POLLUTION CONTROL HEARINGS BOARD
FOR THE STATE OF WASHINGTON

Airport Communities Coalition,

Appellant,

v.

Department of Ecology and
The Port of Seattle,

Respondents.

PCHB No. 01-160

DECLARATION OF ROGER A. PEARCE

Roger A. Pearce declares as follows:

1. Identity of Declarant. I am one of the attorneys representing respondent Port of Seattle in this action. I am over the age of eighteen, have personal knowledge of the facts stated in this declaration, and am competent to testify to those facts.

2. Identification of Attached Documents. Attached as exhibits to this declaration are true and correct copies of the following documents which were prepared by the Port of Seattle and its expert constultants and which have been provided to the Department of Ecology pursuant to the amended §401 Certification on JARPA Application No. 1996-4-02325:

Exhibit A. Wetland A17 Restoration plan, which is part of the Miller Creek Riparian Corridor and Instream Enhancement Project and was prepared pursuant to Condition D.4 of

AR 005910

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

ORIGINAL

the amended §401 Certification and submitted to the Washington Department of Ecology on or about November 9, 2001.

Exhibit B. Proposed Construction BMPs to Prevent Interception of Contaminated Ground Water by Utility Coridors and Plan to Monitor Potential Contaminant Transport to Soil and Ground Water via Subsurface Utility Lines, both of which were prepared pursuant to Condition F.1 of the amended §401 Certification and both of which were submitted to the Washington Department of Ecology on October 2, 2001.

Exhibit C. Third Runway Embankment Seepage and Groundwater Monitoring Plan, which was prepared pursuant to Condition E.3 of the amended §401 Certification and was submitted to the Washington Department of Ecology on November 16, 2001.

Exhibit D. Appendices F and N to the revised Natural Resources Mitigation Plan ("NRMP"). The revised NRMP was prepared pursuant to Conditions D.1 through D.7 of the amended §401 Certification and was submitted to the Department of Ecology on or about November 20, 2001. The NRMP responds to the conditions and requirements in Section D of the amended §401 Certification. Appendices F and N summarize the additional mitigation proposed by the Port. The additional mitigation (5.79 acres) is located in the Miller Creek basin and has been planned at the request of the U.S. Army Corps of Engineers to further assure no net loss of wetland functions would result from the Master Plan Update projects.

I declare under penalty of perjury under the laws of the state of Washington that the foregoing is true and correct.

Executed at Seattle, Washington, this 26th day of November 2001.

Roger A. Pearce

Roger A. Pearce

AR 005911

FOSTER PEPPER & SHEFELMAN PLLC
1111 THIRD AVENUE, SUITE 3400
SEATTLE, WASHINGTON 98101-3299
206-447-4400

Miller Creek Riparian Corridor and Instream Enhancement Project

Wetland A17 Restoration

Seattle-Tacoma International Airport Master Plan Update Improvements

Port of Seattle

Parametrix, Inc.

November 2001

MILLER CREEK RIPARIAN CORRIDOR AND INSTREAM ENHANCEMENT PROJECT

WETLAND A17 RESTORATION

SEATTLE-TACOMA INTERNATIONAL AIRPORT MASTER PLAN UPDATE IMPROVEMENTS

Prepared for

PORT OF SEATTLE
Seattle-Tacoma International Airport
P.O. Box 69727
Seattle, Washington 98168-0727

Prepared by

PARAMETRIX, INC.
5808 Lake Washington Blvd. N.E., Suite 200
Kirkland, Washington 98033-7350

November 2001
556-2912-001 (03B)

TABLE OF CONTENTS

AR 005915

LIST OF FIGURES

LIST OF TABLES

AR 005916

1. INTRODUCTION

As currently configured, Seattle-Tacoma International Airport (STIA) is unable to efficiently meet existing and future regional air travel demands. In response to growth forecasts for passenger and cargo volumes at STIA, a variety of facility improvements are planned to meet travel demands in the Puget Sound Region and reduce aircraft arrival delays during poor weather. These improvements were developed through a master planning process, then updated to reflect revised growth forecasts for passenger use.

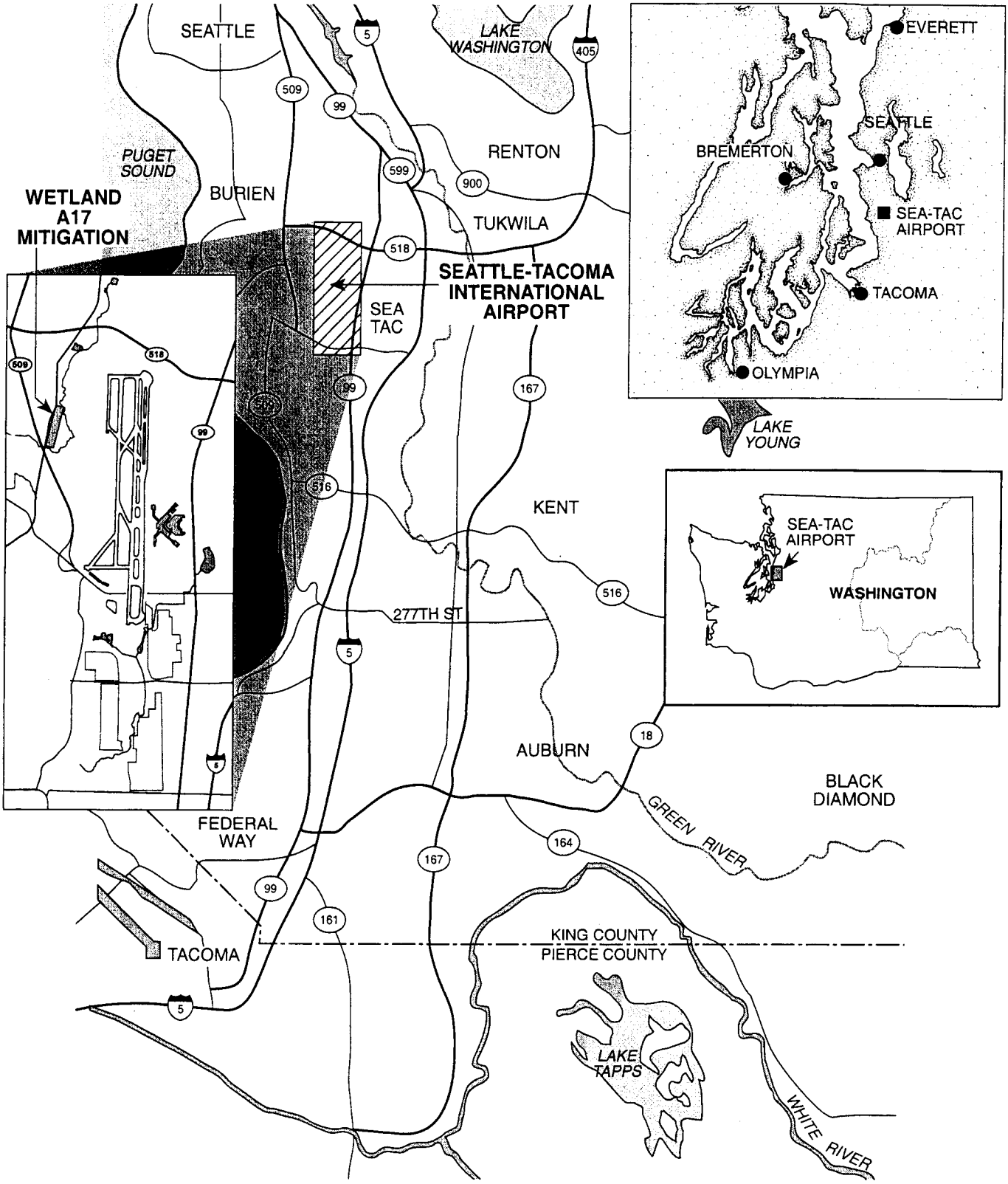
Master Plan Update improvements that directly affect streams and wetlands include extending runway safety areas at the north ends of two existing runways, developing the South Aviation Support Area (SASA), and constructing a new third runway. The Port of Seattle (Port) submitted a mitigation plan (*Natural Resource Mitigation Plan Master Plan Update Improvements Seattle Tacoma International Airport* [NRMP] [Parametrix 2000a]) as part of its request for Section 404 and Section 401 Clean Water Act approvals from the U.S. Army Corps of Engineers (ACOE) and the Washington State Department of Ecology (Ecology). The NRMP provides detailed mitigation designs for impacts to wetlands, streams, floodplains, and drainage channels that would occur during implementation of the STIA Master Plan Update improvement projects. The NRMP will be revised to reflect conditions in the Section 401 water quality certification and additional mitigation requested by ACOE. This report will be submitted to Ecology in advance of the date identified in the Section 401 water quality certification.

1.1 TEMPORARY IMPACTS AND WETLAND A17 MITIGATION

During review of the Master Plan Update improvements, Ecology (2001) requested that additional mitigation be provided to address impacts from temporary construction-related impacts, some of which could span a 5-year period[1]. This additional mitigation consists of restoring wetland, channel, and buffer areas associated with Wetland A17. The minimum area of new mitigation (wetland and buffer) is 11.71 acres; however, this plan provides 12.01 acres of mitigation. The new mitigation reduces the temporal impacts to wetlands and wetland functions resulting from temporary impacts that extend for more than 1 year. As described in the NRMP, wetland areas subject to temporary impacts will be restored.

This report describes the additional in-basin mitigation on about 12 acres of property that is designed to restore and enhance physical and biological functions in Wetland A17 (including its sub-areas, Water D, Wetlands A17a, A17b, A17c, and A17d). Additionally, the upland buffers surrounding the wetland and Water D (a small intermittent stream that flows through the wetland) will be enhanced. The mitigation area is located in the Third Runway Acquisition Area, and is owned, or will be owned by the Port (Figure 1).

[1] Temporary construction impacts affect up to 2.05 acres of wetland.



Port of Seattle/Wetland A17 Mitigation Plan/556-2912-001/01(03) 9/01 (K)

N

SCALE IN FEET

0 7,500 15,000

AR 005918

Figure 1
Location of Seattle-Tacoma International Airport and Wetland A17 Mitigation Site

In developing this plan, the Port used guidance from Ecology and ACOE to identify an appropriate in-basin mitigation activity that will compensate for project impacts to wetland and stream functions. Elements of this mitigation plan are specifically targeted to restore and increase organic carbon production and export functions the area may provide to Miller Creek located downstream of the Master Plan project area.

The mitigation described in this report represents an addition to the Miller Creek riparian corridor and instream enhancement projects described in Section 5.2 of the NRMP. Because Wetland A17 and Water D are located immediately adjacent to the Miller Creek mitigation site, and because it uses the same restoration and enhancement techniques, it will be integrated into the previously described mitigation plan and legally binding restrictive covenants.

1.2 OTHER MITIGATION REQUESTED BY THE ARMY CORPS OF ENGINEERS

In addition to mitigation at Wetland A17, ACOE has asked the Port to provide addition mitigation that further assures potential impacts to wetland functions are mitigated. The Port is evaluating addition mitigation at Lora Lake (including increased buffer and wetland restoration by removing historic fill) and at the Des Moines Way Nursery site[2] (to consist of wetland restoration, wetland enhancement, Miller Creek enhancement, and upland buffer enhancement).

1.3 OVERALL MITIGATION

As a result of the new mitigation described in Sections 1.1 and 1.2, over 112 acres of on-site mitigation in the Des Moines, Miller, and Walker Creek watersheds is provided (Table 1). The combination of wetland fill and restoration results in a 3 to 4 percent loss of wetland and aquatic habitat area for these watersheds (Table 2). The NRMP explains how the 112 acres of in-basin and 65 acres of off-site mitigation is designed to compensate for the loss of wetland functions associated with these impacts.

[2] The Des Moines Way Nursery site is located at the NE quadrant of the intersection of SR 518 and Des Moines Memorial Drive.

Table 1. Summary of wetland mitigation credit for Seattle-Tacoma International Airport Master Plan Update improvements.

