

## 3.0 Results and Discussion

### 3.1 Bainbridge Island

A brief overview of Bainbridge Island shoreline conditions is summarized below, with some discussion of the factors that most significantly influenced scoring. Individual management area (MA) and reach results are reported separately in Section 3.2 of the report. To facilitate readability, tables referred to in this section are collected in Appendix A; maps, charts, and figures can be found in Appendix B. Raw controlling factor (CF) scores and ecological function (EF) scores for each reach are included in Appendix C and Appendix D, respectively.

*Number of MAs = 9*

*Mean MA CF Score (Normalized) = -0.44 (Range: -0.56 to -0.30)*

*Median MA CF Score (Normalized) = -0.47*

*Number of Reaches = 201*

*Island-Wide Qualitative Rating: Moderate Impact*

*Mean Reach CF Score (Normalized) = -0.45 (Range: -0.87 to 0.00)*

*Median Reach CF Score (Normalized) = -0.48*

*Mean Reach EF Score = 20.2 (Range: 10 to 36)*

*Median Reach EF Score = 20*

#### 3.1.1 Description

Bainbridge Island comprises 281,574 linear ft of shoreline (Table A-1). A total of 21 alongshore cells were used to define nine Management Areas (MAs), composed of 201 individual shoreline reaches around the Island (Figure 3). Shoreline reaches are distributed by geomorphic class as follows: spit/backshore (76), high bluff (54), low bank (33), marsh/lagoon (33), and rocky shore (5) (Figure 4). The smallest management area on Bainbridge Island is Manzanita Bay (MA-9; 10 reaches, 18,879 linear ft), and the longest is Point White – Battle Point (MA-8; 38 reaches, 51,650 ft). Sediment sources and wave exposure classes are shown in Figure B-1.

Overhanging riparian vegetation covers approximately 27% (76,399 linear ft) of the entire Bainbridge Island shoreline (Table A-1, Figure B-2). Within the Island's 200-ft riparian zone (over 50 million ft<sup>2</sup>), naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 54% of land cover, whereas impervious surfaces (e.g., roads, roofs) represent 23% of the riparian zone land cover (Table A-1, Figure B-3).

Overall, 82% of Bainbridge Island shorelines are currently in residential, recreational, commercial, or industrial use (Best 2003). The development pattern is dominated by single-family residences, although the Island's shorelines host two state parks and many local parks, a fish-pen aquaculture operation, a ferry terminal, a ferry maintenance and repair facility, marinas, mixed-use development, and a Superfund site (a former creosote wood treatment plant and ship yard) (Best 2003). Related impacts are shown in Figure B-4.

Approximately 48% of Bainbridge Island's shoreline is modified by armoring, with most of this represented by vertical rip rap or vertical concrete structures (Table A-1, Figure B-5). In total, 25% of the shoreline has armoring that encroaches into the intertidal zone. A total of 2,931 point modifications were recorded along Bainbridge Island shorelines (unpublished data, COBI 2002), at an average density of 10.4

structures per 1,000 ft (Table A-1, Figure B-6). The most common structures were stairs (526), followed by buoys (495), upland structures at the waterline (341), and docks (330).

The Island-wide distributions of subtidal/intertidal marine vegetation, forage-fish spawning areas, salmon-bearing streams, and geoduck and clam resources are shown in Figures B-7, B-8, and B-9.

### **3.1.2 Limiting Factors and Opportunities**

The average normalized controlling factor (CF) score of all reaches Island-wide was -0.45 (median -0.48, range: -0.87 to 0.00), whereas the average of all normalized MA scores was -0.44, (median -0.47, range: -0.56 to -0.30) (Table A-2; Figure B-10). The values above represent baseline scores over all of Bainbridge Island for relative comparison with individual MAs and reaches, which are discussed in detail below. The most highly impacted MA on Bainbridge Island is Eagle Harbor (MA-5; CF Score -0.56), which also included some of the most highly disturbed reaches over the study area (Figure B-12, Figure B-13, Appendix C). The least-impacted MAs are Murden Cove (MA-4; normalized CF Score -0.33) and Blakely Harbor (MA-6; normalized CF Score -0.30). Scores of documented ecological functions (EF) were highest in Manzanita Bay (MA-9; EF Score 23.9), Agate Passage (MA-1; EF Score 28.4), and Port Madison Bay (MA-2; EF Score 23.0), the northern portion of Bainbridge Island (Figure B-11, Appendix D). In contrast, the lowest EF Scores were observed in Eagle Harbor (MA-5; EF Score 17.9), Blakely Harbor (MA-6; EF Score 17.6), and Rich Passage (MA-7; EF Score 16.1). Prioritization methods for best determining management options based on these results is discussed in Appendix E; Figure B-14 provides a graphical display for reference.

Because the analysis involved only data from Bainbridge Island (the population of interest), it is currently inappropriate to make comparisons relative to all of Puget Sound. Bainbridge Island's diverse shoreline conditions range from polluted urban waterfronts to moderate-density residential development, to fairly undisturbed stretches of shoreline with intact riparian habitats. Therefore, Bainbridge Island represents a microcosm of Puget Sound, with on average, moderate levels of impacts to nearshore resources, but extreme examples of high and low impacts as well (Figures B-12, B-13, and B-14).

On average, the mean raw reach score for individual controlling factor metrics over all Bainbridge Island was -2.10, which provides some basis for distinguishing specific metrics which influenced cumulative scores in a positive or negative direction (Table A-3). Substrate type (-2.90) and depth/slope (-2.61) metrics had the lowest (worst) average scores and represented the most impacted controlling factors over the entire Island (Figure B-15, Figure B-16). Scoring of both metrics was influenced by percentage of shoreline armoring data. As well, the substrate metric reflected the density of all point modifications, whereas depth-slope reflected the relative amount of dredging and armoring encroachment. In summary, the low (poor) scores in these metrics suggest that high rates of shoreline armoring (48% of shoreline), armoring encroachment (25% of shoreline), and point modifications (10.4 structures per 1000 ft shoreline) have significantly changed the historic composition of substrate and depth-slope contours along Bainbridge Island shorelines.

Hydrology (-1.23) and physical disturbance (-1.60) raw controlling factor metrics scored highest (best) and represented the least-impacted controlling factors over all Bainbridge Island reaches (Table A-3; Figure B-15). Scores of both metrics were highly influenced by land cover. As well, the hydrology metric reflects the presence of unnatural tidal constrictions along the shoreline, armoring encroachment, and outfall density. The physical disturbance metric characterized recurring human activities along the shoreline and was also influenced by the presence of urban waterfront activity and the density of floating structures and boat ramps. The relatively higher scores in these metrics suggest that low-to-moderate density residential land use within the marine riparian zone (54% naturally vegetated surfaces, 23%

impervious surfaces) has likely helped to sustain some historic level of hydrology function and protection from physical disturbance along many of Bainbridge Island shorelines.

## 3.2 Management Areas

A brief description of each Bainbridge Island management area (MA) is summarized below, with some discussion of the predominant limiting factors that negatively influenced scoring, as well as suggestions of opportunities for improvement. Individual reach results are reported separately as a subheading under the corresponding MA and in Appendix C.

### 3.2.1 Agate Passage Management Area (MA-1) (Reaches 3217 – 3223; 3487 – 3491)

*MA CF Qualitative Rating = Moderate Impact*

*Mean Reach CF Score (Normalized) = -0.47 (Reach score range: -0.69 to 0.00)*

*Median Reach CF Score (Normalized) = -0.54*

*Number of Reaches = 12*

*Mean Reach EF Score = 28.4 (Range: 22 to 32)*

*Median Reach EF Score = 29*

#### Description

Agate Passage (MA-1) comprises 19,495 ft of shoreline along Agate Passage and around Agate Point (Table A-1). It comprises 12 reaches, most of which are classified as high bluff (9) and the remainder classified as low bank (3) (Figure B-17). MA-1 comprises two drift cells with northerly alongshore drift that converge at Agate Point. The southern boundary of the first drift cell begins at a divergence zone north of Manzanita Bay and moves along the western shoreline along Agate Passage, encompassing a long stretch of shoreline with eroding feeder bluffs (Figure 3). The smaller second cell begins at a divergence zone located just southeast of Agate Point on the western shore of Port Madison, and also includes a small area with unstable feeder bluff activity. Relative to wave exposure, shorelines are considered “semi-protected” along Agate Passage to “protected” along Port Madison (Figure B-18). There are no major watersheds in MA-1, with all runoff considered coastal sheetflow.

Overhanging riparian vegetation covers approximately 36% of the MA-1 shoreline, the highest value observed of any MA (Table A-1, Figure B-23). Similarly, within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 71% of land cover (Figure B-22). Impervious surfaces (e.g., roads, roofs) represent 17% of the riparian zone land cover. As such, riparian zone land-cover class values in Agate Passage represent one of the best ratios of percentage of natural vegetation to %TIA on Bainbridge Island.

Shoreline development in MA-1 is primarily residential in nature. Approximately 57% of shoreline is modified by armoring and 21% of the shoreline has armoring that encroaches into the intertidal zone (Table A-1; Figure B-19). A total of 235 point modifications were recorded along MA-1 shorelines, at an average of 12.1 modifications per 1000 ft, among the highest densities on Bainbridge Island (Figure B-20). The most common structures were stairs (64), a common feature for shoreline access along high bluffs, followed by overwater structures, such as docks or piers (32).

#### Limiting Factors

The average normalized CF score within MA-1 was -0.47, well within the middle range of MA scores on Bainbridge Island (Table A-2; Figure B-10, Figure B-13). Consequently, the Agate Passage MA was rated “moderate” in terms of relative impact to shoreline controlling factors on Bainbridge Island.

Relative to other areas, MA-1 scored particularly low (poor) in the following controlling factor metrics: loss of natural shade, sediment supply, pollution, and hydrology (Table A-3; Figure B-16). The fact that MA-1 had the lowest (worst) average natural shade score (-2.75) while also having the highest total percentage (36%) of shoreline with overhanging riparian vegetation was puzzling. Closer examination of the data revealed that most short reaches in the MA exhibited relatively low vegetation scores, whereas some longer reaches had riparian cover exceeding 90%. While still useful, this suggests that a simple, additive index alone may prove misleading when average assessment scores are scaled up within a larger landscape. Alternative measures, such as using median and upper/lower quartiles may characterize the cumulative landscape scores better than simply using the average. Sediment supply scores were influenced primarily by the high percentage of armoring in front of important feeder bluffs and backshore sediment sources. Pollution scores were low in MA-1 because of recreational shellfish closures and warnings in five of twelve reaches associated with proximity to a sewer treatment plant outfall. High %TIA in the marine riparian zone and outfall densities along the shoreline in some reaches further influenced low pollution and hydrology metric scores.

On a positive note, MA-1 exhibited high (good) scores in the physical disturbance metric relative to other MAs (Table A-3, Figure B-16). This value is primarily attributed to the residential nature of the shoreline, high forested cover, and relatively moderate number of docks, mooring buoys, and ramps due to poor shoreline access afforded by the high bluff geomorphology of most reaches.

#### Opportunities

The most obvious opportunities for improving scoring of controlling factor metrics include removal of armoring structures in front of feeder bluffs to allow natural sediment processes. This approach will yield obvious results at down-drift reaches dependent upon alongshore sediment sources. Some high-bluff reaches in this MA were in particularly good condition, including Reach 3488, one of the least-impacted, high-bluff reaches on Bainbridge Island. This reach exhibits natural feeder bluff activity, large woody debris (LWD) recruitment, downed trees and overhanging riparian vegetation at the base of the bluffs, high forest cover in the landward riparian zone, and no linear or point modifications along the shoreline.

The EF scores are particularly high in MA-1 relative to the rest of Bainbridge Island because of the prevalence of forage-fish (herring, sandlance, and surf smelt) spawning areas documented along most reaches (Table A-4; Figure B-11, Figures B-24, B-25, B-26, Appendix D). Eelgrass beds and geoduck resources are also abundant along most shorelines.

#### Individual Reaches Within MA-1 (Figure B-27, Appendix C, Appendix D)

##### Reach 3217

- CF Rating = Moderate/High Impact; Normalized score = -0.689
- Most impacted CF metrics: sediment supply, pollution
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1658 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 24.1%; Riparian zone land use: No data on %TIA; No data on %forested
- Total shoreline armoring: 86.9%; Total encroaching: 61.6%
- Total point modifications: 14; Density: 8.4/1000 ft; most common is stairs, with 3/1000 ft
- Other: shellfish closure present
- EF Score: 32

##### Reach 3218

- CF Rating = Moderate/High Impact; Normalized score = -0.622
- Most impacted CF metric: pollution

- Least impacted CF metric: depth/slope, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 349 ft
- Sediment source: Backshore; Wave exposure: semi-protected
- Overhanging vegetation: 16.4%; Riparian zone land use: No data on %TIA, No data on %forested
- Total shoreline armoring: 39.3%; Total encroaching: 0%
- Total point modifications: 9; Density: 25.8/1000 ft; most common is pilings, with 11.5/1000 ft
- Other: shellfish closure present
- EF Score: 32

#### Reach 3219

- CF Rating = Moderate Impact; Normalized score = -0.578
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, sediment supply, depth/slope, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 541 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 29.4%; Riparian zone land use: No data on %TIA, No data on %forested
- Total shoreline armoring: 45%; Total encroaching: 0%
- Total point modifications: 11; Density: 20.3/1000 ft; most common is overwater structures, with 5.5/1000 ft
- Other: shellfish closure present
- EF Score: 30

#### Reach 3220

- CF Rating = Moderate Impact; Normalized score = -0.556
- Most impacted CF metric: pollution
- Least impacted CF metric: physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 624 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 7.7%; Riparian zone land use: No data on %TIA, No data on %forested
- Total shoreline armoring: 61.8%; Total encroaching: 0%
- Total point modifications: 10; Density: 16/1000 ft; most common is stairs, with 6.4/1000 ft
- Other: shellfish closure present
- EF Score: 30

#### Reach 3221

- CF Rating = Moderate Impact; Normalized score = -0.6
- Most impacted CF metric: pollution
- Least impacted CF metric: physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 2161 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 14.8%; Riparian zone land use: No data on %TIA, No data on %forested
- Total shoreline armoring: 60%; Total encroaching: 0%
- Total point modifications: 31; Density: 14.3/1000 ft; most common is upland structures at waterline, with 3.2/1000 ft
- Other: shellfish closure present
- EF Score: 26

#### Reach 3222

- CF Rating = Low/Moderate Impact; Normalized score = -0.378
- Most impacted CF metric: substrate type
- Least impacted CF metric: hydrology, physical disturbance

- Geomorphic class: Low Bank; Shoreline length: 1019 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 46.5%; Riparian zone land use: 20% TIA, 72.6% forested
- Total shoreline armoring: 49.3%; Total encroaching: 0%
- Total point modifications: 13; Density: 12.8/1000 ft; most common is upland structures at waterline, with 4.9/1000 ft
- Other:
- EF Score: 30

#### Reach 3223

- CF Rating = Low/Moderate Impact; Normalized score = -0.333
- Most impacted CF metrics: natural shade, substrate type
- Least impacted CF metric: hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1591 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 36.6%; Riparian zone land use: 10.4% TIA, 82.7% forested
- Total shoreline armoring: 53.9%; Total encroaching: 8.3%
- Total point modifications: 12; Density: 7.5/1000 ft; most common is stairs, with 3.8/1000 ft
- Other: next to Agate Pass bridge
- EF Score: 26

#### Reach 3487

- CF Rating = Moderate/High Impact; Normalized score = -0.622
- Most impacted CF metrics: sediment supply, substrate type
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 810 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 18.6%; Riparian zone land use: 44% TIA, 50.6% forested
- Total shoreline armoring: 68.9%; Total encroaching: 11.7%
- Total point modifications: 17; Density: 21/1000 ft; most common is groins, with 7.4/1000 ft
- Other: heavily cleared for homes, lawns, views; lots of rock engineering
- EF Score: 22

#### Reach 3488

- CF Rating = No Impact, Normalized score = 0
- Most impacted CF metrics:
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope, pollution, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1439 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 90.2%; Riparian zone land use: 8.8% TIA, 84.2% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 0
- Other: nice tidal flats, downed trees, feeder bluff in good shape
- EF Score: 28

#### Reach 3489

- CF Rating = Low/Moderate Impact, Normalized score = -0.222
- Most impacted CF metric: sediment supply
- Least impacted CF metric: natural shade, artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1504 ft

- Sediment source: Backshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 97.1%; Riparian zone land use: 11.1% TIA, 83.6% forested
- Total shoreline armoring: 5.7%; Total encroaching: 0%
- Total point modifications: 8; Density: 5.3/1000 ft; most common is outfalls, with 3.3/1000 ft
- Other: shoreline heavily covered with downed trees (LWD) from slope
- EF Score: 28

#### Reach 3490

- CF Rating = Moderate Impact; Normalized score = -0.511
- Most impacted CF metric: sediment supply
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 3453 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 31.5%; Riparian zone land use: 10.2% TIA, 77.7% forested
- Total shoreline armoring: 63.9%; Total encroaching: 61.4%
- Total point modifications: 39; Density: 11.3/1000 ft; most common is upland structures at waterline, with 3.5/1000 ft
- Other: riprap at base of cliff, little LWD retention
- EF Score: 30

#### Reach 3491

- CF Rating = Moderate Impact; Normalized score = -0.533
- Most impacted CF metric: substrate type
- Least impacted CF metric: hydrology
- Geomorphic class: High Bluff; Shoreline length: 4347 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 24.5%; Riparian zone land use: 22% TIA, 58.7% forested
- Total shoreline armoring: 78.7%; Total encroaching: 16.9%
- Total point modifications: 71; Density: 16.3/1000 ft; most common is stairs, with 5.1/1000 ft
- Other:
- EF Score: 27

### 3.2.2 Port Madison Bay Management Area (MA-2) (Reaches 3193 – 3216)

*Qualitative Rating = Moderate Impact*

*Mean CF Score (Normalized) = -0.47 (Range: -0.70 to -0.03)*

*Median CF Score (Normalized) = -0.48*

*Number of Reaches = 24*

*Mean EF Score = 23.1 (Range: 16 to 36)*

*Median EF Score = 20*

#### Description

MA-2 comprises 32,037 ft of shoreline that encompasses much of Port Madison and the entirety of Port Madison Bay (Table A-1). MA-2 comprises 24 reaches, most of which are classified as marsh/lagoon (8), followed by high bluff (6), spit/backshore (6), and low bank (4) (Figure B-17). MA-2 is defined by two drift cells with southerly alongshore drift that terminate into Port Madison Bay, an area that lacks appreciable alongshore drift (Figure 3). The northern boundary of the first drift cell begins at a divergence zone located just southeast of Agate Point on the western shore of Port Madison and moves south into Port Madison Bay, encompassing a short stretch of shoreline with eroding feeder bluffs. The smaller second cell begins at a divergence zone located on the eastern shore of Port Madison. Relative to

wave exposure, shorelines are considered “semi-protected” to “protected” along Port Madison, and “very protected” within Port Madison Bay (Figure B-18). MA-2 receives upland flows from Coho Creek (WRIA 15.0319A), as well as from several other small coastal streams.

Overhanging riparian vegetation covers approximately 26% of the MA-2 shoreline (Table A-1, Figure B-23). However, within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 66% of land cover (Figure B-22). Impervious surfaces (e.g., roads, roofs) represent 14% of the riparian zone land cover.

Shoreline development in MA-2 is primarily residential in nature, with a large number of structures for accessing and mooring watercraft in this protected anchorage. Approximately 61% of the shoreline is modified by armoring, and 35% of the shoreline has armoring that encroaches into the intertidal zone, in both categories the highest percentage of all MAs on Bainbridge Island (Table A-1, Figure B-19). Much of this armoring is characterized as fill or land-building, as opposed to erosion protection that might be observed in a more exposed section of shoreline.

A total of 445 point modifications were recorded along MA-2 shorelines, at an average of 14 modifications per 1000 ft (Table A-1, Figure B-20). As previously noted, most of these structures are for accessing boats, with the most common structure being mooring buoys (96), followed by overwater structures (e.g., boat houses) (31), docks (88), and piers (69). At least eight marinas, defined as a pier/float with more than five mooring slips, were present within MA-2 (Figure B-21). A total of 22 outfalls were also recorded in MA-2. The Washington Department of Fish & Wildlife (WDFW) has also reported the chronic mortality of herring embryos in Hidden Cove, though the cause is still under investigation.

