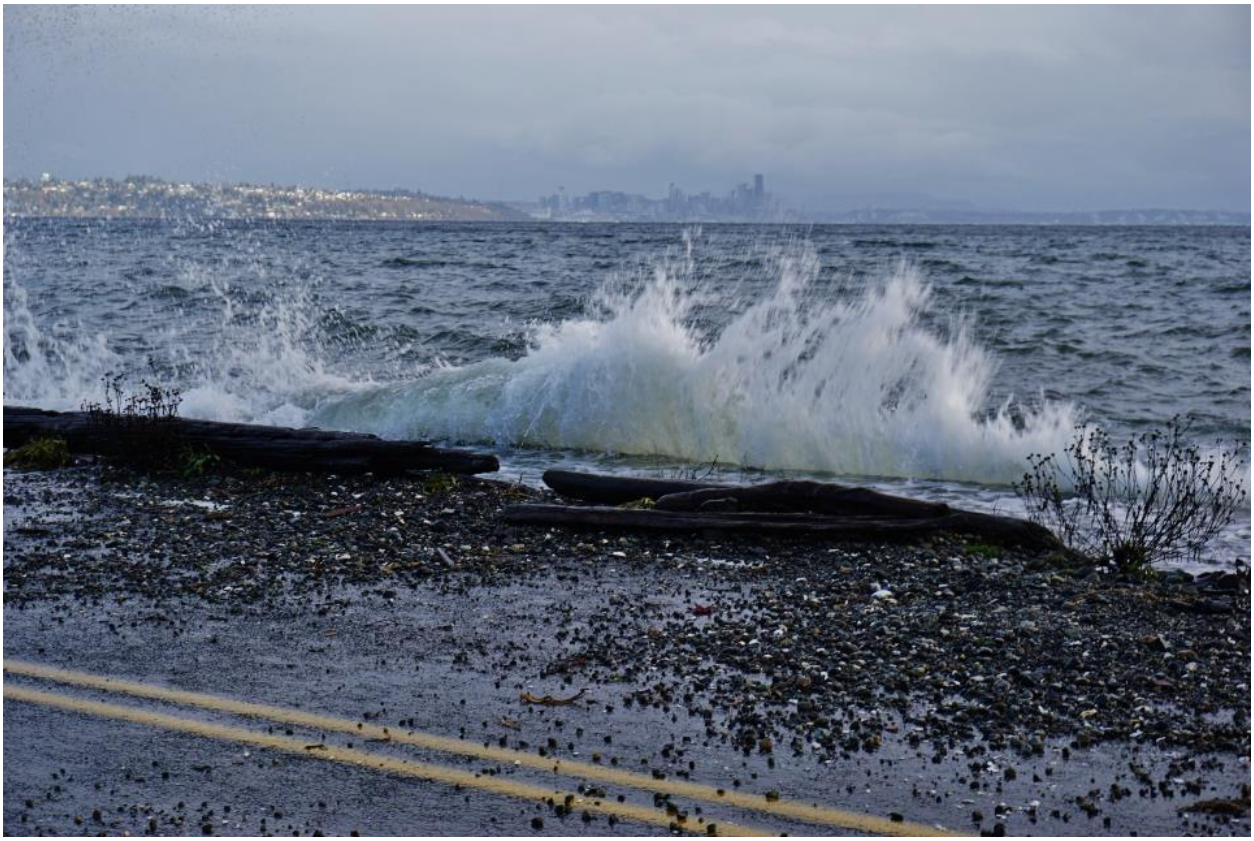
GLOSSARY

Frequently Flooded Areas: Lands subject to a one percent or greater chance of flooding in any given year. These areas include, but are not limited to, floodplains adjacent to streams, lakes, coastal areas, and wetlands.

Attachment B – Sea Level Rise on Bainbridge Island: A Preliminary Assessment

Sea Level Rise on Bainbridge Island

A Preliminary Assessment



Manitou Beach, December 20, 2018, 3:40 pm. Water level: 9.91 ft NAVD88 (12.25 ft MLLW).

Report to the City of Bainbridge Island,
Climate Change Advisory Committee
October 24th, 2019

CITY OF
BAINBRIDGE ISLAND

Acknowledgements

The Climate Change Advisory Committee was established in 2017 by the City Council of Bainbridge Island to take action on climate change and increase the community's resilience (Ordinance no. 2017-13). The Committee's work plan calls for an evaluation of climate impacts and recommendations to the City for adaptation and mitigation actions.

The following document fulfills Action 10.1 in the 2019-20 Draft Work Plan, which specifically calls for an evaluation of the vulnerability of City assets and other infrastructure to the impacts of sea level rise. Identified by the Committee as a high priority action item, this report is also intended to provide a template for subsequent assessments.

The principal author of and photographer for this report is James Rufo Hill, who began the effort while serving on the Climate Change Advisory Committee. This report builds upon the 2016 Bainbridge Island Climate Impacts Assessment, which was written by Lara Hansen, Stacey Nordgren, and Eric Mielbrecht. Finally, generous assistance was provided by City of Bainbridge Island staff, especially Christy Carr and Gretchen Brown. Thank you, all.

Contents

Summary

Among climate change impacts, sea level rise stands out because even if humans stopped emitting greenhouse gases today, global oceans would continue to absorb excess heat, expand, and rise for centuries (Clark et al 2016). Because we are nowhere close to stopping greenhouse gas emissions, sea level rise is among the more certain impacts—it's not a question of if, but rather when. Given that Bainbridge is an island, we are acutely vulnerable to this phenomenon.

Puget Sound has risen by more than 9 inches during the past century (NOAA 2019). Continued global warming is expected to accelerate rising sea levels over the next century and beyond. The most likely projections, i.e. central estimates, from the best available science (Miller et al 2018) indicate that relative to the year 2000, Bainbridge Island will experience one foot of sea level rise by the year 2060, 2.3 feet by 2100, and 3.8 feet by 2150. High end projections give Bainbridge one foot of sea level rise by 2040, 5.2 feet by 2100, and 10.4 feet by 2150. Considerable uncertainty remains with respect to emissions scenarios and timing, but again each of the above amounts are certain to eventually occur around Puget Sound and worldwide.

This preliminary assessment provides the City of Bainbridge Island with mapping and planning methodologies, a framework for adaptation, and an understanding of its exposure to sea level rise. It is expected that the City follow-up this report by using high-resolution Geographic Information Systems (City of Seattle 2019) to analyze and inform final decision-making at the parcel level.

Key Findings:

- Most of the City's infrastructure is not immediately vulnerable to sea level rise. A limited number of assets, primarily related to sewer service around Eagle Harbor, plus some low-lying streets, already experience or will soon experience inundation from sea level rise, especially during astronomical high tides, a.k.a. king tide events.
- The most significant impact will be to private property owners around the island, many of whom currently experience occasional nuisance flooding (EPA 2019). By the middle of this century, many of these waterfront residences will face severe inundation. Areas most exposed include Hedley Spit/Point Monroe, Manitou Beach, and Schel Chelb Estuary/Point White Drive.
- Other vulnerable community assets include Washington State Ferries (both the terminal and maintenance facility), the Wyckoff Superfund site, Fay Bainbridge Park, and to a lesser extent, the Winslow Wastewater Treatment Plant.
- Accelerated bluff erosion will threaten additional high-bank properties and septic systems.
- Increased saltwater intrusion will stress water resources adjacent to the shoreline.
- Next steps include meeting with City staff, briefing City council, engaging community members, and performing additional high-resolution analyses.

1. Introduction

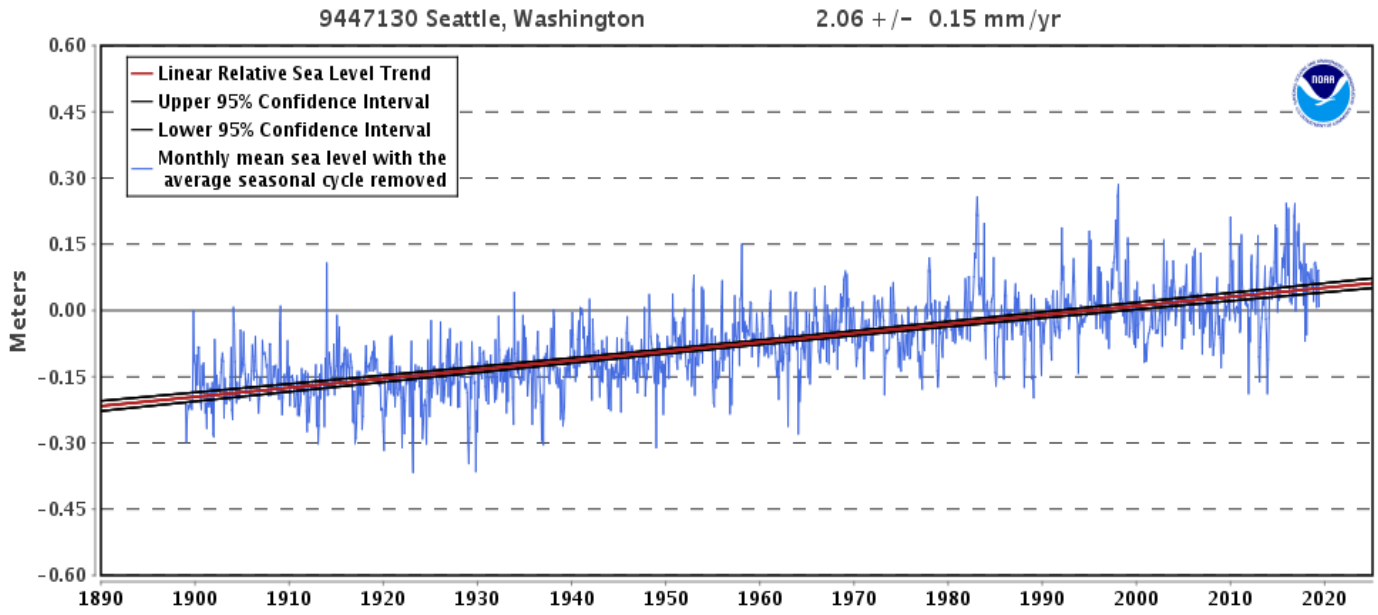
1.1 Sea Level Trends

Sea levels have been rising globally for a century or two, but the heating of oceans and melting of ice has caused sea level rise to accelerate in recent decades. Local water levels have risen slowly and steadily since measurements began in 1899. Figure 1 below details the trend, which has averaged approximately 2.06 millimeters per year, good for almost 10 inches of sea level rise.

Whereas coastal flooding once rarely occurred on Bainbridge Island, "nuisance flooding" has become at least an annual event in some areas (EPA 2019, NOAA 2019). Sea level rise is especially apparent each winter during "King Tide" events when gravitational forces acting on Earth are strongest.

Planners globally and locally noticed these trends and have started to act. Around Puget Sound, organizations are collaborating to minimize risk. The City of Olympia, which has experienced a rapid increase in flooding events, has developed a detailed adaptation plan (City of Olympia 2019). The City of Seattle, The Port of Seattle, and King County are in the process of writing joint sea level rise guidance and policies (City of Seattle 2019). The Swinomish Tribe is already monitoring adaptive management practices (Swinomish Indian Tribal Community 2009).

Figure 1: Long-term sea level trend, Colman Dock, Seattle.



Above: since records began in 1899 (x-axis), sea levels have risen locally at a rate of 2.06 millimeters per year (y-axis), ~~which equals almost 10 inches total~~.
Source: https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=9447130

Correction: SLR from 1899 to 2020 was 0.68 feet (8.16 inches).

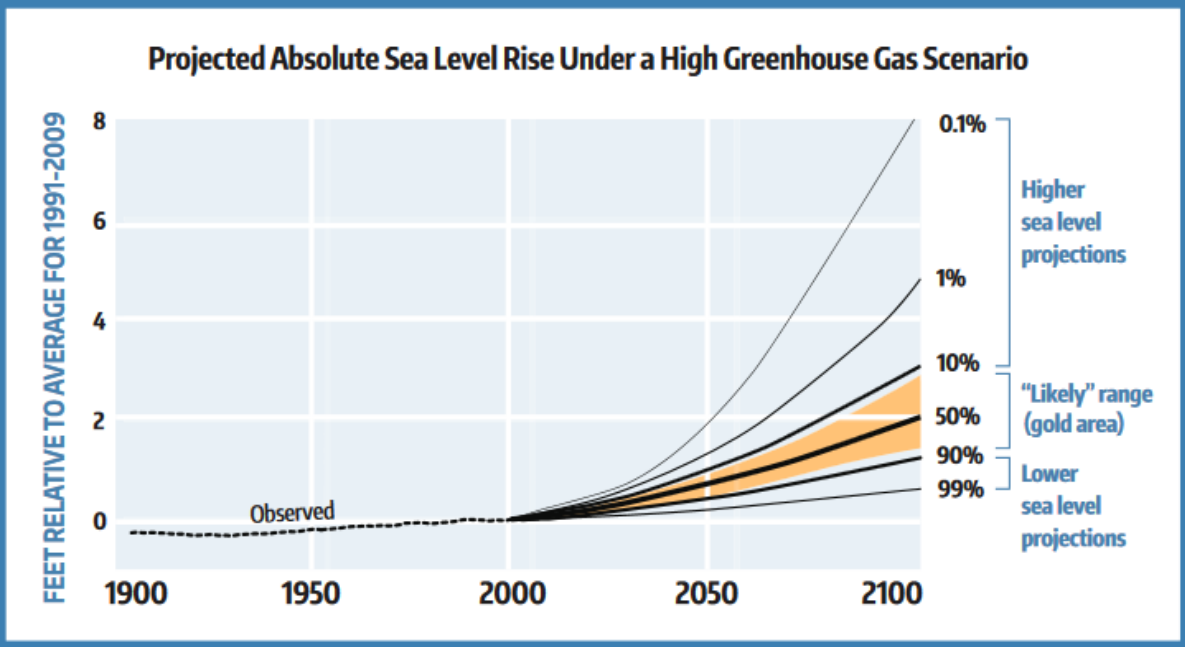
1.2 Sea Level Rise Projections

Changes in sea level will be both absolute and relative. The former refers to the height of the ocean surface in response to global warming. The latter includes local geological, hydrological, and

atmospheric effects. For example, the Olympic Mountains are undergoing post-glacial rebound, meaning they are still rising in response to the weight of ice sheets having been removed. Therefore, communities along the Strait of Juan de Fuca are currently experiencing *dropping* sea levels, because the rate of rebound is outpacing the rate of sea level rise. Eventually, the rate of sea level rise in such locations will surpass the rate of rebounding vertical land movement.

Absolute projections tend to make splashy headlines, but for planning purposes, relative projections are required. For example, Hansen and Sato (2011) assert that "multi-meter sea level rise on the century time scale are not only possible, but almost dead certain." That said, sea level rise is driven by global phenomena, and absolute projections represent a baseline from which relative projections are made. Figure 2 (Miller et al 2018) below underscores the large range in absolute projections.

FIGURE 2: Absolute sea level rise projections, through 2100, for a high greenhouse gas scenario (RCP 8.5), for Washington State. Projections are based on Kopp et al. (2014) and observed variations in absolute sea level are shown for 1907-2007.[4] All results are shown relative to the average for 1991-2009. The probability values are "probabilities of exceedance", i.e., the current best assessment of the likelihood that absolute sea level will rise by at least a given change in elevation.



Fortunately, over the past few decades there have been a series of studies that account for local Puget Sound geography. The most recent report, Projected Sea Level Rise for Washington State (Miller et al 2018), represents the best available science. Beyond having updated methods, the report is unique in that it features new probabilistic projections, and it provides community-scale information, including four different, albeit nearly identical projections for Bainbridge Island.

Considerable uncertainty exists for the rate at which polar ice will contribute to sea level rise. Uncertainty related to global emissions scenarios is perhaps even more complex. Despite warnings and

policy efforts, humanity has generally followed the path of high greenhouse gas scenarios. This report therefore only examines this "business as usual" approach. If we start emitting fewer greenhouse gases, then lower sea level projections could be considered across Puget Sound and worldwide.

Central ("most likely") estimates from the best available science indicate that Bainbridge Island will experience 1 foot of sea level rise by the year 2060, 2.3 feet by 2100, and 3.8 feet by 2150 (see yellow box below). The "one percent chance" scenario, i.e. rapid ice melt, projects 10.4 feet of rise by 2150 (see red box below). Again, due to climate dynamics sea level rise is likely to accelerate over the course of the next century, and it's less a matter of how much, but when.

Table 1: Projected average sea level magnitude, in feet, for different assessed likelihoods and time periods (Bainbridge Island).

	Assessed Probability of Exceedance:									
19 year period centered on:	99	95	90	83	50	17	10	5	1	0.1
2010	-0.1	0	0	0	0.1	0.2	0.2	0.2	0.3	0.3
2020	0	0	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6
2030	0	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.8	0.9
2040	0	0.2	0.3	0.3	0.6	0.8	0.9	1	1.1	1.4
2050	0.1	0.3	0.4	0.5	0.8	1.1	1.2	1.3	1.6	2.1
2060	0.2	0.4	0.5	0.7	1	1.4	1.6	1.7	2.1	3.1
2070	0.2	0.6	0.7	0.9	1.3	1.8	2	2.2	2.7	4.2
2080	0.3	0.7	0.9	1.1	1.6	2.2	2.4	2.7	3.4	5.7
2090	0.4	0.9	1.1	1.3	1.9	2.6	2.9	3.2	4.2	7
2100	0.5	1	1.3	1.5	2.3	3.1	3.5	3.9	5.2	8.8
2110	0.6	1.1	1.4	1.7	2.4	3.4	3.7	4.2	5.8	10.2
2120	0.7	1.3	1.6	1.9	2.8	3.9	4.3	4.9	6.9	11.8
2130	0.8	1.4	1.8	2.1	3.1	4.3	4.9	5.6	8	14
2140	0.9	1.6	1.9	2.3	3.5	4.9	5.5	6.3	9.1	16.5
2150	0.9	1.7	2.1	2.5	3.8	5.4	6.1	7.1	10.4	18.8

Note: similar to how climate is often defined as 30-year average weather, tides are observed and summarized over a 19-year period known as an "epoch," hence the centering around decades.
Source: http://www.wacoastalnetwork.com/files/theme/wcrp/SLR-Report-Miller-et-al-2018.pdf

2. Methods

2.1 Datums

A tidal datum is a standard elevation tied to a certain height or phase of the tide (NOAA 2019). When measuring and planning for sea level rise it is critical that datums and references to elevation remain consistent.

Because of its importance to marine navigation, the most popular datum (e.g., often cited by NOAA) is mean lower-low-water (MLLW). Mean higher-high water (MHHW) is frequently used in sea-level rise literature because of the implied risk associated with "average daily" high tides. Under Washington State's Public Trust Doctrine, public ownership of tidelands, with some exceptions, begins at extreme low water. Sometimes municipalities use their own references (e.g., King County METRO datum). Land-based surveys, including most Geographic Information systems, use the North American Vertical Datum (NAVD88).

Note: tidal datums are updated on a regular basis. NOAA's National Ocean Service uses a 19-year period (National Tidal Datum Epoch, 1983-2001) as the standard. The epoch is revised every 20-25 years. Certain regions with anomalous sea level changes, including Puget Sound, use a modified epoch; however, this report references the 1983-2001 epoch. Since this assessment is examining land-based assets, all elevations reference NAVD88 unless otherwise noted.

2.2 Station Datum

The National Oceanic and Atmospheric Administration has been measuring water levels nationally for over a century. When measuring and planning for sea level rise it is critical that the highest quality datums available are used.

There are a handful of official NOAA tide gages in the Central Puget Sound region. The closest to Bainbridge Island exist in Poulsbo, Brownsville, and Bremerton. Each of those gages, however, suffers from incomplete data or relatively short periods of record.

We are fortunate in to have a gage close by with one of the longest periods of record in NOAA's entire network (Coleman Dock, Seattle). Established on January 1, 1899 NOAA's Seattle tide gage not only provides quality data, but it puts long-term global climate change and sea level rise into perspective. Furthermore, a comparison of current water levels between all functioning Central Puget Sound tide gages reveals only minor differences in datums (NOAA 2019).

Given Coleman Dock's superior data quality and regional consistency, it is used exclusively in this report to reference water levels on Bainbridge Island.

2.3 Tidal Datums and Exceedance Probability Levels

As previously mentioned, when measuring and planning for sea level rise it is critical that datums and references to elevation remain consistent. Just as important is an understanding of exceedance probabilities. For example, an asset located near mean lower-low water will almost always be under

water. An asset located at mean higher-high water will experience, on average, daily flooding. A "50th percentile" water level should be expected to occur every other year, and so forth.

Locally, Mean Higher-High Water (MHHW), also known as an average daily high tide, measures 9.02 feet NAVD88. An annual extreme water level, or a 99th percentile event, measures 10.50 feet NAVD88. A biennial extreme water level measures 11.29 feet NAVD88, and a "100-year" water level, or 1% event measures 12.20 feet NAVD88.

These distinctions are especially important to consider when viewing maps. Maps can only depict one datum at a time, typically MHHW. A map highlighting 3 feet of sea level rise on Bainbridge at the same time depicts today's 1% water level.

2.4 Mapping

The first step in assessing sea level rise usually involves mapping, which typically involves manipulating geographic information systems (GIS) to portray future inundation. The most common method in which a single (sea) surface is raised, is referred to as the "bathtub" approach. More sophisticated methods, such as hydraulic grade line analyses, better capture local variability and features.

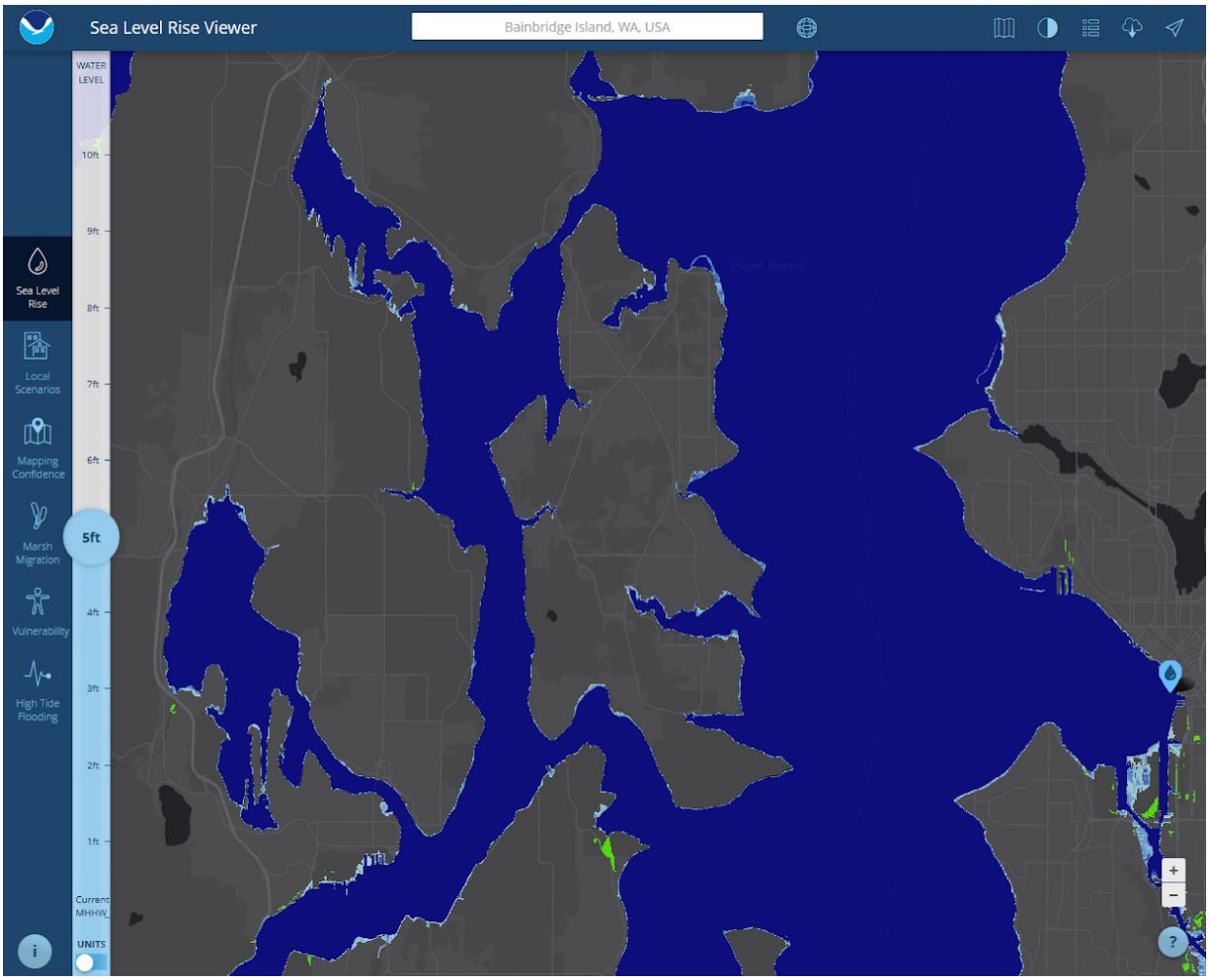
This assessment and report build upon methods developed by NOAA, which they describe as a modified bathtub approach (NOAA 2017), but it is necessary that COBI replicate the NOAA methods using its own GIS. For example, Seattle Public Utilities' high-resolution maps have been used for planning for a decade and were featured in the 2014 National Climate Assessment (City of Seattle 2019).

3. Results

Fortunately, the resolution and accuracy of web-based GIS maps have advanced in recent years. Initial drafts and related presentations of this report utilized low resolution GIS (Kitsap County Parcel Search and Google Earth). In 2019, NOAA published a Sea Level Rise Viewer (Figure 5) that incorporates the latest digital elevation model (Puget Sound LiDAR Consortium). NOAA's viewer should be used as a first order assessment tool—it only zooms-in so far.

It is recommended that City of Bainbridge Island staff utilize full GIS when surveying coastal assets, so that elevations can be assessed at the parcel level or even smaller. That said, a user need not zoom-in to fully understand basic risk. Some areas simply stand out. What follows in the results section are a series of screen captures of Bainbridge Island's most obviously vulnerable areas.

Figure 5: NOAA Sea Level Rise Viewer.



Source: https://coast.noaa.gov/slr/#/layer/slr/5/-13641138.69260028/6043609.973720823/13/dark/93/0.8/2050/interHigh/midAccretion

Note: there are a few ways to interpret the water level of 12 feet NAVD88 depicted in the following series of screen captures. That water level has been exceeded twice on record, most recently in 2012, and has nearly been exceeded a handful of other times (NOAA 2019). It therefore represents today's

extreme water level. According to central estimates, the depicted water level will occur annually by the 2060s, monthly by the 2090s, and nearly every day by the 2030s.

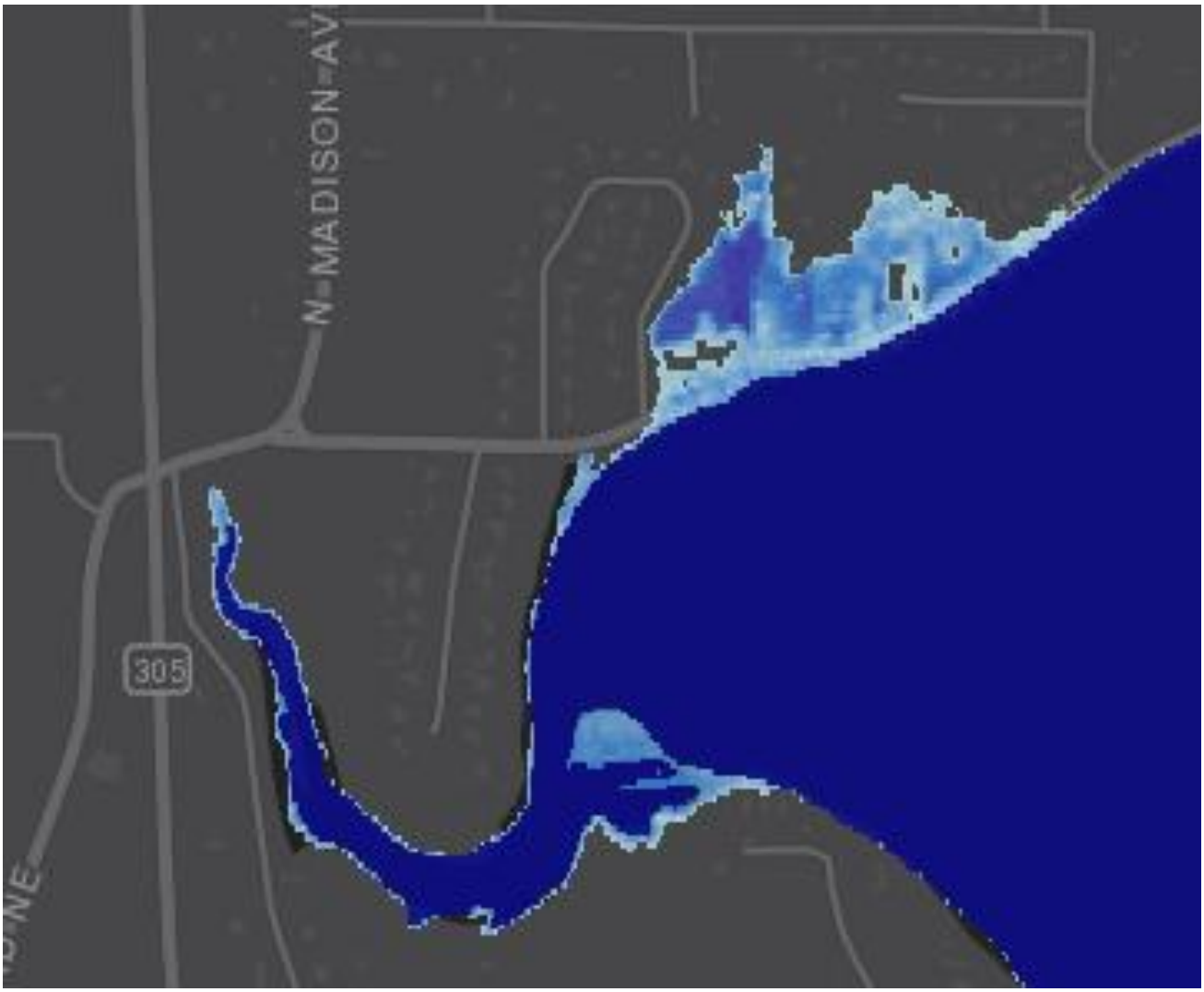
According to the "rapid ice loss" scenario, the depicted water level of 12 feet NAVD88 would occur annually by the 2040s, monthly by the 2060s, and daily by the 2070s. For further reference, the photograph on the cover of this report features a water level of less than 10 feet NAVD88.

