King County
Brightwater
TREATMENT SYSTEM

BRIGHTWATER POST-CONSTRUCTION

Eelgrass Program:
2012 Eelgrass Dive Survey Report

Task 500

Subtask 560

April, 2013

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King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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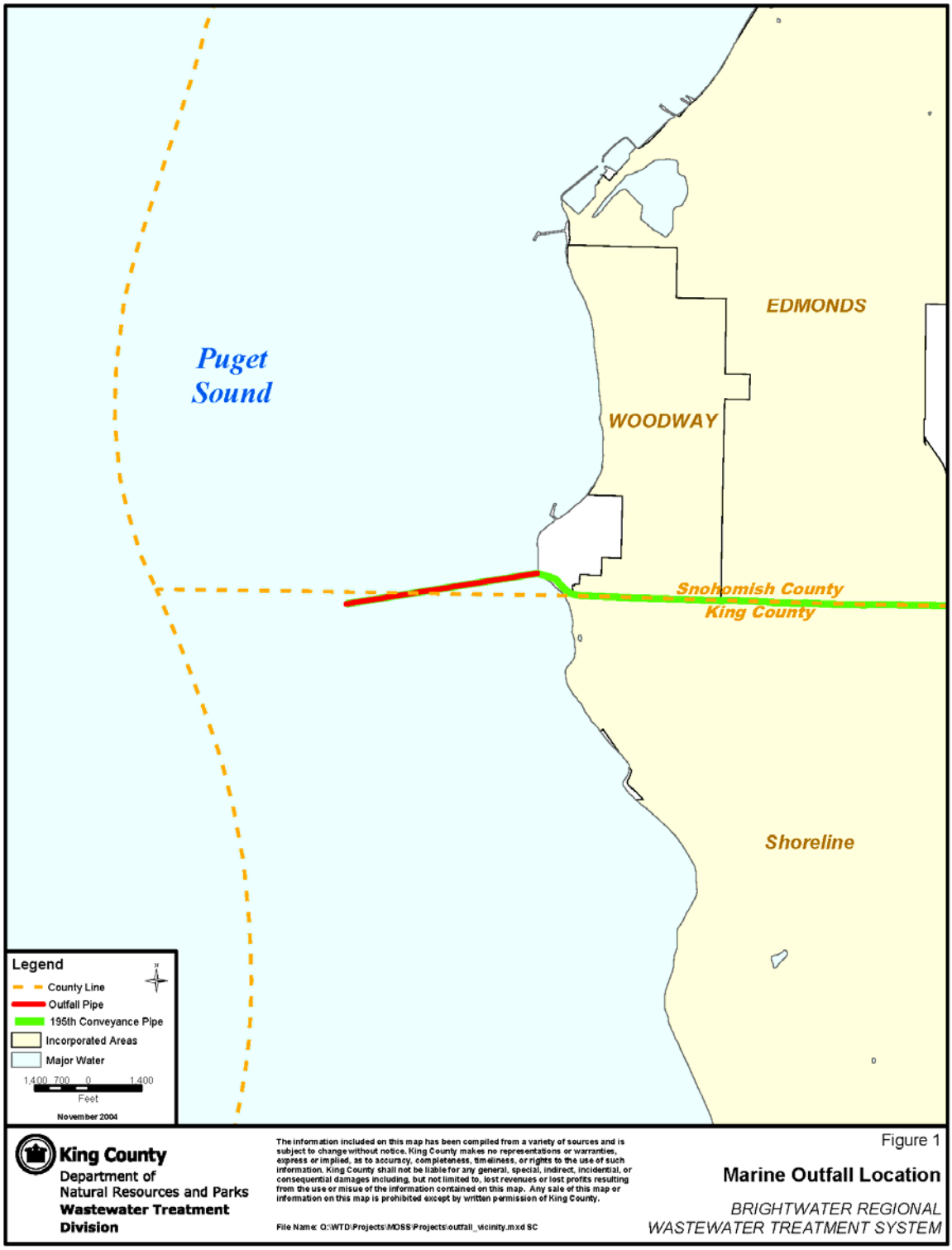
Chapter 1
Introduction

As part of the Brightwater Treatment System, King County (County) completed construction of a new marine outfall in 2008, immediately south of Point Wells, Washington (Figure 1). Although the outfall was sited at Point Wells to minimize effects on nearshore marine areas, specifically native eelgrass (*Zostera marina*) beds, unavoidable impacts to eelgrass during the construction phase of this project occurred (King County 2003a, b). The County prepared an Eelgrass Restoration and Biological Resources Implementation Work Plan (Work Plan) that describes a multi-year eelgrass monitoring program for the Brightwater Outfall project (King County 2008a). The eelgrass monitoring component of the Work Plan includes both dive-based density surveys and a combination of sonar and underwater video-based coverage surveys. The construction schedule called for pre-construction monitoring surveys to be conducted in 2004, 2006, and 2008 in order to establish baseline site conditions.

Disturbed areas of eelgrass within the Marine Outfall Corridor were restored in May 2009 by Grette Associates (King County 2009). As specified in the Work Plan and Work Plan Addendum (King County 2010a), post-transplant monitoring of the Marine Outfall Corridor and Reference Area is required from 2009 through 2014. (For years in which no dive survey will be completed, an ROV survey will occur.) This report provides methods and results for the fourth post-transplant monitoring dive survey conducted September 10 and 11, 2012.


Puget Sound
EDMONDS
WOODWAY
Snohomish County
King County
Shoreline
Legend
County Line
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Incorporated Areas
Major Water
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Feet
November 2004
King County
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Figure 1
Marine Outfall Location
BRIGHTWATER REGIONAL
WASTEWATER TREATMENT SYSTEM

1.1 Previous Eelgrass Surveys

Pre-construction dive surveys were conducted at the site using the methods described in detail in Chapter 2 of this document and in previous survey reports (e.g., King County 2006, 2008b, 2010b, and 2011). These surveys utilized 2 sets of transects spaced at 5-ft intervals with density measurements (triplicate counts) conducted every 10 ft in the Outfall Area and every 20 ft at the Reference Area location (Figure 2). Also, in 2004 and again in 2008, the eelgrass within the entire Study Area (defined in Section 1.2) was mapped using Side-Scan sonar and roughly quantified using underwater videography (PNNL 2006, 2010). The results of those efforts are presented under a separate cover.

Transplant activities occurred within disturbed areas in the Marine Outfall Corridor in May 2009 (King County 2009). Eelgrass was planted in 2 bands (A and B) at densities equal to or greater than densities measured during pre-construction surveys (King County 2009).

The first post-construction survey was completed in September of 2009, only 4 months after the May 2009 transplant efforts. Due to the short time period between transplant and survey, a large difference in eelgrass density was neither expected nor observed within the transplanted Corridor; bands A and B remained in the approximate size and shape as they had been planted. In 2009, where present, average eelgrass density in the Outfall Corridor was 107 shoots/m^2. Individual density measurements ranged from 1 to 237 shoots/m^2. Across all sample points, including those where eelgrass was not present, eelgrass density in the outfall corridor was 43 shoots/m^2.

The second post-construction survey was completed in September 2010. Bands A and B remained in the approximate size and shape as they had been planted and some spreading of planted bands was noted. In 2010, where present, average eelgrass density in the Outfall Corridor was 148 shoots/m^2. Individual density measurements ranged from 13 to 582 shoots/m^2. Across all sample points, including those where eelgrass was not present, eelgrass density in the Outfall Corridor was 61 shoots/m^2.

