CITY OF BAINBRIDGE ISLAND
ENVIRONMENTAL TECHNICAL ADVISORY COMMITTEE

MEMORANDUM

TO: Planning Commission and City Council

FROM: ETAC

DATE: May 22, 2012

RE: Technical Framework for No Net Loss

No Net Loss Framework for COBI

Executive Summary

Ensuring "no net loss of ecological function" is a key requirement of the SMP Update. Policies and regulations are to be used to ensure that adverse impacts of new and existing development are mitigated according to the following prioritized sequence.

1. **Avoid** the impact by not taking a certain action;
2. **Minimize** impacts by limiting actions or using appropriate technology to avoid or reduce impacts;
3. **Rectify** impacts by repairing, rehabilitating, or restoring the affected environment;
4. **Reduce** or eliminate the impact over time by preservation and maintenance operations;
5. **Compensate** for impacts by replacing, enhancing, or providing substitute resources or environments; and
6. **Monitor** the impacts and take appropriate corrective measures.

A plan for the **restoration** of shorelines with impaired ecological function is also called for, and it is recognized that restoration may be needed to achieve 'no net loss', given cumulative and on-going impacts.

For the purposes of the SMP, ecological functions are natural processes and components of an ecosystem that sustain shoreline and nearshore dependent species and resources (*e.g.*, wading birds, clams, fish, kelp forests, spawning areas, and eelgrass beds), as well as protecting public health and safety. Ecological functions provide "conditions for reproduction, resting, hiding and migration; and food production and delivery". Other functions include sediment transport & stabilization, removing excess nutrients & toxic compounds, and maintaining temperature.

Direct measurement of ecological functions can be difficult. Alternatives include measuring the 1) biological resources that depend on the functions, 2) habitat size, and 3) the factors that negatively impact ecological functions.

The term 'Managed factors' refers to human development activities which can adversely affect ecological functions. The factors can be 'managed' by SMP policies and regulations. They

include the alteration of natural vegetation (clearing, waste dumping, and the introduction of exotic species) and built structures (aquaculture, armoring, buildings, *etc*.).

A suggested approach to addressing managed factors includes the following.

1. Clearly state the effects on ecological functions that X managed factor can have.
2. Identify the uncertainties and data gaps associated with these effects.
3. Determine how the managed factor is measured?
4. Determine how the impact should be addressed?

There are many data gaps and uncertainties regarding the evaluation of ecological functions and the determination of net effects. They include questions of scale, data sources & measurement techniques, and the viability of off-site and out-of-kind mitigation. Monitoring ecological functions and managed factor effects will be challenging but essential to future SMP updates.

Introduction

A key requirement of the SMP Update is to ensure that there is "no net loss of ecological function" associated with continuing development. The general goal of this document is to outline the Environmental Technical Advisory Committee's interpretation of the no-net-loss concept and how it can be implemented on Bainbridge Island.

Specific objectives include the following.
1) explain the requirement, including guidelines on how it is to be achieved
2) define 'ecological functions' and offer options for assessing them
3) describe the human development activities ('managed factors') that can affect ecological functions
4) suggest an approach to addressing the relationships between 'managed factors' and the no-net-loss framework
5) discuss data gaps and uncertainties

We believe there can be flexibility in how Bainbridge Island approaches the no-net-loss requirement. While the Washington Administrative Code is clear about the general requirement and provides priority guidelines on how it should be addressed, there are no proscriptive rules in specific regulations or policies that must be used with respect to No Net Loss. COBI has already adopted a set of shoreline regulations & policies, which will be reconsidered as part of the Update process. Our hope is that this document will help Bainbridge citizens, COBI staff, and elected officials better understand the constraints and options available.