#### Limiting Factors

The average normalized CF score within MA-2 was -0.47, again well within the middle range of MA scores on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). Relative to other areas, MA-2 scored particularly low (poor) in the artificial shade and substrate-type metrics (Table A-3, Figure B-16). Artificial shade scores were influenced primarily by the high density of shade-causing structures such as docks, piers, boats, buoys, and other overwater structures, and the relatively high number of marinas. High densities of these types of structures, combined with heavily armored shorelines, also combined to low (poor) scores in the substrate metric.

Even though reaches had relatively high rates of shoreline armoring, the wave-energy metric in MA-2 scored high (good) relative to other MAs, primarily because much of the shoreline is considered “very protected” from wave energy (Figure B-16). Thus, shorelines would be less likely to experience the detrimental effects of reflective wave energy in this “very protected” setting.

#### Opportunities

One of the least impacted spit/barrier/backshore reaches on Bainbridge Island is Reach 3194 in Port Madison Bay (MA-2), which has few linear or point modifications along shorelines, some low backshore/dune or riparian vegetation, and LWD accumulation on the backshore (Appendix C, Figure B-27).

Scoring of controlling factor metrics in MA-2 would improve by removing or maximizing light penetration under existing shade-causing structures, especially those that occur over or near eelgrass resources. One of the most obvious opportunities for improving scores in a number of metrics would be to minimize and remove shoreline armoring in this MA, especially since this is not a high wave energy area.

As well, EF scores are particularly high in MA-2 relative to the rest of Bainbridge Island as a result of the prevalence of documented forage-fish (herring, sandlance, and surf smelt) spawning areas (Table A-4, Figure B-11, Figures B-24, B-25, B-26, Appendix D). Current investigations of herring embryo mortality by WDFW may guide related management options in this MA in the future. Coho salmon are also documented to spawn in the single large tributary found within the bay (Coho Creek, WRIA 15.0319A), and efforts should be made to maximize functions of juvenile rearing areas, both in-stream and in nearby shoreline habitats (Haring 2000). Eelgrass is abundant along the semi-protected shorelines of Port Madison, although the historic extent of eelgrass within the very protected confines of Port Madison Bay is unclear. Geoduck and clam resources are also abundant along this part of Bainbridge Island.

#### Individual Reaches within MA-2 (Figure B-27, Appendix C, Appendix D)

##### Reach 3193

- CF Rating = Moderate/High Impact; Normalized score = -0.622
- Most impacted CF metric: substrate type
- Least impacted CF metric: pollution
- Geomorphic class: Low Bank; Shoreline length: 1159 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 4.5%; Riparian zone land use: 8.5% TIA, 67.6% forested
- Total shoreline armoring: 87%; Total encroaching: 62.9%
- Total point modifications: 22; Density: 19/1000 ft; most common is stairs, with 4.3/1000 ft
- Other:
- EF Score: 22

##### Reach 3194

- CF Rating = Low Impact, Normalized score = -0.025
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope, hydrology, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1218 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 9.4%; Riparian zone land use: 10.6% TIA, 50.1% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 0
- Other:
- EF Score: 32

##### Reach 3195

- CF Rating = Low/Moderate Impact; Normalized score = -0.371
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: wave energy, natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 473 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 0%; Riparian zone land use: 19.1% TIA, 14.2% forested
- Total shoreline armoring: 9.6%; Total encroaching: 0%
- Total point modifications: 5; Density: 10.6/1000 ft; most common is buoys, with 4.2/1000 ft
- Other:
- EF Score: 27

##### Reach 3196

- CF Rating = Moderate Impact; Normalized score = -0.486

- Most impacted CF metric: substrate type
- Least impacted CF metric: wave energy, natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 627 ft
- Sediment source: Backshore; Wave exposure: very protected
- Overhanging vegetation: 0%; Riparian zone land use: 13.2% TIA, 55.5% forested
- Total shoreline armoring: 35.7%; Total encroaching: 0%
- Total point modifications: 17; Density: 27.1/1000 ft; most common is buoys, with 14.4/1000 ft
- Other:
- EF Score: 30

#### Reach 3197

- CF Rating = Moderate Impact; Normalized score = -0.6
- Most impacted CF metrics: artificial shade, substrate type
- Least impacted CF metric: wave energy
- Geomorphic class: High Bluff; Shoreline length: 3344 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 43.7%; Riparian zone land use: 10.9% TIA, 66.9% forested
- Total shoreline armoring: 83.8%; Total encroaching: 0%
- Total point modifications: 77; Density: 23/1000 ft; most common is buoys, with 8.4/1000 ft
- Other: 4 marina(s) present
- EF Score: 21

#### Reach 3198

- CF Rating = Low/Moderate Impact; Normalized score = -0.375
- Most impacted CF metrics: artificial shade, substrate type
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1236 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 58.9%; Riparian zone land use: 12.3% TIA, 80.5% forested
- Total shoreline armoring: 48.3%; Total encroaching: 0%
- Total point modifications: 9; Density: 7.3/1000 ft; most common is pilings, with 1.6/1000 ft
- Other: 1 marina(s) present
- EF Score: 24

#### Reach 3199

- CF Rating = Moderate/High Impact; Normalized score = -0.625
- Most impacted CF metrics: artificial shade, substrate type
- Least impacted CF metric: wave energy
- Geomorphic class: High Bluff; Shoreline length: 1126 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 1.5%; Riparian zone land use: 8.5% TIA, 76.6% forested
- Total shoreline armoring: 78.3%; Total encroaching: 64.3%
- Total point modifications: 21; Density: 18.6/1000 ft; most common is buoys, with 5.3/1000 ft
- Other: 2 marina(s) present
- EF Score: 19

#### Reach 3200

- CF Rating = Moderate Impact; Normalized score = -0.6
- Most impacted CF metrics: substrate type, depth/slope
- Least impacted CF metric: wave energy
- Geomorphic class: High Bluff; Shoreline length: 1338 ft

- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 25.8%; Riparian zone land use: 24.1% TIA, 67.8% forested
- Total shoreline armoring: 88.3%; Total encroaching: 88.3%
- Total point modifications: 20; Density: 15/1000 ft; most common is piers, with 4.5/1000 ft
- Other:
- EF Score: 18

#### Reach 3201

- CF Rating = Moderate Impact; Normalized score = -0.425
- Most impacted CF metric: substrate type
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1302 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 34%; Riparian zone land use: 10.7% TIA, 82.6% forested
- Total shoreline armoring: 65%; Total encroaching: 3.6%
- Total point modifications: 27; Density: 20.7/1000 ft; most common is floating docks, with 5.4/1000 ft
- Other:
- EF Score: 19

#### Reach 3202

- CF Rating = Low/Moderate Impact; Normalized score = -0.325
- Most impacted CF metric: substrate type
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 907 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 43.1%; Riparian zone land use: 15.3% TIA, 81.5% forested
- Total shoreline armoring: 43.5%; Total encroaching: 25.2%
- Total point modifications: 7; Density: 7.7/1000 ft; most common is railways, with 2.2/1000 ft
- Other:
- EF Score: 16

#### Reach 3203

- CF Rating = Low/Moderate Impact; Normalized score = -0.3
- Most impacted CF metrics: natural shade, artificial shade
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2168 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 20.6%; Riparian zone land use: 20.3% TIA, 56% forested
- Total shoreline armoring: 32.2%; Total encroaching: 2.6%
- Total point modifications: 27; Density: 12.5/1000 ft; most common is floating docks, with 4.2/1000 ft
- Other:
- EF Score: 16

#### Reach 3204

- CF Rating = Moderate Impact; Normalized score = -0.475
- Most impacted CF metric: substrate type
- Least impacted CF metric: wave energy
- Geomorphic class: Low Bank; Shoreline length: 2790 ft
- Sediment source: Don't Know; Wave exposure: very protected

- Overhanging vegetation: 33.6%; Riparian zone land use: 18.9% TIA, 59.2% forested
- Total shoreline armoring: 52%; Total encroaching: 50.8%
- Total point modifications: 55; Density: 19.7/1000 ft; most common is floating docks, with 5.7/1000 ft
- Other:
- EF Score: 18

#### Reach 3205

- CF Rating = Moderate/High Impact; Normalized score = -0.65
- Most impacted CF metrics: substrate type, depth/slope
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 864 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 10.9%; Riparian zone land use: 25.2% TIA, 33% forested
- Total shoreline armoring: 87.4%; Total encroaching: 74.3%
- Total point modifications: 16; Density: 18.5/1000 ft; most common is stairs, with 3.5/1000 ft
- Other:
- EF Score: 16

#### Reach 3206

- CF Rating = Moderate/High Impact; Normalized score = -0.65
- Most impacted CF metrics: substrate type, depth/slope
- Least impacted CF metric: wave energy
- Geomorphic class: Low Bank; Shoreline length: 298 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 29.7%; Riparian zone land use: 18% TIA, 69.9% forested
- Total shoreline armoring: 98.6%; Total encroaching: 98.6%
- Total point modifications: 16; Density: 53.7/1000 ft; most common is buoys, with 20.2/1000 ft
- Other: 1 marina(s) present
- EF Score: 16

#### Reach 3207

- CF Rating = Moderate Impact; Normalized score = -0.5
- Most impacted CF metrics: natural shade, substrate type
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 875 ft
- Sediment source: Unknown; Wave exposure: very protected
- Overhanging vegetation: 13.8%; Riparian zone land use: 16.7% TIA, 47.8% forested
- Total shoreline armoring: 66.2%; Total encroaching: 17.6%
- Total point modifications: 10; Density: 11.4/1000 ft; most common is upland structures at waterline, with 2.3/1000 ft
- Other: Treasure Island
- EF Score: 20

#### Reach 3208

- CF Rating = Low/Moderate Impact; Normalized score = -0.25
- Most impacted CF metric: natural shade
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1275 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 38.4%; Riparian zone land use: 12.2% TIA, 71.4% forested

- Total shoreline armoring: 25.3%; Total encroaching: 15%
- Total point modifications: 5; Density: 3.9/1000 ft; most common is overwater structures, with 0.8/1000 ft
- Other: includes pier which serves as access to island
- EF Score: 20

#### Reach 3209

- CF Rating = Moderate Impact; Normalized score = -0.425
- Most impacted CF metrics: natural shade, depth/slope
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1940 ft
- Sediment source: Don't Know; Wave exposure: very protected
- Overhanging vegetation: 20.2%; Riparian zone land use: 16.4% TIA, 59.7% forested
- Total shoreline armoring: 61%; Total encroaching: 51.2%
- Total point modifications: 5; Density: 2.6/1000 ft; most common is floating docks, with 1/1000 ft
- Other:
- EF Score: 18

#### Reach 3210

- CF Rating = Moderate/High Impact, Normalized score = -0.7
- Most impacted CF metrics: substrate type, depth/slope
- Least impacted CF metric: wave energy
- Geomorphic class: Low Bank; Shoreline length: 950 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 16.7%; Riparian zone land use: 25.2% TIA, 33.2% forested
- Total shoreline armoring: 93.5%; Total encroaching: 85.4%
- Total point modifications: 17; Density: 17.9/1000 ft; most common is buoys, with 7.4/1000 ft
- Other:
- EF Score: 18

#### Reach 3211

- CF Rating = Low/Moderate Impact; Normalized score = -0.375
- Most impacted CF metrics: wave energy, artificial shade, substrate type
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 838 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 16.1%; Riparian zone land use: 11.4% TIA, 53.8% forested
- Total shoreline armoring: 43.7%; Total encroaching: 0%
- Total point modifications: 7; Density: 8.4/1000 ft; most common is stairs, with 2.4/1000 ft
- Other:
- EF Score: 20

#### Reach 3212

- CF Rating = Moderate Impact; Normalized score = -0.525
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2098 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 19.8% TIA, 51.6% forested
- Total shoreline armoring: 90.4%; Total encroaching: 28%
- Total point modifications: 34; Density: 16.2/1000 ft; most common is piers, with 2.9/1000 ft

- Other:
- EF Score: 30

#### Reach 3213

- CF Rating = Low/Moderate Impact; Normalized score = -0.356
- Most impacted CF metric: sediment supply
- Least impacted CF metric: pollution
- Geomorphic class: High Bluff; Shoreline length: 2010 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 64.3%; Riparian zone land use: 6.1% TIA, 84.4% forested
- Total shoreline armoring: 37.1%; Total encroaching: 37.1%
- Total point modifications: 6; Density: 3/1000 ft; most common is stairs, with 0.5/1000 ft
- Other:
- EF Score: 36

#### Reach 3214

- CF Rating = Low/Moderate Impact; Normalized score = -0.35
- Most impacted CF metrics: wave energy, artificial shade, sediment supply, substrate type, pollution, physical disturbance
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 686 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 17.9%; Riparian zone land use: 14% TIA, 80.7% forested
- Total shoreline armoring: 14.2%; Total encroaching: 0%
- Total point modifications: 6; Density: 8.7/1000 ft; most common is floating docks, with 2.9/1000 ft
- Other: encompasses Bloedel Reserve
- EF Score: 32

#### Reach 3215

- CF Rating = Moderate/High Impact; Normalized score = -0.622
- Most impacted CF metric: depth/slope
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1507 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 12.8%; Riparian zone land use: 11.2% TIA, 76.7% forested
- Total shoreline armoring: 98.8%; Total encroaching: 98.8%
- Total point modifications: 17; Density: 11.3/1000 ft; most common is stairs, with 6/1000 ft
- Other:
- EF Score: 34

#### Reach 3216

- CF Rating = Moderate/High Impact; Normalized score = -0.667
- Most impacted CF metrics: substrate type, depth/slope
- Least impacted CF metric: pollution
- Geomorphic class: High Bluff; Shoreline length: 1009 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 23.5%; Riparian zone land use: 5.4% TIA, 92.9% forested
- Total shoreline armoring: 91.6%; Total encroaching: 82.9%
- Total point modifications: 19; Density: 18.8/1000 ft; most common is stairs, with 5.9/1000 ft
- Other:
- EF Score: 32

### **3.2.3 Rolling Bay-Point Monroe Management Area (MA-3) (Reaches 3176 – 3192, plus Reach 6002)**

*Qualitative Rating = Moderate Impact*

*Mean CF Score (Normalized) = -0.42 (Range: -0.8 to -0.13)*

*Median CF Score (Normalized) = -0.43*

*Number of Reaches = 18*

*Mean EF Score = 22.7 (Range: 18 to 26)*

*Median EF Score = 23.5*

#### Description

Rolling Bay-Point Monroe (MA-3) comprises 29,707 ft of shoreline that encompasses Point Monroe, Point Monroe Lagoon, as well as Rolling Bay to Skiff Point (Table A-1, Figure 2). Rolling Bay-Point Monroe (MA-3) comprises 18 reaches broken into the following categories: high bluff (11), spit/backshore (5), low bank (1), and a large marsh/lagoon (1) (Figure B-28). Much of MA-3 contains extensive tideflats. MA-3 is defined by two drift cells that converge at Point Monroe (Figure 3). The smaller drift cell begins at a divergence zone located on the eastern shore of Port Madison and moves southeast into Point Monroe Lagoon; high bluffs on the landward margin of the lagoon have exhibited some recent instability. The larger second cell begins to the south at a divergence zone located near Skiff Point, with northerly alongshore drift that terminates at the end of Point Monroe. Relative to wave exposure, shorelines along the eastern shore facing Puget Sound are considered “semi-protected,” with “very protected” shorelines within Point Monroe Lagoon (Figure B29). MA-3 receives most upland flows from Dripping Water Creek (WRIA 15.0320) and unnumbered 28, which drain upland areas with low levels of land use (1% TIA).

Overhanging riparian vegetation covers approximately 29% of the MA-3 shoreline (Table A-1, Figure B-34). However, within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 57% of land cover (Figure B-33). Impervious surfaces (e.g., roads, roofs) represent 17% of the riparian zone land cover.

Shoreline development in MA-3 is primarily residential in nature. Many of the homes built along the spit at Point Monroe are built on fill that directly abuts the shoreline, where encroachment is likely underestimated. However, MA-3 shorelines also include Fay Bainbridge State park, which is a stretch of relatively undeveloped sandy beach with shoreline access for recreation. Approximately 38% of shoreline is modified by armoring and 27% of the shoreline has armoring that encroaches into the intertidal zone (Table A-1, Figure B-30).

A total of 291 point modifications were recorded along MA-3 shorelines, at an average of 10 modifications per 1000 ft (Table A-1, Figure B-31). Most of these modifications are structures at the waterline (112), as well as docks (33) and overwater structures (28). A total of 8 outfalls were also recorded in MA-3.

#### Limiting Factors

The average normalized CF score within MA-3 was -0.42, within the middle range of MA scores on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). The wave-energy metric for MA-3 scored particularly low (poor) relative to all other MAs (Table A-3, Figure B-16). Low (poor) wave-energy scores were influenced not only by extent of shoreline armoring within each reach, but also by the

prevalence of vertical concrete-type bulkheads that encroached into the intertidal zone along shorelines with higher wave exposure.

Conversely, the artificial shade and hydrology metrics in MA-3 scored high (good) relative to other MAs (Table A-3, Figure B-16). Artificial shade scores were high (good) primarily because of the low density of shading structures, such as docks and piers, present along MA-3 shorelines. In part, the poor shoreline access (high bluffs) and higher relative wave exposure of this MA is not conducive to mooring and accessing boats. The only multi-boat pier (marina) along this stretch of shoreline was located in the lagoon behind Point Monroe (Figure B-32). Hydrology scores were also relatively high (good), despite the influence of impaired tidal hydrology as a result of armoring encroachment. Much of this can be attributed to low TIA (17%) within the marine riparian zone, the lack of artificial tidal constrictions along the shoreline, and relatively low density of outfalls.

Two of the most highly affected high-bluff reaches on Bainbridge Island (Reaches 3177 and 3178) are located within Rolling Bay (MA-3) (Figure B-38). These reaches are feeder bluffs (at least historically); however, each has homes and bulkheads built at the base of the bluffs, with high rates of armoring (>90%), high densities of point modifications, no overhanging riparian vegetation, and a relatively high %TIA in marine riparian zone.

#### Opportunities

One of the least-impacted spit/barrier/backshore reaches on Bainbridge Island (Reach 3186) encompasses Fay Bainbridge State Park, which has no linear or point modifications along the shoreline, low backshore/dune or riparian vegetation, and LWD accumulation on the backshore (Figure B-38).

The most obvious opportunities for improving scoring of controlling factors metrics include removal or modification of unnecessary armoring structures, especially those that encroach into the intertidal zone. These actions may reduce reflective wave energy, allow resumption of natural sediment processes, preserve intertidal and subtidal vegetated habitats such as eelgrass, and enhance forage-fish spawning functions (Figure B-14).

The EF scores were moderate-to-high in MA-3 relative to the rest of Bainbridge Island (Table A-4, Figure B-11, Appendix D) because of the prevalence of documented herring and sandlance spawning areas, principally in the northern region near Point Monroe (Figure B-34). Cutthroat trout are also documented to spawn in Dripping Water Creek (WRIA 15.0320), and efforts should be made to maximize functions of juvenile rearing areas, both in-stream and in nearby shoreline habitats. Continuous-to-patchy eelgrass beds are found along much of the shoreline, as are geoduck resources (Figures B-35, B-37).