The third post-construction survey was completed in September 2011. Band A and B appeared to have shifted approximately 10 ft waterward in some places and remained in the approximate size and shape as observed in 2010. In 2011, where present, average eelgrass density in the Outfall Corridor was 169 shoots/m^2. Individual density measurements ranged from 4 to 431 shoots/m^2. Across all sample points, including those where eelgrass was not present, eelgrass density in the Outfall Corridor was 57 shoots/m^2.

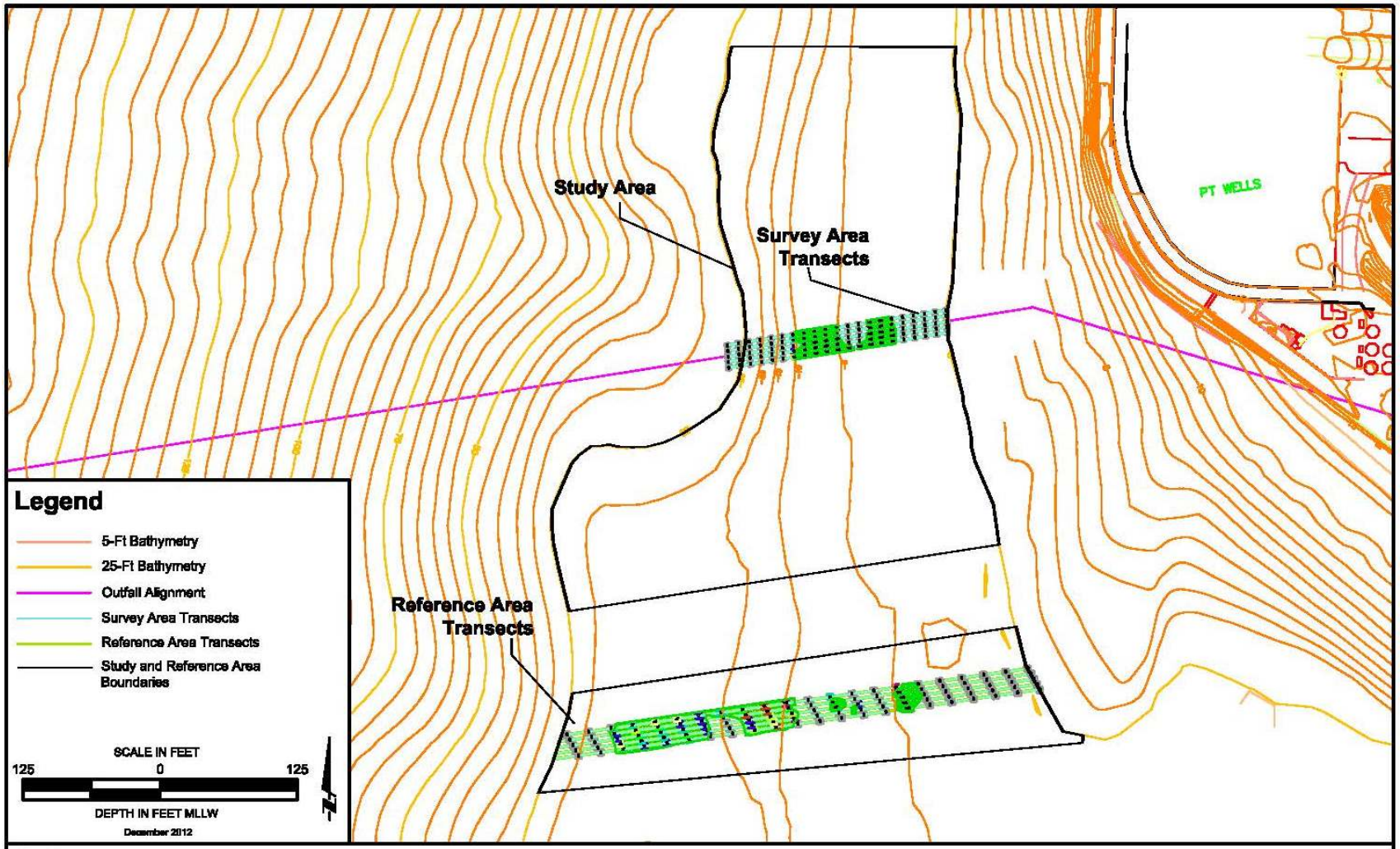

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FIGURE 2

Marine Outfall Site
Study Area, Survey Area and Reference Area

1.2 Survey Areas

For pre-construction monitoring, the Work Plan defines three specific monitoring areas at Point Wells: the Eelgrass Study Area (sonar and underwater video only), the Marine Outfall Corridor, and the Eelgrass Reference Area (Figure 2). Based on 2003 eelgrass distribution at this site (King County 2003b), all monitoring areas include elevations between approximately 0 ft MLLW and -25 ft MLLW. The diver surveys in 2004, 2006, 2008, 2009, 2010, 2011 and 2012 (described in this report) were conducted only in the Marine Outfall Corridor and the Eelgrass Reference Area. For clarification purposes, a description of the Eelgrass Study Area is included below.

The Eelgrass Study Area surrounds the proposed Outfall Alignment and is bounded from east to west by the upper and lower range of potential eelgrass habitat, and from north to south by the area in which unanticipated impacts from construction, boats, and barges would have been confined during 2008 construction.

The Marine Outfall Corridor is within the greater Eelgrass Study Area. It is a 23-ft wide area centered along the outfall pipeline alignment, including allowances for the 12-ft wide sheeted trench area with an additional 5.5-ft wide area on either side of the sheeted trench to account for potential localized effects from 2008 construction (i.e., driving sheet pile walls, excavating material with a clamshell dredge, backfilling, etc…).

The Eelgrass Reference Area is approximately 332 ft SSE of the Marine Outfall Corridor, well outside of the area in which construction impacts would have been anticipated.

1.3 Dive Survey Monitoring Schedule

A total of three pre-construction dive surveys were conducted in the Outfall Corridor and Reference Areas in 2004, 2006, and 2008 (Table 1) as directed by the Work Plan. The Work Plan also calls for dive surveys in 2009, 2010, 2011, 2012 and 2014. The 2012 monitoring effort is the forth post-transplant survey and represents Year 3 of the post-transplant monitoring schedule (Table 1).

Table 1. Dive Survey Monitoring Schedule.

Year, Season	Eelgrass Post-Transplant Monitoring Year	Survey Areas	Survey Purpose
2004, Summer	Year -5	Marine Outfall Corridor, Reference Area	Establish baseline and variation
2006, Summer	Year -3	Marine Outfall Corridor, Reference Area	Establish variation
2008, Spring	Year -1	Marine Outfall Corridor, Reference Area	Establish variation
2009, Summer	Year 0*	Marine Outfall Corridor, Reference Area	Transplant monitoring
2010, Summer	Year 1	Marine Outfall Corridor, Reference Area	Transplant monitoring
2011, Summer	Year 2	Marine Outfall Corridor, Reference Area	Transplant monitoring
2012, Summer	Year 3	Marine Outfall Corridor, Reference Area	Transplant monitoring
2014, Summer	Year 5	Marine Outfall Corridor, Reference Area	Transplant monitoring

*Year 0 indicates the transplanting of eelgrass

Chapter 2
Methods

Pre-construction eelgrass density monitoring occurred in two survey areas: the Marine Outfall Corridor and the Eelgrass Reference Area. Five transects were defined ahead of time in each area, and end point coordinates were identified on base maps. Transects 1, 3, and 5 at the Marine Outfall Corridor were defined using the shallow endpoints for the three center transects from the 2003 eelgrass diver survey (King County 2003b). For pre- and post-construction surveys in both survey areas, transects were spaced 5 ft apart (Figures 3 and 4). As described in previous reports, after construction, rebar stakes in the Outfall Corridor were placed every 40 ft for the length of the 200-ft transects. The stakes in the Reference Area remained as originally placed, also every 40 ft, for the length of the 460-ft transects.

