METRO North Beach Mitigation Plan and Specifications Document

Prepared for **METRO**

January 1991

Prepared by:
Parametrix, Inc.
Bellevue, WA

METRO NORTH BEACH
MITIGATION PLAN

Prepared for

METRO, Seattle
821 2nd Avenue
Seattle, WA 98104

Prepared by

PARAMETRIX, INC.
13020 Northup Way
Bellevue, WA 98005

January 1991

TABLE OF CONTENTS

Page

1. INTRODUCTION 1
   1.1 PROJECT DESCRIPTION 1
   1.2 AFFECTED HABITATS AT NORTH BEACH 2
   1.3 MITIGATION GOALS 3

2. LOCATION AND OPERATION OF THE PBF 4
   2.1 LOCATION OF THE PBF 4
   2.2 OPERATION OF THE PBF 4

3. INTERIM EELGRASS HABITAT AT NORTH BEACH 6
   3.1 SUMMARY OF TRANSPLANT PLAN FOR THE INTERIM EELGRASS HABITAT 6
      3.1.1 Site Selection 6
      3.1.2 Transplant Design and Specifications 8
   3.2 MONITORING OF THE INTERIM EELGRASS HABITAT 9

4. OPERATIONAL MONITORING PROGRAM 11
   4.1 OPERATIONAL EELGRASS MONITORING PROGRAM 11
   4.2 OPERATIONAL EPIBENTHIC MONITORING PROGRAM 13
      4.2.1 Sample Collection and Initial Sorting 13
      4.2.2 Statistical Testing of Transect Data 15
   4.3 HABITAT ASSESSMENT CRITERIA 16
   4.4 INDEPENDENT IMPACT EVENT SAMPLING 18

5. HABITAT REPLACEMENT AFTER REMOVAL OF THE PBF 19

6. CONTINGENCY MITIGATION PLAN 20

7. SUMMARY 21

REFERENCES 24

APPENDIX A CONSTRUCTION DOCK – OPERATIONAL PLAN

LIST OF FIGURES

Page

Figure 1. Location of the proposed barging facility at North Beach, Metro West Point 5

Figure 2. Location of the proposed transplant site at North Beach, Metro West Point 7

Figure 3. Survey transect stakes for the marine environmental study at North Beach, Metro West Point 12

Figure 4. Flow diagram for eelgrass monitoring at North Beach 22

Figure 5. Timeline for eelgrass mitigation at North Beach 23

LIST OF TABLES

Page

Table 1. Key epibenthos prey species as identified by U.S. Fish and Wildlife and Washington Department of Fisheries 14

Table 2. Statistical analysis matrix for epibenthos monitoring at Metro North Beach 17

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The Municipality of Metropolitan Seattle (Metro) is required under a court-ordered consent decree with the Washington State Department of Ecology (Ecology) to upgrade the West Point Sewage Treatment Facility from primary to secondary sewage treatment. As part of the construction plan, Metro intends to construct a temporary barging facility on the North Beach of West Point to move construction materials to and from the site. This facility is expected to be put in place in early 1991 and to be removed by 1998. To construct this proposed barging facility (PBF), Metro requires a Section 10 permit from the U.S. Army Corps of Engineers (Corps).

The marine environment off of North Beach is known to be an important habitat to many recreational and commercially important fish and shellfish species. Certain state and federal agencies that review Section 10 permits have raised concerns regarding the PBF. These agencies include U.S. Fish and Wildlife (USFW), U.S. Environmental Protection Agency (EPA), Ecology, Washington Department of Fisheries (WDF), and Washington Department of Natural Resources (DNR). These agencies require that Metro accomplish three general objectives before giving their consent for the Section 10 permit. These objectives are as follows:

1. Metro must document the North Beach marine habitat and its use by important species.

2. Metro must address the probable impacts to the marine habitat and species caused by the PBF.

3. Metro must develop a suitable and acceptable plan to mitigate those probable impacts.

The first two objectives have been addressed in a document entitled *North Beach Marine Environmental Study*, which was submitted to all the concerned regulatory agencies.

Metro and its consultants have determined that construction and operation of the PBF will result in the unavoidable, but temporary, loss of 0.05 acres of eelgrass habitat within the construction zone of the PBF. This document presents a multi-level approach to mitigate the loss of the eelgrass habitat at North Beach due to construction-related impacts. This approach includes replacement of the habitat directly impacted by the PBF, monitoring for further impacts to habitats proximal to those which are directly impacted, establishment of thresholds for further mitigation, restoration of impacted habitat to the original condition once the PBF is removed at the end of construction, and a contingency mitigation plan.

1.2 AFFECTED HABITATS AT NORTH BEACH

Parametrix studied the project site to delineate vegetative, benthic, and fish communities from West Point to the end of Metro property at North Beach. The resulting document, *North Beach Marine Environmental Study* (hereinafter called the *Environmental Study*), addressed the following issues:

- **Marine Vegetation.** Aerial mapping of the eelgrass (*Zostera marina*) beds from West Point to Shilshole was conducted in the summer of 1990. The entire area of eelgrass identified in that study was approximately 58 acres. The PBF would directly affect only 0.05 acres of eelgrass, which accounts for only 0.09% of the total eelgrass habitat at North Beach. Diver surveys were also conducted to establish baseline plant density data on selected key transects near the PBF for further monitoring. Additional surveys were conducted in December, 1990.

- **Nearshore Fish Use.** Weekly beach seines conducted at North Beach in April, May, June, and August 1990 documented the use of those habitats by outmigrating juvenile salmonids and recreational and commercially important non-salmonid fish. Fish stomach contents were also analyzed to help determine where fish were feeding at North Beach.

- **Epibenthic and Benthic Infaunal Analyses.** Samples were collected in spring and summer 1990 to establish baseline data on epibenthic ("living upon" the substrate) and benthic infaunal ("living within" the substrate) organisms at North Beach. Both epibenthic and benthic infaunal organisms are food for juvenile fish at North Beach.

- **Macroinvertebrate Use.** Divers conducted surveys to quantitatively determine what important crab or clam species were found at North Beach. Divers swam identified transects, and counted the number of Dungeness and rock crabs, geoducks, and horse clams they encountered. At the PBF site, very few of these species were found.

The *Environmental Study* identified three zones of possible impact at North Beach (Figure 1). These are:

- Zone 1. The area within the footprint of or immediately proximal to the PBF. This zone begins at the tip of West Point and ends at transect station W9 (see Figure 3), 200 ft east of the PBF. Transect stations R1, B1, and W1 - W9 are in Zone 1. It is anticipated that the region will most likely experience measurable adverse effects from the PBF.

- Zone 2. The region beginning east of transect station W9, and extending 800 ft eastward. Transect stations P1 and P2 are in Zone 2. Zone 2 is sufficiently far from the PBF that direct impacts from the PBF are unlikely. However, this region will be monitored closely to measure for long-term or operation impacts.

- Zone 3. Zone 3 begins east of Zone 2, and was not given an easternmost boundary. Zone 3 has been designated as a reference area by which to measure natural variations in the marine environment. A single transect, R2 is set in Zone 3.

As noted in the *Environmental Study*, the PBF will result in the unavoidable loss of 0.05 acres of eelgrass directly under the construction footprint of the PBF. Implementation of the proposed mitigation plan described herein will compensate for this loss of eelgrass habitat through replacement by transplant.

1.3 MITIGATION GOALS

Metro's objective in this habitat mitigation plan is to ensure that an alternative eelgrass habitat is provided during construction and use of the PBF, and that there is no net loss of eelgrass habitat (value and function) after the temporary PBF is removed. To meet this objective, the mitigation plan proposes the following specific goals:

1. Establish substantive environmental baseline data from which to (1) locate the PBF in the area of least impact, (2) craft an adequate compensatory replacement plan, and (3) monitor PBF operation impacts.