Mitigation	Mitigation Area (ac)	Mitigation Credit
IN-BASIN		
Wetland Restoration – Credit ratio 1:1		
Remove Fill Adjacent to Lora Lake	1.00	1.00
Remove Fill at Des Moines Way Nursery Site	2.00	2.00
Remove Fill at Wetland A17	0.30	0.30
Vacca Farm (prior converted cropland and other upland)	6.60	6.60
Temporary Impacts	2.05	2.05
Subtotal	**11.95**	**11.95**
Wetland Enhancement – Credit ratio 1:2		
Des Moines Way Nursery	0.86	0.43
Vacca Farm (Farmed Wetland, Other Wetlands, Lora Lake)	5.70	2.85
Wetlands in Miller Creek Wetland and Riparian Buffer	10.25	5.12
Tyee Valley Golf Course	4.50	2.25
Wetland in Des Moines Creek Buffer	1.01	0.51
Subtotal	**22.32**	**11.16**
Buffer Enhancement- Credit ratio 1:5		
Miller Creek Buffer, South of Vacca Farm	40.86	8.17
Vacca Farm	4.58	0.92
Lora Lake	1.81	0.36
Tyee Valley Golf Course Mitigation Area Buffer	1.57	0.31
West Branch Des Moines Creek Buffer	3.38	0.68
Des Moines Way Nursery	2.73	0.55
Subtotal	**54.93**	**10.99**
Preservation – Credit Ratio 1:10		
Borrow Area 3 Wetland	2.35	0.24
Borrow Area 3 Buffer	21.20	2.10
Subtotal	**23.55**	**2.34**
Total In-Basin [a, b]	**112.75**	**36.44**
OUT-OF-BASIN		
Wetland Creation[c] - Credit ratio 1:1		
Forest (17.20 acres), shrub (6.0 acres), emergent (6.20 acres), and open water (0.60 acres)	29.98	29.98
Wetland Enhancement - Credit ratio 1:2	19.50	9.75
Buffer Enhancement - Credit ratio 1:5	15.90	3.18
Total Out-of-Basin	**65.38**	**42.91**
TOTAL	**177.43**	**79.35**

[a] Mitigation credit has not been assigned for relocating a portion of Miller Creek channel, instream enhancement projects, drainage channel replacement, Des Moines Creek buffer enhancement, or a $300,000 trust fund for watershed restoration.

[b] In-basin mitigation area divided by wetland impacts (18.37 acres permanent plus 2.05 acres temporary) provides a 5.5:1 aerial replacement ratio.

[c] Based on maps of hydric soils, mitigation can be also characterized as restoration.

Table 2. Changes in wetland and aquatic habitat areas in the Miller, Walker, and Des Moines Creek basins.

Watershed and Sub-Area		Area	Impact	Restoration
Miller Creek Basin				
Arbor Lake		3.7	0.00	0.00
Lake Burien		30	0.00	0.00
Riparian wetlands near S. 144th Way		2.00	0.00	0.00
Tub Lake Peatland/N. SeaTac Park Wetlands		21.01	0.00	0.00
North Employee Parking Lot Wetlands 1,2		0.81	0.00	0.00
Des Moines Way Nursery		0.86	0.00	2.00
Runway Safety Areas/North End		27.84	2.75	0.40
Vacca Farm Mitigation		8.07	0.00	6.60
Miller Creek Riparian		1.05	1.05	0.03
Third Runway Embankment		15.74	11.03	1.2
	Total	**111.08**	**14.83**	**10.23**
NET CHANGE[a]: -4.5 acres	**4.0%**			
Walker Creek Basin				
Wetland 43		33.43	0.00	0.00
Wetland 44		3.08	0.54	0.28
Miscellaneous		0.99	0.99	0.00
	Total	**37.5**	**1.53**	**0.28**
NET CHANGE[a]: -1.25 acres	**3.3%**			
Des Moines Creek Basin				
WSDOT Wetland B		6.60	0.00	0.00
Bow Lake Wetlands		25	0.00	0.00
SASA Area		7.22	2.95	0.17
Borrow Areas		24.24	1.04	0.00
Tyee Valley Golf Course		38.51	0.07	0.00
	Total	**101.57**	**4.06**	**0.17**
NET CHANGE[a]: -3.89 acres	**3.8%**			
PROJECT TOTAL		**250.15**	**20.42**	**10.68**
NET CHANGE -9.74 acres	**3.9%**			

[a] Estimates of changes exceed actual changes, because they do not include riparian wetlands outside the project area, wetlands at the mouths of Miller, Walker, and Des Moines Creeks, or other wetlands that are likely to be present on undeveloped or developed areas. See Tables 4.1-2 and 4.1-3 in the NRMP (Parametrix 2000a) for a summary of the mitigation planned to compensate for wetland functions associated with these changes.

AR 005921

2. WETLAND A17 RESTORATION AND ENHANCEMENT

Existing residential development in Wetland A17 and its buffers includes about 34 buildings, several culverts and fill crossings, lawns, fences, driveways, gardens, retaining walls, and other impacts of human habitation. As a result of these land uses, native vegetation has been removed from most of Wetland A17 and its associated buffers. Native forest vegetation has been removed and replaced by impervious surfaces, buildings, lawn, or landscaping. These alterations have contributed to the reduced ability of the existing wetland and buffer to support biological and physical functions necessary to maintain functioning habitat in the wetland and adjacent stream.

The goal of this mitigation plan is to increase functional performance of Wetland A17 (which includes wetland fragments delineated as Wetlands A17a, A17b, A17c, and A17d, a ditch named Water D, and their associated upland buffers). Enhancement of the wetland, Water D, and buffers will improve the biological functions of the wetland and the riparian buffer, by restoring natural patterns of nutrient cycling and retention, and by increasing organic carbon export to Miller Creek. The mitigation will also improve the habitat and food resources in the area. The restoration and enhancement of these areas will improve the current degraded condition of the area by removing existing disturbances and pollutant sources. The mitigation will also remove invasive non-native plant species such as Himalayan blackberry (*Rubus discolor*), English ivy (*Hedera helix*), and reed canarygrass (*Phalaris arundinacea*).

To achieve the mitigation goal, restoration activities will include removing buildings, driveways, culverts, fences, and invasive non-native plants from the area. Areas within wetlands and buffers that contain buildings will be regraded to restore topographic contours and replanted with native trees and shrubs. A native forested buffer will be established along the entire length of Water D and by removing three portions from culverts, approximately 125 linear ft of channel will be restored.

This mitigation plan will add a total of 12.01 acres of mitigation to the Miller Creek riparian corridor (Table 3). The mitigation will consist of the following:

- Restoration of 0.30 acre of filled wetland that is adjacent to Wetland A17.
- Enhancement of 2.69 acres of Wetlands A17a, A17b, A17c, and A17c.
- Enhancement of 8.86 acres of upland buffer around the wetland and Water D channel
- Enhancement of 0.16 acre of the Water D channel.
- Restoration of 125 linear feet of the Water D channel by removing culverts and fill.

The report organization is based upon the *Guidelines for Developing Freshwater Wetlands Mitigation Plans and Proposals* (Ecology 1994). The mitigation plan, goals, and objectives are introduced first, followed by a description of the project site, existing ecological conditions, the rationale for selecting the project, and any constraints associated with the proposed mitigation. Finally, the mitigation design is described in detail including performance standards, monitoring schedules, and maintenance and contingency measures necessary to ensure mitigation success.

Table 3. Summary of mitigation areas and mitigation credit for Wetland A17 restoration.

Mitigation	Mitigation Area (acres)	Mitigation Credit (acres)
Wetland Restoration – Credit ratio 1:1		
Fill in Wetland A17	0.30	0.30
Wetland Enhancement – Credit ratio 1:2		
Wetland A17	2.69	1.35
Water D	0.16	0.08
Buffer Enhancement- Credit ratio 1:5		
Wetland A17 and Water D	8.86	1.77
TOTAL MITIGATION	**12.01**	**3.50**

2.1 GOALS, OBJECTIVES, AND DESIGN CRITERIA

The primary goal of this plan is to restore non-avian habitat wetland functions to Wetland A17, Water D, and their associated buffers. The wetland functions to be enhanced include nutrient and sediment trapping, organic matter export, small mammal habitat, and amphibian habitat. These actions will also improve and support aquatic habitat functions in Miller Creek, which is located immediately downslope of the mitigation area. The specific design objectives and design criteria for the mitigation area are listed in Table 4.

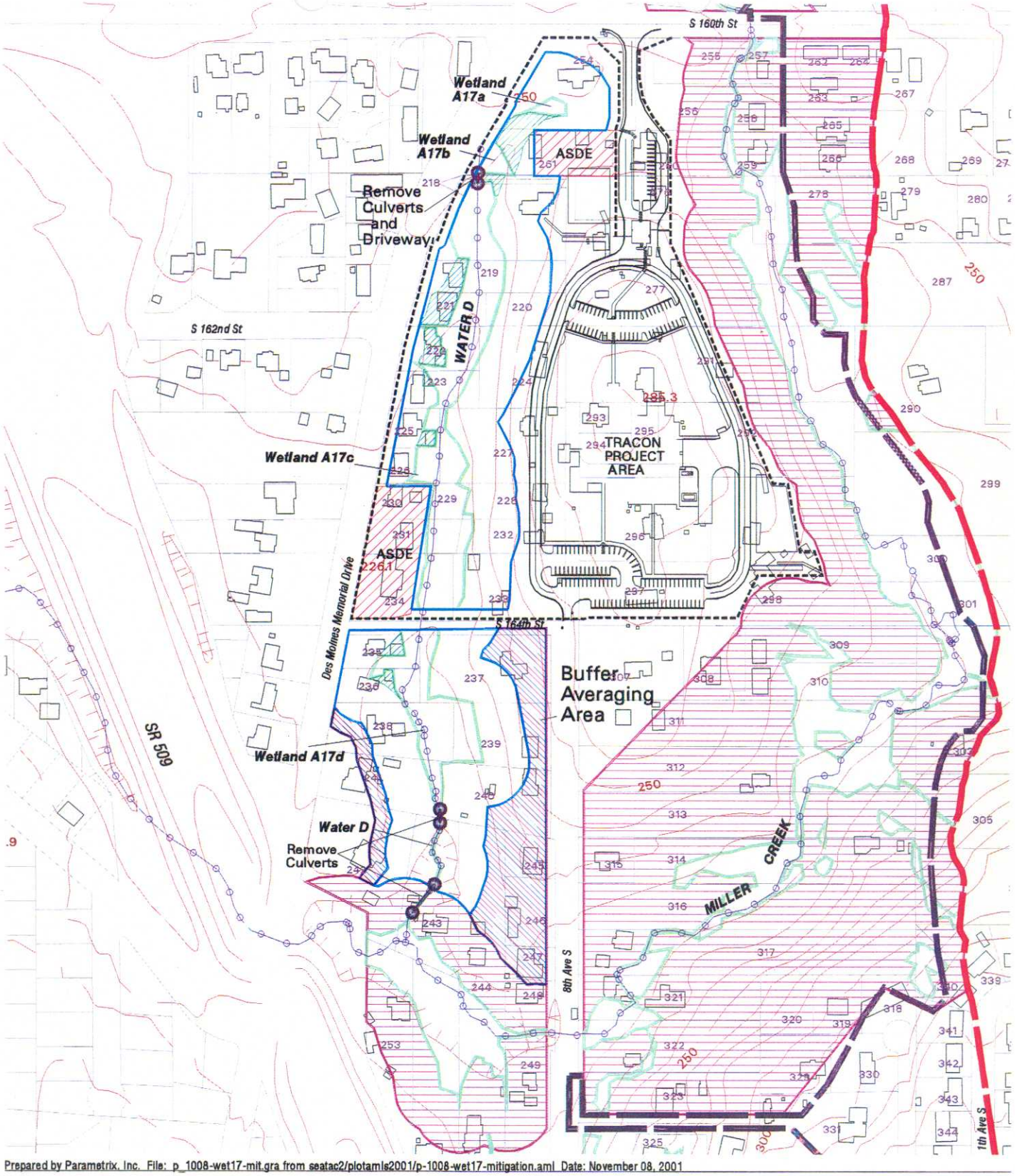
Because of its proximity and similarity to the mitigation planned in the Miller Creek riparian corridor, the Wetland A17 mitigation area will be incorporated into the Miller Creek riparian corridor mitigation project. The NRMP, including Appendix B and the restrictive covenants, will be revised to reflect this new mitigation.

2.2 MITIGATION SITE DESCRIPTION

The mitigation area is located adjacent to the Miller Creek riparian corridor mitigation area and is within a portion of the third runway "acquisition area" (see Figure 1). The mitigation site is bounded by South 160th Street to the north, the main stem of Miller Creek to the south, 8th Avenue South to the east, and Des Moines Memorial Drive to the west. The mitigation site consists of Wetland A17, Water D, and associated uplands. Wetland A17 is located in a shallow swale, and is located generally within back yards of several houses (Figure 2). Water D is a small ditch with intermittent flow occurring within Wetland A17, ultimately draining into Miller Creek. The topography of the site is relatively flat in the western portion of the project area, generally from the eastern wetland boundary to Des Monies Memorial Drive. The eastern portion of the mitigation area slopes to the west from a topographic ridge situated outside of the project area.