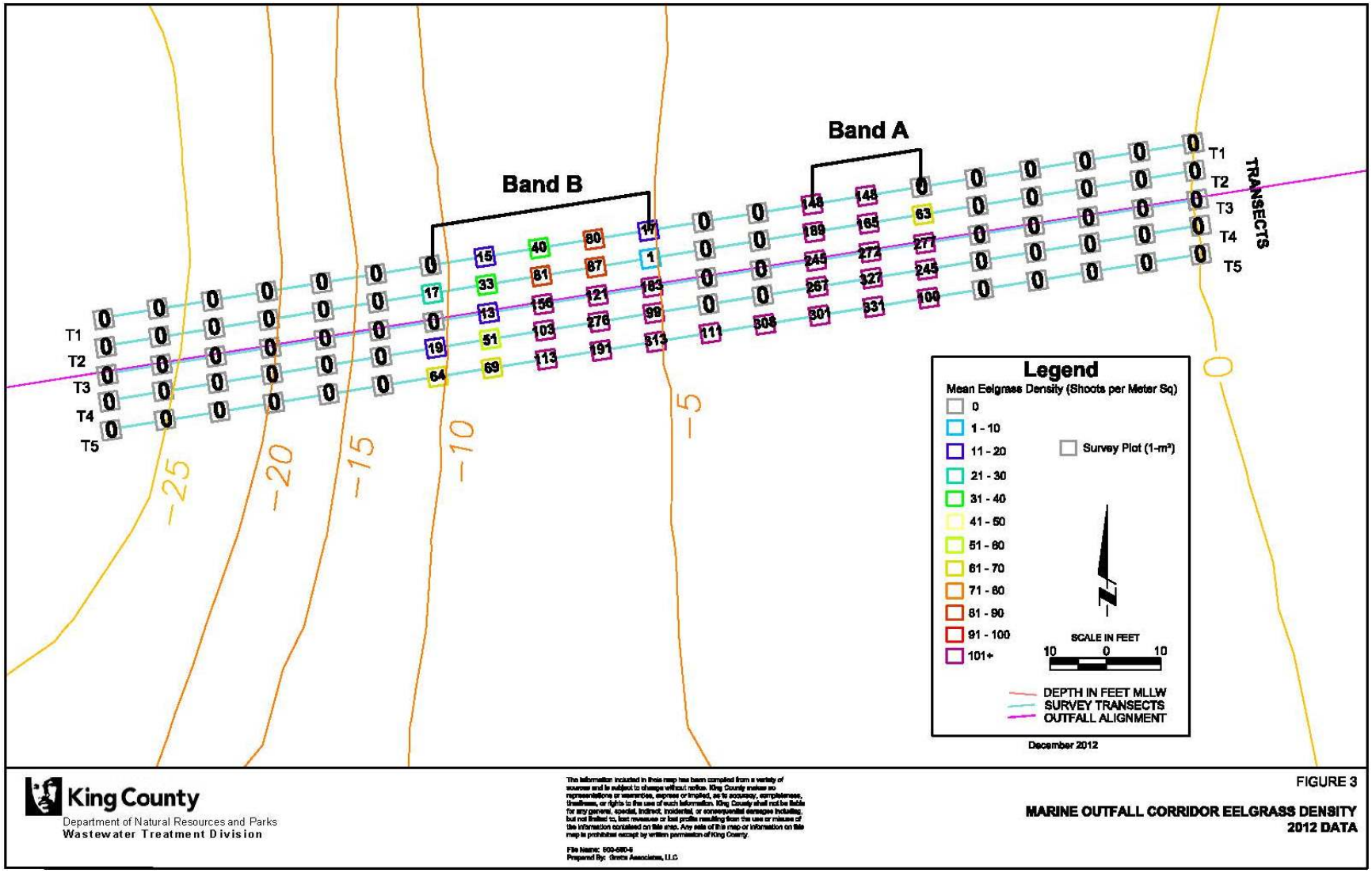

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FIGURE 3

MARINE OUTFALL CORRIDOR EELGRASS DENSITY 2012 DATA

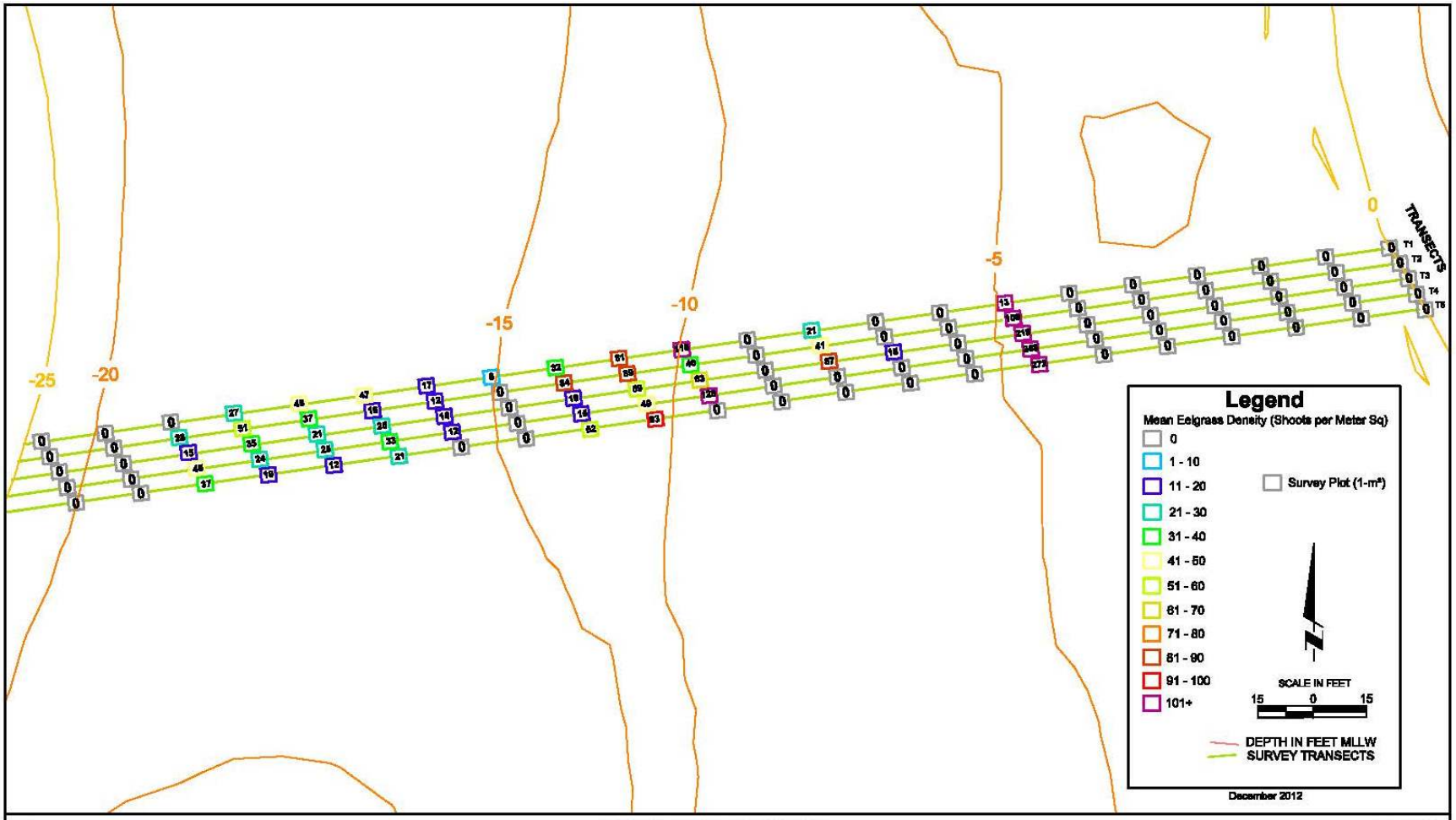

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FIGURE 4

REFERENCE AREA EELGRASS DENSITY 2012 DATA

2.1 Identification of Survey Areas

During the 2012 survey, a dGPS was used to relocate shallow endpoints marked by rebar stakes at both the Marine Outfall Corridor and the Eelgrass Reference Area (Table 2). Transect tapes were deployed from these markers and extended to the deep endpoint markers. Most of the rebar stakes were located in the Marine Outfall Corridor and the Eelgrass Reference Area. In instances where a rebar stake was not located, a compass bearing was used to find the next rebar (40 ft beyond the missing stake) and the transect line continued. Missing/non-located rebar markers were replaced once transects were established.