2. Locate the PBF in the area of least impact, and provide stringent operational guidelines to minimize any additional impacts.

3. Create and maintain an alternative eelgrass habitat at North Beach to compensate for the temporary loss of habitat caused by the PBF.

4. Establish an operational monitoring program at North Beach to determine further impacts to eelgrass and epibenthos caused by PBF operations.

5. Establish specific criteria for interpreting the operational monitoring data, and for determining if additional negative impacts have occurred as a result of PBF operation.

6. Provide a compensatory restoration program that will ensure there is no net loss of eelgrass from the project site after the PBF is removed.

7. Develop a contingency mitigation plan that will be implemented should all habitat replacement efforts at North Beach prove unsuccessful.

The first specific goal has been met, and is the subject of the *Environmental Study*. The remainder of this document addresses the additional mitigation goals set by Metro.

2. LOCATION AND OPERATION OF THE PBF

2.1 LOCATION OF THE PBF

Metro addressed the use of a temporary barging facility as an alternative for moving materials to and from the West Point site in its *SEPA Final Supplemental Environmental Impact Statement* (FSEIS) (Metro 1988). Based on the FSEIS, Metro determined that barging some construction materials to and from the West Point site was a preferred alternative to moving all construction materials by truck through Discovery Park. The potential for disrupting nesting bald eagles, impacts to Discovery Park use, and the number of truck trips through the neighboring Magnolia community were all important reasons in determining that barging some construction materials was preferable to moving all construction materials through Discovery Park.

Metro reviewed a number of alternative designs and locations for the barging facility before submitting the selected alternative to the Corps with the Section 10 permit application in April 1990 (Figure 1). Of all the locations that were considered by Metro, the proposed location of the PBF is not optimum for construction operations. However, Metro recognized the concerns of the regulatory agencies and Native American tribes, and chose the current location to minimize the impact of the construction footprint on North Beach eelgrass and tribal fishing activities.

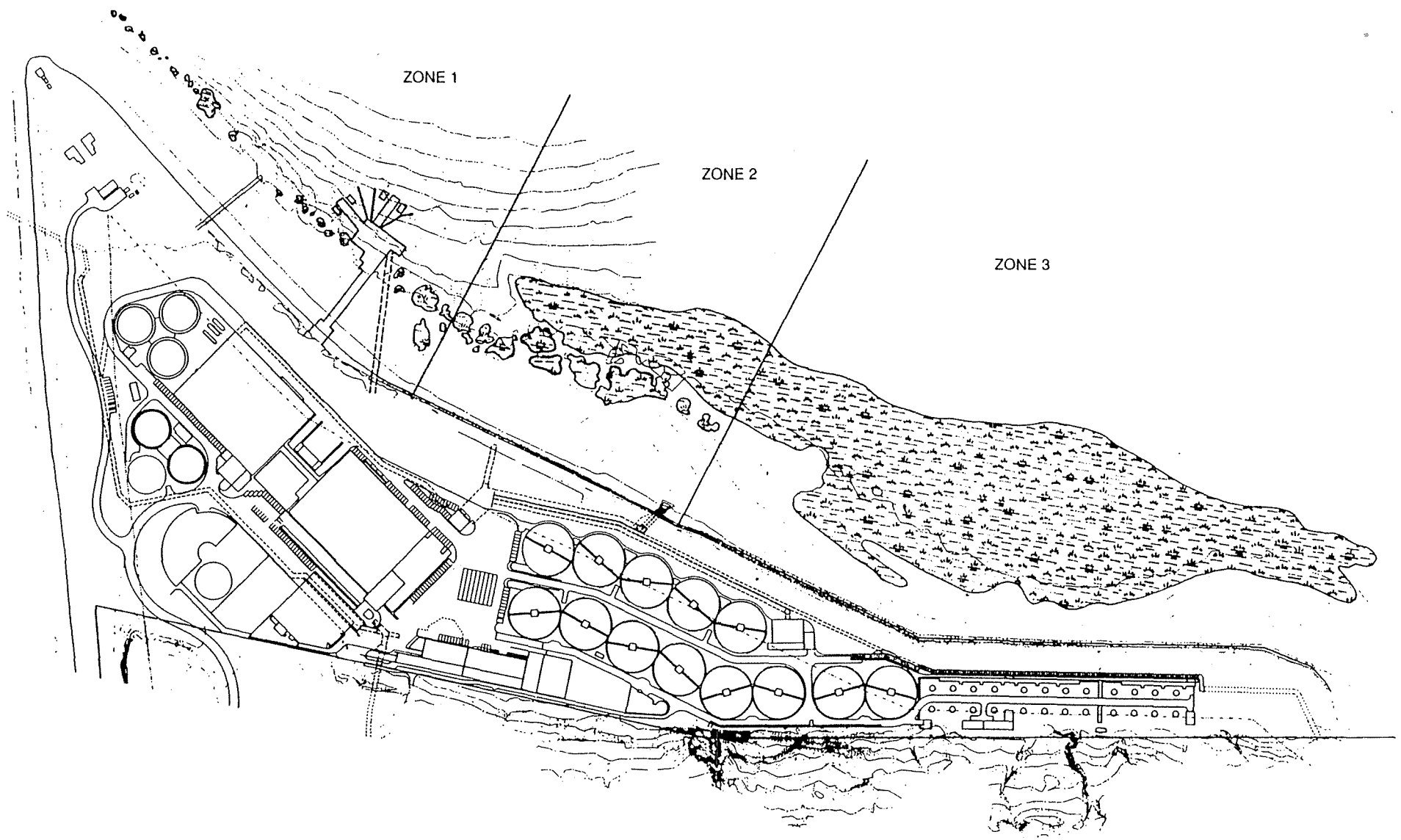
The first objective of any mitigation plan is to avoid or minimize to the extent possible any adverse impacts. The *Environmental Study* confirmed that the proposed location would have the least impact on offshore communities. In addition, Metro's commitment to remove the PBF at the end of West Point construction, as well as removal of the existing pier at North Beach, will avoid any long-term removal of marine habitat at North Beach.

2.2 OPERATION OF THE PBF

Metro has designed an operation plan for the facility. This plan will ensure that PBF operations will not result in further habitat destruction. That document is provided in Appendix A, and is not discussed further here.

Should an accidental event involving a sizeable spill of petroleum occur from use of the barge facility, a complete eelgrass, epibenthic and benthic survey will be conducted within 30 days of the event. These data will be compared to both the baseline and reference data to determine if any measurable adverse impacts have occurred as a result of the event.

In the event that any measurable adverse impacts have occurred as a result of the event, Metro will consult with the resource agencies to determine the appropriate steps to be taken.



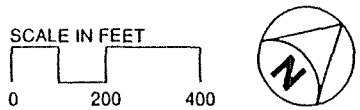


Figure 1.
Location of the proposed barging facility at North Beach, Metro West Point.

3. INTERIM EELGRASS HABITAT AT NORTH BEACH

The review of the eelgrass habitat at North Beach in the *Environmental Study* documented a combined area of 2,204 ft^2 (0.05 acres) of eelgrass that will likely be affected by building the PBF. Metro is committed to providing compensatory alternative habitat for this loss during PBF operations (hereinafter called the interim eelgrass habitat). Metro's interim eelgrass habitat mitigation program will consist of transplanting and monitoring a single 10,315-ft^2 area of eelgrass at North Beach. If highly successful, this program will result in a net gain of eelgrass at North Beach at the end of construction.

3.1 SUMMARY OF TRANSPLANT PLAN FOR THE INTERIM EELGRASS HABITAT

The selection of the transplant plots and the transplant design and specifications for the interim eelgrass habitat are discussed below.