Wetland A17 was delineated and surveyed by Parametrix. The boundaries were verified by ACOE as reported in the *Wetland Delineation Report Master Plan Update Improvements Seattle-Tacoma International Airport* (Parametrix 2000b).

AR 005923



Prepared by Parametrix, Inc. File: p_1008-wet17-mit.gra from seatac2/plotamls2001/p-1008-wet17-mitigation.aml Date: November 08, 2001

N

Feet

0 100 200 300

- Wetland Enhancement
- Wetland Restoration
- Miller Creek Mitigation Area
- Buffer Averaging Area
- ASDE Alternative Site
- Master Plan Project Area
- Building
- Culvert
- Creek
- Wetland Buffer
- TRACON Fence
- Permanent Impact Line
- Temporary Impact Line
- 250 Contour Line (10 ft interval)
- Parcel Boundary
- 237 Parcel Number

Figure 2
Proposed Mitigation Areas at Wetland A17 and Water D

AR 005924

Table 4. Mitigation goals, design objectives, and design criteria for the Wetland A17 restoration project.

Design Objectives	Design Criteria
Enhance and restore 2.99 acres of riparian wetland (not including Water D).	Demolish and remove structures located within the wetland and buffer. Remove fences, driveways, sidewalks, etc. from the wetland and buffer.
	Regrade portions of the wetland where residential structures have been located to establish historic topography in the wetland. Restore wetland conditions to these areas.
	Remove the driveway between Wetlands A17a and A17b and remove the driveway and culvert between Wetlands A17b and A17c. Restore the areas to wetland conditions.
	Plant native tree species at a density sufficient to achieve 280 trees per acre in identified areas.
	Plant native shrub species sufficient to achieve densities of at least 2,100 shrubs per acre in identified areas.
	Plant existing lawn areas and other areas dominated by non-native species with native forest and shrub vegetation.
Enhance and restore approximately 8.86 acres of riparian buffer along Wetland A17 and Water D.	Demolish and remove structures; driveways, sidewalks, fences, lawn, landscaping, and non-native vegetation located within the buffer of Wetland A17 and Water D.
	Remove potential water quality impacts such as septic systems (at least 14 of the 29 parcels have on-site septic systems) and on-site impervious surface that generates untreated stormwater runoff.
	Plant native forest vegetation along riparian buffer areas that are cleared or disturbed during demolition activities.
Increase shade and detritus input to Water D (0.16 acre).	Plant the buffer adjacent to the stream with native trees and shrubs, where applicable, to provide overhanging vegetation and provide future sources of large woody debris (LWD) and organic matter into the stream.
	Remove railroad ties retaining portions of the Water D stream bank. Add LWD to the Water D channel to increase and restore rates of in-channel processing of organic matter.
Provide long-term protection to the mitigation area.	Establish restrictive covenants to permanently protect Wetland A17, Water D, and their buffers.
	Install fencing and signs to designate the area as a protected mitigation site.

2.3 OWNERSHIP

The Port owns all parcels subject to the mitigation actions described in this report. The mitigation site has been located to avoid potential conflicts with the design and siting of the TRACON and ASDE facilities.

AR 005925

2.4 RATIONALE FOR SELECTION

Restoring the riparian habitat in Wetland A17 and Water D provides on-site and in-kind opportunities to mitigate temporary impacts to wetland and stream functions from implementation of the Master Plan Update improvements. Despite historic degradation, the downstream reaches of Miller Creek contain salmonids in downstream areas. Acquisition, permanent protection, and

restoration of a significant portion of Miller Creek, including this mitigation area have the potential to significantly enhance wetland and aquatic habitats in the Miller Creek basin, including downstream segments not within the project area. Removing residential land uses and associated non-point source pollution and physical impacts, such as clearing and dumping, will enhance the wetland and riparian plant communities, as well as water quality and aquatic habitat within the stream.

The restoration and enhancements provide an exceptional opportunity to remove anthropogenic impacts, and to establish a large, contiguous riparian habitat corridor within a highly urbanized watershed. Few such opportunities exist to perform habitat restoration at this scale on significant salmonid-bearing streams in the Seattle area urban environment.

2.5 CONSTRAINTS

There are no implementation constraints to the mitigation plan as proposed.

2.6 BUFFER AVERAGING

A buffer averaging approach was used to establish protective buffers around Wetland A17 and Water D. Buffer averaging was necessary to provide sufficient area for two airport navigation facilities (see Figure 2). The navigation facilities are the Airport Surface Detection Equipment (ASDE) facility and a security fence and 20-ft setback associated with the Terminal Radar Approach Control (TRACON) facility.

The Federal Aviation Administration (FAA) has identified two potential sites where ASDE could be located. The FAA is currently evaluating the suitability of these two alternative locations, which total 0.93 acre. The potential sites have been removed from the mitigation area and (a minimum of) 0.93 acre is added to the buffer averaging areas.

The TRACON security fence is the only part of the TRACON site that conflicts with Wetland A17 mitigation. Because FAA security requirements include the clearing vegetation 20 ft away from the fenceline, the area where this clearing is required (0.55 acre) has been excluded from the mitigation area. This area (0. 55 acre) is also included in the buffer averaging areas.

Overall, as shown in Figure 2, to compensate for the reduction of buffer width described above, approximately 1.48 acres of additional buffer is established at the southeast and southwest portions of Wetland A17.

2.7 ECOLOGICAL ASSESSMENT OF THE MITIGATION SITE

The overall site conditions located within the project area were assessed and native and non-native plant communities were identified (Appendix A). The following section summarizes existing conditions found within the Wetland A17 project area.

2.7.1 Hydrology

Wetland hydrology in Wetland A17 is maintained by shallow groundwater sources and surface inflow from Water D, which originates in back yard ditches west of Des Moines Memorial Drive and north of South 160th Street. Soil saturation is present in portions of the wetland during much of the year. Short periods of shallow inundation occur during wet periods and were observed in several locations in the wetland during April and October 2000. Flowing water is generally present in Water D during much of the time between November and May.

2.7.2 Soils

Soils in the project area were mapped as Alderwood and Norma soil types by the 1952 soil survey of King County (USDA 1952). The Norma soil is a hydric (wetland) soil type that occurs in drainageways, while the Alderwood soil type formed in uplands on glacial till soils. The *Soil Survey of King County Area Washington* (Snyder et al. 1973) excluded the area from soil mapping. Field investigations found soils in the wetland to be alluvial soils with areas of high organic matter (sapric muck) near the center of Wetland A17, near Water D. Soils throughout the remainder of the wetland were sandy loam. The soil in the buffer typically consists of Alderwood series which, are primarily made up of moderately well drained soils forming on glacial till (Snyder et al. 1973). In some upland areas, the soils were predominantly a sandy loam, with a soil profile that corresponds to Indianola soils (Snyder et al. 1973).

2.7.3 Vegetation

Wetland A17 contains forest, shrub, and emergent wetland communities. Dominant vegetation in the forested portions of the wetland are black cottonwood (*Populus balsamifera*), red alder (*Alnus rubra*), western redcedar (*Thuja plicata*), and Pacific willow (*Salix lucida*). The shrub-dominated areas of the wetland primarily consist of Himalayan blackberry and salmonberry (*Rubus spectabilis*) with creeping buttercup (*Ranunculus repens*), reed canarygrass, common velvetgrass (*Holcus lanatus*), field morning glory (*Convolvulus arvensis*), and horsetail (*Equisetum* spp.) below. In several locations, especially in the western portion of the project area, the emergent communities consist of lawns associated with homes. The lawn areas contain red fescue (*Festuca rubra*), bluegrass (*Poa* spp.), common velvet-grass, and creeping buttercup. In the limited areas that are not mowed, small-fruited bulrush (*Scirpus microcarpus*), beaked sedge (*Carex stipata*), watercress (*Rorippa nasturtium-aquaticum*), and slough sedge (*Carex obnupta*) are present.

Upland vegetation on either side of Wetland A17 has been altered by residential development. For example, the upland vegetation on the west side of the wetland consists primarily of turf grass lawns, areas of ornamental non-native landscaping, or non-native invasive plant species such as Himalayan blackberry, reed canarygrass, English holly (*Ilex aquifolium*), or cherry laurel (*Prunus laurocerasus*). Several mature trees such as Douglas fir (*Pseudotsuga menziesii*), western redcedar, and other non-native tree species have been planted around houses and in maintained lawn area to create a park-like setting. The majority of the upland vegetation on the east side has been removed and replaced with lawn and landscaping; however, some parcels, such as parcels 228, 232, and 237 contain patches of native Pacific northwest forest vegetation. Common species identified in the canopy layer of these areas include Douglas fir, western redcedar, bigleaf maple (*Acer*

macrophyllum), and Pacific madrone (*Arbutus menziesii*) with Indian plum (*Oemleria cerasiformis*), hazelnut (*Corylus cornuta*), vine maple (*Acer circinatum*), swordfern (*Polystichum munitum*), and salal (*Gaultheria shallon*) in the understory.

AR 005928

3. MITIGATION DESIGN

As described earlier, the mitigation plan consists of enhancing Wetland A17, Water D, and associated upland buffers by restoring native plant communities (see Figure 2). Since vegetation conditions within Wetland A17 vary; four general enhancement actions will be implemented (Table 5). Additionally, Appendix A contains a table that describes mitigation actions that will occur on each parcel. Depending on existing conditions in a given part of the buffer, mitigation actions may include one of the following actions:

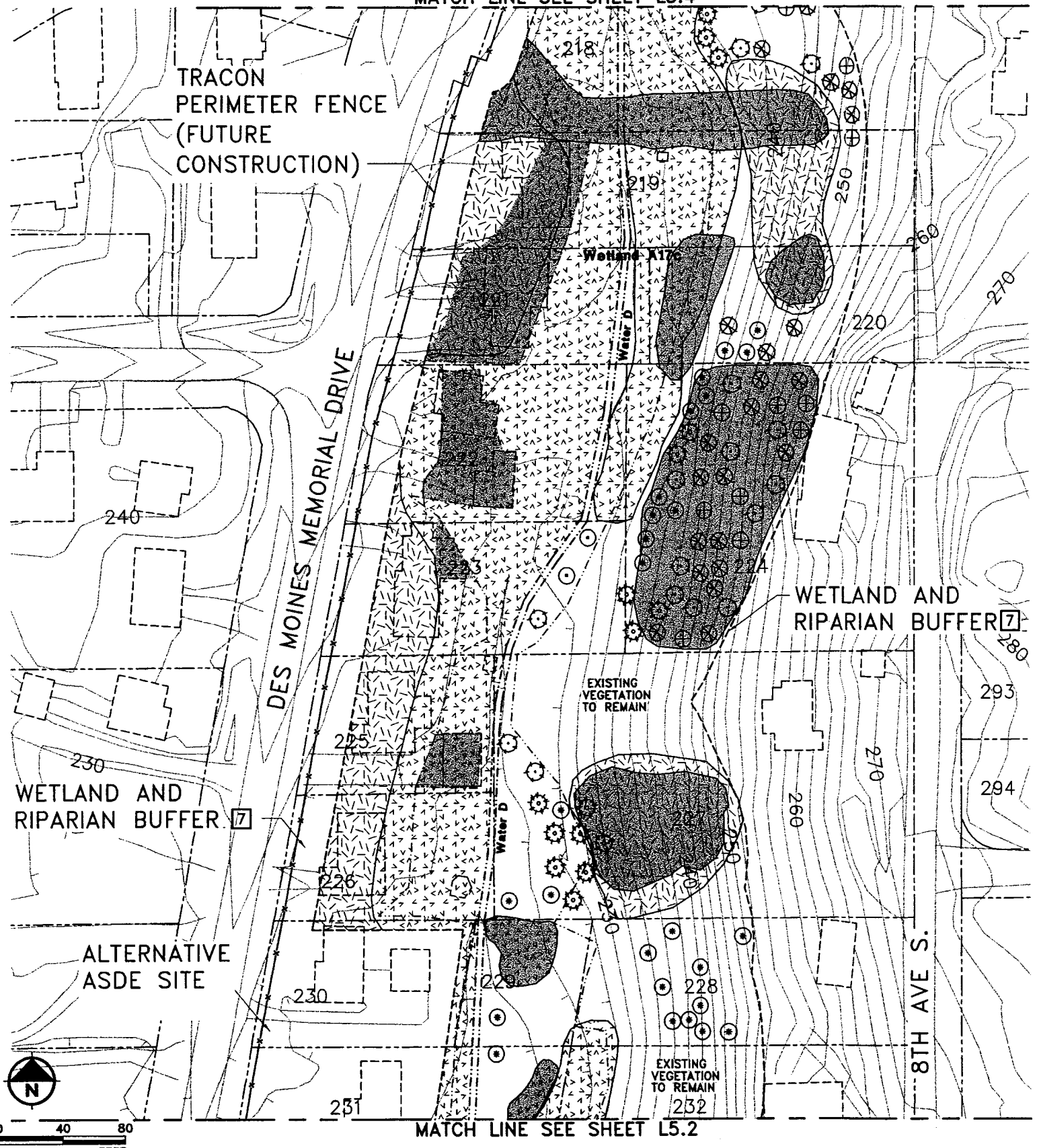
- Removing structures and/or existing non-native invasive vegetation, regrading the area, and re-planting with native vegetation (i.e., clearing and re-planting).
- Controlling and managing patches of non-native invasive vegetation and re-planting with native vegetation (i.e., invasive vegetation management and re-planting).
- Retaining the existing native vegetation matrix but infill planting to increase species diversity and habitat structure (i.e., infill planting).
- Retaining and protecting existing native vegetation with the designated buffer (i.e., protection).