At the Eelgrass Reference Area, shallow endpoint markers were located using the dGPS points from King County. Transects were deployed from the rebar markers found at that point, and all markers were located during the dive survey.

Table 2. Transect End and Reference Point Coordinates (NAD 83).

Area, Transect, Point	Northing	Easting
WDNR Survey Monument 1	287663.56	1256628.75
WDNR Survey Monument 2	287662.59	1256670.75
Marine Outfall, 1, onshore	288247.63	1255853.58
Marine Outfall, 5, onshore	288227.55	1255854.88
Marine Outfall, 1, offshore	288218.42	1255671.01
Marine Outfall, 5, offshore	288197.56	1255667.62
Eelgrass Reference, 1, onshore	287924.36	1255927.13
Eelgrass Reference, 5, onshore	287905.71	1255937.91
Eelgrass Reference, 1, 200-ft midpoint	287863.86	1255505.96
Eelgrass Reference, 5, 200-ft midpoint	287842.75	1255498.97
Eelgrass Reference, 1, offshore	287863.86	1255729.16
Eelgrass Reference, 5, offshore	287877.26	1255739.94

2.2 Survey Methods

The eelgrass survey methods are based on 2003-2007 Washington Department of Fish and Wildlife (WDFW) Eelgrass/Macroalgae Habitat Survey Guidelines. At each sample location, divers recorded triplicate shoot counts within a 0.25-m^2 quadrat rotated around the sample location to the 2, 6, and 10 o'clock positions (relative to waterward orientation on the survey tape). The inside corner of the quadrat pivoted around the same center point to ensure repeatability. This center point was the pre-determined distance measured on a fiberglass survey tape stretched between permanent markers, in sample intervals specific to each survey area. Underwater video of the transects within the Corridor is also recorded during each annual dive survey.

As previously noted, divers stretched a fiberglass survey tape along each transect based on endpoint rebar stakes and interior stakes. Triplicate shoot counts were recorded at 10-ft intervals in the Marine Outfall Corridor and at 20-ft intervals in the Eelgrass Reference Area. Qualitative observations of macroalgae species presence and distribution as well as qualitative notes on substrate type were recorded within each sample quadrat. In addition, divers noted the edges of eelgrass area along each transect (e.g., "begin" at 25 ft, "end" at 32 ft; "begin" at 54 ft, "end" at 67 ft) for each of the 10 transects. At the Marine Outfall Corridor, 21 sample locations were recorded along each transect, for a total of 105 samples. At the Eelgrass Reference Area, a total of 24 sample locations were recorded along each transect, for a total of 120 samples.

Starting in 2010, a visual underwater delineation of the eelgrass at both the Outfall Corridor and the Eelgrass Reference Area was also included in the survey. The purpose of this delineation is to enable between-year comparisons of areal coverage within both the Marine Outfall Corridor and the Eelgrass Reference Area to compare against post-construction performance standards. Divers sketched the boundaries of all eelgrass areas using rebar markers and transect lines as reference (Figures 5 and 6). Note that the delineations only capture eelgrass located between transects 1 and 5 for each sampling area, and not the broader native eelgrass bands extending to the north and south.

2.3 Density Calculations

Eelgrass shoot density for each sample, reported as the number of eelgrass shoots per square meter, is calculated from the mean of the triplicate shoot count at the sample location multiplied by four (since the quadrats are 0.25-m^2). The 2003-2007 WDFW method requires that samples with eelgrass in at least one replicate are included for density calculations for the entire survey area; samples for which all three replicates have a shoot count of zero are not included. This method results in a density calculation that is specific to each transect, not the entire transplant area.