Figure 6: Eagle Harbor (12 feet NAVD88)

The depicted water level of 12 feet NAVD88 represents today's extreme tide. According to central estimates it will occur annually by the 2060s, monthly by the 2090s, and daily (MHHW) by the 2130s. According to the "rapid ice loss" scenario, 12 feet NAVD88 will occur annually by the 2040s, monthly by the 2060s, and daily (MHHW) by the 2070s.

From north to south, notably low-lying areas of Eagle Harbor include beach deposits on Wing Point (approximately 6 properties), Hawley Cove (approximately 4 properties), the modified land that is the Washington State Ferries maintenance facility, the old Strawberry Cannery area, much of the inner harbor, Pritchard Park, and the Wykoff Superfund Site.

Figure 7: Murden Cove, Manitou Beach



The depicted water level of 12 feet NAVD88 represents today's extreme tide. According to central estimates it will occur annually by the 2060s, monthly by the 2090s, and daily (MHHW) by the 2130s. According to the "rapid ice loss" scenario, 12 feet NAVD88 will occur annually by the 2040s, monthly by the 2060s, and daily (MHHW) by the 2070s.

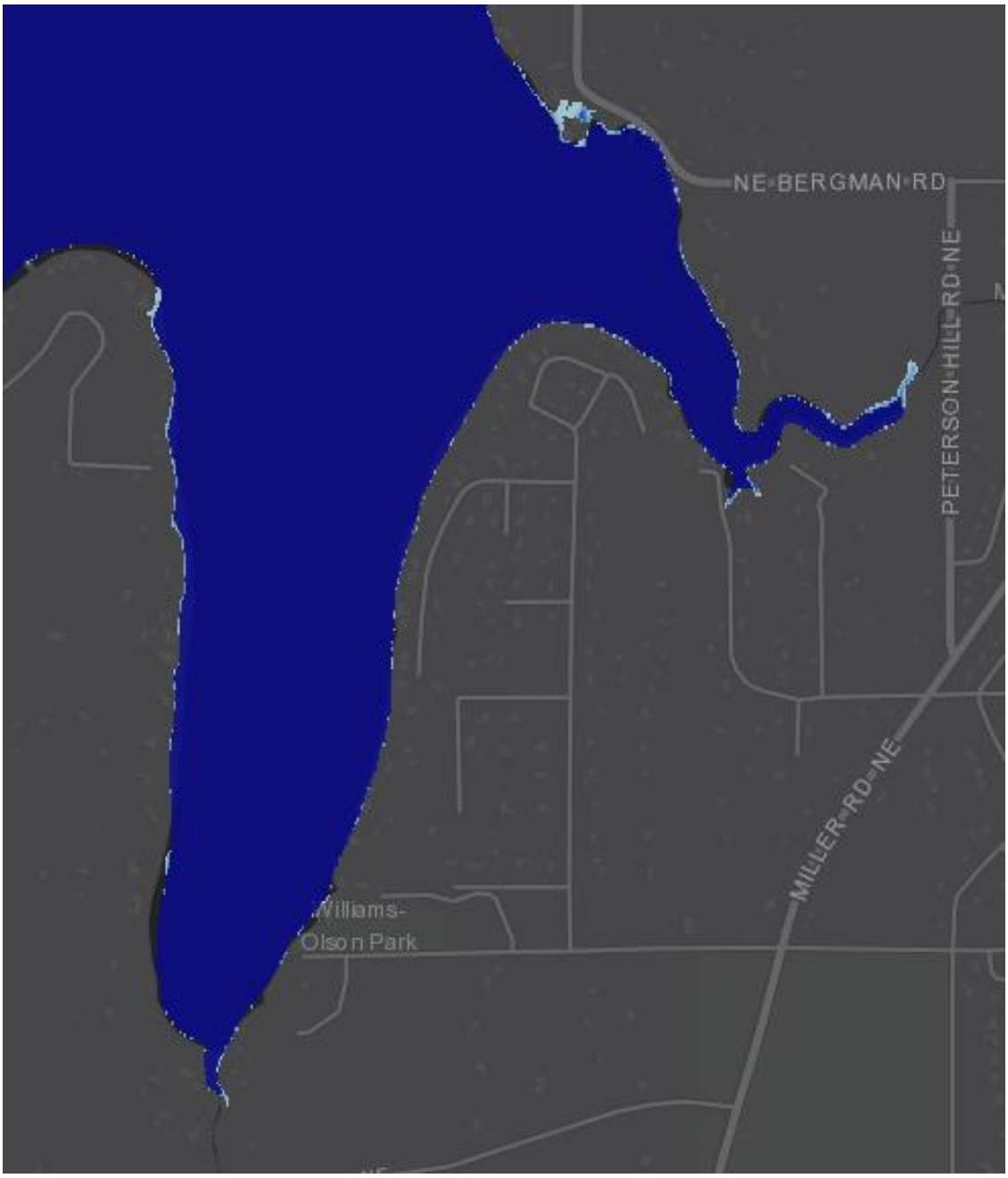
Approximately 15 affected properties, mostly behind Manitou Beach Drive. Areas around Murden Cove will also likely face increased erosion. For reference, see cover photo and Figure 14 (Appendix).

Figure 8: Hedley Spit, Fay Bainbridge Park

The depicted water level of 12 feet NAVD88 represents today's extreme tide. According to central estimates it will occur annually by the 2060s, monthly by the 2090s, and daily (MHHW) by the 2130s. According to the "rapid ice loss" scenario, 12 feet NAVD88 will occur annually by the 2040s, monthly by the 2060s, and daily (MHHW) by the 2070s.

Up to 70 properties exposed along the spit and beside the park. "Nuisance flooding" is already common in these locations. For reference, see Figure 15 (Appendix).

Figure 9: Manzanita Bay



The depicted water level of 12 feet NAVD88 represents today's extreme tide. According to central estimates it will occur annually by the 2060s, monthly by the 2090s, and daily (MHHW) by the 2130s. According to the "rapid ice loss" scenario, 12 feet NAVD88 will occur annually by the 2040s, monthly by the 2060s, and daily (MHHW) by the 2070s.

Only a few properties affected around Manzanita Bay. Notable are potential impacts to the creek at Peterson Hill Road and the Bergman/Manzanita street connection.

Figure 10: Point White, Lynwood Center, and Pleasant Beach

The depicted water level of 12 feet NAVD88 represents today's extreme tide. According to central estimates it will occur annually by the 2060s, monthly by the 2090s, and daily (MHHW) by the 2130s. According to the "rapid ice loss" scenario, 12 feet NAVD88 will occur annually by the 2040s, monthly by the 2060s, and daily (MHHW) by the 2070s.

Approximately 15-20 properties affect between Pleasant Beach and Point White, plus Point White Drive and Schel Chelb Estuary.

3.1 City of Bainbridge Island Assets and Infrastructure

The City of Bainbridge Island (COBI) owns and manages a relatively limited number of assets in areas exposed to sea level rise. Most obvious are public streets, many of which run adjacent to coastlines or end at the beach. Other exposed assets include City Sewer Service Areas, notably Winslow, Rockaway, South Island, Pleasant Beach, Lynwood Center and Point White.

It is recommended that every COBI asset be listed in a table, created using COBI GIS, then sorted by ("invert") elevation and then ranked by criticality. The table could then be used as a foundation for a more complete risk assessment.

Figure 11: Sewer Service Areas

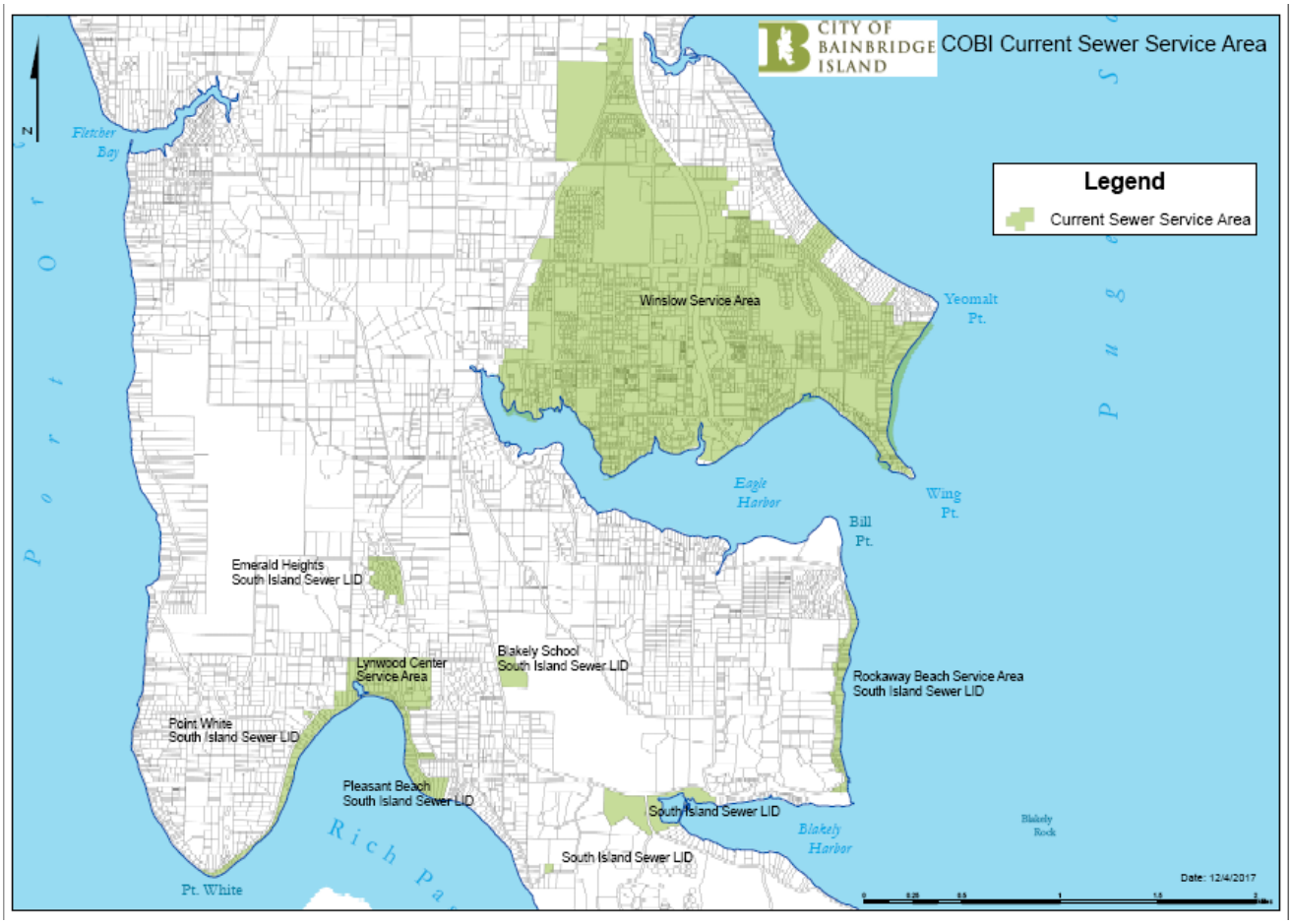
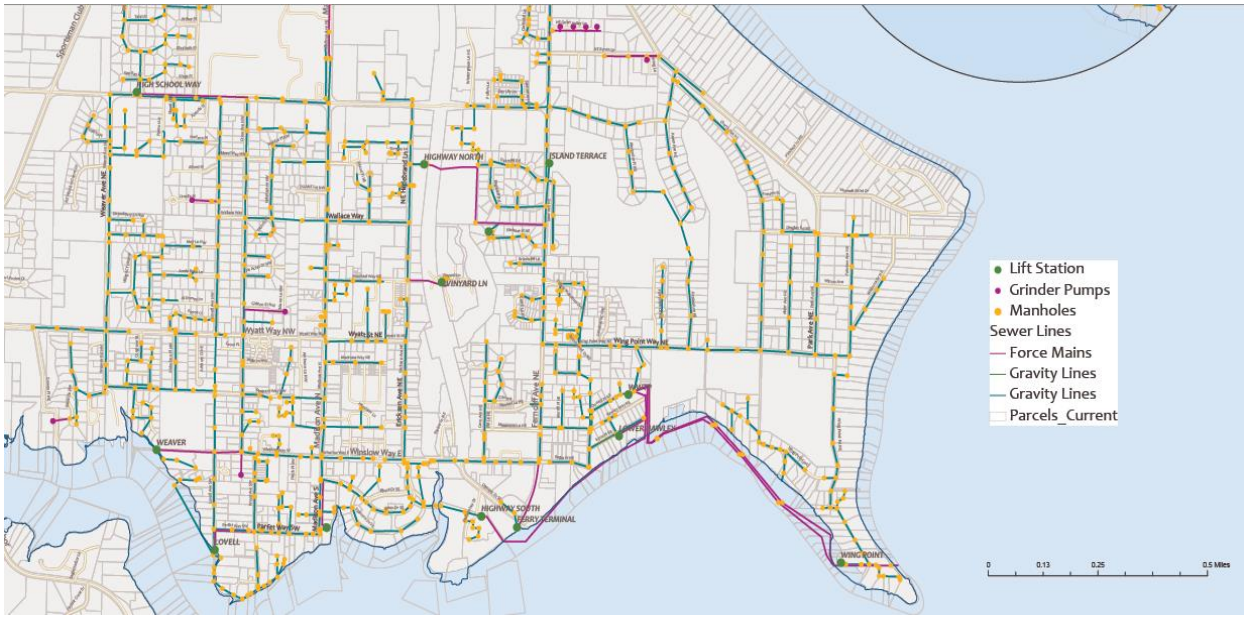
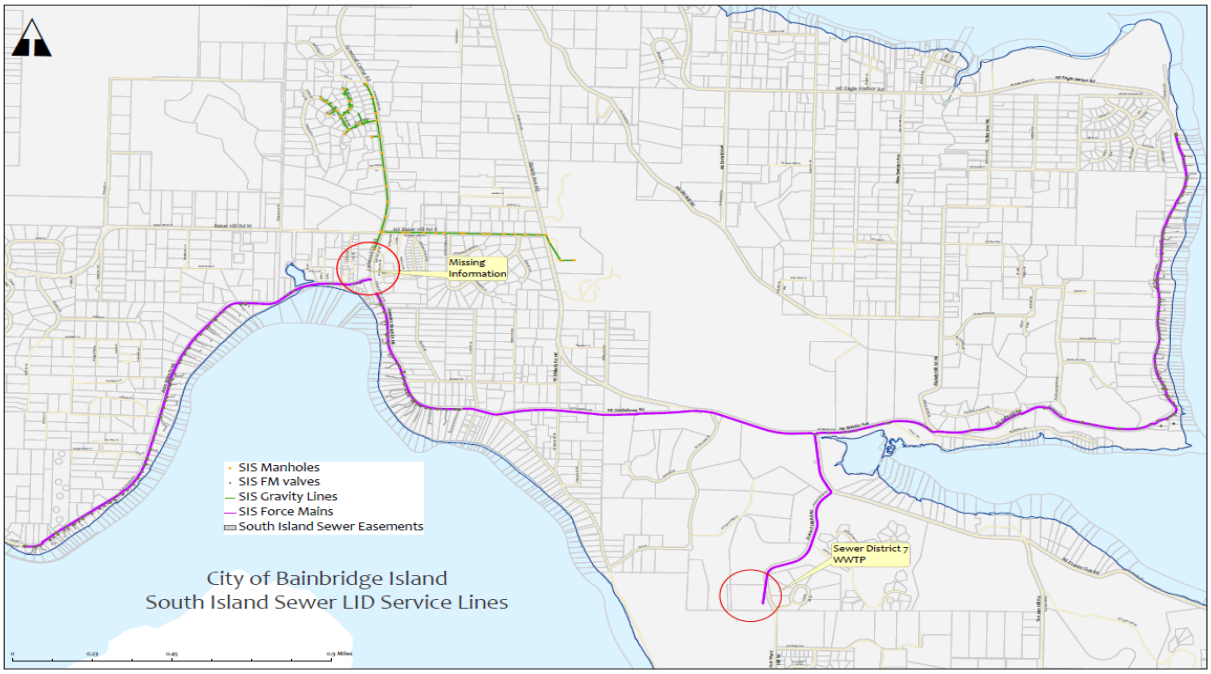


Figure 12: Winslow Sewer Service Area



Of the City's 500 "manholes," approximately 36 are exposed to sea level rise, as are 5 pump stations and 3 force mains (Figure 12). These estimates were "eyeballed" and underscore the need to use high-resolution GIS for planning purposes. Interviews with City staff also indicate that some of these assets, such as maintenance holes with water-tight lids, are designed to function while submerged.

Figure 13: South Island Sewer Service Lines



4. Discussion

This preliminary assessment attempts to provide an understanding of sea level rise and the ways in which it will impact Bainbridge Island. Puget Sound's shoreline has risen over the past century, and it is certain to rise much more for centuries to come. In some ways, The City of Bainbridge Island is fortunate to have relatively few critical assets exposed. In other ways, it is expressly challenged as a significant portion of the community will be directly impacted. Given this assessment, what follows are some suggested strategies to adapt and increase resilience.

4.1 Adaptation Strategies

One of the more challenging aspects to planning for and adapting to sea level rise is picking a number, year, and/or scenario. Outlined in this report, and in the best available science, are myriad options. It is recommended that any asset being considered for adaptation, build to an elevation no lower than the central estimate, or 50th percentile projection using the "business as usual" scenario. It is also recommended, based on the experiences of the municipalities and agencies cited in this report, that plans articulate a way in which adaptation to the 1% (rapid ice loss) projection *can* happen. In other words, **COBI should protect and build to the "middle" number now and demonstrate a way to get to the "high" number when necessary.**

Regarding specific assets, approximately 36 of COBI's 500 "manholes" and three or more force mains are exposed to sea level rise (Figures 12 & 13). Most appear to be vulnerable within the next 50 years, if not sooner. Each should be inspected, inventoried, and retrofitted (for example, with locking lids) or replaced if necessary. These inherently resilient assets should be able to function when submerged.

At least 5 lift/pump stations are exposed (Figures 12 & 13). Each should be inspected, and elevations of critical elements (for example, electrical panels) should be recorded. Such facilities can be redesigned, protected with barriers, or eventually be replaced.

A handful of roadways are particularly exposed. Some streets could be closed to motorized traffic in anticipation of broader action. Emergency access should be preserved, and non-motorized access could be increased (which itself is a co-benefit that furthers other COBI climate change goals). Examples include:

- Manitou Beach Drive (Figure 14) in the vicinity of the Manitou Beach Open Space area. This road and a few adjacent landward properties already experience regular flooding. Consider re-routing motorized Rolling Bay and Skiff Point area traffic to Valley Rd or alternate routes.
- Point White Drive at Schel Chelb Estuary. Consider re-routing motorized Crystal Springs and Point White area traffic to Baker Hill Rd or alternate routes.
- Manzanita Road at Manzanita Bay. All motorized traffic, notably that which uses the arterial to avoid Highway 305, could be re-routed.
- Eagle Harbor Drive at the head of the Harbor is the primary pathway between the south end of Bainbridge and Winslow. Maintaining a connection to Wyatt Way, if desired, will likely require large and costly infrastructure. A possible alternative would be to re-route traffic to High School Road via Fletcher Bay Road.
- Point Monroe Drive, as seen in Figure 8, cannot be re-routed.

Many private properties, both low-lying and high bank, will be impacted. Conventional flood protection such as bulkheads and seawalls will not prevent sea level rise and in some cases may exacerbate the problem. New waterfront construction or re-development, if not prohibited outright, should be guided by prudent shoreline policy. The City should evaluate whether current building and shoreline regulations sufficiently mitigate risk associated with the impacts of sea level rise on shoreline stability and flooding.

Mentioned in the summary but not addressed in the results is saltwater intrusion, bluff erosion, and septic systems. Rising seas will alter the nature of water resources adjacent to the shoreline. It is recommended that COBI add sea level rise to its water resources monitoring program. Additional study of septic systems given future inundation and increased bluff erosion is also recommended.

Ultimately, community-wide retreat or redevelopment should be managed by COBI in coordination with regional, state, and federal partners. In the near-term, it is recommended that City staff meet with Climate Change Advisory Committee members to review this preliminary assessment. Ample time should also be provided for City Council to briefed and to further study the issue. And all members of the community, but especially those who presently enjoy living beside rising waters, should be engaged to determine an equitable and resilient path forward.

Sea level rise is a form of displacement. We may not be sure how quickly it will occur, but we are certain that it will occur. We must plan proactively and pursue no-regrets strategies. Rising to this challenge will cost us much less than waiting until the next flood.

References

City of Olympia. (2019). Olympia Sea Level Rise Response Plan. Retrieved from http://olympiawa.gov/~/media/Files/PublicWorks/Water-Resources/SLR/SLR-Plan/SLR-Plan-Complete.pdf?la=en

City of Seattle. (2019). Sea-Level Rise Map. Retrieved from http://www.seattle.gov/utilities/environment-and-conservation/climate-change-program/projected-changes/sea-level-rise-map

Clark, P.U., et al. 2016. Consequences of twenty-first-century policy for multi-millennial climate and sea-level change. Nature Climate Change, volume 6, pages 360–369.

EPA. (2019). Climate Change Indicators: Coastal Flooding, Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-coastal-flooding

Hansen, J.E., and M. Sato. 2011. Paleoclimate Implications for Human-Made Climate Change. NASA Goddard Institute for Space Studies and Columbia University Earth Institute, New York.

Hansen, L.J., S.J. Nordgren and E.E. Mielbrecht. 2016. Bainbridge Island Climate Impacts Assessment. EcoAdapt, Bainbridge Island, WA.

Miller, I.M., et al. 2018. Projected Sea Level Rise for Washington State – A 2018 Assessment. A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, University of Oregon, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project.

NOAA. (2019). Seattle, WA - Station ID: 9447130. Retrieved from https://tidesandcurrents.noaa.gov/stationhome.html?id=9447130

NOAA. (2017). Detailed Method for Mapping Sea Level Rise Inundation. Retrieved from https://coast.noaa.gov/data/digitalcoast/pdf/slr-inundation-methods.pdf

NOAA. (n.d.). Sea Level Rise Viewer. Retrieved from https://coast.noaa.gov/slr/
Swinowmish-nsn.gov. (2009). Swinomish Climate Change Initiative. Retrieved from http://www.swinomish-nsn.gov/climate_change/about/about.html

Appendix

Figure 14: Manitou Beach Drive

December 20, 2018. Water level: approximately 10 feet NAVD88

Figure 15: Point Monroe Drive

December 20, 2018. Water level: approximately 10 feet NAVD88

Attachment C – Tides, Water Levels, & Relative Sea Level Rise Projections for Bainbridge Island

This attachment provides:

- Background information on tides and water levels relevant to Bainbridge Island so that past and future coastal flooding events can be understood in context with current and future sea levels.
- Sea level rise projections for tidal and flood datums are presented based on five different "risk profiles" which are intended to help translate the complexity of future probabilities into relatable terms to support policy-level discussions. Background on the sea level rise projections is provided in Attachment B.

Notes on how to use tidal and land elevations:

- Land elevations can be compared to the topographic lines and building elevations on a map, land survey, site plan, design drawing, or a GPS reading. Make sure the map, drawing, or GPS is using the NAVD88 datum.
- Tidal elevations can be compared to the bathymetric lines and water depths on a navigational chart, marine survey, site plan, design drawing, or a corrected tide observation. Make sure the map or drawing is based on the MLLW datum for the current tidal epoch (1983-2001).
- Land elevations can be easily converted to current tidal elevations by adding 2.34 feet (i.e. 13' MLLW + 2.34' = 15.34' NAVD88).
- Current tidal elevations can be easily converted to land elevations by subtracting 2.34 feet (i.e. 10' NAVD88 – 2.34' = 7.66' MLLW).

How to Use the Information in this Attachment

Step 1. Determine the appropriate "risk profile" for the situation. The risk profile should be selected to reflect the acceptable tolerance of the subject area, project, structure type, or habitat type to tidal flooding. The risk profiles are summarized in Table C-1 below and detailed in graphs and tables later in this attachment.

Table C-1. Flood Risk Profiles for Sea Level Rise Projections

Profile	Risk of Future Flooding	What does this mean?
1	Very High Risk	99% chance that actual water levels will exceed this projection
2	High Risk	90% chance that actual water levels will exceed this projection
3	Moderate Risk	50/50 chance that actual water levels will exceed this projection
4	Low Risk	10% chance that actual water levels will exceed this projection
5	Very Low Risk	1% chance that actual water levels will exceed this projection

Step 2. Determine the appropriate timeframe for the situation (e.g. lifespan of a structure).

Step 3. Use the tables and figures in this attachment to:

- Align the location and design of a project to the appropriate risk profile as demonstrated in Example #1 below.
- Assess the vulnerability of an existing area, structure, or habitat as demonstrated in Example #2 below.

Example #1: Where should something I value (e.g. building, infrastructure, habitat) be located based on the appropriate risk profile?

If you want to build a single-family residence with an expected lifespan of 100 years along a shoreline in the AE Flood Zone (14' BFE) and in a location where the shoreline buffer is 100' from the OHWM and you want a low risk (10% chance) of future flooding from sea level rise, then use Risk Profile 4 to identify that:

A. The approximate OHWM is projected to be 17.3' MLLW (15' NAVD88) in 100 years.
B. The AE Flood Zone (14' BFE) is projected to be 20.6' MLLW (18.3' NAVD88) in 100 years.

Therefore, build the house 100' landward of the 15' NAVD88 topographic line and make sure the first floor of the house is no lower than 19.3' NAVD88 (18.3' NAVD88 plus the 1-foot currently required freeboard).

Example #2: What is the risk of flooding to something I value (e.g. building, infrastructure, habitat) at its current elevation?

If you have an existing boathouse with a current floor elevation of 14' MLLW, the remaining lifespan of the structure is estimated at 30 years, and you are willing to tolerate a moderate risk (50% chance) of future flooding from sea level rise, then use Risk Profile 3 to identify that:

A. An Extreme High Water (EHW) event would currently result in 0.7 feet (i.e. 14.68' – 14') of still water flooding in the boathouse (not including wave height).
B. In 30-years there is a 50% chance the still water flooding from an EHW event would exceed 1.3 feet (i.e. 15.28' – 14').
C. Add significant wave height from Figure C-8 to model total water levels like those experienced on 12/17/2012.

Use Figure C-5 to identify the frequency (i.e. the chance of occurring each year) that a certain still water level might be exceeded.

D. The frequency of the still water level exceeding 14' MLLW currently is on average every 7 years (or about a 14% chance of occurring each year).
E. The likelihood of an EHW event happening currently is on average every 50 years (or about a 2% chance of occurring each year).

F. In 30 years, the frequency of the still water level exceeding 14' MLLW will be on average every 1.5 years (about a 67% chance of occurring each year). This is because in 30 years the recurrence frequency at 14' MLLW needs to be adjusted to account for sea level rise (i.e. 14' – 1.3' SLR = 13.2' MLLW) and will be occur as frequently as the 13.2' MLLW water level today on the historic return frequency curve.

Tides, Waves, and Water Levels

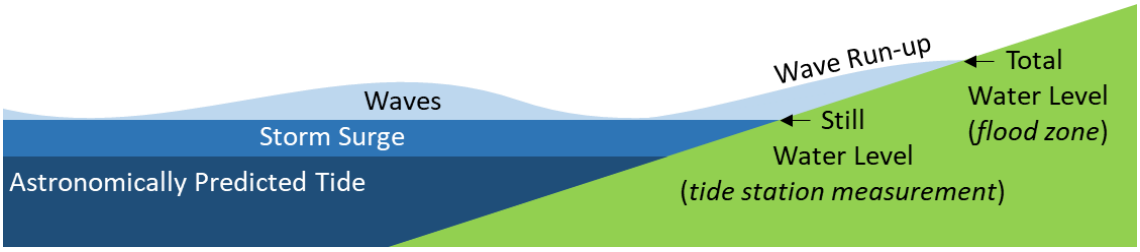
The water levels we experience along the shorelines of Bainbridge Island are due to the combination of the following components. (see Figure C-1)

- Astronomically predicted tides, which are what you will find in a tide table and is the water level as affected only by the gravitational forces of the moon and sun
- Storm surge, which is the affect on the water level by the combined forces of atmospheric pressure, offshore winds, freshwater flowing into coastal waters, and oceanic temperature oscillations
- Waves and wave run-up, which are driven by localized winds and affected by the shape of the sea bottom and the shoreline

A tide station measures the "still water level", which is the combination of the first two components. Our shorelines experience the "total water level", which is the combination of all three components. (see Figure C-1) This distinction is important to keep in mind.

The FEMA flood zones along the Bainbridge Island shoreline essentially reflect where there is a 1% chance in any given year of the total water level exceeding the defined base flood elevation (BFE). It is important to note that FEMA flood zones are based on historic data (not future sea level rise) and are often not updated frequently enough to stay current.

