REPORT

YEAR-5 POST-CONSTRUCTION EELGRASS SURVEY
TAYLOR AVENUE DOCK

Prepared for

City of Bellingham Parks and Recreation Department

3424 Meridian Street

Bellingham, Washington 98225

Prepared by

Anchor QEA, LLC

1423 Third Avenue, Suite 300

Seattle, Washington 98101

October 2009

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1 INTRODUCTION

The City of Bellingham (City) completed construction of an over-water pedestrian walkway over Bellingham Bay in 2004. The walkway improved public access along the Bellingham Bay waterfront and connected the South Bay Trail and the Interurban Trail. The walkway is located approximately 2 miles southwest of Bellingham's Central Business District and approximately 1.5 miles north of Fairhaven's Central Business District (Figure 1).

In order to monitor the anticipated improvements to the eelgrass bed associated with the new walkway, an *Eelgrass Mitigation Plan* was prepared for the project (Pacific International Engineering 2000; see Appendix A). The *Eelgrass Mitigation Plan* establishes specific eelgrass shoot density performance standards that must be achieved during post-construction surveys. Baseline post-construction information was collected in Year-0 (2004) (Anchor 2004), and post-construction surveys were conducted in Year-1 (2005) and Year-3 (2007) (Anchor 2005; Anchor 2008). This year's Year-5 survey in 2009 completes the required post-construction monitoring.

This report documents the methods and results of the Year-5 eelgrass survey, and compares this year's data to that from Year-0 monitoring, as well as to the performance standards established in the *Eelgrass Mitigation Plan* for the project.

K:\Jobs\090062-City-of-Bellingham\090062-01-Taylor Dock\09006201-RP-007.dwg FIG 1

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NOTE: Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Bellingham S. and Eliza Island, Washington.

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Scale in Feet

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Figure 1
Vicinity Map
Taylor Avenue Dock
Bellingham, Washington

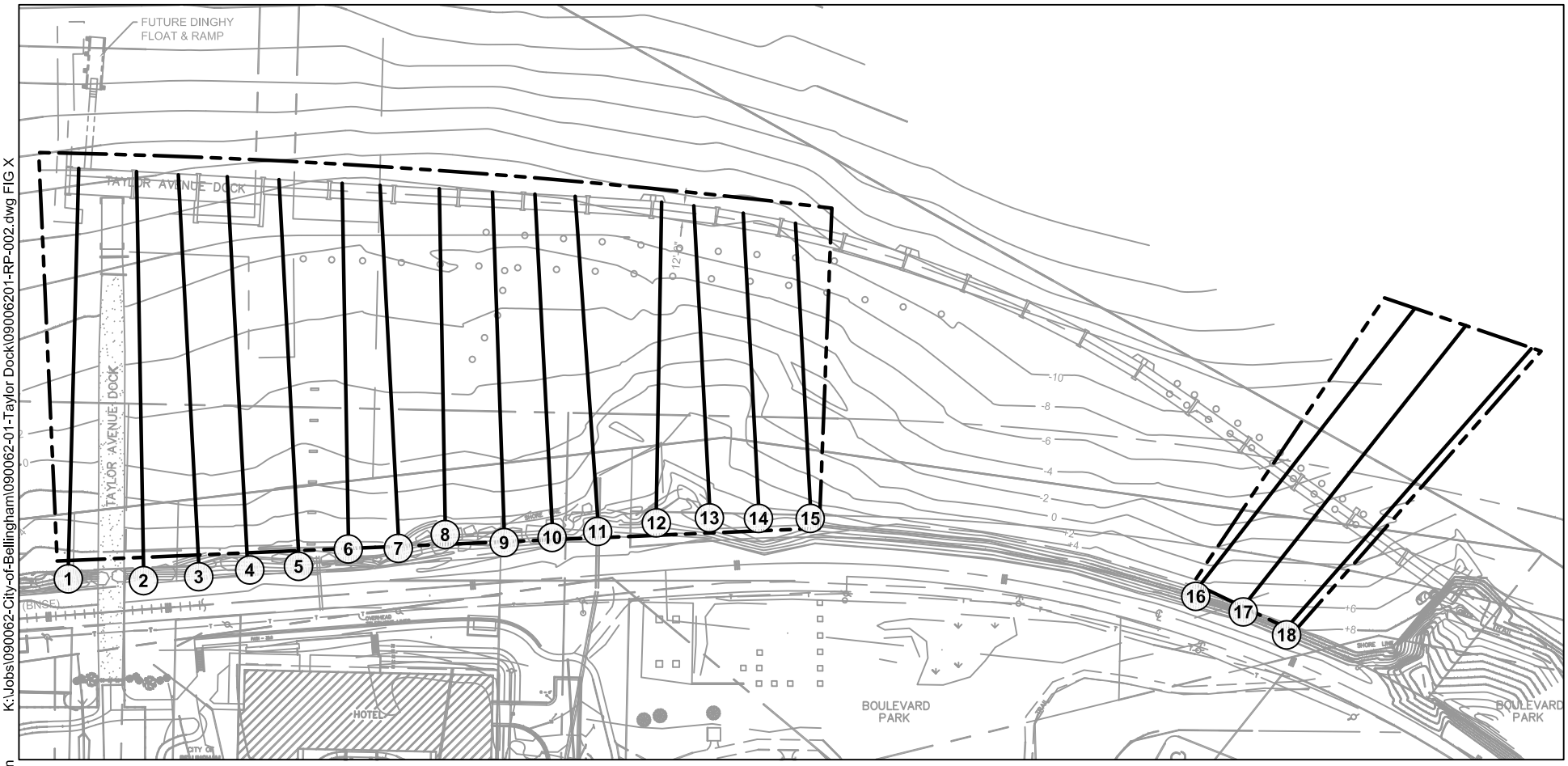
2 METHODS

2.1 Field Survey

The Year-5 eelgrass survey was conducted on July 22, July 24, and August 13 and 14, 2009. Intertidal work was completed on the July dates and subtidal work on the August dates. The survey was conducted by two qualified divers using self-contained underwater breathing apparatus (SCUBA) gear. Both divers and the boat operator maintained lines of communication using wireless communications. The eelgrass survey was completed using the same survey methods as used in previous survey years (Anchor 2004; Anchor 2005). Eighteen transects were set (Figure 2) along the same alignment as established during this previous monitoring[1]. All transects began at the base of the riprap armoring the shoreline and extended perpendicular to shore to the offshore edge of the walkway. In addition, in Year-5, the eelgrass margin was recorded at low tide as an additional check on the transect data. This margin was delineated by walking the line of eelgrass extent with a differential global positioning system (DGPS) and recording a line feature.

For each transect, observations of physical parameters, biological characteristics, and locations were recorded. Observation points were spaced 20 feet apart along each transect. In accordance with WDFW *Intermediate Macroalgae/Eelgrass Habitat Survey Guidelines* (WDFW 1996), divers recorded water depth, time, surface substrate type, eelgrass density, percentage and species of macroalgae cover, and presence of macrofauna. Eelgrass shoot density was characterized by counting shoots within a 0.25-meter square (m^2) quadrat in one of two ways: if shoot density was less than 30 shoots per quadrat, shoots were counted, or if shoot density was greater than 30 shoots per quadrat, the count was summarized as "dense." Three quadrat counts were repeated at each observation point. In addition, the inner and outer edges of eelgrass beds and eelgrass occurrence were noted along the transect line. Location information for each transect was collected using a Trimble Pathfinder DGPS.

[1] Fifteen transects were positioned in the southern and middle portions of the project area and oriented perpendicular to shore; three transects were positioned near the north end of the project and oriented in a more northerly direction than perpendicular to shore. Because of the dock location, the southernmost transect (Transect 1) began on shore, approximately 25 feet south of the Taylor Avenue access trestle, and the next transect to the north (Transect 2) was positioned 10 feet north of the northern edge of the access trestle. Spacing between these two transects was 60 feet. Continuing northward, the remaining transects were spaced at 40-foot intervals, including the three transects at the north end of the project area.



LEGEND:

1 Transect Line Location and Number

Year-5 Survey Area

NOTES:

1. Base map prepared from electronic file provided by Berger/Abam Engineers, Inc.
2. Horizontal Datum - WA SPN NAD83.

0 120
Scale in Feet

K:\Jobs\090062-City-of-Bellingham\090062-01-Taylor Dock\09006201-RP-002.dwg FIG X

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Figure 2
Year-5 Post Construction Eelgrass Transect Locations
Taylor Avenue Dock
Bellingham, Washington

2.2 Eelgrass Comparison to Performance Standards

The *Eelgrass Mitigation Plan* sets forth performance standards to be met by the conclusion of Year-1, Year-3, and Year-5 monitoring activities (Pacific International Engineering 2000; see Appendix A). The *Eelgrass Mitigation Plan* identifies two areas where eelgrass recovery may occur. The "Restored Area" is a 15,790-square-foot (ft^2) area where eelgrass is expected to colonize because habitat was improved through the removal of overwater and in-water structures that had previously limited eelgrass growth. The "Additional Area Available for Eelgrass Colonization," hereafter called the "Available Area," is a 10,820-ft^2 area where eelgrass is less certain to colonize due to water depths or substrate conditions. While it is expected that some eelgrass recolonization may occur throughout the eelgrass bed, only the Restored Area is considered for purposes of meeting the performance standards.

The performance standards require the colonization of increasing numbers of eelgrass shoots in a 1,430-ft^2 portion of the 15,790-ft^2 Restored Area during Year-1, Year-3, and Year-5. The total number of shoots in a 1,430-ft^2 portion of the Restored Area was calculated by first creating polygons around the observation points on each transect in the Restored Area. Recalling that survey transects were spaced 40 feet apart and observations were recorded every 20 feet on each transect, each observation point was considered to represent eelgrass distribution in an 800-ft^2 polygon (40 feet times 20 feet). In this way, two observation points were used to calculate the shoot count for comparison with the performance standard: one observation point was applied to an 800-ft^2 polygon and the second observation point was applied to the remaining 630-ft^2 polygon (to total 1,430 ft^2). The number of eelgrass shoots in each polygon was then estimated by multiplying the average (of three quadrat counts) shoot density by the area of these polygons. Total shoot counts were summed for these contiguous polygons with high shoot estimates and that covered a combined area of approximately 1,430 ft^2.

3 RESULTS AND DISCUSSION

3.1 Eelgrass Distribution and Shoot Densities

As in previous years, native eelgrass (*Zostera marina*) and non-native eelgrass (*Z. japonica*) were documented at the site, and native eelgrass was dominant. The characteristics of native and non-native distributions are described below in terms of inshore/offshore margins, depth ranges, and shoot densities.

A continuous bed of native eelgrass extends throughout the survey area; transect data and eelgrass margins are shown on Figures 3a and 3b. Compared to the Year-0 post-construction surveys, the Year-5 native eelgrass bed in the main portion of the survey area (Transects 1 through 15) continued to show signs of expansion along its offshore margin in several places, especially in Transects 5 through 8 and in the dense areas (i.e., areas with a quadrat shoot count of greater than 30 shoots per quadrat; see Figure 4). The transect data show the Year-5 inshore margin of native eelgrass as slightly more offshore as compared to Year-0 (see Figure 4); however, the eelgrass margin line as recorded by DGPS on the shore indicates that the margin has not moved appreciably (see Figures 3a and 3b).

In the northern portion of the survey area (Transects 16 to 18), the native eelgrass distribution is slightly more offshore than that observed in Year-0 (see Figure 4). However, eelgrass continued to grow in the Impact Area that was identified based on the presence of eelgrass in 1998[2] (Taylor Associates and Battelle Marine Sciences Lab 1998).

The inshore margin of native eelgrass occurred at variable elevations ranging between +1.7 feet mean lower low water (MLLW) (Transect 11) and -11.1 feet MLLW (Transect 18; see Table 1). As in previous years, the variability of these inshore elevations is likely to be due to the presence of sandstone bedrock outcroppings (Transects 12 to 14, and 18), which do not provide suitable substrate for eelgrass. Within the area bounded by the dock (i.e., Transects 1 through 15), the deepest offshore margin of native eelgrass was -8.6 feet MLLW (Transect 10) and the shallowest was +1.7 feet MLLW (Transect 11; see Figure 3a and Table 1). Along Transects 16 through 18, which are located further north and extend offshore from the

[2] The Impact Area is the portion of the eelgrass bed documented in the 1998 survey that extends under the walkway at the northern end of the walkway alignment.

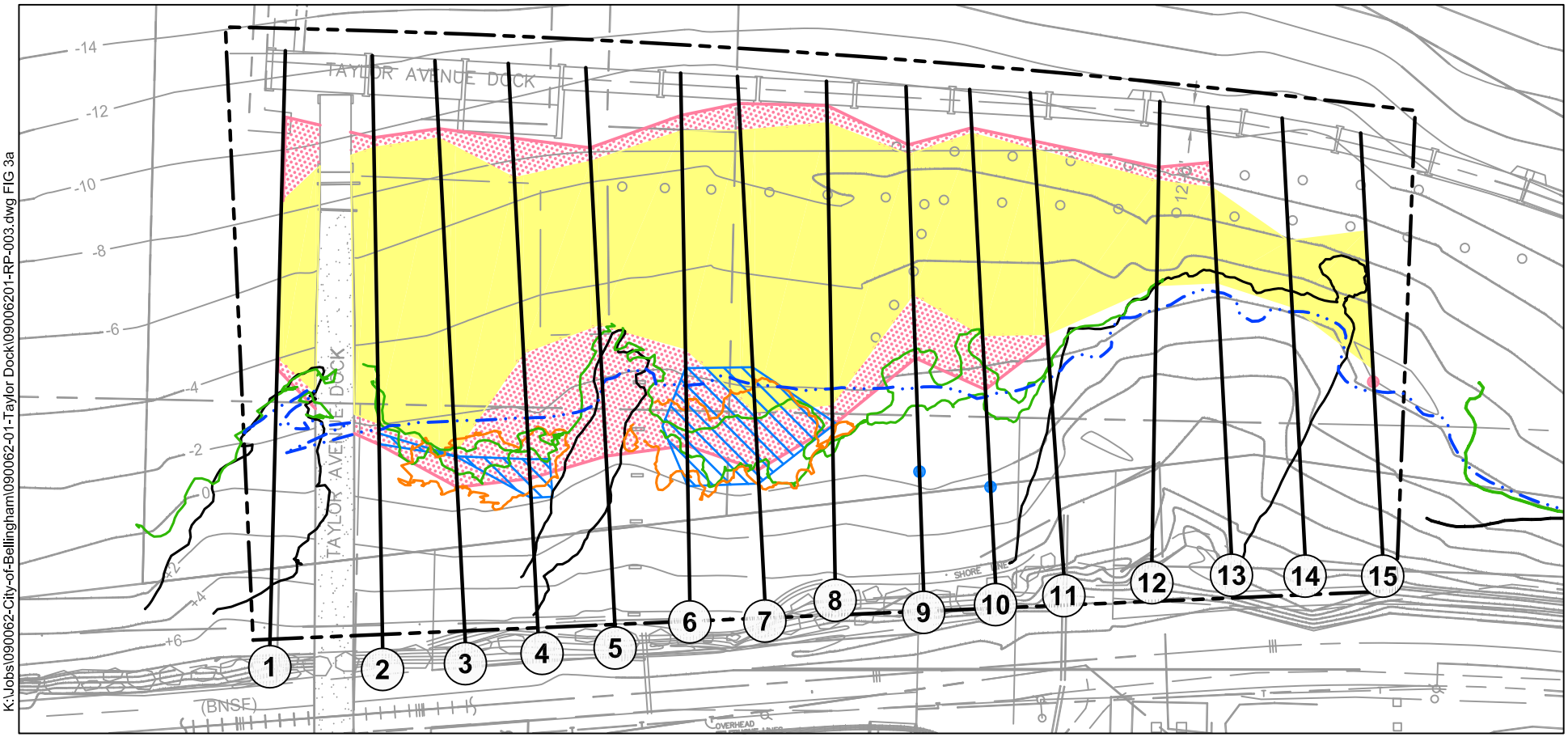
walkway, native eelgrass was observed between depths of +0.5 feet MLLW and -11.1 feet MLLW (Transects 16 and 18, respectively; see Figure 3b and Table 1).