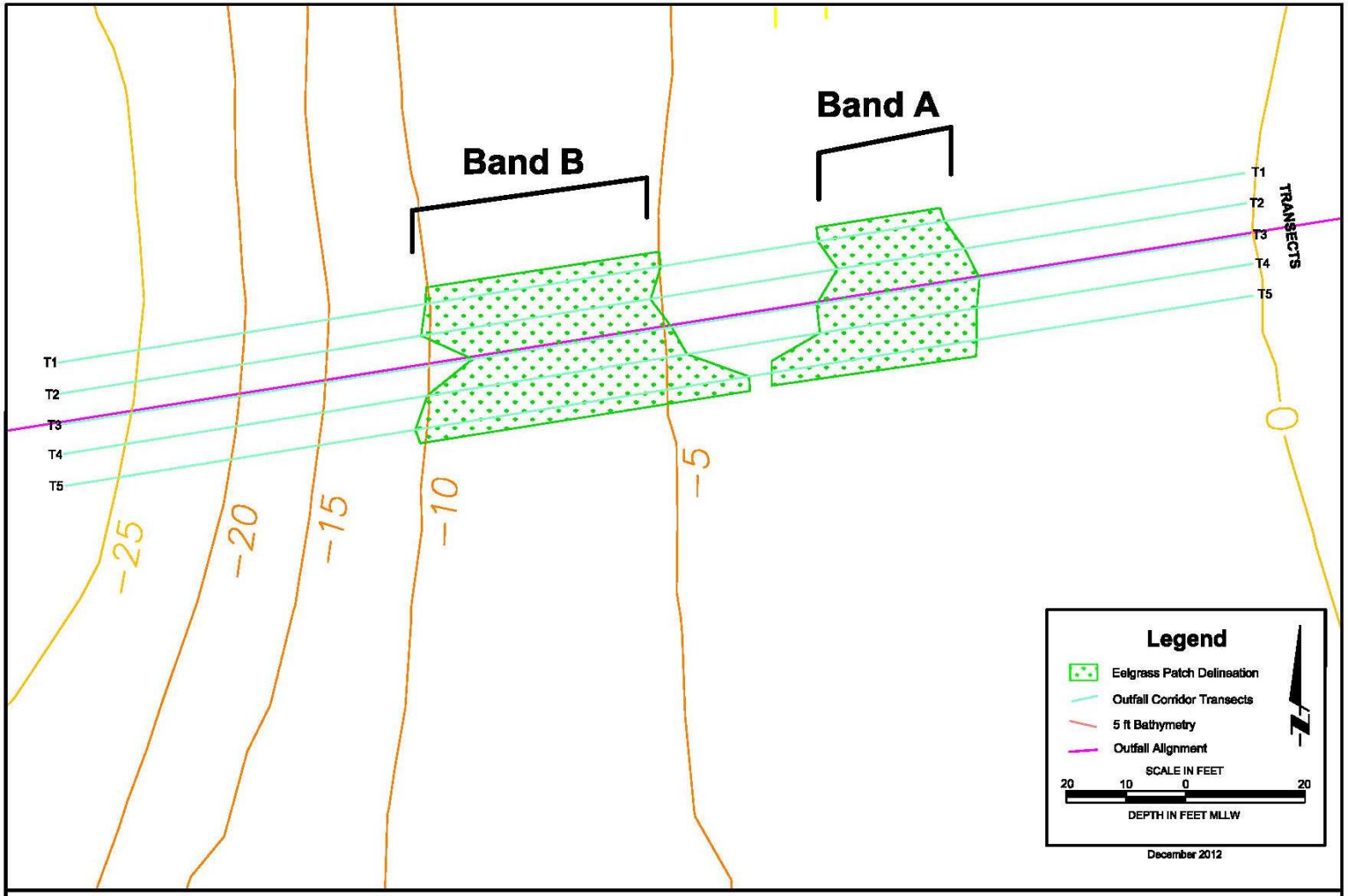

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FIGURE 5

MARINE OUTFALL CORRIDOR EELGRASS DELINEATION 2012 DATA

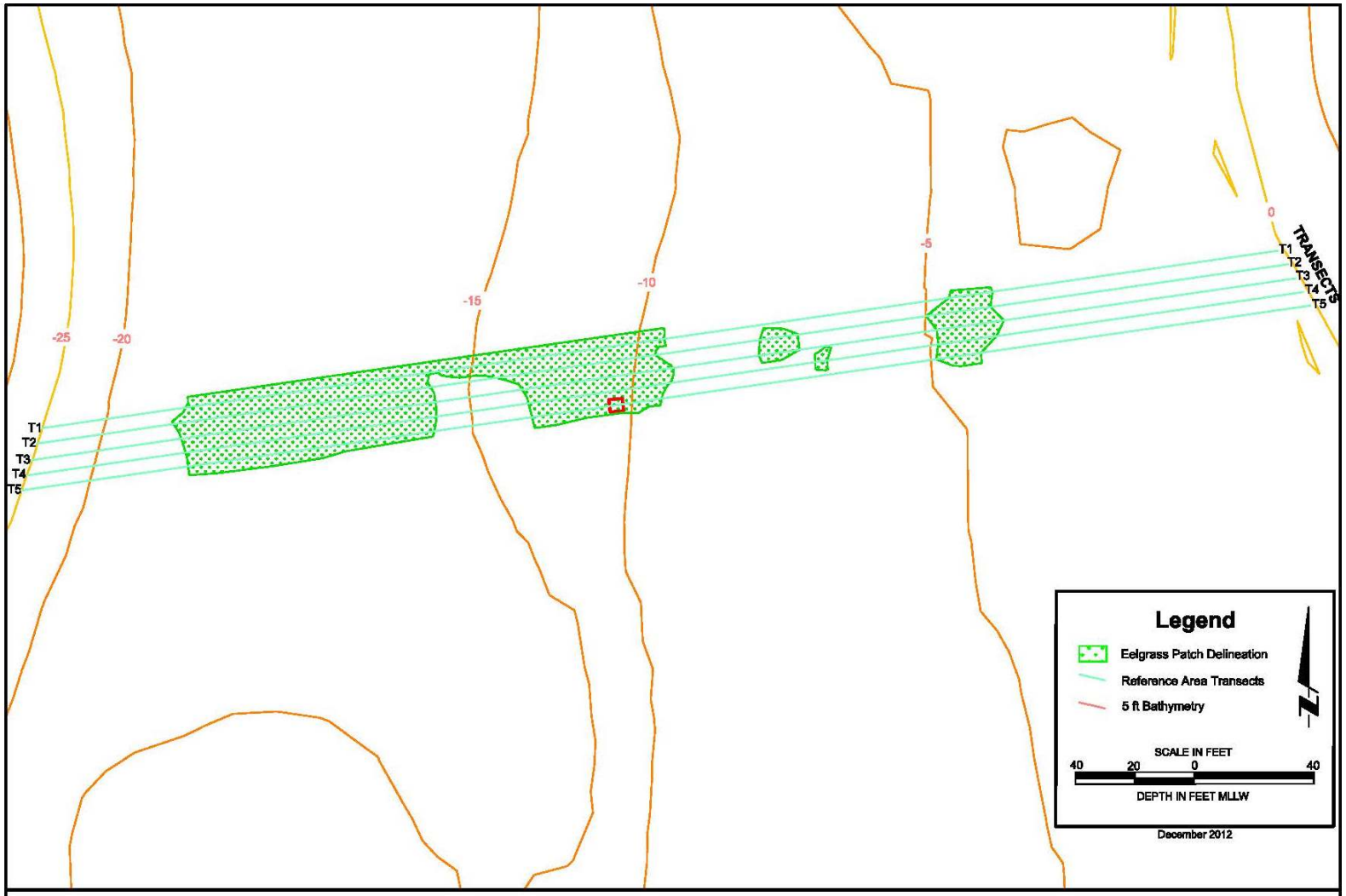

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FIGURE 6

REFERENCE AREA EELGRASS DELINEATION 2012 DATA

Chapter 3
Survey Results

3.1 Marine Outfall Corridor

3.1.1 Density of transplanted bands

Eelgrass was planted in May 2009 within the Outfall Corridor according to the Work Plan guidelines. Plants were placed in two distinct bands (A and B), replicating the approximate area of eelgrass in pre-construction conditions (King County 2009; Figures 3, 5 and 7). The bands were located between approximately -2 and -12 ft MLLW; band A was located within the 0 to -5 ft MLLW contours (between 50 and 70 ft on the Outfall Corridor transects) and band B between the -5 to -15 ft MLLW contours (between 100 and 140 ft on the Outfall Corridor transects). Eelgrass was planted at densities greater than those measured during pre-construction surveys in order to maximize the likelihood of transplant success. The number of individual plants placed into the Corridor in 2009 was approximated to be between 10,000 and 16,000.

During the September 2012 survey, the location of eelgrass corresponded closely to the two bands originally planted in 2009 (Figure 7). The density of band A in September 2012 was 205 shoots/m^2 (compared to 222 shoots/m^2 in 2011) and the density of band B was 86 shoots/m^2 (compared to 69 shoots/m^2 in 2011) (Figure 8).

3.1.2 Overall eelgrass density

In the Marine Outfall Corridor, 39 of the 105 samples (37 percent) included eelgrass (Table 3). Where present, average eelgrass density in this area was 145 shoots/m^2. Individual density measurements ranged from 1 to 331 shoots/m^2 (Figure 3). Across all sample points, including those where eelgrass was not present, eelgrass density in the outfall corridor was 54 shoots/m^2. Eelgrass was present only above -15 ft MLLW. The greatest average eelgrass density by elevation was 219 shoots/m^2 between 0 and -5 ft MLLW; greatest coverage (100 percent of sampled locations) occurred between -5 and -10 ft MLLW (Table 3). No rooted eelgrass was observed in the debris mat at the toe of the slope (-25 ft MLLW, 190 ft along transects) in the Marine Outfall Corridor.

Table 3. 2012 Eelgrass Observations by Elevation at Each Survey Area.