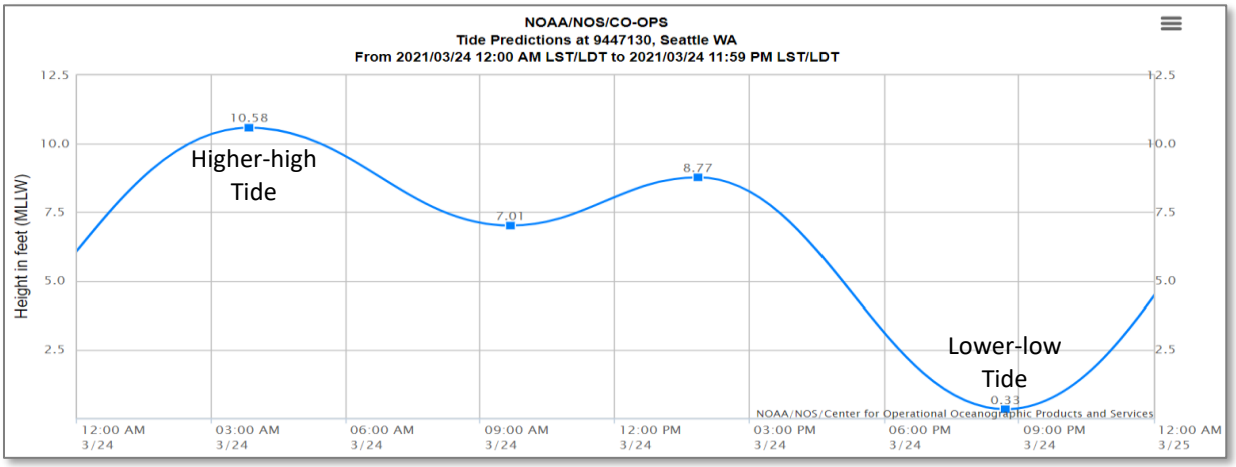
Figure C-1. Water Level Components



Bainbridge Island experiences two high tides and two low tides each day, all of which are normally of unequal height (see Figure C-2). Therefore, we have a daily higher-high tide and a daily lower-low tide. These are averaged into mean higher-high water (MHHW) and mean lower-low water (MLLW). MLLW is used as the zero datum from which all tidal elevations are measured. For example, MHHW is 11.36 feet above MLLW (or in shorthand: 11.36' MLLW). The National Oceanic and Atmospheric Administration (NOAA) is responsible for measuring and

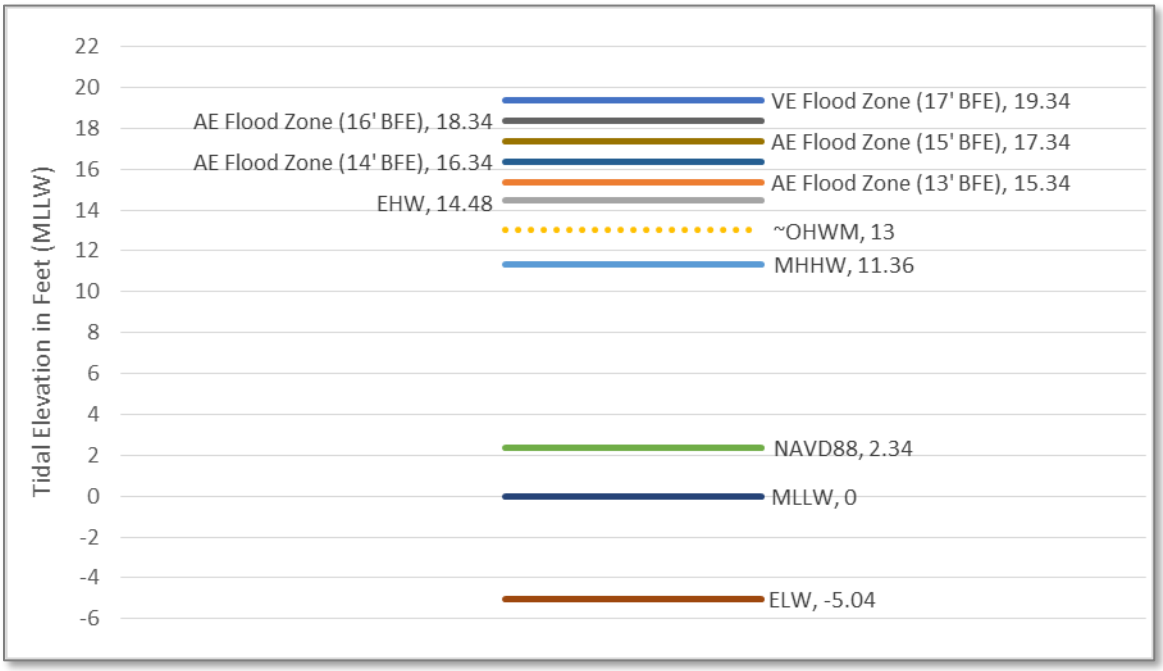
defining tidal elevations in the United States. Bainbridge Island uses the tidal elevation datums defined for the Seattle Tide Station (ID 9447130) located in Elliot Bay (see Figure C-3 and Table C-1). Tidal datums are recalculated every 19-years based on the long-term astronomical cycle that affects tides.

Figure C-2. Daily Tides



(Source: NOAA Seattle Tide Predictions)

Figure C-3. Coastal Water Levels for Bainbridge Island



(Source: NOAA Seattle Tide Station Datums, 3/15/2021; Flood zones from WA RiskMAP)

Note: The Ordinary high water mark (OHWM) cannot be defined by a specific tidal elevation however it has been observed at approximately 13’ MLLW around Bainbridge Island.

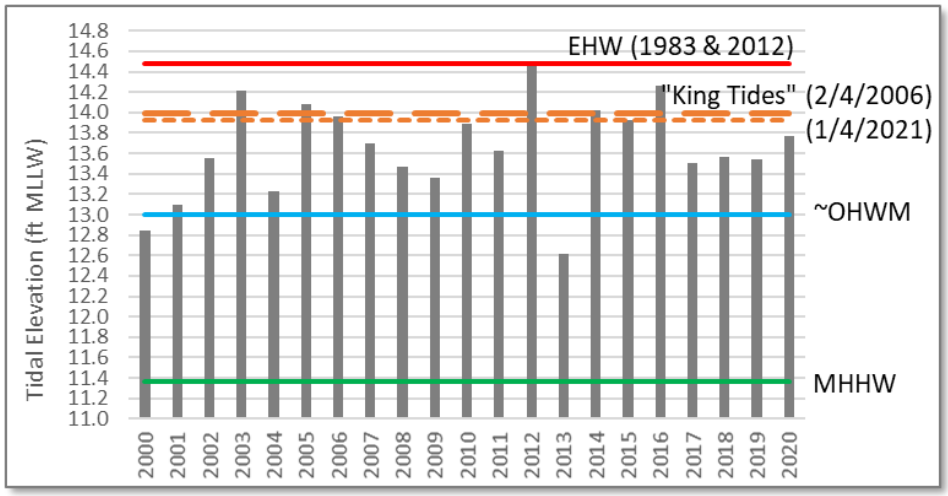
Table C-1. Coastal Water Levels for Bainbridge Island

Datum	Tidal Elevation (ft MLLW)	Land Elevation (ft NAVD88)	Description
VE Flood Zone (17' BFE)	19.34	17	Static Base Flood Elevation for Flood Zone VE
AE Flood Zone (16' BFE)	18.34	16	Static Base Flood Elevation for Flood Zone AE
AE Flood Zone (15' BFE)	17.34	15	Static Base Flood Elevation for Flood Zone AE
AE Flood Zone (14' BFE)	16.34	14	Static Base Flood Elevation for Flood Zone AE
AE Flood Zone (13' BFE)	15.34	13	Static Base Flood Elevation for Flood Zone AE
EHW	14.48	12.14	Extreme High Water (Highest Observed Tide on 1/27/1983 and 12/17/2012)
Approx. OHWM	13	10.66	Approximate Ordinary High Water Mark
MHHW	11.36	9.02	Mean Higher-High Water
NAVD88	2.34	0	North American Vertical Datum of 1988
MLLW	0	-2.34	Mean Lower-Low Water
ELW	-5.04	-7.38	Extreme Low Water (Lowest Observed Tide on 1/4/1916)

(Source: NOAA Seattle Tide Station Datums on 3/15/2021; Flood zones from WA RiskMAP)

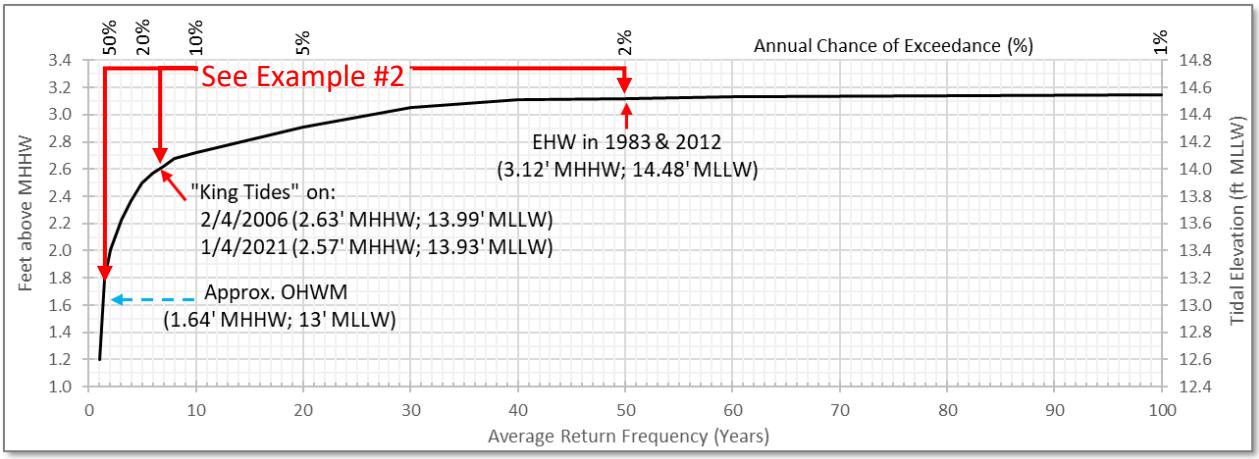
"King Tide" is the term used to describe the highest observed tide of the year (Figure C-4). These typically include a significant tidal surge component (e.g. 1.64 feet of tidal surge on 12/17/2012, see Figure C-6). The highest tide ever observed becomes the Extreme High Water (EHW) datum, which has been measured only twice at 14.48' MLLW in 1983 and on 12/17/2012. Figure C-5 documents the historic frequency of King Tides at certain elevations and the likelihood a certain water level will be exceeded in any given year. As sea levels rise, today's extreme high water levels will increasingly become more common.

Figure C-4. Recent King Tides for Bainbridge Island



(Source: NOAA Seattle Tide Station Observations)

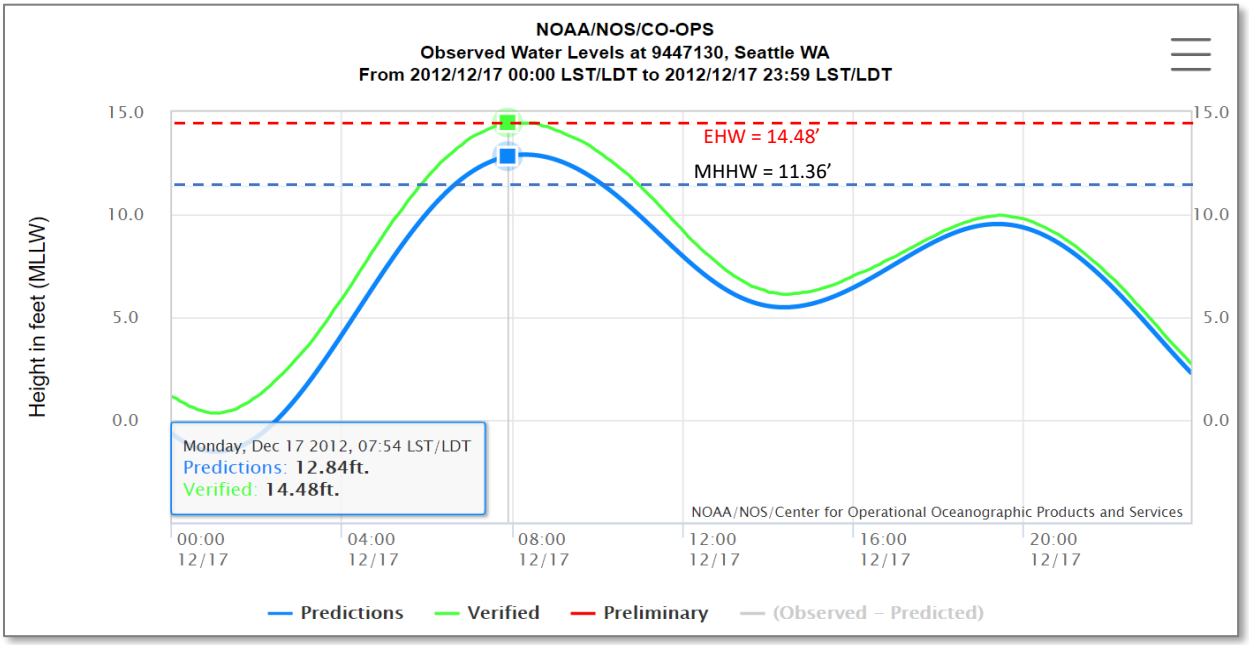
Figure C-5. King Tide Historic Return Frequency Curve for Bainbridge Island



(Source: Miller et al. 2019. Extreme Coastal Water Level in Washington State: Guidelines to Support Sea Level Rise Planning)

Note: The frequency curve is based on the highest annual tides (i.e "King Tides") recorded at the Seattle Tide Station since it began operating in 1898 (adjusted to the current tidal datum). Measurements are given in feet above the current MHHW datum (on the left) and in the current MLLW datum (on the right).

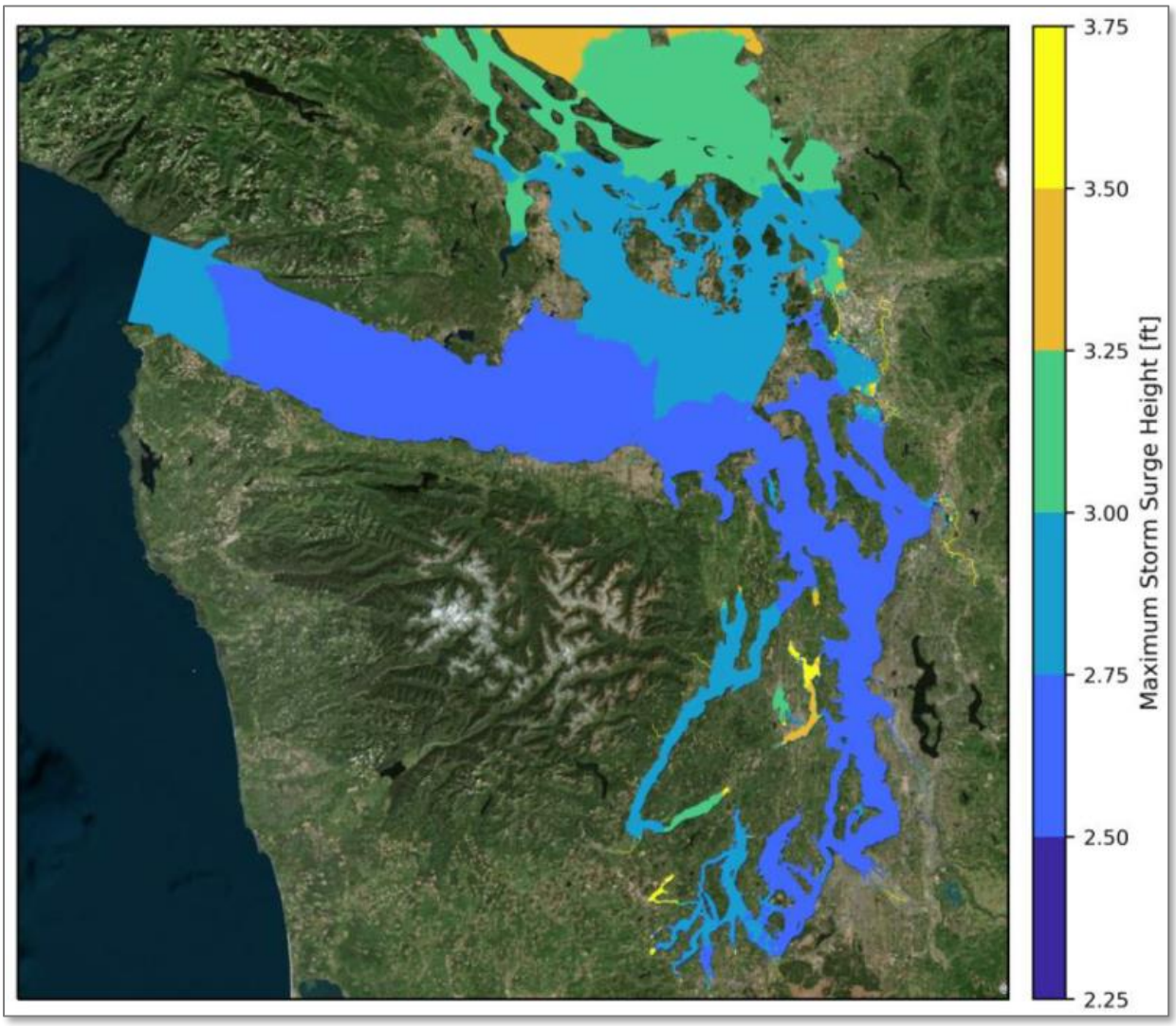
Figure C-6. December 17, 2012 King Tide at the Extreme High Water Level



Source: NOAA Tides and Currents website (Seattle Tide Station 9447130)

Figure C-7 models the maximum storm surge that is likely to occur around Bainbridge Island, which varies significantly from 2.5 feet along our northern, eastern, and southern shorelines to 3.25 feet along our southwest shoreline and 3.5 feet along our northwest shoreline.

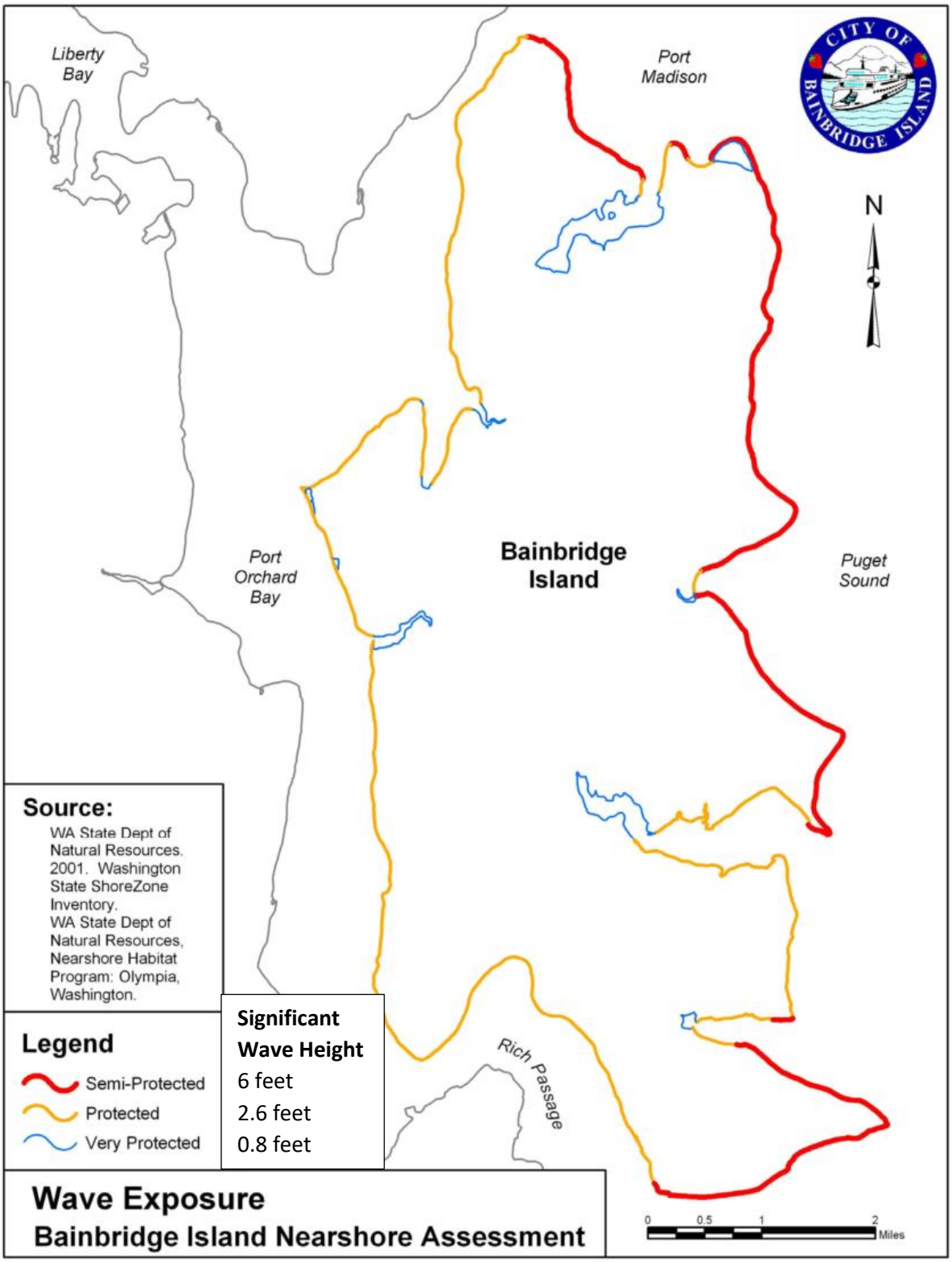
Figure C-7. Maximum Storm Surge for Puget Sound



(Source: Miller et al. 2019. Extreme Coastal Water Level in Washington State: Guidelines to Support Sea Level Rise Planning)

"Significant wave heights" (i.e. an engineering standard based on the average of the highest 1/3 of waves) around Bainbridge Island were documented in the Bainbridge Island Nearshore Assessment and associated with the wave exposure classifications as shown in Figure C-8. Note the maximum wave height may be nearly twice as high as the significant wave height.

Figure C-8. Wave Exposure and Significant Wave Heights for Bainbridge Island



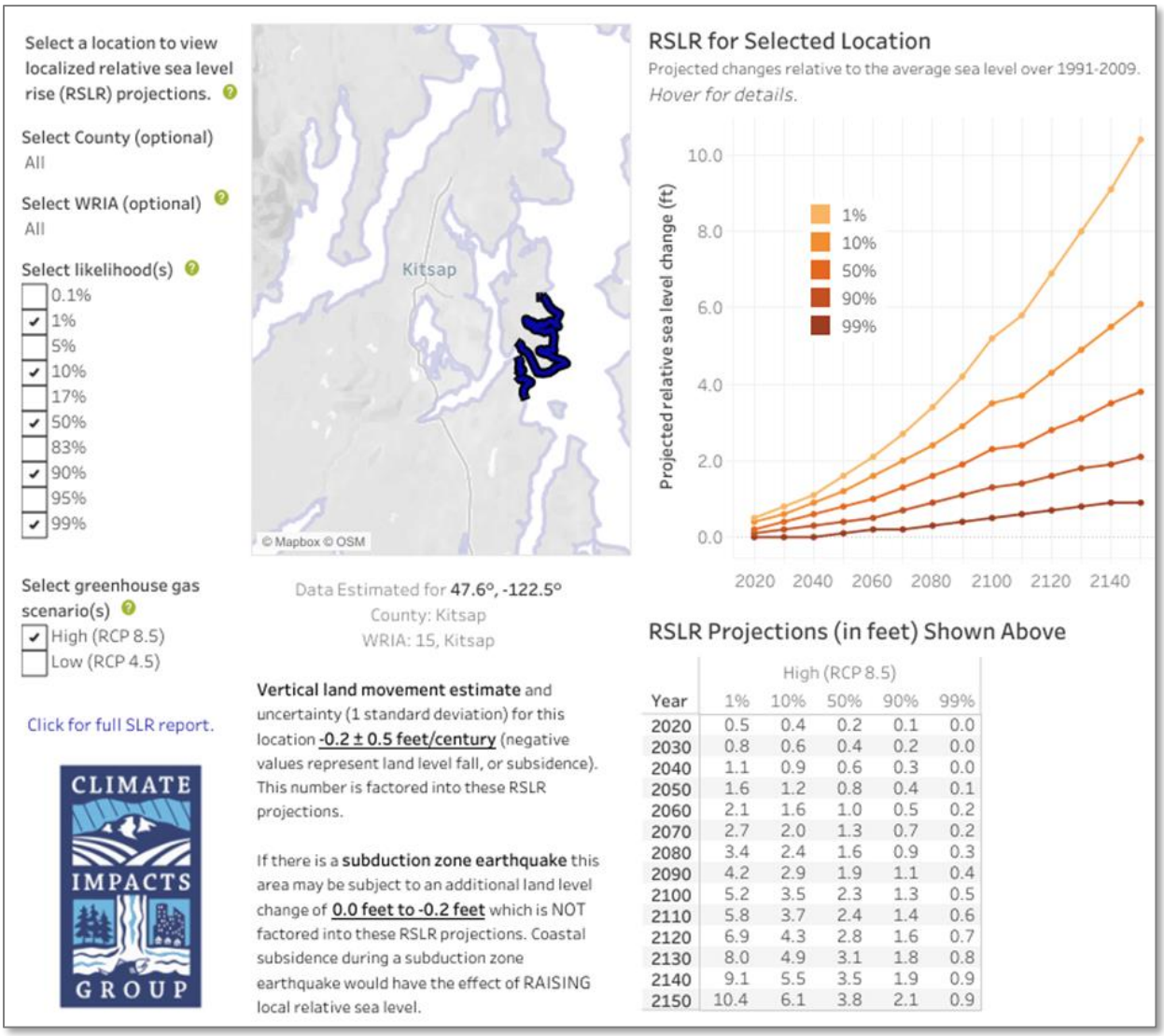
(Source: Williams et al. 2003. Bainbridge Island Nearshore Assessment: Summary of Best Available Science)

Sea Level Rise Projections

See Attachment B for background information. The following charts and tables are based on the model results in Figure A-1.

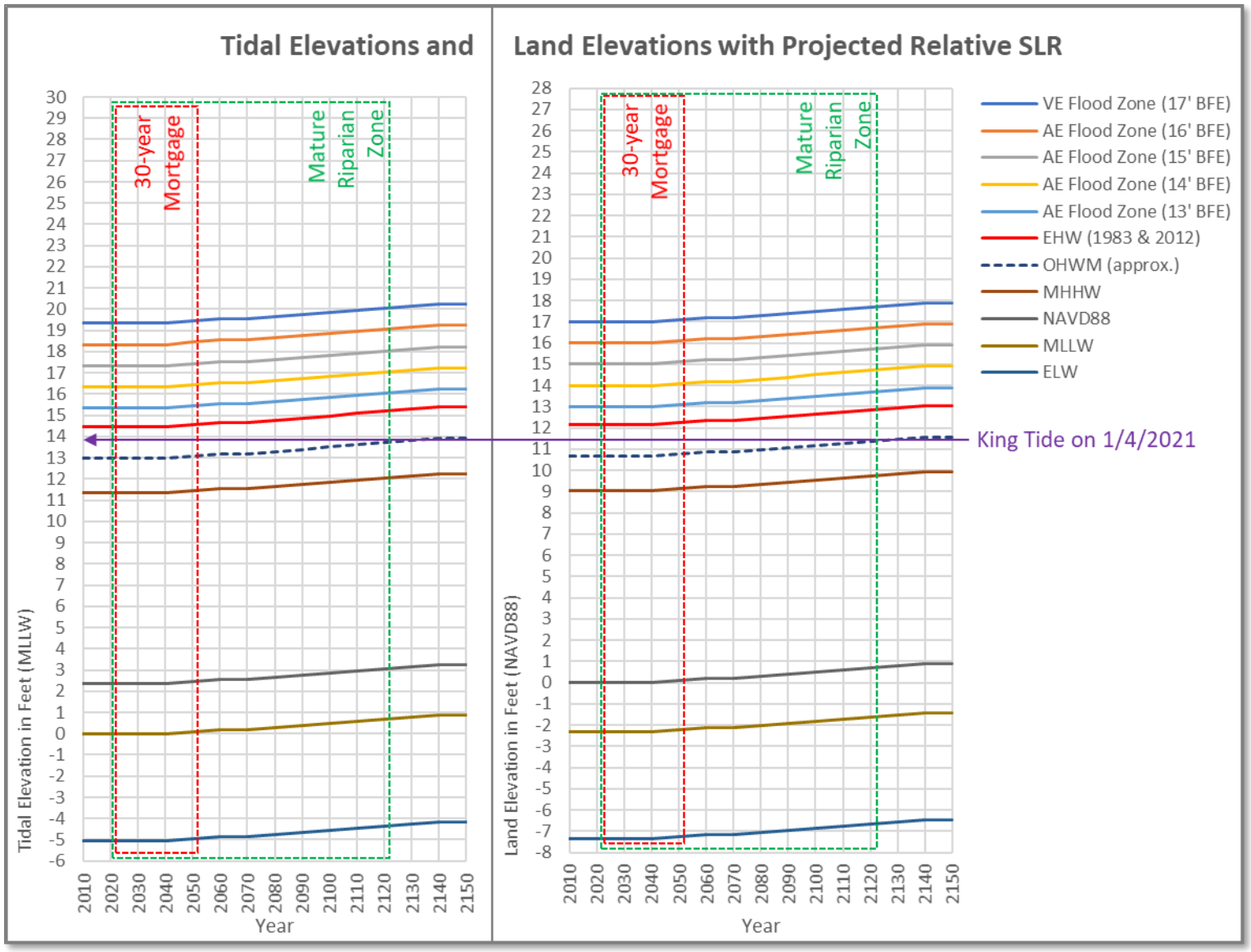
Note: Projecting tidal elevations based on relative sea level rise is considered a reliable methodology while projecting flood zone elevations based only on relative sea level rise is less reliable and ignores other factors accounted for in flood zone analysis that may change due to climate change, such as sea level rise effects on wave run up and changes in freshwater flows into coastal waters. The USGS is developing a model called PS-CoSMoS that is intended to address such issues.