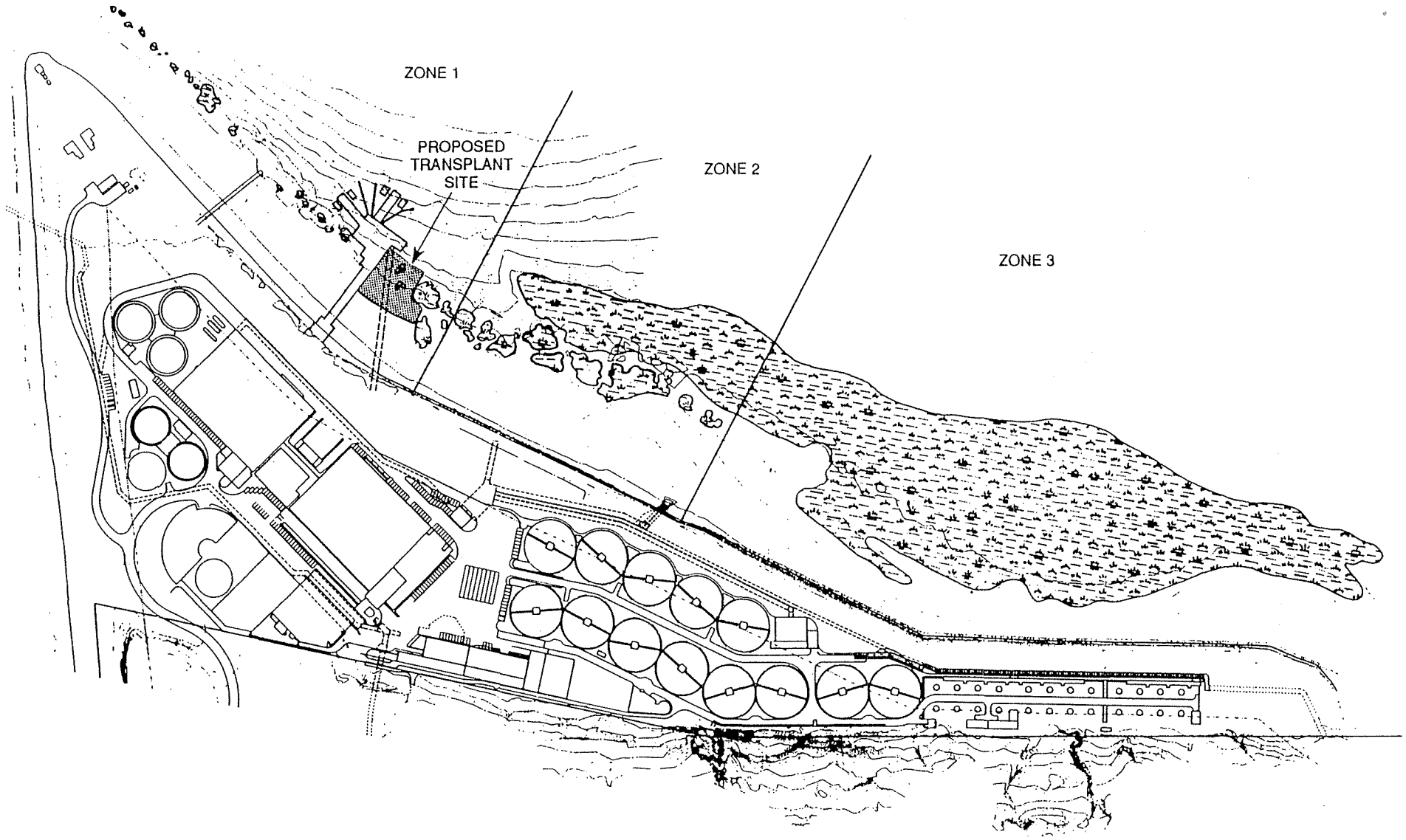
3.1.1 Site Selection

The proposed site for the interim eelgrass habitat is shown in Figure 2. Selection of a suitable plot for transplanting and maintaining an interim eelgrass plot at North Beach is difficult due to the dense and luxurious coverage all the way to Shilshole. To develop a successful transplant program, a minimum transplant ratio is 2:1 (two transplant units for each mitigation unit), and an optimum ratio is 4:1 (Phillips personal communication 1990). After careful review of North Beach, there appears to be a suitable plot currently not occupied by eelgrass growth. This plot has an area of roughly 13,700 ft^2, which will allow for a 4:1 (8,816 ft^2) transplant ratio, and 1,499 ft^2 to allow for expected losses under the footprint of the conveyor.

Site selection criteria, as described by Merkel and Hoffman (1990), were applied to the proposed transplant plot. These include the following:

- **Areas Lacking Eelgrass.** While the proposed plot is currently devoid of eelgrass to the mean lower low water (MLLW = 0.0 tide level), there is extensive eelgrass to the MLLW bordering the site. As noted in the *Environmental Study*, eelgrass is only a recent colonizer of North Beach; bull kelp (*Nereocystis lutkeana*) predominated the site as late as the late 1970s. At that time, eelgrass may not have yet expanded into that area.

- **Depth Range.** The proposed site was selected based on examination of nearby bed bathymetry. The depth range is suitable for good growth.



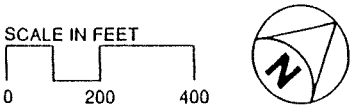


Figure 2.
Location of the proposed transplant site at North Beach, Metro West Point.

- **High Currents.** High currents and storms are common reasons for eelgrass transplant failures. The longshore current at North Beach runs west toward West Point. The PBF will act as a breakwater against the predominant winter storms (from the southwest), which will in turn protect the initial transplants.

- **Low Currents.** As noted above, the longshore current should not be impeded by the presence of the PBF.

- **Slopes/Unstable or Unsuitable Sediments.** The slope and sediment composition is identical to that found at nearby dense eelgrass patches.

Based on current information and predictions concerning the PBF's impact on waves and currents, the proposed transplant site appears to be suitable.

3.1.2 Transplant Design and Specifications

The exact planting design criteria and specifications for the interim eelgrass habitat are under development. A detailed set of plans and planting specifications, hereafter called the *Specifications,* will be submitted to the Corps and appropriate resource agencies for their review before beginning the transplant program. The objective will be to optimize the plant coverage over the 10,315 ft^2. The following is a general discussion of the issues that will be resolved and placed in the *Specifications*:

- **Timing of the Transplant.** The current construction schedule for the PBF is to begin in June 1991. Due to the proximity of the interim habitat to the PBF, transplanting will not occur until after all the support pilings have been put into place. This decision is based on the concern that the pile placement efforts could "silt in" the newly transplanted site. In addition, postponing the transplant until after the PBF piles are driven will allow the site to be protected from southwesterly winter storms. If construction of the PBF is delayed beyond the 1990-1991 winter, transplanting will occur in the winter of 1991-1992.

- **Source of Transplant Stock.** There is a good probability that some of the eelgrass within the area of the PBF will continue to survive and grow. As such, Metro has elected to not take donor plugs for transplanting from those patches. Transplant stock will most likely come from the extensive Zone 3 bed east of the transplant site. Careful extraction of the material from the donor bed will not cause any net loss of eelgrass after one year (Phillips, 1980; Walton and Wert, 1989; Merkel, 1990). Transplant stock within the donor bed will be selected for use in either subtidal or intertidal plantings. The lower edge of the intertidal zone is -3.7 ft MLLW. Plants salvaged above the -3.7 ft MLLW mark will be used in intertidal plantings; below, will be subtidal.

- **Transplant Method.** There are currently two principal methods used for transplanting eelgrass: the bare-root method (Fonseca et al., 1982), and the sediment plug method (Phillips, 1980). Both methods have demonstrated success. However, in a recent review, a modified bare-root method was found to offer advantages over sediment plugs (Merkel, 1990). These have included operational efficiencies, reduction in donor bed damage, and better transplant success rates. The transplant method includes a mixture of both planting types to ensure optimum success. Planting methods will be detailed in the *Specifications*.

- **Plant Spacing.** Spacing of the bare-root units and sediment plugs will be on 2 ft centers along 57 parallel rows extending eastward from the wharf. A small test area will contain similar planting units on alternating 1 ft and 3 ft centers.