I. The No Net Loss Framework

As outlined in the Washington Administrative Code (WAC), the Shoreline Master Program (SMP) "...shall include regulations and mitigation standards ensuring that each permitted development will not cause a net loss of ecological function...". To ensure no net loss (NNL), and also protect other shoreline functions and uses, "policies, programs, and regulations that address adverse cumulative impacts should be fairly allocated among development opportunities". For shorelines with impaired ecological functions, the SMP shall include goals

and policies for restoration; identify existing restoration related policies and programs; and utilize "...established or funded non-regulatory policies and programs..." (paraphrased from WAC 173-26-186, pages 13 and 14 of 100). The Shoreline Management Act (SMA) defines the baseline for measuring no net loss to be "existing shoreline conditions" which, practically speaking, is the most recent understanding of the condition of ecological functions and resources (*e.g.*, the nearshore characterization or more recent data supplementing that characterization). NNL does not mean that 'existing shoreline conditions' are sustaining healthy ecosystems. Often they are not. The minimum requirement is only that further deterioration is prevented.

As part of the guidelines to assure NNL of ecological functions, the WAC calls for "provisions to address the impacts of specific common shoreline uses, development activities and modification actions". The WAC recognizes that "any development has potential or actual impacts" to ecological functions. NNL is to be achieved by application of development standards and "mitigation measures in accordance with the mitigation sequence" (WAC 173-26-201, pg. 27). The mitigation sequence prioritizes actions as follows.

1. Avoid the impact by not taking a certain action;
2. Minimize impacts by limiting actions or using appropriate technology to avoid or reduce impacts;
3. Rectify impacts by repairing, rehabilitating, or restoring the affected environment;
4. Reduce or eliminate the impact over time by preservation and maintenance operations;
5. Compensate for impacts by replacing, enhancing, or providing substitute resources or environments; and
6. Monitor the impacts and take appropriate corrective measures.

The WAC does not state this directly; however in our opinion, minimizing (#2) or reducing (#3) impacts would not appear to completely achieve NNL, and would also therefore require compensation (#5). The WAC does state that when using compensatory measures "preferential consideration shall be given to measures that replace the impacted functions directly and in the immediate vicinity of the impact" (WAC 173-26-201, pg. 29). "However, alternative compensatory mitigation within the watershed that address limiting factors or identified critical needs for shoreline resource conservation ….. may be authorized." This last sentence opens the door to off-site mitigation, particularly in cases where on-site mitigation may not be possible or adequate to achieve no net loss, and also implies that mitigation for other ecological functions may be considered compensatory. The relative value of off-site and out-of-kind mitigation may be less certain than direct on-site replacement of impacted functions (see section V. c.).

The SMP is intended to specify shoreline policies and regulations that protect natural resources while allowing development and use. The policies and regulations address factors that are deemed to be within the city's purview to manage. These factors include vegetated buffers and shoreline modifications, and the current SMP contains provisions to regulate them. The SMP update will include a review of existing policies & regulations and provide an approach to addressing the NNL requirement. The approach would be to first evaluate whether existing policies and regulations are achieving NNL. If not, the next step is to identify what modifications to existing policies and regulations could be implemented to achieve NNL.

Figure 1 provides a conceptual view of how to achieve NNL. It illustrates that both existing and new development can produce loss of ecological functions. Only relying on mitigation to maintain NNL will not be successful, because there are cumulative and ongoing impacts that occur in the landscape (both temporal and spatial) from any development disturbance that mitigation for individual projects typically does not address. A cumulative impact is "the impacts on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" (National Environmental Policy Act, 40 CFR ~ 1508.7). As indicated on Figure 1, restoration will be needed to achieve – and potentially exceed-- the NNL requirement.