#### Individual Reaches within MA-3 (Figure B-38, Appendix C, Appendix D)

##### Reach 3176

- CF Rating = Moderate Impact; Normalized score = -0.467
- Most impacted CF metric: pollution
- Least impacted CF metric: hydrology
- Geomorphic class: High Bluff; Shoreline length: 427 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 12.3%; Riparian zone land use: 22.6% TIA, 34.1% forested
- Total shoreline armoring: 52.2%; Total encroaching: 0%
- Total point modifications: 2; Density: 4.7/1000 ft; most common is upland structures at waterline, with 2.3/1000 ft
- Other: shellfish closure present
- EF Score: 20

#### Reach 3177

- CF Rating = Moderate/High Impact, Normalized score = -0.8
- Most impacted CF metrics: wave energy, natural shade, substrate type, depth/slope, pollution
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1311 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 39.2% TIA, 36.8% forested
- Total shoreline armoring: 89.1%; Total encroaching: 89.1%
- Total point modifications: 24; Density: 18.3/1000 ft; most common is upland structures at waterline, with 12.2/1000 ft
- Other: shellfish closure present
- EF Score: 18

#### Reach 3178

- CF Rating = Moderate/High Impact, Normalized score = -0.756
- Most impacted CF metrics: wave energy, natural shade, sediment supply, depth/slope, pollution
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 852 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 25.4% TIA, 48.3% forested
- Total shoreline armoring: 100%; Total encroaching: 100%
- Total point modifications: 6; Density: 7/1000 ft; most common is upland structures at waterline, with 2.3/1000 ft
- Other: shellfish closure present
- EF Score: 20

#### Reach 3179

- CF Rating = Low Impact, Normalized score = -0.178
- Most impacted CF metric: sediment supply
- Least impacted CF metric: natural shade, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 5675 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 81.4%; Riparian zone land use: 13.6% TIA, 81.8% forested
- Total shoreline armoring: 26.5%; Total encroaching: 18.4%
- Total point modifications: 10; Density: 1.8/1000 ft; most common is upland structures at waterline, with 0.7/1000 ft
- Other:
- EF Score: 25

#### Reach 3180

- CF Rating = Low/Moderate Impact; Normalized score = -0.4
- Most impacted CF metrics: natural shade, sediment supply
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 905 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 8%; Riparian zone land use: 14.1% TIA, 74.3% forested
- Total shoreline armoring: 34.2%; Total encroaching: 34.2%
- Total point modifications: 1; Density: 1.1/1000 ft; most common is outfalls, with 1.1/1000 ft
- Other:
- EF Score: 22

#### Reach 3181

- CF Rating = Moderate Impact; Normalized score = -0.578
- Most impacted CF metrics: wave energy, depth/slope
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 583 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 10.7%; Riparian zone land use: 36.6% TIA, 44.5% forested
- Total shoreline armoring: 99.9%; Total encroaching: 99.9%
- Total point modifications: 3; Density: 5.1/1000 ft; most common is upland structures at waterline, with 5.1/1000 ft
- Other:
- EF Score: 23

#### Reach 3182

- CF Rating = Low/Moderate Impact; Normalized score = -0.325
- Most impacted CF metrics: wave energy, sediment supply, depth/slope
- Least impacted CF metric: natural shade, artificial shade, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 944 ft
- Sediment source: Foreshore; Wave exposure: semi-protected
- Overhanging vegetation: 6.6%; Riparian zone land use: 29.2% TIA, 51.3% forested
- Total shoreline armoring: 42.8%; Total encroaching: 42.8%
- Total point modifications: 3; Density: 3.2/1000 ft; most common is upland structures at waterline, with 1.1/1000 ft
- Other:
- EF Score: 22

#### Reach 3183

- CF Rating = Moderate Impact; Normalized score = -0.533
- Most impacted CF metrics: wave energy, sediment supply
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 616 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 11.6%; Riparian zone land use: 19.4% TIA, 65.8% forested
- Total shoreline armoring: 68.8%; Total encroaching: 63.8%
- Total point modifications: 4; Density: 6.5/1000 ft; most common is upland structures at waterline, with 4.9/1000 ft
- Other:
- EF Score: 21

#### Reach 3184

- CF Rating = Moderate Impact; Normalized score = -0.511
- Most impacted CF metrics: sediment supply, depth/slope
- Least impacted CF metric: artificial shade, pollution, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 2485 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 17%; Riparian zone land use: 7.6% TIA, 64.8% forested
- Total shoreline armoring: 66.4%; Total encroaching: 66.4%
- Total point modifications: 1; Density: 0.4/1000 ft; most common is stairs, with 0.4/1000 ft
- Other:
- EF Score: 24

#### Reach 3185

- CF Rating = Low Impact, Normalized score = -0.178
- Most impacted CF metric: natural shade
- Least impacted CF metric: wave energy, sediment supply, substrate type, depth/slope, hydrology
- Geomorphic class: High Bluff; Shoreline length: 915 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 9.2%; Riparian zone land use: 22.3% TIA, 47% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 4; Density: 4.4/1000 ft; most common is buoys, with 2.2/1000 ft
- Other: LWD on beach backshore
- EF Score: 25

#### Reach 3186

- CF Rating = Low Impact, Normalized score = -0.125
- Most impacted CF metrics: artificial shade, physical disturbance
- Least impacted CF metric: wave energy, natural shade, sediment supply, substrate type, depth/slope, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2782 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 20.8% TIA, 35.6% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 12; Density: 4.3/1000 ft; most common is upland structures at waterline, with 2.5/1000 ft
- Other: borders Fay Bainbridge State Park,
- EF Score: 24

#### Reach 3187

- CF Rating = Low/Moderate Impact, Normalized score = -0.225
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: natural shade, artificial shade, pollution, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 712 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 1.7% TIA, 0% forested
- Total shoreline armoring: 13.7%; Total encroaching: 0%
- Total point modifications: 3; Density: 4.2/1000 ft; most common is upland structures at waterline, with 2.8/1000 ft
- Other: Fay Bainbridge State Park, backshore dunes and LWD
- EF Score: 20

#### Reach 3188

- CF Rating = Moderate Impact; Normalized score = -0.6
- Most impacted CF metrics: substrate type, depth/slope
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1711 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 30.6% TIA, 0% forested
- Total shoreline armoring: 87.4%; Total encroaching: 66.5%
- Total point modifications: 47; Density: 27.5/1000 ft; most common is upland structures at waterline, with 17.5/1000 ft
- Other: Point Monroe

- EF Score: 26

Reach 3189

- CF Rating = Low/Moderate Impact; Normalized score = -0.325
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1764 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 26% TIA, 1.2% forested
- Total shoreline armoring: 15.5%; Total encroaching: 7%
- Total point modifications: 17; Density: 9.6/1000 ft; most common is buoys, with 5.1/1000 ft
- Other: outer half of Point Monroe
- EF Score: 24

Reach 3190

- CF Rating = Moderate Impact; Normalized score = -0.6
- Most impacted CF metrics: natural shade, physical disturbance
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 3447 ft
- Sediment source: Unknown; Wave exposure: very protected
- Overhanging vegetation: 0%; Riparian zone land use: 29.2% TIA, 2.3% forested
- Total shoreline armoring: 36.6%; Total encroaching: 0%
- Total point modifications: 109; Density: 31.6/1000 ft; most common is upland structures at waterline, with 9.3/1000 ft
- Other: 1 marina(s) present; inside of Point Monroe, encroachment likely underestimated
- EF Score: 22

Reach 6002

- CF Rating = Low/Moderate Impact, Normalized score = -0.225
- Most impacted CF metrics: artificial shade, substrate type
- Least impacted CF metric: wave energy, natural shade
- Geomorphic class: High Bluff; Shoreline length: 1976 ft
- Sediment source: Unknown; Wave exposure: very protected
- Overhanging vegetation: 92.7%; Riparian zone land use: 2.8% TIA, 82.9% forested
- Total shoreline armoring: 8.3%; Total encroaching: 0%
- Total point modifications: 16; Density: 8.1/1000 ft; most common is floating docks, with 3/1000 ft
- Other: High bluffs inside Point Monroe
- EF Score: 24

Reach 3191

- CF Rating = Moderate Impact; Normalized score = -0.467
- Most impacted CF metric: substrate type
- Least impacted CF metric: pollution, hydrology
- Geomorphic class: Low Bank; Shoreline length: 1432 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 29.8%; Riparian zone land use: 6.3% TIA, 71.7% forested
- Total shoreline armoring: 36.3%; Total encroaching: 8%
- Total point modifications: 21; Density: 14.7/1000 ft; most common is piers, with 2.1/1000 ft
- Other: broad beach in shallow bay
- EF Score: 24

Reach 3192

- CF Rating = Low/Moderate Impact; Normalized score = -0.289
- Most impacted CF metrics: sediment supply, substrate type
- Least impacted CF metric: hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1168 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 66.2%; Riparian zone land use: 16.3% TIA, 61.7% forested
- Total shoreline armoring: 39.7%; Total encroaching: 17.6%
- Total point modifications: 8; Density: 6.9/1000 ft; most common is stairs, with 2.6/1000 ft
- Other:
- EF Score: 24

### 3.2.4 Murden Cove Management Area (MA-4) (Reaches 3156 – 3175)

*Qualitative Rating = Low/Moderate Impact*

*Mean CF Score (Normalized) = -0.33 (Range: -0.64 to 0.00)*

*Median CF Score (Normalized) = -0.34*

*Number of Reaches = 20*

*Mean EF Score = 20.2 (Range: 13 to 26)*

*Median EF Score = 20.5*

#### Description

Murden Cove (MA-4) comprises 28,843 ft of shoreline that encompasses all of Murden Cove, as well as Yeomalt Point and part of Wing Point (Table A-1, Figure 2). Murden Cove comprises 20 reaches broken into the following categories: high bluff (11), spit/backshore (6), marsh/lagoon (2), and low bank (1) (Figure B-39). Most of MA-4 also contains extensive tidflats. MA-4 is defined by two drift cells that converge at the head of Murden Cove, forming the Murden Cove Creek subestuary (a spit and marsh/lagoon area) that lacks appreciable alongshore drift (Figure 3). The northern end of the first drift cell begins at a divergence zone located at Skiff Point and moves south into Murden Cove, encompassing high feeder bluffs south of Skiff Point. The second cell begins to the south at a divergence zone located near Wing Point and moves in a northerly direction, encompassing a number of feeder bluff areas below Yeomalt Point and southern Murden Cove (Figure B-40). Relative to wave exposure, almost all shorelines along the eastern shore facing Puget Sound are considered “semi-protected,” with a small stretch of “protected” and “very protected” shorelines within Murden Cove (Figure B-40). Murden Cove receives upland flows from Murden Cove Creek (WRIA 15.0321), which drains upland areas with low-to-moderate levels of land use (6% TIA), as well as a number of small coastal streams.

Overhanging riparian vegetation covers approximately 36% of the MA-4 shoreline, tying it with MA-1 for the highest value observed of any MA (Table A-1, Figure B-45). Within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 58% of land cover (Figure B-44). Impervious surfaces (e.g., roads, roofs) represent 18% of the riparian zone land cover.

Shoreline development in MA-4 is primarily residential in nature, with some shoreline backed by public roads. Only 34% of the shoreline is modified by armoring and 19% of the shoreline has armoring that encroaches into the intertidal zone, both values that compare favorably with all other MAs on Bainbridge Island (Table A-1, Figure B-41). Most of the homes along this stretch of shoreline are built on the high bluffs, which generally make the shoreline inaccessible; armoring is generally composed of rip-rap at the toe of bluffs.

A total of 86 point modifications were recorded along MA-4 shorelines (unpublished data, COBI 2002), at an average of three modifications per 1000 ft, by far the lowest density of all MAs on the Island (Table A-1, Figure B-42). Most of these modifications are stairs (29) and structures at the waterline (14). A total of 10 outfalls were also recorded along MA-4 shorelines.

#### Limiting Factors

The average normalized CF score within MA-4 was -0.33, the second highest (best) MA score on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). MA-4 had no particularly low (poor) scores relative to other MAs, but rather, had among the highest (best) scores in four metric categories: artificial shade, substrate type, depth/slope, and physical disturbance (Table A-3, Figure B-16). Artificial shade scores rated well primarily because of the low density of shading structures, such as docks and piers, along MA-4 shorelines. As was seen in MA-3, poor shoreline access (predominance of high bluffs and extensive tide flats) and higher relative wave exposure of this MA is not conducive to mooring and accessing boats. In addition, no marinas or multi-boat piers were documented along this stretch of shoreline (Figure B-43). Substrate type and depth/slope scores were also good because the percentage of shoreline armoring was fairly low in this MA. As well, the substrate metric reflected the relatively low density of point modifications, whereas depth-slope reflected the lack of dredging activity and moderately low level of armoring encroachment. Finally, physical disturbance scores were high (good) primarily because of the low-density residential setting, high-forested cover in the marine riparian zone, and low number of docks, mooring buoys, and ramp densities of most reaches.

#### Opportunities

Murden Cove (MA-4) encompasses one of the least-altered high bluff reaches (Reach 3165) and two of the least-altered marsh/lagoon reaches (Reaches 3170 and 3171) on Bainbridge Island (Figure B-49, Appendix C). Reach 3165 is a feeder bluff, with downed trees at the based of the bluffs, high forest cover in the landward riparian zone, and no linear or point modifications along shoreline. Reaches 3170 and 3171 are located near the outlet of Murden Cove Creek and have abundant LWD accumulation, intact tidal flats, abundant overhanging and marsh vegetation, and no point or linear modifications along the shoreline.

At an MA level, the most obvious opportunities for improving scoring would be to enhance processes and functions at reaches with particularly low (poor) scores (Figure B-14). This may include targeting removal of encroaching armoring structures in front of feeder bluffs or backshore sediment sources to allow natural sediment processes, modifying or softening armoring structures in front of roads, and removal of constrictions to remnant tidal marshes in Reach 3173 (Figure B-49). Additionally, historic maps and photographs show an extensive backshore marsh along Manitou Beach, which is now fragmented and impacted by development (Peter Namtvedt Best, personal communications). Restoring and reconnecting this marsh to Murden Cove would provide additional functional benefit.

The EF scores were moderate in MA-4 relative to the rest of Bainbridge Island (Figure B-11, Appendix D). There are some small documented areas of surf smelt and sandlance spawning (Figure B-47). Cutthroat trout, coho, and chum salmon are also documented to spawn in Murden Cove Creek (WRIA 15.0321) (Haring 2000), and efforts should be made to preserve spawning access and functions of juvenile rearing areas, both in-stream and in nearby shoreline habitats. Continuous-to-patchy eelgrass beds are found in parts of Murden Cove, and geoduck resources are abundant throughout the MA (Figure B-46 and B-48).

#### Individual Reaches within MA-4 (Figure B-49, Appendix C, Appendix D)

##### Reach 3156

- CF Rating = Moderate/High Impact; Normalized score = -0.622

- Most impacted CF metrics: natural shade, depth/slope, pollution
- Least impacted CF metric: artificial shade
- Geomorphic class: High Bluff; Shoreline length: 267 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 14.8% TIA, 39.3% forested
- Total shoreline armoring: 100%; Total encroaching: 100%
- Total point modifications: 0
- Other: shellfish closure present; Wing Point
- EF Score: 18

#### Reach 3157

- CF Rating = Moderate Impact; Normalized score = -0.422
- Most impacted CF metrics: natural shade, pollution
- Least impacted CF metric: artificial shade, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 717 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 27.2% TIA, 43.7% forested
- Total shoreline armoring: 37%; Total encroaching: 14.5%
- Total point modifications: 4; Density: 5.6/1000 ft; most common is stairs, with 5.6/1000 ft
- Other: shellfish closure present; broad backshore with LWD recruitment
- EF Score: 18

#### Reach 3158

- CF Rating = Low/Moderate Impact; Normalized score = -0.311
- Most impacted CF metric: pollution
- Least impacted CF metric: hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 3639 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 57.3%; Riparian zone land use: 17.2% TIA, 59.5% forested
- Total shoreline armoring: 17.2%; Total encroaching: 13.1%
- Total point modifications: 12; Density: 3.3/1000 ft; most common is stairs, with 2.2/1000 ft
- Other: shellfish closure present; LWD recruitment on beach from bluffs
- EF Score: 26

#### Reach 3159

- CF Rating = Low Impact, Normalized score = -0.133
- Most impacted CF metric: natural shade
- Least impacted CF metric: wave energy, artificial shade, sediment supply, depth/slope, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 387 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 6.3%; Riparian zone land use: 13.3% TIA, 61% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 2; Density: 5.2/1000 ft; most common is upland structures at waterline, with 5.2/1000 ft
- Other:
- EF Score: 24

#### Reach 3160

- CF Rating = Moderate Impact; Normalized score = -0.6
- Most impacted CF metric: depth/slope

- Least impacted CF metric: natural shade, artificial shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 287 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 44% TIA, 9.6% forested
- Total shoreline armoring: 100%; Total encroaching: 100%
- Total point modifications: 1; Density: 3.5/1000 ft; most common is boat ramps, with 3.5/1000 ft
- Other:
- EF Score: 26

#### Reach 3161

- CF Rating = Low/Moderate Impact; Normalized score = -0.325
- Most impacted CF metrics: wave energy, artificial shade, substrate type, pollution, physical disturbance
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2013 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 10.5%; Riparian zone land use: 38% TIA, 25% forested
- Total shoreline armoring: 14.3%; Total encroaching: 3.1%
- Total point modifications: 16; Density: 7.9/1000 ft; most common is upland structures at waterline, with 2/1000 ft
- Other:
- EF Score: 20

#### Reach 3162

- CF Rating = Low/Moderate Impact; Normalized score = -0.244
- Most impacted CF metric: sediment supply
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1980 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 47.6%; Riparian zone land use: 11.2% TIA, 66.2% forested
- Total shoreline armoring: 22.8%; Total encroaching: 14.6%
- Total point modifications: 4; Density: 2/1000 ft; most common is stairs, with 1/1000 ft
- Other:
- EF Score: 24

#### Reach 3163

- CF Rating = Moderate Impact; Normalized score = -0.578
- Most impacted CF metric: sediment supply
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1730 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 13.6%; Riparian zone land use: 18.6% TIA, 59.4% forested
- Total shoreline armoring: 86.5%; Total encroaching: 39.5%
- Total point modifications: 10; Density: 5.8/1000 ft; most common is outfalls, with 2.3/1000 ft
- Other:
- EF Score: 22

#### Reach 3164

- CF Rating = Low/Moderate Impact; Normalized score = -0.356
- Most impacted CF metric: sediment supply
- Least impacted CF metric: pollution, physical disturbance

- Geomorphic class: High Bluff; Shoreline length: 1208 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 77.8%; Riparian zone land use: 5.6% TIA, 76.5% forested
- Total shoreline armoring: 57%; Total encroaching: 51.9%
- Total point modifications: 7; Density: 5.8/1000 ft; most common is stairs, with 3.3/1000 ft
- Other:
- EF Score: 26

#### Reach 3165

- CF Rating = Low Impact, Normalized score = -0.067
- Most impacted CF metric: natural shade
- Least impacted CF metric: wave energy, artificial shade, sediment supply, substrate type, depth/slope, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 182 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 43.8%; Riparian zone land use: 18.2% TIA, 66.2% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 0
- Other:
- EF Score: 22

#### Reach 3166

- CF Rating = Moderate; Normalized score = -0.467
- Most impacted CF metrics: sediment supply, depth/slope
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1434 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 67%; Riparian zone land use: 13.7% TIA, 66% forested
- Total shoreline armoring: 89.1%; Total encroaching: 89.1%
- Total point modifications: 3; Density: 2.1/1000 ft; most common is pilings, with 2.1/1000 ft
- Other:
- EF Score: 22

#### Reach 3167

- CF Rating = Moderate/High Impact; Normalized score = -0.644
- Most impacted CF metrics: substrate type, depth/slope
- Least impacted CF metric: pollution, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 636 ft
- Sediment source: Backshore; Wave exposure: semi-protected
- Overhanging vegetation: 14.2%; Riparian zone land use: 15.5% TIA, 53.6% forested
- Total shoreline armoring: 100%; Total encroaching: 72.4%
- Total point modifications: 10; Density: 15.7/1000 ft; most common is upland structures at waterline, with 3.1/1000 ft
- Other: large shallow tide flats
- EF Score: 14

#### Reach 3168

- CF Rating = Moderate Impact; Normalized score = -0.425
- Most impacted CF metrics: wave energy, sediment supply, substrate type
- Least impacted CF metric: natural shade, artificial shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 438 ft

- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 17.5% TIA, 58.2% forested
- Total shoreline armoring: 78.6%; Total encroaching: 19.9%
- Total point modifications: 3; Density: 6.9/1000 ft; most common is boat ramps, with 4.6/1000 ft
- Other:
- EF Score: 13

#### Reach 3169

- CF Rating = Low Impact, Normalized score = -0.125
- Most impacted CF metric: wave energy
- Least impacted CF metric: natural shade, artificial shade, pollution, hydrology, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1483 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 7.2% TIA, 80.8% forested
- Total shoreline armoring: 4.8%; Total encroaching: 0%
- Total point modifications: 0
- Other: LWD accumulation on spit
- EF Score: 16

#### Reach 3170

- CF Rating = Low Impact, Normalized score = -0.05
- Most impacted CF metric: natural shade
- Least impacted CF metric: wave energy, artificial shade, sediment supply, substrate type, depth/slope, pollution, hydrology, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 760 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 56.3%; Riparian zone land use: 5.3% TIA, 88.3% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 0
- Other:
- EF Score: 21

#### Reach 3171

- CF Rating = No Impact, Normalized score = 0
- Most impacted CF metrics:
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope, pollution, hydrology, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 3929 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 95.7%; Riparian zone land use: 5% TIA, 88.4% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 2; Density: 0.5/1000 ft; most common is outfalls, with 0.3/1000 ft
- Other:
- EF Score: 24

#### Reach 3172

- CF Rating = Low/Moderate Impact, Normalized score = -0.222
- Most impacted CF metric: natural shade
- Least impacted CF metric: artificial shade, hydrology, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 1173 ft
- Sediment source: Alongshore; Wave exposure: protected