3.2 MONITORING OF THE INTERIM EELGRASS HABITAT

For the first year after the transplants, divers will monitor the transplant site quarterly. For the remainder of the PBF operation, monitoring will decrease to twice annually in July and December. Diver transects will be established through the transplant site. Immediately following the transplant, a baseline survey will be conducted to determine the number of turions per quadrat every 10 m. In the following monitoring periods, divers will swim the same transects and again conduct turion counts.

A select number of the transplant donor sites will also be monitored to confirm that no damage has occurred as a result of the plug donation. Three, $1m^2$ sites will be marked off within the donor bed (#35) using PVC stakes driven into the sediment. Immediately before, and then after, plant removal, turion counts will be taken. Thereafter, those sites will be re-counted during the scheduled monitored events, until such time as the pre-harvest densities are achieved.

Once per year (July) throughout the operation of the PBF, aerial photographs will be taken of the entire marine habitat at North Beach. Immediately following the transplant, a baseline photo will be taken by which to measure future gains or losses. In subsequent photographs, the area covered by eelgrass in the transplant unit will be determined.

To determine if the transplant plot is functionally equivalent to the naturally occurring beds, epibenthic samples will be collected in Years 2 and 5 post-transplant. Samples will be collected once per month in April, May, June, and August as part of the concurrent operational monitoring program. Species will be sorted, identified, numbered, and then analyzed as defined in Section 4.2.

Metro is committed to maintaining this habitat throughout use of the PBF. To determine whether additional transplanting is necessary during PBF operation, the following threshold criteria have been established:

- Maintain a minimum of 2,204 ft^2 of eelgrass within the transplant plot.

- Maintain turion densities within the transplant plot equivalent to reference area densities.

- Maintain eelgrass that has healthy, actively growing leaves and flowers within the transplant plot.

Unless a significant die-off of eelgrass at the interim habitat is noted, these threshold criteria will not be applied until the second summer after transplant to allow for a sufficient amount of time for the eelgrass to become established. Thereafter, threshold criteria will be applied annually, in August after review of the year's monitoring program.

Epibenthos data will be examined to determine if the plots are functionally equivalent to the natural beds. Methods for conducting those analyses are discussed in Section 4.2. Those data will not be used to determine if additional transplants are necessary during PBF operation; they will be used solely to determine if a functionally equivalent habitat has been created.

If all of the threshold criteria are not met, Metro will review the program with the resource agencies, and where possible determine what factors led to the decline in eelgrass, and attempt a second transplant into the site. A second failure to meet all the threshold criteria at the transplant site will trigger further consultations between Metro and the resource agencies as to the appropriate course of action. If recommended by the agencies, Metro is committed to attempting a third transplant.

Any additional square footage gained from the interim eelgrass habitat, or from eelgrass habitat still underneath the PBF, will be considered additive and applicable against any other losses that may occur to eelgrass at North Beach due to PBF construction and operation.

Monitoring reports will be issued within 60 days after sampling to the appropriate resource agencies, except in Years 2 and 5 when epibenthic analysis will require a longer time lag.

4. OPERATIONAL MONITORING PROGRAM

While the immediate effects of the PBF are known, the longer-term effects to the marine habitat caused by the presence and operation of the facility are difficult to predict. Factors such as current alterations, interruption of longshore sediment transport, and impacts caused by operation of tugs and barges at the facility may result in adverse impacts to the remaining habitat at North Beach. Therefore, a close monitoring program is necessary to provide early information regarding any further habitat degradation. This section will describe the proposed operational monitoring program and the methods for determining if any further statistically significant impacts are occurring in the area of North Beach outside of the location of the PBF.

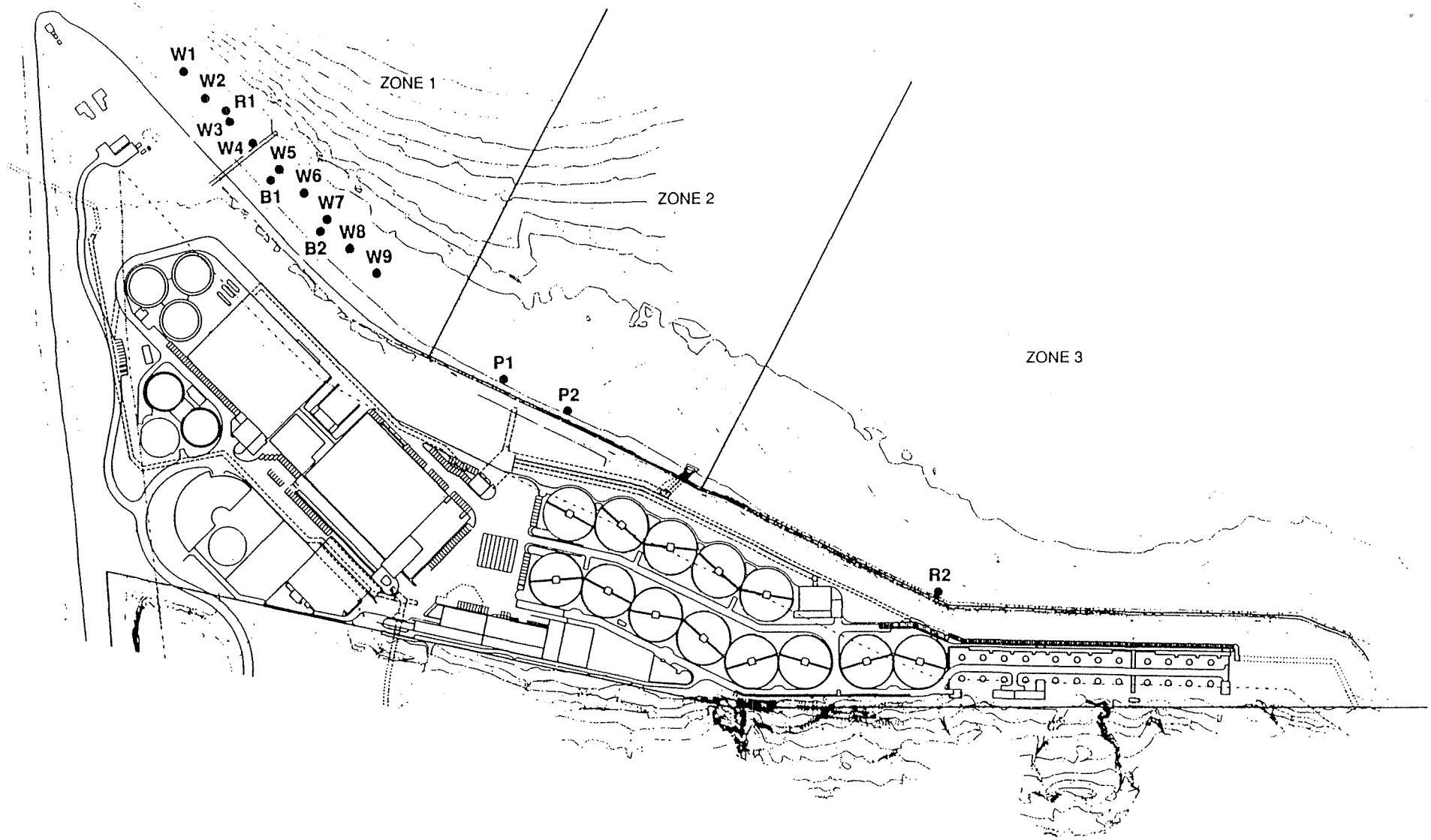
4.1 OPERATIONAL EELGRASS MONITORING PROGRAM

Throughout PBF operations at North Beach, regular diver surveys will be conducted at five of the preconstruction transects. Transects W1, W3, P1, P2, and R2 (Figure 3) will be monitored bimonthly in the first six months after construction, quarterly for the next 18 months, and then twice annually (July and December) for the remainder of the construction period. Divers will record turion density, as was done in the preconstruction surveys. Station R2 is believed to be sufficiently far away from the PBF to act as a suitable reference transect by which to compare the remaining stations.