Native eelgrass shoot densities are summarized in Table 1 with designations of continuous and patchy coverage. "Continuous" refers to an extended eelgrass bed, while "patchy" refers to areas with only a few eelgrass shoots or a patch of eelgrass that is disconnected (i.e., non-continuous) from other eelgrass areas. At one or more observation points along all of the 18 transects, eelgrass shoot densities met or exceeded the 120 shoots per m^2 criterion (i.e., 30 shoots per 0.25-m^2 survey quadrat) for characterizing "dense" eelgrass. This is slightly more transects than in all years; in Year-0 and Year-3, 16 transects had shoot counts meeting or exceeding the dense eelgrass criterion, and in Year-1, 15 transects met or exceeded the criterion.

For Year-5, conservatively assuming a shoot density of 120 shoots per m^2 in those areas delineated as dense[3], the average calculated shoot density in the continuous eelgrass bed was 107 shoots per m^2, which is higher than the shoot densities reported for both Year-1 and Year-3 (99 shoots per m^2 in both).

As in all previous years, non-native eelgrass occurred along the southern portion of the Taylor Avenue Dock survey area (see Table 2 and Figure 3a). Also as in previous years, distribution of this species was generally patchy and it extended to higher elevations in the intertidal zone than the native eelgrass.

[3] Areas were characterized as "dense" where shoot densities exceeded 30 shoots per 0.25-m^2 quadrat. Higher eelgrass shoot densities were almost always present in these dense areas, thus making the assumption of 120 shoots per m^2 in shoot density calculations a conservative one.



LEGEND:

- Z. marina - Patchy
- Z. marina - Dense, Continuous
- Z. japonica - Patchy
- Eelgrass Observed
- Year-5 Survey Area
- Water Line at 1:25 pm on 7/22/09 (-1.98 ft MLLW)
- Z. japonica Zone
- Z. marina Bed
- Bedrock and Riprap
- (1) Transect Line Location and Number

NOTES:

1. Base map prepared from electronic file provided by Berger/Abam Engineers, Inc.
2. Horizontal Datum - WA SPN NAD83.

0 80
Scale in Feet

K:\Jobs\090062-City-of-Bellingham\090062-01-Taylor Dock\09006201-RP-003.dwg FIG 3a

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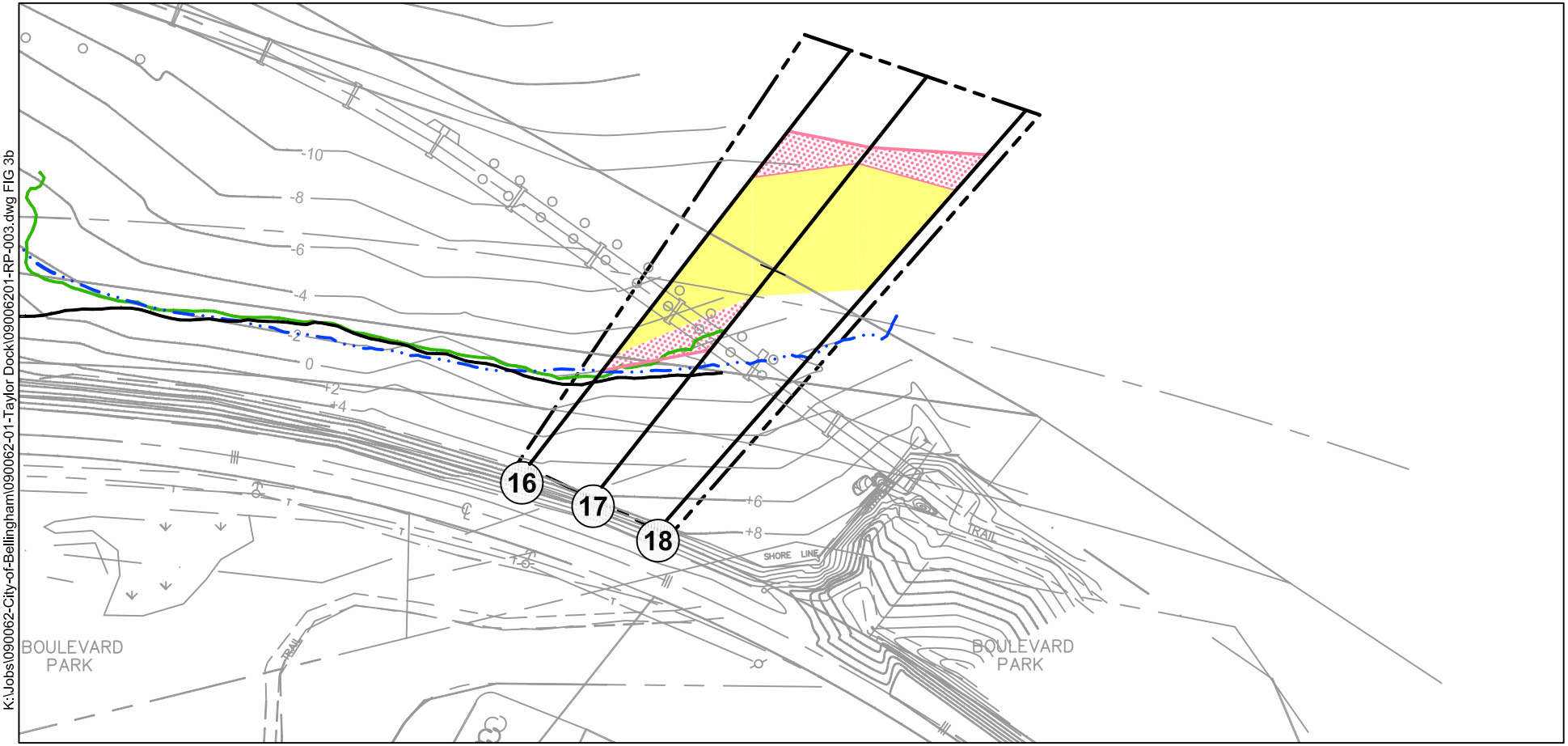
Figure 3a
Year-5 Post-Construction Native and Non-Native Eelgrass Distribution
Taylor Avenue Dock
Bellingham, Washington



LEGEND:

- Z. marina - Patchy
- Z. marina - Dense, Continuous
- Z. japonica - Patchy
- Eelgrass Observed
- Year-5 Survey Area
- Water Line at 1:25 pm on 7/22/09 (-1.98 ft MLLW)
- Z. japonica Zone
- Z. marina Bed
- Bedrock and Riprap
- (16) Transect Line Location and Number

NOTES:

1. Base map prepared from electronic file provided by Berger/Abam Engineers, Inc.
2. Horizontal Datum - WA SPN NAD83.

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Scale in Feet

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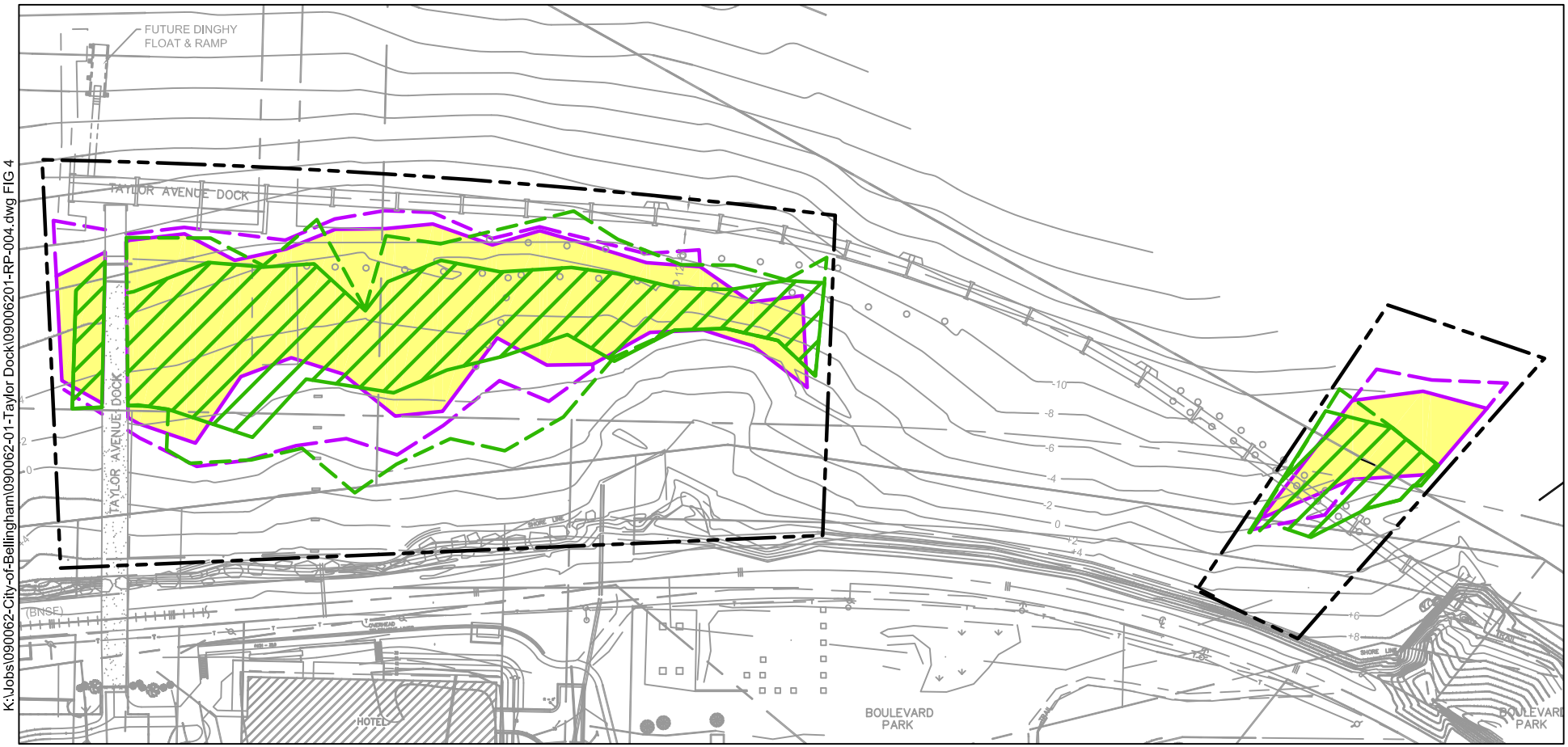
Figure 3b
Year-5 Post-Construction Native and Non-Native Eelgrass Distribution
Taylor Avenue Dock
Bellingham, Washington



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LEGEND:

- Year-5 Survey Area
- Year-0 Native Eelgrass Extent - Includes Dense, Continuous, and Patchy Areas
- Year-0 Native Eelgrass Bed (dense, continuous)
- Year-5 Native Eelgrass Extent - Includes Dense, Continuous, and Patchy Areas
- Year-5 Native Eelgrass Bed (dense, continuous)

Notes:

1. Base map prepared from electronic file provided by Berger/Abam Engineers, Inc.
2. Horizontal Datum - WA SPN NAD83.

0 80
Scale in Feet

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Figure 4
Comparison of (Year-0 and -5) Native Eelgrass Distributions
Taylor Avenue Dock
Bellingham, Washington

Table 1
Summary of Native Eelgrass Distribution Observations

Transect	Native Eelgrass Coverage and Distance (ft) from Inshore Start of Transect			Elevation Range of Native Eelgrass (approximate ft MLLW)	Average Shoot Density in Native Eelgrass Bed (per m^2) [b]	Range of Shoot Density in Native Eelgrass Bed (per m^2)
	Inshore (sparse, patchy)	Bed (continuous)	Deep (sparse, patchy)			
1	142-148	148-229	229-272	-0.4 to -6.9	92	49-120
2	105-116	116-258	258-263	+0.6 to -6.4	104	77-120
3	80-98	98-260	260-265	-1.2 to -8.4	101	40-120
4	80-145	145-235	--	+0.6 to -6.4	120	All dense (120)
5	88-156	156-240	240-247	-0.2 to -7.2	120	All dense (120)
6	80-130	130-242	242-250	+0.4 to -7.6	116	97-120
7	67-97	97-256	256	+0.6 to -6.9	96	40-120
8	79-90	90-235	235-244	+1.1 to -6.5	112	72-120
9	120-153	153-225	225-230	-1.6 to -6.1	120	All dense (120)
10	100-128	128-232	232-235	-0.5 to -8.6	120	All dense (120)
11	120-124	124-217	--	+1.7 to -5.6	113	92-120
12	--	142-196	196-203	+1.7 to -5.7	120	All dense (120)
13	--	140-189	189-202	-3.3 to -8.3	120	All dense (120)
14	--	128-162 172-183 [a]	--	-1.5 to -6.3	120	All dense (120)
15	89-96	96-167	167-175	-1.5 to -8.3	113	92-120
16	60-71	71-183	183-217	+0.5 to -10.1	117	113-120
17	91-125	125-212	212-223	-1.1 to -10.1	120	All dense (120)
18	--	158-225	225-250	-2.1 to -11.1	99	35-120

Notes:
-- No native eelgrass observed.
a There was a hole in the native eelgrass bed created by a pile of riprap.
b The calculation of average native eelgrass shoot density conservatively assumes a density of 120 shoots per m^2 in those areas delineated as "dense." Actual densities exceed that value at almost all dense locations, but the shoot counts stopped when the threshold to be characterized as dense was achieved.

Table 2
Summary of Non-Native Eelgrass (*Zostera japonica*) Distribution Observations

Transect	Year-5 Distance from Inshore Start of Transect (ft)
1	None observed
2	105-110
3	96
4	70-100
5	None observed
6	59-120
7	60-120
8	80
9	62
10	49
11	None observed
12	None observed
13	None observed
14	None observed
15	None observed
16	None observed
17	None observed
18	None observed

3.2 Comparison to Performance Standards

As in other years, Year-5 shoot density results were compared to the performance standards set forth in the *Eelgrass Mitigation Plan* (Pacific International Engineering 2000; see Appendix A) and described in Section 2.2 using the conservative estimate of 120 shoots per m^2 in areas delineated as dense[4]. Identical to Year-3, the estimated total number of shoots in a 1,430-ft^2 portion of the Restored Area containing dense eelgrass (Figure 5) was 15,942 shoots (Table 3). This is because eelgrass in the 1,430-ft^2 area was again dense (>30 shoots per ft^2) throughout the area. Again, in comparison to the performance standards, this total shoot

[4] Areas were characterized as "dense" where shoot densities exceeded 30 shoots/0.25m2 quadrat. Higher eelgrass shoot densities were almost always present in these dense areas, thus making the assumption of 120 shoots per m2 in shoot density calculations a conservative one.