- Overhanging vegetation: 4%; Riparian zone land use: 10.2% TIA, 54.8% forested
- Total shoreline armoring: 6.7%; Total encroaching: 0%
- Total point modifications: 1; Density: 0.9/1000 ft; most common is upland structures at waterline, with 0.9/1000 ft
- Other: small shallow embayment
- EF Score: 17

#### Reach 3173

- CF Rating = Low Impact, Normalized score = -0.175
- Most impacted CF metric: hydrology
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2150 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 10.8% TIA, 50.3% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 2; Density: 0.9/1000 ft; most common is outfalls, with 0.9/1000 ft
- Other: tidal constriction (culvert) to remnant tidal marsh; backshore is taken up by road, LWD recruitment along entire shoreline
- EF Score: 16

#### Reach 3174

- CF Rating = Moderate Impact; Normalized score = -0.5
- Most impacted CF metric: sediment supply
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1632 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 1.5%; Riparian zone land use: 37% TIA, 29.2% forested
- Total shoreline armoring: 80.3%; Total encroaching: 6.4%
- Total point modifications: 4; Density: 2.5/1000 ft; most common is overwater structures, with 0.6/1000 ft
- Other: backshore dominated by road, LWD recruitment good
- EF Score: 17

#### Reach 3175

- CF Rating = Moderate Impact; Normalized score = -0.422
- Most impacted CF metric: pollution
- Least impacted CF metric: artificial shade, hydrology
- Geomorphic class: High Bluff; Shoreline length: 2799 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 22.4%; Riparian zone land use: 31.7% TIA, 35.3% forested
- Total shoreline armoring: 60.5%; Total encroaching: 24.7%
- Total point modifications: 5; Density: 1.8/1000 ft; most common is pilings, with 1.4/1000 ft
- Other: shellfish closure present
- EF Score: 18

### 3.2.5 Eagle Harbor Management Area (MA-5) (Reaches 3121 – 3155)

*Qualitative Rating = Moderate/High Impact*

*Mean CF Score (Normalized) = -0.56 (Range: -0.87 to -0.25)*

*Median CF Score (Normalized) = -0.58*

*Number of Reaches = 35*

*Mean EF Score = 17.9 (Range: 12 to 24)*

*Median EF Score = 18*

#### Description

Eagle Harbor (MA-5) comprises 46,054 ft of shoreline that encompasses all of Rockaway Beach and Eagle Harbor, including all of Bill Point and part of Wing Point (Table A-1, Figure 2). This diverse MA comprises 35 reaches broken into the following categories: marsh/lagoon (10), spit/backshore (8), low bank (8), and high bluff (4) (Figure B-39). MA-5 is defined by three major drift cells (Figure 3). Two of them begin at the outer margins of Eagle Harbor (Wing Point and Bill Point) and move westward, terminating in the middle of Eagle Harbor, an area that lacks appreciable alongshore drift. The third drift cell begins at a divergence zone located just to the north of Blakely Harbor and moves north along Rockaway beach to Bill Point. Relative to wave exposure, all shorelines along the eastern shore, facing Puget Sound, are considered “semi-protected,” whereas the inner portion of Eagle Harbor is considered “very protected” (Figure B-40). Eagle Harbor receives upland flows from six watersheds with moderate-to-high levels of land use: WRIA 15.0330 (TIA 3%), WRIA 15.0329 (TIA 4%), Sportsman’s Club Pond Creek (WRIA 15.0325; TIA 10%), WRIA unnumbered 48 (TIA 60%), Ravine Creek (WRIA 15.0324; TIA 40%), and WRIA unnumbered 22 (TIA 18%).

Overhanging riparian vegetation covers approximately 23% of the MA-5 shoreline, among the lowest values for this characteristic among MAs on Bainbridge Island (Table A-1, Figure B-45). Within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose only 36% of land cover, whereas impervious surfaces (e.g., roads, roofs) represent 45% of land cover (Figure B-44). Eagle Harbor was the only MA on Bainbridge Island where the %TIA exceeded the percentage of natural vegetation in the marine riparian zone.

Eagle Harbor (MA-5) is the commercial and industrial heart of Bainbridge Island, and includes the City’s downtown, a Washington State Ferry terminal and repair facility, multiple commercial marinas, and a Superfund site at Bill Point, throughout portions of the outer harbor, and at the mouth of the Ravine Creek. There is also the City’s Waterfront Park in Eagle Harbor that provides shoreline access, boat launch facilities, and visitor moorage (Figure B-43). The remainder of MA-5 shoreline has typical single-family residential development, with some shoreline backed by public roads. Almost 53% of the shoreline is modified by armoring and 30% of the shoreline has armoring that encroaches into the intertidal zone, high values when compared with all other MAs on Bainbridge Island (Table A-1, Figure B-41).

A total of 506 point modifications were recorded along MA-5 shorelines, at an average of 11 modifications per 1000 ft (Table A-1, Figure B-42). Most of these modifications are associated with boat facilities, including pilings (89), moored boats (78), mooring buoys (66), and docks (60). At least 17 marinas, defined as a dock with more than five mooring slips, were present along the shoreline of MA-5. A total of 38 outfalls were also recorded along MA-5 shorelines.

#### Limiting Factors

The average normalized CF score within MA-5 was -0.56, the lowest (worst) MA score on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). Eagle Harbor (MA-5) had among the lowest (poorest)

scores of all MAs in four of the nine metrics: depth slope, pollution, hydrology, and physical disturbance; no metrics placed among the high (good) scores (Table A-3, Figure B-16). Depth and slope scores were low (poor), in part, because dredging activity occurred in at least seven reaches within the MA. As well, depth and slope scores reflected the relatively high rate of armoring encroachment (30%) along Eagle Harbor shorelines. Pollution scores were low (poor) in MA-5 because of recreational shellfish closures/warnings throughout all reaches in and around Eagle Harbor from contaminated runoff, marinas, the Eagle Harbor/Wyckoff Superfund Site, and the sewage treatment plant outfall at Wing Point. High %TIA in the marine riparian zone (45%), high outfall densities, and impaired tidal hydrology due to the high rate of armoring encroachment influenced the low (poor) hydrology metric score. Finally, physical disturbance scores were low (poor) primarily because of the “urban” setting (ferry activity) of some reaches, low forested cover in the marine riparian zone (36%), and relatively high number of docks, mooring buoys, and ramp densities within most reaches.

Some of the most highly impacted reaches on Bainbridge Island were located in Eagle Harbor (MA-5), including reaches 3131, 3141, 3143, and 3144 as well as reaches 3125 and 3126 associated with the Eagle Harbor/Wyckoff Superfund site on Bill Point (Figure B-49, Appendix C). In all cases, these reaches were characterized by exceptional amounts of fill and armoring, most of which encroached into the intertidal zone, high levels of point modifications, including docks and piers, and a high %TIA in the marine riparian zone.

#### Opportunities

Numerous opportunities exist for improving scoring of CF metrics at the individual reach level and perhaps on a sub area basis within MA-5, although the net improvement to the entire Eagle Harbor MA would likely be a significant challenge considering the current level of alterations (Figure B-14). The best opportunities for improvement should be sought before opportunities are lost or significantly limited further, especially opportunities to improve water quality and remove fill that can help restore some of the marsh/lagoon habitat permanently lost due to Superfund remediation. Regardless, best management practices would recommend actions that improve CF scores, such as minimizing and removing shoreline armoring in areas where erosion does not place structures at risk (e.g., Waterfront Park), maximizing light penetration in overwater structures, and improving the relative percentage of forested-to-impervious surface area in the marine riparian zone. Redevelopment may occur in an urban area at a faster rate than elsewhere, opportunities for restoration or enhancement might arise during the redevelopment of properties and infrastructure.

The EF scores were low (17.9) in MA-5 relative to the rest of Bainbridge Island (Figure B-11), despite the presence of at least three fish-bearing streams and some areas of documented sand lance and surf smelt spawn (Table A-4, Figure B-47). Low EF scores can be attributed to the low levels of overhanging vegetation, patchy distribution of eelgrass, and the paucity of geoduck resources in Eagle Harbor (Figures B-46 and B-48). Historic records document that herring once spawned in Eagle Harbor, but give no indication as to the reason for population declines (Chapman et al. 1941). Currently, high pollution levels prohibit the harvest and consumption of fish and shellfish from these waters.

#### Individual Reaches within MA-5 (Figure B-49, Appendix C, Appendix D)

##### Reach 3121

- CF Rating = Low/Moderate Impact; Normalized score = -0.267
- Most impacted CF metric: natural shade
- Least impacted CF metric: hydrology
- Geomorphic class: Low Bank; Shoreline length: 644 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 17.4%; Riparian zone land use: 15.2% TIA, 57% forested

- Total shoreline armoring: 23.8%; Total encroaching: 17.8%
- Total point modifications: 2; Density: 3.1/1000 ft; most common is buoys, with 3.1/1000 ft
- Other:
- EF Score: 19

#### Reach 3122

- CF Rating = Moderate Impact ; Normalized score = -0.475
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade, artificial shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1770 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 58.4% TIA, 35.4% forested
- Total shoreline armoring: 63.5%; Total encroaching: 29%
- Total point modifications: 25; Density: 14.1/1000 ft; most common is stairs, with 6.2/1000 ft
- Other:
- EF Score: 20

#### Reach 3123

- CF Rating = Moderate Impact ; Normalized score = -0.575
- Most impacted CF metric: wave energy
- Least impacted CF metric: natural shade, artificial shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 4019 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 3.8%; Riparian zone land use: 44.6% TIA, 30.8% forested
- Total shoreline armoring: 82.3%; Total encroaching: 49.5%
- Total point modifications: 46; Density: 11.4/1000 ft; most common is upland structures at waterline, with 5/1000 ft
- Other: homes at base of bluff
- EF Score: 18

#### Reach 3124

- CF Rating = Moderate Impact ; Normalized score = -0.578
- Most impacted CF metrics: wave energy, depth/slope, pollution
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 836 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 29%; Riparian zone land use: 32.2% TIA, 49.7% forested
- Total shoreline armoring: 69.4%; Total encroaching: 69.4%
- Total point modifications: 0Other: shellfish closure present
- EF Score: 24

#### Reach 3125

- CF Rating = Moderate/High Impact, Normalized score = -0.7
- Most impacted CF metrics: wave energy, depth/slope, pollution
- Least impacted CF metric: natural shade, artificial shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1244 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 4%; Riparian zone land use: 74.5% TIA, 5.6% forested
- Total shoreline armoring: 99.6%; Total encroaching: 99.6%
- Total point modifications: 4; Density: 3.2/1000 ft; most common is pilings, with 3.2/1000 ft
- Other: shellfish closure present; Creosote (Bill) Point

- EF Score: 20

Reach 3126

- CF Rating = Moderate/High Impact, Normalized score = -0.7
- Most impacted CF metrics: wave energy, depth/slope, pollution
- Least impacted CF metric: natural shade, artificial shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 402 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 84.7% TIA, 0% forested
- Total shoreline armoring: 100%; Total encroaching: 100%
- Total point modifications: 0
- Other: shellfish closure present; Creosote (Bill) Point
- EF Score: 14

Reach 3127

- CF Rating = Moderate Impact ; Normalized score = -0.575
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade, artificial shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1141 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 57.7% TIA, 23.5% forested
- Total shoreline armoring: 100%; Total encroaching: 41.4%
- Total point modifications: 0
- Other: shellfish closure present; inside of Creosote (Bill) Point
- EF Score: 12

Reach 3128

- CF Rating = Moderate Impact ; Normalized score = -0.425
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade, artificial shade, hydrology, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 374 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 22.7% TIA, 71.2% forested
- Total shoreline armoring: 100%; Total encroaching: 0%
- Total point modifications: 1; Density: 2.7/1000 ft; most common is pilings, with 2.7/1000 ft
- Other: shellfish closure present; inside of Creosote (Bill) Point
- EF Score: 12

Reach 3129

- CF Rating = Low/Moderate Impact ; Normalized score = -0.325
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade, artificial shade, hydrology, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 446 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 70.5%; Riparian zone land use: 13.6% TIA, 80.6% forested
- Total shoreline armoring: 64.7%; Total encroaching: 0%
- Total point modifications: 1; Density: 2.2/1000 ft; most common is pilings, with 2.2/1000 ft
- Other: shellfish closure present
- EF Score: 16

#### Reach 3130

- CF Rating = Moderate/High Impact ; Normalized score = -0.625
- Most impacted CF metrics: depth/slope, pollution
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2871 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 34.3%; Riparian zone land use: 42% TIA, 52% forested
- Total shoreline armoring: 33.8%; Total encroaching: 24.1%
- Total point modifications: 17; Density: 5.9/1000 ft; most common is overwater structures, with 2.1/1000 ft
- Other: dredged regions, 4 marina(s), and shellfish closure present
- EF Score: 14

#### Reach 3131

- CF Rating = High Impact, Normalized score = -0.844
- Most impacted CF metrics: natural shade, substrate type, depth/slope, pollution
- Least impacted CF metric: sediment supply, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 386 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 61.3% TIA, 31% forested
- Total shoreline armoring: 97.8%; Total encroaching: 53.1%
- Total point modifications: 9; Density: 23.3/1000 ft; most common is outfalls, with 7.8/1000 ft
- Other: dredged regions, 1 marina(s), and shellfish closure present
- EF Score: 14

#### Reach 3132

- CF Rating = Moderate/High Impact ; Normalized score = -0.644
- Most impacted CF metrics: substrate type, pollution
- Least impacted CF metric: hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 2959 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 32.2%; Riparian zone land use: 42.7% TIA, 41.5% forested
- Total shoreline armoring: 71.6%; Total encroaching: 27.9%
- Total point modifications: 114; Density: 38.5/1000 ft; most common is boats, with 14.2/1000 ft
- Other: shellfish closure present
- EF Score: 24

#### Reach 3133

- CF Rating = Moderate Impact ; Normalized score = -0.55
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1318 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 18.7%; Riparian zone land use: 40.1% TIA, 51.7% forested
- Total shoreline armoring: 61.9%; Total encroaching: 8.3%
- Total point modifications: 17; Density: 12.9/1000 ft; most common is floating docks, with 3.8/1000 ft
- Other: shellfish closure present; broad shallow mudflat
- EF Score: 18

Reach 3134

- CF Rating = Moderate/High Impact ; Normalized score = -0.686
- Most impacted CF metrics: substrate type, pollution
- Least impacted CF metric: wave energy, natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1230 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 19.6%; Riparian zone land use: 33.7% TIA, 53.2% forested
- Total shoreline armoring: 74.1%; Total encroaching: 34.1%
- Total point modifications: 19; Density: 15.4/1000 ft; most common is floating docks, with 6.5/1000 ft
- Other: shellfish closure present; broad tidal flat
- EF Score: 18

Reach 3135

- CF Rating = Low/Moderate Impact ; Normalized score = -0.4
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, natural shade
- Geomorphic class: Low Bank; Shoreline length: 689 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 85.3%; Riparian zone land use: 41.5% TIA, 37.2% forested
- Total shoreline armoring: 63.8%; Total encroaching: 18.1%
- Total point modifications: 1; Density: 1.5/1000 ft; most common is buoys, with 1.5/1000 ft
- Other: shellfish closure present; point of land
- EF Score: 19

Reach 3136

- CF Rating = Low/Moderate Impact ; Normalized score = -0.325
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2214 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 21.6%; Riparian zone land use: 39.9% TIA, 41.1% forested
- Total shoreline armoring: 22.5%; Total encroaching: 19.7%
- Total point modifications: 9; Density: 4.1/1000 ft; most common is pilings, with 2.7/1000 ft
- Other: shellfish closure present; extensive tide flats
- EF Score: 18

Reach 3137

- CF Rating = Moderate Impact ; Normalized score = -0.5
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1816 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 38.7%; Riparian zone land use: 19.3% TIA, 56% forested
- Total shoreline armoring: 46.1%; Total encroaching: 33.2%
- Total point modifications: 19; Density: 10.5/1000 ft; most common is pilings, with 6.1/1000 ft
- Other: shellfish closure present; extensive mudflats, fronts road
- EF Score: 19

#### Reach 3138

- CF Rating = Low/Moderate Impact ; Normalized score = -0.375
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2682 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 28.5%; Riparian zone land use: 11.1% TIA, 57.1% forested
- Total shoreline armoring: 13.5%; Total encroaching: 9.1%
- Total point modifications: 13; Density: 4.8/1000 ft; most common is upland structures at waterline, with 1.1/1000 ft
- Other: shellfish closure present; extensive mudflats, saltmarsh
- EF Score: 20

#### Reach 3139

- CF Rating = Low/Moderate Impact ; Normalized score = -0.25
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, sediment supply, substrate type, depth/slope
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1515 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 65.2%; Riparian zone land use: 22.5% TIA, 50% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 5; Density: 3.3/1000 ft; most common is outfalls, with 1.3/1000 ft
- Other: shellfish closure present; outlet for Sportsman's Club Creek
- EF Score: 22

#### Reach 3140

- CF Rating = Low/Moderate Impact ; Normalized score = -0.3
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2035 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 43.6%; Riparian zone land use: 29.7% TIA, 36.7% forested
- Total shoreline armoring: 8.5%; Total encroaching: 8.5%
- Total point modifications: 3; Density: 1.5/1000 ft; most common is outfalls, with 1/1000 ft
- Other: shellfish closure present; clearing for parking lots
- EF Score: 21

#### Reach 3141

- CF Rating = Moderate/High Impact, Normalized score = -0.725
- Most impacted CF metrics: depth/slope, pollution
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2012 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 33.9%; Riparian zone land use: 61.2% TIA, 17.5% forested
- Total shoreline armoring: 56.1%; Total encroaching: 23.3%
- Total point modifications: 21; Density: 10.4/1000 ft; most common is floating docks, with 3/1000 ft
- Other: dredged regions, 1 marina(s), and shellfish closure present
- EF Score: 20

#### Reach 3142

- CF Rating = Moderate Impact ; Normalized score = -0.571
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 305 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 0%; Riparian zone land use: 49.4% TIA, 34.9% forested
- Total shoreline armoring: 34.7%; Total encroaching: 0%
- Total point modifications: 5; Density: 16.4/1000 ft; most common is pilings, with 3.3/1000 ft
- Other: shellfish closure present; dune vegetation, no clearing, spit not included in COBI database
- EF Score: 19

#### Reach 3143

- CF Rating = High Impact, Normalized score = -0.867
- Most impacted CF metrics: artificial shade, substrate type, depth/slope, pollution, physical disturbance
- Least impacted CF metric: sediment supply, hydrology
- Geomorphic class: Low Bank; Shoreline length: 708 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 12.6%; Riparian zone land use: 82.2% TIA, 5.1% forested
- Total shoreline armoring: 87.5%; Total encroaching: 0%
- Total point modifications: 20; Density: 28.2/1000 ft; most common is floating docks, with 7.1/1000 ft
- Other: dredged regions, 3 marina(s), and shellfish closure present
- EF Score: 14

#### Reach 3144

- CF Rating = High Impact, Normalized score = -0.822
- Most impacted CF metrics: natural shade, depth/slope, pollution, physical disturbance
- Least impacted CF metric: sediment supply
- Geomorphic class: Low Bank; Shoreline length: 536 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 93.9% TIA, 2.2% forested
- Total shoreline armoring: 63.6%; Total encroaching: 63.6%
- Total point modifications: 11; Density: 20.5/1000 ft; most common is outfalls, with 7.5/1000 ft
- Other: dredged regions, 1 marina(s), and shellfish closure present
- EF Score: 13

#### Reach 3145

- CF Rating = Moderate/High Impact ; Normalized score = -0.675
- Most impacted CF metrics: pollution, physical disturbance
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 927 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 42.8%; Riparian zone land use: 88.3% TIA, 0.6% forested
- Total shoreline armoring: 54.4%; Total encroaching: 32.8%
- Total point modifications: 14; Density: 15.1/1000 ft; most common is buoys, with 4.3/1000 ft
- Other: 1 marina(s), and shellfish closure present
- EF Score: 16

#### Reach 3146

- CF Rating = Moderate/High Impact, Normalized score = -0.733
- Most impacted CF metrics: natural shade, artificial shade, pollution, physical disturbance
- Least impacted CF metric: wave energy, depth/slope, hydrology
- Geomorphic class: Low Bank; Shoreline length: 471 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 86.4% TIA, 0% forested
- Total shoreline armoring: 62.4%; Total encroaching: 12.3%
- Total point modifications: 15; Density: 31.9/1000 ft; most common is boats, with 10.6/1000 ft
- Other: 2 marina(s), and shellfish closure present; part of Waterfront Park with public boat launch, moorage and recreational facilities
- EF Score: 17