	Marine Outfall Corridor				Eelgrass Reference Area			
Elevation (ft below MLLW)	**Average shoots/m^2 eelgrass***	**n***	**Average shoots/m^2 entire sample****	**Samples****	**Average shoots/m^2 eelgrass***	**n***	**Average shoots/m^2 entire sample****	**Samples****
0 – 5	219	16	70	50	196	5	28	35
5 – 10	102	20	102	20	64	8	20	25
10 – 15	33	3	10	10	57	10	41	14
15 – 20	0	0	0	6	26	24	20	31
20 – 25	0	0	0	19	0	0	0	5
>25	--	--	--	--	0	0	0	10
All	145	39	54	105	57	47	22	120

* Based on observations with eelgrass (each observation is a density based on triplicate shoot counts)
** Based on all observations made at each elevation

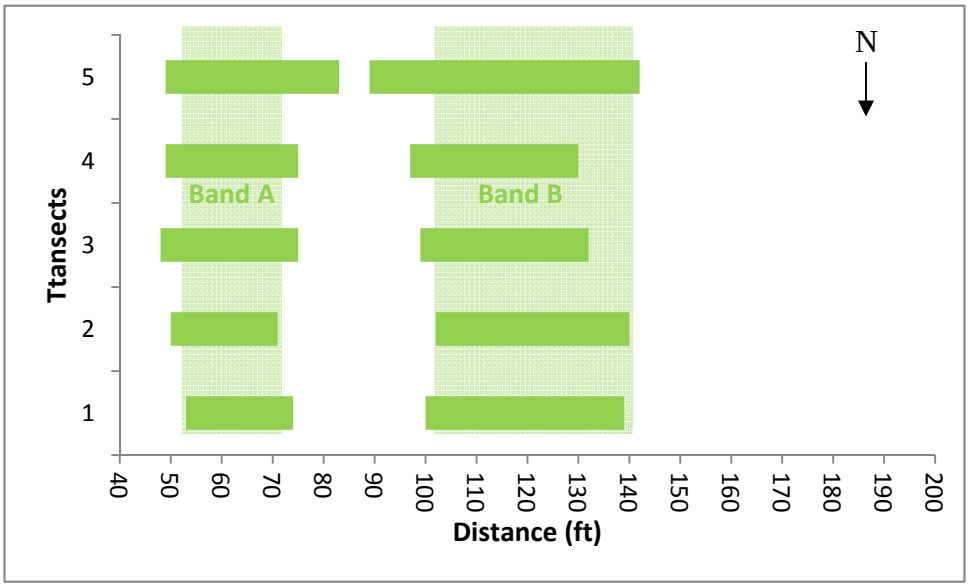


Figure 7. Eelgrass edge locations in the Outfall Corridor, September 2012 (dark green bands). For clarity, the shallowest portion of the corridor (0-40 ft distance), where no eelgrass was present, is not displayed on the figure. Light green shading indicates the locations of bands A and B which were transplanted in May of 2009.

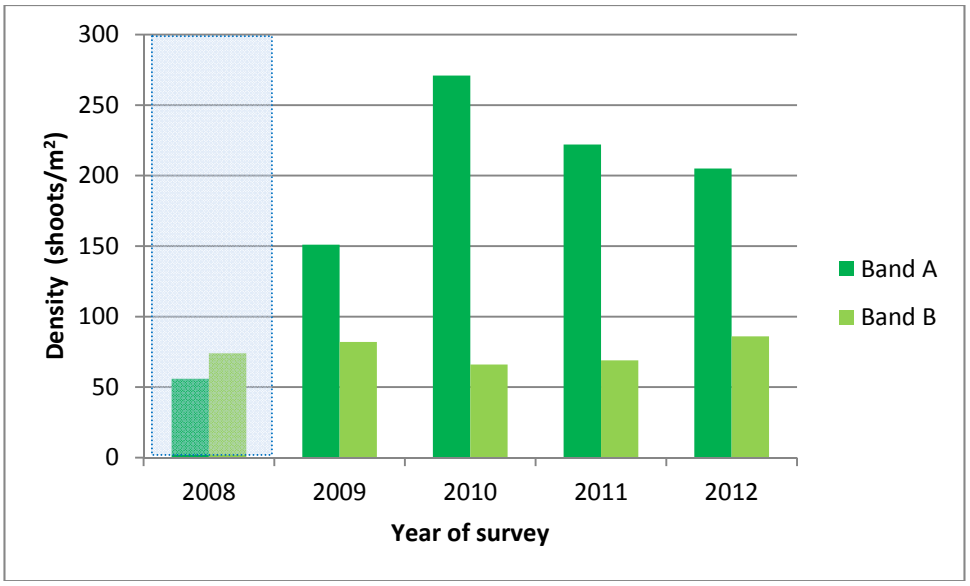


Figure 8. Mean density of eelgrass in bands A and B in the Outfall Corridor over time. Density measurements are based on all observations made in each band. The blue shading indicates pre-construction, pre-transplant eelgrass density data.

3.1.3 Areal coverage of eelgrass

As described in Section 2.2, areal coverage of eelgrass within the Outfall Corridor was delineated by divers starting in 2010. Inter-annual comparison of areal coverage within the Corridor is therefore only possible for post-construction years, and is presented in Table 4. Because the area transplanted with eelgrass is known, the 2009 areal coverage measurement could be extrapolated using the Corridor dimensions of band A (400 sq ft) and band B (800 sq ft). In 2012, eelgrass covered approximately 1,654 sq ft of the Corridor.

Table 4. Post-transplant Areal Coverage of Eelgrass for Each Survey Area.

	Marine Outfall Corridor		Eelgrass Reference Area	
Year	**Total areal coverage (sq ft)**	**% change**	**Total areal coverage (sq ft)**	**% change**
2009	1200*		*no data*	
2010	1962	+64%	6349	
2011	2171	+11%	4350	-31%
2012	1654	-31%	4265	-2%

* The 2009 areal coverage is equal to the total area planted with eelgrass in the spring of 2009.

3.1.4 Substrate and macroalgae cover

Patterns of substrate composition and algae coverage were similar on all five survey transects (Appendix A). Substrate was generally sandy for the extents of each transect, with some shell hash, gravel and cobble interspersed. Macroalgal coverage (which was primarily comprised of *Ulva* spp.) was not particularly diverse in comparison to earlier years' surveys. Macroalgae species presence in the Marine Outfall Corridor is presented in Table 5.

3.2 Eelgrass Reference Area

3.2.1 Eelgrass density

In the Eelgrass Reference Area, 47 of the 120 samples (39 percent) included eelgrass (Table 3). Where present, average eelgrass density in the Reference Area was 57 shoots/m^2 (Table 3). Across all sample points, including those where eelgrass was not present, eelgrass density in the Reference Area was 22 shoots/m^2 (Table 3). Individual density measurements ranged from 8 to 368 shoots/m^2 (Figure 4). Eelgrass was present between 100 ft and 400 ft on the transects (Figure 9). Greatest eelgrass density (where present) by elevation was 196 shoots/m^2 between 0 and -5 ft MLLW; greatest coverage (77 percent of sampled locations) occurred between -15 and -20 ft MLLW (Table 3). Similar to the 2011 survey results, a division between two main eelgrass bands was noted between approximately 130 and 160 ft on all transects (Figures 4, 6 and 9). A second division in the deeper band was observed on Transects 3-5 around 270 to 300 ft distance. This second, deeper division appeared in correlation with increased macroalgae coverage in an area where bathymetry changes quickly between -10 and -15 MLLW, before flattening out between -15 and -20 MLLW. Eelgrass along the Reference Area transects ended between 380 and 400 ft, just above -20 ft MLLW.