Table 5. Wetland restoration and enhancement approach within the Wetland A17 mitigation area.

Activity	Explanation and Comments
Wetland Restoration	Wetland restoration will result by removing structures and foundations from the edge of the wetland (i.e., Parcels 219, 221, 222, 225, 235, and 236). Restoration also occurs by removing driveway fill and culverts between Wetland A17a and A17b and between A17b and A17c. In these restoration areas, topography will be restored to pre-development conditions and to elevations where seasonal wetland and stream hydrology will be present. These actions will restore about 0.30 acre of wetland, and is shown on Sheets C12 and C13.
Stream Channel Restoration	Stream channel restoration will occur as a result of removing the driveway fill and culverts located on Parcels 218 and 261. Additional restoration will occur by removing two culverts located on Parcels 240, 241 and 243. This work is shown on Sheets C12 and C13. Cross sections of the restored channel are shown on Sheet C12.
Stream Channel Enhancement	Stream enhancement will include, in addition to the revegetation described below, channel improvements to Water D. The channel improvements will include removing footbridges, removing railroad ties, removing other debris, and placing woody debris and logs in the channel. Placing LWD in the channel will reduce erosion and increase retention and processing of organic matter in the stream. In the long run, woody debris will promote channel migration and meandering in a more natural fashion compared to the existing ditched channel. The placement of woody debris is shown on Sheets C12 and C13.
Wetland Enhancement/ Buffer Restoration Plantings	Several strategies are taken in existing wetlands and buffers where enhancements are planned. These are described below.

Table 5. Wetland restoration and enhancement approach within the Wetland A17 mitigation area (continued).

Activity	Explanation and Comments
Remove structures, driveways, and/or non-native invasive vegetation and replant the areas.	Non-native invasive species such as Himalayan and evergreen blackberry (*Rubus laciniatus*), field morning glory, reed canarygrass, and English ivy will be removed from certain portions of the buffer; these areas are shaded in Sheets L5.1 through L5.4. Removing non-native invasive plants will depend upon vehicular access, the potential risk of sedimentation in wetlands or Water D from vegetation removal, and whether or not invasive species can be controlled adequately without removal. Areas of non-native invasive species will be wholly removed only where there is appropriate access and if existing desirable vegetation will not be adversely affected. Re-vegetation will consist of planting native trees and shrubs in areas, such as lawns associated with residences, that do not currently have an overstory of vegetation. Under planting will occur under existing tree canopies where an understory is absent or lacks diversity. Native trees and shrubs to be used in these enhancements are listed on Sheet L6.
Control and/or manage invasive vegetation and re-plant with native vegetation.	Non-native invasive species such as Himalayan and evergreen blackberry, field morning glory, and English ivy will be controlled and managed in certain portions of the buffer where removal is not necessary or possible. For example, invasive species within the buffer may be left in place if removal could cause erosion or sedimentation to the stream or adjacent wetlands. In some areas, patches of invasive species may be treated with herbicide and/or physically removed. These patches may range in size from approximately 200 to 600 ft^2. Coniferous tree species will be planted in the open area to promote reforestation that would eventually shade out invasive species. These plantings will also provide diversity, seed stock, and recruitment of LWD into the riparian buffer.
Infill plant in existing native/ non-native vegetation.	Native trees and shrubs will be planted to increase (1) the amount of shade over Water D, (2) LWD recruitment, and (3) colonization of native trees and shrubs.
Maintain existing conditions	These limited areas either contain well-vegetated buffer that does not require enhancement activities or are inaccessible and cannot be enhanced without causing harm to desirable vegetation.



NOTES:

1. SEE SHEET L6 FOR PLANT SCHEDULE.
2. FENCES AND SIGNS WILL BE INSTALLED AT THE EDGE OF ALL WETLAND AND RIPARIAN BUFFER AREAS.
3. AREAS WITHOUT A PLANTING HATCH DO NOT REQUIRE SHRUB OR TREE PLANTING TO MEET PROPOSED MITIGATION GOALS.
4. TREES GREATER THAN 4" DIA. WILL NOT BE REMOVED DURING CONSTRUCTION OF THIS MITIGATION.
5. IN SOME LOCATIONS BLACKBERRY, JAPANESE KNOTWEED AND YELLOW FLAG IRIS WILL BE REMOVED BY HAND FROM AREAS OUTSIDE THE INDICATED CONSTRUCTION AREAS TO MEET PROPOSED MITIGATION GOALS.
6. S. 164TH STREET SHALL BE REVEGETATED IF IT IS DETERMINED TO NOT BE NEEDED FOR ACCESS PURPOSES.

[7] APPROXIMATELY 9 ACRES OF BUFFER AVERAGING AREA IS ADDED TO THE WETLAND AND RIPARIAN BUFFER TO COMPENSATE FOR ENCROACHMENTS AND THE EXISTING SANITARY SEWER EASEMENT. ALL BUFFER AREAS ARE PLACED IN RESTRICTIVE COVENANTS.

LEGEND

- *Abies grandis* / Grand fir
- *Acer macrophyllum* / Bigleaf maple
- *Picea sitchensis*/Sitka spruce
- *Populus trichocarpa*/Black cottonwood
- *Thuja plicata*/Western redcedar
- *Pseudotsuga menziesii*/Douglas Fir
- HYDROSEED DISTURBED AREAS
- FLOODPLAIN ZONE
- RIPARIAN AND WETLAND ZONE
- UPLAND ZONE #1
- UPLAND ZONE #2
- REMOVE UNDESIRABLE VEGETATION
- 260 EXISTING CONTOUR
- 159 PARCEL NUMBER
- PARCEL BOUNDARY
- WETLAND BOUNDARY

AR 005931

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES: XREF'S: TOE 29120IP PONDS BASE 29120IWL 29120IDE ROADS 29120ILA BUFFER
FILENAME: 29128IL5_3
DATE: 11/07/01

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.	P. FENDT
DESIGNED	T. MITCHELL
DRAWN BY	PJT/SRH
SCALE	1"=40'
DATE	NOVEMBER 2001
CHECKED BY	-
APPROVED BY	P. FENDT

REVISIONS

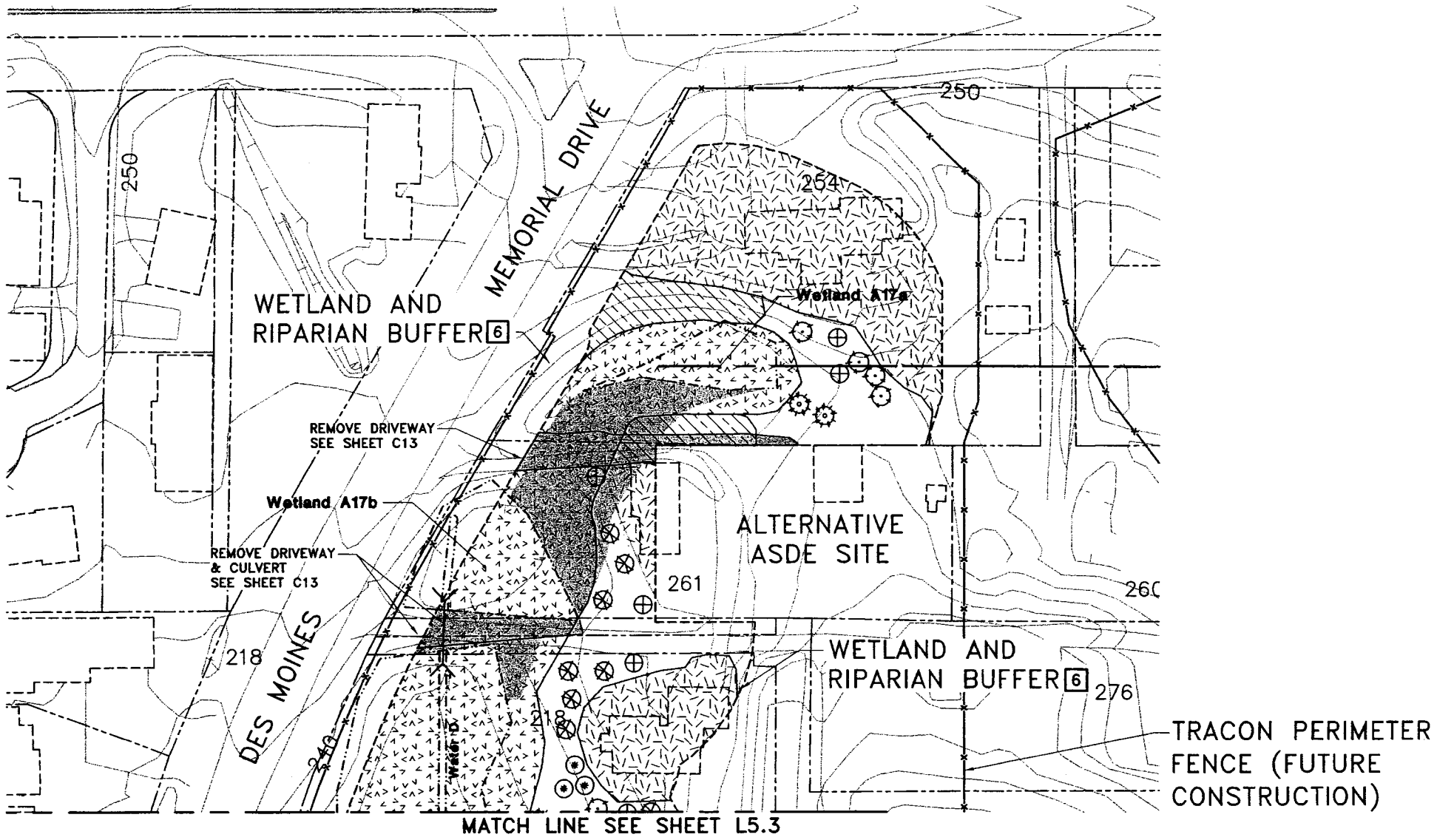
NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER	
DESIGNED	
DRAWN BY	
SCALED	
DATE	
CHECKED BY	
APPROVED BY	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: MILLER CREEK INSTREAM AND BUFFER ENHANCEMENT
SHEET TITLE: LANDSCAPE PLAN

WORK ORDER NO.	-
CONSULTANT'S NO.	29128IL5_3
PORT OF SEATTLE NO.	STIA-9806-L5.3

APPENDIX B



NOTES:

1. SEE SHEET L6 FOR PLANT SCHEDULE.
2. FENCES AND SIGNS WILL BE INSTALLED AT THE EDGE OF ALL WETLAND AND RIPARIAN BUFFER AREAS.
3. AREAS WITHOUT A PLANTING HATCH DO NOT REQUIRE SHRUB OR TREE PLANTING TO MEET PROPOSED MITIGATION GOALS.
4. TREES GREATER THAN 4" DIA. WILL NOT BE REMOVED DURING CONSTRUCTION OF THIS MITIGATION.
5. IN SOME LOCATIONS BLACKBERRY, JAPANESE KNOTWEED AND YELLOW FLAG IRIS WILL BE REMOVED BY HAND FROM AREAS OUTSIDE THE INDICATED CONSTRUCTION AREAS TO MEET PROPOSED MITIGATION GOALS.
6. APPROXIMATELY 9 ACRES OF BUFFER AVERAGING AREA IS ADDED TO THE WETLAND AND RIPARIAN BUFFER TO COMPENSATE FOR ENCROACHMENTS AND THE EXISTING SANITARY SEWER EASEMENT. ALL BUFFER AREAS ARE PLACED IN RESTRICTIVE COVENANTS.