#### Reach 3147

- CF Rating = Moderate/High Impact ; Normalized score = -0.65
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2718 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 39.5%; Riparian zone land use: 70.7% TIA, 21.1% forested
- Total shoreline armoring: 55.6%; Total encroaching: 55.6%
- Total point modifications: 23; Density: 8.5/1000 ft; most common is boats, with 3.3/1000 ft
- Other: 1 marina(s), and shellfish closure present; part of Waterfront Park
- EF Score: 18

#### Reach 3148

- CF Rating = Moderate Impact ; Normalized score = -0.6
- Most impacted CF metrics: artificial shade, depth/slope, pollution, physical disturbance
- Least impacted CF metric: wave energy, natural shade, sediment supply
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 233 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 98.7% TIA, 0% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 15; Density: 64.3/1000 ft; most common is pilings, with 51.5/1000 ft
- Other: dredged regions, urban waterfront, 2 marina(s), and shellfish closure present; WSDOT repair facility covers entire shoreline; extensive fill
- EF Score: 13

#### Reach 3149

- CF Rating = Moderate/High Impact ; Normalized score = -0.622
- Most impacted CF metrics: depth/slope, pollution, physical disturbance
- Least impacted CF metric: wave energy, sediment supply
- Geomorphic class: High Bluff; Shoreline length: 2031 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 29.9%; Riparian zone land use: 62.6% TIA, 18.1% forested
- Total shoreline armoring: 31.5%; Total encroaching: 21.3%
- Total point modifications: 35; Density: 17.2/1000 ft; most common is pilings, with 13.3/1000 ft
- Other: dredged regions, urban waterfront, 1 marina(s), and shellfish closure present; includes WSDOT ferry terminal
- EF Score: 18

#### Reach 3150

- CF Rating = Moderate Impact ; Normalized score = -0.475
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2455 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 1.5%; Riparian zone land use: 28.6% TIA, 39.6% forested
- Total shoreline armoring: 58.8%; Total encroaching: 24.1%
- Total point modifications: 16; Density: 6.5/1000 ft; most common is stairs, with 2/1000 ft
- Other: shellfish closure present; large intertidal beach, backed by marsh and LWD
- EF Score: 21

#### Reach 3151

- CF Rating = Moderate/High Impact ; Normalized score = -0.622
- Most impacted CF metric: pollution
- Least impacted CF metric: hydrology
- Geomorphic class: High Bluff; Shoreline length: 944 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 3%; Riparian zone land use: 27% TIA, 44.4% forested
- Total shoreline armoring: 71.1%; Total encroaching: 20.4%
- Total point modifications: 11; Density: 11.7/1000 ft; most common is buoys, with 4.2/1000 ft
- Other: shellfish closure present
- EF Score: 20

#### Reach 3152

- CF Rating = Low/Moderate Impact ; Normalized score = -0.4
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 815 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 22.8% TIA, 50% forested
- Total shoreline armoring: 17.9%; Total encroaching: 0%
- Total point modifications: 8; Density: 9.8/1000 ft; most common is buoys, with 4.9/1000 ft
- Other: shellfish closure present; wide backshore with dune vegetation and LWD accumulation
- EF Score: 16

#### Reach 3153

- CF Rating = Low/Moderate Impact ; Normalized score = -0.4
- Most impacted CF metrics: natural shade, pollution
- Least impacted CF metric: wave energy, artificial shade, hydrology, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 463 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 33.9% TIA, 45.5% forested
- Total shoreline armoring: 39.5%; Total encroaching: 0%
- Total point modifications: 2; Density: 4.3/1000 ft; most common is pilings, with 4.3/1000 ft
- Other: shellfish closure present; barrier beach with lagoon
- EF Score: 20

#### Reach 3154

- CF Rating = Moderate/High Impact ; Normalized score = -0.644
- Most impacted CF metrics: natural shade, depth/slope, pollution
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 726 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 21.6% TIA, 48.8% forested
- Total shoreline armoring: 92.3%; Total encroaching: 81.4%
- Total point modifications: 5; Density: 6.9/1000 ft; most common is groins, with 5.5/1000 ft
- Other: shellfish closure present
- EF Score: 20

#### Reach 3155

- CF Rating = Moderate/High Impact ; Normalized score = -0.644
- Most impacted CF metrics: natural shade, depth/slope, pollution
- Least impacted CF metric: artificial shade
- Geomorphic class: Low Bank; Shoreline length: 116 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 48% TIA, 28% forested
- Total shoreline armoring: 100%; Total encroaching: 100%
- Total point modifications: 0
- Other: shellfish closure present; part of Wing Point
- EF Score: 20

### 3.2.6 Blakely Harbor Management Area (MA-6) (Reaches 3105 – 3120)

*Qualitative Rating = Low/Moderate Impact*

*Mean CF Score (Normalized) = -0.30 (Range: -0.68 to 0.00)*

*Median CF Score (Normalized) = -0.33*

*Number of Reaches = 16*

*Mean EF Score = 17.6 (Range: 10 to 27)*

*Median EF Score = 17*

#### Description

MA-6 comprises 20,345 ft of shoreline that encompasses all of Blakely Harbor, including part of Restoration Point (Table A-1, Figure 2). Blakely Harbor is an embayment comprising 16 reaches broken into the following categories: spit/backshore (7), low bank (6), rocky shore (2), and marsh/lagoon (1) (Figure B-50). MA-6 is defined by two drift cells with westerly alongshore drift that terminate at the head of Blakely Harbor, with the log pond area lacking appreciable alongshore drift (Figure 3). The first drift cell begins at a divergence zone located at a point on the northern margin of Blakely Harbor and moves west into the harbor; this short stretch of shoreline has scarce sediment abundance and encompasses a small reach with rocky shore (Figure B-51). The second drift cell begins at Restoration Point, a rocky headland with scarce sediment abundance and no appreciable alongshore drift, and moves northwest into Blakely Harbor. Relative to wave exposure, shorelines along the southern stretch of MA-6 are considered “semi-protected,” whereas the interior of Blakely Harbor is considered “protected” to “very protected” (Figure B-51). Blakely Harbor receives upland flows from five watersheds with low levels of land use and high forest cover: WRIA unnumbered 56 (TIA 1%), WRIA unnumbered 77 (TIA 2%), WRIA 15.0332 (TIA <1%), Macs Dam Creek (WRIA 15.0331; TIA <1%), and unnumbered 65 (TIA <1%).

Overhanging riparian vegetation covers approximately 29% of the MA-6 shoreline (Table A-1, Figure B-56). Within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 59% of land cover, whereas impervious surfaces (e.g., roads, roofs) represent 19% of land cover (Figure B-55).

Historically, Blakely Harbor was the home of a large commercial sawmill, which included a log rafting pond in the upper reaches of the bay that was constructed with a large stone jetty that constricted tidal flows (Figure B-54). This area is now parkland with public shoreline access, recreational trails, and plans for an interpretive center. The remainder of MA-6 shoreline has single-family residential development. Only 22% of the shoreline is modified by armoring and 17% of the shoreline has armoring that encroaches into the intertidal zone, the lowest values for any MA on Bainbridge Island (Table A-1, Figure B-52).

A total of 132 point modifications were recorded along MA-6 shorelines (unpublished data, COBI 2002), at an average of 6.5 modifications per 1000 ft, among the lowest on Bainbridge Island (Table A-1, Figure B-53). Most of these modifications were composed of mooring buoys (32), pilings (19), stairs (15), groins (14), and docks (14). The rock jetty built in the upper bay to create the historic log pond represents an unnatural tidal constriction in upper Blakely Harbor (Figure B-54). As well, a total of 8 outfalls were recorded along MA-6 shorelines.

#### Limiting Factors

The average normalized CF score within MA-6 was -0.33, the highest (best) MA score on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). MA-6 had no particularly low (poor) scores relative to other MAs, but rather, had among the best scores in seven of the nine metric categories: wave energy, natural shade, sediment supply, substrate type, depth/slope, pollution, and hydrology (Table A-3, Figure B-16). High (good) wave-energy scores were influenced primarily by the relatively low rate of shoreline armoring (22%) and low rate of armor encroachment (17%) into the intertidal zone. Natural shade scores were low (poor) despite a fairly average total percentage (29%) of total shoreline with overhanging riparian vegetation. Much of this can be attributed to the prevalence of spit/backshore geomorphic class reaches (7 of 16 reaches), where natural shade is not considered an issue because these habitats often are exposed, lack overhanging riparian vegetation, or are composed of low dune vegetation. As well, a number of other reaches in the Blakely Harbor MA also had riparian cover exceeding 90%.

Sediment supply scores were high (good) primarily because of the combination of low shoreline armoring rates combined with the lack of feeder bluffs and backshore sediment sources. However, groins (14) were a somewhat conspicuous feature along this stretch of shoreline with alongshore sediment transport and scarce-to-moderate sediment abundance, which lowered (worsened) sediment supply scores. High (good) substrate-type scores were influenced by low rates of shoreline armoring in this MA, as well as the relatively low density of point modifications (6.5/1000 ft shoreline). Low armoring and armoring encroachment rates also contributed to high (good) scores in the depth/slope metric, despite two reaches with a likely history of dredging activity. Pollution scores were high in MA-6 because of a lack of recreational shellfish closures or warnings, marinas and fish farms. Relatively low %TIA in the marine riparian zone and outfall densities along the shoreline in some reaches further influenced high (good) pollution metric scores. Finally, hydrology scores were also relatively high (good), despite the influence of an artificial tidal constriction in reach 3116, because of low %TIA scores (19%) within the marine riparian zone, low rates of armoring encroachment into the intertidal zone, and relatively low outfall densities.

#### Opportunities

Three of the least-impacted, low-bank reaches on Bainbridge Island are located in Blakely Harbor (MA-6), including Reaches 3112, 3113, and 3114 (Figure B-60, Appendix C). In all cases, the marine riparian

zone of these reaches is composed of fairly intact forest, with no linear modifications and few point modifications present along the shoreline.

At an MA level, the most obvious opportunities for improving scoring would be to enhance processes and functions at reaches with particularly high scores (Figure B-14). This effort may include targeting removal or modification of encroaching armoring structures or groin structures, and modifying/removing the rock jetty that constricts tidal exchange to back-bay habitats in Reach 3115 (Figure B-60).

The EF scores were low (poor) in MA-6 relative to the rest of Bainbridge Island despite high CF scores (Table A-4, Figure B-11, Appendix D). This difference may be attributed to the relatively small documented area of surf-smelt spawning habitat, limited extent of eelgrass in the bay, as well as the lack of geoduck resources found therein (Figures B-57, B-58, and B-59). However, cutthroat trout, and coho salmon are also documented to spawn in two streams, Macs Dam Creek (WRIA 15.0331) and WRIA 15.0332, and efforts should be made to preserve spawning access and functions of juvenile rearing areas, both in-stream and in nearby shoreline habitats (Haring 2000). Blakely Harbor also provides additional support as a non-natal rearing area to juvenile salmon, including chinook and pink salmon; these functions were not quantified in the index.

#### Individual Reaches Within MA-6 (Figure B-60, Appendix C, Appendix D)

##### Reach 3105

- CF Rating = Low Impact, Normalized score = -0.15
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, pollution, hydrology
- Geomorphic class: Rocky Shore; Shoreline length: 2700 ft
- Sediment source: Don't Know; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 9.5% TIA, 14.8% forested
- Total shoreline armoring: 1.2%; Total encroaching: 0%
- Total point modifications: 1; Density: 0.4/1000 ft; most common is groins, with 0.4/1000 ft
- Other: fronts golf course
- EF Score: 14

##### Reach 3106

- CF Rating = Low/Moderate Impact; Normalized score = -0.4
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 352 ft
- Sediment source: Don't Know; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 28.4% TIA, 10.6% forested
- Total shoreline armoring: 24.6%; Total encroaching: 0%
- Total point modifications: 10; Density: 28.4/1000 ft; most common is buoys, with 17.1/1000 ft
- Other:
- EF Score: 10

Reach 3107

- CF Rating = Low/Moderate Impact, Normalized score = -0.222
- Most impacted CF metric: natural shade
- Least impacted CF metric: hydrology, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 2358 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 17.3%; Riparian zone land use: 20.7% TIA, 65.7% forested
- Total shoreline armoring: 14.2%; Total encroaching: 14.2%
- Total point modifications: 1; Density: 0.4/1000 ft; most common is buoys, with 0.4/1000 ft
- Other: some clearing of vegetation for road
- EF Score: 18

Reach 3108

- CF Rating = Low/Moderate Impact ; Normalized score = -0.333
- Most impacted CF metrics: wave energy, depth/slope
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 1402 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 43.6%; Riparian zone land use: 9% TIA, 85.5% forested
- Total shoreline armoring: 51.5%; Total encroaching: 45.7%
- Total point modifications: 2; Density: 1.4/1000 ft; most common is outfalls, with 1.4/1000 ft
- Other: some clearing of vegetation for road
- EF Score: 16

Reach 3109

- CF Rating = Moderate Impact ; Normalized score = -0.422
- Most impacted CF metric: wave energy
- Least impacted CF metric: artificial shade
- Geomorphic class: Low Bank; Shoreline length: 522 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 20.7%; Riparian zone land use: 14.2% TIA, 50.3% forested
- Total shoreline armoring: 63.1%; Total encroaching: 59%
- Total point modifications: 7; Density: 13.4/1000 ft; most common is groins, with 7.7/1000 ft
- Other:
- EF Score: 14

Reach 3110

- CF Rating = Moderate/High Impact ; Normalized score = -0.675
- Most impacted CF metrics: wave energy, substrate type
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1522 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 16.4% TIA, 41.4% forested
- Total shoreline armoring: 87.5%; Total encroaching: 63%
- Total point modifications: 33; Density: 21.7/1000 ft; most common is stairs, with 4.6/1000 ft
- Other:
- EF Score: 16

Reach 3111

- CF Rating = Low/Moderate Impact ; Normalized score = -0.325
- Most impacted CF metric: wave energy

- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 394 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 24.4%; Riparian zone land use: 13.7% TIA, 51.5% forested
- Total shoreline armoring: 55.3%; Total encroaching: 0%
- Total point modifications: 1; Density: 2.5/1000 ft; most common is floating docks, with 2.5/1000 ft
- Other:
- EF Score: 14

#### Reach 3112

- CF Rating = No Impact Normalized score = 0
- Most impacted CF metrics:
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope, pollution, hydrology, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 373 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 100.1%; Riparian zone land use: 2.8% TIA, 92.9% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 1; Density: 2.7/1000 ft; most common is outfalls, with 2.7/1000 ft
- Other:
- EF Score: 19

#### Reach 3113

- CF Rating = No Impact, Normalized score = 0
- Most impacted CF metrics:
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope, pollution, hydrology, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 331 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 98.4%; Riparian zone land use: 2.8% TIA, 96.5% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 0Other:
- EF Score: 22

#### Reach 3114

- CF Rating = Low Impact, Normalized score = -0.089
- Most impacted CF metric: artificial shade
- Least impacted CF metric: wave energy, sediment supply, substrate type, depth/slope, pollution, hydrology
- Geomorphic class: Low Bank; Shoreline length: 1291 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 70.4%; Riparian zone land use: 10% TIA, 88.5% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 3; Density: 2.3/1000 ft; most common is outfalls, with 0.8/1000 ft
- Other:
- EF Score: 27

#### Reach 3115

- CF Rating = Low/Moderate Impact ; Normalized score = -0.3
- Most impacted CF metric: hydrology
- Least impacted CF metric: wave energy, physical disturbance

- Geomorphic class: Marsh/Lagoon; Shoreline length: 3018 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 48.3%; Riparian zone land use: 17.6% TIA, 77% forested
- Total shoreline armoring: 16.1%; Total encroaching: 16.1%
- Total point modifications: 4; Density: 1.3/1000 ft; most common is pilings, with 0.7/1000 ft
- Other: tidal constriction present
- EF Score: 20

#### Reach 3116

- CF Rating = Low/Moderate Impact ; Normalized score = -0.375
- Most impacted CF metric: depth/slope
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2032 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 5.5%; Riparian zone land use: 37.3% TIA, 53.4% forested
- Total shoreline armoring: 4.3%; Total encroaching: 4.3%
- Total point modifications: 13; Density: 6.4/1000 ft; most common is pilings, with 3/1000 ft
- Other: dredged regions present
- EF Score: 17

#### Reach 3117

- CF Rating = Moderate Impact ; Normalized score = -0.475
- Most impacted CF metric: depth/slope
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1477 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 18.9%; Riparian zone land use: 46.7% TIA, 45.2% forested
- Total shoreline armoring: 13.4%; Total encroaching: 5.6%
- Total point modifications: 20; Density: 13.5/1000 ft; most common is buoys, with 3.4/1000 ft
- Other: dredged regions present
- EF Score: 17

#### Reach 3118

- CF Rating = Moderate Impact ; Normalized score = -0.425
- Most impacted CF metrics: wave energy, artificial shade, substrate type, depth/slope
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 543 ft
- Sediment source: Foreshore; Wave exposure: protected
- Overhanging vegetation: 18%; Riparian zone land use: 26.3% TIA, 72.9% forested
- Total shoreline armoring: 56.8%; Total encroaching: 56.8%
- Total point modifications: 6; Density: 11.1/1000 ft; most common is floating docks, with 3.7/1000 ft
- Other:
- EF Score: 16

#### Reach 3119

- CF Rating = Moderate Impact ; Normalized score = -0.475
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1098 ft
- Sediment source: Alongshore; Wave exposure: protected

- Overhanging vegetation: 15.7%; Riparian zone land use: 44.6% TIA, 49.1% forested
- Total shoreline armoring: 36.3%; Total encroaching: 27.5%
- Total point modifications: 29; Density: 26.4/1000 ft; most common is buoys, with 6.4/1000 ft
- Other:
- EF Score: 17

#### Reach 3120

- CF Rating = Low Impact, Normalized score = -0.05
- Most impacted CF metric: artificial shade
- Least impacted CF metric: wave energy, natural shade, sediment supply, substrate type, depth/slope, pollution, hydrology, physical disturbance
- Geomorphic class: Rocky Shore; Shoreline length: 932 ft
- Sediment source: Alongshore, with feeder bluff activity; Wave exposure: semi-protected
- Overhanging vegetation: 97.9%; Riparian zone land use: 0.6% TIA, 96.2% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 1; Density: 1.1/1000 ft; most common is buoys, with 1.1/1000 ft
- Other: good home setbacks
- EF Score: 24

### **3.2.7 Rich Passage Management Area (MA-7) (Reaches 3540; 3080 – 3104, plus Reaches 6000-6001)**

*Qualitative Rating = Moderate Impact*

*Mean CF Score (Normalized) = -0.47 (Range: -0.78 to -0.05)*

*Median CF Score (Normalized) = -0.46*

*Number of Reaches = 28*

*Mean EF Score = 16.1 (Range: 12 to 22)*

*Median EF Score = 15.5*

#### Description

Rich Passage (MA-7) comprises 34,565 ft of shoreline that encompasses most of Rich Passage, from Restoration Point to Point White, including Pleasant Beach and South Beach (Table A-1, Figure 2). Rich Passage (MA-7) encompasses a long stretch of shoreline made up of 28 reaches composed primarily of spit/backshore (21) and low bank (3) geomorphic classes; it also includes rocky shores (3) near Restoration Point and one marsh/lagoon reach at the restored Schel-Chelb estuary (Figure B-50). MA-7 is defined by two drift cells that converge in the embayment near the outlet of Schel-Chelb estuary (Figure 3). The first drift cell begins at Restoration Point, a rocky headland with scarce sediment abundance and no appreciable alongshore drift, and moves westward (Figure B-51). The second drift cell begins at a divergence zone located at Point White and moves eastward. Relative to wave exposure, shorelines along the eastern stretch of MA-7 near Restoration Point are considered “semi-protected,” whereas the interior of Rich Passage is considered “protected” (Figure B-51). Rich Passage receives upland runoff from direct coastal sheetflow, as well as several small watersheds with moderate-to-low levels of land use and high forest cover: WRIA 15.0337 (TIA 2%), WRIA 15.0335 (TIA 2%), WRIA 15.0334 (TIA 3%), WRIA 15.0333 (TIA <1%), and Schel-Chelb Creek (WRIA 15.0325).