It is possible that eelgrass will continue to grow within the construction footprint of the PBF. If this happens, additional transects will be added under the barge dock footprint as necessary to the diver survey.

Aerial photos will be taken once a year in July to monitor the coverage of all eelgrass beds at North Beach. The area coverage will be digitized and compared to the baseline photos. For each photo period, the digitized areas will be ground-truthed by divers measuring the circumference of several prespecified eelgrass patches. The digitized area calculations will then be compared to the actual measurements to determine if discrepancies exist. If necessary, the digitized area calculations will be adjusted based on the difference between field and computer-measured areas.

Data analysis will consist of comparing the turion density data to baseline density data using a one-way analysis of variance (ANOVA). If a statistically significant decrease in density is noted, the reference area data will be examined to determine if a decrease also occurred in the reference area, and if so, the proportional decrease relative to the baseline will be calculated. This proportional value will then be applied to the test transect data, and the statistical analysis reconducted. For example, if the reference area showed a 30% decrease in turion density relative to the baseline densities, the test transect data would be scaled by 30% and the statistical analysis reconducted.



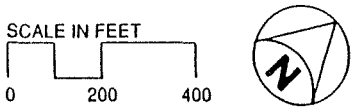


Figure 3.
Survey transect stakes for the marine environmental study at North Beach, Metro West Point.

The aerial coverage data will be analyzed by comparing the computed area for each numbered bed in the *Environmental Study* to the baseline areas using a paired two-tail *t*-test. If a statistically significant decrease is noted, the same procedures for comparing the data with the reference area described above will be followed. An alpha (α) level of 0.1 will be used for each analysis.

4.2 OPERATIONAL EPIBENTHIC MONITORING PROGRAM

An epibenthic monitoring program will be conducted to determine if PBF operations alter the value and function of the eelgrass habitat at North Beach. The resource agencies have identified "value and function" as density of known prey epibenthos species for juvenile salmon and other economically important non-salmonid species . This analysis will then statistically compare those key species identified in Table 1 to the numbers found in the baseline (*Environmental Study*) assessment.

4.2.1 Sample Collection and Initial Sorting

The epibenthic monitoring program will be conducted during Years 2 and 5 of the operation of the PBF, using the transects and techniques defined in the *Environmental Study*. This will include monitoring of the epibenthos underneath the PBF. Transects R1, B1, P1, and R2 (see Figure 3) will be sampled once in April, May, June, and August at +2 MLLW and -2 MLLW. All sampling will be conducted during the lowest tide sequence of the month, as close to the date of the baseline sampling as possible. Sampling underneath the PBF is included because some epibenthic organisms will continue to use that habitat during facility operations.

All epibenthic organisms will be sorted, identified to the lowest possible taxonomic level, and numbered. However, for statistical comparisons, the analysis will focus on only those species identified as preferred prey taxa (see Table 1). This list represents a composite of preferred prey taxa lists from WDF and USFW. It also includes species found both in the North Beach epibenthos sampling and in salmonid stomachs during baseline sampling.

For subsequent statistical analysis, the preferred prey species are combined into groups based on the phylogenetic relationships recommended by WDF. For the analysis, all individual species data within each group are pooled to yield a single number. For example, in Group 1 the total number of *Harpacticus, Tisbe, Zaus,* and *Ectinosoma* will be combined for each replicate at a specific transect station and tidal height.

Table 1. Key epibenthos prey species as identified by U.S. Fish and Wildlife and Washington Department of Fisheries.

Group 1: Harpacticoida		
Harpacticus spp.	*Ectinosoma* spp.[1]	
Tisbe spp.		
Zaus spp.		
Group 2: Amphipoda		
Corophium spp.	*Photis* spp.	*Pontogeneia* spp.
Aoroides spp.	*Paramoera* spp.	*Hyale* spp.
Ischyrocerus spp.	*Eogammerus* spp.	*Allorchestes angusta*
Anisogammarus spp.	*Parapleustes* spp.	*Calliopius* spp.
Paracalliopiella spp.		
Group 3: Isopoda, Tanaidacea, and Cumacea		
Isopoda		
Gnorimosphaeroma spp.		
Tanaidacea		
Leptochelia spp.		
Cumacea		
Cumella spp.		
Group 4: Diptera		
Chironomidae (only larval or pupal stages of epibenthic species)		

While Table 1 represents the best knowledge to date concerning key prey species, other species may be added or excluded at a later date in consultation with Metro and the resource agencies.

[1]For August sampling only.

4.2.2 Statistical Testing of Transect Data

The analysis is conducted to determine if there are any statistically detectable differences between test transects and the baseline data for group species densities. Thus, the following null hypothesis will be tested for each group, station, and month that samples are collected:

- H_0: A statistical difference cannot be detected between a transect station in the current monitoring period and its baseline data for group species densities.

- H_A: A statistical difference can be detected between a transect station in the current monitoring period and its baseline data for group species densities.

- $\alpha = 0.10$

Prior to conducting the analysis, it will be important to determine if a parametric or nonparametric statistical test will be used. To use a parametric statistical test, the data must be normally distributed and be homoscedastic. To test the normality of the data, a "Goodness of Fit" test will be conducted (Zar 1984). To determine whether the data are homoscedastic, Bartlett's test for homogeneity of variance will be applied to the data (Zar 1984). If the data are found to be normal and homoscedastic, the parametric ANOVA test will be used to determine if there are differences between that test transect data and the baseline data. If the data are not found to be normal or homoscedastic, the data set will be examined to determine whether an appropriate data transformation can be used to meet the conditions for parametric analysis. The most commonly used transformations for these types of data are either the natural logarithmic transformation, or the $\log_{10}(x + 1)$ (Zar 1984). If the data are homoscedastic after transformation, an ANOVA will be used. If not, a nonparametric Kruskal-Wallis test will be used for comparing stations to baseline data.

Epibenthic zooplankton data are highly variable, and often contain outlier data points; that is, a single species at any given station in the samples may be incidentally high or low. In statistical analysis, this can often lead to misinterpretation of the data. In the North Beach analysis, all data will be initially screened for outliers. If these are encountered, the analysis will be first conducted according to the methods described below. The analysis will then be reconducted, but the outlier species data will be removed from all station data sets. The two analyses will be compared to determine what effect the outlier had on analysis. Both analyses will be reported, but best professional judgement of Metro, its consultants, and the resource agencies will be used to determine which analysis will be used to evaluate the habitat.

Data were examined during the *Environmental Study* to determine if the replicate samples taken at the two tidal heights could be pooled. Exploratory analysis demonstrated that the data could not be pooled. As a result, all subsequent analyses are based on separate tidal stations for each transect.

For a monitoring year, statistical comparisons will be made to the baseline data for each sampling period, transect, tidal height, and group. If the group data are equal to or greater than the baseline data, a statistical test will not be necessary to satisfy the conditions of null hypothesis (H_0). The analysis matrix is shown in Table 2. The analysis will proceed by testing for the conditions of the H_0 in each of the matrix squares. For example, for R1 in an April sampling event, if no statistical differences for Group 1 are found when compared to the baseline data (H_0), the box is scored with a "+". If sample results are statistically less than baseline (H_A), it is scored with a "-".

Any statistical differences detected can be the result of natural variations. To control for natural marine environmental changes that do occur, the reference area data (R2) will also be compared to its baseline data. If a statistically significant decrease in group species densities is noted, the reference area data will be examined to determine if a decrease also occurred in the reference area, and if so, the proportional decrease relative to the baseline will be calculated. This proportional value will then be applied to the test transect data, and the statistical analysis reconducted. If the results of the statistical analysis remain unchanged, the matrix box will be scored with a "-". If applying the reference area proportional scaler indicates the analysis then meets the requirements of the H_0, the matrix box will be scored with a "+".