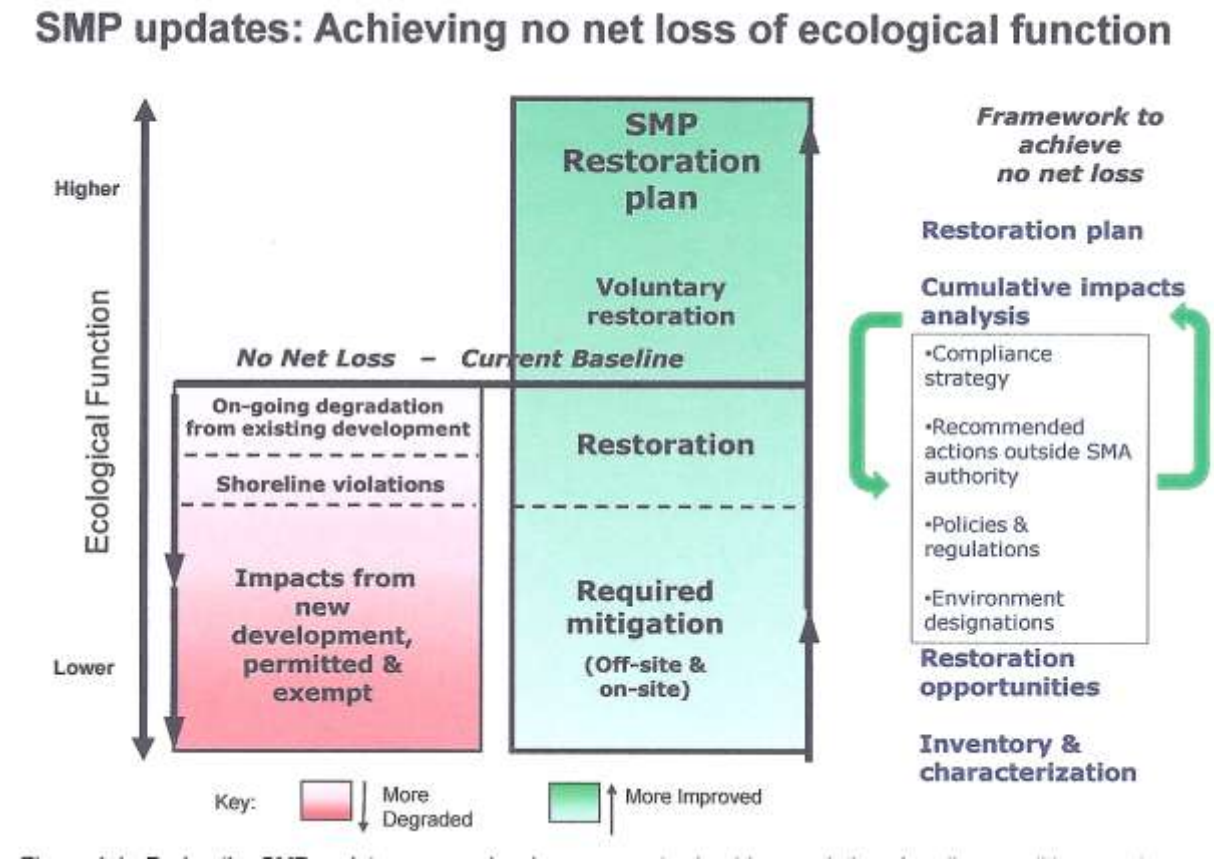

Figure 1. Conceptual view of how to achieve no net loss
(from Chapter 4 of the SMP Handbook).

The City's permitting process reviews each proposed project individually, which discourages property owners and planners from addressing the cumulative effects of development. Taken individually, associated adverse environmental impacts from a project may appear insignificant. However, adverse impacts gain significance when similar development impacts are collectively evaluated across a reach or landscape scale. For example, a small bulkhead addition that is situated within a reach of the shoreline that supplies sediment (*e.g.*, a feeder bluff), may only have a small effect on reduction in sediment supply; however, if multiple properties add to bulkheading in the same reach, the cumulative effects of lost sediment could lead to beach starvation downdrift of the supply area. Each addition, viewed in isolation, may not be viewed

as significantly affecting supply, but are more significant when reviewed as a whole in terms of the sediment dynamics of the reach.

When restoration is added to mitigation measures, larger reach and landscape scale ecological losses can be prevented and sometimes even improved from baseline conditions. Restoration can occur on a single-lot scale such as requiring beach nourishment for existing bulkhead repairs and/or permitting only soft shore stabilization solutions for replacements and new bulkheads. Restoration can also occur on a larger scale with investment in focused restoration programs.

II . What are ecological functions?

a . Suggested Broad Definition For the purposes of the SMP, ecological functions are natural processes and components of an ecosystem that sustain shoreline and nearshore dependent species and resources (*e.g.*, wading birds, clams, fish, kelp forests, spawning areas, and eelgrass beds), as well as protecting public health and safety.