Overhanging riparian vegetation covers approximately 8% of the MA-7 shoreline, by far the lowest such value over Bainbridge Island (Table A-1, Figure B-56). However, low overhanging riparian cover is expected because of the relatively high percentage of reaches classified as spit/backshore that typically do not have this type of vegetation. Within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 42% of land cover, whereas impervious surfaces

(e.g., roads, roofs) represent 26% of land cover (Figure B-55). Besides Eagle Harbor (MA-5), riparian zone land-cover class values in Rich Passage represent the worst ratios of percentage of natural vegetation to %TIA on Bainbridge Island (Table A-1).

Most of the MA-7 shoreline is backed by single-family residential development, with highly accessible beaches afforded by the typical regional geomorphology (i.e., low bank to spit/backshore). Shorelines within the Rich Passage MA include road frontage, a state park, restored estuary, commercial fish farm, and a sewage treatment outfall. Fort Ward State Park is a waterfront park with a boat launch, shoreline access, and trails (Figure B-54). Schel-Chelb estuary, near Lynwood Center, is a 2-acre wetland that was constructed to restore tidal flushing and fish access to the Pleasant Beach Watershed<sup>1</sup>. A commercial aquaculture facility for Atlantic salmon exists in the waters off of South Beach. As well, the Kitsap County Sewer District #7 treatment facility discharges into Rich Passage, just east of Fort Ward State Park. Approximately 52% of the MA-7 shoreline is modified by armoring, and 21% of the shoreline has armoring that encroaches into the intertidal zone (Table A-1, Figure B-52).

A total of 402 point modifications were recorded along MA-7 shorelines (unpublished data, COBI 2002), at an average of 11.6 modifications per 1000 ft (Table A-1, Figure B-53). Most of the modifications along this residentially developed shoreline are represented by stairs (110), mooring buoys (94), groins (43), structures at the waterline (42), and overwater structures such as docks (10) and piers (2). A total of 29 outfalls were also recorded.

#### Limiting Factors

The average normalized CF score within Rich Passage (MA-7) was -0.47, within the middle range of scores on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). MA-6 had among the lowest (worst) scores in the wave energy and physical disturbance metrics relative to other MAs (Table A-3, Figure B-16). Low (bad) wave-energy scores were influenced primarily by the relatively high rate of shoreline armoring (52%), especially by vertical concrete structures that may enhance reflected wave energy. Physical disturbance scores were low (poor) primarily because of the low percentage of forested cover in the marine riparian zone (42%), and the relatively high number of dock, mooring buoy, and ramp densities within most reaches in this MA, where shorelines are highly accessible and residential development is high.

Two of the most highly altered spit/barrier/backshore reaches on Bainbridge Island (Reaches 3093 and 3088) were found in Rich Passage (MA-7) (Figure B-60, Appendix C). These reaches were characterized by exceptional amounts of armoring, most of which encroach into the intertidal zone, high levels of point modifications, including groins and upland structures at the waterline, and greater than 30% TIA in the marine riparian zone. As well, Reach 3083 is located close to the salmon net pen aquaculture facility and in a zone where high pollution levels associated with the Fort Ward sewage discharge have led to advisories against the harvest and consumption of shellfish.

Rich Passage had among the best (highest) scores in natural shade and sediment supply metrics (Table A-3, Figure B-16). Natural shade scores were the highest (best) despite being the MA with the lowest total percentage (8%) of shoreline with overhanging riparian vegetation on Bainbridge Island. This discrepancy is attributed to the fact that 75% (21 of 28) of the reaches are classified as spit/backshore geomorphic classes, where natural shade was not considered an issue because these habitats often are exposed, lack overhanging riparian vegetation, or are composed of low dune vegetation. Similarly, sediment supply scores were high (good) primarily because of the absence of feeder bluffs and backshore sediment sources that would magnify the negative influence of armoring along this stretch of shoreline.

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<sup>1</sup> Schel-Chelb was constructed as mitigation for construction activities associated with the capping of contaminated sediments at the Eagle Harbor ship yard as part of the Eagle Harbor/Wyckoff Superfund Cleanup.

Groins (42) were a highly conspicuous feature along MA-7 shorelines, and did reduce sediment supply scores slightly. These results suggest that the scoring scheme might be modified to better balance the negative effects of armoring rates in areas with backshore sediment supply against the influence of groins in areas with alongshore transport and scarce-to-moderate sediment abundance.

#### Opportunities

Two of the least-impacted spit/barrier/backshore reaches on Bainbridge Island included Reaches 3091 and 3092, part of Fort Ward State Park in Rich Passage (MA-7) (Appendix C). Both reaches have few linear or point modifications along shorelines and high rates of overhanging riparian vegetation along the shoreline.

Numerous opportunities exist for improving scoring of CF metrics at the individual reach level, as well as at the MA level. Some of the most effective actions would seek to minimize and remove armoring, especially armoring that encroaches into the intertidal zone, maximize light penetration of overwater structures, and improve the relative percentage of forested-to-impervious surface area in the marine riparian zone. As well, groins should be removed if possible, and the tidal constriction at the mouth of Schel-Chelb estuary could possibly be further improved by replacing existing culverts with a small bridge.

The EF scores were lower (worse) in MA-7 (16.1) than in any other MA on Bainbridge Island (Table A-4, Figure B-11, Appendix D). This may be attributed to the relatively limited extent of documented forage-fish spawning (sand lance spawning has been noted near Reach 3083), sparse-to-patchy extent of eelgrass throughout the MA, and minimal geoduck resources (Figures B-57, B-58, and B-59). Cutthroat trout and coho salmon are also documented to spawn in one tributary, Schel-Chelb Creek (WRIA 15.0028X), within MA-7. Efforts should be made to improve spawning access and functions of juvenile rearing areas, both in-stream and in nearby shoreline habitats.

#### Individual Reaches within MA-7 (Figure B-60, Appendix C, Appendix D)

##### Reach 3540

- CF Rating = Moderate/High Impact, Normalized score = -0.778
- Most impacted CF metrics: wave energy, natural shade, substrate type, depth/slope
- Least impacted CF metric: artificial shade, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 1501 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 41.3% TIA, 33.1% forested
- Total shoreline armoring: 94.9%; Total encroaching: 82.4%
- Total point modifications: 27; Density: 18/1000 ft; most common is stairs, with 5.3/1000 ft
- Other:
- EF Score: 14

##### Reach 3080

- CF Rating = Moderate Impact; Normalized score = -0.6
- Most impacted CF metrics: natural shade, depth/slope
- Least impacted CF metric: physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 901 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 29.3% TIA, 40.5% forested
- Total shoreline armoring: 100%; Total encroaching: 100%
- Total point modifications: 7; Density: 7.8/1000 ft; most common is upland structures at waterline, with 2.2/1000 ft

- Other: heavy encroachment and signs of erosion
- EF Score: 15

#### Reach 3081

- CF Rating = Moderate Impact ; Normalized score = -0.475
- Most impacted CF metrics: sediment supply, substrate type, pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1938 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 1.7%; Riparian zone land use: 39% TIA, 30% forested
- Total shoreline armoring: 43.8%; Total encroaching: 31.6%
- Total point modifications: 24; Density: 12.4/1000 ft; most common is upland structures at waterline, with 3.1/1000 ft
- Other: heavily residential
- EF Score: 16

#### Reach 3082

- CF Rating = Low/Moderate Impact ; Normalized score = -0.35
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, natural shade, depth/slope
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1668 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 44.4% TIA, 14.7% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 16; Density: 9.6/1000 ft; most common is buoys, with 3/1000 ft
- Other: shellfish closure present
- EF Score: 15

#### Reach 6000

- CF Rating = Low/Moderate Impact ; Normalized score = -0.325
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, natural shade, depth/slope, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 507 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 22% TIA, 39.8% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 4; Density: 7.9/1000 ft; most common is buoys, with 3.9/1000 ft
- Other: shellfish closure present
- EF Score: 21

#### Reach 6001

- CF Rating = Low/Moderate Impact ; Normalized score = -0.375
- Most impacted CF metrics: natural shade, pollution, hydrology
- Least impacted CF metric: wave energy, artificial shade, sediment supply, substrate type, depth/slope, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1468 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 9.7% TIA, 66% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 4; Density: 2.7/1000 ft; most common is outfalls, with 2.7/1000 ft
- Other: tidal constriction, and shellfish closure present; Schel-chelb Estuary

- EF Score: 22

#### Reach 3083

- CF Rating = Moderate/High Impact ; Normalized score = -0.65
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1961 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 1.9%; Riparian zone land use: 45.3% TIA, 31.3% forested
- Total shoreline armoring: 47.4%; Total encroaching: 33%
- Total point modifications: 37; Density: 18.9/1000 ft; most common is upland structures at waterline, with 6.1/1000 ft
- Other: shellfish closure present; clearing associated with road fronting beach
- EF Score: 21

#### Reach 3084

- CF Rating = Moderate Impact ; Normalized score = -0.6
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1165 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 27.2%; Riparian zone land use: 29.4% TIA, 43% forested
- Total shoreline armoring: 93.2%; Total encroaching: 0%
- Total point modifications: 46; Density: 39.5/1000 ft; most common is stairs, with 10.3/1000 ft
- Other:
- EF Score: 17

#### Reach 3085

- CF Rating = Moderate Impact ; Normalized score = -0.525
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 499 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 24.4% TIA, 58.6% forested
- Total shoreline armoring: 100%; Total encroaching: 0%
- Total point modifications: 7; Density: 14/1000 ft; most common is stairs, with 4/1000 ft
- Other: extensive intertidal zone
- EF Score: 18

#### Reach 3086

- CF Rating = Moderate Impact ; Normalized score = -0.45
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1230 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 49.8% TIA, 23.5% forested
- Total shoreline armoring: 15.4%; Total encroaching: 0%
- Total point modifications: 10; Density: 8.1/1000 ft; most common is buoys, with 3.3/1000 ft
- Other: high LWD retention
- EF Score: 15

#### Reach 3087

- CF Rating = Low/Moderate Impact ; Normalized score = -0.3
- Most impacted CF metrics: wave energy, artificial shade, sediment supply, substrate type, physical disturbance
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 877 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 23.3% TIA, 47.6% forested
- Total shoreline armoring: 6.7%; Total encroaching: 0%
- Total point modifications: 7; Density: 8/1000 ft; most common is buoys, with 3.4/1000 ft
- Other: high LWD retention
- EF Score: 14

#### Reach 3088

- CF Rating = Moderate/High Impact, Normalized score = -0.7
- Most impacted CF metrics: wave energy, substrate type, depth/slope
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 855 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 28.9% TIA, 48.6% forested
- Total shoreline armoring: 91.4%; Total encroaching: 88.3%
- Total point modifications: 21; Density: 24.6/1000 ft; most common is stairs, with 8.2/1000 ft
- Other:
- EF Score: 12

#### Reach 3089

- CF Rating = Moderate/High Impact ; Normalized score = -0.675
- Most impacted CF metrics: wave energy, substrate type, depth/slope
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1464 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 4.9%; Riparian zone land use: 39.8% TIA, 41.6% forested
- Total shoreline armoring: 67.5%; Total encroaching: 67.5%
- Total point modifications: 21; Density: 14.3/1000 ft; most common is groins, with 5.5/1000 ft
- Other:
- EF Score: 14

#### Reach 3090

- CF Rating = Low/Moderate Impact ; Normalized score = -0.375
- Most impacted CF metrics: wave energy, sediment supply, depth/slope
- Least impacted CF metric: natural shade, pollution
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 674 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 53.8%; Riparian zone land use: 9.5% TIA, 76.9% forested
- Total shoreline armoring: 34.6%; Total encroaching: 34.6%
- Total point modifications: 2; Density: 3/1000 ft; most common is boat ramps, with 1.5/1000 ft
- Other:
- EF Score: 16

#### Reach 3091

- CF Rating = Low Impact, Normalized score = -0.05

- Most impacted CF metrics: pollution, hydrology
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 923 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 99.8%; Riparian zone land use: 0.4% TIA, 97.6% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 1; Density: 1.1/1000 ft; most common is outfalls, with 1.1/1000 ft
- Other: Fort Ward State Park
- EF Score: 18

#### Reach 3092

- CF Rating = Low Impact, Normalized score = -0.05
- Most impacted CF metrics: artificial shade, pollution
- Least impacted CF metric: wave energy, natural shade, sediment supply, substrate type, depth/slope, hydrology, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2363 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 27.4%; Riparian zone land use: 14.5% TIA, 61.6% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 2; Density: 0.8/1000 ft; most common is pilings, with 0.4/1000 ft
- Other: Fort Ward State Park
- EF Score: 16

#### Reach 3093

- CF Rating = Moderate/High Impact, Normalized score = -0.7
- Most impacted CF metrics: pollution, physical disturbance
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 746 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 52.8% TIA, 6.7% forested
- Total shoreline armoring: 100%; Total encroaching: 0%
- Total point modifications: 8; Density: 10.7/1000 ft; most common is buoys, with 4/1000 ft
- Other: fish farm, and shellfish closure present; encroachment by new development likely underestimated
- EF Score: 18

#### Reach 3094

- CF Rating = Moderate/High Impact ; Normalized score = -0.65
- Most impacted CF metrics: pollution, physical disturbance
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 421 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 40.2% TIA, 0.9% forested
- Total shoreline armoring: 55.6%; Total encroaching: 0%
- Total point modifications: 13; Density: 30.9/1000 ft; most common is buoys, with 21.4/1000 ft
- Other: 1 marina(s), fish farm, and shellfish closure present
- EF Score: 14

#### Reach 3095

- CF Rating = Moderate Impact ; Normalized score = -0.425

- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 703 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 6.5% TIA, 46.9% forested
- Total shoreline armoring: 20.1%; Total encroaching: 0%
- Total point modifications: 10; Density: 14.2/1000 ft; most common is buoys, with 8.5/1000 ft
- Other: fish farm, and shellfish closure present; bedrock terrace in foreshore
- EF Score: 14

#### Reach 3096

- CF Rating = Moderate/High Impact ; Normalized score = -0.625
- Most impacted CF metrics: substrate type, pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 3262 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0.5%; Riparian zone land use: 17.8% TIA, 36% forested
- Total shoreline armoring: 67.4%; Total encroaching: 13.8%
- Total point modifications: 50; Density: 15.3/1000 ft; most common is stairs, with 7.1/1000 ft
- Other: fish farm, and shellfish closure present; bedrock terrace in foreshore
- EF Score: 14

#### Reach 3097

- CF Rating = Moderate Impact ; Normalized score = -0.6
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1810 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 13.7%; Riparian zone land use: 19.4% TIA, 49.5% forested
- Total shoreline armoring: 83.6%; Total encroaching: 1.4%
- Total point modifications: 28; Density: 15.5/1000 ft; most common is stairs, with 5.5/1000 ft
- Other: road in backshore
- EF Score: 20

#### Reach 3098

- CF Rating = Moderate Impact ; Normalized score = -0.511
- Most impacted CF metric: natural shade
- Least impacted CF metric: pollution, hydrology, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 1263 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 3.9% TIA, 72.6% forested
- Total shoreline armoring: 96%; Total encroaching: 17.6%
- Total point modifications: 8; Density: 6.3/1000 ft; most common is stairs, with 4/1000 ft
- Other: rock terrace in foreshore
- EF Score: 18

#### Reach 3099

- CF Rating = Moderate Impact ; Normalized score = -0.45
- Most impacted CF metrics: wave energy, substrate type
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1229 ft

- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 20.4% TIA, 56.2% forested
- Total shoreline armoring: 94.3%; Total encroaching: 0%
- Total point modifications: 13; Density: 10.6/1000 ft; most common is stairs, with 4.1/1000 ft
- Other: rock terrace in foreshore
- EF Score: 16

#### Reach 3100

- CF Rating = Moderate Impact ; Normalized score = -0.55
- Most impacted CF metric: wave energy
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1572 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 1.3%; Riparian zone land use: 28.4% TIA, 60.8% forested
- Total shoreline armoring: 95.2%; Total encroaching: 45.3%
- Total point modifications: 21; Density: 13.4/1000 ft; most common is stairs, with 5.7/1000 ft
- Other: rock terrace in foreshore
- EF Score: 14

#### Reach 3101

- CF Rating = Low/Moderate Impact ; Normalized score = -0.375
- Most impacted CF metrics: wave energy, sediment supply, substrate type
- Least impacted CF metric: natural shade, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1414 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 14.7% TIA, 41.5% forested
- Total shoreline armoring: 40.2%; Total encroaching: 0%
- Total point modifications: 13; Density: 9.2/1000 ft; most common is stairs, with 2.8/1000 ft
- Other: bedrock terrace in foreshore, start of golf course
- EF Score: 16

#### Reach 3102

- CF Rating = Low/Moderate Impact ; Normalized score = -0.35
- Most impacted CF metrics: depth/slope, physical disturbance
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, hydrology
- Geomorphic class: Rocky Shore; Shoreline length: 903 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 12.9% TIA, 3.5% forested
- Total shoreline armoring: 42.8%; Total encroaching: 38.3%
- Total point modifications: 1; Density: 1.1/1000 ft; most common is upland structures at waterline, with 1.1/1000 ft
- Other: bedrock terrace in foreshore, golf course
- EF Score: 14

#### Reach 3103

- CF Rating = Low/Moderate Impact ; Normalized score = -0.4
- Most impacted CF metrics: depth/slope, physical disturbance
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, hydrology
- Geomorphic class: Rocky Shore; Shoreline length: 236 ft

- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 45.9% TIA, 3.5% forested
- Total shoreline armoring: 91.8%; Total encroaching: 0%
- Total point modifications: 1; Density: 4.2/1000 ft; most common is stairs, with 4.2/1000 ft
- Other: golf course
- EF Score: 14

#### Reach 3104

- CF Rating = Low Impact, Normalized score = -0.2
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, pollution, hydrology
- Geomorphic class: Rocky Shore; Shoreline length: 1013 ft
- Sediment source: Alongshore; Wave exposure: semi-protected
- Overhanging vegetation: 0%; Riparian zone land use: 1.9% TIA, 0% forested
- Total shoreline armoring: 9.6%; Total encroaching: 0%
- Total point modifications: 0
- Other: Restoration Point, golf course
- EF Score: 14

### 3.2.8 Point White – Battle Point Management Area (MA-8) (Reaches 3502 – 3539)

*Qualitative Rating = Moderate Impact*

*Mean CF Score (Normalized) = -0.47 (Range: -0.75 to -0.10)*

*Median CF Score (Normalized) = -0.48*

*Number of Reaches = 38*

*Mean EF Score = 19.8 (Range: 13 to 30)*

*Median EF Score = 18.5*

#### Description

The Point White to Battle Point management area (MA-8) comprises 54,650 ft, the longest MA on Bainbridge Island (Table A-1, Figure 2). It fronts Port Orchard Bay and includes Battle Point, Battle Point Lagoon, Fletcher Bay, Tolo Lagoon, and part of Point White. MA-8 comprises 38 reaches composed of the following geomorphic classes: spit/backshore (16), high bluff (10), marsh/lagoon (7), and low bank (5) (Figure B-61). MA-8 is defined by two major drift cells that converge at Battle Point (Figure 3). The larger drift cell begins at a divergence zone located at Point White and moves north past Fletcher Bay and a nearby reach with eroding feeder bluffs (Figure B-62)). The second drift cell begins at a divergence zone located just south of Arrow Point and moves south to Battle Point; most of this drift cell encompasses a large stretch of eroding feeder bluffs. Relative to wave exposure, all west-facing shorelines are considered “protected,” whereas the interior of small embayments and estuaries is considered “very-protected” (Figure B-62). MA-8 receives upland flows from five watersheds with low levels of land use: WRIA unnumbered 73 (TIA 2%), Fletcher/Springbrook Creek (WRIA 15.0340; TIA 1%), WRIA unnumbered 72 (TIA 1%), WRIA 15.0339 (TIA 0%), WRIA 15.0338 (TIA 2%).

Overhanging riparian vegetation covers approximately 32% of the MA-8 shoreline (Table A-1, Figure B-67). Within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 56% of land cover, whereas impervious surfaces (e.g., roads, roofs) represent 22% of land cover (Figure B-66).

Shoreline development in MA-1 is primarily residential in nature. Approximately 50% of the MA-7 shoreline is modified by armoring, and 22% of the shoreline has armoring that encroaches into the intertidal zone (Table A-1, Figure B-63). A total of 616 point modifications were recorded along MA-8 shorelines (unpublished data, COBI 2002) at an average of 11.9 modifications per 1000 ft (Figure B-64). Most of the modifications along this residentially developed shoreline were represented by stairs (132), mooring buoys (113), docks (73), upland structures at the waterline (61), overwater structures (57), groins (37), and piers (24). A total of 32 outfalls were also recorded along MA-8 shorelines.