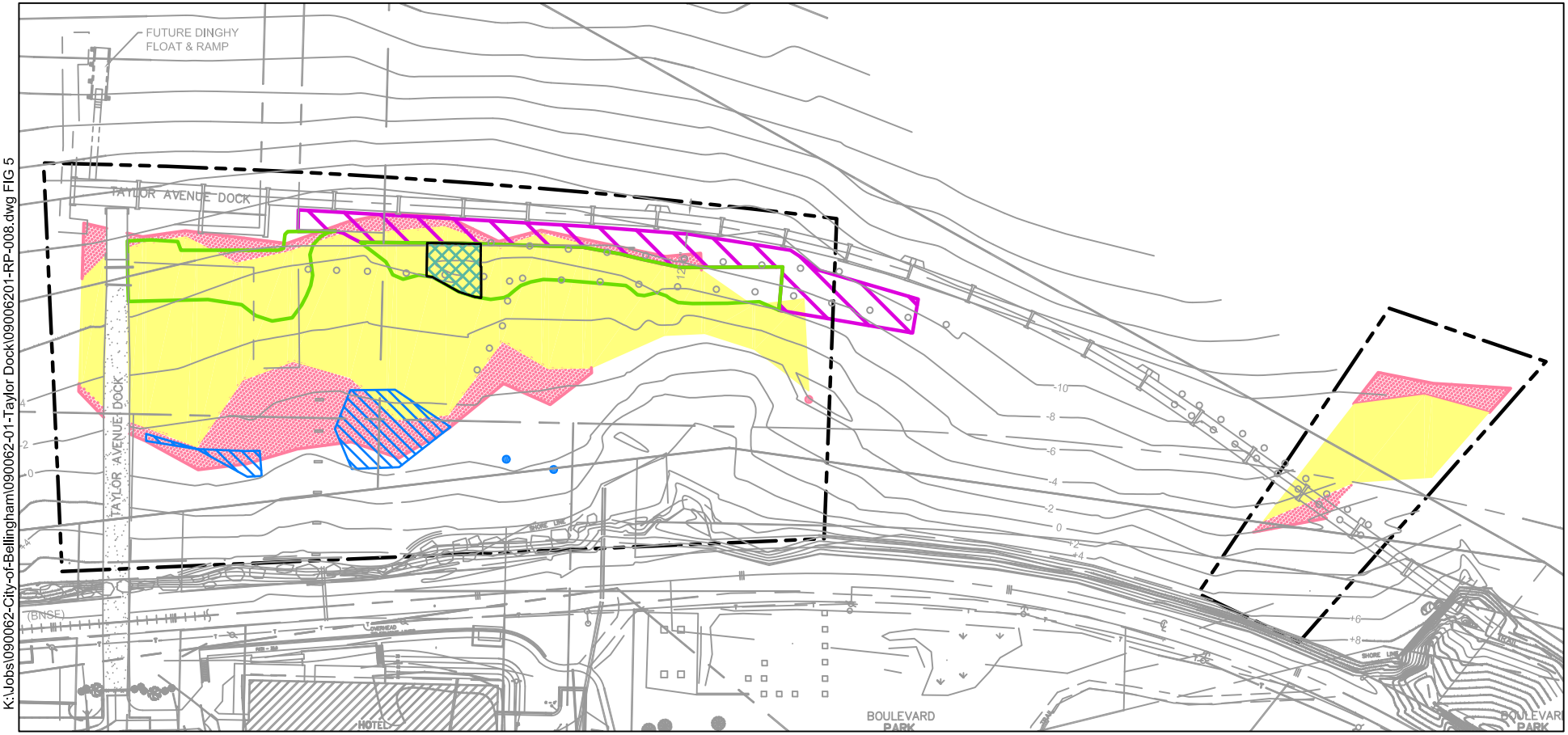
estimate far exceeds the Year-5 performance standard of 13,741 shoots. Total shoot counts from Year-1 and Year-3 monitoring exceeded their respective standards as well.

Table 3
Year-5 Monitoring Results Compared to Performance Standards

Year	Performance Standard [a]	Restored Area [a] Shoot Estimate	Performance Standard Achieved?
Year-0 (August 2004)	N/A	6,418	N/A
Year-1 (August 2005)	1,374 eelgrass shoots (10 percent of the Year-5 standard)	14,701	Yes
Year-3 (August 2007)	6,870 eelgrass shoots (50 percent of the Year-5 standard)	15,942	Yes
Year-5 (August 2009)	13,741 eelgrass shoots	15,942	Yes

Notes:
a Area where eelgrass recovery is evaluated is 1,430 ft^2 of the total 15,790-ft^2 Restored Area.

In terms of colonization patterns, results from the Year-5 survey show that the native eelgrass bed in the survey area for Transects 1 through 15 has maintained a generally similar size and shape as compared to previous years' monitoring. With respect to all years of monitoring, some variations in eelgrass density and location have occurred, but with no distinct pattern that would warrant concern for overall eelgrass survival in the area. For example, as compared to Year-0, the offshore and inshore margins of the continuous eelgrass bed appear to have expanded in some places and contracted in others (see Figure 5). Similarly, the offshore margin of the Year-5 patchy eelgrass appears to have expanded in some places and contracted in others compared to Year-0 (see Figure 5). Despite these variations, the shoot estimate in the performance standard area of the Restored Area has continued to increase (see Table 3).



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LEGEND:

- Z. marina - Patchy
- Z. marina - Dense, Continuous
- Z. japonica - Patchy
- Eelgrass Observed
- Year-5 Survey Area
- Restored Area
- Additional Area Available for Eelgrass Colonization
- Eelgrass Area Used for Comparison to Performance Standards

NOTES:

1. Base map prepared from electronic file provided by Berger/Abam Engineers, Inc.
2. Horizontal Datum - WA SPN NAD83.

0 120
Scale in Feet

ANCHOR QEA

Figure 5

Year-5 Native Eelgrass Distribution and Restored Area/Additional Area Available for Eelgrass Colonization
Taylor Avenue Dock
Bellingham, Washington

3.3 Macrofauna and Macroalgae Communities

As in previous years, a diverse macrofauna community was observed in the project area. The macrofauna community observed included three fish species, four crab species, and four sea star species (Table 4).

Similar to Year-1 and Year-3, the macroalgae assemblage in the project area was dominated by *Fucus gardneri* in the upper intertidal zone and *Enteromorpha* spp. in the lower intertidal zone. In the subtidal portions, an understory kelp species, *Laminaria saccharina*, was most commonly found. *Gracilaria* spp. and *Ulva* spp. were also widely distributed in the survey area. The red algae *Smithora naiadum* was commonly found growing on eelgrass blades throughout the project area. Complete notes of macrofauna and macroalgae observations are included in the transect field data sheets (see Appendix B).

Table 4

Macrofauna Observed During Eelgrass Survey

Common Name	Scientific Name
Cnidarians	
Plumose Anemone	*Metridium senile*
Mollusks	
Fat Gaper (Horse clam)	*Tresus capax*
Pacific Gaper (Horse clam)	*Tresus nuttalli*
Blue Mussel	*Mytilus edulis*
Hooded Nudibranch	*Melibe leonine*
Eelgrass Limpet	*Lottia alveus*
Arthropods	
Acorn Barnacle	*Balanus glandula*
Red Rock Crab	*Cancer productus*
Graceful Cancer Crab	*Cancer gracilis*
Purple Shore Crab	*Hemigrapsus nudus*
Hermit Crab	*Pagurus* spp.
Echinoderms	
Sunflower Star	*Pycnopodia helianthoides*
False Ochre Star	*Evasterias troschelli*
Pink Short-Spined Sea Star	*Pisaster brevispinus*
Ochre Star	*Pisaster ochraceus*
Fishes	
Goby	Family Gobiidae
Shiner Perch	*Cymatogaster aggregate*
Saddleback Gunnel	*Pholis ornata*

4 CONCLUSIONS

The eelgrass bed near the construction area and throughout the survey area continues to thrive, and growth patterns over all years indicate no evidence of post-construction effects. In addition, the nearshore area bounded by the dock supports a diverse community of macrofauna and macroalgae.

As was documented during the Year-1 and Year-3 post-construction monitoring, the Year-5 eelgrass survey documents that the performance standards set forth in the *Eelgrass Mitigation Plan* have been successfully achieved. Eelgrass distributions and densities in the Taylor Avenue Dock survey area have expanded following the renovation of the dock.

5 REFERENCES

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APPENDIX A
EELGRASS MITIGATION PLAN – TAYLOR AVENUE DOCK WATERFRONT AND BEACH ACCESS (PACIFIC INTERNATIONAL ENGINEERING 2000)

Eelgrass Mitigation Plan

Taylor Avenue Dock Waterfront and Beach Access

City of Bellingham
Parks and Recreation Department

Prepared for:

City of Bellingham
Parks and Recreation Department
and
Berger/ABAM Engineering

March 31, 2000

PACIFIC INTERNATIONAL ENGINEERING PLLC
310 WATERFRONT PARK BLDG • 144 RAILROAD AVENUE • EDMONDS, WASHINGTON • 98020

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1. Introduction

1.1. Background

The City of Bellingham Parks & Recreation Department ("Parks") proposes to formally develop a waterfront trail connection, passive recreation areas, and over-water public access to waterfront and beaches at the historical Taylor Avenue Dock. The proposed trail would serve as the primary connection between the South Bay Trail and the Interurban Trail. The dock improvements would provide much-needed public shoreline access. The project area is located approximately two miles southwest of Bellingham's Central Business District and approximately 1½ miles north of Fairhaven's Central Business District (Figure 1).

Historically, the citizens of Bellingham have been closely connected to Bellingham Bay, just as they are today. The Bay continues to provide jobs, food, and recreation such as boating and wildlife viewing. From 1898 until approximately 1965, the Taylor Avenue Dock was used as commercial property, and the canning, warehouse, and oil industries utilized the dock and adjacent railroad line. The now-abandoned dock is in need of restoration; the other dilapidated in-water structures need to be removed.

This project is driven by the community's demand for public open space, waterfront parks, and shoreline access. Out of 17.5 miles of shoreline within the City of Bellingham, there are only 1.62 miles of accessible waterfront, and the public has approved a levy that identified Taylor Avenue Dock as a project to be funded. This project will provide residents and visitors a chance for close-up exploration of tidelands ecology through an over-the-water experience; it will provide a desired aesthetic viewing opportunity; and it will provide safety improvements to the railroad crossings. The proposed park would expand on the existing Boulevard Park, greatly improving the pedestrian and bicycle connection between Bellingham and Fairhaven, and would provide access to the waterfront.

The proposed Taylor Avenue Dock project will also result in the removal of debris and invasive plants, the addition of native vegetation, enhancement of the waterfront bluff, a play meadow, a restroom for trail and park users, and environmental education opportunities through the use of interpretive signage.

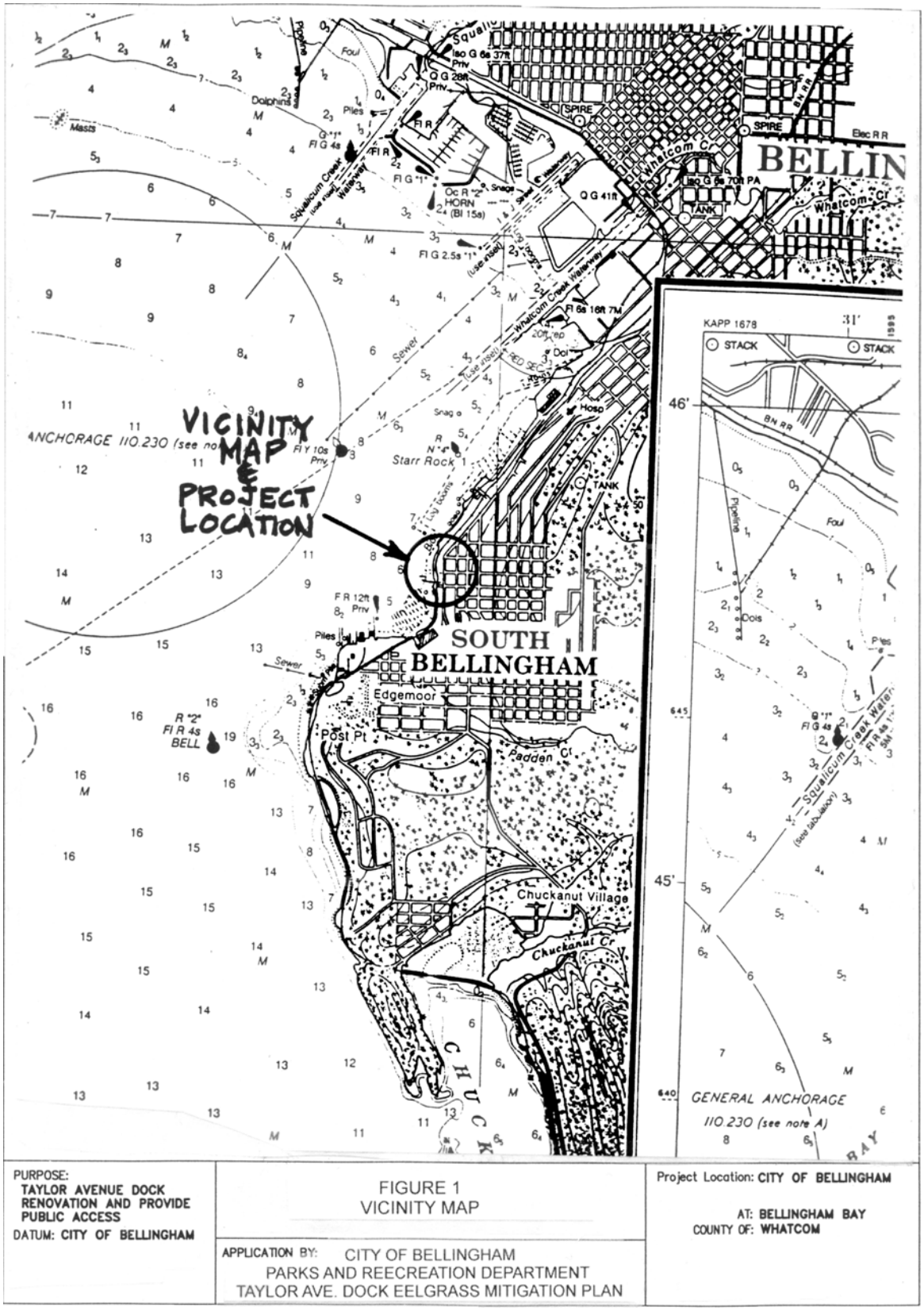


Figure 1 Vicinity Map

This project meets the objectives in the City of Bellingham's Shoreline Master Program (access to shoreline), the 1995 Comprehensive Plan (City/private industry partnerships to establish public access to marine shoreline), and the City's Neighborhood Plan (pedestrian access to and along the waterfront).