LEGEND

- *Abies grandis* /Grand fir
- *Acer macrophyllum* / Bigleaf maple
- *Picea sitchensis*/Sitka spruce
- *Populus trichocarpa*/Black cottonwood
- *Thuja plicata*/Western redcedar
- *Pseudotsuga menziesii*/Douglas Fir
- HYDROSEED DISTURBED AREAS
- FLOODPLAIN ZONE
- RIPARIAN AND WETLAND ZONE
- UPLAND ZONE #1
- UPLAND ZONE #2
- REMOVE UNDESIRABLE VEGETATION
- EXISTING CULVERT
- 260 EXISTING CONTOUR
- 159 PARCEL NUMBER
- PARCEL BOUNDARY
- WETLAND BOUNDARY

N

40 0 40 80
SCALE FEET

AR 005932

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES:
XREFS: TOE 291201P PONDS BASE 291201WL 291281DE ROADS 291281LA BUFFER
FILENAME: 291281L5_4
DATE: 11/08/01

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./ARCH: P. FENDT
DESIGNED BY: T. MITCHELL
DRAWN BY: PJT/SRH
SCALE: 1"=40'
DATE: NOVEMBER 2001
CHECKED BY: --
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNER:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: MILLER CREEK INSTREAM AND BUFFER ENHANCEMENT
SHEET TITLE: LANDSCAPE PLAN

WORK ORDER NO. --
CONSULTANT'S NO. 291281L5_4
PORT OF SEATTLE NO. STIA-9806-L5.4

APPENDIX B

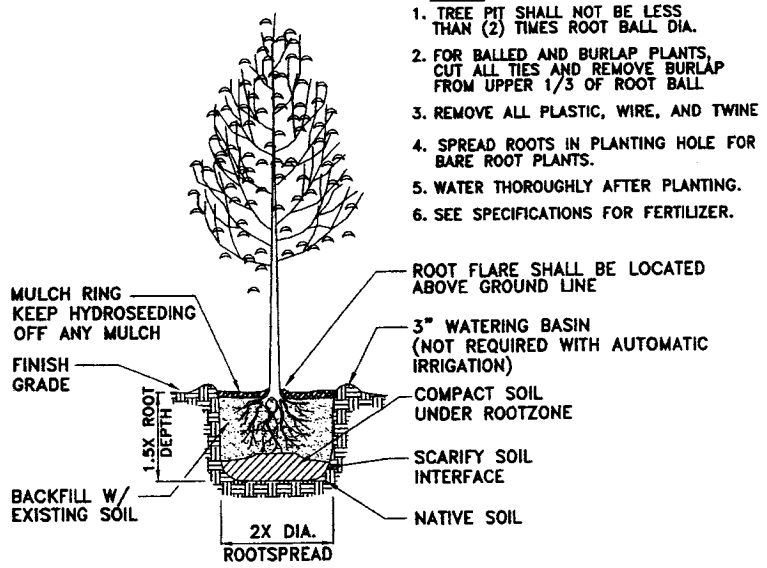
MILLER CREEK BU[illegible]R ENHANCEMENT PLANT SCHEDULE

Symbol	Botanical Name /Common Name	Size	Quantity	Condition / Remarks
⊕	*Abies grandis* / Grand fir	18"– 72"ht.	27	Container or B&B. Rooting to sides and bottom of can or burlap.
⊕	*Acer macrophyllum* / Bigleaf maple	18"– 72"ht.	18	" "
⊕	*Picea stichensis*/Sitka spruce *	18"– 72"ht.	56	" "
⊕	*Populus trichocarpa*/Black cottonwood	18"– 72"ht.	77	" "
⊕	*Thuja plicata*/Western redcedar *	18"– 72"ht.	142	" "
⊗	*Pseudotsuga menziesii*/Douglas Fir	18"– 72"ht.		
	FLOODPLAIN ZONE - Single Species Groups of 3 to 7		**Density(Plants Per Acre)**	
	TREES		280	– Container or B&B. Rooting to sides and bottom of can or burlap.
	Alnus rubra/Red alder	36"– 72" ht.		
	Populus trichocarpa/Black cottonwood	36"– 72" ht.		
	SHRUBS		2,100	– Container. Rooting to sides and bottom of can. Live stakes shall be 36"–48" ht., 1/2"–1" dia., with a minimum of 10 viable, undamaged buds on each stake. 3–4 buds shall be below grade. – Space 4.5' O.C. typical.
	Salix hookeriana/Hooker's willow	1gal/Live stakes		
	Salix lucida spp. lasiandra/Pacific willow	1gal/Live stakes		
	Salix scouleriana/Scoulers willow	1gal/Live stakes		
	Salix stichensis/Sitka willow	1gal/Live stakes		
	Spiraea douglasii/Hardhack spiraea	1 gal.		
	RIPARIAN AND WETLAND ZONE - Single Species Groups of 7 to 12			
	TREES		280	– Container or B&B. Rooting to sides and bottom of can or burlap.
	Alnus rubra/Red alder	36"– 72" ht.		
	Fraxinus latifolia/Oregon Ash	36"– 72" ht.		
	Picea stichensis/Sitka spruce *	36"– 72" ht.		
	Populus trichocarpa/Black cottonwood	36"– 72" ht.		
	Thuja plicata/Western redceder *	36"– 72" ht.		
	SHRUBS		2,100	– Container. Rooting to sides and bottom of can. Live stakes shall be 36"–48" ht., 1/2"–1" dia., with a minimum of 10 viable, undamaged buds on each stake. 3–4 buds shall be below grade. – Space 4.5' O.C. typical.
	Physocarpus capitatus/Pacific ninebark	1 gal.		
	Rosa pisocarpa/Clustered rose	1 gal.		
	Salix hookeriana/Hookers willow	1gal/Live stakes		
	Salix lucida spp. lasiandra/Pacific willow	1gal/Live stakes		
	Salix scouleriana/Scoulers willow	1gal/Live stakes		
	Salix stichensis/Sitka willow	1gal/Live stakes		
	Spiraea douglasii/Hardhack spiraea	1 gal.		
	UPLAND ZONE #1 - Single Species Groups of 7 to 12			
	TREES		280	– Container or B&B. Rooting to sides and bottom of can or burlap.
	Acer macrophyllum/Bigleaf maple	36"– 72" ht.		
	Alnus rubra/Red alder	36"– 72" ht.		
	Pseudotsuga menziesii/Douglas fir	36"– 72" ht.		
	Tsuga heterophylla/Western hemlock *	36"– 72" ht.		
	SHRUBS		2,100	– Container. Rooting to sides and bottom of can. Live stakes shall be 36"–48" ht., 1/2"–1" dia., with a minimum of 10 viable, undamaged buds on each stake. 3–4 buds shall be below grade. – Space 4.5' O.C. typical.
	Acer circinatum/Vine maple	1 gal.		
	Rosa pisocarpa/Clustered rose	1 gal.		
	Salix scouleriana/Scoulers willow	1gal/Live stakes		
	Spiraea douglasii/Hardhack spiraea	1 gal.		
	UPLAND ZONE #2 - Single Species Groups of 3 to 7			
	TREES		280	– Container or B&B. Rooting to sides and bottom of can or burlap.
	Acer macrophyllum/Bigleaf maple	36"– 72" ht.		
	Picea stichensis/Sitka spruce *	36"– 72" ht.		
	Pseudotsuga menziesii/Douglas fir	36"– 72" ht.		
	Thuja plicata/Western redcedar *	36"– 72" ht.		
	Tsuga heterophylla/Western hemlock *	36"– 72" ht.		
	SHRUBS		2,100	– Container. Rooting to sides and bottom of can. Live stakes shall be 36"–48" ht., 1/2"–1" dia., with a minimum of 10 viable, undamaged buds on each stake. 3–4 buds shall be below grade. – Space 4.5' O.C. typical.
	Acer circinatum/Vine maple	1 gal.		
	Salix scouleriana/Scoulers willow	1gal/Live stakes		
	Spiraea douglasii/Hardhack spiraea	1gal		

* Western redcedar, Western hemlock and Sitka spruce shall be planted in a second planting phase, to follow year–3 monitoring. These plants shall be located by the wetland biologist in locations where partial shade and favorable soil moisture is present.

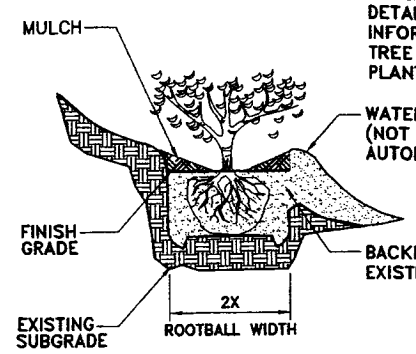
Notes:

1. Preserve and protect all trees and shrubs not designated for removal. Provide, erect, and maintain barricades necessary to prevent access to area within driplines of existing trees. Allow no vehicular or pedestrian traffic, or storage of construction materials within barricades.
2. For each planting zone Contractor shall lay out a 10,000 s.f. test plot, in which the positions of all plants shall be staked with flags that are color coded to represent specific species. Layout for each zone shall be inspected and approved prior to commencement of planting. Approved staking shall serve as the plant layout standard for the remainder of each zone.
3. Shrub masses shall consist of multiple single–species groups (see detail 6). Contractor shall ensure that these single–species groups have a variety of sizes and shapes, and that shrub masses have a variety of species. See planting schedule for numbers of plants in single–species groups.
4. Hydroseed all planting areas. Re–seed areas that are disturbed by subsequent work. Keep hydroseeding off any mulch circles except where needed to protect roots of conifers.



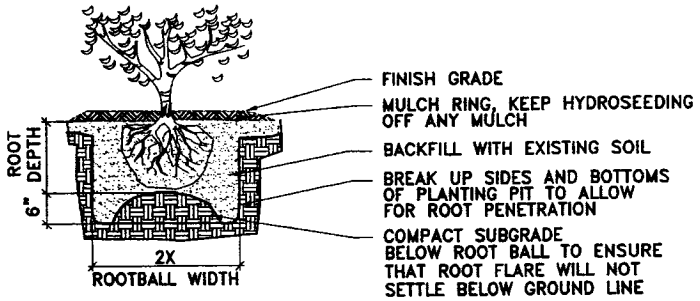
NOTES:
1. TREE PIT SHALL NOT BE LESS THAN (2) TIMES ROOT BALL DIA.
2. FOR BALLED AND BURLAP PLANTS, CUT ALL TIES AND REMOVE BURLAP FROM UPPER 1/3 OF ROOT BALL
3. REMOVE ALL PLASTIC, WIRE, AND TWINE
4. SPREAD ROOTS IN PLANTING HOLE FOR BARE ROOT PLANTS.
5. WATER THOROUGHLY AFTER PLANTING.
6. SEE SPECIFICATIONS FOR FERTILIZER.

DETAIL TREE PLANTING (TYPICAL) — 1 TYP

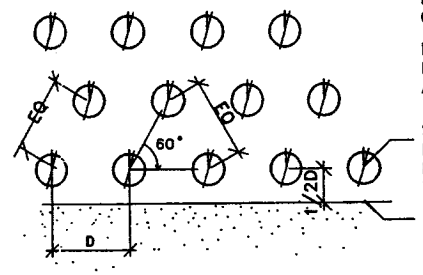


NOTE: REFER TO PLANTING DETAILS 1 AND 3 FOR INFORMATION SPECIFIC TO TREE AND SHRUB PLANTING

DETAIL PLANTING ON SLOPES N.T.S. — 2 TYP



DETAIL SHRUB PLANTING (TYPICAL) — 3 TYP

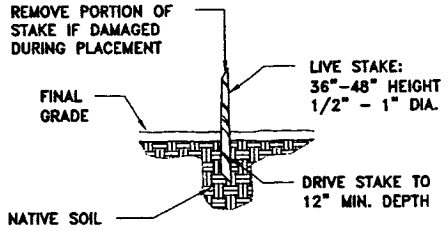


NOTE: ALL GROUNDCOVER/SHRUB SPACING SHALL BE EQUIDISTANT UNLESS OTHERWISE SPECIFIED

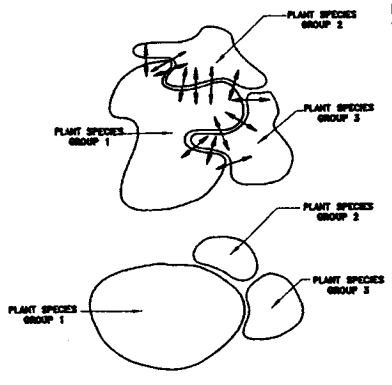
DISTANCE (D) ON CENTER AS REQUIRED TO MEET PLANTS PER ACRE STANDARD.

START FIRST ROW OF PLANTING AT 1/2 THE PERPENDICULAR SPACING BETWEEN ROWS

DETAIL TRIANGULAR SHRUB SPACING (TYPICAL) — 4 TYP



DETAIL LIVE STAKE (TYPICAL) — 5 TYP



DO THIS: USE IRREGULAR "PUZZLE–SHAPED" PLANT GROUPINGS.