4.3 HABITAT ASSESSMENT CRITERIA

In this program, the habitat will be assessed based on its current performance relative to the baseline data for eelgrass site spatial coverage, turion density, and epibenthos densities. As described previously, appropriate corrective factors will be applied to the data if it is found that the reference area also decreased relative to the baseline data.

The criteria for evaluating habitat performance outside of the direct PBF impact zone, and for determining whether the post-PBF habitat replacement is successful are as follows:

1. Eelgrass site spatial area and coverage is not statistically different from the baseline coverage, or a similar proportional decrease in the reference area (Zone 3) coverage relative to baseline is observed.

2. Eelgrass turion densities are not statistically different from the baseline coverage, or a similar proportional decrease in the reference density relative to baseline is observed.

3. Within the epibenthos matrix analysis, there must be at least 75% agreement with the baseline data for each transect. That is, for R1, 12 of the 16 cells must be scored with a "+". The same condition applies to B1 and P1; 12 of 16 cells must show no significant difference between the baseline and transect data.

Table 2. Statistical analysis matrix for epibenthos monitoring at Metro North Beach.

	Group 1		Group 2		Group 3		Group 4	
	+2	-2	+2	-2	+2	-2	+2	-2
April								
R1								
B1								
P1								
May								
R1								
B1								
P1								
June								
R1								
B1								
P1								
August								
R1								
B1								
P1								

+ = No statistically significant difference detected between baseline and current sampling
− = Statistically significant difference detected between baseline and current sampling

If analysis of data collected from a survey during operation of the PBF indicates a deviation from these criteria, an additional survey must be conducted within four weeks. If further degradation is documented (that is, area coverage, turion density, or epibenthos decrease), Metro will immediately contact the resource agencies. The overall impact will be reviewed, and a decision will be reached as to the appropriate course of action as deemed necessary by the Corps, the resource agencies, and in consultation with Metro.

4.4 INDEPENDENT IMPACT EVENT SAMPLING

Events independent of Metro operations may arise that severely affect the marine community at North Beach. Such events could include severe winter storms, heavy frost during a low tide sequence, an oil spill, or a pollution influx. If such an event should occur, Metro will conduct both an eelgrass and epibenthos sampling within 30 days to determine whether the North Beach environment was affected. Should such an event occur, it will be necessary for Metro, the Corps, and the resource agencies to reexamine this monitoring plan to determine the appropriate course of action. The appropriate course of action to be taken will not involve a greater habitat replacement effort on the part of Metro than the effort that would have been required if the impact did not occur.

5. HABITAT REPLACEMENT AFTER REMOVAL OF THE PBF

The PBF is a temporary facility, and is scheduled to be removed after construction at the West Point facility has been completed. Metro is committed to replacing the spatial loss of the original eelgrass, plus any additional losses that may have occurred during operation of the PBF, after the facility is removed.

By this point, sufficient information will have been gained from all transplant efforts to accurately plan for and predict the results of further transplant efforts back into the footprint of the PBF. A final habitat rehabilitation specification document will be delivered to the agencies prior to engaging in any further transplant effort. The resource agencies will be asked to review and comment on this document. If previous mitigation efforts have been successful, eelgrass transplant will proceed using the most time- and cost-efficient method demonstrated by the project.

A five-year monitoring program will be initiated to determine if the final replacement effort has successfully mitigated all impacted habitat with a functionally equivalent eelgrass habitat. Eelgrass spatial coverage and turion densities will be assessed annually according to the procedures outlined in Section 4.1. Epibenthic data will be collected in the second and fifth year of the monitoring program in April, May, June, and August. Those data will be analyzed in accordance with the procedures outlined in Section 4.2. The assessment criteria defined in Section 4.3 will be applied to the post-PBF restored habitat after the data collected in the fifth year is analyzed.

If the habitat replacement effort meets the habitat assessment criteria defined in Section 4.3, the entire habitat will be considered to have been replaced, and the mitigation project will be completed. Alternately, if the habitat replacement effort fails to meet the habitat assessment criteria, but Metro has successfully created a functionally equivalent habitat at the interim eelgrass habitat site, the entire habitat will be considered to have been mitigated, and the mitigation project will be completed.

If all transplant efforts fail (interim eelgrass habitat and habitat replacement after removal of the PBF), a five-year monitoring program will be initiated to determine if the impacted areas in Zone 1 will naturally recover the initial eelgrass beds. If at the end of that period of time the beach fails to recover to baseline conditions (as determined in Section 4.3), Metro will consult the resource agencies and implement the contingency mitigation plan.

6. CONTINGENCY MITIGATION PLAN

The contingency mitigation plan will be implemented only if there is a net loss (in value and function) of eelgrass habitat after all habitat replacement efforts are concluded upon removal of the PBF. Metro is committed to implementing one of two possible options in consultation with the resource agencies.

Option A: **Offsite, Not in Kind Mitigation Project.** Metro and the resource agencies will identify a mitigation project that they deem appropriate. This may include such projects as restoration of a degraded marine habitat, salmonid enhancement project, land purchase and set-aside for identified critical species, wetlands restoration, or any other suitable project. Metro will undertake the project with its own technical staff and consultants.

Option B: **Monetary Settlement.** Metro will provide a monetary settlement naming the Washington State Department of Fisheries as beneficiary to fund mitigation research and/or other mitigation projects.

In either option, the costs to Metro of implementing the contingency mitigation plan shall be calculated as follows:

$$1 - \frac{\text{area of eelgrass habitat successfully transplanted}}{\text{area of eelgrass habitat lost due to PBF}} \times \text{costs incurred by Metro in all its habitat replacement efforts at North Beach to that point.} = \text{Funds available for implementing Option A or B}$$

7. SUMMARY

The program specified in this document presents an approach to habitat replacement that includes the following core elements:

- Provide interim eelgrass habitat during PBF operations
- Monitor all eelgrass during PBF operations
- Provide habitat replacement after PBF removal that would yield a minimum of no net loss of eelgrass
- In the event all mitigation efforts fail, provide an option of either offsite, not-in-kind mitigation or a monetary settlement.

A decision flow chart for the effort proposed in this plan is shown in Figure 4, and a timeline for implementation in Figure 5. The proposed plan insures good faith and best effort by Metro to achieve compensatory habitat replacement at North Beach, and imposes a financial penalty upon Metro for loss of habitat, if all habitat replacement efforts fail.

Both the best-case and worst-case scenarios from this mitigation plan offer benefits to the resource agencies. In the best case, both the interim eelgrass habitat effort and the habitat replacement effort will be successful, resulting in a net gain of eelgrass habitat at North Beach. In addition, a good deal of both practical and scientific information will be generated by which to conduct additional mitigation for other projects at other sites. A median effort will result in no net loss of eelgrass at the site and the addition of the practical and scientific information. A complete failure of the project could still result in a net loss of a minimal amount of the eelgrass habitat at North Beach (0.09%), a large body of information by which to evaluate future projects that could impact the marine environment, and either offsite, not-in-kind, mitigation or a cash settlement with which the agencies could pursue their own mitigation efforts beyond the Metro project.