The project objectives are to:

- Respond to and meet the demands of the public for safe public shoreline access and scenic viewing.
- Respond to and meet the demands of the public for an improved trail network.
- Respond to and meet the demands of the public for additional passive recreation areas.
- Respond to and meet the demands of the public for maintenance of historical links to the City's past.
- Amend the existing lease with the Department of Natural Resources (DNR) to extend coverage to the entire project site (currently covers the dock area only).
- Provide environmental educational opportunities, such as interpretive signage and beach access.
- Collaborate with the various public and private entities that comprise the Bellingham Bay Demonstration Pilot Project to implement pertinent portions of the Comprehensive Strategy related to public access and habitat improvements.
- Blend features of the natural and built environments to provide a pleasant and unique aesthetic experience.
- Remove potentially toxic creosote-treated timber pilings from the project area, using Best Management Practices (BMPs) to minimize disturbance of sediments.
- Provide enhanced wildlife habitat in both the upland and marine environments.
- Minimize impacts to existing habitats, including eelgrass.

The proposed project does not result in impacts to wetlands, however it will result in unavoidable impacts to eelgrass (*Zostera marina*). This mitigation plan has been prepared to meet the mitigation requirements for the unavoidable impact to 0.026 acre (1,145 ft^2) of *Z. marina*.

1.2. Project Purpose and Description

The overall project purpose is to provide public access to the beach and waterfront and a safe, enjoyable, and educational passive recreation area on the public shoreline in the City of Bellingham.

To achieve the project purpose, the project consists of the following actions and will occur in three phases:

Phase 1:

1. Remove the remaining portions of an abandoned railroad trestle (approximately 1,000 creosote-treated timber piles).
2. Construct a new concrete overwater walkway (installation of approximately 70 steel or concrete piles) parallel to the shore and connecting the southern end of Boulevard Park, between Bayview Drive and Easton Avenue, to the new Taylor Avenue pavilion dock (“pedestrian pier”).
3. Remove the dilapidated portion of the Taylor Avenue dock and replace it with a new dock (“pavilion dock”).
4. Renovate an abandoned trestle (“renovated trestle”) leading from the pavilion dock to the future support facilities at the foot of Taylor Avenue.
5. Construct trail connection from the bluff area to the beach.

Phase 2:

Depending on favorable bids during Phase 1 and funding from additional sources, several amenities will be added:

6. Dinghy dock and picnic pavilion on the pavilion dock.
7. Lighting for the pier and dock.
8. Park plaza (restroom, picnic area, signage).
9. Parking and landscaping.

Phase 3:

1. Expand the City’s waterfront park system by creating formal walking and jogging trails, picnic areas, and interpretive signage.
2. Improve scenic viewpoints in the upland area in the northern portion of the project area.

The entire project is shown on Figure 2.

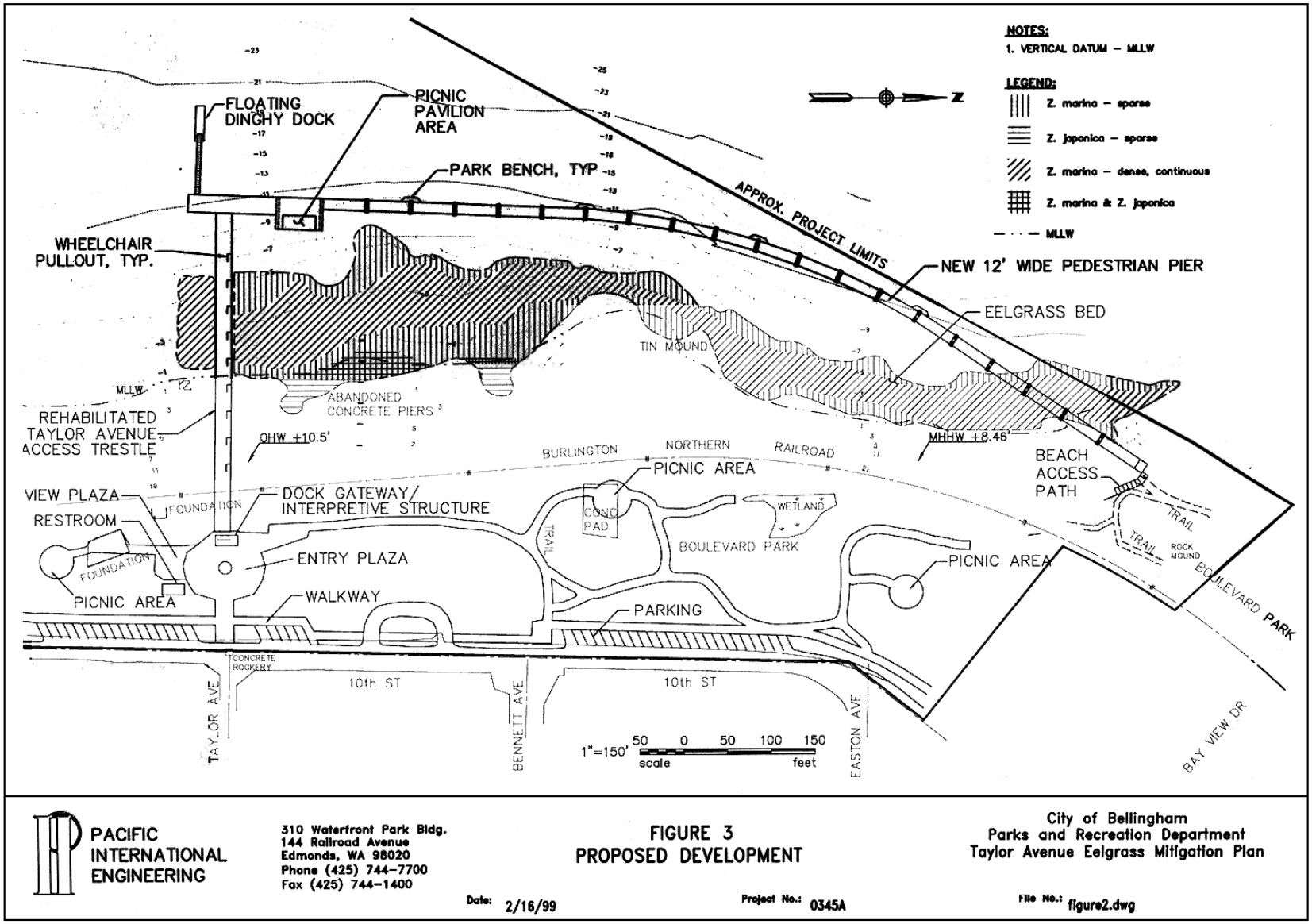


Figure 2 Proposed Development (Figure 3 of BE)

2. Impact Area

2.1. Impact Area Location

An eelgrass bed, or meadow, comprised of both *Z. marina* and *Z. japonica* has been identified and delineated at the site. On August 5-7, 1998, a survey was done by Taylor Associates and divers from Battelle Marine Sciences Laboratory to document the distribution of eelgrass, as well as to make other observations on the biota and substrate of the area.

A total of 1,145 ft^2 (320 ft^2 of sparse cover and 825 ft^2 of dense cover) or 0.026 acre of *Z. marina* will be directly covered by the northern end of the pedestrian pier.

2.2. Impact Area Description

While no threatened or endangered plant species have been known to be on or near the site, the estuarine habitat of the entire Bellingham Bay is important to the flora and fauna of this ecoregion.

The nearshore (shoreward of about –10 ft MLLW) provides habitat for salmon feeding and refuge. In early 1999, Puget Sound Chinook salmon, which utilize the entire ecoregion, is likely to be listed as a threatened species. Padden Creek, south of the project site, supports Chinook, coho, and chum salmon, and steelhead. Juvenile outmigrants are expected to feed on epibenthos and may use the eelgrass beds for rearing, refuge and feeding before moving into deeper offshore waters.

The high intertidal beaches at the project site and immediately north and south of the project site are documented surf smelt and Pacific sand lance spawning beaches. Construction activities will primarily occur offshore in the lower intertidal area and should not result in a direct impact to these spawning beaches. After construction, the types of uses and activities are not anticipated to result in adverse impacts to the spawning beaches. Coordination with Washington Department of Fish & Wildlife (WDFW) will be necessary to ensure that construction activities are timed to avoid, to the extent possible, peak spawning times.

3. Mitigation Approach

Features of the mitigation action include:

- Avoidance and minimization of impacts.
- The establishment of eelgrass habitat and increased opportunity for eelgrass colonization.
- Preservation of project area.
- Five-year monitoring plan to evaluate the success of habitat improvements.
- Contingency plans if habitat improvements do not result in eelgrass colonization or if there is a decline in the eelgrass population related to project activities.

3.1. Mitigation Summary

The removal of obstacles to eelgrass colonization is the primary objective of this mitigation plan. Those obstacles include over-water structures that shade eelgrass habitat and pilings and debris that act as barriers to colonization. In-water removal of the creosote-treated structures is expected to improve the sediment quality. Increased eelgrass coverage and density will also potentially improve the rate of sedimentation in the project area, thus promoting additional colonization in the long term. Finally, by keeping the property in public ownership, impacts from other uses such as commercial development will be avoided.

It is noteworthy that the width of the eelgrass meadow, and its denseness, is greatest near the southern end of the site. The removal of impacts to eelgrass to the south of the site, coupled with the avoidance of shading structures that appear to inhibit its growth in this area, allow the greatest possible opportunity for *Z. marina* colonization. The eelgrass bed on the site is currently growing the most densely in depths between 0 and –8 ft MLLW. While other eelgrass beds found in Bellingham Bay have been found to grow to depths up to –16 ft MLLW, this mitigation plan is developed with the anticipation that given the appropriate conditions (substrate, light), *Z. marina* will expand to a depth of about –8 ft MLLW.

3.1.1. Avoidance and Minimization

The comprehensive mapping of the existing eelgrass boundary on the project site made it possible to identify two changes to the original project design that result in avoidance of impacts to the eelgrass. These redesigns of the pedestrian pier resulted in avoiding impacts to approximately 1,585 ft^2 of *Z. marina*. A revision to the original plan reduces the potential shading

effect of the picnic pavilion substructure by reducing its size. By reducing the width of the substructure by four feet, or by 20% overall, the potential of the picnic pavilion to shade the adjacent substrate is also reduced, and the opportunity for eelgrass colonization is increased. Construction of this shelter consists of five 4-ft precast concrete sections. Thus, size reductions must be made in 4-ft modules. Reducing the structure to 16 ft in width is the maximum reduction without eliminating the picnic pavilion from the project. Additionally, moving the structure to the west side of the pedestrian pier to minimize shading impacts results in a concern for the personal safety of visitors who would have their backs to the approaching foot traffic. By reducing the size of the picnic pavilion, approximately 200 ft^2 of substrate between –7 and –8 ft MLLW will have no direct shading from the new structure.

Initially, the location and alignment of the pedestrian pier, pavilion dock, and renovated trestle would impact up to 2,635 ft^2 (0.06 acre) of eelgrass (1,810 ft^2 of sparse eelgrass cover and 825 ft^2 of dense eelgrass cover). In that original plan, eelgrass would be covered by the pavilion dock at the southern end of the project, and by the pedestrian pier at the northern end. Based on a detailed eelgrass survey conducted in August 1998, the location and alignment of the pavilion dock and pedestrian pier were reevaluated to determine if they could be located and aligned to avoid and minimize impacts to eelgrass.

The revised site plan layout avoids 1,490 ft^2 of sparse eelgrass cover at the southern end of the project by moving the pedestrian pier and pavilion dock to the west. This shift results in a total of 1,145 ft^2 (0.026 acre) of unavoidable eelgrass impact from the pedestrian pier at the northern end where the pedestrian pier connects to the existing trail connection at the southern end of Boulevard Park.

The original development plan called for a park bench to be placed on the pedestrian pier where the pier crosses the eelgrass bed. To further avoid impacts, the bench, which would have increased the over-eelgrass portion of the pier by 95 ft^2, has been eliminated from this area.

To further reduce shading impacts to eelgrass, the pedestrian pier is the minimum width necessary to meet public access requirements. Additionally, the underside will be at approximately +16.8 ft MLLW, about 5 ft above the highest tidal elevation, allowing for greater light availability to the eelgrass. The pedestrian pier's relatively narrow width, height from surface of water, and north-south orientation will minimize direct overwater impacts and potential impacts due to shading. In addition, maximum spacing of piles will be used to minimize shading and hydrographic isolation of the eelgrass.

3.1.2. Habitat Improvement – Removal of Shading Structures

Approximately 14,415 ft^2 (0.33 acre) of existing dock and supporting structures between about –1.5 ft and –24 ft MLLW will be removed. Eelgrass is already starting to colonize between about –2 and –4 ft MLLW under portions of the existing dock (approximately 1,445 ft^2 that are severely dilapidated), and seaward immediately north of the existing dock at about –6 ft MLLW. Removal of approximately 5,800 ft^2 of over-water dock structure between –1.5 ft and –8 ft MLLW will restore the substrate directly beneath it, as well as approximately 970 ft^2 of adjacent substrate. Therefore, removal of this portion of the existing dock is expected to provide additional opportunity (about 6,770 ft^2 between –4 and –8 ft MLLW) for eelgrass to continue to naturally colonize in the area (Table 1; Figure 3).

Table 1.
Calculated areas of substrate for eelgrass expansion, by type of mitigation activity.

Mitigation Activity	Area of Activity	Result	Eelgrass Area Restored	Mitigation Expectation
Removal of shading structures below –8 ft MLLW	7,170 ft^2	No increase in colonization area expected	N/A	No increase in colonization of *Z. marina* expected
Removal of shading structures between –2 and –8 ft MLLW	5,800 ft^2	Area open to colonization due to removal of decking between –2 and –8 MLLW	6,770 ft^2	Colonization of *Z. marina* in this area
Removal of creosote-treated timber pilings and metal debris between –4 and –6 ft MLLW	1,300 ft^2	Substrate directly open to colonization	9,020 ft^2	Colonization of *Z. marina* in this area
		Total area directly open to colonization	15,790 ft^2	
Indirect colonization opportunities by removal of creosote-treated timber pilings and metal debris between –6 and –10 ft MLLW	10,820 ft^2	Substrate indirectly open to colonization	10,820 ft^2	Colonization depends on site conditions

3.1.3. Habitat Improvement – Increased Colonization Opportunities

3.1.3.1. Removal of Existing Pilings

Creosote-treated timber structures and piles will be removed and disposed of or salvaged. Complete removal, rather than cutting at the mudline, is expected to benefit juvenile salmon by removing creosote from the aquatic environment and providing an opportunity for existing eelgrass beds to expand beyond –6 ft MLLW. Approximately 1,000 timber piles will be removed either by using chokers and a floating crane or with a vibratory hammer. Approximately 1,000 ft^2 of substrate will be made directly available for potential eelgrass colonization after the pilings have been removed.