Figure A-1. Relative Sea Level Rise Model Inputs and Results



(Source: UW Climate Impacts Group. Interactive Sea Level Rise Data Visualization)

Risk Profile 1. Very High Risk of Future Flooding (*99% chance that actual water levels will exceed these projections*)



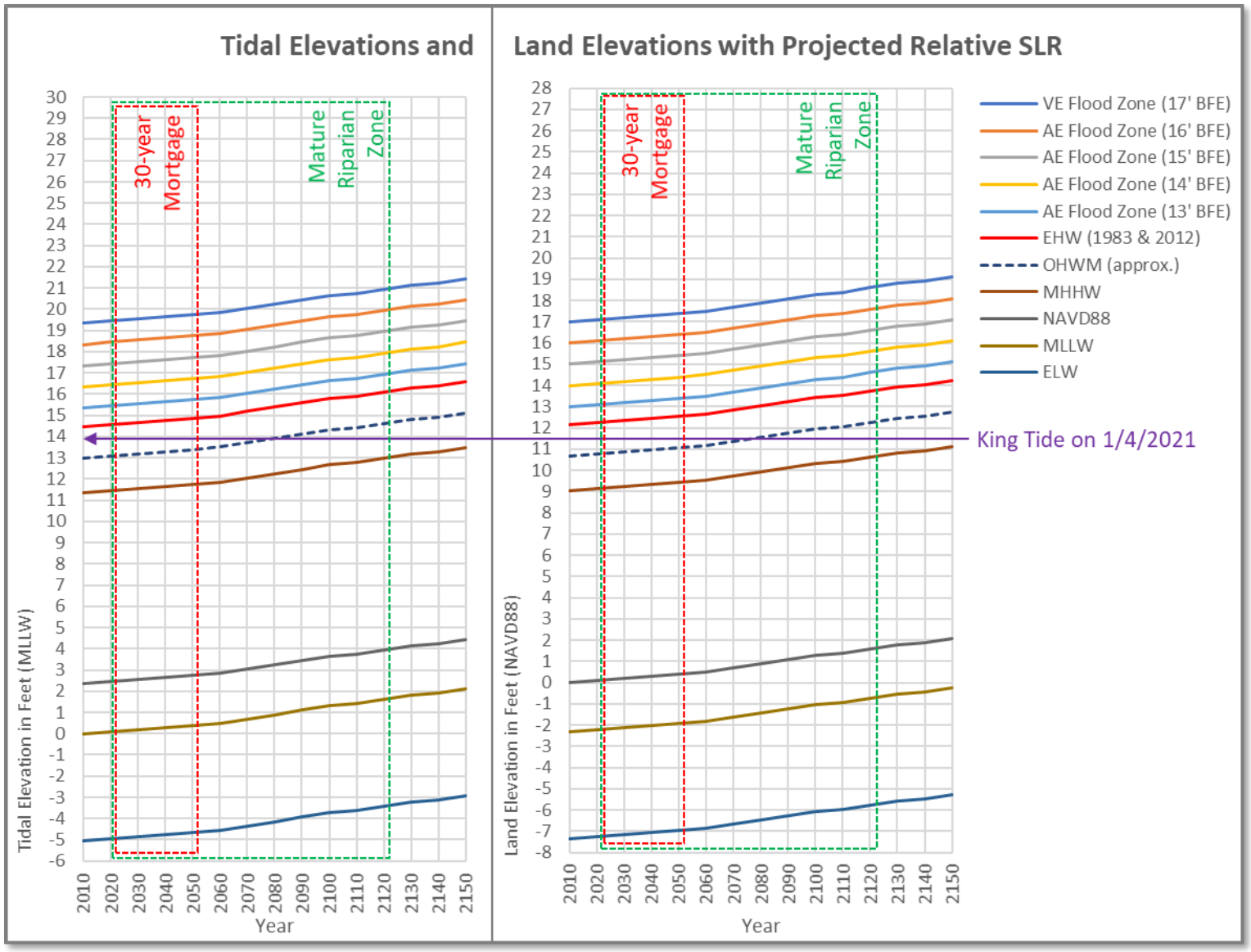
Risk Profile 1. Very High Risk of Future Flooding (*99% chance that actual water levels will exceed these projections*)

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Tidal Elevation (ft MLLW)	19.34	19.34	19.34	19.34	19.44	19.54	19.54	19.64	19.74	19.84	19.94	20.04	20.14	20.24	20.24
AE Flood Zone (16' BFE)		18.34	18.34	18.34	18.34	18.44	18.54	18.54	18.64	18.74	18.84	18.94	19.04	19.14	19.24	19.24
AE Flood Zone (15' BFE)		17.34	17.34	17.34	17.34	17.44	17.54	17.54	17.64	17.74	17.84	17.94	18.04	18.14	18.24	18.24
AE Flood Zone (14' BFE)		16.34	16.34	16.34	16.34	16.44	16.54	16.54	16.64	16.74	16.84	16.94	17.04	17.14	17.24	17.24
AE Flood Zone (13' BFE)		15.34	15.34	15.34	15.34	15.44	15.54	15.54	15.64	15.74	15.84	15.94	16.04	16.14	16.24	16.24
EHW (1983 & 2012)		14.48	14.48	14.48	14.48	14.58	14.68	14.68	14.78	14.88	14.98	15.08	15.18	15.28	15.38	15.38
OHWM (approx.)		13	13.00	13.00	13.00	13.10	13.20	13.20	13.30	13.40	13.50	13.60	13.70	13.80	13.90	13.90
MHHW		11.36	11.36	11.36	11.36	11.46	11.56	11.56	11.66	11.76	11.86	11.96	12.06	12.16	12.26	12.26
NAVD88		2.34	2.34	2.34	2.34	2.44	2.54	2.54	2.64	2.74	2.84	2.94	3.04	3.14	3.24	3.24
MLLW		0	0.00	0.00	0.00	0.10	0.20	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.90
ELW		-5.04	-5.04	-5.04	-5.04	-4.94	-4.84	-4.84	-4.74	-4.64	-4.54	-4.44	-4.34	-4.24	-4.14	-4.14

Current Planning Horizons		
CIP|CIP|CIP	Capital Improvement Plans (6-yr mandatory horizon)	
Comp Plan	Comprehensive Plan w/ Capital Facilities Plan (20-year mandatory horizon)	
Comprehensive Plan (City 100-yr extended horizon)		

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Land Elevation (ft NAVD88)	17	17.00	17.00	17.00	17.10	17.20	17.20	17.30	17.40	17.50	17.60	17.70	17.80	17.90	17.90
AE Flood Zone (16' BFE)		16	16.00	16.00	16.00	16.10	16.20	16.20	16.30	16.40	16.50	16.60	16.70	16.80	16.90	16.90
AE Flood Zone (15' BFE)		15	15.00	15.00	15.00	15.10	15.20	15.20	15.30	15.40	15.50	15.60	15.70	15.80	15.90	15.90
AE Flood Zone (14' BFE)		14	14.00	14.00	14.00	14.10	14.20	14.20	14.30	14.40	14.50	14.60	14.70	14.80	14.90	14.90
AE Flood Zone (13' BFE)		13	13.00	13.00	13.00	13.10	13.20	13.20	13.30	13.40	13.50	13.60	13.70	13.80	13.90	13.90
EHW (1983 & 2012)		12.14	12.14	12.14	12.14	12.24	12.34	12.34	12.44	12.54	12.64	12.74	12.84	12.94	13.04	13.04
OHWM (approx.)		10.66	10.66	10.66	10.66	10.76	10.86	10.86	10.96	11.06	11.16	11.26	11.36	11.46	11.56	11.56
MHHW		9.02	9.02	9.02	9.02	9.12	9.22	9.22	9.32	9.42	9.52	9.62	9.72	9.82	9.92	9.92
NAVD88		0	0.00	0.00	0.00	0.10	0.20	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.90
MLLW		-2.34	-2.34	-2.34	-2.34	-2.24	-2.14	-2.14	-2.04	-1.94	-1.84	-1.74	-1.64	-1.54	-1.44	-1.44
ELW		-7.38	-7.38	-7.38	-7.38	-7.28	-7.18	-7.18	-7.08	-6.98	-6.88	-6.78	-6.68	-6.58	-6.48	-6.48

Risk Profile 2. High Risk of Future Flooding (*90% chance that actual water levels will exceed these projections*)



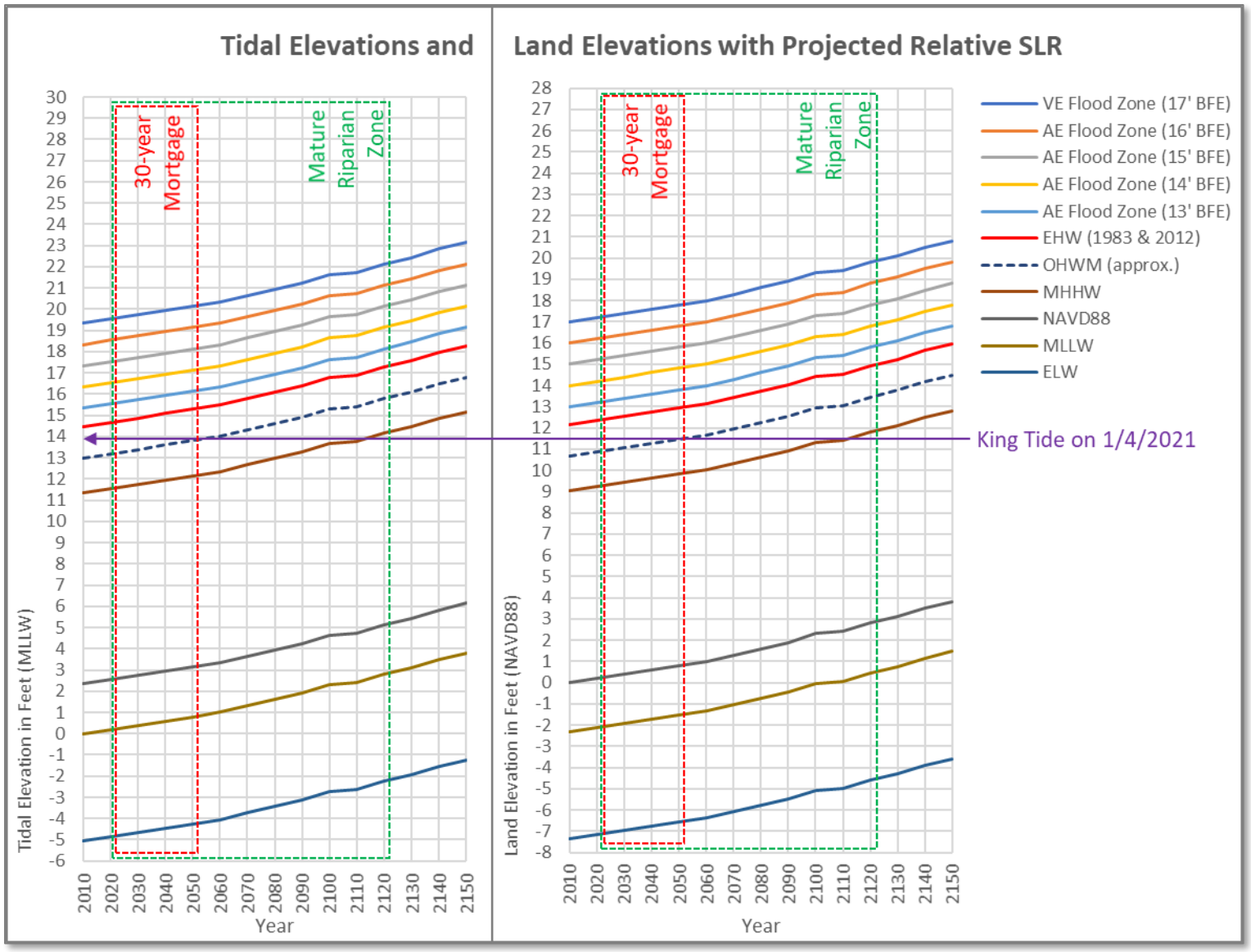
Risk Profile 2. High Risk of Future Flooding (*90% chance that actual water levels will exceed these projections*)

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Tidal Elevation (ft MLLW)	19.34	19.44	19.54	19.64	19.74	19.84	20.04	20.24	20.44	20.64	20.74	20.94	21.14	21.24	21.44
AE Flood Zone (16' BFE)		18.34	18.44	18.54	18.64	18.74	18.84	19.04	19.24	19.44	19.64	19.74	19.94	20.14	20.24	20.44
AE Flood Zone (15' BFE)		17.34	17.44	17.54	17.64	17.74	17.84	18.04	18.24	18.44	18.64	18.74	18.94	19.14	19.24	19.44
AE Flood Zone (14' BFE)		16.34	16.44	16.54	16.64	16.74	16.84	17.04	17.24	17.44	17.64	17.74	17.94	18.14	18.24	18.44
AE Flood Zone (13' BFE)		15.34	15.44	15.54	15.64	15.74	15.84	16.04	16.24	16.44	16.64	16.74	16.94	17.14	17.24	17.44
EHW (1983 & 2012)		14.48	14.58	14.68	14.78	14.88	14.98	15.18	15.38	15.58	15.78	15.88	16.08	16.28	16.38	16.58
OHWM (approx.)		13	13.10	13.20	13.30	13.40	13.50	13.70	13.90	14.10	14.30	14.40	14.60	14.80	14.90	15.10
MHHW		11.36	11.46	11.56	11.66	11.76	11.86	12.06	12.26	12.46	12.66	12.76	12.96	13.16	13.26	13.46
NAVD88		2.34	2.44	2.54	2.64	2.74	2.84	3.04	3.24	3.44	3.64	3.74	3.94	4.14	4.24	4.44
MLLW		0	0.10	0.20	0.30	0.40	0.50	0.70	0.90	1.10	1.30	1.40	1.60	1.80	1.90	2.10
ELW		-5.04	-4.94	-4.84	-4.74	-4.64	-4.54	-4.34	-4.14	-3.94	-3.74	-3.64	-3.44	-3.24	-3.14	-2.94

Current Planning Horizons		
	CIP|CIP|CIP	Capital Improvement Plans (6-yr mandatory horizon)
	Comp Plan	Comprehensive Plan w/ Capital Facilities Plan (20-year mandatory horizon)
	Comprehensive Plan (City 100-yr extended horizon)	

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Land Elevation (ft NAVD88)	17	17.10	17.20	17.30	17.40	17.50	17.70	17.90	18.10	18.30	18.40	18.60	18.80	18.90	19.10
AE Flood Zone (16' BFE)		16	16.10	16.20	16.30	16.40	16.50	16.70	16.90	17.10	17.30	17.40	17.60	17.80	17.90	18.10
AE Flood Zone (15' BFE)		15	15.10	15.20	15.30	15.40	15.50	15.70	15.90	16.10	16.30	16.40	16.60	16.80	16.90	17.10
AE Flood Zone (14' BFE)		14	14.10	14.20	14.30	14.40	14.50	14.70	14.90	15.10	15.30	15.40	15.60	15.80	15.90	16.10
AE Flood Zone (13' BFE)		13	13.10	13.20	13.30	13.40	13.50	13.70	13.90	14.10	14.30	14.40	14.60	14.80	14.90	15.10
EHW (1983 & 2012)		12.14	12.24	12.34	12.44	12.54	12.64	12.84	13.04	13.24	13.44	13.54	13.74	13.94	14.04	14.24
OHWM (approx.)		10.66	10.76	10.86	10.96	11.06	11.16	11.36	11.56	11.76	11.96	12.06	12.26	12.46	12.56	12.76
MHHW		9.02	9.12	9.22	9.32	9.42	9.52	9.72	9.92	10.12	10.32	10.42	10.62	10.82	10.92	11.12
NAVD88		0	0.10	0.20	0.30	0.40	0.50	0.70	0.90	1.10	1.30	1.40	1.60	1.80	1.90	2.10
MLLW		-2.34	-2.24	-2.14	-2.04	-1.94	-1.84	-1.64	-1.44	-1.24	-1.04	-0.94	-0.74	-0.54	-0.44	-0.24
ELW		-7.38	-7.28	-7.18	-7.08	-6.98	-6.88	-6.68	-6.48	-6.28	-6.08	-5.98	-5.78	-5.58	-5.48	-5.28

Risk Profile 3. Moderate Risk of Future Flooding (*50% chance that actual water levels will exceed these projections*)



Risk Profile 3. Moderate Risk of Future Flooding (*50% chance that actual water levels will exceed these projections*)

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Tidal Elevation (ft MLLW)	19.34	19.54	19.74	19.94	20.14	20.34	20.64	20.94	21.24	21.64	21.74	22.14	22.44	22.84	23.14
AE Flood Zone (16' BFE)		18.34	18.54	18.74	18.94	19.14	19.34	19.64	19.94	20.24	20.64	20.74	21.14	21.44	21.84	22.14
AE Flood Zone (15' BFE)		17.34	17.54	17.74	17.94	18.14	18.34	18.64	18.94	19.24	19.64	19.74	20.14	20.44	20.84	21.14
AE Flood Zone (14' BFE)		16.34	16.54	16.74	16.94	17.14	17.34	17.64	17.94	18.24	18.64	18.74	19.14	19.44	19.84	20.14
AE Flood Zone (13' BFE)		15.34	15.54	15.74	15.94	16.14	16.34	16.64	16.94	17.24	17.64	17.74	18.14	18.44	18.84	19.14
EHW (1983 & 2012)		14.48	14.68	14.88	15.08	15.28	15.48	15.78	16.08	16.38	16.78	16.88	17.28	17.58	17.98	18.28
OHWM (approx.)		13	13.20	13.40	13.60	13.80	14.00	14.30	14.60	14.90	15.30	15.40	15.80	16.10	16.50	16.80
MHHW		11.36	11.56	11.76	11.96	12.16	12.36	12.66	12.96	13.26	13.66	13.76	14.16	14.46	14.86	15.16
NAVD88		2.34	2.54	2.74	2.94	3.14	3.34	3.64	3.94	4.24	4.64	4.74	5.14	5.44	5.84	6.14
MLLW		0	0.20	0.40	0.60	0.80	1.00	1.30	1.60	1.90	2.30	2.40	2.80	3.10	3.50	3.80
ELW		-5.04	-4.84	-4.64	-4.44	-4.24	-4.04	-3.74	-3.44	-3.14	-2.74	-2.64	-2.24	-1.94	-1.54	-1.24

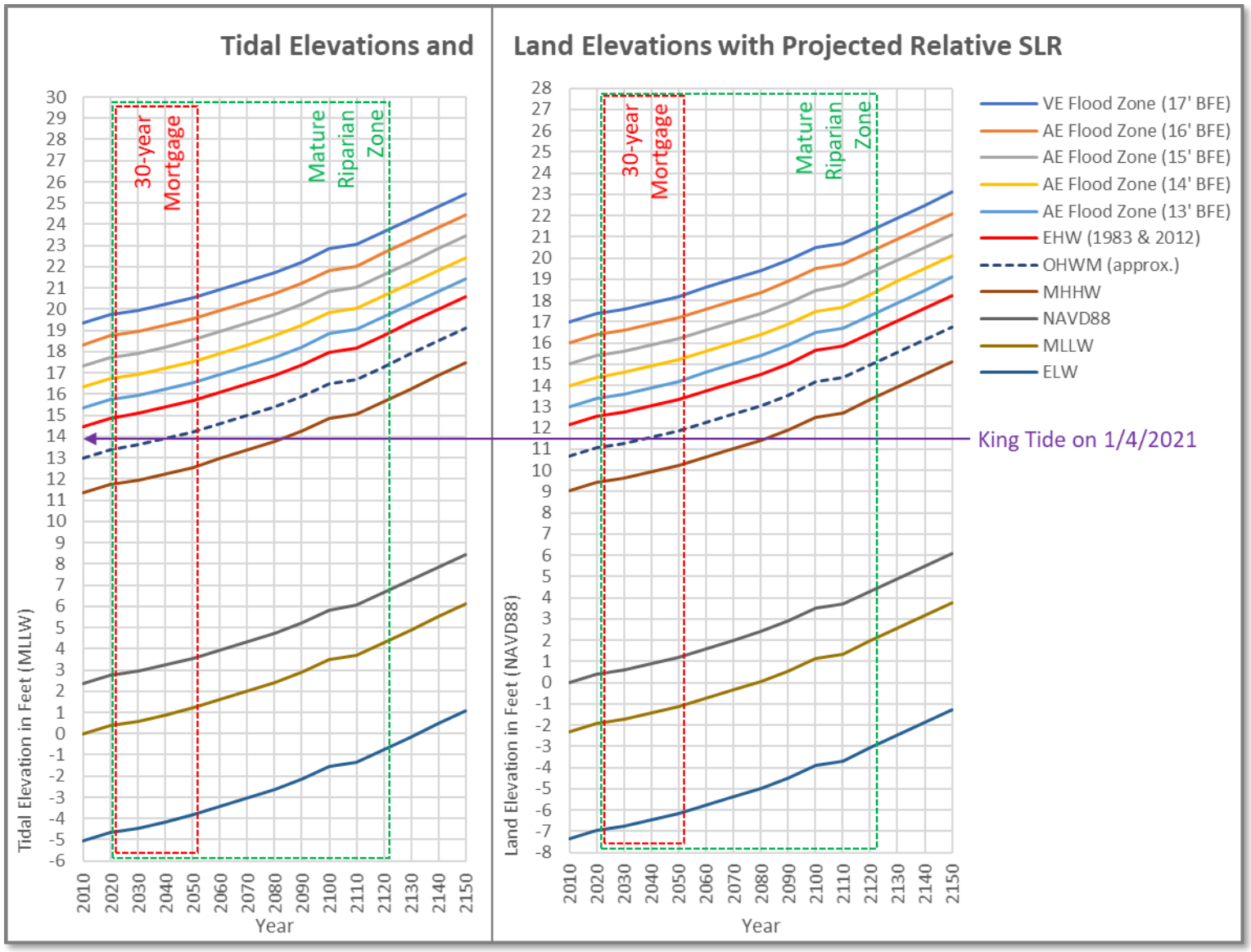
See Example #2

Current Planning Horizons

CIP|CIP|CIP	Capital Improvement Plans (6-yr mandatory horizon)
Comp Plan	Comprehensive Plan w/ Capital Facilities Plan (20-year mandatory horizon)
Comprehensive Plan (City 100-yr extended horizon)	

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Land Elevation (ft NAVD88)	17	17.20	17.40	17.60	17.80	18.00	18.30	18.60	18.90	19.30	19.40	19.80	20.10	20.50	20.80
AE Flood Zone (16' BFE)		16	16.20	16.40	16.60	16.80	17.00	17.30	17.60	17.90	18.30	18.40	18.80	19.10	19.50	19.80
AE Flood Zone (15' BFE)		15	15.20	15.40	15.60	15.80	16.00	16.30	16.60	16.90	17.30	17.40	17.80	18.10	18.50	18.80
AE Flood Zone (14' BFE)		14	14.20	14.40	14.60	14.80	15.00	15.30	15.60	15.90	16.30	16.40	16.80	17.10	17.50	17.80
AE Flood Zone (13' BFE)		13	13.20	13.40	13.60	13.80	14.00	14.30	14.60	14.90	15.30	15.40	15.80	16.10	16.50	16.80
EHW (1983 & 2012)		12.14	12.34	12.54	12.74	12.94	13.14	13.44	13.74	14.04	14.44	14.54	14.94	15.24	15.64	15.94
OHWM (approx.)		10.66	10.86	11.06	11.26	11.46	11.66	11.96	12.26	12.56	12.96	13.06	13.46	13.76	14.16	14.46
MHHW		9.02	9.22	9.42	9.62	9.82	10.02	10.32	10.62	10.92	11.32	11.42	11.82	12.12	12.52	12.82
NAVD88		0	0.20	0.40	0.60	0.80	1.00	1.30	1.60	1.90	2.30	2.40	2.80	3.10	3.50	3.80
MLLW		-2.34	-2.14	-1.94	-1.74	-1.54	-1.34	-1.04	-0.74	-0.44	-0.04	0.06	0.46	0.76	1.16	1.46
ELW		-7.38	-7.18	-6.98	-6.78	-6.58	-6.38	-6.08	-5.78	-5.48	-5.08	-4.98	-4.58	-4.28	-3.88	-3.58

Risk Profile 4. Low Risk of Future Flooding (*10% chance that actual water levels will exceed these projections*)



Risk Profile 4. Low Risk of Future Flooding (*10% chance that actual water levels will exceed these projections*)

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Tidal Elevation (ft MLLW)	19.34	19.74	19.94	20.24	20.54	20.94	21.34	21.74	22.24	22.84	23.04	23.64	24.24	24.84	25.44
AE Flood Zone (16' BFE)		18.34	18.74	18.94	19.24	19.54	19.94	20.34	20.74	21.24	21.84	22.04	22.64	23.24	23.84	24.44
AE Flood Zone (15' BFE)		17.34	17.74	17.94	18.24	18.54	18.94	19.34	19.74	20.24	20.84	21.04	21.64	22.24	22.84	23.44
AE Flood Zone (14' BFE)		16.34	16.74	16.94	17.24	17.54	17.94	18.34	18.74	19.24	19.84	20.04	20.64	21.24	21.84	22.44
AE Flood Zone (13' BFE)		15.34	15.74	15.94	16.24	16.54	16.94	17.34	17.74	18.24	18.84	19.04	19.64	20.24	20.84	21.44
EHW (1983 & 2012)		14.48	14.88	15.08	15.38	15.68	16.08	16.48	16.88	17.38	17.98	18.18	18.78	19.38	19.98	20.58
OHWM (approx.)		13	13.40	13.60	13.90	14.20	14.60	15.00	15.40	15.90	16.50	16.70	17.30	17.90	18.50	19.10
MHHW		11.36	11.76	11.96	12.26	12.56	12.96	13.36	13.76	14.26	14.86	15.06	15.66	16.26	16.86	17.46
NAVD88		2.34	2.74	2.94	3.24	3.54	3.94	4.34	4.74	5.24	5.84	6.04	6.64	7.24	7.84	8.44
MLLW		0	0.40	0.60	0.90	1.20	1.60	2.00	2.40	2.90	3.50	3.70	4.30	4.90	5.50	6.10
ELW		-5.04	-4.64	-4.44	-4.14	-3.84	-3.44	-3.04	-2.64	-2.14	-1.54	-1.34	-0.74	-0.14	0.46	1.06

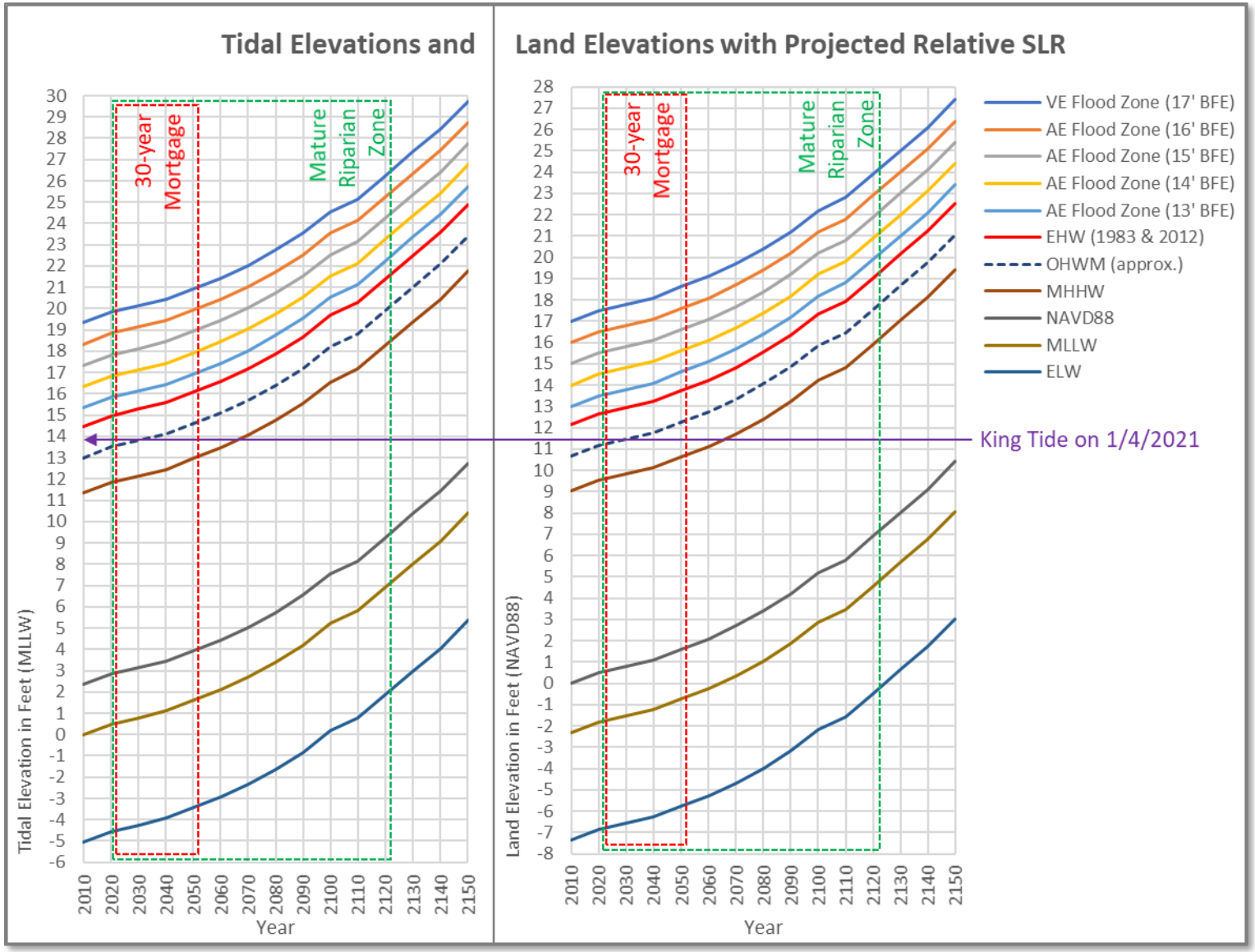
Current Planning Horizons

CIP | CIP | CIP	Capital Improvement Plans (6-yr mandatory horizon)
Comp Plan	Comprehensive Plan w/ Capital Facilities Plan (20-year mandatory horizon)
Comprehensive Plan (City 100-yr extended horizon)	