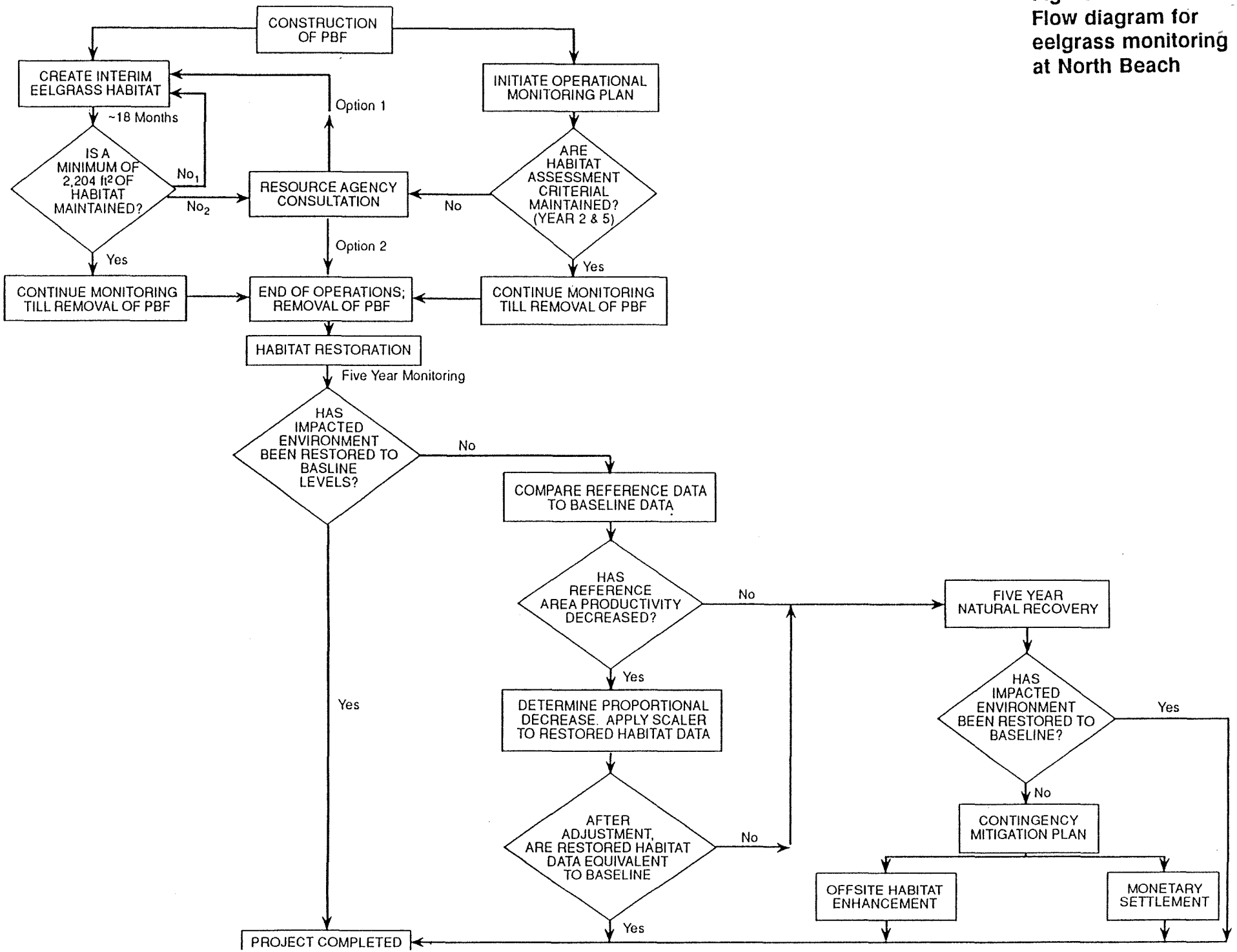
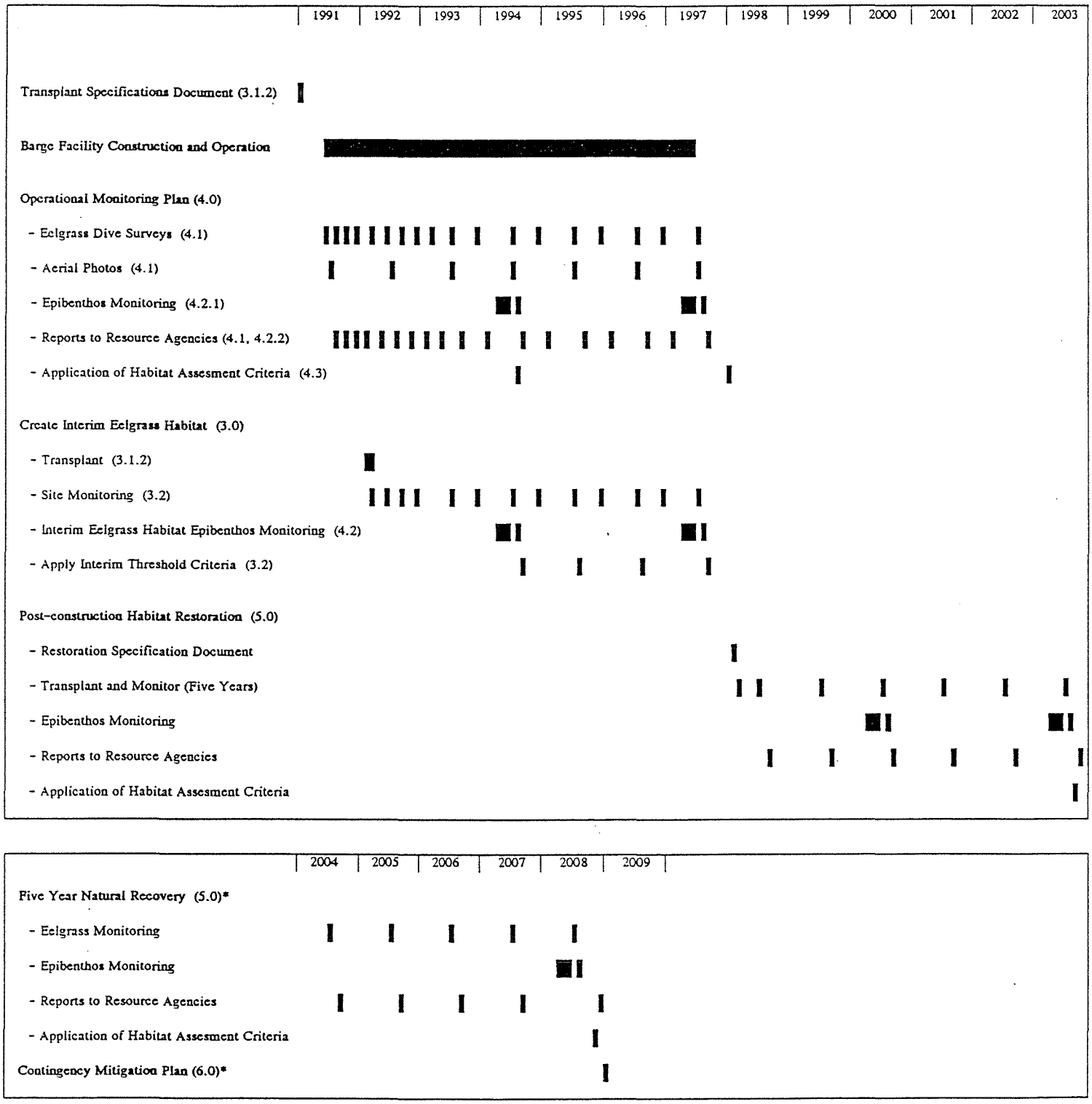


Figure 4.
Flow diagram for eelgrass monitoring at North Beach

Figure 5. Timeline for eelgrass mitigation at North Beach.



* If necessary

REFERENCES

Connors, P.G. 1986. Large scale eelgrass transplant studies, Bodega Harbor, California. Report to Sonoma County Regional Parks, August, 1986. 42 pp.

Fonsenca, M.S., W.J. Kenworthy, and G.W. Thayer. 1982. A low-cost planting technique for eelgrass (*Zostera marina* L.). U.S. Army Corps of Engineers. CETA 82-6. 15 pp.

Hoffman, R.S. 1990. Recovery of eelgrass beds in Mission Bay, San Diego, California, following beach restoration work *in* Proceedings of the California Eelgrass Symposium. May 27 and 25, 1988. Chula Vista, California. Sweetwater River Press, National City California. 78 pp.