The preferred method of completely removing the pilings is either by vibratory hammer or chokers. Other alternatives, such as clamshell bucket, cutting off the piles at the mudline, breaking off the piles, and doing nothing were also evaluated. The clamshell method may result in suspension of sediments and debris, and it is inappropriate for large areas. Cutting at the mudline is potentially dangerous, leaves creosote material in the substrate, is an obstacle to public beach access, and is expensive. The vibratory extraction and the choker methods are safe, efficient, and clean, cost effective, requires no equipment on the bottom, and results in minimal disturbance to sediments. The machinery and equipment will be constantly monitored for leakage of hydraulic fluid into the marine environment.

One method to avoid suspension of sediment once the pile is pulled out of the sediment is to pause, let the sediment clinging to the pile slough off and fall the short distance to the surface and settle, then continue removal. The use of a floating debris barrier will help contain larger debris. The currents in the Bellingham Bay are not anticipated to affect the dispersal of any sediments suspended by this activity. The substrate in the project area is primarily sand and cobble, which will have less sediment suspension than mucky, muddy sediments.

3.1.3.2. Removal of Debris

The amount of increased colonization area from the removal of scrap metal and other debris in the project area is difficult to quantify. The Battelle Marine Sciences Laboratory divers who performed the eelgrass survey have indicated that the lack of visibility prevented a complete examination of the metal debris found on the substrate. However, Liam Antrim, lead diver for Battelle, has indicated that approximately 300 ft^2 of substrate surface area would be exposed by removing the debris, and that this debris is found in areas likely to be colonized by eelgrass. Mr. Antrim

also indicated that removal of the metal debris is not likely to disturb the existing eelgrass.

A total of approximately 9,020 ft^2 of substrate will be made available for potential eelgrass colonization after the pilings and metal debris have been removed (see Table 1; Figure 3).

3.1.3.3. Additional Area Available for Eelgrass Colonization

Once the timber piles and debris have been removed, approximately 10,820 ft^2 beyond the piles (between –6 and –8 ft MLLW) will be available for colonization by *Z. marina*. Based on available information, this area is likely to provide suitable habitat for colonization of *Z. marina*. However, colonization in this area may take longer than the areas closer to where the eelgrass currently flourishes. Therefore, this area is included in the monitoring program, but it is not included in calculation of the mitigation replacement ratio[1] (see Table 1; Figure 3).

3.1.4. Protection and Preservation of Project Site

The current Harbor Area designation allows certain water-borne commercial development of this area. The lease for the property from DNR for this project will place the property under protection from development that otherwise might occur. Upland improvements will preserve habitat for wildlife.

The Bellingham Bay Demonstration Pilot Project (Pilot Project) Team includes representatives from eight federal and state regulatory agencies, local businesses and Tribes, the City and Port of Bellingham, and community and educational entities. The Pilot Project Team has developed a Comprehensive Strategy to guide future decisions regarding aquatic and shoreline land uses, habitat restoration, sediment clean up and source control, and sediment clean up and disposal. Integration of these elements into near-term alternatives and near-term and long-term actions (i.e., activities that could occur in the absence of sediment clean-up) encourages cooperative partnerships, environmental protection, and cost-effective planning. To that end, the Comprehensive Strategy identifies long-term recommended strategies for specific geographic subareas of Bellingham Bay, and an overall strategy that represents all of the subarea strategies. The Taylor Avenue Dock project falls within the South Hill Subarea. The overall recommended strategy for the South Hill Subarea is to provide a balance between uses of the shoreline for public access and

[1] Since this defined 10,820 ft^2 is not part of this mitigation plan, and should colonization occur, it may become a component of the Bay-wide habitat improvement activities planned in the future.

recreational purposes and habitat protection and restoration. The Taylor Avenue Dock project is compatible with the draft Comprehensive Strategy and direction of the Pilot Project, and with anticipated near-term and future land uses in this area as envisioned in the Pilot's Comprehensive Strategy.

The mitigation plan will be implemented as a condition of the City of Bellingham local shoreline permit and critical areas ordinance, state of Washington Department of Ecology water quality certification, the Corps Section 10 permit, and the WDFW Hydraulic Project Approval (HPA). A five-year monitoring plan is proposed to evaluate whether mitigation objectives are achieved. An adaptive management and contingency plan is provided to ensure that interim performance standards are being assessed and that desired results of the mitigation action are achieved.

3.2. Mitigation Goals, Objectives, and Performance Standards

3.2.1. Goals

The primary mitigation goals are to:

1. Achieve no net loss of *Z. marina*;
2. Provide additional suitable habitat for eelgrass expansion; and
3. Monitor area to evaluate the success of colonization.

3.2.2. Objectives

To achieve these goals, the following objectives have been developed for the mitigation action:

1. Establish additional eelgrass habitat by removing dilapidated over-water structures which currently shade out the eelgrass.
2. Establish additional eelgrass habitat by removing approximately 1,000 creosote wood pilings.
3. Restore eelgrass habitat by removing metal sheeting and other debris from the substrate.
4. Provide site protection through a legal instrument, such as a lease with DNR.
5. Develop and conduct a monitoring plan that will evaluate the success of eelgrass colonization.

3.2.3. Performance Standards

The performance standards correspond to the design objectives and defines measurable criteria that are evaluated to predict when a mitigation element has been successfully implemented or accomplished and whether overall mitigation goals have been met at the end of the monitoring program (Table 2).

Preliminary densities were determined during the Eelgrass Bed Survey performed by Taylor Associates and Battelle Marine Sciences Laboratories in August 1998. Divers recorded eelgrass shoot density in 0.25 m^2 quadrats. These data will be used to frame this mitigation plan, and final baseline densities will be obtained during the first monitoring report in Year 0.

Density of the existing natural eelgrass bed characterized as "sparse" averages 60 shoots per m^2 (personal communications with Liam Antrim, Battelle Marine Sciences Lab). Eelgrass characterized as "dense" averages 120 shoots per m^2 (Taylor Associates 1998). The performance standards of this mitigation plan are based on the average density of the natural eelgrass where the impacts will occur.

To achieve a no net loss to eelgrass area and function, the impacts have been calculated as follows:

Area of dense eelgrass impacted
825 ft^2/76.7 m^2 x 120 shoots/m^2 = 9,207 shoots

Area of sparse eelgrass impacted
320 ft^2/29.8 m^2 x 60 shoots/m^2 = 1,786 shoots

Total area of impact
1,145 ft^2/106 m^2 = 10,993 shoots

To mitigate for a temporal loss of eelgrass area and function, the mitigation requirements have been calculated as follows, based on a 25% increase from no net loss calculations:

Area of dense eelgrass mitigated
1,031 ft^2/96 m^2 x 120 shoots/m^2 = 11,509 shoots

Area of sparse eelgrass mitigated
400 ft^2/37 m^2 x 60 shoots/m^2 = 2,232 shoots

Total area of mitigation
1,430 ft^2/133 m^2 = 13,741 shoots

Overall performance standards will be met once colonization of at least 13,741 shoots in at least 1,430 ft^2 (133 m^2) of the 15,790 ft^2 where substrates will be restored by removing in- and over-water structures which inhibit eelgrass growth can be demonstrated.

Calculation of areal eelgrass mitigation ratio:

$$\frac{15{,}790\ ft^2\ (6{,}770+9{,}020)\ \text{increased eelgrass habitat}}{1{,}145\ ft^2\ \text{eelgrass impact}} = 13.8:1$$

Table 2 . Mitigation goals and associated design objectives, design criteria, and final performance standards.

Design Objective	Design Criteria	Final Performance Standard
Expand on-site eelgrass habitat by removing dilapidated over-water structures which shade out the eelgrass.	Removal of 14,415 ft^2 of existing dock structure and adjacent remains of railroad trestle to remove shading and other barriers to eelgrass colonization.	Colonization of *Z. marina* in 1,430 ft^2 in approximately 15,790 ft^2 of habitat restored by removal of existing over-water structures which shade out eelgrass, and by removal of existing in-water structures which inhibit eelgrass colonization, to meet the following criteria: • Number of eelgrass shoots found in 1,430 ft^2 restored area shall be 10% of 13,741, or 1,374 shoots by end of Year 1. • Number of eelgrass shoots found in restored area shall be 50% of 13,741, or 6,870 shoots by end of Year 3. • Number of eelgrass shoots found in restored area shall be 100%, or 13,741 shoots by end of Year 5.
Establish on-site eelgrass habitat by removing approximately 1,000 creosote wood pilings.	Removal and disposal of 1,000 wood pilings using chocker shocks or vibratory hammer.	
Restore on-site eelgrass habitat by removing metal sheeting and other debris from the substrate.	Removal of metal debris under dilapidated railroad trestle near edge of existing eelgrass bed using divers and winches to avoid impacts to existing eelgrass.	

Protect site from impacts from uses consistent with the Harbor Area designation, and from potential uses that otherwise would occur.	Negotiate lease agreement with DNR which details the intended uses within the area, and which eliminates other uses with potentially high eelgrass impacts (such as private permanent moorage).	Legal instrument such as a lease agreement with the DNR, or other legal protection of the site fully executed by the completion of project construction.
Evaluate the success of eelgrass colonization.	Develop and conduct an approved monitoring plan.	Report submitted in Years 0, 1, 3, and 5 detailing the boundaries and density of *Z. marina.*

The criteria for determining the success of colonization is based upon a comparison of eelgrass coverage (area) and density (shoots per square meter) established at Year 0 with the area and density of the eelgrass bed during the monitoring period. The extent of the vegetated cover is defined as that area where eelgrass is present and where gaps in coverage are less than one meter between individual shoot clusters. Density of shoots is defined by the number of shoots per square meter (m^2) present in representative samples. Should performance standards be met before the 5-year monitoring period ends, Parks will propose that it be released from further monitoring requirements.

4. Opportunities and Constraints

4.1. Opportunities

This project offers the opportunity to add to the dearth of available eelgrass survey data in the Pacific Northwest. The site is part of a multi-disciplinary study looking at the past, present, and future uses of Bellingham Bay, and the merging of financial, planning, and scientific resources has improved this project.

4.2. Constraints

As in most coastal areas, Bellingham Bay water clarity (light penetration) appears to be the limiting factor to eelgrass colonization. *Z. marina* is known to grow to depths of –24 ft MLLW in Washington waters; however, in Bellingham Bay it is uncommon to find it growing below -16 ft MLLW. In consideration of this limitation, primary eelgrass habitat at the project site is defined as that between 0 and –8 ft MLLW. Constraints relative to the removal of the piles are yet unestablished, but may include (1) pile integrity and (2) possible sediment contamination.

5. Monitoring Plan

5.1. Monitoring

Monitoring activities will focus on the collection of data to evaluate:

- Areal coverage of *Z. marina*
- Density of *Z. marina*
- The spatial distribution of macroalgae and fauna in the eelgrass bed

Monitoring will occur according to the schedule indicated in Table 3.

Table 3. Monitoring methods and reporting schedule.

Activity	Performance Standard	Method	Month	Frequency
Monitor eelgrass habitat restored by removing dilapidated over-water structures which shade out the eelgrass.	Density, areal coverage	Measurements along established transects taken by qualified marine biologists.	August	Years 0, 1, 3, 5
Monitor eelgrass habitat restored by removing creosote wood pilings and debris from the substrate.	Density, areal coverage	Measurements (along established transects taken by qualified marine biologists).	August	Years 0, 1, 3, 5
Monitor spatial distribution of macroalgae and fauna in the eelgrass bed.	Reporting	Visual observations (along established transects taken by qualified marine biologists).	August	Years 0, 1, 3, 5

Monitoring activities would be completed along transects with measurements at fixed points (e.g., at 20-ft intervals along the transect); however, as determined in the field, additional monitoring may be needed to document unique conditions.

Surveys will follow the WDFW guidelines for intermediate eelgrass/macroalgae habitat surveys, with some additions to the data collection requirements. The approximate location of the proposed project transects is presented in Figure 3. The southern-most transect will be approximately 25 feet south of the existing Taylor Avenue access trestle, which is oriented perpendicular to the shoreline. Subsequent transects to the north will also be oriented perpendicular to the shoreline and spaced at

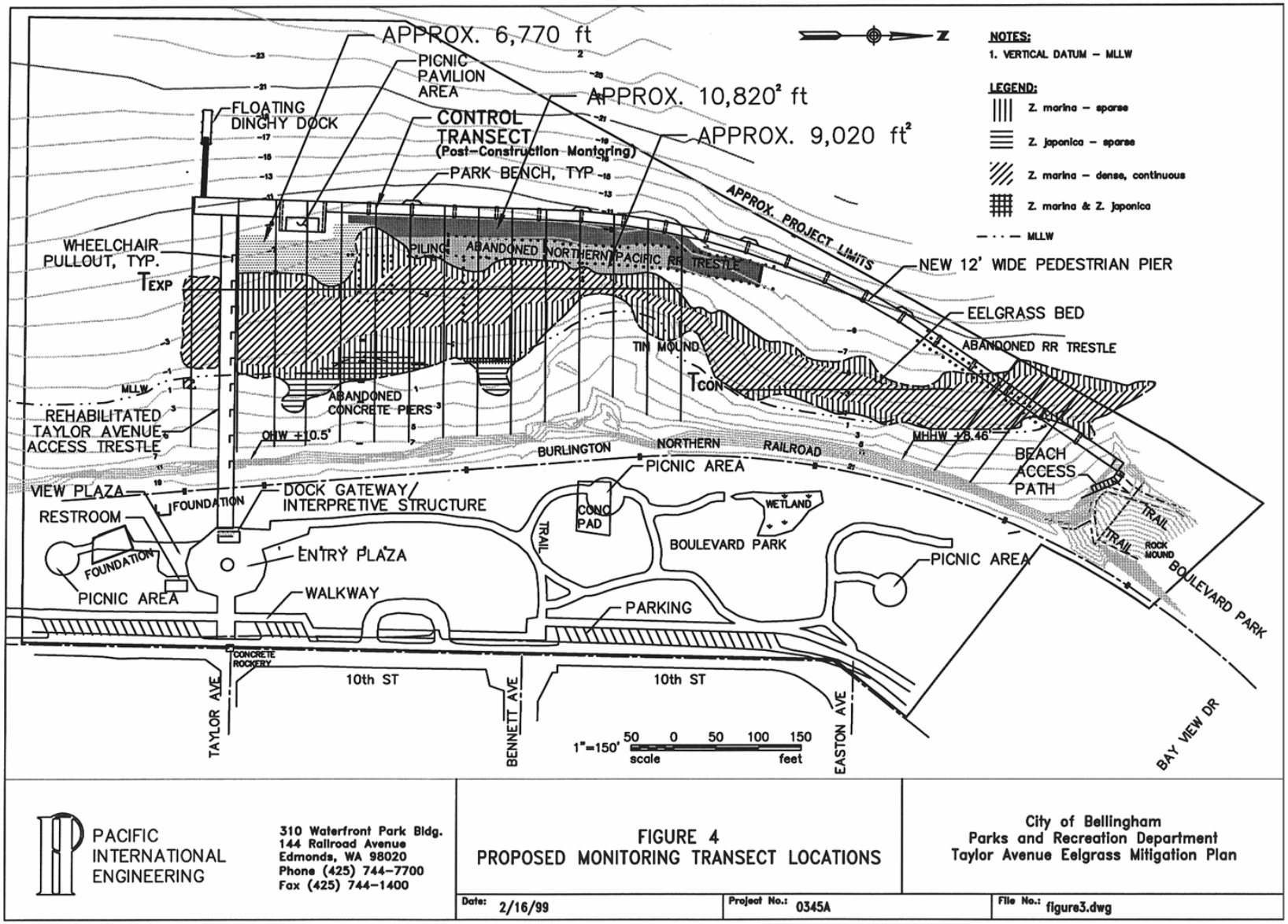


Figure 3 Proposed Monitoring Transect Locations (Figure 4 of BE)

40-foot intervals. A total of approximately 18 transects will be completed to cover the mitigation area. Transects will start at approximately mean high water and extend to and under the pedestrian pier.