NOT THIS: AVOID UNIFORM PLANT GROUPINGS.

DETAIL SHAPES OF PLANTING MASSES NTS — 6 TYP

AR 005933

AGENCY REVIEW NOT FOR CONSTRUCTION

CALL 48 HOURS BEFORE YOU DIG 1–800–424–5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822–8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.: P. FENDT
DESIGNED BY: J. SWENSEN
DRAWN BY: PJT/SRH
SCALE: AS SHOWN
DATE: NOVEMBER 2001
CHECKED BY: –
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

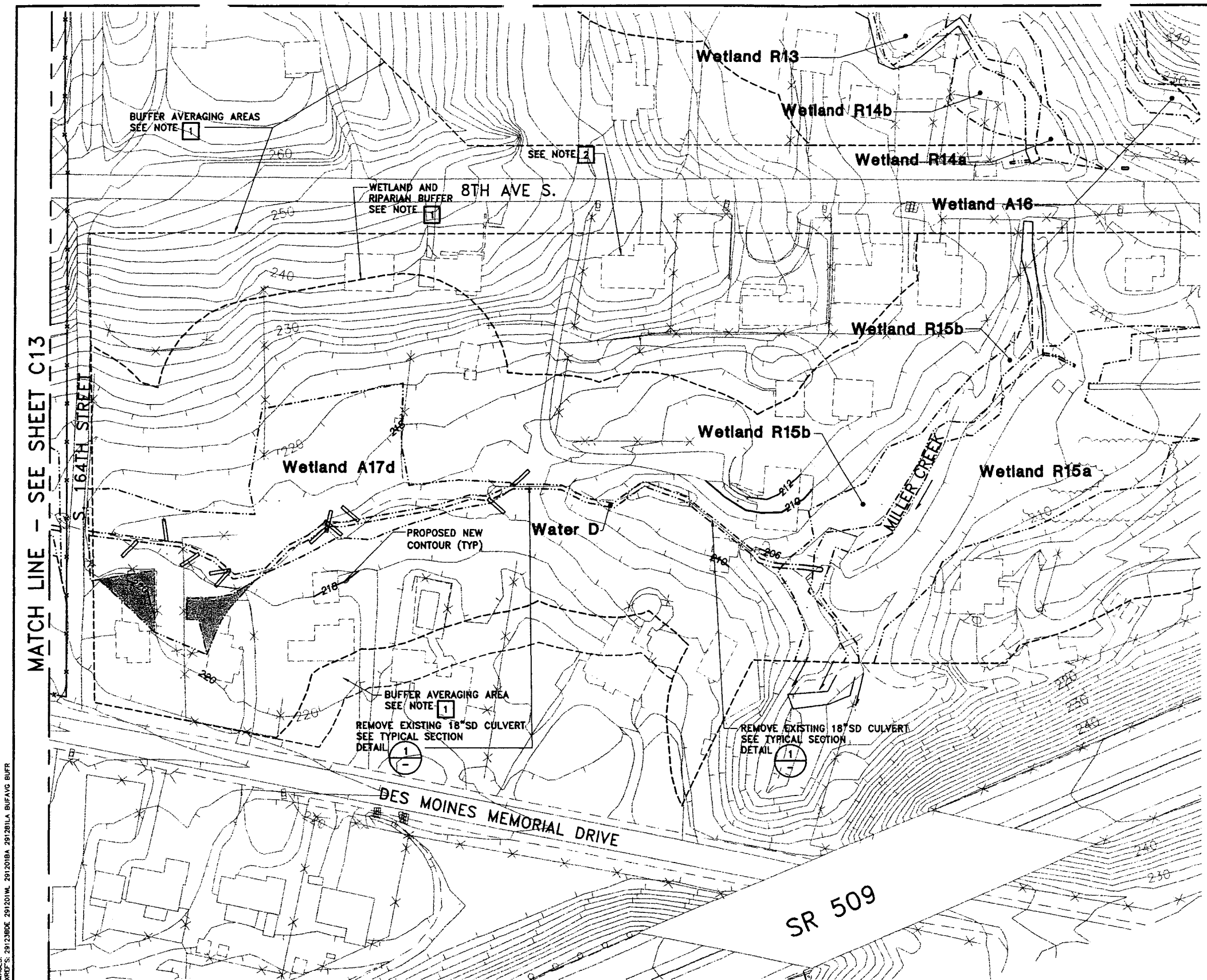
PROJECT ENGINEER:
DESIGNED:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: MILLER CREEK INSTREAM AND BUFFER ENHANCEMENTS
SHEET TITLE: PLANTING SCHEDULE AND DETAILS

WORK ORDER NO.: –
CONSULTANT'S NO.: 291281L6
PORT OF SEATTLE NO.: STIA–9806–L6

APPENDIX B

IMAGES:
XREFS:
FILENAME: 291281L6
DATE: 11/07/01

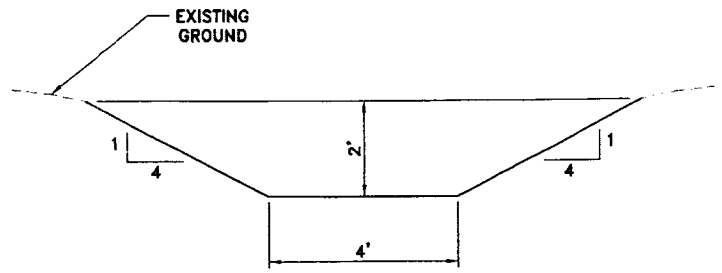


LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING CULVERT
- WETLAND BOUNDARY
- WOODY DEBRIS (LOGS)
- WETLAND RESTORATION

NOTES:

1. REFER TO SHEETS L5.1 AND L5.2 FOR PLANTING PLAN
2. BUILDINGS SHOWN WITH- - - -HAVE BEEN OR WILL BE REMOVED BY THE PORT OF SEATTLE



DETAIL 1/-
TYPICAL CROSS SECTION
FOR CHANNEL AFTER CULVERT
(MATCH EXISTING CULVERT SLOPE)
N.T.S.

N

50 0 50 100
SCALE FEET

AGENCY REVIEW
NOT FOR CONSTRUCTION

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.: P. FENDT
DESIGNED BY: A. WILCOX
DRAWN BY: PJT/SRN
SCALE: 1"=50'
DATE: NOVEMBER 2001
CHECKED BY: --
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNER:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: WETLAND A17 MITIGATION
SHEET TITLE: SITE GRADING

AR 005934

WORK ORDER NO.
CONSULTANT'S NO. 291281C-18
PORT OF SEATTLE NO. STIA-9806-C12

APPENDIX B

IMAGES:
XREF'S: 291238DE 291201WL 291201BA 291281LA RUFAVG BUFR
DATE: 11/07/01 FILENAME: 291281C-18

Wetland A17a

ALTERNATIVE ASDE LOCATION

WETLAND AND RIPARIAN BUFFER SEE NOTE 1

Wetland A17c

SEE NOTE 2

8TH AVE S.

S. 160TH STREET

Water D

PROPOSED NEW CONTOURS (TYP)

REMOVE EXISITNG DRIVEWAY FILL

REMOVE EXISTING CULVERT AND DRIVEWAY FILL

Wetland A17b

PROPOSED NEW CONTOURS (TYP)

ALTERNATIVE ASDE LOCATION

DES MOINES MEMORIAL DRIVE

S. 162ND STREET

MATCH LINE – SEE SHEET C12

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING CULVERT
- WETLAND BOUNDARY
- BUFFER AVERAGING AREA
- WETLAND RIPARIAN BUFFER
- TRACON FENCE
- WOODY DEBRIS (LOGS)
- WETLAND RESTORATION

NOTES:

1. REFER TO SHEETS L5.3 AND L5.4 FOR PLANTING PLAN.
2. BUILDINGS SHOWN WITH ----- HAVE BEEN REMOVED BY THE PORT OF SEATTLE.

N

50 0 50 100
SCALE FEET

IMAGES:
XREF'S: 291238DE 291201WL 291201BA 291281LA BUFFER

DATE: 11/08/01 FILENAME: 291281C-19

AGENCY REVIEW
NOT FOR CONSTRUCTION

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./ARCH.	P. FENDT
DESIGNED:	A. WILCOX
DRAWN BY:	PJT/SRM
SCALE:	1"=50'
DATE:	NOVEMBER 2001
CHECKED BY:	-
APPROVED BY:	P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:	
DESIGNER:	
DRAWN BY:	
SCALE:	
DATE:	
CHECKED BY:	
APPROVED BY:	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

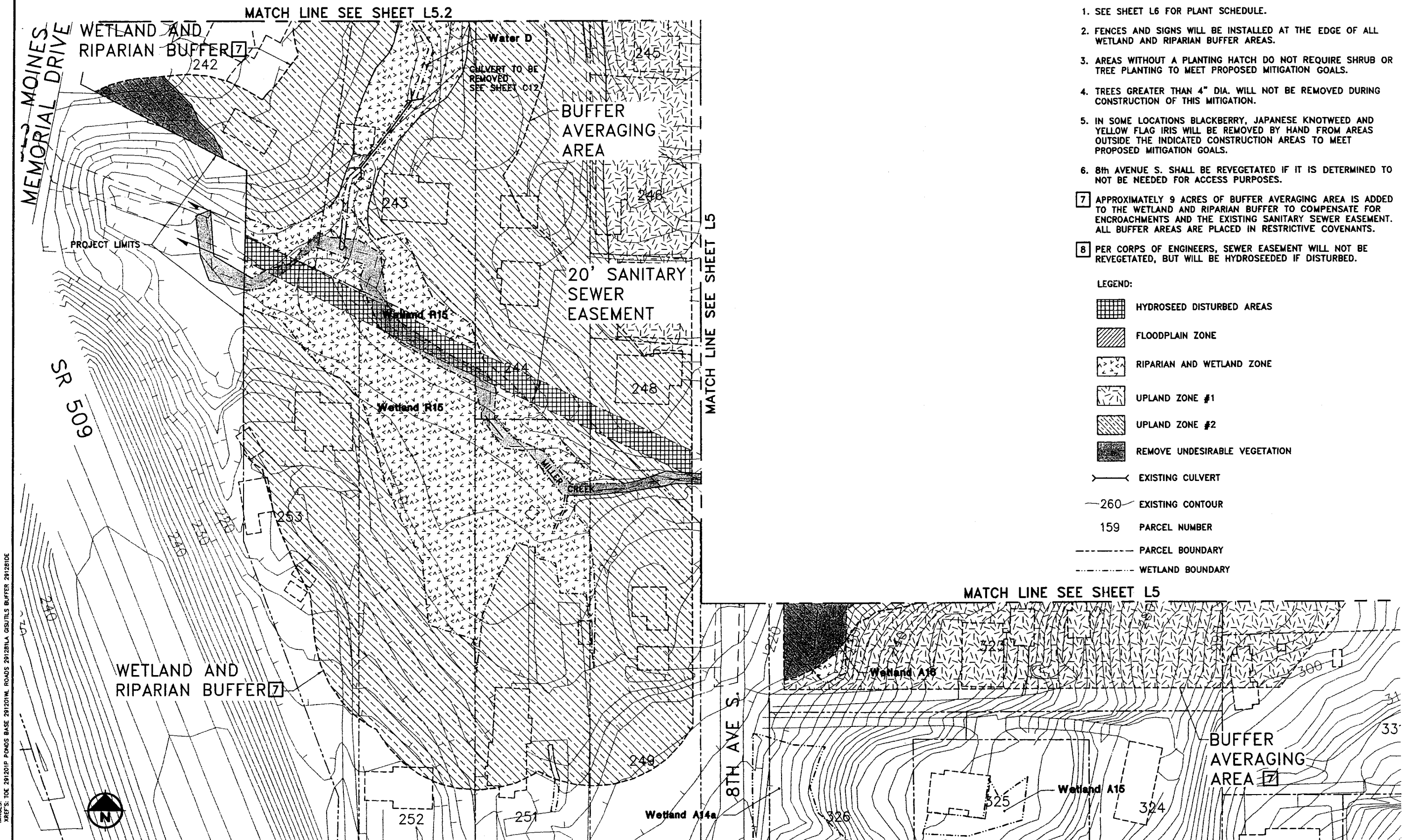
PROJECT: WETLAND A17 MITIGATION

SHEET TITLE: SITE GRADING

AR 005935

WORK ORDER NO.	-
CONSULTANT'S NO.	291281C-19
PORT OF SEATTLE NO.	STIA-9806-C13

APPENDIX B



NOTES:

1. SEE SHEET L6 FOR PLANT SCHEDULE.
2. FENCES AND SIGNS WILL BE INSTALLED AT THE EDGE OF ALL WETLAND AND RIPARIAN BUFFER AREAS.
3. AREAS WITHOUT A PLANTING HATCH DO NOT REQUIRE SHRUB OR TREE PLANTING TO MEET PROPOSED MITIGATION GOALS.
4. TREES GREATER THAN 4" DIA. WILL NOT BE REMOVED DURING CONSTRUCTION OF THIS MITIGATION.
5. IN SOME LOCATIONS BLACKBERRY, JAPANESE KNOTWEED AND YELLOW FLAG IRIS WILL BE REMOVED BY HAND FROM AREAS OUTSIDE THE INDICATED CONSTRUCTION AREAS TO MEET PROPOSED MITIGATION GOALS.
6. 8th AVENUE S. SHALL BE REVEGETATED IF IT IS DETERMINED TO NOT BE NEEDED FOR ACCESS PURPOSES.