See Example #1

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Land Elevation (ft NAVD88)	17	17.40	17.60	17.90	18.20	18.60	19.00	19.40	19.90	20.50	20.70	21.30	21.90	22.50	23.10
AE Flood Zone (16' BFE)		16	16.40	16.60	16.90	17.20	17.60	18.00	18.40	18.90	19.50	19.70	20.30	20.90	21.50	22.10
AE Flood Zone (15' BFE)		15	15.40	15.60	15.90	16.20	16.60	17.00	17.40	17.90	18.50	18.70	19.30	19.90	20.50	21.10
AE Flood Zone (14' BFE)		14	14.40	14.60	14.90	15.20	15.60	16.00	16.40	16.90	17.50	17.70	18.30	18.90	19.50	20.10
AE Flood Zone (13' BFE)		13	13.40	13.60	13.90	14.20	14.60	15.00	15.40	15.90	16.50	16.70	17.30	17.90	18.50	19.10
EHW (1983 & 2012)		12.14	12.54	12.74	13.04	13.34	13.74	14.14	14.54	15.04	15.64	15.84	16.44	17.04	17.64	18.24
OHWM (approx.)		10.66	11.06	11.26	11.56	11.86	12.26	12.66	13.06	13.56	14.16	14.36	14.96	15.56	16.16	16.76
MHHW		9.02	9.42	9.62	9.92	10.22	10.62	11.02	11.42	11.92	12.52	12.72	13.32	13.92	14.52	15.12
NAVD88		0	0.40	0.60	0.90	1.20	1.60	2.00	2.40	2.90	3.50	3.70	4.30	4.90	5.50	6.10
MLLW		-2.34	-1.94	-1.74	-1.44	-1.14	-0.74	-0.34	0.06	0.56	1.16	1.36	1.96	2.56	3.16	3.76
ELW		-7.38	-6.98	-6.78	-6.48	-6.18	-5.78	-5.38	-4.98	-4.48	-3.88	-3.68	-3.08	-2.48	-1.88	-1.28

Risk Profile 5. Very Low Risk of Future Flooding (*1% chance that actual water levels will exceed these projections*)



Risk Profile 5. Very Low Risk of Future Flooding (*1% chance that actual water levels will exceed these projections*)

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Tidal Elevation (ft MLLW)	19.34	19.84	20.14	20.44	20.94	21.44	22.04	22.74	23.54	24.54	25.14	26.24	27.34	28.44	29.74
AE Flood Zone (16' BFE)		18.34	18.84	19.14	19.44	19.94	20.44	21.04	21.74	22.54	23.54	24.14	25.24	26.34	27.44	28.74
AE Flood Zone (15' BFE)		17.34	17.84	18.14	18.44	18.94	19.44	20.04	20.74	21.54	22.54	23.14	24.24	25.34	26.44	27.74
AE Flood Zone (14' BFE)		16.34	16.84	17.14	17.44	17.94	18.44	19.04	19.74	20.54	21.54	22.14	23.24	24.34	25.44	26.74
AE Flood Zone (13' BFE)		15.34	15.84	16.14	16.44	16.94	17.44	18.04	18.74	19.54	20.54	21.14	22.24	23.34	24.44	25.74
EHW (1983 & 2012)		14.48	14.98	15.28	15.58	16.08	16.58	17.18	17.88	18.68	19.68	20.28	21.38	22.48	23.58	24.88
OHWM (approx.)		13	13.50	13.80	14.10	14.60	15.10	15.70	16.40	17.20	18.20	18.80	19.90	21.00	22.10	23.40
MHHW		11.36	11.86	12.16	12.46	12.96	13.46	14.06	14.76	15.56	16.56	17.16	18.26	19.36	20.46	21.76
NAVD88		2.34	2.84	3.14	3.44	3.94	4.44	5.04	5.74	6.54	7.54	8.14	9.24	10.34	11.44	12.74
MLLW		0	0.50	0.80	1.10	1.60	2.10	2.70	3.40	4.20	5.20	5.80	6.90	8.00	9.10	10.40
ELW		-5.04	-4.54	-4.24	-3.94	-3.44	-2.94	-2.34	-1.64	-0.84	0.16	0.76	1.86	2.96	4.06	5.36

Current Planning Horizons	
CIP|CIP|CIP	Capital Improvement Plans (6-yr mandatory horizon)
Comp Plan	Comprehensive Plan w/ Capital Facilities Plan (20-year mandatory horizon)
Comprehensive Plan (City 100-yr extended horizon)	

		Datum	Projected Elevation with Relative Sea Level Rise													
		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
VE Flood Zone (17' BFE)	Land Elevation (ft NAVD88)	17	17.50	17.80	18.10	18.60	19.10	19.70	20.40	21.20	22.20	22.80	23.90	25.00	26.10	27.40
AE Flood Zone (16' BFE)		16	16.50	16.80	17.10	17.60	18.10	18.70	19.40	20.20	21.20	21.80	22.90	24.00	25.10	26.40
AE Flood Zone (15' BFE)		15	15.50	15.80	16.10	16.60	17.10	17.70	18.40	19.20	20.20	20.80	21.90	23.00	24.10	25.40
AE Flood Zone (14' BFE)		14	14.50	14.80	15.10	15.60	16.10	16.70	17.40	18.20	19.20	19.80	20.90	22.00	23.10	24.40
AE Flood Zone (13' BFE)		13	13.50	13.80	14.10	14.60	15.10	15.70	16.40	17.20	18.20	18.80	19.90	21.00	22.10	23.40
EHW (1983 & 2012)		12.14	12.64	12.94	13.24	13.74	14.24	14.84	15.54	16.34	17.34	17.94	19.04	20.14	21.24	22.54
OHWM (approx.)		10.66	11.16	11.46	11.76	12.26	12.76	13.36	14.06	14.86	15.86	16.46	17.56	18.66	19.76	21.06
MHHW		9.02	9.52	9.82	10.12	10.62	11.12	11.72	12.42	13.22	14.22	14.82	15.92	17.02	18.12	19.42
NAVD88		0	0.50	0.80	1.10	1.60	2.10	2.70	3.40	4.20	5.20	5.80	6.90	8.00	9.10	10.40
MLLW		-2.34	-1.84	-1.54	-1.24	-0.74	-0.24	0.36	1.06	1.86	2.86	3.46	4.56	5.66	6.76	8.06
ELW		-7.38	-6.88	-6.58	-6.28	-5.78	-5.28	-4.68	-3.98	-3.18	-2.18	-1.58	-0.48	0.62	1.72	3.02

Attachment D – Preliminary Maps of Key Vulnerabilities to Sea Level Rise

Figure D-1. Commercial/Industrial Development Vulnerable under the Moderate Risk Profile

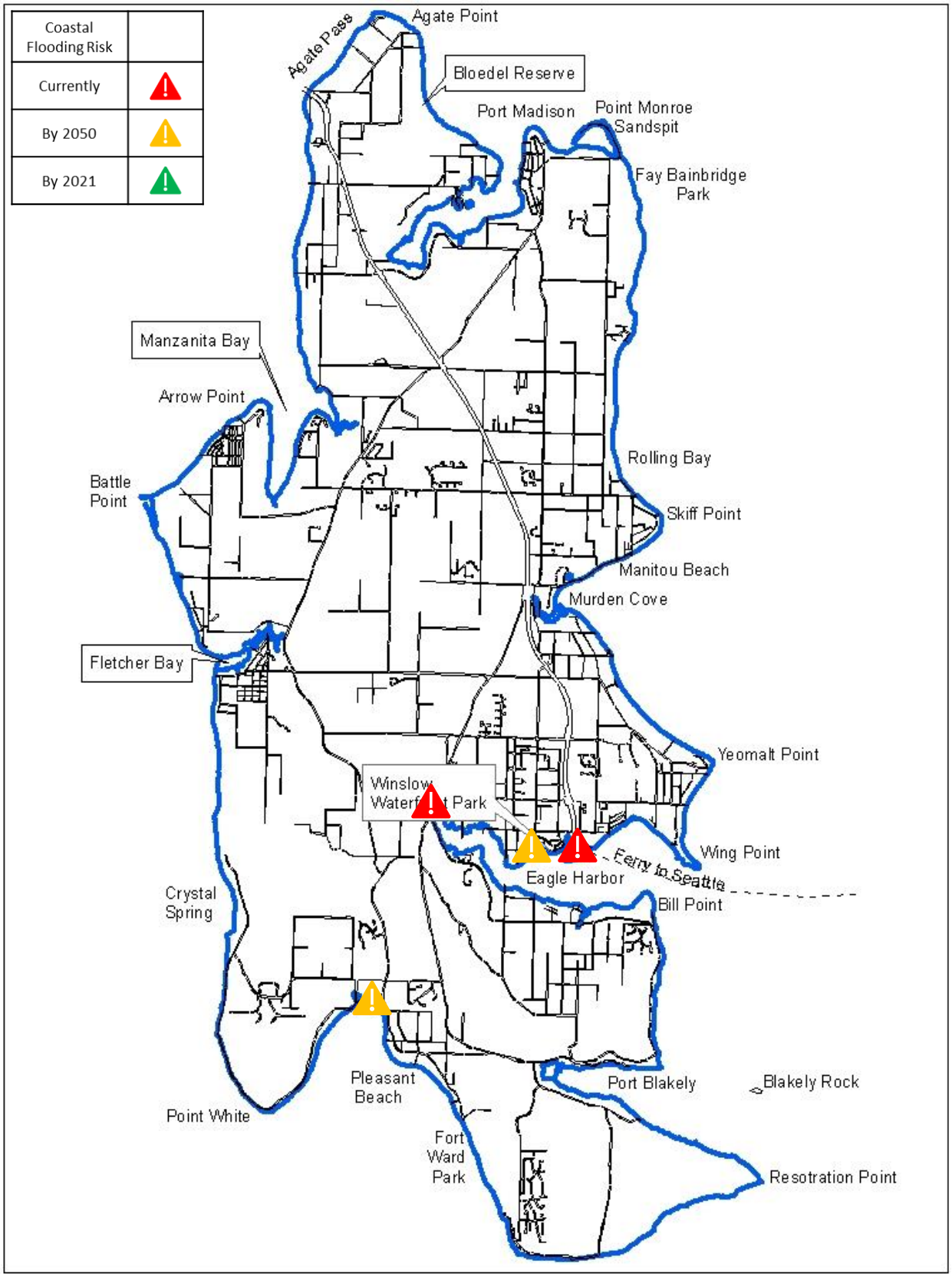


Figure D-2. Residential Areas Vulnerable under the Moderate Risk Profile

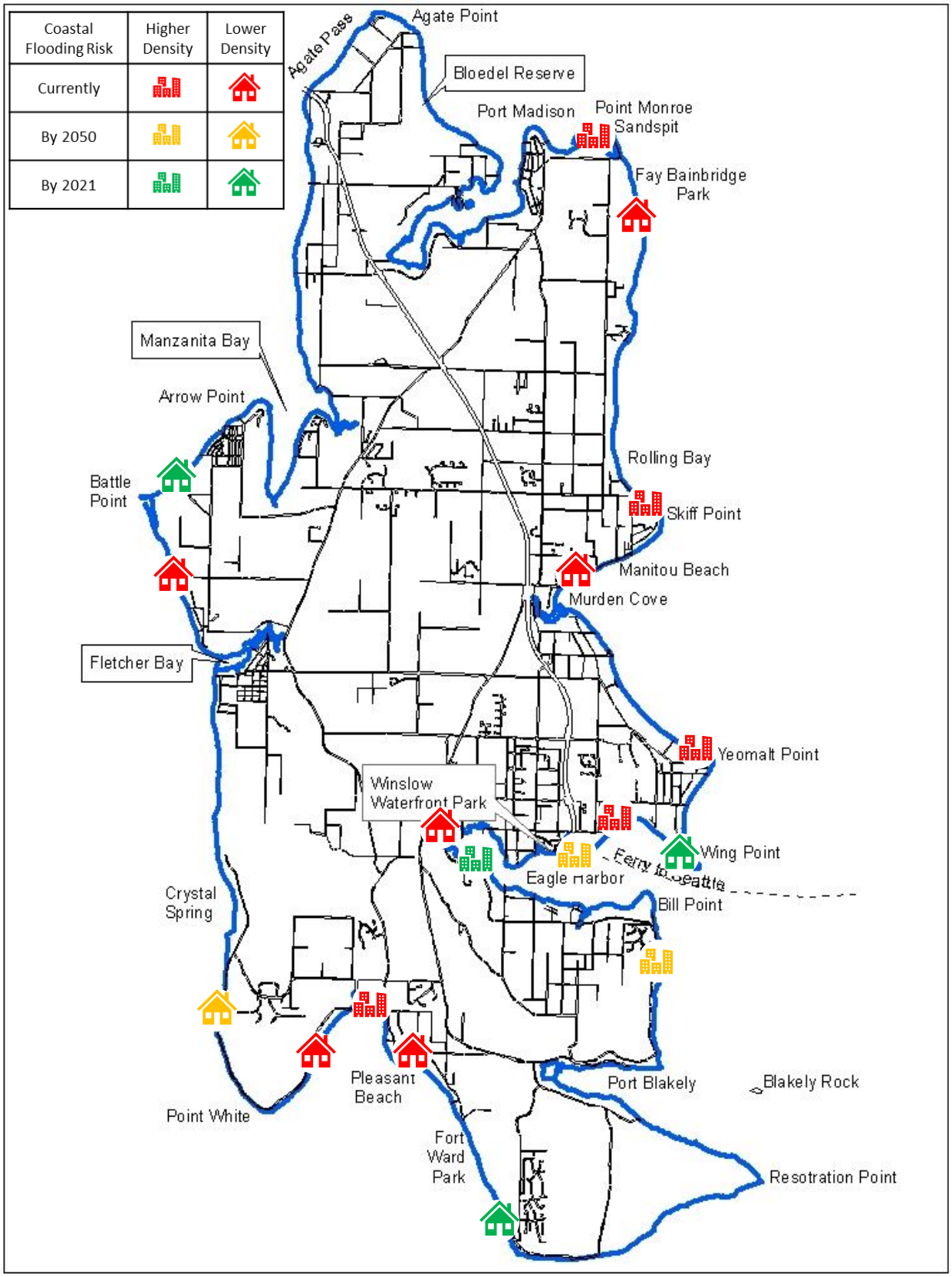


Figure D-3. Roads Vulnerable under the Moderate Risk Profile

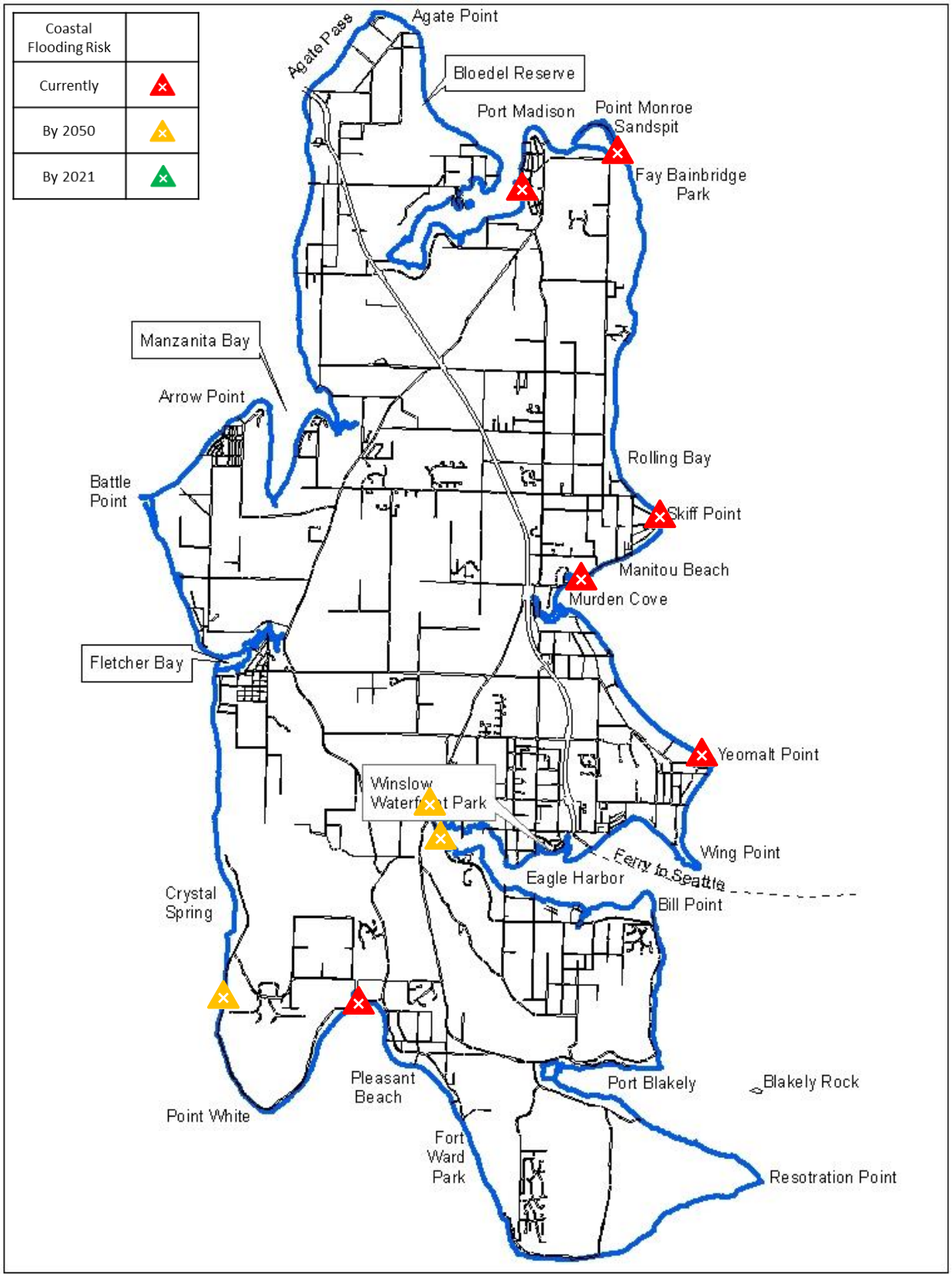
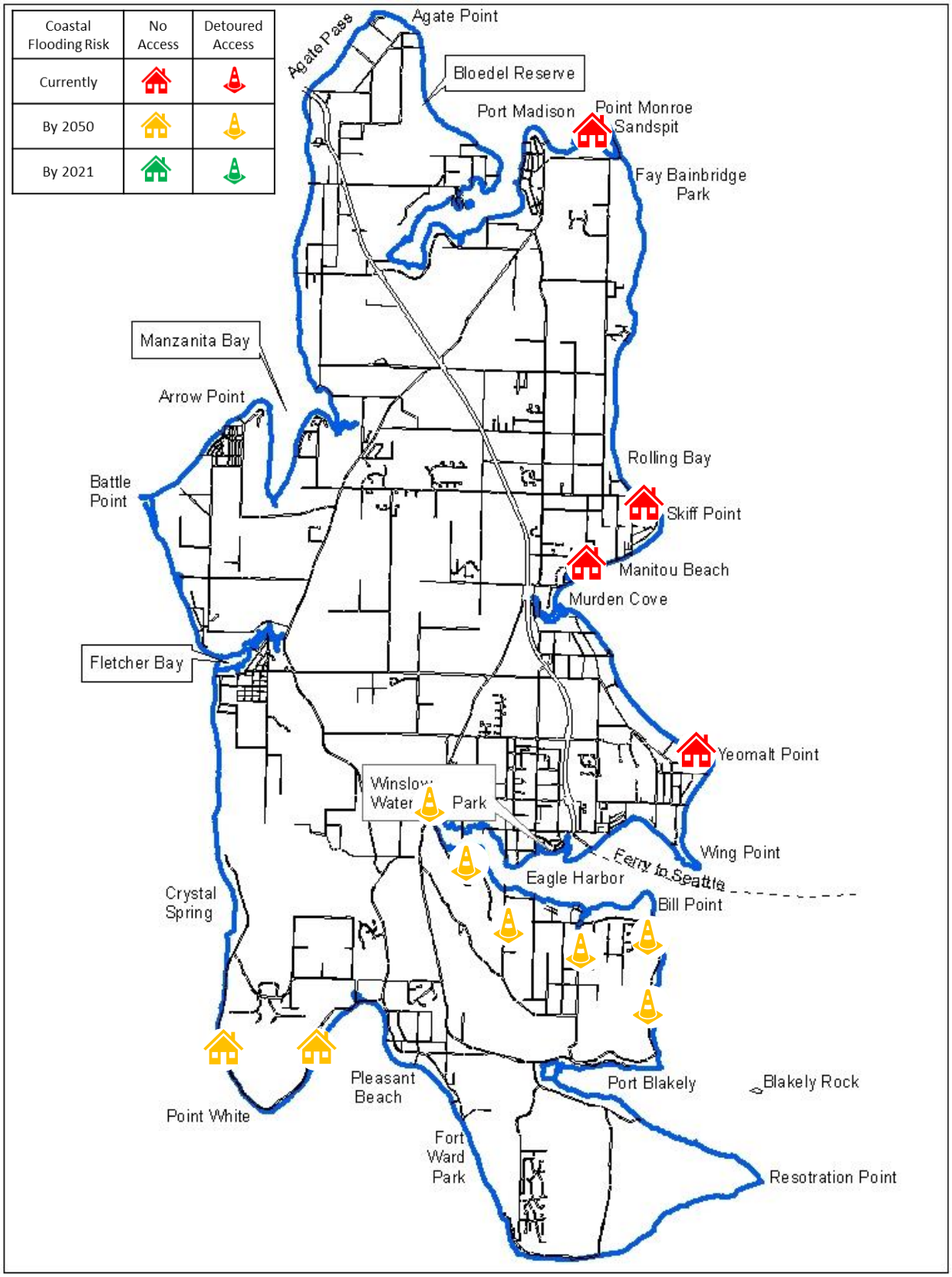


Figure D-4. Neighborhood Access Vulnerable under the Moderate Risk Profile



Attachment E – Island County Sea Level Rise Adaptation Best Practices Matrix

Island County Sea Level Rise Strategy Study
Best Practices for Sea Level Rise Adaptation

Appendix 2A: Best Practices Matrix

Strategy	Practice	Description	Community Applicability H - Historic Beach B - Coastal Bluff C - Canal	Timeframe S - Short-term M - Medium-term L - Long-term	Permitting P - permitted X - prohibited C - conditional SED - shoreline environmental designation	Scale I - Individual Homeowner S - Small Groups N - Neighborhood	Example/+	Location	Link
	PROTECT	"Protection" seeks to control natural systems through hard and soft barriers and reduces impacts on a "zone that would be impacted without protection."							
	Soft Protection Measures	"Green solutions utilize ecological and environmental principles and practices to provide flood protection, as well as reduce erosion and stabilize shorelines, while also enhancing habitats and improving aesthetics (as compared to hard solutions). Often, soft solutions are less expensive than hard solutions and lower in maintenance, but they are not permanent and are subject to erosion." (AI, 2018)							
	Soft Shorelines	Soft Shorelines are designed coastal areas that reduce shoreline erosions through the use of natural materials. They are often "gently sloping natural banks" that "protect coastal ecosystems, and help reduce storm surge strengths along the coastline."(AI, 2018) Designers limit the amount and type of hardscape elements used and emphasize the use of plants and sands. The goal is to return to or reinforce natural systems along coastlines.	H, B, C	S, M, L	P	I, S, N	South Bay Sponge Hampton Roads Sea Level Rise/Flooding Adaptation Forum Oylmpic Sculpture Park More information	Bay Area, CA, USA Hampton Roads, VA, USA Seattle, WA, USA	http://www.resilientbayarea.org/south-bay-sponge https://digitalcommons.odu.edu/hraforum/ http://www.weissmanfredi.com/project/seattle-art-museum-olympic-sculpture-park https://fortress.wa.gov/ecy/publications/publications/1406009.pdf
	Beach Nourishment	"Replacement of augmentation of beach sand removed by ocean waters." (Watson & Adams, 2011) May occur naturally or artificially.	H, B	S, M	P	S, N	Marine Park City of Del Mar Sea-Level Rise Adaptation Plan Local Coastal Program Update, Land Use Plan	Bellingham, WA, USA Del Mar, CA, USA Santa Monica, CA, USA	https://wdfw.wa.gov/sites/default/files/publications/01583/wdfw01583.pdf https://www.delmar.ca.us/DocumentCenter/View/3580/Revised-Adaptation-Plan-per-Council-May-21 https://www.smgov.net/uploadedFiles/Departments/PCD/Plans/Local-Coastal-Plan/LUP%20FINAL%20DRAFT%2011.19.18.pdf
	Hard Protection Measures	"Often developed by civil and environmental engineers, are flood protection structures that are (almost always) permanent. Hard solutions focus on controlling flooding and sea level rise... The downside of these projects is their disruption of ecological systems. They are generally expensive and require maintenance." (AI, 2018)							
	Bulkhead	"Wall or other structure, often wood, steel, stone, or concrete, designed to retain or prevent sliding or erosion of the land. Occasionally bulkheads are used to protect against wave action." (Watson & Adams, 2011) Similar to seawalls.	H, B, C	S, M	P/C	I, S, N	Marine Park Golden Gate National Recreation Area	Bellingham, WA, USA San Francisco, CA, USA	https://wdfw.wa.gov/sites/default/files/publications/01583/wdfw01583.pdf https://www.nps.gov/subjects/climatechange/upload/CAS_Case_Study_22.pdf
	Breakwater	"A structure that forms a harbor and basin to protect the shore from the effects of waves, as well as to provide a safe place for fishing vessels to berth." Functions to "calm water, reduce wave height, and prevent shoreline erosion." (AI, 2018)	C	M	C in Aquatic and High Intensity SED	S, N	Scape Living Breakwaters	Staten Island, NY, USA	https://www.scapestudio.com/projects/living-breakwaters-competition/
	Dikes	"A constructed wall or embankment along a shore to prevent flooding of low-lying land." (Watson & Adams, 2011) Also known as a levee.	H, C	S, M	C/X (in natural SED) P in High Intensity SED	I, S, N	Motorway Dike	Netherlands	https://www.holland.com/global/tourism/destinations/provinces/friesland/the-afsluitdijk.htm
	Dry Floodproofing	"prevents water from entering a structure through watertight designs." (AI, 2018)	H, B, C	S, M	P	I	University of Texas Perimeter Wall and Dry Floodproofing Project	Houston, TX, USA	https://www.fema.gov/media-library-data/1541615774329-170190ea05ddbbb6fdc5f1170a018d41/P-936_11-06-18_508r.pdf
	Floodwall	"Floodwalls are vertical artificial barriers, either temporary or permanent, designed to withstand waters from a river, waterway or ocean." (AI, 2018) "A floodwall can surround a structure or, depending on flood depths, site topography, and design preferences, can protect isolated openings such as doors, windows, and basement entrances, including entry doors and garage doors." (FEMA, 2007)	H, B, C	S, M	P/C	I, S, N	Mobile Floodwall	Grein, Austria	https://interestingengineering.com/mobile-flood-walls-keeps-austrian-town-safe
	Revetment	"(i) A facing of stone or concrete to protect an embankment or shore structure against erosion by wave action or currents; (ii) a retaining wall, typically sloped." (Watson & Adams, 2011) Includes riprap. Often material that is not anchored or has little anchoring like rocks placed on beach.	H, B, C	S, M	P/C	I, S	Cleveleys Coastal Protection	Cleveleys, United Kingdom	https://www.wyre.gov.uk/info/200485/coastal_defence/1293/cleveleys_coastal_defence_scheme
	Seawall	"Seawalls are vertical structures designed to protect habitation from major wave and tidal action." (AI, 2018) See bulkhead.	H, B, C	S, M	P/C	I, S	The Seawall	Vancouver, Canada	https://vancouver.ca/parks-recreation-culture/seawall.aspx
Protect	**Surge barrier**	"Surge barriers, fixed dam structures with movable gates, provide some of the highest levels of protection from coastal storm surge." (AI, 2018)	H, B, C	M	potentially C in aquatic SED	N	Marina Bay Barrage Lake Borgne Storm Surge Barrier	Singapore New Orleans, LA, USA	https://www.pub.gov.sg/marinabarrage/aboutmarinabarrage https://www.floodauthority.org/the-system/lake-borgne-surge-barrier/

Island County Sea Level Rise Strategy Study
Best Practices for Sea Level Rise Adaptation