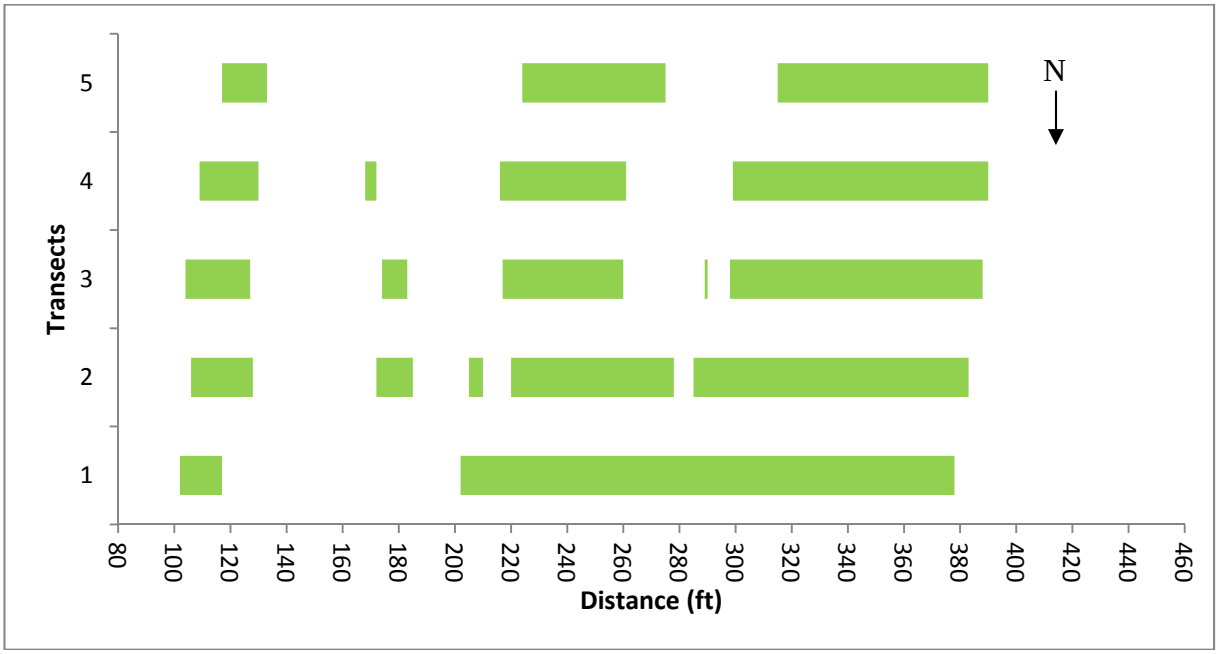


Figure 9. Eelgrass edge locations in the Reference Area, September 2012. For clarity, the shallowest portion of the transects (0-80 ft distance), where no eelgrass was present, is not displayed on the figure.

3.2.2 Areal coverage of eelgrass

As described in Section 2.2, areal coverage of eelgrass within the Reference Area was measured via visual delineation by divers starting in 2010. Between-year comparisons of areal coverage of eelgrass in the Reference Area is therefore only possible for 2010, 2011, and

2012 and is illustrated in Table 4. In 2012, 4,265 sq ft of the surveyed Reference Area was covered by eelgrass.

3.2.3 Substrate and macroalgae cover

Substrate in the Reference Area was generally coarser above -5 ft MLLW and was similar in composition along all five transects, starting with cobble and gravel substrates at the shallow end and transitioning to sandy substrate beyond 80 ft (Appendix A). Macroalgae species were observed in areas of coarse substrate in the shallow end of the survey area as well as on the slope or its toe between -10 and -15 ft MLLW (Table 5). Macroalgae composition in this area included large blades of *Saccharina latissima* (formerly *Laminaria* spp.) and a diverse assemblage of smaller species. *Ulva* spp. and *S. latissima* were also observed at all five depth bins within the Reference Area (Table 5).

Table 5. 2012 Macroalgae Species Observed at Each Survey Area.

Elevation (ft below MLLW)	Marine Outfall Corridor			Reference Area		
	Species	**n***	**Samples****	**Species**	**n***	**Samples****
0 – 5	*Ulva* spp. *Saccharina latissima*† *Smithora naiadum* *Gracilaria spp.*	21 5 8 1	50	*Ulva* spp. *Saccharina latissima*† Coralline algae *Gracilaria* spp. *Mazzaella splendens* *Desmarestia ligulata* *Sparlingia pertusa* *Porphyra perfoata* *Chondracanthus* spp.	25 9 4 3 2 1 1 1 1	35
5 – 10	*Ulva* spp. *Saccharina latissima*† *Smithora naiadium*	15 4 16	20	*Ulva* spp. *Saccharina latissima*† Smithora naidium	7 1 2	25
10 – 15	*Ulva* spp.	4	10	*Ulva* spp. *Gracilaria* spp. *Saccharina latissima*† *Porphyra perfoata* *Prionitis* spp.	14 6 5 1 1	14
15 – 20	*Ulva spp.* *Saccharina latissima*† *Smithora naiadium*	4 1 1	6	*Ulva* spp. *Ceramium* spp. *Gracilaria* spp. *Saccharina latissima*† *Fauchea* spp. *Porphyra* spp.	30 3 15 16 2 2	31
20 – 25	*Ulva* spp. *Smithora naiadium*	8 2	19	*Ulva* spp. *Saccharina latissima*†	2 2	5
>25	n/a			*Ulva* spp. *Saccharina latissima*†	4 2	10
All			105			120

* Number of sampling locations where each species was observed
** Total number of observations made at each elevation
† Formerly *Laminaria* spp.

Chapter 4
Discussion

4.1 Outfall Corridor and Reference Area Eelgrass

4.1.1 Density of eelgrass

In 2012, the overall average density of sample points with eelgrass in the Outfall Corridor decreased 14 percent than that recorded in 2011; however, average density is 36 percent greater compared to the 2009 post-transplant survey (King County 2010b). The biggest fluctuation in sample points with eelgrass occurred between 0-5 ft MLLW, which decreased 23 percent. No other depth bins showed significant change in density. Across all sample points, including those without eelgrass, the density of the Corridor in 2012 slightly decreased (53 shoots/m^2) compared to the same measurement in 2011 (57 shoots/m^2).

The eelgrass density in band A decreased by approximately 8 percent, while the density in band B increased approximately 25 percent. Compared to the survey completed within three months post-transplant in 2009, eelgrass in the Outfall Corridor increased slightly in average density in 2012 (King County 2010b).

As discussed, the density of eelgrass in the Outfall Corridor, across all sample points, was 54 shoots/m^2 in 2012. Extrapolated to cover the area of the entire Corridor (which is 4,000 ft^2, or 371.6 m^2 in size), an estimated 19,695 shoots of eelgrass were observed in total. Since between 10,000 and 16,000 shoots were planted post-construction, this indicates that planted eelgrass has not only survived but increased in total shoot number since planting.

Density of eelgrass shoots in the Reference Area decreased about 59 percent overall in 2012 compared to values reported in 2011 (Table 6). The number of samples with eelgrass along each sampling transect did not change greatly from 2011 to 2012, although Figure 9 indicates fewer contiguous eelgrass patches in the shallow half of the transects than were observed in previous surveys.

4.1.2 Areal coverage of eelgrass

In the Outfall Corridor, eelgrass plants were observed to cover almost all of bands A and B, and appeared to extend both between and outside of the planted areas (eelgrass appeared to be merging between the two bands along the southern edge of the Corridor on Transect 5). Changes in measured areal coverage of the Outfall Corridor indicate that the eelgrass has increased coverage since the transplant in 2009.

The shifts in percent areal coverage within the Corridor are not unexpected, based on the observed changes in eelgrass density and perceived distribution over the course of the seven-year study. Previous eelgrass studies have indicated a wide fluctuation in both density and areal coverage of eelgrass on an annual basis (Thom et al. 2003).

The elevation range at which eelgrass was observed in 2012 remained similar to that observed in previous years at both study sites (Table 6). No eelgrass was observed at a depth greater than -15 ft MLLW in the Outfall Corridor during the 2012 survey, which has been the case during every survey (pre- and post-construction) to date with the exception of 2010. The Reference Area did not appear to expand significantly shallower or deeper than in previous years' surveys.

In Puget Sound, eelgrass typically becomes light limited at around -7 m (-22.96 ft) relative to Mean Sea Level (MSL) (Thom et al. 1999), which is approximately -13.5 ft MLLW based on 9.47 ft MSL at Edmonds. A number of other factors contribute to the survival of eelgrass, including substrate, current, water quality, and light transmission. These conditions may affect local differences in eelgrass plant density as well as differences observed at sites throughout Puget Sound. Inter-annual variation in site conditions, including light availability, water temperature, and nutrients may have influenced the decreased densities observed at the Reference Area compared to previous years.