7 APPROXIMATELY 9 ACRES OF BUFFER AVERAGING AREA IS ADDED TO THE WETLAND AND RIPARIAN BUFFER TO COMPENSATE FOR ENCROACHMENTS AND THE EXISTING SANITARY SEWER EASEMENT. ALL BUFFER AREAS ARE PLACED IN RESTRICTIVE COVENANTS.

8 PER CORPS OF ENGINEERS, SEWER EASEMENT WILL NOT BE REVEGETATED, BUT WILL BE HYDROSEEDED IF DISTURBED.

LEGEND:

- HYDROSEED DISTURBED AREAS
- FLOODPLAIN ZONE
- RIPARIAN AND WETLAND ZONE
- UPLAND ZONE #1
- UPLAND ZONE #2
- REMOVE UNDESIRABLE VEGETATION
- EXISTING CULVERT
- 260 EXISTING CONTOUR
- 159 PARCEL NUMBER
- PARCEL BOUNDARY
- WETLAND BOUNDARY

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES:
XREF'S: TOE 29120IP PONDS BASE 29120IWL ROADS 29128ILA QSUTILS BUFFER 29128IOE

DATE: 11/08/01 FILENAME: 291281L5_1

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./ARCH.	P. FENDT
DESIGNED	T. MITCHELL
DRAWN BY	PJT/SRM
SCALE	1" =40'
DATE	NOVEMBER 2001
CHECKED BY	-
APPROVED BY	P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER	
DESIGNED	
DRAWN BY	
SCALED	
DATED	
CHECKED BY	
APPROVED BY	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

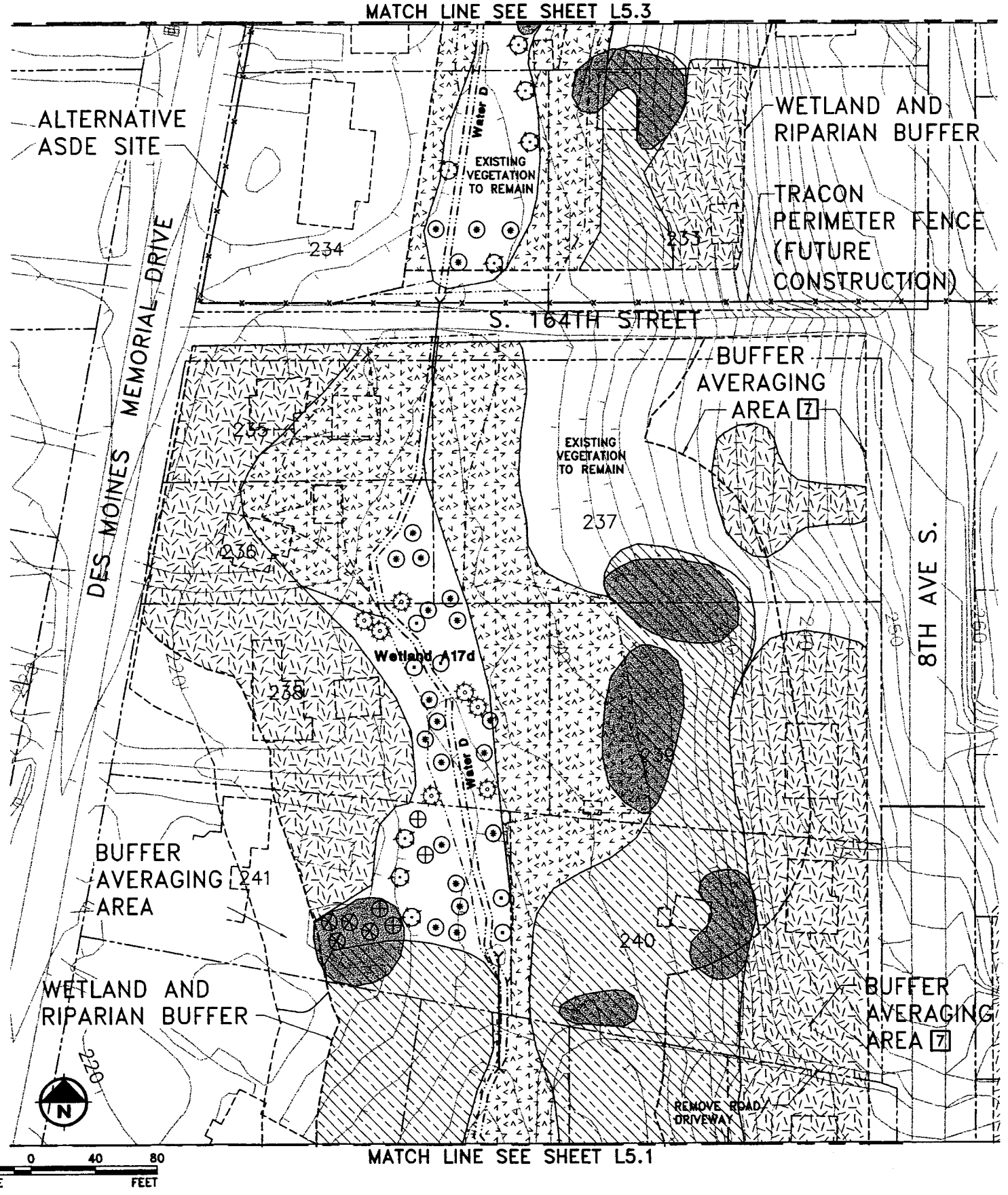
PROJECT: MILLER CREEK INSTREAM AND BUFFER ENHANCEMENT

SHEET TITLE: LANDSCAPE PLAN

WORK ORDER NO.	-
CONSULTANT'S NO.	291281L5_1
PORT OF SEATTLE NO.	STIA-9806-L5.1

APPENDIX B

AR 005936



NOTES:

1. SEE SHEET L6 FOR PLANT SCHEDULE.
2. FENCES AND SIGNS WILL BE INSTALLED AT THE EDGE OF ALL WETLAND AND RIPARIAN BUFFER AREAS.
3. AREAS WITHOUT A PLANTING HATCH DO NOT REQUIRE SHRUB OR TREE PLANTING TO MEET PROPOSED MITIGATION GOALS.
4. TREES GREATER THAN 4" DIA. WILL NOT BE REMOVED DURING CONSTRUCTION OF THIS MITIGATION.
5. IN SOME LOCATIONS BLACKBERRY, JAPANESE KNOTWEED AND YELLOW FLAG IRIS WILL BE REMOVED BY HAND FROM AREAS OUTSIDE THE INDICATED CONSTRUCTION AREAS TO MEET PROPOSED MITIGATION GOALS.
6. 8th AVE S. SHALL BE REVEGETATED IF IT IS DETERMINED TO NOT BE NEEDED FOR ACCESS PURPOSES.
7. APPROXIMATELY 9 ACRES OF BUFFER AVERAGING IS ADDED TO THE WETLAND AND RIPARIAN BUFFER TO COMPENSATE FOR ENCROACHMENTS AND THE EXISTING SANITARY SEWER EASEMENT. ALL BUFFER AREAS ARE PLACED IN RESTRICTIVE COVENANTS.

LEGEND

- *Abies grandis* / Grand fir
- *Acer macrophyllum* / Bigleaf maple
- *Picea sitchensis*/Sitka spruce
- *Populus trichocarpa*/Black cottonwood
- *Thuja plicata*/Western redcedar
- *Pseudotsuga menziesii*/Douglas Fir
- HYDROSEED DISTURBED AREAS
- FLOODPLAIN ZONE
- RIPARIAN AND WETLAND ZONE
- UPLAND ZONE #1
- UPLAND ZONE #2
- REMOVE UNDESIRABLE VEGETATION
- EXISTING CULVERT
- 260 EXISTING CONTOUR
- 159 PARCEL NUMBER
- PARCEL BOUNDARY
- WETLAND BOUNDARY

AR 005937

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES: XREF'S: TOE 291201P PONDS BASE 291201ML ROADS 291281DE 291281LA BUFFER
FILENAME: 291281L5_2
DATE: 11/08/01

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.: P. FENDT
DESIGNED: T. MITCHELL
DRAWN BY: PJT/SRH
SCALE: 1"=40'
DATE: NOVEMBER 2001
CHECKED BY: –
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED:
DRAWN BY:
SCALED:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: MILLER CREEK INSTREAM AND BUFFER ENHANCEMENT
SHEET TITLE: LANDSCAPE PLAN

WORK ORDER NO.: –
CONSULTANT'S NO.: 291281L5_2
PORT OF SEATTLE NO.: STIA-9806-L5.2

APPENDIX B

3.1 GRADING AND/OR CLEARING

The mitigation site is a residential area that contains driveways, fences, and 34 buildings. Grading activities will include removing existing structures, fill material, driveways, and three culverts (totaling about 125 linear ft) in the designated wetland and buffer areas (see Sheets C12 and C13). Most of the buildings have already been demolished and removed, but several structures and foundations remain. The mitigation actions will remove all structures, underground storage tanks, septic systems, and driveways within the mitigation site. Several foundations and driveways are immediately adjacent wetlands, and their removal will result in land surfaces at or slightly below that of adjacent wetlands. These activities will restore about 0.30 acre of wetland.

Additional minor grading will remove landscape features such as retaining walls. Hand clearing of invasive plants from portions of Water D is also proposed. In some upland locations, the top 6 to 12 inches of topsoil may be tilled and removed as necessary to remove the rootstocks of invasive species.

There is little or no native vegetation near the structures to be demolished. However, when desirable vegetation is present, demolition will be designed to minimize disturbance to this native vegetation and soils. The contractor responsible for demolition of structures within the buffer areas will follow BMPs to prevent erosion and sedimentation to the stream. The Port has already demolished many residential structures within the buffer using sediment and erosion control BMPs to prevent erosion and sedimentation to the stream or wetlands. The standard practices implemented prior to any demolition activity include use of barrier and sediment fences between the demolition site and any wetland or water feature are effective at preventing indirect impacts from the demolition area. These standard BMPs will continue to be used throughout the demolition activities associated with the Miller Creek buffer enhancement plan. Materials removed from the buffer area during demolition will be disposed of off-site at an approved upland disposal facility.

3.2 WATER D ENHANCEMENT

Enhancement actions within Water D will consist of removing existing small footbridges, railroad ties, debris, and placing LWD within the channel. Placing LWD in the channel will promote organic matter and sediment retention and the in-channel processing of organic matter. In the longer run, the LWD will promote natural channel forming processes (e.g., channel meandering and migration) which would gradually convert the linear ditched channel to a more natural wetland/channel system.

LWD placement in Water D will generally conform to existing Washington State Department of Fish and Wildlife (WDFW) guidelines and be consistent with the Hydraulic Project Approval permit to be issued by WDFW. Western redcedar, Douglas fir, western hemlock, and bigleaf maple logs will be used. The general location where logs will be installed is shown on Sheets C3 through C7; however, they will be field-placed by the project engineer and/or habitat biologist during construction. The logs will not be anchored because Water D does not have high enough peak flows that would result in log movement. Much of the wood to be used in the restoration can be salvaged from existing on-site sources.

3.3 EXPECTED HYDROLOGY

In general, wetlands in the mitigation area will be maintained by existing groundwater and surface water sources. The wetland mitigation areas (including the areas where culverts and fill material will be removed) would be expected to continue to have saturated soils during the winter, early spring, and early summer months.

3.4 HAZARD WILDLIFE CONSIDERATIONS

The landscape approach has been developed to be consistent with the Wildlife Hazard Management Plan (WHMP) (USDA 2000) and the restoration actions identified in the Miller Creek riparian and instream enhancement projects (refer to Section 5.2 in the NRMP). Mitigation actions in the buffer, such as replacing the existing open areas (i.e., lawns and fields) with forest and shrub vegetation, will reduce hazard wildlife (i.e., flocking birds, waterfowl, and raptors) by covering and screening the mitigation areas with dense vegetation. Additionally, to minimize wildlife hazards, the plants to be installed produce few fruits, berries, or nuts that are used as food sources.