There may be flexibility to identify shoreline/nearshore dependent resources of particular concern. Battelle (2003) addresses "benthic macroinvertebrates that are of commercial or recreational significance, selected forage fish, groundfish, salmonids, and key marine birds and mammals". SMP Guidelines (WAC 173-26-201 describe critical salt water habitats. "Critical saltwater habitats include all kelp beds, eelgrass beds, spawning and holding areas for forage fish, such as herring, smelt and sandlance; subsistence, commercial and recreational shellfish beds; mudflats, intertidal habitats with vascular plants, and areas with which priority species have a primary association."

b . What the WAC says

SMP Guidelines (WAC 173-26-201, pages 34 and 35) identify shoreline ecological functions in general terms. Only those associated with "Marine Waters", and to a lesser extent, "Wetlands" are applicable to Bainbridge Island (*i.e.*, we have no rivers, streams, or lakes that qualify as regulated under SMP guidelines because they are smaller than the size criteria stipulated as regulatable under the SMP; they are instead managed under the critical areas ordinance). The SMP guidelines divide ecological functions into Hydrologic, Vegetation, and Habitat categories. The Hydrologic and Vegetation categories contain redundant, overlapping, and sometimes conflicting components that can be reduced to the following.

- transporting and stabilizing sediment
- attenuating wave and tidal energy
- removing excessive nutrients and toxic compounds
- recruitment, redistribution, and reduction of woody debris and other organic material
- maintaining temperature

The Habitat category functions are "for aquatic and shoreline-dependent birds, invertebrates, mammals; amphibians; and anadromous and resident native fish", and "may include but are not limited to; space or conditions for reproduction, resting, hiding and migration; and food production and delivery".

Battelle's reports, the 'Bainbridge Island Nearshore Assessment' and the 'Habitat Characterization & Assessment, Management Strategy Prioritization, and Monitoring Recommendations' list the following ecological functions:

- disturbance regulation
- prey production
- reproduction
- refuge
- carbon sequestration
- maintenance of biodiversity
- movement/migration

Ecological functions that sustain biological resources are provided by the habitats used by those resources. Habitat preservation could therefore serve as a simplified approach to protecting the functions. Table 1 in the Appendix lists Bainbridge Island habitats that sustain marine biological resources along with considerations regarding the measurement of related ecological functions.

c. Measuring Ecological Functions

Ecological function can be difficult to measure. Most functions can be measured in principle; however, the process can be expensive and could be inconclusive. Consider for example programs to attempt to measure the 'transportation and stabilization of sediment' or the 'attenuation of wave and tidal energy', both of which are very complicated concepts that could take many years and complicated study designs to accurately quantify. We propose that alternatives be considered, including the options listed below. The first two of these alternatives are directly related to ecological function.

- Biological Resources: As the purpose of ecological functions is to sustain biological resources, measuring the health, diversity, or volume of the specific biological resource may be appropriate as a metric as to how well the function is actually working for biota. Conceptually, the most direct approach could be the population size of valued resources such as clams or forage fish. The collection and analysis of meaningful, reliable resource data could be expensive.
- Habitat Area: As ecological functions are generally provided by natural habits, measuring the extent of those habitats could serve as a proxy for the functions. We note that measuring area may be an oversimplification or not in all cases the best metric for understanding functional importance; for example, in an edge or transitional system, another metric such as habitat length may be as, or more, important than width in defining a habitat's importance. In addition, it is essential to consider the quality of the habitat simultaneously with the quantity; area metrics alone do not describe how well the habitat performs in providing ecological functions. Examples of ecological habitats and measurements that could be used to monitor their extent are provided in Table 1.
- Managed Factors (described further in Section 3 below): In supporting the NNL goal, the SMP seeks to limit the negative impacts of development related factors that could be managed by COBI via policy and/or regulation. The existing SMP focuses on shoreline modifications and native vegetation. The effects of these factors on ecological functions