Appendix 2A: Best Practices Matrix

Strategy	Practice	Description	Community Applicability H - Historic Beach B - Coastal Bluff C - Canal	Timeframe S - Short-term M - Medium-term L - Long-term	Permitting P - permitted X - prohibited C - conditional SED - shoreline environmental designation	Scale I - Individual Homeowner S - Small Groups N - Neighborhood	Example/+	Location	Link
Accommodate	**ACCOMODATE**	Accommodation allows natural systems to occur and "human impacts are minimized by adjusting human use of the coastal zone via changing land use/crop types, applying flood resilience measures, etc." (Zommers & Alverson, 2018)							
	Advanced Septic Systems	A system that uses a secondary treatment before releasing waste into leechfield.	H, B, C	S, M	P	I, S	Rhode Island Coastal Property Guide	Rhode Island, USA	http://climatechange.ri.gov/documents/rhode-island-coastal-property-guide-2014.pdf
	Anchored Septic Systems	Using concrete blocks or other anchoring materials to prevent septic systems from floating up from the ground.	H, B, C	S	P	I, S	Septic Tank Buoyancy Control Workshop, Infiltrator Water Technologies	Connecticut, USA	http://neiwpcc.org/wp-content/uploads/2019/04/Lentz_Septic-Tank-Buoyancy-101_040219.pdf
	Community Drainfield & other alternative on-site sewer systems	Placing septic tanks and drainfields away from coastlines and flood/erosion risk; either through community consolidation (e.g. cluster systems or alternative site design).	H, B, C	S, M, L	P	I, S, N	University of Rhode Island Cooperative Extension	Rhode Island, USA	http://cels.uri.edu/rinemo/publications/WW.CreativeDesignAndManagement.pdf
	Water supply diversification	Diversification of water supply to decrease coastal groundwater extraction rates. Includes on-site recycled water systems and service agreements for increased discharge at upland wells and well relocation.	H, B, C	S, M, L	P	I, S, N	Sea-Level Rise Impacts on Drinking Water: A Groundwater Modeling Study in Newmarket, NH	Newmarkey, NH,USA	http://www.strafford.org/cmsAdmin/uploads/final_groundwater-modeling-report_001.pdf
	Elevated Structures	A structure where "all or most of vital building infrastructure is raised above the flood line." (AI, 2018)	H, B, C	S, M	P	I	Perez Art Museum Seagate Rehabilitation & Nursing Center	Miami, FL, USA Brooklyn, NY, USA	https://www.yaleclimateconnections.org/2018/10/museum-protects-art-from-sea-level-rise/ https://toolkit.climate.gov/case-studies/engaging-stakeholders-planning-sea-level-rise
	Utility Relocation	Elevating or relocating septic and other at risk utilities.	H, B, C	S, M, L	P	I, S, N	Road Elevation	Florida Keys, FL, USA	https://www.miamiherald.com/news/local/environment/article197735369.html
	Floodable Plain	"Flat areas adjacent to a river or body of water that can be flooded when the water body's capacity is exceeded." (AI, 2018)	H, B, C	M, L	P - under ecological restoration	S, N	Cumberland Park	Nashville, TN, USA	https://www.nashville.gov/parks-and-recreation/parks/cumberland-park.aspx
	Floodable Square	"Floodable squares and parks are lowered urban areas that become pools during heavy rainfall or flooding from the sea or river." (AI, 2018)	H, B, C	M, L	P - under ecological restoration	S, N	Benthemplein Water Square	Rotterdam, The Netherlands	https://www.publicspace.org/works/-/project/h034-water-square-in-benthemplein
	Raised Ground (fill)	"A strategy that invites water to penetrate waterfront districts while elevating infrastructure such as roads to sustain human use during floods. This technique provides the opportunity for development for residential, office, hotel, retail, and transit uses." (AI, 2018)	H, B, C	S, M	C/P (grading and fill)	I, S, N	Hafencity	Hamburg, Germany	https://www.urbangreenbluegrids.com/projects/hafencity-hamburg-germany/
	Wet Floodproofing	"allows floodwater to enter and leave a structure through designated openings and thus requires non occupied space." (AI, 2018)	H, B, C	S, M	P	I	Burnham Hall	Lincoln, VT, USA	https://accd.vermont.gov/sites/accdnew/files/documents/CD/CPR/CPR-VERI-Toolkit-Floodproofing-CaseStudies.pdf
Retreat	**MANAGED RETREAT**	"Retreat" or "planned retreat" allows natural systems to occur without human intervention. "Human impacts are minimized by pulling back from the coast via land use planning, development controls, planned migration, etc." (Zommers & Alverson, 2018) In some cases, retreat many be an unavoidable response. However, "this option is economically feasible only if it is possible to relocate within their existing property, either to higher ground or with a greater setback from a flood source." (Watson & Adams, 2011)							
	On-Site	Relocating upland away from flood risk within property.	H, B, C	S, M	P	I	Rhode Island Coastal Property Guide	Rhode Island, USA	http://climatechange.ri.gov/documents/rhode-island-coastal-property-guide-2014.pdf
	Off-Site	Relocating upland away from flood risk to a different property.	H, B, C	M, L	P - requires land aquisition	I, S, N	Rio Bogota Flood Control Village of Soldiers Grove Managed Retreat at Surfer's Point Isle De Charles Resettlement	Colombia Soldiers Grove, WI, USA Ventura Beach, CA, USA Isle De Charles, LA, USA	http://documents.worldbank.org/curated/en/113621513887766611/Colombia-Rio-Bogota-Environmental-Recuperation-and-Flood-Control-Project-restructuring https://dma.wi.gov/DMA/divisions/wem/mitigation/docs/stories/Soldiers_Grove_LTerm_Benefits_Relocation.pdf https://www.arcgis.com/apps/MapJournal/index.html?appid=bea8d4142fcf47bc90078e845e296d64 http://isledejeancharles.la.gov/

Aquaculture Survey Results

Contents

Introduction

The City conducted an online survey between February 26, 2021 and March 26, 2021 as part of early policy input for an amendment regarding aquaculture during the City's Shoreline Master Program (SMP) Periodic Review. The survey was posted on the City's "Engage Bainbridge" SMP Periodic Review project webpage and was advertised:

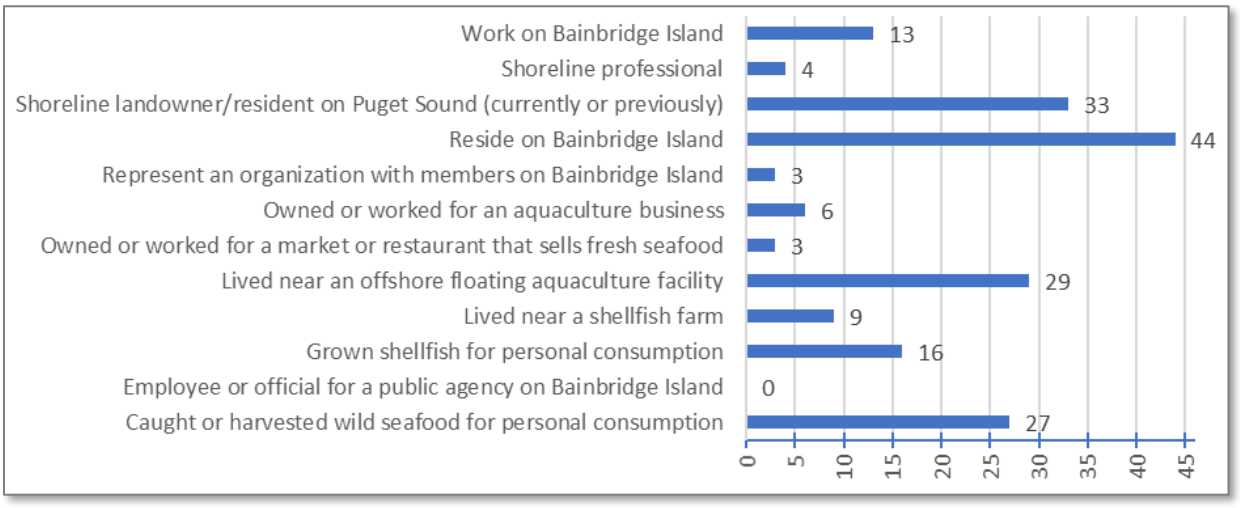
- In a banner ad on the City website homepage
- On the City's SMP webpage
- On the front page of the March 2021 COBI Connects newsletter that is mailed to every household on Bainbridge Island
- Via the 2/26/2021 City Manager Report weekly email which has a large number of subscribers
- Via email to 1,126 subscribers of the City's SMP notification list along with several other notification lists
- By forwarding the above email to 132 "interested parties" identified by staff
- Government-to-government letter to the Suquamish Tribe

Email reminders on March 25 and 26, 2021 included:

- 1,126 subscribers of the City's SMP notification list along with several other notification lists
- The 2/26/2021 City Manager Report weekly email which has a large number of subscribers

Who Participated?

A total of 66 responses were received. Respondents were asked to describe themselves by selecting as many of the following categories as applicable.



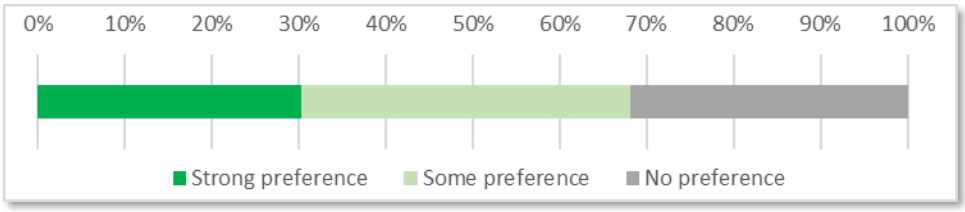
If applicable, respondents were asked to identify their organization. The following organizations were named.

Cooke Aquaculture
Native Trust
Northwest Aquaculture Alliance (NWAA)
Rich Passage Estates Homeowners' Association

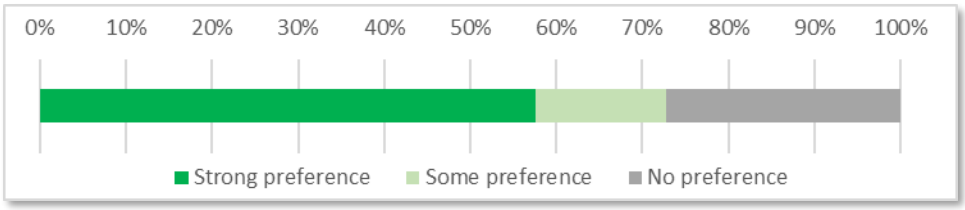
Seafood Preferences

All 66 respondents stated they consume seafood. All respondents were asked the following questions to understand seafood preferences.

Q: How much would you prefer that the seafood available in Bainbridge Island markets and restaurants be "locally" sourced? (Assume we are only considering seafood that can be grown locally and that the safety of the seafood is the same, whether locally sourced or not)



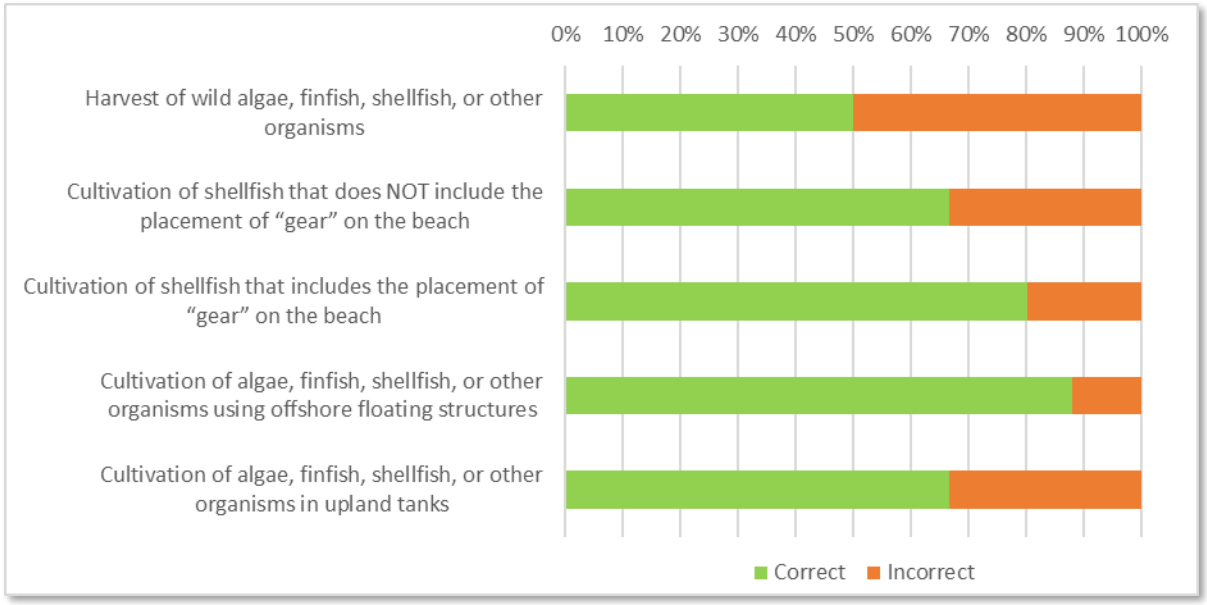
Q: How much would you prefer that aquaculture raised "locally" are native species?



Aquaculture Awareness

Respondents were asked the following question to measure awareness about aquaculture.

Q: Mark any of the following that you would consider to be an "aquaculture" activity?



Respondents were given the option to describe "other" types of aquaculture activities. The following are the answers submitted:

Cultivating shellfish on privately owned beaches is not any different than planting carrots in your yard. A lot of homeowners are growing shellfish for their own consumption on their private and taxed beaches using gear and no gear.
I think of Aquaculture as a commercial operation, not individual harvest of fish or shellfish
Many "wild" fisheries rely on hatchery production of juveniles and seeding in an upland aquaculture facility. Hatcheries are aquaculture facilities.

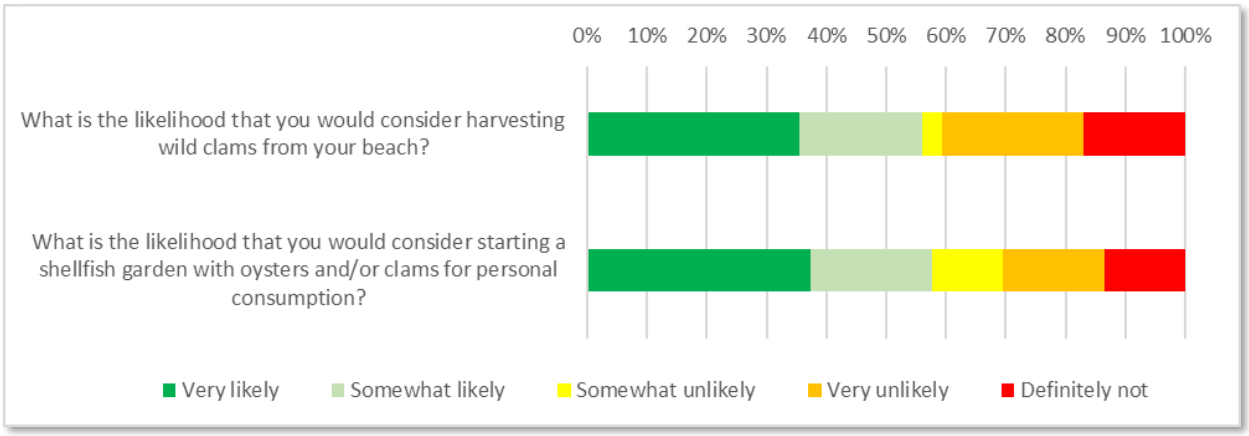
Intertidal Aquaculture Preferences & Concerns

Respondents were asked a series of questions regarding their preferences and concerns for intertidal aquaculture.

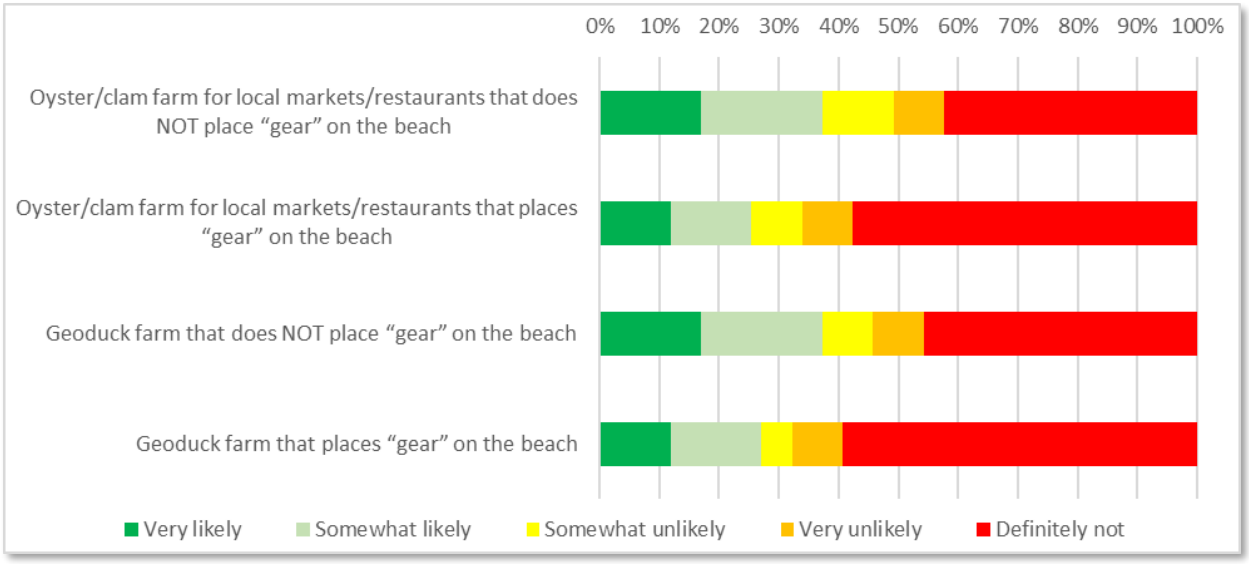
Instructions to Respondents

For the following questions, imagine you own shoreline property on Bainbridge Island with tidelands that would be suitable and safe for shellfish farming.

Q: What is the likelihood you would consider harvesting wild clams from you beach?
Q: What is the likelihood you would consider starting a shellfish garden with oysters and/or clams for personal consumption?



Q: What is the likelihood that you would consider leasing your tidelands to one of the following types of commercial shellfish farms?



Q: Describe what concerns, if any, you would have if a neighbor started a shellfish garden?

Anesthetics are a concern. And I like natural Shorelines undisturbed by bags of shellfish
Beach erosion
commercial activity on the shoreline
Debris and plastics related to aquaculture
Environmental impact, pollution, smell.
I am fine with my neighbors starting a shellfish garden on their own beach.
I am supportive of below water shellfish gardens. The problem with floating structures are they become an eyesore over time and smell.
I welcome neighbors starting shellfish gardens. Shellfish are proven to clean the water and improve the environment. I currently grow oysters in Eagle Harbor specifically for this purpose (not to eat).
I would not be concerned about a neighbor staring a shellfish garden of native species for personal use. It would be beneficial from the standpoint of encouraging the growing and consuming of food locally, thus reducing the need for transportation of food, which has a huge carbon footprint. Also, beneficial in conservation of local species in the Puget Sound.
I'd be unhappy but if it must be there, I'd want it to be legal and ecologically sound. But I would rather it not happen at all. I don't want the excretion in water that I, other locals and their children use recreationally. I don't want the additional sealife that the farm would attract.
If for personal use, I would not foresee a problem.
If handled and inspected properly, okay.
My beach is located next to the Cooke Net Pen. Others that have grown oysters found that they were filled with red worms. The water is polluted.
No concerns
No concerns at all. The oysters being used in our neighborhood are from Fisheries and Wildlife and are unable to reproduce therefore not affecting the local oyster population.
No concerns.
No concerns. I would help them.
None
None at all, but I'd like to know where you draw the line on invasive species since manilla clams, little necks clams and oysters are non-native.
None if for personal consumption. Shellfish each filter almost 50 gallons of water each per day. Great participation in the health of the Sound.
None what so ever
None whatsoever, as long as they shared the "spoils" with neighbors!
None whatsoever. I live in a neighborhood with family oyster shellfish garden. They are well tended and an excellent opportunity for community sharing, lessons for our children, and food sourcing.
None whatsoever. My neighbors have shellfish gardens and they are a benefit to the neighborhood. They share the oysters, teach our children about aquatic species, track their bags carefully. This is a wonderful intergenerational opportunity on Bainbridge Island.
None, if done safely with ecosystems in mind.
None.

Plastic and other pollution from materials that break off or break down over time. Any pesticides used to kill invertebrates like ghost shrimp. Any digging for planting or harvesting that disturbed intertidal habitat.
Properly maintain gear and source shellfish spat from licensed shellfish farm.
Species should be native
The introduction of non-native species. Use of feed, chemicals, pollutants.
The scale. Fine with it if not too big, but would not want a commercial operation run from my neighbors tideland.
What are the rules/regulations for starting a shellfish garden? Is my neighbor following them? What will be the nearby impacts?
Would prefer that a permit was required and standards were met

Q: Describe what concerns, if any, you would have if a <u>shellfish farm</u> started on your neighbor's tidelands?

Again, any floating structure would be involve "gear" with the exception of bags in the tidelands are an eyesore and typically smell.
commercial activity on the shoreline
Commercial aquaculture not appropriate on private (single family zoned) tidelands, just as any other commercial operation is not appropriate in a single family zone.
Commercial harvesting is a noisy distributive process to the native wildlife as well as the neighborhood.
Environmental impact to other species, smell, pollution
Habitat destruction if digging is involved, visual and noise issues with any. Anything larger than an adjacent homeowner's personal use does not belong in a residential area.
I do not care if others want to do it but we have our own shellfish garden and would not lease to others
I don't have enough information to answer the questions above.
I think that a commercial level operation for growing shellfish should be limited to tidelands that are a certain size, and perhaps take up a percentage of the tideland ownership, less than 100 percent. Not being familiar with the size of private tidelands that could potentially be leased for a shellfish farm off of Bainbridge Island, I find it hard to comment on this in general.
I would be supportive of my neighbor having a few bags of oysters or gathering wild clams. That sort of use of our property is what makes living here so special. It puts no strain on the environment. They are filter feeders and do no harm. I would object strongly if my neighbor leased any part of his tidelands or sold anything at all. We live in a residential area, NOT a commercial area. Additionally, I believe it is difficult enough for our ecology to support itself. I don't believe we need to put any more stress upon it. I strongly feel that we need to get rid of the fish pens immediately. They employ almost no one. Their vehicles are in poor repair and make a lot of diesel fumes. They make a tremendous amount of pollution. They sell everything out of the area. There are no benefits, NONE, to allowing them to stay in our waters. They are not good neighbors.

I'd worry about the increase in traffic and business activity on already small and congested shoreline roads.
Its unnatural. We need to retain and protect as much natural tidelands undisturbed as we can
No concerns
No concerns.
Noise, pollution, impact on local species.
None
None
None as its their property. But I am on Rockaway Beach and I worry that anything from my beach is polluted by Creosote.
Not sure that the tidelands are suitable as they border a net pen facility. Some of the tidelands are owned as a group and not individually.
Nothing really important comes to mind
Ok
Only if commercial
Plastic and other pollution from materials that break off or break down over time. Plastic tubes in the mud for planting geoducks (leaching, microplastics, etc.) Any pesticides used to kill invertebrates like ghost shrimp. Any digging for planting or harvesting that disturbed intertidal habitat.
Smell, gear, destruction of native species
Species should be native
That the neighbor would follow the same criteria that I follow on my own tidelands.
The intrusion of the commercial aquafarmers themselves. The noise they create from their boats, doing their actual aquafarming and their daily presence is from first hand experience intrusive. Native aquafarmers farm Geoducks off our tidal waters and they are very intrusive. Loud when they are yelling instructions to each other, multiple boats on site at one time (ie 3-4 or more). Foul language being used. They conduct their farming throughout the entire day for the full duration of open season and they are not only disruptive to the serenity of the area for local residents but for the wildlife (ie for the sealions and seals that would ordinarily be passing by the area). Their presence changes the natural flow of activity for the time they are here.
The only concern I have in our tidelands is the cleanliness of the water if we were in pristine condition. I would welcome it.
Too many people disturbing the beach
Upsetting balance of ecosystem, gear and debris. I have witnessed lots of shellfish debris loose along the shores of hood canal.
We would be concerned with a commercial shellfish farm that might endanger the farms of our local residents.
Would prefer it in public tidelands owned by the city

Offshore Aquaculture Perceptions and Concerns

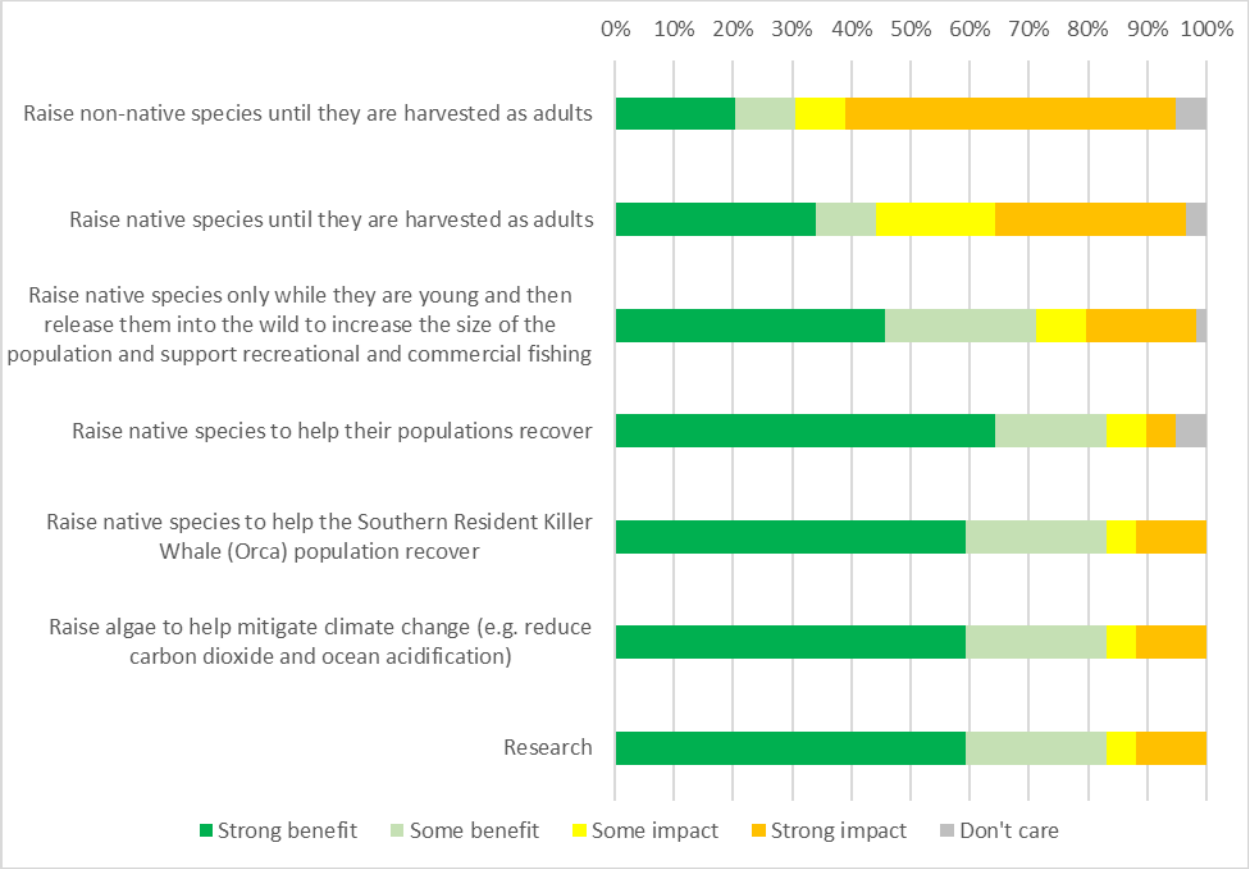
Offshore aquaculture falls into a management area called "shorelines of statewide significance". This is an area where the City's SMP can only consider statewide interests. The following questions were asked to understand how respondents perceived certain types of aquaculture as benefiting or impacting statewide interests.

Instructions to Respondents

For the following questions:

- Consider the economic, ecological, and cultural significance of each activity to the Puget Sound region and the state.
- Assume they would occur in an offshore location utilizing a floating structure.

Q: How much do you think the following types of aquaculture activities benefit or impact the greater interests of our Puget Sound region and the state?



Q: Describe any concerns, if any, you would have about offshore floating aquaculture?

Absolutely not! Too harmful to the ecosystem
Although I agree bringing native species “back” is a strong benefit, if it can only be done in offshore floating fish pens, it continues to be impactful due to the nature of crowding, disease, and discharge when growing to adult size in these conditions. Let’s bring native species back without the use of net pens.
Any human influence in our seas/oceans is a concern.
Both food and drugs used in farming are detrimental to the environment. "Accidental" release of farm fish is another problem for native fish.
Concentration of waste, risk of escape, risk of spreading disease
Concern about commercial activity that is not properly monitored and maintained.
Concerned about fish pens where non native species might get out. Not so worried about oyster bags. But might be a good idea to develop well-thought out design standards for floating shellfish aquaculture.
Current hatchery programs to raise and release native populations only have limited effect. Cultivating fish in net pens except for during a limited time during their juvenile development would only increase the negative impact. Currently, Steelhead are endangered and the EPA has documented that net pens have some impact on wild populations. Before endangered species are cultivated additional research and an Environmental Impact is needed. Diseases, feces, uneaten food, and heavy use of medicated feed have negative environmental consequences. I have limited knowledge about shellfish but am concern regarding commercial methods of harvesting, use of plastics, and chemical. Raising algae and other plants sounds like a good idea.
depends on what is being raised and the amount of pollution is released into the water
Done sustainably, with proper oversight, I do not have any concerns. We need to stop buying seafood from foreign countries!
Eyesore; risk of escaping fish
Fecal water pollution, antibiotics release into Sound, smell, somewhat unsightly (see existing Cooke fishpens- which are not too bad, actually.)
Fish aquaculture is not clean farming. The fish produce a lot of feces which cannot be fully contained in the tanks, thus polluting the local waters. Sea lice and illness are more prevalent among the tanked/farmed fish. The quality of the meat of the fish has been questioned by some scientific experts. Much thought and consideration needs to go into making a decision to continue to support existing commercial fishing business and setting up future ones. If the fish tanks are used to raise locals species of salmon for example from fry into young adults to be returned to the wild, then the positive returns may outweigh the negatives. The Orca population is struggling as we know. Bridges and manmade waterways in the Sound along with considerable water traffic (tankers, ferry and commercial fishing as well as tour boats) all have taken their toll on the Orcas and will continue to do so without consideration of what can be changed... ie limiting both commercial and sight seeing boats on the water for example. There are a lot of pros and cons to aquaculture!
Gear
Humane treatment of animals, disease, pollution, impact on other species
I am against all offshore floating aquaculture.