METRO, 1988. Final supplemental environmental impact statement. West Point secondary treatment facilities. Municipality of Metropolitan Seattle, September 1988.

Merkel, K.W. 1990. Recovery of eelgrass beds in Mission Bay, San Diego, California, following beach restoration work *in* Proceedings of the California Eelgrass Symposium. May 27 and 25, 1988. Chula Vista, California. Sweetwater River Press, National City California. 78 pp.

Merkel, K.W., and R.S. Hoffman (*in press*). The use of dredged materials in the restoration of eelgrass meadows: A Southern California perspective *in* Proceedings of a regional workshop: beneficial uses of dredge material in the western U.S., 21-25 May 1990, San Diego California. Landin, M.S. *et al.* eds. U.S. Army Corp of Engineers, Waterways Experimental Station, Vicksburg, MS.

Phillips, R.C. 1980. Transplanting methods *in* Handbook of seagrass biology, R.C. Phillips and C.P. McRoy (eds). Garland STPM Press, pp 41-56.

Walton, J.M. and W. Wirt. 1989. Eelgrass transplant report. John Wayne Marine Mitigation. 1985-1989. Fisheries Technology Program. Peninsula College, Port Angeles, WA.

Zar, J.H. 1984. Biostatistical analysis. Prentice Hall, Inc., Englewood Cliffs, N.J. 07632. 718 pp.

APPENDIX A

CONSTRUCTION DOCK — OPERATIONAL PLAN

A7110-193.04e

August 17, 1990

WEST POINT SECONDARY TREATMENT FACILITIES
CONSTRUCTION DOCK - OPERATIONAL PLAN

Barge Routes:

The most likely destinations for barges will be south Puget Sound, the Duwamish River, the Ship Canal, and north Puget Sound. If barges operate at dawn or dusk (sun below horizon), or at night, during the fishing season (generally mid-July through January), barge routes will generally operate in an east to west direction to and from the construction dock in order to avoid or minimize interaction between fishing vessels and construction barges and to avoid north to south movements through Shilshole Bay. Barges will stay in designated vessel traffic lanes when rounding West Point to further reduce potential conflicts.

Since tidal current charts indicate a prevailing current with a southwest set in the area off the dock, approaches to the dock would normally be from the west. Undockings would also be from the west, heading northeast until the barge clears the dock. The vessel can then head into the vessel traffic lanes.

Under normal weather conditions (winds less than 30 knots), a maneuvering area extending 500 feet off both ends of the dock and 500 feet wide off the pier face should be sufficient for the tow boat and barge in their maneuvers near the pier. More room would probably be required under stormy conditions.

Barges are not expected to transport materials to or from the Elliott Bay Marina site due to the incompatibility of construction schedules.

Hours Of Operation:

To the extent possible, barges will operate only during daylight hours. In the event barge movements are required during the fishing season at dawn and dusk (sun below horizon), or at night, a minimum of 48 hour notice shall be provided to the tribes. Points of contact shall be Metro's Construction Manager and the Tribes' Fisheries Managers.

Metro shall provide notice of tribal fishing regulations for inner and outer Elliott Bay, Shilshole Bay and the Ship Canal (Areas 10 and 10A) to all barge operators. Because tribal fishing regulations may change with less than 24 hours notice, Metro shall establish a procedure for informing the barge operators of the date and time that the areas are open for fishing.

Similarly, Metro shall establish a procedure with the tribal fisheries managers to provide regular information on scheduled barge movements (e.g. information for tribal fisheries "hotline" announcements).

Other methods of communication between Metro and individual fishermen will likely be necessary, especially during low visibility periods (i.e. fog), and methods of communication shall be identified and evaluated on an annual basis before the beginning of the fishing season. The communication method between towboats and fishing vessels will be verified prior to barge movements.

Any costs associated with Metro towboat/tribal fishing boat communication will be born by Metro. However, in most cases advanced notification of barge movements and active enforcement of traffic routes should be adequate.

Patrol Boat:

Metro will operate one patrol boat equipped with radio communications equipment and staffed with trained personnel during the fishing season. The goals for the patrol activity include monitoring and diverting barge traffic around tribal fishing activities. Metro shall consult with the Tribes' fisheries patrol, the U.S. Coast Guard and other police agencies and coordinate Metro's patrol activities with these entities.

Staging Of Barges:

During the fishing season, barges shall not be anchored off-shore of West Point at night, except at the existing buoy owned by the Corps of Engineers. Barges shall also tie-up to the construction dock during the fishing season while waiting to offload or load cargo, or while awaiting the arrival of a tug to transport them to their destination.

Number Of Barges:

As stated in Metro's Corps of Engineers permit application for the construction dock, the number of barges using the dock may range up to 6 arriving and 6 departing per day, depending on construction contractor operations. However, this is expected to be the peak level of operation, and the duration would be limited. The number of barges regularly arriving and departing is expected to be 3 or less per day, on a Monday through Friday basis.

Hazardous Materials Handling:

Hazardous materials will not be transported by barge and fueling operations will be limited to those required for equipment located on the dock (cranes, generators, etc.)

Construction Dock Operational Considerations:

The dock will be comprised of tight timber decking and a bull rail to reduce the likelihood of spilling materials into the water. Conveyor equipment to be utilized in the transport of excavated spoils will have spill protection pans for sections located over water. The dock will be regularly swept to avoid a build-up of materials. To minimize the potential for petroleum products associated with the operation of equipment and vehicles on the dock from entering the water, absorbent materials will be regularly used to clean the dock and properly disposed of.

Contingency Plan:

Spillage Of Construction Materials And Excavated Spoils -

Metro shall document the spillage of these materials and, as part of a monitoring program of subtidal habitat, shall document any environmental impacts resulting from such spillage. As part of its post-construction restoration of the site, Metro shall take appropriate steps, as approved by the Corps of Engineers and resource agencies, to mitigate the impact of such spillage. Such steps could include the removal of the materials and the restoration of bottom contours.

Spillage Of Petroleum Products -

Since these products will not be transported by barge, any spillage would likely be small and associated with the operation of equipment on the dock or from a towboat. Equipment capable of containing and cleaning-up a petroleum spill shall be readily available on the Metro treatment plant site. The following types of clean-up materials will be kept on hand:

* Absorbent pads such as those made by 3-M, Conweb, or Unisorb.

* Petro barrier installed around the footings of the pier. The barrier would prevent any spills from the pier from reaching the water outside of the barrier.

* Containment boom which could be deployed around a vessel, such as those made by Kepner Boom or 3-M.

* A small boat or two will also be available for immediate use in the deployment of the required pads and barriers.

All spills, regardless of size, must be reported to the U.S. Coast Guard National Response Center (1-800-424-8802) as soon as possible. The Coast Guard will assume responsibility for coordination of private contractor efforts in oil spill clean-up.

Metro shall maintain sufficient contingency funds to mitigate for damaged tribal fishing nets or contaminated catch as a result of a spill in the vicinity of an actively fishing net.

Fishing Equipment Replacement -

Metro shall provide $20,000 to be divided between the Muckleshoot and Suquamish tribes for establishment of revolving funds to pay for the cost of equipment which might be damaged by barge traffic. The funds shall be managed by the tribes. The objective of the funds is to provide a means for tribal fishermen to replace damaged nets and gear as soon as possible so that down time from fishing is kept to a minimum.

The incidences of loss and the cost of fishing equipment damaged as a result of barge operations shall be reviewed annually. Based upon this review, this amount may be adjusted as necessary to fulfill the funds' objective.

Joint Committee:

Tribes and Metro will establish a small group of representatives to participate in periodic joint meetings to review the success of the operational plan and to make recommendations for changes. Among other responsibilities, the committee will recommend a process for verifying responsibility for net damage in a timely manner, and recommend a process for incorporating changes into the operational plan and resolving disputes between the parties.

LE:ce

L\LE51790