are often uncertain and variable. An argument could be made that measuring the extents of the managed factors themselves and limiting them to baseline values would provide a simplified approach to NNL – if the factors potentially causing ecological function loss do not increase, then perhaps there would be no further net loss of ecological function. Unfortunately, this approach is not entirely valid. It is likely that existing factors contribute to an on-going degradation process that will further degrade ecological function with time; for example, shoreline armoring may interrupt sediment supply but the effects of this interruption may not be measurable for some period of time following installation. Managed factors should be measured in any case to provide a foundation for investigating their influence on ecological functions. It is extremely important, however, to design measurements that are robust enough to help answer questions about the relationships between potential impacts and managed factors. For example, measuring the amount of armored shoreline can provide information about how much armoring exists on Bainbridge, but several additional pieces of information, including armoring location relative to the tidal interface, drift cell location, local geomorphology, and upland vegetation, are important to understanding the potential for effects on ecological functions.

III. **Managed Factors**

"Managed factors" refers to human development activities in the area of the shoreline which have the potential to cause loss of, or adverse effect on, one or more ecological functions. The term "managed" is used to clarify that these are activities that can be regulated by the COBI SMP. There are other human factors or human-driven processes (*e.g.*, land use practices beyond COBI's jurisdiction; sea level rise) and natural processes (*e.g.*, earthquakes, severe storm events, sea level rise) that can be planned for or responded to in the SMP; however, these are not processes that the SMP can directly control.

Types of managed factors include:

1. Alteration of natural vegetation, including
    a. Clearing or tree removal
    b. Waste dumping
    c. Introduction of exotic species
2. Built structures, including
    d. Upland construction: buildings, roads, parking and other impervious surfaces
    e. Shoreline armoring
    f. Docks, Piers and floats
    g. Aquaculture

Table 2 in the Appendix provides an example matrix table of development activities (managed factors), impacts on ecological functions, and potential response activities (minimize/mitigate/restore). Some cells have been filled in as examples; this should be considered a starting point and not a comprehensive list.

IV. An outline for addressing managed factors in the context of the NNL framework:

1. Clearly state the effects on ecological functions that X managed factor can have.
2. Identify the uncertainties and data gaps associated with these effects.
3. How is the managed factor measured?
4. How should the impact be addressed?

The Appendix at the end of this provides tables that outline some tools for compiling ways to measure and identify uncertainties for managed factors and ecological functions. These tables could be further developed and expanded in order to outline possible approaches for monitoring these functions and factors on Bainbridge Island.

V. **Data Gaps and Uncertainties**

a. How do we address scale? Are there certain functions the island's shoreline should be performing as a whole? Do we expect certain functions based on the profile/structure or reach/drift cell level? Is it ok to allow local losses? Can we realistically manage on the smaller scales?

Habitat structures and processes, which influence function (aka, "controlling factors"), may scale up as well as be important at a subunit scale.

Possible scales of measurement of functions and impacts include:

1. Island-wide functions
    a. Tall trees for roosting birds (e.g., number of trees greater than 100 feet in height and their location)
    b. Bald eagle nests, heron rookeries (as an indirect measurement of the presence of supporting habitat; note eagle and heron presence may be statistically inversely related because they are species that generally avoid each others nesting areas)
2. Drift-cell specific
    a. Vegetative habitat: such as the kelp stand at northern end of eagle harbor, eelgrass beds (location, number, and area)
    b. Spawning habitat: such as condition of habitat at Pt Monroe (location, species, number, and area)
    c. Refugia (location, species, number, and area)
2. By geomorphic class (See Table 2 of Williams et al. 2003)
    Rocky
    Marsh/Lagoon
    Spit/Barrier/Backshore
    Low bank
    High bluff

One way to approach scale may be to define what functions are important generically/island-wide, rather than to look at what functions dominate at drift cell or other smaller category (bay, bluff area, etc). Otherwise, there is a problem with the sheer amount of data collection and "micro-management" required to manage at these smaller scales.