I am concerned that misplaced attitudes about floating aquaculture will result in Washington not being a leader in the area, loss of rural jobs, loss of a local supply of sustainable seafood, and increased reliance on imports and/or harvest of wild fish stocks that cannot support the level of demand for protein.
I think it is a great idea. Supports many coastal areas. As a kind of centralized operation, it provides a ton of trickle down to many other vendors and service providers. It's certainly better than the cumulative effects of commercial fishing.
I think offshore floating aquaculture could be beneficial in that it takes some of the pressure off of commercial fishing in the Puget Sound, thus benefiting Orca's and other species that rely on salmon. I think fish pens should not be located in areas where the water cannot flush out the pollutants of these operations. They are an industrial source of contaminants in the water, and should potentially be treated as a point source pollutant.
I would need more details before I would be in favor of research use, but I am opposed to doing the "raising" in residential areas. If there are areas where people do not live or play on the island, I would need to know the impact before agreeing to it, but I might. NOTE: Above I checked strong impact meaning negative impact. You didn't have fair choices.
Interference with native sea life; contamination; excessive light and noise; lack of proper oversight; risks of damage too high
It's ugly and why would I want to eat farmed salmon?
Many concerns about impacts to environment, critical habitat and listed and protected species.
My last comments stand. The offshore floating aquaculture are a polluting BLIGHT that provides the local residents nothing but harm. That means the humans, the fish, sea lions, other fish, etc. The company sells everything off-shore, they drive huge trucks into the neighborhood, they do not maintain their vehicles well and they gush diesel fumes. They attract a tremendous number of sea lions who make a lot of noise pollution for the immediate neighbors (check the decibel level.). The amount of food waste and fecal waste those fish pens disgorge into our water is unconscionable. The number of dead fish is staggering. They provide no benefit to the local community, the at-large community, the ecology or the economy. Please get RID of them.
Need to be banned. They are filthy, disease racked feedlots that destroy the environment and threaten native wild fish with their diseases, lice, and attraction of predators
No concerns
No concerns. Norway appears to be able to farm fish safely and profitably. I believe the same thing could be done in the Puget Sound. https://www.fishfarmingexpert.com/article/world-s-first-offshore-fish-farm-arrives-in-norway/ World's first offshore fish farm arrives in Norway
None
None
None for native species
None really. I know we have a lot to learn, and I would like our region to become a global leader in this valuable life sustaining green technology. The way we learn is by doing. We need to monitor what we do closely, but if we donâ€™t participate, we are likely to be left behind.
None, if done safely
None, if properly managed.

None. We need to farm the oceans if we want to have food to eat, reduce carbon levels and take pressure off of wild fish and shellfish populations. We have shown repeatedly through out human history that we can quickly "over harvest" the amount of natural production in the environment and deplete these population to the point of extinction.
Non-native species in net pens are being phased out due to recent legislation. (WDFW also testified that the bill should also prohibit native species.) Raising native species has a strong negative impact as they have the potential to weaken the gene pool, risk of escapements, pollution from facilities from uneaten food and antibiotics, fish feces, possible viruses and diseases and transmittal to other fish including threatened and endangered species, false attraction of fish, birds and marine mammals. EPA has recently determined that marine net pens are likely to adversely affect (LLA) several species including Puget Sound Steelhead and Chinook Salmon. The costs to the state to monitor and control the marine pen industry do not justify its use of state waters. ($500,000 to inspect pens after the Cypress Island collapse) Cooke Aquaculture Pacific has a history of non-compliance here and paid the state $400, 000 in fines and an environmental group a $2.75 million dollar settlement. The product is not consumed in WA State, the profits go to a Canadian Company which provides minimal employment here and has lost leases in the state. Raise native species only while they are young and then release them into the wild to increase the size of the population and support recreational and commercial fishing...here are we assuming a form of sea ranching? Raising native fish in net pens may not have the desired result or correlate to Orca recovery. Research is needed as WDFW's decision to allow native fish in net pens is based on a decades old Environmental Impact Statement minimally updated for the endangered species act. An updated EIS is critical but most likely circumvented due to the costs.
Not sure
Nutrient pollution, BOD, aggregate and concentrate predators in unnatural numbers and locations
Pacific oysters are non-native but naturalized to the PNW over the last 100 yrs plus.
Please do not allow offshore floating aquaculture. Fish pens should only be on land. Fish pens in the Puget Sound are riddled with ecological issues that are not healthy for the Sound nor the wildlife that populates the Sound. This is an issue that affects who I vote for.
Pollution
Pollution from floating aquaculture is my primary concern.
Pollution of Puget Sound waters. Noise and pollution near residential areas.
Pollution, unsightly, noisy, fish are fed toxic chemicals, risk of releasing non-native fish
Raising fish or animals in offshore pens that require concentrated application of food, pesticides, etc, does not belong in the coastal waters of this heavily populated region. These types of activities need to be done on land, where the water can be treated and reused, not released into the environment.
Releasing fish into the wild will have negative impact if fish are not healthy and make wild fish sick.
Relying on wild seafood forces the state and commercial interests to focus on protecting the entire ecosystem. My main concern is that increased aquaculture will reduce the incentive to protect rivers, tidelands and Puget Sound. I would also be concerned about escaped non-native species

Should not impede maritime navigation.
Siting, disease transfer, water quality, fish escape, food sourcing, and marine mammal impacts. Non-native finfish have, in multiple cases, introduced new parasites and harmful fungi that have caused severe damage to ecosystems. Excess feed, feces and antibiotics that leak from densely packed fish pens have quantifiable negative impacts on the surrounding environment. All aquaculture operations should be considered point sources under the Clean Water Act and be required to obtain a discharge permit. The ecological sustainability of cultivated fish is largely dependent on the sustainability of forage fish fisheries. Aquaculture companies should be required to publish reports with the complete traceability of all aquaculture feed products. In addition, aquaculture operations should only be stocked with eggs, larvae, or juveniles from pen-raised lineages, in order to avoid the need for wild capture. Fish escape. Risks to marine mammals. Areas with high risk of interactions with marine mammals and turtles, particularly ESA-listed population segments, should be excluded from offshore aquaculture development. That includes the Southern Resident orcas, which frequent our waters in Puget Sound.
Smell, eyesore, needs to be marked appropriately to avoid danger to watercraft.
Strong concerns - this should not be allowed
The issues with the non native failures are disturbing
There aren't enough of aquaculture sites
They bring sea lions and look ugly and noisy and ruin the landscape
Threat to navigation and potential pollution
Waste and disease from the pens can impact native fish. Pens can also attract an excessive number of sea lions if not properly shielded.

Additional Thoughts

Q: Please add anything else here that you would like to share on the topic of aquaculture. (Optional)

I believe the COBI should let the state regulate the fish farms that are in state waters and if it wants to it can prohibit shoreside support facilities. I just don't see why we do that and if the businesses want the pens on the state waters they can support them from elsewhere. If a neighbor wants to grow some bags of oysters on his or her beach for personal consumption that should be their right.
Any attempt to restrict raising shellfish for my personal consumption on my private property will be met with legal challenges and restriction of access to anyone walking the beach above the mean low tide line.
Any restrictions placed on aquaculture should be reasonable and fair. I strongly oppose preventing the use of oyster bags unless there is a viable alternative.
Aquaculture in my mind is no different than terrestrial agriculture. We are used to seeing agriculture on land and generally have a favorable view of farming on land, but when it comes to farming in the water, people are not used to seeing it and therefore don't understand it. We should be growing more of our food locally, both on land and in the sea and not relying on importing our food from overseas. Local food production will reduce energy use, carbon emissions, and increase local food security.
Aquaculture is the way of the future to help feed our nation. We can use aquaculture to help rebuild stocks of pacific salmon that would benefit to have better recreational and commercial fishing. Also by improving pacific salmon stock it help feed the orca populations.
Aquaculture isn't just about farming anymore, it should be considered a tool for helping restore our local salmon and steelhead runs, the staff that run these facility are some of leading experts in the world in salmon husbandry and biology.
Commercial shellfish farms are a legitimate issue for city government. Regulating shellfish gardens on owner property is not.
Fish farms should not be in the here
Good option to help replenish our ocean.
I am concerned about 1) the noise caused by noisy equipment, and an influx of harbor seals and sea lions around fish pens, 2) the impact of concentrations of fish feed on the under water environment, 3) beach erosion.
I am extremely against aquaculture, especially floating finfish pens, as they are VERY polluting. I think artificially growing seafood of any kind should be done onshore only.
I am hopeful the COBI will disassociate itself with all fish pens in the area.
I am ok with my neighbors using their Beach for personal consumption of shellfish. However, I am against all commercial operations.
I do not believe that fish farms belong in residential neighborhoods, or those heavily used for recreational purposes.

I do not think the shoreline plan should be amended to prohibit individual property owners from responsibly growing oysters in bags on the beach, as I see no negative impact from this activity. I was a volunteer Planning Commission for Kitsap County for many years, and have worked in Land Use Planning for the Suquamish Tribe and Snohomish County for several years. Through this work I am familiar with the planning process and the various interest groups. In general I have not been a supporter of the Private Property rights groups that challenge the City's Shoreline Management Plan, and I support protection of shorelines, including limiting bulkheads and similar shoreline structures. Prohibiting private landowners from growing shellfish on the beach seems like a policy that has little or no benefit to our shorelines. In addition, I think such a overreach would lead environmentally responsible shoreline owners who are currently not supporters of Private Property rights groups which challenge our shoreline management plan, to consider supporting these organizations that challenge the plan. Responsible shoreline owners who care about the environment, should not be disenfranchised by overreaching policies in our shoreline management plan.
I hope that COBI does not launch another effort to ban shellfish bags around Bainbridge. I know there are still some that want this to happen, believing this is the solution to all plastic waste - it is not. I've had my oyster garden going on 15 years. I still have the same 5 bags I started with. It's not that difficult to maintain a system that functions without creating waste. Thanks for listening.
I hope that this study does not generalize. A few bags of oysters, filtering water is orders of magnitude less impactful than any commercial operation.
I support the City Council's Resolution No. 2020-18 which supports an alternate lease proposal for the aquatic lands in Rich Passage that are currently leased for commercial finfish aquaculture. I would prefer that this acreage be either return to nature or used for restorative purposes.
I think there is confusion among some island residents about why an amendment to the current Aquaculture section of the SMP is deemed necessary. It would be useful if the City provided a clear statement explaining why this effort is being undertaken, and what the expected public benefit would be.
It needs a lot more research with regard to adverse impacts to the environment.
It seems as though there is much to do about nothing when it comes to restricting private oyster farming on private property for personal consumption. I have yet to read a study that demonstrates the negative economic impact and negative environmental impact from doing so. Not everyone who lives on the shoreline chooses to farm oysters and those that do are very conscientious of what they are doing. These "farmers" are stewards for the environment. They are on the beach checking their oysters, assessing the beach as they do so, connecting with their neighbors... it's like a "neighborhood watch for the shoreline".
It would be nice if there were a company that sold locally sourced or grown seafood here on the island. There was a place in the San Juans where you could buy shellfish on a dock. That was nice and didn't see like a bad use of the property/neighborhood. However, the fish pens on the south end are not the place. Cars have to drive through a narrow street with houses close to the street to get to the fish pens or down a one lane road. That is not where we need a commercial building. The fish pens need to go and not be replaced with another polluting, noisy, blight of a business. Thank you for taking the time to read my thoughts
Move floating net pens to onshore tanks to raise any type of finned fish both non-native and native so effluent can be controlled. They are disgusting filthy feedlots

Sentiments of nearby residents and others are echoed in Resolution No. 2020-18 which supports an alternate lease proposal for the aquatic lands in Rich Passage that are currently leased for commercial finfish aquaculture for the “purposes of restoring these aquatic lands to their natural state and restoring full access of these aquatic lands for the public's full benefit, use, and enjoyment”
The fish farm on the south end of Bainbridge Island was started long before the homes were build near the facility. People that buy land next to a pig farm, fish farm or shooting range and then complain about the smell or noise should have purchased property somewhere more to their liking. Council should not force a business to leave because people moved in afterward and now are complaining. If Council is going to do something than put a form in the permitting process that says "yes, I know the fish farm exits and I have no objection to its presence near my home." If a fish farm business fails to follow fair regulations than the State of Washington should put its license, but Bainbridge should not regulate a business off the Island because of gentrification.
The US currently ranks 16th in the world in terms of aquaculture production--behind countries such as China, Thailand, Vietnam, and Norway. Aquaculture has become a very sustainable industry, and the time has come for the USA to become food-secure by producing our own food, and relying less on imports.
We live on Rich Passage which has been contaminated by Bremerton Naval Shipyard activity. Net pen fish flesh has a clay grey color due to the food the fish are fed. The fish fillets are dyed pink to make them saleable.
We need to return all of our waters for native spices and eliminate fish farming of genetically altered fish.
We understand the concerns about large commercial facilities on Bainbridge Island. There should be no concern about personal shellfish gardens on our own tidelands. Next thing you know you will be trying to regulate what kind of kale we can have in our garden.

Flooding from Sea Level Rise Survey Results

Contents

Introduction

The City conducted an online survey between February 26, 2021 and March 26, 2021 as part of early policy input for an amendment regarding flooding from sea level rise during the City's Shoreline Master Program (SMP) Periodic Review. The survey was posted on the City's "Engage Bainbridge" SMP Periodic Review project webpage and was advertised:

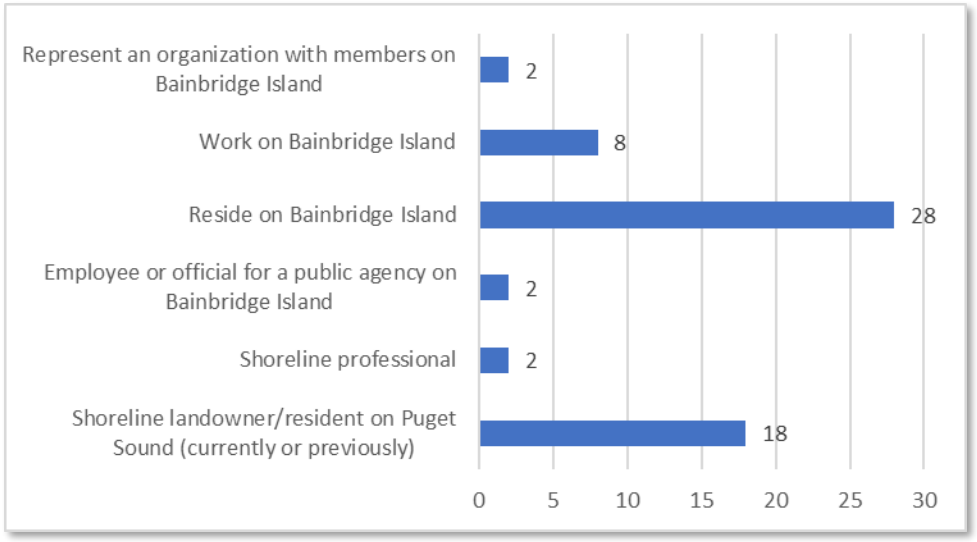
- In a banner ad on the City website homepage
- On the City's SMP webpage
- On the front page of the March 2021 COBI Connects newsletter that is mailed to every household on Bainbridge Island
- Via the 2/26/2021 City Manager Report weekly email which has a large number of subscribers
- Via email to 1,126 subscribers of the City's SMP notification list along with several other notification lists
- By forwarding the above email to 132 "interested parties" identified by staff
- Government-to-government letter to the Suquamish Tribe

Email reminders on March 25 and 26, 2021 included:

- 1,126 subscribers of the City's SMP notification list along with several other notification lists
- The 2/26/2021 City Manager Report weekly email which has a large number of subscribers

Who Participated?

A total of 30 responses were received. Respondents were asked to describe themselves by selecting as many of the following categories as applicable.



If applicable, respondents were asked to identify their organization. The following organizations were named.

Bainbridge Island Watershed Council
Bainbridge Island Parks & Recreation
City of Bainbridge Island
Weed Warriors for native plant restoration. Affiliated with Sustainable Bainbridge

First Thoughts

Respondents were asked to share a few words that come to mind about sea level rise to understand what may be "top of mind" on the topic.

Q: What words come to mind when you think about sea level rise?

Climate change. Extreme weather.
climate change; unavoidable
Coastal cities at risk; significant population shifts
Coastal erosion
Coastal flooding, habitat loss, salinity changes to streams/groundwater, and Erosion or depositing of material in waterways.
Danger to infrastructure, people not able to get water, electricity or sewage, danger to homes, lives, and livelihoods, lowered property values, mandatory to sell property to escape issues on the island and move somewhere else to protect investments.
Destruction, loss of land area
Disaster
Economy. Social. Impact
Erosion, landslides
Flooding, increase in slope instability along the shoreline, increase in liquefaction risks, critical infrastructure in danger.
Flooding, retreat
Get to preparing or start treading water
Global warming
Global warming. Coastal flooding. Weather severity.
How to protect my home and land
I live on one of the highest hills on Bainbridge Island.
Inevitable
inevitable in the short term.
inevitable, costly, destructive and dangerous
Insurance, sewer, septic, retreat
Is this an issue that is appropriate for the COBI to be worried about NO!
NOT A PROBLEM! .6 feet in 100 years? Even 100yr forecast is easily manageable.
Opportunity
Prepare
property damage, flooding, loss of intertidal habitat, shrinking shorelines, shoreline destabilization, erosion
Sea level rise is happening, but predicted rates of rapid acceleration due to global warming are still hypothetical.
So what
water

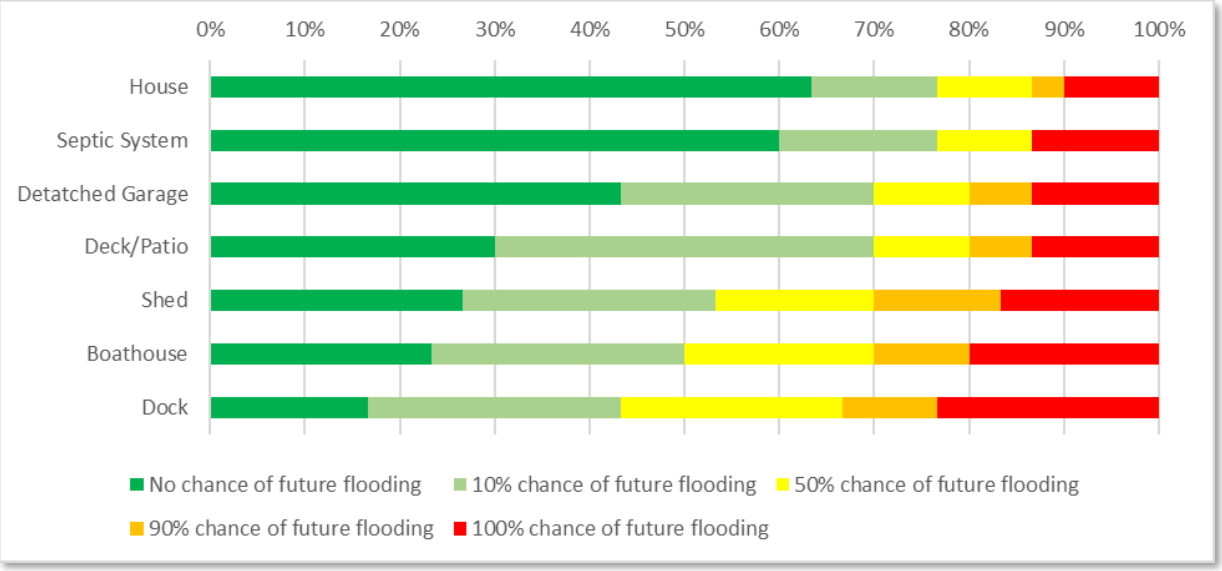
Property Risk Assessment

Respondents were asked to assess the risk of sea level rise to certain types of private residential development for the purpose of understanding risk tolerance and about future property values to understand public perceptions.

Instructions to Respondents

Imagine you are building or buying a home on a low-lying shoreline susceptible to future flooding from sea level rise.

Q: What level of future flooding RISK would you tolerate when making that investment? Please consider each of the following structures as if the future flood risk would occur at some point during its functional lifespan.

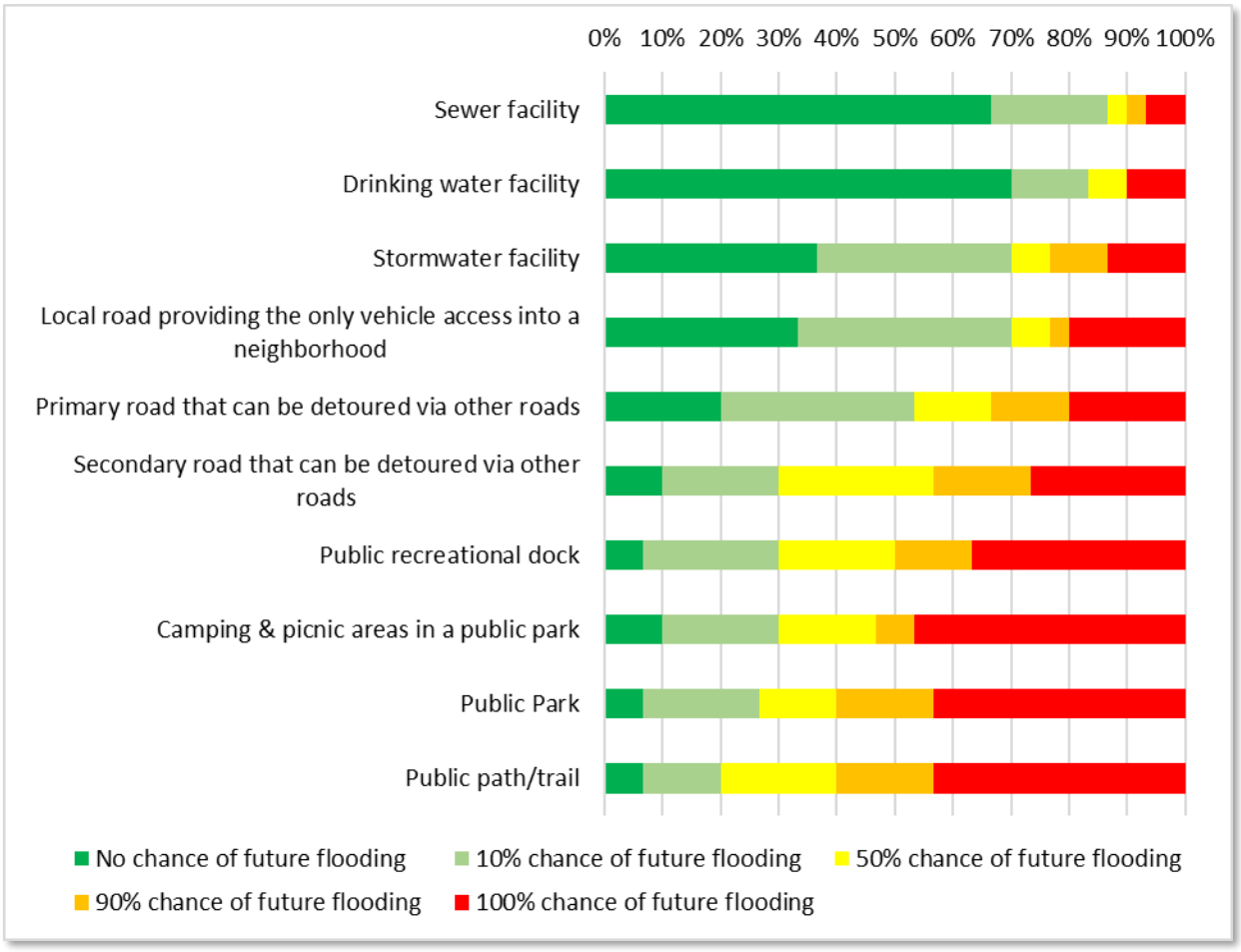


Q: What do you think will happen in the future to the VALUE of property located in low-lying areas susceptible to future flooding from sea level rise?

Community Infrastructure Risk Assessment

Respondents were asked to assess the risk of sea level rise to certain types of community infrastructure for the purpose of understanding risk tolerance.

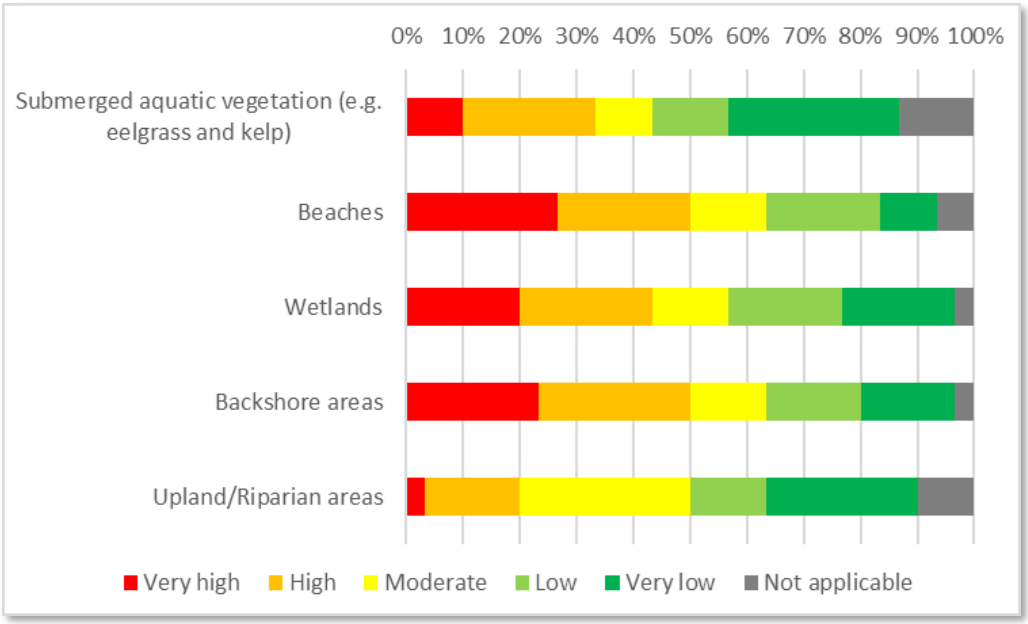
Q: What level of future flooding RISK would you tolerate for the following types of community infrastructure?



Ecological Risk Assessment

Respondents were asked to assess the risk of sea level rise to certain shoreline habitats for the purpose of understanding perceptions of ecological vulnerability.

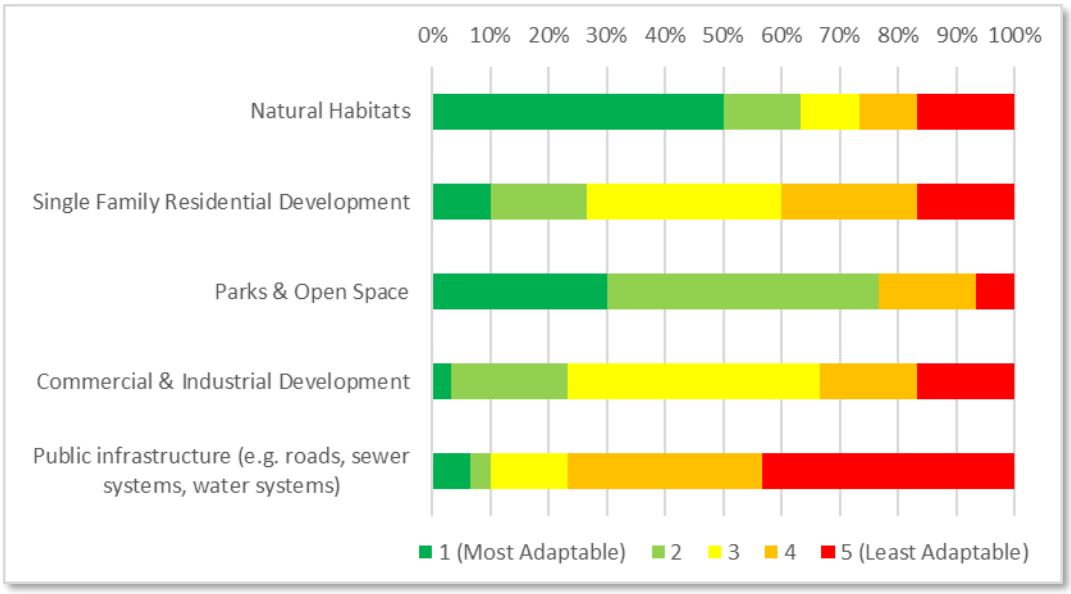
Q: How would you rate the RISK to the following shoreline habitats from sea level rise?



Adapting to Sea Level Rise

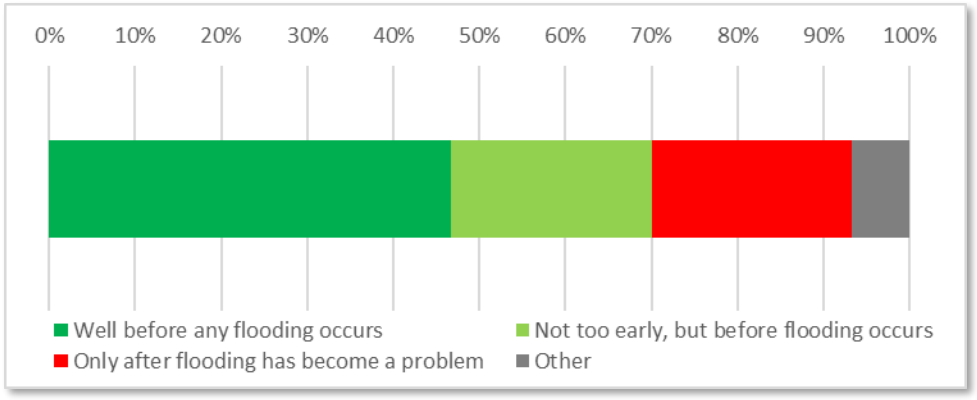
Respondents were asked a series of questions related to adaptation to sea level rise for the purpose of gaining an understanding of perceptions, risk tolerance, and ideas for adaptation.

Q: In general, how would you rank the ADAPTABILITY of the following to sea level rise in a low-lying shoreline area? (1st being the most adaptable & 5th being the least adaptable)



Private Development

Q: In general, when do you think ACTIONS should be taken to adapt PRIVATE DEVELOPMENT in low-lying areas to sea level rise?



The “Other” responses included the following:

During the COBI permitting process. Facilities built in a flood plain should not expect public revenue to bail them out when a flood occurs.
FEMA has millions of dollars to study this issue and we should rely on them...NOT COBI!

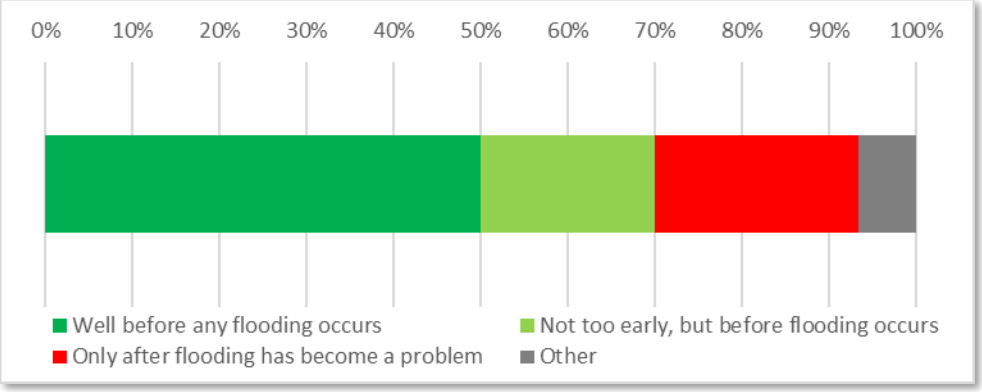
Q: What types of ACTIONS do you think will need to be implemented to adapt low-lying PRIVATE DEVELOPMENT to sea level rise?