#### Limiting Factors

The average normalized CF score within MA-8 was -0.47, within the middle range of MA scores on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). Individual metric scores for MA-8 did not rank among the best or worst in any metric category compared with other MAs (Table A-3, Figure B-16). However, metric scores within the Point White - Battle Point MA very closely mirrored the pattern observed over all of Bainbridge Island (Figure B-15), with substrate type and depth and slope metrics exhibiting lower (worse) average scores and hydrology and physical disturbance metrics exhibiting higher (better) average scores.

Some of the most highly altered spit/backshore and marsh/lagoon reaches on Bainbridge Island were located in the Point White - Battle Point MA (Figure B-71, Appendix C). Backshore Reaches 3533 and 3505 were characterized by exceptional amounts of armoring (>80%), most of which encroached into the intertidal zone, high levels of point modifications, and either shellfish closures due to pollution or a high %TIA in the marine riparian zone. Marsh/lagoon Reaches 3518 and 3522 near the mouth of Fletcher Bay were also characterized by high armoring rates, most of which encroached into the intertidal zone, high numbers of docks and piers, loss of overhanging riparian vegetation, subtidal dredging for channel maintenance, and shellfish closures due to pollution (Figure B-65).

#### Opportunities

Opportunities for improving scoring of CF metrics in MA-8 would target a variety of approaches to limiting impairment of controlling factors (Figure B-14). Action items might include minimizing and removing shoreline armoring and intertidal encroachment in areas where wave erosion is not an issue (e.g., Fletcher Bay) or in front of feeder bluffs, maximizing light penetration of overwater structures, checking and upgrading septic systems to improve water quality in Fletcher Bay, and reducing the amount of impervious surfaces in the marine riparian zone.

The EF scores were moderate in MA-8 (19.8) when compared with all other MAs on Bainbridge Island (Table A-4, Figure B-11, Appendix D). Spawning by forage fish, such as herring, sandlance, and surf smelt, has been documented within some reaches of MA-8, especially in the north near Battle Point (Figures B-69). Cutthroat trout, steelhead, chum, and coho salmon are also documented to spawn in Fletcher Creek (WRIA 15.0340) and other streams in Fletcher Bay. Efforts should be made to improve spawning access and functions of juvenile rearing areas, both in-stream and in nearby shoreline habitats. Geoduck beds have been documented throughout the MA-8 shoreline, although eelgrass is sparse-to-patchy along these shorelines (Figure B-68 and B-70).

#### Individual Reaches within MA-8 (Figure B-71, Appendix C, Appendix D)

##### Reach 3502

- CF Rating = Moderate/High Impact; Normalized score = -0.667
- Most impacted CF metrics: sediment supply, substrate type, depth/slope
- Least impacted CF metric: pollution, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1640 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: protected

- Overhanging vegetation: 17.3%; Riparian zone land use: 24.1% TIA, 61.2% forested
- Total shoreline armoring: 94.4%; Total encroaching: 88.6%
- Total point modifications: 29; Density: 17.7/1000 ft; most common is stairs, with 5.5/1000 ft
- Other:
- EF Score: 24

#### Reach 3503

- CF Rating = Low/Moderate Impact ; Normalized score = -0.289
- Most impacted CF metric: sediment supply
- Least impacted CF metric: natural shade, artificial shade, pollution, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 547 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 82.1%; Riparian zone land use: 8.2% TIA, 72% forested
- Total shoreline armoring: 33.8%; Total encroaching: 33.8%
- Total point modifications: 1; Density: 1.8/1000 ft; most common is outfalls, with 1.8/1000 ft
- Other:
- EF Score: 24

#### Reach 3504

- CF Rating = Moderate Impact ; Normalized score = -0.489
- Most impacted CF metric: sediment supply
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1524 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 59%; Riparian zone land use: 13.5% TIA, 54.8% forested
- Total shoreline armoring: 65.5%; Total encroaching: 57.4%
- Total point modifications: 19; Density: 12.5/1000 ft; most common is stairs, with 3.9/1000 ft
- Other:
- EF Score: 22

#### Reach 3505

- CF Rating = Moderate/High Impact, Normalized score = -0.725
- Most impacted CF metrics: sediment supply, substrate type
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1451 ft
- Sediment source: Unknown, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 11.1%; Riparian zone land use: 23.2% TIA, 21.8% forested
- Total shoreline armoring: 92.6%; Total encroaching: 61.2%
- Total point modifications: 35; Density: 24.1/1000 ft; most common is stairs, with 6.2/1000 ft
- Other: broad shallow foreshore
- EF Score: 20

#### Reach 3506

- CF Rating = Moderate Impact ; Normalized score = -0.467
- Most impacted CF metrics: natural shade, sediment supply
- Least impacted CF metric: pollution
- Geomorphic class: High Bluff; Shoreline length: 1237 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 19.4%; Riparian zone land use: 8.6% TIA, 83.2% forested
- Total shoreline armoring: 35.4%; Total encroaching: 35.4%
- Total point modifications: 7; Density: 5.7/1000 ft; most common is floating docks, with 1.6/1000 ft

- Other: natural LWD recruitment from cliff at south end
- EF Score: 24

Reach 3507

- CF Rating = Low Impact, Normalized score = -0.15
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: wave energy, natural shade, sediment supply, substrate type, depth/slope, pollution, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 501 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 5.5% TIA, 0% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 1; Density: 2/1000 ft; most common is buoys, with 2/1000 ft
- Other: Battle Point
- EF Score: 26

Reach 3508

- CF Rating = Low Impact, Normalized score = -0.2
- Most impacted CF metrics: pollution, physical disturbance
- Least impacted CF metric: wave energy, natural shade, artificial shade, sediment supply, substrate type, depth/slope
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 141 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 66.7% TIA, 0% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 0
- Other: Battle Point
- EF Score: 24

Reach 3509

- CF Rating = Low Impact, Normalized score = -0.15
- Most impacted CF metric: natural shade
- Least impacted CF metric: wave energy, substrate type, depth/slope, hydrology, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 3166 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 31.9%; Riparian zone land use: 11.1% TIA, 65.3% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 2; Density: 0.6/1000 ft; most common is piers, with 0.3/1000 ft
- Other: inside Battle Point
- EF Score: 18

Reach 3510

- CF Rating = Low Impact, Normalized score = -0.1
- Most impacted CF metric: artificial shade
- Least impacted CF metric: wave energy, natural shade, sediment supply, substrate type, depth/slope, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1210 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 3.5%; Riparian zone land use: 12.6% TIA, 45.5% forested
- Total shoreline armoring: 0%; Total encroaching: 0%

- Total point modifications: 3; Density: 2.5/1000 ft; most common is pilings, with 0.8/1000 ft
- Other:
- EF Score: 24

#### Reach 3511

- CF Rating = Moderate Impact ; Normalized score = -0.533
- Most impacted CF metrics: natural shade, sediment supply, substrate type
- Least impacted CF metric: hydrology
- Geomorphic class: Low Bank; Shoreline length: 1481 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 6.1%; Riparian zone land use: 23.3% TIA, 47.9% forested
- Total shoreline armoring: 70%; Total encroaching: 0%
- Total point modifications: 15; Density: 10.1/1000 ft; most common is stairs, with 2.7/1000 ft
- Other: encroachment appears to be underestimated
- EF Score: 30

#### Reach 3512

- CF Rating = Moderate Impact ; Normalized score = -0.55
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 718 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 39.5% TIA, 37% forested
- Total shoreline armoring: 51.8%; Total encroaching: 0%
- Total point modifications: 16; Density: 22.3/1000 ft; most common is upland structures at waterline, with 9.8/1000 ft
- Other:
- EF Score: 24

#### Reach 3513

- CF Rating = Low/Moderate Impact ; Normalized score = -0.325
- Most impacted CF metric: natural shade
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1421 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 6.8%; Riparian zone land use: 42.1% TIA, 33% forested
- Total shoreline armoring: 19.3%; Total encroaching: 0%
- Total point modifications: 3; Density: 2.1/1000 ft; most common is piers, with 2.1/1000 ft
- Other: heavy accumulation of LWD
- EF Score: 18

#### Reach 3514

- CF Rating = Low/Moderate Impact ; Normalized score = -0.375
- Most impacted CF metric: physical disturbance
- Least impacted CF metric: wave energy, natural shade, sediment supply, depth/slope
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 531 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 100% TIA, 0% forested
- Total shoreline armoring: 0%; Total encroaching: 0%
- Total point modifications: 8; Density: 15.1/1000 ft; most common is buoys, with 9.4/1000 ft
- Other: barrier beach in front of lagoon

- EF Score: 20

#### Reach 3515

- CF Rating = Low/Moderate Impact ; Normalized score = -0.4
- Most impacted CF metric: substrate type
- Least impacted CF metric: hydrology
- Geomorphic class: Low Bank; Shoreline length: 363 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 65.9%; Riparian zone land use: 29.6% TIA, 51.2% forested
- Total shoreline armoring: 59.5%; Total encroaching: 0%
- Total point modifications: 19; Density: 52.4/1000 ft; most common is upland structures at waterline, with 19.3/1000 ft
- Other:
- EF Score: 24

#### Reach 3516

- CF Rating = Moderate Impact ; Normalized score = -0.422
- Most impacted CF metric: sediment supply
- Least impacted CF metric: hydrology
- Geomorphic class: High Bluff; Shoreline length: 2377 ft
- Sediment source: Backshore, with feeder bluff activity; Wave exposure: protected
- Overhanging vegetation: 50.7%; Riparian zone land use: 19.3% TIA, 62.1% forested
- Total shoreline armoring: 62.7%; Total encroaching: 0%
- Total point modifications: 27; Density: 11.4/1000 ft; most common is stairs, with 3.8/1000 ft
- Other: downed trees and LWD recruitment from bluffs
- EF Score: 24

#### Reach 3517

- CF Rating = Moderate/High Impact ; Normalized score = -0.667
- Most impacted CF metrics: natural shade, depth/slope
- Least impacted CF metric: hydrology
- Geomorphic class: Low Bank; Shoreline length: 984 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 45.1% TIA, 35.9% forested
- Total shoreline armoring: 91.3%; Total encroaching: 29.6%
- Total point modifications: 13; Density: 13.2/1000 ft; most common is stairs, with 4.1/1000 ft
- Other: dredged regions present
- EF Score: 18

#### Reach 3518

- CF Rating = Moderate/High Impact, Normalized score = -0.7
- Most impacted CF metrics: natural shade, substrate type, depth/slope, pollution
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 763 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 0%; Riparian zone land use: 16.5% TIA, 47.8% forested
- Total shoreline armoring: 99.3%; Total encroaching: 24.2%
- Total point modifications: 14; Density: 18.4/1000 ft; most common is stairs, with 7.9/1000 ft
- Other: dredged regions, and shellfish closure present; large tide flats, mouth of Fletcher Bay
- EF Score: 15

#### Reach 3519

- CF Rating = Moderate Impact ; Normalized score = -0.575
- Most impacted CF metrics: substrate type, pollution
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 664 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 47.7%; Riparian zone land use: 27% TIA, 50.2% forested
- Total shoreline armoring: 82.2%; Total encroaching: 0%
- Total point modifications: 16; Density: 24.1/1000 ft; most common is floating docks, with 7.5/1000 ft
- Other: shellfish closure present; inside Fletcher Bay
- EF Score: 16

#### Reach 3520

- CF Rating = Moderate Impact ; Normalized score = -0.6
- Most impacted CF metrics: substrate type, pollution
- Least impacted CF metric: wave energy, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 388 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 23%; Riparian zone land use: 15.6% TIA, 58.4% forested
- Total shoreline armoring: 89.5%; Total encroaching: 0%
- Total point modifications: 7; Density: 18/1000 ft; most common is floating docks, with 7.7/1000 ft
- Other: shellfish closure present; small inlet in Fletcher Bay
- EF Score: 13

#### Reach 3521

- CF Rating = Low/Moderate Impact ; Normalized score = -0.3
- Most impacted CF metric: pollution
- Least impacted CF metric: wave energy, natural shade, hydrology
- Geomorphic class: Marsh/Lagoon; Shoreline length: 6268 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 84.4%; Riparian zone land use: 16.1% TIA, 63.8% forested
- Total shoreline armoring: 11.5%; Total encroaching: 4.6%
- Total point modifications: 34; Density: 5.4/1000 ft; most common is floating docks, with 2.1/1000 ft
- Other: shellfish closure present
- EF Score: 20

#### Reach 3522

- CF Rating = Moderate/High Impact ; Normalized score = -0.675
- Most impacted CF metrics: depth/slope, pollution
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 2373 ft
- Sediment source: Backshore; Wave exposure: very protected
- Overhanging vegetation: 37.1%; Riparian zone land use: 31.2% TIA, 55.8% forested
- Total shoreline armoring: 57.5%; Total encroaching: 47.3%
- Total point modifications: 56; Density: 23.6/1000 ft; most common is floating docks, with 6.7/1000 ft
- Other: dredged regions, 1 marina(s), and shellfish closure present, high bluffs in backshore
- EF Score: 21

#### Reach 3523

- CF Rating = Moderate Impact ; Normalized score = -0.429
- Most impacted CF metrics: depth/slope, pollution
- Least impacted CF metric: wave energy, natural shade, artificial shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 402 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 0%; Riparian zone land use: 31.6% TIA, 0% forested
- Total shoreline armoring: 3.9%; Total encroaching: 3.9%
- Total point modifications: 0
- Other: dredged regions, and shellfish closure present; inside southern spit of Fletcher Bay
- EF Score: 18

#### Reach 3524

- CF Rating = Moderate Impact ; Normalized score = -0.425
- Most impacted CF metric: depth/slope
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 401 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 33.3% TIA, 0% forested
- Total shoreline armoring: 10.1%; Total encroaching: 10.1%
- Total point modifications: 2; Density: 5/1000 ft; most common is buoys, with 5/1000 ft
- Other: dredged regions present; southern barrier to Fletcher Bay
- EF Score: 19

#### Reach 3525

- CF Rating = Moderate/High Impact, Normalized score = -0.733
- Most impacted CF metrics: wave energy, natural shade, substrate type, depth/slope
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1525 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 38.6% TIA, 48.5% forested
- Total shoreline armoring: 91.3%; Total encroaching: 84%
- Total point modifications: 30; Density: 19.7/1000 ft; most common is stairs, with 6.6/1000 ft
- Other:
- EF Score: 16

#### Reach 3526

- CF Rating = Low/Moderate Impact, Normalized score = -0.222
- Most impacted CF metrics: artificial shade, sediment supply, substrate type
- Least impacted CF metric: pollution, hydrology
- Geomorphic class: High Bluff; Shoreline length: 2324 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 76.1%; Riparian zone land use: 7.7% TIA, 90.2% forested
- Total shoreline armoring: 22.8%; Total encroaching: 11.6%
- Total point modifications: 17; Density: 7.3/1000 ft; most common is stairs, with 2.6/1000 ft
- Other: good setbacks, much LWD accumulation on beach
- EF Score: 24

#### Reach 3527

- CF Rating = Low/Moderate Impact ; Normalized score = -0.289
- Most impacted CF metrics: artificial shade, sediment supply, substrate type, pollution

- Least impacted CF metric: wave energy, natural shade, depth/slope, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1004 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 62%; Riparian zone land use: 14.5% TIA, 82.3% forested
- Total shoreline armoring: 28.5%; Total encroaching: 6.5%
- Total point modifications: 5; Density: 5/1000 ft; most common is floating docks, with 2/1000 ft
- Other:
- EF Score: 22

#### Reach 3528

- CF Rating = Low Impact, Normalized score = -0.111
- Most impacted CF metrics: wave energy, natural shade, sediment supply, substrate type, depth/slope
- Least impacted CF metric: artificial shade, pollution, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1256 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 73.7%; Riparian zone land use: 3.3% TIA, 93% forested
- Total shoreline armoring: 11.5%; Total encroaching: 2.4%
- Total point modifications: 4; Density: 3.2/1000 ft; most common is stairs, with 1.6/1000 ft
- Other: lots of LWD accumulation
- EF Score: 22

#### Reach 3529

- CF Rating = Low/Moderate Impact ; Normalized score = -0.3
- Most impacted CF metrics: artificial shade, substrate type
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 755 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 33.6% TIA, 53% forested
- Total shoreline armoring: 29%; Total encroaching: 0%
- Total point modifications: 13; Density: 17.2/1000 ft; most common is upland structures at waterline, with 4/1000 ft
- Other: broad beach on small spit of land
- EF Score: 16

#### Reach 3530

- CF Rating = Moderate/High Impact ; Normalized score = -0.689
- Most impacted CF metrics: wave energy, substrate type
- Least impacted CF metric: pollution, hydrology, physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 3301 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 15.9%; Riparian zone land use: 16.7% TIA, 67.8% forested
- Total shoreline armoring: 83.2%; Total encroaching: 44.4%
- Total point modifications: 73; Density: 22.1/1000 ft; most common is buoys, with 5.1/1000 ft
- Other:
- EF Score: 18

#### Reach 3531

- CF Rating = Moderate/High Impact ; Normalized score = -0.667
- Most impacted CF metrics: substrate type, depth/slope

- Least impacted CF metric: artificial shade, pollution, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1562 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 31.5%; Riparian zone land use: 12.8% TIA, 68.8% forested
- Total shoreline armoring: 90.5%; Total encroaching: 81.1%
- Total point modifications: 28; Density: 17.9/1000 ft; most common is groins, with 5.1/1000 ft
- Other:
- EF Score: 16

#### Reach 3532

- CF Rating = Moderate Impact ; Normalized score = -0.475
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 564 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 24.3% TIA, 57.8% forested
- Total shoreline armoring: 51.8%; Total encroaching: 38.1%
- Total point modifications: 8; Density: 14.2/1000 ft; most common is stairs, with 3.5/1000 ft
- Other:
- EF Score: 16

#### Reach 3533

- CF Rating = Moderate/High Impact, Normalized score = -0.75
- Most impacted CF metrics: wave energy, substrate type, pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1279 ft
- Sediment source: Unknown; Wave exposure: protected
- Overhanging vegetation: 12.8%; Riparian zone land use: 35.6% TIA, 41.4% forested
- Total shoreline armoring: 80.3%; Total encroaching: 43.3%
- Total point modifications: 29; Density: 22.7/1000 ft; most common is stairs, with 5.5/1000 ft
- Other: shellfish closure present
- EF Score: 18

#### Reach 3534

- CF Rating = Moderate Impact ; Normalized score = -0.575
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 622 ft
- Sediment source: Unknown; Wave exposure: protected
- Overhanging vegetation: 12.3%; Riparian zone land use: 7.8% TIA, 46.9% forested
- Total shoreline armoring: 83.8%; Total encroaching: 0%
- Total point modifications: 4; Density: 6.4/1000 ft; most common is outfalls, with 3.2/1000 ft
- Other: shellfish closure present; cleared for road
- EF Score: 18

#### Reach 3535

- CF Rating = Moderate Impact ; Normalized score = -0.575
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 987 ft
- Sediment source: Backshore; Wave exposure: protected

- Overhanging vegetation: 30.5%; Riparian zone land use: 35.9% TIA, 41.6% forested
- Total shoreline armoring: 53.4%; Total encroaching: 0%
- Total point modifications: 22; Density: 22.3/1000 ft; most common is buoys, with 5.1/1000 ft
- Other: shellfish closure present; road fronts shoreline
- EF Score: 18

Reach 3536

- CF Rating = Low/Moderate Impact ; Normalized score = -0.3
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade, artificial shade, physical disturbance
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 565 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: No data on %TIA, No data on %forested
- Total shoreline armoring: 15.1%; Total encroaching: 0%
- Total point modifications: 0
- Other: shellfish closure present, some encroachment by waterfront homes
- EF Score: 18

Reach 3537

- CF Rating = Moderate Impact ; Normalized score = -0.5
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 1080 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 8.5%; Riparian zone land use: 20.7% TIA, 38.8% forested
- Total shoreline armoring: 12.2%; Total encroaching: 0%
- Total point modifications: 20; Density: 18.5/1000 ft; most common is buoys, with 6.5/1000 ft
- Other: shellfish closure present; road fronts shoreline
- EF Score: 16

Reach 3538

- CF Rating = Moderate/High Impact ; Normalized score = -0.625
- Most impacted CF metric: pollution
- Least impacted CF metric: natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 3031 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 32.3% TIA, 20.2% forested
- Total shoreline armoring: 93.4%; Total encroaching: 3.3%
- Total point modifications: 30; Density: 9.9/1000 ft; most common is stairs, with 3.6/1000 ft
- Other: shellfish closure present; road fronts shoreline
- EF Score: 14

Reach 3539

- CF Rating = Moderate/High Impact ; Normalized score = -0.667
- Most impacted CF metric: pollution
- Least impacted CF metric: physical disturbance
- Geomorphic class: Low Bank; Shoreline length: 1243 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 10.8%; Riparian zone land use: 37.9% TIA, 47.1% forested
- Total shoreline armoring: 94%; Total encroaching: 38.9%

- Total point modifications: 6; Density: 4.8/1000 ft; most common is overwater structures, with 1.6/1000 ft
- Other: shellfish closure present; road fronts shoreline
- EF Score: 14

### 3.2.9 Manzanita Bay Management Area (MA-9) (Reaches 3492 – 3501)

*Qualitative Rating = Moderate Impact*

*Mean CF Score (Normalized) = -0.49 (Range: -0.71 to -0.13)*

*Median CF Score (Normalized) = -0.54*

*Number of Reaches = 10*

*Mean EF Score = 23.9 (Range: 20 to 33)*

*Median EF Score = 22.5*

#### Description

Manzanita Bay (MA-9) is the smallest management area on Bainbridge Island, comprising 18,879 linear feet of shoreline that encompass all of Manzanita Bay and Arrow Point (Table A-1, Figure 2). MA-9 comprises only 10 reaches composed of the following geomorphic classes: marsh/lagoon (3), high bluff (3), spit/backshore (2), and low bluff (2) (Figure B-61). MA-9 is basically defined by four drift cells (Figure 3). The first drift cell begins at a divergence zone located outside the northern margin of Manzanita Bay and moves south into Little Manzanita Bay. The second drift cell is quite small and moves eastward into Little Manzanita Bay along its south shore. The third and fourth drift cells move south from divergence zones near Arrow Point and south of Little Manzanita Bay and converge at the head of Big Manzanita Bay. Relative to wave exposure, shorelines of MA-9 are considered “very-protected” in upper embayment reaches, or “protected” (Figure B-62). No feeder bluffs have been documented in MA-9. Manzanita Bay receives upland flows from two watersheds with low to moderate levels of land use: Manzanita Creek (WRIA 15.0344; TIA 5%) and WRIA unnumbered 29 (TIA <1%).