b. Recognizing uncertainties and data gaps in measurements

As with any attempt to understand and monitor complex ecosystem processes, COBI faces substantial challenges in appropriately and sufficiently tracking ecological functions and managed factors. The nearshore characterization relies on a broad range of data sources, many of which have limitations and gaps that introduce uncertainty into the use of these data in establishing baseline conditions and managing for no net loss. For example, the intercoastal grain size atlas that is used as a source of information on grain size is provided at a scale that is probably too coarse to be accurate for COBI and needs ground-truthing; DNR eelgrass bed data are known to have been subjected to substantial interpolation in order to rate bed density; our forage fish data sets that are provided by the Island's beach seine study are temporally intensive but not spatially complete, as they target a subset of the island's shorelines that are geomorphically diverse (R Ericson, pers. comm.). We do not have COBI-specific rates of sediment drift or bluff erosion rates that provides accurate information about the movement and supply of sediments within drift cells, although these metrics have been studied elsewhere in Puget Sound and regional or nearby information could be used to provide rough estimates for Bainbridge. COBI's ability to achieve the directives set forward by the NNL framework depends on addressing data gaps where feasible (*e.g.*, See Table 1 in the appendix for a starting point for identifying measurements and data gaps), and being explicit about uncertainties and how these uncertainties limit or affect the ability to monitor and evaluate shoreline functions.

c. Compensatory mitigation and uncertainty in off-site and out-of-kind solutions.

The WAC states a preference for on-site in-kind mitigation that would more directly compensate for negative impacts. The compensatory value of off-site mitigation would require technical judgment on the comparability of sites and likely equivalence of effects.

Out-of-kind mitigation would be more difficult to evaluate. It would require value judgments on the relative ecological value of different functions.

Uncertainty regarding the compensatory value of mitigation that would be both off-site and out-of-kind would be compounded.

One possible approach to dealing with out-of-kind mitigation is to use tools such as increased 'compensation ratios', such as those used in wetland mitigation guidance, as a precaution to allow for increased uncertainty. For example, X linear ft of impact could require mitigation applied to a much longer length if it is off-site.

VI. Conclusions

No Net Loss is a framework which establishes maintenance of current overall conditions as a minimum requirement for management of shoreline ecological functions under the SMP. The framework of 1) avoid 2) minimize 3) mitigate may not account for ongoing degradation associated with baseline conditions; some degree of restoration will also be needed.

Ecological functions can be challenging to fully describe, and even more challenging to effectively monitor, at a site-specific level. However, monitoring of ecological functions is an essential component of the process of understanding the status of nearshore ecological functions. Biological resources themselves, or their habitat, can be used as indicator metrics for monitoring functions. Managed factors, or the anthropogenic activities that are known or believed to be

associated with effects on ecological functions, can be used as proxies in terms of gauging the level of potential effects. Any functions or factors that are selected for monitoring must be placed in the context of how functions or effects on functions can change across scales, and what the limitations are to gathering data effectively and efficiently.

REFERENCES

Williams, Gregory D., Ronald M. Thom, and Nathan Evans, 2004. Bainbridge Island Nearshore Habitat Characterization and Assessment, Management Strategy Prioritization and Monitoring Recommendations. PNWD 3391Prepared for the City of Bainbridge Island, by Battelle Marine Sciences Laboratory, Sequim, Washington. November 2004. http://www.ci.bainbridge-isl.wa.us/nearshore_report.aspx.

Williams, G.D., R.M. Thom, M.C. Miller, D.L. Woodruff, N.R. Evans, P.N. Best, 2003. Bainbridge island Nearshore Assessment: Summary of the Best Available Science. PNWD 3233. Prepared for the City of Bainbridge Island, Bainbridge island WA by Battelle
Marine Sciences Laboratory, Sequim, WA.

APPENDIX

Table 1. Examples of the types of direct measurements that may be taken to measure habitats and their ecological functions. The table is partially filled in to indicate how it might be used. This table is simply a starting point for thinking about Bainbridge-specific habitats and functions, and is not meant to prescribe or comprehensively describe all potential habitats and measurements.