For the data to be collected, divers will stop at 20-foot intervals along each transect to record at a single point the water depth, surface substrate type, the presence of eelgrass, percent macroalgae cover, dominant species of macroalgae, and bivalve species and siphon density. At stations where eelgrass is present, divers will record eelgrass shoot density, macroalgae percentage cover, and geoduck and other large bivalve siphon density using a 0.25-m^2 quadrat. This qualification will be done only for stations with eelgrass. If eelgrass is present on a transect but does not occur at the predetermined stations, at least one station will be added to provide an estimate of eelgrass density along that transect. At each of the transects, the inner and outer edges of eelgrass beds or patches and macroalgae habitat will be noted, as well as abrupt changes in bathymetry or other large features (e.g., boulders and pilings). General observations will be recorded for the presence and relative abundance of macrofauna (e.g., crab and fish) and other anecdotal observations pertinent to habitat characterization at the project site.

The same protocol will be utilized along the Control Transect (see Figure 3). This transect will be monitored to measure natural fluctuations in the eelgrass bed. Natural disturbance and seasonal variations in growth are to be expected, and the success of the colonization can be placed in context of the overall health of the eelgrass bed.

Field data will be used to generate a site map indicating the distribution and density of eelgrass in the mitigation area, macroalgae, surface substrate, and depth contours. Water depth measurements will be corrected to MLLW. The over-water and in-water structures will also be shown on the map.

6. Site Protection

The aquatic lands are managed by DNR, and leased by the City of Bellingham Parks and Recreation Department. The Parks Department will identify the area as an eelgrass management protection area.

7. Adaptive Management and Contingency Plan

Monitoring results will be reported in Years 0, 1, 3, and 5, by October 31, to the Corps and WDFW, so that contingency actions, if any are required, can be implemented.

In addition to the annual report, an as-built report will be completed following construction of the project (i.e., Year 0) and submitted to the WDFW and other appropriate agencies. The as-built report will define existing conditions (e.g., bathymetry, eelgrass species, density, and eelgrass boundaries) in the mitigation area following project construction. It will serve as the baseline from which achievement of mitigation objectives can be measured. Each monitoring report will document project success relative to the mitigation performance standards.

All contingencies cannot be anticipated. The contingency plan should be flexible so that modifications can be made if portions of the final design do not produce the desired results. Problems or potential problems should be evaluated by a qualified marine biologist, WDFW and the Parks Department. Specific contingency actions will be developed, agreed to by consensus, and implemented based on all scientifically and economically feasible recommendations.

Figure 4 shows the predicted development path of the eelgrass colonization. The matrix shows the various actions that could be implemented depending on the relationship between time from construction completion and percent of colonization of eelgrass. For example, if, after Year 3, new eelgrass colonization yields at least 6,870 shoots, no action need be taken. If, however, at that same time period, fewer than 6,870 shoots occur, some action may be needed. The most prudent action would be to investigate potential disturbances or impediments to eelgrass growth and survival. Rehabilitative measures can then be identified and taken. Alternative actions may involve planting eelgrass. If it appears that performance standards will likely never be met regardless of what actions are taken, then the standards will be reevaluated. A contingency plan that outlines a problem recognition and resolution process is shown in Figure 5.

Contingencies may include the following:

- Transplanting eelgrass to areas within the project site between -4 and -8 ft MLLW, specific location to be determined based on monitoring results.

		Year 1	Year 3	Year 5
Total Number of Shoots	At least 13,741 (100%)	No Action	No Action	No Action
	At least 6,870 (50%)	No Action	No Action	Investigate Disturbances and Fix; Transplant/ Rehabilitate
	At least 1,374 (10%)	No Action	Investigate Disturbances and Fix; No Action	Investigate Disturbances and Fix; Transplant/ Rehabilitate; Reevaluate Goals/Standards/ Mitigation

Time from Construction Completion

Figure 4 Predicted Development Path for Colonization of Eelgrass

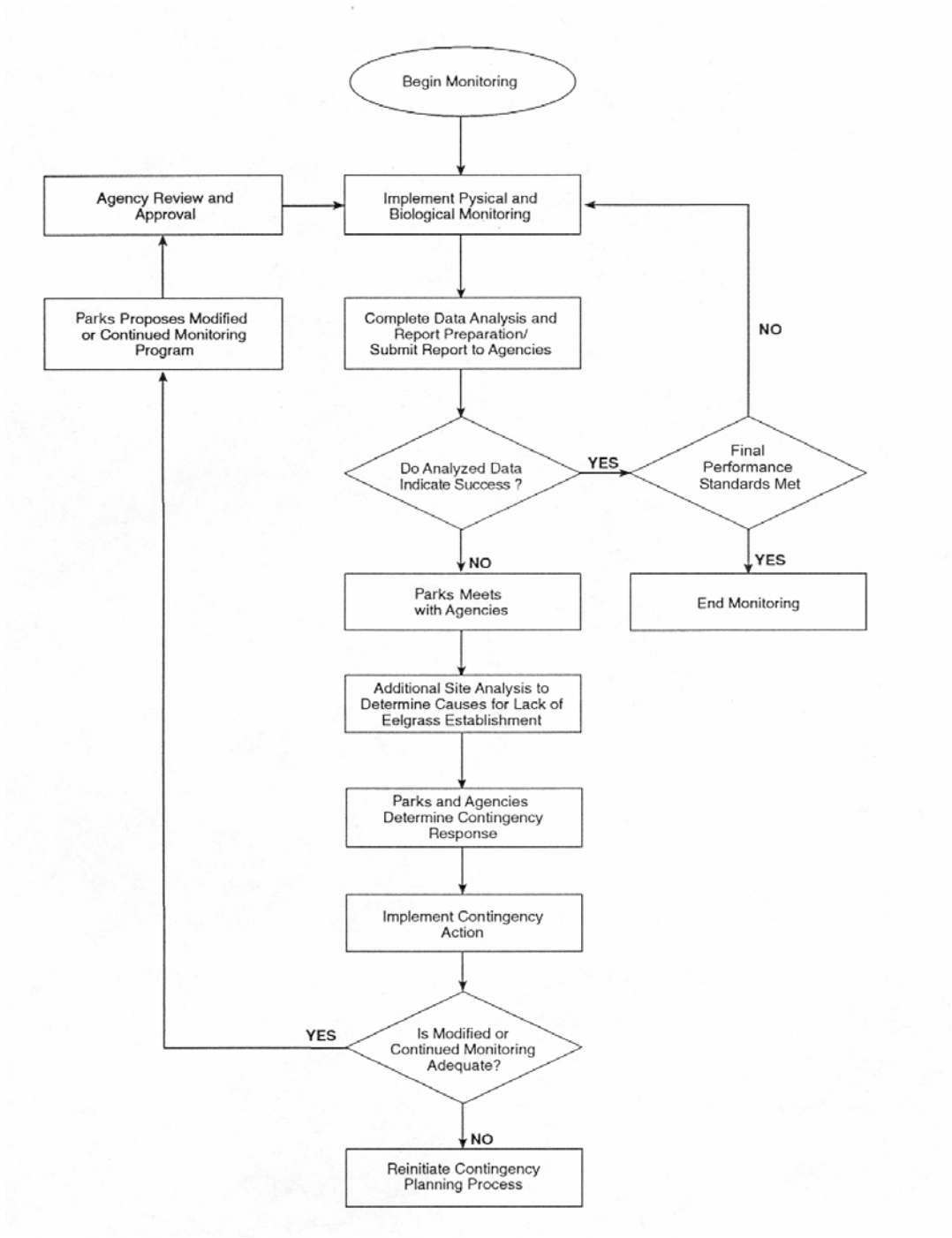


Figure 5 Contingency Planning Process

- Donor material will be taken from the project vicinity, and will include a minimum of two additional distinct sites to better ensure genetic diversity of the donor plants.
- Transplanting methods will be based on existing research in eelgrass transplantation and severity of the lack of colonization. For example, transplant units that contain an average of 4 bare root shoots will be planted. Planting the transplant units will be accomplished by excavating a hole approximately equal to the size of the rhizome and inserting the unit into the hole at a depth of approximately 2 inches below the substrate. It may be necessary to anchor the planting units. The hole is then back-filled with sediment (McKenzie et al., 1997)
- Success for transplanting efforts will have the same criteria as for the original monitoring effort.

8. Maintenance Plan

The maintenance activity associated with this mitigation action is the maintenance of the activities that may otherwise increase shading over long periods of time to the eelgrass meadow. For example, permanent moorage of boats along the pedestrian pier will not be allowed. Temporary moorage is available at the dinghy dock where no eelgrass is growing. Dropping anchors for moorage over eelgrass beds will not be allowed.

The dinghy dock will be stored during winter months at an appropriate secure location. The storage location, as yet to be identified, will not be in or near mud flats, wetlands, or other sensitive areas. The WDFW will be notified in advance of the storage location and written approval by the WDFW will be obtained prior to storage of the dinghy dock float.

The maintenance requirement of the concrete structure and steel or concrete piles is minimal, much less than maintenance of wood structures, and will have no effect on eelgrass.

Events independent of this project may occur that affect the eelgrass at the Taylor Avenue Dock. If such events occur, Parks will coordinate with WDFW to reevaluate the monitoring plan. Any changes or actions taken will not involve greater eelgrass replacement effort on the part of Parks other than that which would be required had the impact not occurred.

If, during the monitoring program, other maintenance needs are identified as necessary to ensure the success of the mitigation project, they will be implemented.

9. Responsible Parties

The mitigation action will be implemented by the City of Bellingham Parks and Recreation Department with assistance from qualified marine biologists with experience in eelgrass restoration. Mr. Byron Elmendorf is Director for the Department. Tracey McKenzie and Lennie Rae Cooke, Pacific International Engineering, prepared this mitigation plan.

10. References

Antrim, Liam, Battelle Marine Sciences Laboratory, Personal Communication, Sequim, Washington, January 14 and February 10, 1999.

McKenzie, T. and Thom, R., *Anacortes Multimodal Ferry Terminal Project Eelgrass Mitigation Plan,* Parametrix, Inc. and Battelle Marine Sciences Laboratories, Kirkland, Washington, April 1997.

Taylor Associates, *Eelgrass Bed Survey for Proposed Dock Replacement*, Final Draft Report, Taylor Associates and Battelle Marine Sciences Laboratory, Seattle, Washington, October 1998.

APPENDIX B
YEAR-5 POST-CONSTRUCTION EELGRASS SURVEY TRANSECT FIELD DATA SHEETS

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 7/22/09 **Diver** PTS **Start** Inshore / Offshore **Transect** 1

25 ft from South Margin of T.A.D.

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense _____
Distance (ft) to end of Zm bed/continuous dense _____
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2)			Macroalgae Cover (spp and percent)	Macrofauna
					Q1	Q2	Q3		
0	dry ~12ft	1353	photo 4406	RR for railroad	N			none	none
20	dry ~9ft	1355		c g. spall interstitial s g brick	N			10 Fuc	barn
40	dry ~8ft	1355		bedrock RR g spall some g, sh hash	N			50 Fuc	mussel barn
60	dry ~6ft	1356		bedrock RR s s sh hash over bedrock	N			25 Fuc	mussel barn
80	dry ~3ft	1358		bedrock some si s g sh hash over bedrock	N			50 Fuc	mussel barn
100	dry ~1ft	1359		bedrock	N			50 Ulva	barn

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/13/09 **Diver** PTS **Start Inshore / Offshore** **Transect** 1

Distance (feet) to start of Zj _____	**Distance (ft) to start of Zm bed/continuous dense** 148
Distance to end of Zj _____	**Distance (ft) to end of Zm bed/continuous dense** 229
Distance (ft) to start of Zm 142	**Distance (ft) to end of Zm** _____

2 - 100 is next
3 - 100
4 - 80

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent) vis 3-5 ft	Macrofauna
120	6	1500		Bedrock	no			Ulva 10	Bar
140				bedrock inshore S si offshore				Ulva 40	
160	8	13 03		S si	D	D	D		
180	10	13 05		S si down piling	Ø	D	D	<5 Gran <5 Lam	[illegible]
200	10	15 08		S si	D	D	D	<5 Lam	Limpet
220	11	15 12		S si	4	25	8	20 Lam	
240	12	15 14		~~si S~~	none on trans patch to left between 237 ft			20 Lam 5 Gra	Pycno phrev 243
Zm 253-257				12 ft @ 1516				10 Lam 80 grac	9
260	12	15 17		si S sh					goby
Zm	1 shoot			at 272 12 ft @ 1518					
280	13	15 19		S si sh	none			5 grac	horse plumes 5 gra
300	15	1521		S si	none			20 Lam	

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 7/22/09 **Diver** PTS **Start Inshore / Offshore** **Transect** 2

10 ft north of T.A.D.
in shade

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense _____
Distance (ft) to end of Zm bed/continuous dense _____
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2)			Macroalgae Cover (spp and percent)	Macrofauna
					Q1	Q2	Q3		
0	dry ~10ft			RR for railroad	N			none	none
20	dry ~7ft			g (2-3") over sh hash 5 RR g spall	N			25 Fuc	barn
40	dry ~5ft			g over s scatt RR	N			20 Fuc	barn mussels
60	dry ~3ft			s RR g (1-2") g spall	N			5 Fuc	barn mussels
80	dry 0.5ft			bedrock some si over bedrock	N			90 Ulva	none

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/13 **Diver** PTS **Start Inshore / Offshore** **Transect** 3

Distance (feet) to start of Zj 105	**Distance (ft) to start of Zm bed/continuous dense** 263
Distance to end of Zj 110	**Distance (ft) to end of Zm bed/continuous dense** ~~[illegible]~~ 116
Distance (ft) to start of Zm 107	**Distance (ft) to end of Zm** 263

2-100 is next
3-100
4-80

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
300	15	1525		S SI	none				
280	13	1526		S SI metal debris	none			Lam on debris Grne	P brevi C Grnf
260	12	1531		S SI	22	4	20	20 Lam	
240	>12	1532		S SI	D	D	D		Melibe lyn[illegible]
220	12	1533		S SI down pile	D	D	D		
200	11	1535		S SI	D	D	D	<5 grne	[illegible] Frost
180	9	1537		S SI	D	D	D		
160	8	1538		S SI	15	19	24		saddle grn
140	5	1540		S SI	16	23	D		
120	6	1543		S SI	D	13	15		
100	5	1546		S	(32)			40 Lam	

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date _____ **Diver** _____ **Start Inshore / Offshore** **Transect** 3

40 ft north of T2

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense _____
Distance (ft) to end of Zm bed/continuous dense _____
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2)			Macroalgae Cover (spp and percent)	Macrofauna
					Q1	Q2	Q3		
0	dry ~9ft	1406		RR for railroad	N			none	none
20	dry ~7ft	1408		g (1-2") over s g RR	N			none	barn
40	dry ~4ft	1409		c (3-6") g spall RR interstitial g sh. hash	N			5 Fuc	barn
60	dry ~1ft	1410		s c g spall brick	N			10 Ulva	barn
80	wet 0.5ft	1410		s RR	N			40 Ulva	barn

My 1550
Fresh 1546

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date [illegible] Diver RU Start Inshore / Offshore Transect 3

Distance (feet) to start of Zj _____
Distance to end of Zj ~~[illegible]~~ 96
Distance (ft) to start of Zm _____

Distance (ft) to start of Zm bed/continuous dense 98
Distance (ft) to end of Zm bed/continuous dense 260
Distance (ft) to end of Zm 265

2-100 is next
3-100
4-80

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate eelgrass already @80	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
100	5	1549		S si down pile	D	18	D		
120	6	1552		S si RR scattcob	26	23	D		
140	7	1554		S. si	D	D	D		
160	8	1555			16	18	8	Lam 20	
180	9	1557		S si	D	D	D		
200	10	1558		S si	D	D	D		
220	12	1559		S si	D	D	D		Melibe
240	13	1600		S si	D	D	D	Lam 10	Melibe
260	14	1601		S si cobris	Ø	Ø	D		Nudeggs

284 ~~pile~~ @ 283 ½
300 15 1603

S si ~~[illegible]~~ 298 — ssi shell none

none

<5 grams

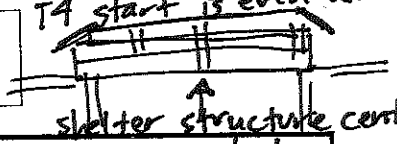
Pyrid Plumb RR 01

PROJECT NAME _____

Date 7-24-09 Diver AW Start Inshore / Offshore

Transect 4

T4 start is even with shelter structure center on dock.



Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense _____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	0 ft dry 1133		shell lg gravel	N	none	none
20	2 ft dry 1133		shell hash lg grav bedrock cobble	N	FUC porph	barn muss.
40	3 ft dry 1134		shell hash lg gravel bedrock	N	FUC.	barn muss.
60	4 ft dry 1136		sand shell	N Zj start @ 70'	ulva FUC. ent	barn muss
			slope T2. 60 shooting water line @ 89' = 7.0		Slope: T3: 2:36 pm 60 shooting water line @ 86: = 6.8	
			40 shooting 60' = 7.4		40 shooting 60: 7.3	
			20 shooting 40: 7.5		20 " 40: 7.7	
			0 shooting 20 = 7.8.		0 " 20: 7.7.	
			slope T1. 80 shooting water line @ 97. = 6.8			
			60 shooting 80 = 6.9			
			40 shooting 60 = 7.2			
			20 shooting 40 = 8.3			

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/13/09 **Diver** EP **Start Inshore / Offshore** **Transect** 4

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____

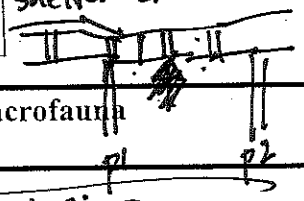
Distance (ft) to start of Zm bed/continuous dense _____
Distance (ft) to end of Zm bed/continuous dense 145
Distance (ft) to end of Zm 235

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
260	13	1546		SH SI	—	—	—	<5 GRACICARIA	—
240	12			SH SI	—	—	—	5 LAM	—
220	10			SH SI	—	—	—	20 LAM 5 GRAC	—
200	10			SH SI	D	D	D	20 LAM 20 GRAC	HOODED NUD EG LIMPETS
180	9	1555		SA SI	D	D	D	5 LAM	EG LIM
160	9			SI ~~FA~~ FS	D	D	D	5 LAM	EVASTERIUS
[illegible]	8			SI FS	14	10	3	10 ULVA	
120	7			SI FS	17	8	8	< 5 ULVA	
100	6	1615 real time		S SI	30 Zm (D) Zj up 2	8 Zm Zj up	22	<5 Ulva	
80	5	1618		S SI	5 Zj up	Ø	Ø	5 Ulva	

PROJECT NAME _____

Date 7-24-09 Diver AW Start Inshore / Offshore Transect (5)

T-5 is 2nd 2x4 from shelter structure.



piling 2 right of

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense _____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna	
0	5 ft dry / 1123		shell hash cobble. brick. sm grav.	N	none	barn.	T5: slope: 2:23pm
20	3.5 ft dry / 1124		brick lg gravel/medgravel	N	FUC porph	mussel barn.	80 shooting water line @ 105' =6.2
40	3 ft dry / 1125		shell hash sand. lg grav brick	N	FUC por	barn mussel	40 shooting 80=8.1 0 shooting 40=9.0
60	1 ft dry / 1126		brick shell sand med/sm grav	N	FUC por	barn mussel	
80	@ water line / 1129		brick sand med/grav	N	Ulva.	barn mussels	

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14/09 **Diver** ED **Start Inshore / Offshore** 88 START 136 **Transect** 5

5-100 start here
6-80
7-120
8-120

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____

Distance (ft) to start of Zm bed/continuous dense 156
Distance (ft) to end of Zm bed/continuous dense 237
Distance (ft) to end of Zm 247

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
300	15	1032	NO	~~SISA~~ SA SI	—	—	—	5 CAM	SHINER
280	13		NO	SHELLY SA SI	—	—	—	—	PISASTER BREVI
[illegible]	12	1042	NO	SH SA SI	—	—	—	30 CAM	EVASTERIAS C MAGISTER
[illegible]	10		NO	SH SI	D	D	D	20 CAM	
[illegible]	9		NO	SHSI	D	D	D	—	ITOODED NUD EG LIMPETS
[illegible]	8	1049	NO	SHSI	D	D	D	—	SAME
[illegible]	8		NO	SI	D	D	D	—	EG LIM
[illegible]	7		NO	SI	D	D	D	—	EVA EG LIM
140	7		NO	SH ~~SA~~ SISA	22	11	28	ULVA 20	
120	6		NO	SH SISA BEDROCK				ULVA 80	BAL GLANDULA
100	4	1059		3[illegible]				FUCUS 10, ULVA 60	~~BAL~~ G, MYT

PROJECT NAME _____

Date 7-24-09 Diver AW

Start Inshore / Offshore

Transect 6

T-6 is 2nd 2x4 from piling 3 to right of shelter structure.

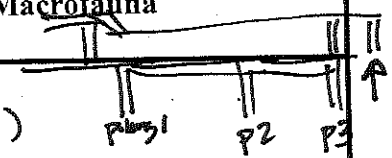
Distance (ft) to start of Zm _____

Distance (ft) to start of Zm bed/continuous dense ____

Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	4ft dry / 1117		med gravel brick shells	N	none	barn. crabs (smal.)
20	3ft dry / 1118		cobble lg/med grav shells	N	FUC	barn muss.
40	1ft dry / 1119		brick. sand med/sm gravel	N	FUC porph	barn muss
60	@ dry water line / 1120		sand quarry spall cobble brick	Zj starts @ 59' to 63' (patch	FUC ulva. porph	barn muss.



TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/ **Diver** _____ **Start Inshore / Offshore** **Transect** 6

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____

Distance (ft) to start of Zm bed/continuous dense ~130
Distance (ft) to end of Zm bed/continuous dense 242
Distance (ft) to end of Zm 250

2027

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
300	15	10 53		SI	[illegible]			Lam 40	
280	13	1055		SI	—	—		Lam 40	
260	12	1057		SI sh	—	—		Lam 50	
240	10	1058		S SI	D	D	D		Mel [illegible]
hole in Zm 225				to 215 small patch 212-215		inside edge hole 202			
220				S sh metal [illegible]				70 Lam 5 Gr	Mel [illegible]
200	9	1101		S SI	D	D	D	Lam 70	
180	8	1102		S SI	D	D	D		
160	7	1103		S SI	19	D	24		
140	6	1107		S SI	D	D	D		
120	5	11 08		S SI	15	12 Zjup	D (33) ~150		
100	5			S SI	D	D	D		
80	4	[illegible]		S SI + pieces [illegible]	5 Zjup	2	∅	Ulva 60	

PROJECT NAME _____

Date 7-24-09 Diver AW Start Inshore / Offshore

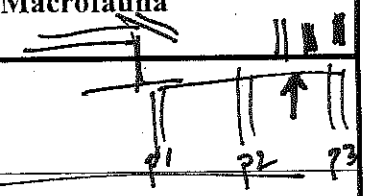
Transeet middle between T-7 is ~~[illegible]~~ ~~[illegible]~~ piling ~~[illegible]~~ 2 & 3 to right of shelter structure

(7)

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense _____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	0 ft dry / 1112		RR sm/med gravel shells	N	FUC porph	barn muss
20	3 ft dry / 1113		RR shells lg grav quarry spall	N	FUC porph	barn muss
40	4.5 ft dry / 1115		RR lg gravel brick quarry spall, sand	N	FUC porph	barn muss.
60	4 ft dry / 1142		quarry spall brick	Y ~~N~~ Zj start @ 60'	ulv	barn muss clam
80	4 ft dry / 1225		mud/sand	Y Zj continues to ≈ 102' Zm starts @ ≈ 67', patchy. bed starts @ 97'	ulv.	none.
100.	4 ft dry / 1228		mud	Y Zm, Zj	none.	none



slope: 2:18 pm
60 shooting 87 @ water line = 6.6
20 shooting 60 = 9.2
0 shooting 20 = 7.5.

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14 **Diver** P3 **Start Inshore / Offshore** **Transect** 7

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____

Distance (ft) to start of Zm bed/continuous dense 142
Distance (ft) to end of Zm bed/continuous dense 256
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
120	5	1032		SSI	D (32)	4 also Zj	D (37)		gobby
140	5	1034		SSI metal debris part of low pilg	21	D	16		Pis ock
160	6	1036		metal debris SSI	D	D	D		
180	7	1037		SSI	D	D	D		peck
200	8	1039		SSI large cone slab	D	Ø	Ø	Desmar 25 grac 10 Ulva 10	
220	10	1040		SSI	D	D	D		melibe
240	10	1041		SSI	D	D	D		melibe
260	11	1042		SSI	Ø	Ø	Ø	Lam 20	
pilg 266-278 280	11	1043		SSI S	none			Lam 30	Pis ock
300	13	1048		SI S	none			Lam 100	

PROJECT NAME _____

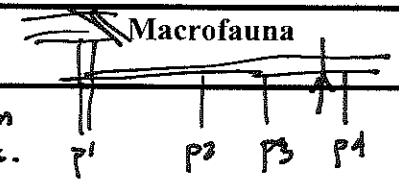
Date 7·24·09 Diver AW Start Inshore / Offshore Transect 8

T-8 is 1st 2x4 left of P4

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense ____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	0 ft dry / 1105		small gravel shell hash	N	FUC	barn muss.
20	2 ft dry / 1105		lg gravel cobble shell hash some sand.	N	FUC.	muss barn
40	3 ft dry / 1110		bedrock shell hash	N	FUC	muss barn
60	4 ft dry / 1148		Bedrock gravel spall shell sand	N	Ulv ent	muss barn.
80	4 ft dry / 1222		sand/mud	Y : Zm @ 79'	Ulv ent	muss barn
100	4 ft dry / 1222		sand/mud	Y continues deeper.		none.



can see Zj @ ~80' between T-8 & T7, moving up @ angle toward T-7, @ 60' on the T7 transect

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14/09 **Diver** PTS **Start Inshore / Offshore** **Transect** 8

Distance (feet) to start of Zj _____	**Distance (ft) to start of Zm bed/continuous dense** 90
Distance to end of Zj _____	**Distance (ft) to end of Zm bed/continuous dense** 235
Distance (ft) to start of Zm _____	**Distance (ft) to end of Zm** 244

[redacted] 5-100
6-80
7-120
8-120

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
280	11	10 12		si s	no			Lam 90	[illegible]
dock 268 – 260	11	1015		si s shelling	no			Lam 70	[illegible]
244-240 Zm patch 240				s si sh hash	Ø	D	D	Lam 40	[illegible]
235 Zm bed start 220	9	1020		s si	D	D	D		Melibe [illegible]
200	9	1021		s si	D	D	D		Smithia [illegible]
180	7	1023		s si	D	D	D		
160	6	1024		s si	D	D	D		
140	6	1025		s si	D	D	D		
120	4	1030		s si	24	21	9		

PROJECT NAME _____

Date 7-24-09 Diver AW Start Inshore / Offshore

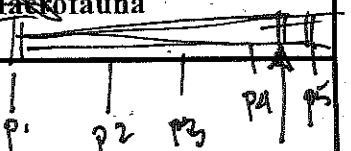
Transect 9

T-9 is 2nd 2x4 left of P-5

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense _____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	~~Macro~~fauna
0	@ft dry 1058		shell hash, quarry spall sand med gravel	N	Fuc porph	crabs (small) barn
20	1 ft dry 1100		quarry spall med/lg gravel. some sand shell hash	N	Fuc	barn mussels.
40	2 ft dry water line @ 1105		sand cobble brick 8mm/med gravel	N	Fuc	muss barn
60	3 ft dry 1150		sand cobble brick med gravel	N	Fuc. por	muss barn
80	3.5 ft dry 1151		Bedrock sand brick lg grav	N @ 62 Zj start	Ulv Ent	muss barn
100	3.5 ft dry 1220		sand	N	Ulv	none.