Table 6. Eelgrass Observations by Elevation at Each Survey Area in 2004, 2006, 2008, 2009, 2010, 2011, and 2012.

	Marine Outfall Corridor		Eelgrass Reference Area	
Elevation (ft below MLLW)	**Average shoots/m^2**	**n***	**Average shoots/m^2**	**n***
2004				
0 – 5	26	9	18	3
5 – 10	29	10	52	11
10 – 15	20	4	29	12
15 – 20	3	1	23	24
20 – 25	7	4	0	0
All	23	28	30	50
2006				
0 – 5	63	9	62	4
5 – 10	59	14	91	11
10 – 15	33	5	35	12
15 – 20	0	0	35	24
20 – 25	0	0	0	0
>25	--	--	0	0
All	55	28	30	50
2008				
0 – 5	73	12	84	3
5 – 10	108	16	68	14
10 – 15	24	5	25	14
15 – 20	0	0	22	24
20 – 25	0	0	0	0
>25	--	--	0	0
All	80	33	38	55
2009				
0 – 5	143	17	398	5
5 – 10	90	20	288	17
10 – 15	50	5	91	13
15 – 20	0	0	52	25
20 – 25	0	0	0	0
>25	--	--	--**	--**
All	107	42	156	60

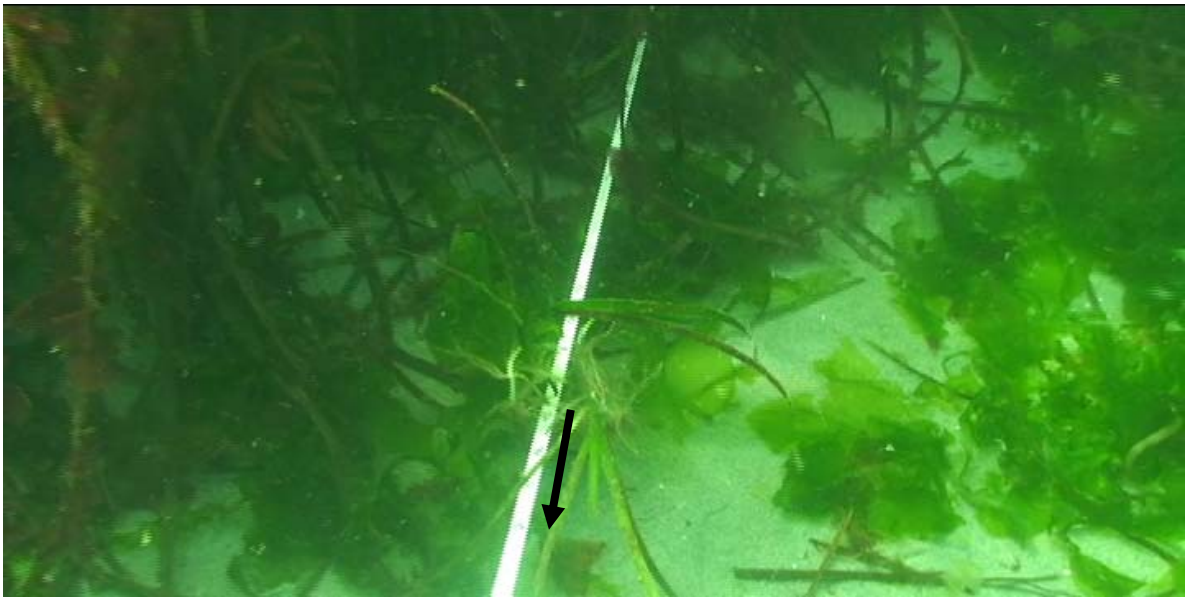
Table 6 Continued.

Elevation (ft below MLLW)	Marine Outfall Corridor Average shoots/m^2	Marine Outfall Corridor n*	Eelgrass Reference Area Average shoots/m^2	Eelgrass Reference Area n*
2010				
0 – 5	247	19	299	8
5 – 10	79	20	233	18
10 – 15	19	3	62	11
15 – 20	16	1	30	26
20 – 25	0	0	0	0
>25	--	--	0	0
All	148	43	128	63
2011				
0 – 5	283	15	406	6
5 – 10	95	17	106	8
10 – 15	23	5	76	9
15 – 20	0	0	29	26
20 – 25	0	0	0	0
>25	--	--	0	0
All	169	37	97	49
2012				
0-5	219	16	196	5
5-10	102	20	64	8
10-15	33	3	57	10
15-20	0	0	26	24
20-25	0	0	0	0
>25	--	--	0	0
All	145	39	57	47

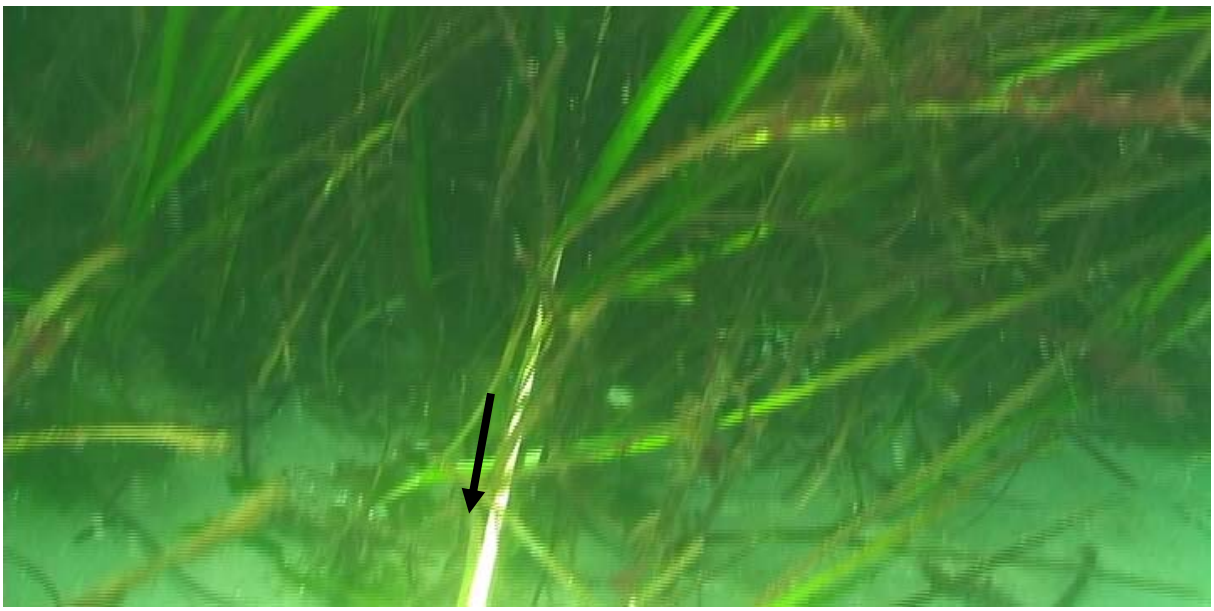
* Number of observations with eelgrass (each observation is a density based on triplicate shoot counts)
**This section of the Reference Area transects was not surveyed in 2009

4.2 Photographs

The following photographs, captured from stills of underwater video, were taken by divers within the Marine Outfall Corridor during the September 2012 survey.



Photograph 1. Transect 1 at 53 ft. Black arrow indicates direction of shore.



Photograph 2. Transect 2 at approximately 50 ft. Black arrow indicates direction of shore.

Photograph 3. Transect 3 at approximately 48 ft. Black arrow indicates direction of shore.

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