Overhanging riparian vegetation covers approximately 35% of the MA-9 shoreline, ranking this MA among the best on Bainbridge Island in this category (Table A-1, Figure B-67). Within the 200-ft riparian zone, naturally vegetated surfaces (coniferous and deciduous trees, shrubs, and wetlands) compose 70% of land cover, whereas impervious surfaces (e.g., roads, roofs) represent only 12% of land cover (Figure B-66). As such, riparian zone land-cover in Manzanita Bay is among the best of all Bainbridge Island MAs.

Shoreline development in MA-9 is primarily residential. Approximately 57% of the shoreline is modified by armoring, and 29% of the shoreline has armoring that encroaches into the intertidal zone, among the highest rates for any MA on Bainbridge Island (Table A-1, Figure B-63). A total of 218 point modifications were recorded along MA-9 shorelines, at an average of 11.5 modifications per 1000 ft (Figure B-64). Most of the modifications along this protected embayment were represented by stairs (63), docks (42), overwater structures (12), groins (7), and piers (9). A total of 9 outfalls were also recorded along MA-9 shorelines.

#### Limiting Factors

The average normalized controlling factor (CF) score within MA-9 was -0.49, within the middle range of MA scores on Bainbridge Island (Table A-2, Figure B-10, Figure B-13). However, Manzanita Bay (MA-9) had among the lowest (worst) scores of all MAs in five of the nine metrics: natural shade, artificial shade, sediment supply, substrate type, and depth/slope (Table A-3, Figure B-16). As was seen in MA-1, the Manzanita Bay MA scored low (bad) on the natural shade metric despite having a relatively high total percentage (35%) of shoreline with overhanging riparian vegetation. Closer examination of the data

revealed that the shoreline along most reaches in MA-9 displayed relatively low coverage of overhanging vegetation (0% to 18%), whereas a few long marsh/lagoon reaches had cover exceeding 50%. Artificial shade scores were influenced primarily by the high density of shade-causing structures such as docks, piers, boats, buoys, and other overwater structures found in this protected anchorage. Sediment supply scores were affected primarily by the high percentage of armoring (57%), especially in front of areas with documented backshore sediment sources, combined with multiple groins (7) and drift-intercepting ramps in areas with alongshore sediment sources. The substrate type metric was similarly influenced by heavily armored shorelines combined with relatively high densities of point modifications. Low (poor) depth and slope scores also reflected the relatively high rate of armoring, combined with encroachment rates (29%), along Manzanita Bay shorelines.

Manzanita Bay (MA-9) had one of the best (highest) scores of all MAs in the pollution metric (Table A-3, Figure B-16). This is partly because of the absence of recreational shellfish closures and warnings, though it should be noted that Manzanita Bay has not been classified by the WA Department of Health. Low pollution metric scores were further aided by few marinas, low outfall densities, and a relatively low %TIA (12%) in the marine riparian zone.

### Opportunities

One of the most obvious opportunities for improving scores in a number of MA-9 metrics would be to minimize and remove shoreline armoring, especially since this is not a high wave-energy area. Scores would also improve by removing or maximizing light penetration under existing shade-causing structures, or reducing the number of docks and overwater structures.

The EF scores are particularly high in MA-9 (23.9) relative to other MAs on Bainbridge Island (Table A-4, Figure B-11, Appendix D). This was likely due to the prevalence of documented spawning by all three forage-fish species (herring, sandlance, and surf smelt) (Figures B-69). Cutthroat trout, chum, and coho salmon are also documented to spawn in the Manzanita Creek (WRIA 15.0344), and efforts should be made to maximize adult passage and juvenile rearing functions, both in-stream and in nearby shoreline habitats. Eelgrass is fairly sparse along most Manzanita Bay shorelines, although geoduck and clam resources are abundant (Figure B-68, Figure B-70).

### Individual Reaches within MA-9 (Figure B-71, Appendix C, Appendix D)

#### Reach 3492

- CF Rating = Moderate Impact; Normalized score = -0.525
- Most impacted CF metric: substrate type
- Least impacted CF metric: natural shade, hydrology
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 2034 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 2.6%; Riparian zone land use: 22.6% TIA, 61.1% forested
- Total shoreline armoring: 95.6%; Total encroaching: 5%
- Total point modifications: 39; Density: 19.2/1000 ft; most common is stairs, with 5.9/1000 ft
- Other:
- EF Score: 22

#### Reach 3493

- CF Rating = Moderate Impact ; Normalized score = -0.425
- Most impacted CF metrics: artificial shade, substrate type, depth/slope
- Least impacted CF metric: wave energy
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1209 ft
- Sediment source: Alongshore; Wave exposure: protected

- Overhanging vegetation: 57.3%; Riparian zone land use: 13% TIA, 72.2% forested
- Total shoreline armoring: 38.7%; Total encroaching: 33.8%
- Total point modifications: 11; Density: 9.1/1000 ft; most common is buoys, with 3.3/1000 ft
- Other: small embayment, some fronting road
- EF Score: 23

Reach 3494

- CF Rating = Low Impact, Normalized score = -0.125
- Most impacted CF metric: substrate type
- Least impacted CF metric: wave energy, natural shade, pollution, hydrology, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 4804 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 81.3%; Riparian zone land use: 7.5% TIA, 75.9% forested
- Total shoreline armoring: 18%; Total encroaching: 4.5%
- Total point modifications: 25; Density: 5.2/1000 ft; most common is stairs, with 2.5/1000 ft
- Other:
- EF Score: 26

Reach 3495

- CF Rating = Moderate/High Impact ; Normalized score = -0.622
- Most impacted CF metrics: natural shade, depth/slope
- Least impacted CF metric: pollution, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 1470 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 11.6% TIA, 81.3% forested
- Total shoreline armoring: 99.9%; Total encroaching: 76.9%
- Total point modifications: 16; Density: 10.9/1000 ft; most common is stairs, with 4.1/1000 ft
- Other:
- EF Score: 33

Reach 3496

- CF Rating = Moderate Impact ; Normalized score = -0.556
- Most impacted CF metric: substrate type
- Least impacted CF metric: pollution, hydrology, physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 3076 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 29.9%; Riparian zone land use: 14.4% TIA, 58.8% forested
- Total shoreline armoring: 52.8%; Total encroaching: 36.6%
- Total point modifications: 50; Density: 16.3/1000 ft; most common is floating docks, with 4.9/1000 ft
- Other:
- EF Score: 30

Reach 3497

- CF Rating = Low Impact, Normalized score = -0.2
- Most impacted CF metrics: natural shade, artificial shade, sediment supply
- Least impacted CF metric: wave energy, pollution, hydrology, physical disturbance
- Geomorphic class: Marsh/Lagoon; Shoreline length: 1698 ft
- Sediment source: Foreshore; Wave exposure: very protected
- Overhanging vegetation: 50.1%; Riparian zone land use: 8.2% TIA, 64.9% forested
- Total shoreline armoring: 6.3%; Total encroaching: 6.3%

- Total point modifications: 8; Density: 4.7/1000 ft; most common is stairs, with 1.2/1000 ft
- Other:
- EF Score: 23

#### Reach 3498

- CF Rating = Moderate/High Impact, Normalized score = -0.711
- Most impacted CF metrics: natural shade, substrate type, depth/slope
- Least impacted CF metric: pollution
- Geomorphic class: Low Bank; Shoreline length: 1414 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 8.3% TIA, 73.9% forested
- Total shoreline armoring: 90.1%; Total encroaching: 74.8%
- Total point modifications: 24; Density: 17/1000 ft; most common is stairs, with 4.2/1000 ft
- Other:
- EF Score: 20

#### Reach 3499

- CF Rating = Moderate Impact ; Normalized score = -0.6
- Most impacted CF metrics: natural shade, substrate type
- Least impacted CF metric: hydrology
- Geomorphic class: Low Bank; Shoreline length: 2080 ft
- Sediment source: Alongshore; Wave exposure: protected
- Overhanging vegetation: 0%; Riparian zone land use: 12.6% TIA, 73.2% forested
- Total shoreline armoring: 91.8%; Total encroaching: 16.8%
- Total point modifications: 32; Density: 15.4/1000 ft; most common is stairs, with 4.8/1000 ft
- Other: 1 marina(s) present
- EF Score: 20

#### Reach 3500

- CF Rating = Moderate Impact ; Normalized score = -0.514
- Most impacted CF metric: substrate type
- Least impacted CF metric: wave energy, natural shade
- Geomorphic class: Spit/Barrier/Backshore; Shoreline length: 427 ft
- Sediment source: Alongshore; Wave exposure: very protected
- Overhanging vegetation: 0%; Riparian zone land use: 20.8% TIA, 65.4% forested
- Total shoreline armoring: 99.5%; Total encroaching: 53%
- Total point modifications: 6; Density: 14.1/1000 ft; most common is upland structures at waterline, with 4.7/1000 ft
- Other:
- EF Score: 22

#### Reach 3501

- CF Rating = Moderate Impact ; Normalized score = -0.578
- Most impacted CF metric: depth/slope
- Least impacted CF metric: physical disturbance
- Geomorphic class: High Bluff; Shoreline length: 668 ft
- Sediment source: Backshore; Wave exposure: protected
- Overhanging vegetation: 17.7%; Riparian zone land use: 14% TIA, 79% forested
- Total shoreline armoring: 100%; Total encroaching: 100%
- Total point modifications: 7; Density: 10.5/1000 ft; most common is stairs, with 4.5/1000 ft
- Other:

- EF Score: 20

### 3.3 Validating Assessment Scores

Graphs of the controlling factor and ecological function metric scores paired by reach suggest a slight correlation between impaired controlling factors and reduced ecological function (Figure B-72). In other words, when assessments suggest impairment of controlling factors within a particular shoreline reach (low score), habitat diversity and other indicators of ecological function (e.g., forage-fish spawning) are often reduced (low score). This relationship appears to be more pronounced in some geomorphic settings, such as low bank, marsh/lagoon, and spit/barrier/backshore habitats (Figures B-74, B-75, B-76), than in others (e.g., high bluffs; Figure B-73). Additional examination of reaches where this relationship does not hold may be useful for refining assessment techniques. As well, these graphical relationships only provide a first step at describing trends. Future efforts should use this information to design studies that address links between individual and cumulative impacts to specific ecological functions. More detailed analysis and discussion of this topic as it relates to prioritizing management actions is included in Appendix E.

### 3.4 Summary Conclusions and Recommendations

Although Bainbridge Island is generally considered semi-rural, over 82% of shoreline parcels are developed to densities only second to the Islands urban centers, and 52% of the shoreline is armored or otherwise modified. Its nearshore ecosystems provide support for a vast number of marine plants and animals and are vital to sustaining endangered species such as salmon, although in many cases these biological functions remain unquantified. The present report outlines a science-based framework for assessing the status of nearshore ecological conditions on Bainbridge Island.

This assessment is intended as a screening tool for prioritizing management actions Island-wide, and should be considered a living document that can be continuously refined as our knowledge base increases. The assessment framework is comprised of the following components:

- A conceptual model that is based on the best available science for the nearshore ecosystem. This model organizes the linkages between human impacts/actions, controlling factors, habitat structure, and ecological functions.
- Two ecologically- relevant spatial scales: reach and management area;
- Geomorphic context at the reach level;
- A scoring system based on the status of nine controlling factors metrics;
- An attempt to validate the scoring with limited existing data on ecological functions.

Key findings of the nearshore assessment were as follows:

- Bainbridge Island's shoreline represents a microcosm of what is generally found in Puget Sound, with moderate levels of impacts to nearshore resources, but extreme examples of high and low impacts as well. Most management areas were considered moderately impacted by human activities.
- Of nine MAs on Bainbridge Island, only Eagle Harbor (MA-5) was considered highly impacted; this MA included some of the most highly disturbed reaches found around the Island. Two MAs stood out as relatively undisturbed or least impacted: Murden Cove (MA-4) and Blakely Harbor (MA-6).

- At a reach level, assessment scoring did identify some stretches of shoreline commonly acknowledged as highly impacted or modified by human actions (e.g., reaches associated with the Wyckoff Superfund site on Bill Point and below feeder bluffs in Rolling Bay), as well as the more pristine reaches with minimal human impacts.
- The substrate type and depth/slope metrics represented the most impacted controlling factors over the entire Island. Low (poor) scores in these metrics suggest that high rates of shoreline armoring, armoring encroachment, and point modifications have significantly changed the historic composition of substrate and depth-slope contours along Bainbridge Island shorelines. Impacts to these controlling factors have likely caused significant affects to the nearshore ecosystem. Most nearshore organisms and habitats assemblages are dependent on specific substrate characteristics (e.g. rocky or sandy) and are limited to particular tidal elevations due to light availability and sensitivity to exposure out of water. Changes in substrate type or depth/slope may have caused habitat shifts or reduced the available area suitable for the formation of habitats and the processes necessary to sustain habitats.
- The hydrology and physical disturbance metrics represented the least-impacted controlling factors Island-wide. The relatively higher (better) scores in these metrics suggest that low-to-moderate intensity residential land use (as opposed to high-intensity urban or industrial land use) along many of the Island's shorelines has likely helped keep impacts to hydrology low and limited physical disturbances. These controlling factors can be sustained by maintaining forested marine riparian zones as well as avoiding and reducing intertidal/subtidal fill, tidal constrictions, and encroaching armoring. The discharge of untreated stormwater should be avoided and reduced. Floats, boats and mooring buoys should be located in deep water where they will not ground. Boats and boating facilities, including docks, buoys, and boat ramps, should be located to avoid and operated to minimize impacts to kelp, eelgrass, and other sensitive habitats.
- Scoring of some cumulative landscape (MA) controlling factor metrics might be improved in future updates of the assessment. For example, average cumulative MA scores associated with the natural shade metric were sometimes negatively associated with conditions at the landscape scale. High (good) scores were observed in MAs with a low total percentage of overhanging riparian vegetation along shorelines, and vice-versa. This discrepancy can largely be attributed to geomorphic factors (i.e., natural shade was not considered an issue in exposed beach/backshore/spit habitats) but may also indicate a weakness in the method for calculating cumulative landscape (MA) assessment scores. Refining the methods used to calculate cumulative landscape (MA) assessment scores (such as including reach length as a means of standardization) and to characterize the cumulative landscape (MA) assessment scoring (such as using median and highest/lowest quartiles) could improve the accuracy of cumulative landscape (MA) assessment results.
- Scoring of some ecological function might be improved in future updates of the assessment. Scores of documented ecological functions were highest (best) in the northern portions of Bainbridge Island, including Manzanita Bay (MA-9), Agate Passage (MA-1), and Port Madison Bay (MA-2). In contrast, the lowest (worst) EF scores were observed in Eagle Harbor (MA-5), Blakely Harbor (MA-6), and Rich Passage (MA-7). However, these scores were highly influenced by the presence of forage fish spawning habitats, one of the few ecological functions that has not been thoroughly and consistently quantified across all reaches, therefore possibly depressing scores where spawning has not yet been evaluated. Predictive mapping of spawning substrate based on sediment characteristics may prove a useful intermediate tool to assess forage fish metrics until field surveys are conducted. EF scoring might be further refined in future updates of the assessment, with distinctions drawn based on geomorphic context, similar to how CF scores were modified in this assessment.

- Preliminary validation efforts suggest that low (poor) controlling factors scores are often correlated with reduced habitat diversity and other indicators of ecological function (e.g., forage-fish spawning), especially in some geomorphic settings. Closer examination of outliers may assist in refining assessment techniques and selecting a more appropriate suite of parameters for monitoring.
- The current assessment methodology primarily focuses on aquatic habitats and functions. Future updates to the assessment should add focus to backshore and marine riparian habitats and functions.
- Improved mapping of feeder bluffs and other sediment sources should be conducted.
- In general, the assessment appeared to offer the right balance of detail and consistency when used as the first step in a screening process for management options.

Appendix E outlines management strategies that are appropriate for Bainbridge Island nearshore habitats, based on the following points:

- Management strategies are applied, in part, based on geomorphic conditions at the reach (site) and management area (landscape) levels. Five fundamental strategies for improving ecosystem functions of nearshore systems include habitat creation, enhancement, restoration, conservation, and preservation.
- Landscape ecology considerations were included in defining management strategies. Management strategy recommendations are assigned according to the level of disturbance at both the management area and reach scales (Figure B-14). If damages are great at both scales, fewer management strategies are likely to be successful. Conversely, if damage is relatively low on both scales, there is a broader array of management options. For example, it would make little sense to restore the ecosystem at a heavily damaged nearshore site (reach) if the landscape (management area) upon which this site depends is also heavily damaged. A more appropriate strategy would be restoration or enhancement of selected attributes of the reach.
- To better refine management actions for a particular site (reach or portion of a reach), eight criteria can be used to enhance ecosystem structure and function based on landscape ecology and restoration ecology principles. The criteria include site size, habitat complexity, accessibility, connectance, potential to conform to natural conditions, potential for self-maintenance, potential benefit to nearshore dependent threatened and endangered species, and potential to improve ecosystem functions (e.g., forage fish spawning areas) within a particular reach or management area.
- The assessment and prioritization framework will be most effective when it involves the local expertise of scientists and resource managers who are familiar with the Bainbridge Island shoreline and its ecological resources.

Assessing the results of management actions requires a monitoring program (Appendix F), which will assist in determining not only whether the actions are successful, but how to adaptively modify or adjust management actions to make them more successful. Other key points that are discussed and considered in the monitoring recommendations include:

- Consideration of monitoring goals, scale (effort in time and space), timing, sampling design and replication, reference site designation, attribute selection, sampling methods, and costs.
- Focus on monitoring that provides data for key attributes within the conceptual framework. In this way, monitoring will link processes to the nearshore habitat structure, integrate a multitude of nearshore habitats that support a variety of functions, establish relationships between structure and function, and ultimately can scale local processes to the broader Puget Sound ecosystem. Suggested key monitoring attributes include: controlling factors (e.g., water quality, sediment processes,

shoreline modifications), habitat structure (e.g., land use-land cover assessment, nearshore riparian cover, shallow water aquatic habitats), and ecological functions (e.g., fish assemblages, exotic species).

- To opportunistically fulfill a range of monitoring goals using rigorous methods under the limited resources (both funding and personnel) available at a local level, we recommend: 1) selectively monitoring several key nearshore parameters; 2) focusing monitoring efforts at ongoing local monitoring and assessment activities; 3) using consistent and standardized protocols; 4) forging partnerships and involving other stakeholders; and 5) leveraging opportunities with existing resources unique to Bainbridge Island.