Habitat	**Controlling factors and processes**	**Characteristic/Structure for measurement**	**Available Measurements**	**Data gaps/uncertainties**	**Planned and suggested additional measurements**
Sandy Beaches:					
Backshore	Geomorphic class	Large woody debris distribution and abundance;			Invertebrate sampling
Intertidal	Geomorphic class; sediment supply	Benthic inventory: infaunal and epifaunal; grain size distribution;	Invertebrate data from nearshore seine program (epifaunal large macroinverts only); grain size: intercoastal atlas	Ryan's proposal focuses on bay/marsh- what about other geomorphic classes? According to Ryan, intercoastal atlas grain size data needs ground-truthing;	Benthic inventory: infaunal grabs via ambient bay study (proposed by Ryan); what about sampling in other geomorphic classes? Ground-truthing Battelle 2004 identified spawning areas; Ulva surveys
Subtidal habitats	Bathymetry; substrate	Clam density/abundance; shellfish advisories	DOH shellfish advisories	DOH fecal sampling	CTD sampling using HS students (proposed by Ryan);
Cobble/Gravel beaches	Geomorphic class;				Invertebrate sampling

Habitat	Controlling factors and processes	Characteristic/Structure for measurement	Available Measurements	Data gaps/uncertainties	Planned and suggested additional measurements
	wave energy				
Bedrock	Wave energy				Invertebrate sampling
Eelgrass beds	Wave energy; geomorphic class	Eelgrass density and distribution; Evidence of forage fish spawning and use	Eelgrass WDNR , EPA data		Ulva surveys
Riparian vegetation zone	Geomorphic class	% Overhanging Veg; Riparian vegetated area; tall roosting trees; nesting data	COBI GIS layer	Indicator proposed by DOE of bald eagle/osprey/great heron nests is problematic because these can be inversely related. Several of these species use more than just shoreline for nesting.	Vegetative diversity
Kelp Beds	Geomorphic class; bathymetry; wave energy	Kelp bed area		EPA data is limited in extent (Blakely, Eagle harbor), but should be looked at	Suquamish Tribe Kelp Bed Study
Marsh/Lagoon	Vegetative community; shoreline form; wave energy	% open area (mudflats); abundance and diversity of marsh vegetation; wading bird surveys	COBI GIS layer	This may be most useful for monitoring invasive plant occurrences; other causes of loss of mudflats are not expected/readily identifiable for BI	Invasive and plant diversity surveys

Table 2. DRAFT example matrix table of development activities (managed factors), impacts on ecological functions, and potential response activities (minimize/mitigate/restore). Some cells have been filled in as examples; this should be considered a starting point and not a comprehensive list.

Habitat	Potential Impacts by Development Activity				Potential Mitigation by Development Activity			
	Upland Construction	Shoreline Armoring	Overwater structures	Aquaculture	Upland Construction	Shoreline Armoring	Overwater structures	Aquaculture
Sandy Beaches:	(+/-) erosion potential could add to beach sediment supply	(-) reduction in sediment supply	Not significant	Not significant				
Backshore					No fill allowed in back shore			
Intertidal					No substantial construction below MHHW	No construction below MHHW		Require monitoring and adherence to WQ standards
Subtidal habitats				Water quality impacts including DO, nutrients, disease; change in substrate				Require monitoring and adherence to WQ standards
Cobble/Gravel beaches					Avoid/minimize clearing of veg along bluff zone			

Bedrock					Avoid/minimize clearing of veg along bluff zone			
Eelgrass beds		Disturbance during construction possible	Shading; disturbance during construction				Not allowed in eelgrass beds	Not allowed in eelgrass beds
Riparian vegetation zone					Avoid/minimize clearing of veg along bluff zone	Avoid/minimize clearing of veg behind bulkhead		
Large/ Roosting Trees					Only allow if critical; require replacement plantings, contribute to purchase/protection of valued large trees	N/A		
Kelp Beds							Not allowed in kelp beds	
Marsh/ Lagoon					No fill allowed in marshes or lagoons			

Table 3. Draft Table Identifying Baseline Inventory of Habitats of Interest on Bainbridge Island and Proposed Monitoring to Confirm NNL

Representative Ecological Habitats	BI Inventory Status	Proposed Monitoring Program Elements
Sand Beaches: backshore, upper intertidal, lower intertidal, pocket beach		
Cobble Beaches		
Marine Riparian Vegetation: tall roosting trees		
Bedrock habitats		
Protected Shallow embayments: marshes, lagoons		
Riparian Corridor		
Kelp Beds		
Eel Grass Beds		