(slope: 2:11 pm

60 shooting water line @ 82 = 6.4'

20 shooting 60. = 8.2

0 shooting 20 = 7.8

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14/09 **Diver** EP **Start Inshore / Offshore** **Transect** 9

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense 155
Distance (ft) to end of Zm bed/continuous dense 225
Distance (ft) to end of Zm 230

9- 20
10- 100
11- 120
12- 140

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
260	15	1325	NO	SH SI	—	—	—	20 LAM	
240	13		NO	SH SI	—	—	—	90 LAM	C MAG
220	12		NO	SH SASI	D	D	D	60 LAM	HOODED NUD EG LIMPETS
200	11		NO	SH SASI	D	D	D	5 LAM	SAME + P BREVISPINUS
180	10	1334	NO	SASI	D	D	D	5 LAM	HERMIT EG LIM HOODED NUD
160	10		NO	SASI	D	D	D	5 LAM 25 ULVA	C PRODUCTUS
140	9		NO	SASI	23	20	16	5 LAM 5 ULVA	
120	8		NO	SISA	29	14	15	5 ULVA	

PROJECT NAME _____

Date 7·24.09 Diver AW Start Inshore / Offshore Transect (10)

T-10 is @ piling 5

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense ____ Distance (ft) to end of Zm _____

shelter

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	0 ft dry / 1155		shell hash bedrock med/sm gravel	N	FUC porph.	barn muss.
20	1 ft dry / 1156		shell sand sm/med gravel	N	FUC	barn muss.
40	3 ft dry / 1157		lg gravel/cobble sand	N → Zj start @ 49'	ulv.	barn.
60	4 ft dry / 1159		sand cobble.	(Zj continues to and into water - can't see end)	ulv	barn : to the ~~east~~ N of this transect is the bedrock area.
80	4 ft dry / 1217		sand cobble	N	ulv.	barn.

p1 p2 p3 p4 p5

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14 **Diver** _____ **Start Inshore / Offshore** **Transect** 1/3

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____

Distance (ft) to start of Zm bed/continuous dense 128
Distance (ft) to end of Zm bed/continuous dense 232
Distance (ft) to end of Zm 235 (shoot)

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
260	17	1336		si	—	—			
240	15	1337		si	—	—		Ulva 20	
220	12	1339		s si	D	D	D	Ulva 20	Mollusc
200	11	1340		s si	D	D	D		Mollusc Crustacea
180	10	1342		s si	D	D	D		
160	9	1343		s si	D	D	D		
140	9	1345		s si	D (34)	D	D		
120	8	1347		s si sl some gr	8	3	[illegible]	Ulva 30	
100	7	1349		s si	D	5 patch	D (Ruppia)		

PROJECT NAME _____

Date 7-24-09 Diver AW Start Inshore / Offshore Transect (11)

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense ____ Distance (ft) to end of Zm _____

T-11 is 2nd 2x4 to left of piling 6

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	0 ft dry / 1202		bedrock RR	N	FUC	none p1 p2 p3 p4 p5 p6
20	0.5 ft dry / 1202		sm gravel sand	N	FUC	barn muss This transect runs parallel to cement pipe (see photo)
40	1 ft dry / 1204		bedrock shell hash RR	N	FUC por	barn muss slope: 2:04 pm.
60	2 ft dry / 1204		RR. bedrock	N	FUC	barn muss. 80 shooting water line @ 94' = 6.9' 40 shooting 80 · = 9.0'
80	4 ft dry / 1205		quarry spall RR bedrock	N	por	muss. barn 0 shooting 40 = 9.0.
100	5 ft dry / 1215		sand shell hash cobble	N - but can see Zm @ appx 120'	u/v.	barn.

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14 **Diver** [illegible] **Start Inshore / Offshore** **Transect** 11

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm 120

Distance (ft) to start of Zm bed/continuous dense 124
Distance (ft) to end of Zm bed/continuous dense 217
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2)			Macroalgae Cover (spp and percent)	Macrofauna
					Q1	Q2	Q3		
120	8	1320		RR S si	0	3	5	Ulva 60	bam
140	9	1323		S si	24	18	27		P bevi
171-175		[illegible]		Zm bed [illegible]					
160	10	1325		S si	D	D	D		
180	11	1327		S si	D	D	D		
200	11	1328		S si	D	D	D		[illegible]
220	13	1329		S si	—	—	—	5 gm	
240	16	1330		si S	—	—	—	Lm 10	
260	18	133[illegible]		si	—	—	—		

12

PROJECT NAME _____

Date 7-24-09 Diver AW Start Inshore / Offshore Transect 12

T-12's 2nd 2x4 ~~next to~~ to right of Piling 7.

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense _____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Shelter / Macrofauna
	0 / 1209		med gravel shell hash	N	none	none P1 P2 P3 P4 P5 P6 P7 Note: 0 point is right next to bedrock. – @ point where walking path comes in.
	20 / 1211		bedrock lg gravel	N	FUC	barn, muss
	40 / 1211		lg gravel cobble	N.	por FUC	barn, muss
	60 / 1211		RR. bedrock	N.	FUC. por	barn muss.
	80 / 1212		bedrock RR	N.	ENT FUC	barn, muss
	100 / 1213		bedrock RR	N.	ent FUC ULV (bedrock all covered in ULV & ent)	barn
	120 / 1213	water line	bedrock	N. ← taut	ULV. (can see Zm @ appx 140' inundated)	barn.

72

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14/09 **Diver** PB **Start Inshore / Offshore** **Transect** _____

9-120
10-100
11-120
12-140

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____

Distance (ft) to start of Zm bed/continuous dense 142
Distance (ft) to end of Zm bed/continuous dense 196
Distance (ft) to end of Zm 203

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
300	-1	1304		si	none				
280	19	1304		si	none				
260	18	1305		si	none			Lam 40	
240	15	1307		si metal debris	—			Lam 30	Pyamo P brevi Cgrac Evast Pisoch
220	14	1309		si sh hash					Cgrac
Zm to left (north)			@ 203						
200	12	1311		si	2	Ø	Ø	Gracc <5	
180	11	13 12		s si	D	D	D		Mollusc
160	8	13 13		s si	D	D	D		
142 end Zm				at edge of bedrock				Ulva 100	Pisoch
140	8	13 13		bedrock RR					

PROJECT NAME _____

Date _____ Diver AW Start Inshore / Offshore Transec 13

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense _____ Distance (ft) to end of Zm _____

T-13 is just to left of P-8.

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	0ft dry 1310		bedrock	N	none	none
20	1ft dry 1310		bedrock shell	N	FUC	barn muss
40	2ft dry 1310		~~mud~~ shell & bedrock	N	FUC	muss barn
60	2ft dry 1311		bedrock mud	N	FUC	muss barn
80	2.5ft dry 1311		bedrock	N	Ent por FUC	muss barn
100	3ft dry 1312		bedrock/sand sm grav	N	ULV.	barn
120	4ft dry 1312		bedrock	N. but can see Zm @ appx 140'	ULV por grac	pisaster barn mussel

slope: 1:49 pm.

• 80 shooting water line @ 122' = 9.0ft.

• 40 shooting 80: = 6.7.

• 0 shooting 40: = 9.0.

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14/09 **Diver** EP **Start Inshore / Offshore** **Transect** 73

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense _____
Distance (ft) to end of Zm bed/continuous dense 189
Distance (ft) to end of Zm 202

13-140 start
14-140
15-120

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
240	18	1515	NO	SH SI	—	—	—	<5 LAM	—
220	16		NO	SH SI	—	—	—	80 LAM	P. BREVI
200	15		NO	SH SI	5	2	2	50 LAM 5 GRACILARIA	PYC ENA
180	13		NO	SH SI	D	D	D	50 LAM	HOODED NUD EG LIMPETS
160	11	1522	NO	SI	D	D	D	—	SAME ↑
140	10		NO	SI	D	D	D	—	SAME

PROJECT NAME _____

Date _____ Diver _____ Start Inshore / Offshore

Transect (14) 1/2 btwn

T-14is @ P8/P9

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense ____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna
0	0ft dry 1320		lg gravel shell hash	N	none	none
20	0.5 ft dry 1320		shell hash lg/med gravel	N	~~none~~ FUC.	barn muss.
40	1ft dry 1320		shell hash sand sm/med gravel.	N	FUC.	barn muss.
60	on top of bedrock 1321	≈ 1ft higher than start point 0.	bedrock	N	FUC.	muss barn
80	also here. 1322		bedrock	N	FUC ENT	barn muss
100	also here 1322		bedrock	N	ulva ent	barn
120	appx level w/ start point 0. 1323		mud/ bedrock	N - but can see zm @ appx. 135	por ulv.	none.

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/14 **Diver** PTS **Start Inshore / Offshore** **Transect** 14

13-140
14-140
15-120

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm 128

Distance (ft) to start of Zm bed/continuous dense 128 128
Distance (ft) to end of Zm bed/continuous dense 183
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
				bedrock ends 128					
140	11	15 24		S Si	D	D	D		goby
147-157 hole				in Zm - it gets larger to north (toward 15)					
160	12	15 26		S Si	D	D	D		R Rock
bedrock				at 162-172 (hole in Zm)					
180	13	15 28		S Si	D	D	D		
200	14	15 29		S Si SL hash	—	—	—	grac 10 Lat 20	
220	16	15 30		Si S	—	—	—	—	Evast
240	19	15 32		Si	—	—	—	—	P brevi Evast

Ali eye ~~5.5~~ 5.5ft

PROJECT NAME _____

Date _____ Diver _____ Start Inshore / Offshore Transect 15

T-15 is @ P9.

Distance (ft) to start of Zm _____ Distance (ft) to end of Zm bed/continuous dense _____

Distance (ft) to start of Zm bed/continuous dense _____ Distance (ft) to end of Zm _____

Dist. (ft)	Depth /Time	GPS? (Y/N, ID #)	Substrate	Eelgrass Presence (Y/N)	Macroalgae	Macrofauna	
0	0 ft dry 1325		RR. med gravel	N	None	none	slope. 1:35pm : -1.5 tide 80 water line shooting @ 40: 3.6
20	0.5 ft dry 1326		med grav. shell hash	N	FUC	barn moss	40 shooting @ 0 : 1.5.
40	2 ft dry 1326		shell hash cobble.	N	FUC	barn moss	
80	3 ft dry 1327		cobble med/lg grav	N	N	barn	
100	2.5 ft dry 1328		shells cobble.	N, but can see Zm @ ≈ 125'	ent U/V.	barn	

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date _____ **Diver** _____ **Start Inshore / Offshore** **Transect** 15

13 - 140 Start
14 - 140
15 - 120

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm 89

Distance (ft) to start of Zm bed/continuous dense 96
Distance (ft) to end of Zm bed/continuous dense 167
Distance (ft) to end of Zm 175

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
220	20	1504		Si	—	—		—	C gruc
212	dock	piling		15ft @ 1505					
202	dock piling								
200	18	1506				—	—		R Rocks P brevi Pyeno
185	vert	broken		piling				Lum 5	
180	14	1508		si sh brok		—	—	Gruc <5	
160	13	1510		s si	D	D	D		Melibe
140	12	1512		s si	D	D	D		
120	11	1513		s si	D	D	D		
100	8	1515		s si bedrock	D	9	D	—	

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 7/22/09 **Diver** PTS **Start Inshore / Offshore** **Transect** 16

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense 61 ft
Distance (ft) to end of Zm bed/continuous dense _____
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2)			Macroalgae Cover (spp and percent)	Macrofauna
					Q1	Q2	Q3		
0	dry ~4ft	1150		RR for railroad	N			25 Fuc	barn
20	dry ~9ft	1150		scatt RR some angular cobble	N			40 Fuc	barn mussels
40	dry ~6ft	1148		scatt RR 5	N			none	barn
60	dry ~3ft	1143		5 sh hash	Y 82	Ø	Ø	5 Ulva	none
86	dry ~0.5ft	1130		5	Y 83	121	58	none	clam

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/13 **Diver** RP **Start Inshore / Offshore** **Transect** 1L0

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense 71
Distance (ft) to end of Zm bed/continuous dense 83
Distance (ft) to end of Zm 217

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
100	8	1223	NO	FS OR SCATT ROCK	29	35	26	—	BAL G
120	9	1231	NO	SI FS	D	D	D	ULVA < 5	BAL G ON STEEL DEBRIS
140	10	1233	NO	SI FS	D	D	D	—	EVASTERIAS
160	11	1235	NO	SI FS	D	D	D	—	LIMPETS
180	13	1238	NO	SI	28	23	31	LAM SACH < 5	PISASTER BREVISPINUS
200	15	1241	NO	SI	12	16	12	—	C GRACILIS
220	16	1245	NO	SI	L	—	—	GRACILARIA < 5	—
240	17	1247	NO	SI	—	—	—	GRAC < 5	—
260									

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 7/22/09 **Diver** PTS **Start Inshore / Offshore** **Transect** 17

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense 103
Distance (ft) to end of Zm bed/continuous dense _____
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2)			Macroalgae Cover (spp and percent)	Macrofauna
					Q1	Q2	Q3		
0	dry ~15ft	1122		RR for railroad	N			20 Fuc	barn
20	dry ~10ft	1123		scatt RR some g sh hash	N			40 Fuc	barn mussels
40	dry ~8ft	1124		scatt RR s some g (1") sh hash	N			none	barn mussels
60	dry ~6ft	1124		scatt RR s some c (3")	N			<5 Fuc 10 Ulva	barn
80	dry ~3ft	1125		scatt RR s sh hash	N			25 Ulva	burrow anem barn
100	dry ~0.5ft	1125		s some C	N			<5 Ulva	barn

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/13 **Diver** PT **Start Inshore / Offshore** **Transect** 17

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm ~~125~~ 91

Distance (ft) to start of Zm bed/continuous dense ~~100~~ 125
Distance (ft) to end of Zm bed/continuous dense _____ 212
Distance (ft) to end of Zm 223

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
120									
94+7		1243		1	4 shoots				
100				under pier at center sparse Zm in area					
109	7	1246							
109-119	edge of bed			Zm to left not right					
120	8	1248		S SI	21	8	22		P brevi
140	9	1253		S SI	D	D	D		
160	10	1254		S SI	D	D	D		
180	13	1255		S SI	D	D	D		
200	15	1257		S SI	D	D	D		
220	16	1258		S SI	4	4	4		
240	17	1300		SI S	none				
260	18	1301		SI S	none				

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 7/22/09 **Diver** PTS **Start Inshore / Offshore** **Transect** 18

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm _____
Distance (ft) to start of Zm bed/continuous dense _____
Distance (ft) to end of Zm bed/continuous dense _____
Distance (ft) to end of Zm _____

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m^2) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
0	dry ~15ft	1120		RR for railroad	N			<5 Fuc	barn
20	dry ~10ft	1119		scatt RR s g sh hash	N			none	barn
40	dry ~8ft	1117		angular C (3-4") over s	N			none	barn
60	dry ~7ft	1115		angular C over s	N			none	barn
80	dry ~5ft	1114		RR g (1-2") q spall	N			20 Fuc	barn muss (Photo 4379; typ RR between 68ft and bedrock)
100	dry ~3ft	1113		q spall RR with sh hash s some g	N			50 Ulva 10 Entero	barn
102 - 117	SHADE			large RR out from 1st bent of dock					
120	dry ~1ft	1110		q spall RR with sh hash s some g	N			30 Ulva 10 Entero	barn
140	dry ~1ft	1110		Bedrock	N			<5 Ulva unid brown sargassum	Pis och

18

TAYLOR AVENUE DOCK YEAR-5 POST-CONSTRUCTION MONITORING

Date 8/13/09 **Diver** PT **Start Inshore / Offshore** **Transect** 18

next obs 120

16 next 100

Distance (feet) to start of Zj _____
Distance to end of Zj _____
Distance (ft) to start of Zm 158

Distance (ft) to start of Zm bed/continuous dense 158
Distance (ft) to end of Zm bed/continuous dense 225
Distance (ft) to end of Zm 250

Dist. (ft)	Depth	Time	GPS (Yes/ No, ID #)	Substrate	Eelgrass Shoots (#/0.25m²) Q1	Q2	Q3	Macroalgae Cover (spp and percent)	Macrofauna
140	7	11		S sh RD	N			50 Ulvm	Pis och
				Zm 3ft to left (south @ 150					
160	8	1213		S	Dense	D	D		
180	10	1214		S	D	D	D		
200	12	12 17		S	D	D	D		
220	14	12 19		S	10	7	9	5 Cam <5 Grne	Pycnd
240	16	12 21		S Si	0	1	0		P brevi
260	18	12 28		S Si	none			<5 Grnu	
280	20	12 29		S	none				