Allow for hard and soft bulkheads to be built.
As long as the owner knows no public money is going to be used to prevent flooding of the property if built in a flood prone area than I don't care what the builder does. Just don't ask me to pay for damage later if the property floods.
Assistance with raising the homes and barriers.
Better insurance structures and more resources to help people adapt with existing infrastructure. Collaborative engagement with municipalities and public services in order to navigate the threats and challenges of sea level rise. Better homeowner education and updating regulations to better incorporate sea level rise into zoning and development regulation.
Building codes
Confirm future access by public roads before new houses are allowed. Expect retreat and plan for a change in access.
Educate the public
Get somebody that knows how to write survey questions to rewrite this survey so it's understandable and not leading to desired answers. This survey is a dysfunctional joke. So what if sea levels rise 6"? Over time you build around it like we have over the past 100 years. You build on a sand bar you're bound to be underwater at some point!
Halt new development and for existing development (existing structures) allow for various types of alterations to permit continued use and access.
Higher first floor elevation requirements
Limit development of at risk areas
Modify or relocate the structures
move infrastructure such as sewage, water, and electrical to highest ground, widen bridge to mainland so people can escape in case of catastrophic flooding
No- annual monitoring of current conditions with minimal proactive actions. Actions should only be taken proactively if flooding would result in immediate Environmental damage, ie oil spill, or other critical event.
None by COBI. Residential Building Code requires private development in flood prone areas to be in conformance with ASCE 24. FEMA provides mapping of flood zones and provides guidance on Flood Risk Analysis. They have far greater resources to address this issue than COBI.
none- Owners are responsible not government
None. It's private.
Nothing from Bainbridge government. It's private development so it can be managed by the owner,
Prevent it from happening on undeveloped lots.
Raising Ht. of buildings first, moving second if not possible shoreline armoring.

Rely on FEMA to do studies, access risk, and make recommendations.
Restrictions on new development Require homeowner liability insurance
Retreat and removal of homes in problem areas. City purchases homes and rents out to get income until homes are no longer useable. Similar to pilot project in California.
Set backs. Limit building in low lying flood areas.
soft shore restoration, raised housing
Some relocation
Stop development altogether in those areas. Begin phasing out existing development to let Nature reclaim the property (i.e., move people out).
Walls, berms, raising structures
We should not be building in flood zones

Public Infrastructure

Q: In general, when do you think ACTIONS should be taken to adapt PUBLIC INFRASTRUCTURE in low-lying areas to sea level rise?



The "Other" responses included the following:

Public facilities need to keep functioning during disasters like earthquakes, tsunamis and flooding. Every effort should be made to build in an appropriate location. The Harrison Clinic is in a moderate landslide hazard area and a seismic moderate hazard area. That is not where COBI should put a 50 year life police station.
When there is demonstrated progression of sea level rise that validates the need

Q: What types of ACTIONS do you think will need to be implemented to adapt low-lying PUBLIC INFRASTRUCTURE to sea level rise?

Anytime infrastructure is changed move to better location if possible.
Bainbridge can step in when it becomes an issue. Otherwise, Bainbridge government has a tendency to over reach.

Build dikes
Depends on specific infrastructure. Beaches - no action Roads - predictive action Electric/Sewer - avoid any impact
Either reduce factors contributing to climate change (good luck) or plan for a future of high water. Actions would make include design to flood proof facilities and move roads away from shorelines
Higher first floor elevation requirements for buildings Higher elevation requirements for facilities and roads
I think you should just let public places be. Spend money on recovery after flooding events until recovery is no longer feasible. Then allow the property to revert to Nature. I think it's too expensive and a waste of time to try to shore up public places against the inevitable, permanent loss of property due to flooding.
Improved wetlands. Large natural areas that can be temporarily flooded such as parks and parking lots.
Legislation
Modify or relocate
move infrastructure such as sewage, water, and electrical to highest ground, widen bridge to mainland so people can escape in case of catastrophic flooding
none
None. When that infrastructure needs replacement put it in a non flooding area!
Plan for the affects of sea level rise. Only after flooding has become a problem is too late.
Please see above, and also, an accurate assessment of public assets and their risk of exposure to SLR, and building long-term funding for the need to move or adapt public assets that are threatened by SLR.
Prepare far ahead
Purchasing property to move infrastructure back.
Reinforcement and relocation of water supply and sewer systems.
Rerouting roads, building bridges, building hard bulkheads, installing pump stations for utilities, moving park infrastructure, building levees.
Retreat, harden, raise.
Same as with private development
Set backs. Limit new projects in low lying areas unless it can be mitigated with barriers, elevation of structures or other way to safe-guard public investment in infrastructure.
Set goals based on worst case scenarios, scientifically based Have 10 year, 20 year, and 50 year plans in place - 8 year plans don’t look out far enough
Storm water and sewer processing along with acceptable community access to safe water sources would be the first priority infrastructure to protect
That is an engineering question. I would like to see COBI plan and implement the necessary changes well before any event occurs. COBI needs to put more effort (think money) into core functions of the city and less into ribbon cutting and feel good projects.
The study it after it becomes a problem. We have other priorities to focus on now.
Walls, berms, raise structures, relocate structures
We need to listen to FEMA recommendations based on science not a bunch of ideas from unknowing citizens.

Aquaculture Amendment Options in Development

The following two options are partial outlines representing early ideas in development by the Planning Department based on staff research and input received by through the early policy input process facilitated by the Department with the Planning Commission, an SMP Stakeholder Focus Group, a public survey, and an SMP Agency group. The early policy input process was used to (1) test ideas emerging from staff research and (2) solicit ideas from the community and experts. The two options in development are intended to reflect:

- Legal constraints;
- Much of the City's previous work on the topic of aquaculture;
- Ideas that emerged from staff research that appear consistent with early policy input; and
- Ideas that emerged from community and expert input.

It cannot be overemphasized that this is a working document, it is incomplete, and is likely to change as the staff continue to develop this into a Department Draft proposal. It is being provided as part of the second Planning Commission workshops to stimulate additional input on this important topic.

Option #1 – 2016 Amendment Modified to be Similar to Compliant Pierce County SMP

Overview

- Retain as many parts of the 2016 aquaculture amendment as possible and modify to be similar to the compliant Pierce County SMP
- Adopt findings stating:
    - Aquaculture is a water-dependent statewide priority that the City will reasonably accommodate
- Recommend private tideland owners record easements not allowing intensive shellfish farming practices if that is a priority in their area.
- Geographic limitations on aquaculture will only include the existing 2014 provisions, if retained (cannot be amended because that would make them subject to appeal)

Option #2 – Recreation, Restoration, & Climate Adaptation Emphasis

Overview

- Retain as many parts of the 2016 aquaculture amendment as possible
- Adopt findings stating:
    - SMA: SMP must give preference to (in the following order):
        - Protecting and restoring ecological functions
            - Note: We are focusing first on this level of this hierarchy to reserve areas necessary for this purpose
        - Water-dependent and associated water-related uses
            - Note: This does not distinguish between commercial and recreational aquacultural uses, so we are emphasizing recreational uses
        - Other water-related and water-enjoyment uses

        - Single family residential uses
        - Non-water-oriented uses.
        - [RCW ###; WAC 173-26-020, WAC 173-26-201(2)(d), and WAC 173-26-251(2)]
    - WAC 173-26-241(3)(b)(i)(A) states that aquaculture is of statewide interest [see slide below]
        - Note: This does not distinguish between commercial, recreational, and subsistence aquacultural uses, so we are emphasizing recreational and subsistence uses.
    - There are many statewide interests [see slide below for preliminary list]
        - Note: Some statewide interests are complimentary and some conflict. Not all statewide interests are best suited for local conditions. Therefore, the City (with Ecology) must use the SMP to identify and manage statewide interests that are appropriate for the local conditions of Bainbridge Island.
    - There are many types of aquaculture [see white paper for more on this]
        - Note: We are emphasizing the types of aquaculture related to recreation, subsistence, habitat restoration, species recovery, science/education
    - WAC 173-26-241(3)(b)(i)(A) authorizes the City to "consider local ecological conditions and provide limits and conditions to assure appropriate compatible types of aquaculture for the local conditions as necessary to assure no net loss of ecological functions."
        - Note: Bainbridge Island has unique local conditions (exposed bedrock and high current areas) that historically had extensive bull kelp beds. These areas should be reserved for bull kelp restoration.
        - Note: Bainbridge Island is highly motivated to mitigate and adapt to climate change as supported by our newly adopted Climate Action Plan.
        - Note: A leading non-profit organization in kelp restoration, native shellfish restoration, and use of kelp for climate change mitigation is home based on Bainbridge Island and the laboratory that supports this work is located adjacent to Bainbridge Island at the NOAA Manchester Field Station.
    - The City will reasonably accommodate those types of aquaculture that are compatible with local conditions and do not conflict with other statewide priorities best suited for Bainbridge Island
- Recommend private tideland owners record easements not allowing intensive shellfish farming practices if that is a priority in their area.
- Existing fish farm will become a nonconforming use

Upland Aquaculture (Shorelands)

- TBD

Intertidal Aquaculture (Shorelines)

- Actions (working ideas)
    - Retain existing geographic restrictions for Island Conservancy, Natural, and Priority Aquatic designations so they are not subject to review on appeal.
    - Focus on:
        - Restoration and protection of recreational and cultural subsistence shellfish beds

        - Personal and community shellfish gardening (define maximum size)
        - Accommodating commercial shellfish with preference for:
            - smaller scale
                - Develop a density standard (acres/linear mile) based on established planning principles like buoy density or residential density
            - Others TBD
    - Work with BI Parks (and Suquamish Tribe, Puget Sound Restoration Fund, WDNR, others?) to identify appropriate park (and WDNR) tidelands for natural seeding and enhancement for public harvest
        - Would need to exempt this type of activity from current restrictions in the Island Conservancy designation
- Allowed uses
    - TBD
- Requirements
    - TBD
- Statewide interests supported
    - Aquaculture
    - Recreation
    - Education
    - Traditional cultural practices?
    - Marine Water Quality
        - Nutrient uptake
    - Ecosystem recovery (Indicators: shellfish beds, local foods, cultural wellbeing, eelgrass)
    - Critical areas (shellfish beds, eelgrass & kelp beds, forage fish spawning)
- Local Conditions
    - Urban Growth Area
    - Near-total buildout on shoreline
        - Mostly residential with small and highly fragmented tidelands
        - Few DNR tideland parcels
        - Park tidelands
    - Permanent or fairly persistent shellfish closures
    - Water quality threats (sewer and petroleum spills)
    - Limited options for landing commercial harvest
    - Others TBD
- Tradeoffs
    - TBD

Offshore Aquaculture (Shoreline of Statewide Significance)

A. Expand Priority Aquatic Designations

- Actions
  - Adopt findings stating:
    - Kelp restoration is of statewide interest and is a priority for the state and BI
      - Support: State bull kelp recovery plan, salmon recovery plan, rockfish recovery plan, orca recovery plan
    - BI has unique local conditions and habitats that should be reserved for this purpose (preferred above water-dependent uses by the SMA)
    - Orchard Rocks was designated a state marine conservation area
  - Update Priority Aquatic Area (Type 3 or create a new Type) designation criteria
  - Amend SMP Designation Map with Priority Aquatic areas to include:
    - Applicable bathymetry and extent of historic kelp beds (will not extend landward of ELW)
    - Federal, state, or locally designated marine protected areas, which currently include:
      - Orchard Rocks conservation area (WAC 220-303-050)
- Allowed uses
  - Restoration
  - Overwater structures that are necessary for the restoration of kelp beds
  - Recreation (with vessel limitations)
  - Education
  - Research/Science
  - Navigational aids
- Requirements
  - TBD
- Statewide interests supported
  - Species Recovery
    - Kelp recovery plan
    - Rockfish recovery plan
    - Salmon recovery plan
    - Orca recovery plan
  - Designated critical area
  - Marine Water Quality
    - Dissolved oxygen
    - Nutrient uptake
    - Ocean acidification buffering
  - Carbon sequestration
  - Recreation (e.g. SCUBA diving, kayaking, fishing, etc)
  - Science/Education
  - Scenic shorelines (e.g. from ferries, parks, boats, etc)
- Local conditions
  - Large extent of historic kelp beds (last bed disappeared in 2015)
    - Supported by studies (see Figure C-5a and C-5b below)
  - Exposed bedrock is a unique physical habitat in Central and South Puget Sound
    - Supported by ShoreZone data and BI Nearshore Assessment

Commented [PB1]: Need background on this designation: when, where, why

Commented [PB2]: STATE MPAs
To protect and preserve a variety of marine fish, shellfish, and habitats, WDFW has established marine reserves at several sites in Puget Sound. These are generally known as Marine Protected Areas (MPAs), and have either broad or focused restrictions on the harvest of marine resources within specified boundaries.
WDFW has established three types of MPAs, specifically:
- **Conservation Areas** where the harvest of ***all*** marine resources is prohibited.
- **Marine Preserves** where the harvest of ***some*** marine resources is prohibited.
- **Sea Urchin** and **Sea Cucumber Exclusion Zones** where the harvest of ***only these species*** is prohibited.

These sites not only help protect marine resources and habitats, but also provide sites for research and education, and are prime locations for divers and other wildlife-viewers. More information on the goals and objectives of MPAs in Washington is available in the Fish and Wildlife Commission's policy and in the comprehensive publication Marine Protected Areas in Washington.

- Importance of kelp to salmon recovery
  - Supported by beach seining documented juvenile salmon from watersheds throughout the Salish Sea
  - Supported by study in Strait documented importance of kelp to salmon
- Home-base of the Puget Sound Restoration Fund (leading partner in kelp restoration)
- Proximity to the Manchester field station

○ Trade-offs
- Existing fish farm in Rich Passage becomes nonconforming (can be 100% replaced under newly updated rules that went into effect 3/5/2021)
- Private recreational buoys may become nonconforming (can be 100% replaced under newly updated rules that went into effect 3/5/2021)
- Potentially limits new development of private recreational buoys and docks

B. Required minimum setback waterward from OHWM for offshore aquaculture

○ Actions
- Create 1,500' setback
  - Consistent with King County requirements for Vashon-Maury Island (see attached)
- Exceptions
  - Restoration that requires a closer location
- Exclusion areas:
  - Priority Aquatic Designations
  - Portions of waterbodies that are too narrow width (i.e. Agate Passage, Rich Passage, harbors, etc)
  - Navigation Lanes
  - Undersea cable areas

○ Allowed uses
- Native finfish species only (consistent with state policy)
- Priority preferences
  - Algae
  - Native species recovery
  - Native species enhancement for wild harvest
  - Commercial Shellfish
  - Commercial finfish

○ Requirements
- Preference for submerged facilities
  - Low-profile facilities required otherwise
- Finfish must have coded-wire tags
- Other requirements from Ord 2016-16 that do not conflict with Pierce County SMP decision
- Other good provisions from the compliant Pierce County SMP

○ Statewide interests supported
- Aquaculture
- Marine Water Quality
  - Dissolved oxygen (for algae only)

Commented [PB3]: Research: What water depths does this result in?

Commented [PB4]: Should a subset have PIT (acoustic) tags that could be tracked by the acoustic arrays throughout the Salish Sea?

        - Nutrient uptake (for algae and shellfish only)
        - Ocean acidification buffering (for algae only)
    - Carbon sequestration (for algae only)
    - Scenic shorelines
- Local conditions
    - Historic offshore aquaculture
    - Climate change mitigation is a priority in our Comp Plan and the Climate Action Plan
    - Extremely limited options for on-island facilities to land harvests
    - Water quality limits the current and potential long-term viability of commercial shellfish aquaculture
        - Frequent shellfish closures
        - History of sewer spills and oil spills
- Tradeoffs
    - Existing fish farm in Rich Passage becomes nonconforming
    - Narrow, higher-current areas that facilitate mixing/dilution of "discharges" could not be utilized
    - Future structures will be located farther into navigable waters
    - Reduces proximity of visual, noise, and smell nuisances to land-based uses

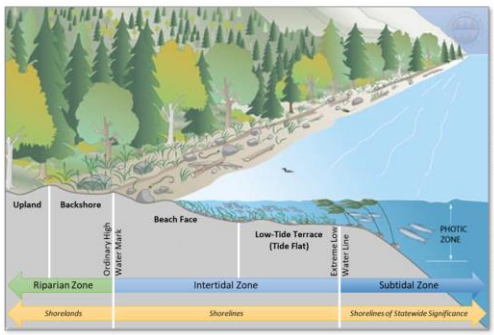
SMA/SMP Hierarchy of Preferences & Cross-shore Distinctions in "Who's Interests" are Considered

Aquaculture

SMP must give preference to (in the following order):

- Protecting and restoring ecological functions
- Water-dependent and associated water-related uses
- Other water-related and water-enjoyment uses
- Single family residential uses
- Non-water-oriented uses.

[WAC 173-26-020, WAC 173-26-201(2)(d), and WAC 173-26-251(2)]



(Credit: Adapted by COBI from a graphic originally created by King County)

Shoreline Jurisdiction Zone	Shorelands	Shorelines	Shorelines of Statewide Significance
Ecological Zone	Riparian Zone	Intertidal Zone	Subtidal Zone
Type of Aquaculture	Upland Aquaculture	Intertidal Aquaculture	Offshore Aquaculture
Who's interests?	SMP may balance local interests with statewide interests		SMP can only consider statewide interests

Summary of Statewide Interests and Local Conditions to be Considered

Aquaculture

Statewide Interests
(What types of aquaculture is Bainbridge Island suitable for?)

Aquaculture is the culture or farming of fish, shellfish, or other aquatic plants and animals. Aquaculture does not include the harvest of wild geoduck associated with the state managed wildstock geoduck fishery. This activity is of statewide interest. Properly managed, it can result in long-term over short-term benefit and can protect the resources and ecology of the shoreline. Aquaculture is dependent on the use of the water area and, when consistent with control of pollution and prevention of damage to the environment, is a preferred use of the water area. Local government should consider local ecological conditions and provide limits and conditions to assure **appropriate compatible types of aquaculture for the local conditions** as necessary to assure no net loss of ecological functions. [WAC 173-26-241(3)(b)(i)(A)]

Other Statewide Interests

Economic Vitality*
Local Foods*
Cultural Wellbeing*
Recreation
Ecological
- **Critical Areas**
  - Shellfish Beds* (recreational and commercial)
  - Eelgrass* and Kelp
- **Species Recovery**
  - Bull Kelp
  - Rockfish
  - Salmon*
- **Marine Water Quality***
  - Dissolved Oxygen
  - Nutrients
  - Ocean Acidification
- **Carbon Sequestration**

[* Puget Sound Recovery Indicator]

Local Conditions

Urban Growth Area
Mostly Residential
Mostly Private Tidelands
- Small
- Highly Fragmented

Frequent Shellfish Closures
Some Permanent Closures
Water Quality Threats
- Sewer Spills
- Oil Spills

Note: This is likely an incomplete list of statewide interests and local conditions.

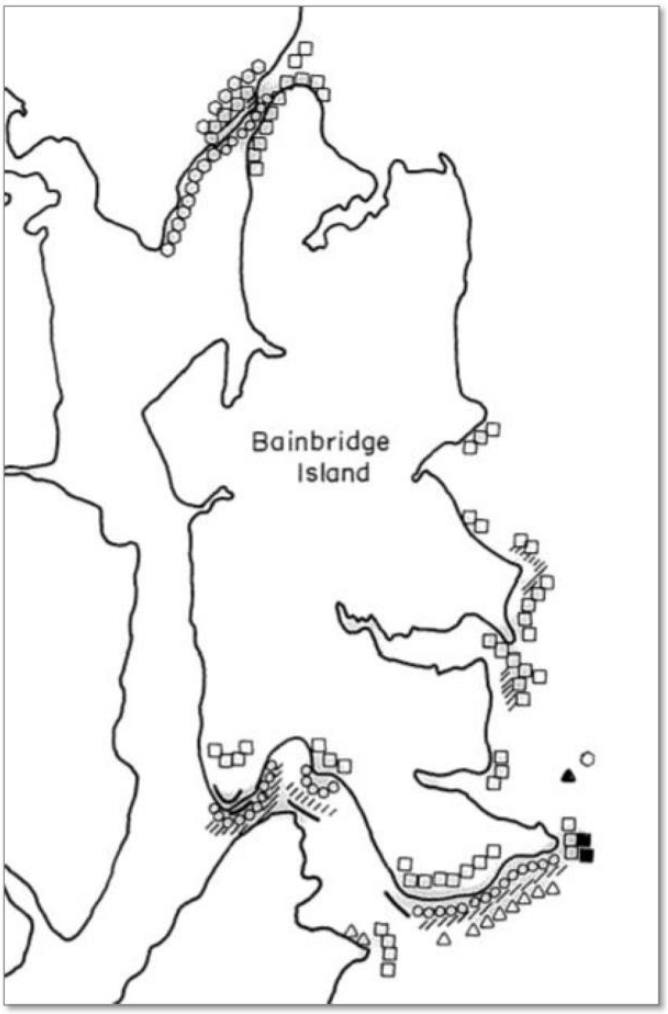


Figure C-5a. Historic Distribution of Kelp around Bainbridge Island[7]

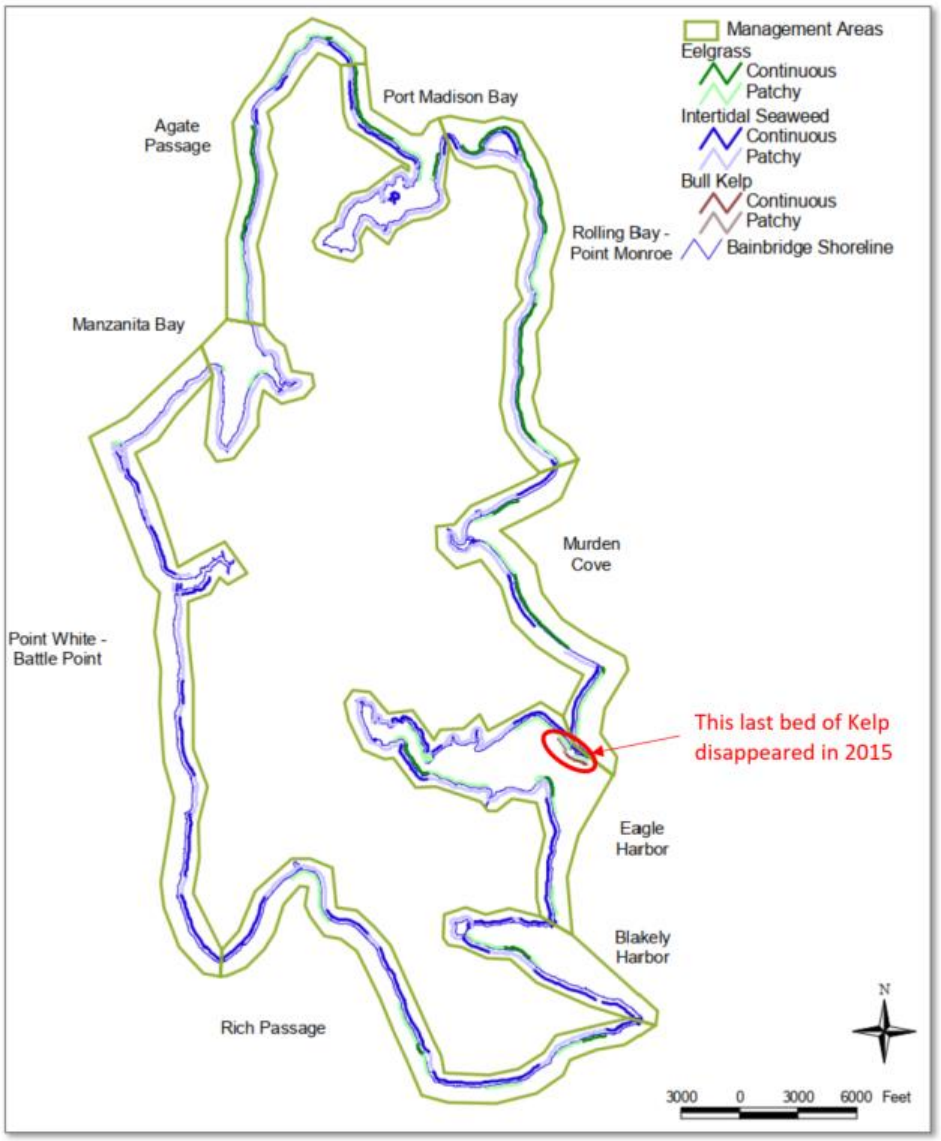
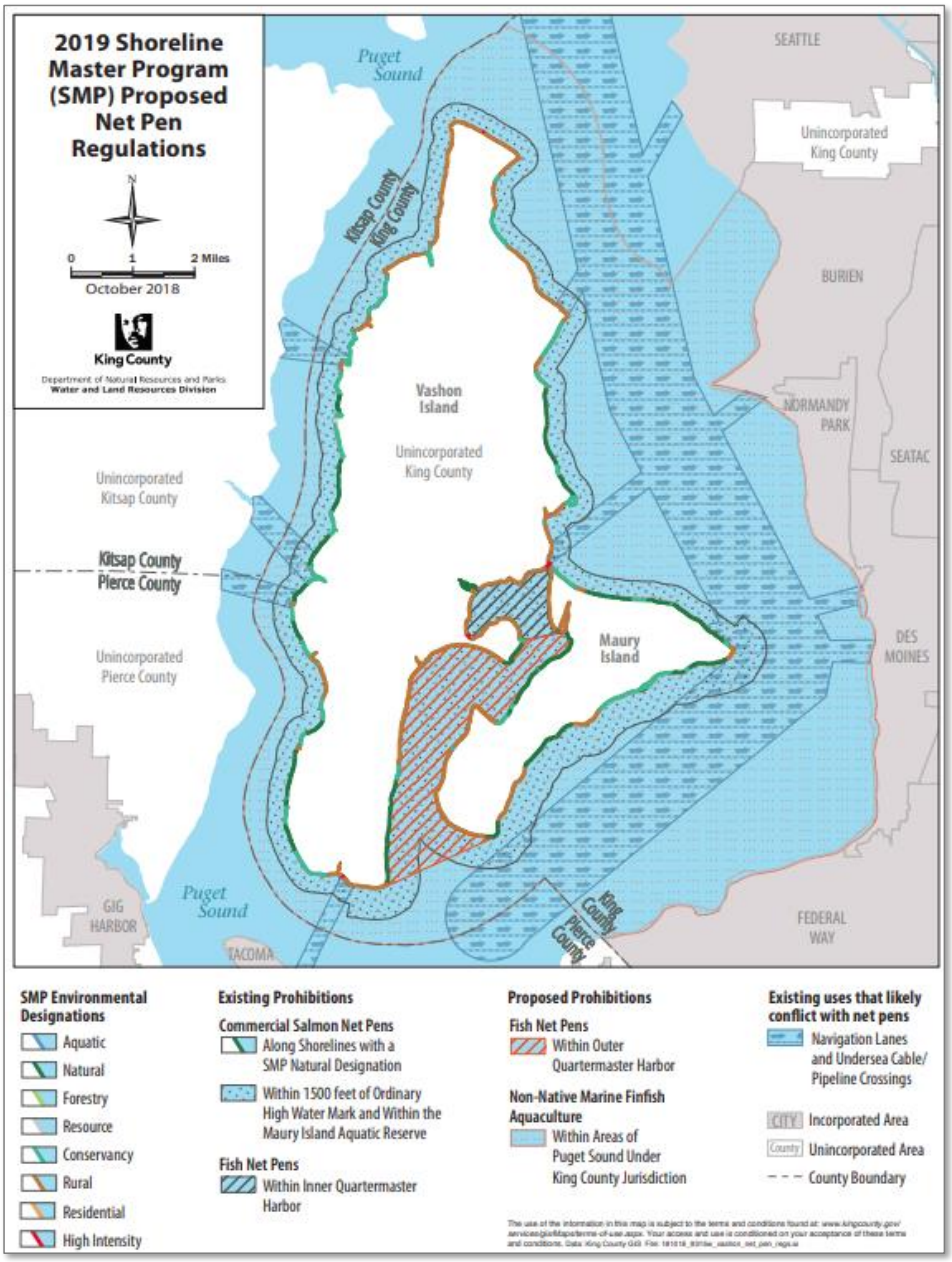


Figure C-5b. Eelgrass, Kelp (circled), and Seaweed Distribution around Bainbridge Island[8]


2019 Shoreline Master Program (SMP) Proposed Net Pen Regulations
N
0 1 2 Miles
October 2018
King County
Department of Natural Resources and Parks
Water and Land Resources Division
Puget Sound
SEATTLE
Unincorporated King County
Kitsap County
King County
BURIEN
Vashon Island
Unincorporated King County
NORMANDY PARK
SEATAC
Unincorporated Kitsap County
Kitsap County
Pierce County
Maury Island
DES MOINES
Unincorporated Pierce County
GIG HARBOR
Puget Sound
TACOMA
King County
Pierce County
FEDERAL WAY
SMP Environmental Designations
Aquatic
Natural
Forestry
Resource
Conservancy
Rural
Residential
High Intensity
Existing Prohibitions
Commercial Salmon Net Pens
Along Shorelines with a SMP Natural Designation
Within 1500 feet of Ordinary High Water Mark and Within the Maury Island Aquatic Reserve
Fish Net Pens
Within Inner Quartermaster Harbor
Proposed Prohibitions
Fish Net Pens
Within Outer Quartermaster Harbor
Non-Native Marine Finfish Aquaculture
Within Areas of Puget Sound Under King County Jurisdiction
Existing uses that likely conflict with net pens
Navigation Lanes and Undersea Cable/ Pipeline Crossings
CITY Incorporated Area
County Unincorporated Area
County Boundary

4/6/2021