3.5 LANDSCAPE PLAN

The landscape plan for the Wetland A17 site is similar to that planned for the Miller Creek wetland and buffer enhancements (see Section 5.2 of the NRMP). A list of plant species similar to that identified for the Miller Creek wetland and buffer restoration (Parametrix 2000a) will be used in the Wetland A17 and buffer enhancement plan (see Sheet L6). Sun-tolerant species such as Douglas fir and red alder will generally be planted in open sunny areas, while species that prefer shade, such as vine maple, will generally be planted in shady areas under existing vegetation.

The proposed plant communities and specific planting zones are shown in detail on Sheets L5.1 through L5.4. Four general planting approaches will be used in the wetland and buffer enhancement area. Planting details that depict how the plants should be installed and spacing should occur are shown in Sheet L6.

Temporary irrigation will be provided within the buffer areas. Irrigation will only be used during the plant establishment phase and will either be removed (if installed above ground) or abandoned in place (if installed below ground).

3.5.1 Existing Wetlands to be Enhanced

Wetlands A17 will be enhanced by (1) removing non-native invasive species in selected areas, (2) infill planting with native tree and shrub species, and (3) removing driveways that bisect Wetlands A17a and A17b and between Wetlands A17b and A17c. Planting densities for infill tree planting will be targeted to achieve greater than 250 stems per acre and for shrub planting will be greater than 1,700 individuals per acre. Infill planting densities are slightly lower than planting densities in cleared and/or graded areas because some native vegetation already exists in areas to be infill planted.

3.5.2 Upland Buffers

Upland Buffers (see Sheets L5.1 through L5.4) are located east and west of the project area, and will be planted with species adapted to seasonally wet, upland soil conditions. The landscape plan for the upland area will focus on planting trees and shrubs in a dense vegetated buffer to protect the enhancement area from surrounding land uses. Trees will be installed to achieve at least 280 stems per acre and will be installed according to the planting plan. Field locations will be approved by the landscape architect or wetland biologist. Shrubs will be installed to achieve greater than 2,100 individuals per acre (see Table 4). The planting scheme in the upland areas will place coniferous and deciduous tree species in patches to create a mixed canopy.

3.6 IMPLEMENTATION

The Wetland A17 mitigation will be incorporated into the Miller Creek wetland and riparian buffer enhancement projects (see Section 5.2 of the NRMP).

3.7 PERFORMANCE STANDARDS AND MONITORING

Performance standards, monitoring approaches, and contingency measures for the Wetland A17 mitigation are listed in Table 6, and are the same as those for the Miller Creek riparian corridor mitigation. Interim vegetation cover standards that the mitigation areas must meet are listed in Table 7, and potentially invasive species that will be controlled on the mitigation are listed in Table 8. If performance standards are not met, specific contingency measures would be implemented, following the adaptive management approach described in Section 4 of the NRMP (Parametrix 2000a).

Monitoring the wetland and riparian buffer projects will be consistent with the monitoring approach and schedule outlined in Section 4 of the NRMP (Parametrix 2000a). Monitoring schedules specific to this project are provided in Table 9. Specific performance standards will be evaluated regularly during the monitoring period to ensure that the wetland and riparian buffer enhancement projects are meeting project goals and design criteria.

3.8 SITE PROTECTION

The Port will execute and file restrictive covenants for the mitigation area with King County no later than sixty (60) days after the issuance of the Section 404 permit by ACOE. The restrictive covenant area encompasses the wetland, buffer, and buffer averaging areas shown in Figure 2. A copy of the restrictive covenant language is included in Appendix B.

The mitigation area will be marked with permanent signs and protected by fencing. Signs will clearly mark the area as a protected wetland mitigation site. The Port will inspect and maintain signs and fencing on a regular basis.

3.9 MAINTENANCE AND CONTINGENCY PLANS

Routine maintenance tasks (e.g., maintaining irrigation system, removing trash) and adaptive management/contingency measures (e.g., weed management, replacing plants) will be implemented consistent with the approach outlined in Section 4 of the NRMP (Parametrix 2000a). Specific contingency actions for each wetland and riparian buffer performance standard are provided in Table 6.

Table 6. Final performance standards, evaluation approach, and contingency measures for wetland and buffer enhancement along Miller Creek.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
1. Riparian buffer areas that are cleared or disturbed during demolition will be planted with native forested and shrub vegetation (these are shaded in Appendix B, Sheets L1 through L5.1). Plant native tree species at densities of greater than 280 per acre. Plant native shrub species at densities of greater than 2,100 per acre.	Plant survival will be 100% following year 1. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Tree density will be at least 280 stems/acre; shrub density will be at least 2,100 individuals per acre in monitoring years 3, 8, and 15. During monitoring years 3, 8, and 15, plant diversity will not decrease by more than 10% from the number of plant species installed at baseline. Cover of native species will be at least 80% at monitoring year 15[a]. Cover of undesirable non-native, invasive[b] species in cleared and planted areas will not exceed 10% in any monitoring year (see Appendix B, Sheets L1 through L5.4 for areas where undesirable vegetation will be removed).	Vegetation sampling (plots, transects, or plotless techniques) to estimate native species cover, density, mortality, and invasive species cover will be used.	If standards are not met: • Select species that are better adapted to existing hydrologic conditions. • Install additional plant material. • Install protective collars to reduce herbivore damage. • Control/reduce non-native invasive species.
2. Lawn and other areas dominated by non-native plant species will be enhanced by planting native forested vegetation.	Plant survival will be 100% following year 1. Average survival of planted stock will be at least 80% during the first 3 monitoring years. Tree density will be at least 280 stems/acre; shrub density will be at least 2,100 individuals per acre in monitoring years 3, 8, and 15. In monitoring years 3, 8, and 15, plant diversity will not decrease by more than 10% from the number of plant species installed at baseline. Cover of native species will be at least 80% at monitoring year 15[a].	See above.	See above.

Table 6. Final performance standards, evaluation approach, and contingency measures for wetland and buffer enhancement along Miller Creek (continued).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
	Cover of non-native, invasive[b] species in cleared and planted areas will not exceed 10% in any monitoring year.		
3. Densely plant the portion of the buffer adjacent to Miller Creek with native trees and shrubs where applicable to provide future sources of LWD to the stream.	Density of trees in buffer is at least 280 stems/acre during monitoring years 3, 8, and 15.	See above.	See above.
5. Install fencing and signs to designate the buffer area as a protected mitigation site.	Signs and/or fencing will clearly mark the buffer edge as a protected mitigation site (see Appendix 0 for fencing specifications).	Check signs and fencing during annual monitoring visits.	Repair and/or re-install damaged or missing signs.

[a] See Table 4.2-1 for interim cover targets (i.e., from year 3 to year 15).

[b] See Table 4.2-2 for list of invasive, non-native species to be monitored and controlled on the mitigation site.

Table 7. Performance standards for vegetation cover (minimum percent) by vegetation zone and monitoring year.

	Vegetation Zone				
			Emergent		
Monitoring Year	Forest[a]	Shrub[a]	Hydroseed	Planted	Invasive Species
0	-	-	0	0	<10
1	-	-	50	10	<10
2	-	-	60	20	<10
3	10	10	70	30	<10
5	25	40	80	50	<10
7	40	65	80	70	<10
10	80	80	80	80	<10
12	80	80	80	80	<10
15	80	80	80	80	<10

[a] Vegetation cover will not be monitored in forest and shrub plant communities during monitoring year 0, 1, or 2. During these years, plant survival performance will be monitored and at year 3, survival must be 80 percent of the original numbers planted.

Table 8. Invasive plant species that will be monitored and controlled in the mitigation sites.

Scientific Name	Common Name
Convolvulus sepium	Hedge bindweed
Cytisus scoparius	Scotch Broom
Lythrum salicaria	Purple loosestrife
Phalaris arundinacea	Reed canarygrass
Polygonum cuspidatum	Japanese knotweed
Polygonum sachalinense	Sachaline
Rubus discolor	Himalayan blackberry
Rubus lacinatus	Evergreen blackberry

Table 9. Wetland A17 mitigation monitoring methods and schedule.

			Years Following Mitigation Implementation								
Feature	Activity	Duration	0	1	2	3	5	7	10	12	15
Plant Survival	Calculate plant survival	Once late spring to early summer	X	X	X	X	X	X	X	X	X
Tree and shrub density/cover	Vegetation sampling	Once late spring to early summer	X	X	X	X	X	X	X	X	X
Vegetation structure	Describe from walk-through surveys, incorporating data from the above analysis as available	Once late spring to early summer	X	X	X	X	X	X	X	X	X

4. REFERENCES

Ecology (Washington State Department of Ecology). 1994. Guidelines for developing freshwater wetlands mitigation plans and proposals. Olympia, Washington.

Ecology (Washington State Department of Ecology). 2001. Water Quality Certification for U.S. Army Corps of Engineers public notice 1996-4-02325. Letter dated September 21, 2001.

Parametrix. 2000a. Natural resource mitigation plan Master Plan Update improvements Seattle-Tacoma International Airport. Prepared by Parametrix for the Port of Seattle. Kirkland, Washington.

Parametrix. 2000b. Wetland delineation report Master Plan Update improvements Seattle-Tacoma International Airport. Prepared by Parametrix for the Port of Seattle. Kirkland, Washington.

Snyder, D.E., G.P. Philip, and R.F. Russell. 1973. Soil survey of King County area, Washington. United States Department of Agriculture, Soil Conservation Service. In cooperation with the Washington Agricultural Experiment Station.

USDA (U.S. Department of Agriculture). 1952. Soil survey, King County, Washington. Series 38, No. 31. United States Department of Agriculture, Soil Conservation Service, in cooperation with the Washington Agricultural Experiment Station and Washington State Planning Council.

USDA (U.S. Department of Agriculture). 2000. Wildlife hazard management plan Seattle-Tacoma International Airport. Seattle, Washington.

APPENDIX A

SUMMARY OF EXISTING CONDITIONS AND PROPOSED MITIGATION

Table A-1. Existing conditions and proposed mitigation actions by parcel for Wetland A17.

Sheet Number	Parcel Number	Location	Existing Conditions	Proposed Mitigation Actions
L5.3 and L5.4	218	Wetland / Stream	The area west of Water D is a young alder forest with relatively dense Himalayan blackberry and field morning glory in the understory. A driveway with a culvert has been placed in the wetland, at the north end of the wetland on this parcel.	Clear Himalayan blackberry from the wetland. Remove the driveway and culvert from the wetland. Regrade the area to match historic contours. Use BMPs and bioengineering techniques to stabilize the area after work is complete. Plant western redcedar and hemlock in red alder forest understory.
		Upland (House removed)	Upland areas are grassed or vegetated with red alder, western redcedar, big-leaf maple, or cherry laurel. A driveway crosses the upland.	Remove Himalayan blackberry and cherry laurel on southern property boundary. Remove driveway and associated fill, and regrade to match contours. Revegetate upland with tree and shrub species.
L5.3	219	Wetland / Stream	West of Water D, wetland vegetation consists of lady fern, soft rush, small-fruited bulrush, common velvetgrass, watercress, and creeping buttercup. East of Water D, wetland vegetation consists of field horsetail, field morning glory, and Himalayan blackberry.	Control blackberry and plant wetland trees and shrubs in en nt wetland area.
		Upland (House remains)	A house, shed, lawn, ornamental shrubs, and areas of blackberry are present on the west side of the parcel. East of the stream, Himalayan blackberry and hydroseeded areas are present on the north side.	Remove driveway, house, shed, and associated fill. Regrade to match historic conditions. Remove Himalayan blackberry and plant with trees. Near the wetland edge plant red alder and black cottonwood.
L5.3	220	Wetland / Stream	The wetlands consist of field horsetail, common velvetgrass, and creeping buttercup.	Infill plant with specified plant species.
		Upland (No house present)	The parcel is forested with some Himalayan blackberry in the understory.	Remove blackberry located on the north side of the parcel and near the wetland edge. Plant sun-tolerant native coniferous tree species.
L5.3	221	Wetland / Stream	Vegetation in the wetland consists of field horsetail, common velvetgrass, and creeping buttercup. Watercress is growing in Water D and three fruit trees are located in the wetland. Water D is lined with creosote railroad ties. Some reed canarygrass and Himalayan blackberry are located on the east property edge.	Remove creosote railroad ties, grade the area back to connect the stream with the floodplain, remove the blackberry, and replant the area with native wetland trees and shrubs.
		Upland (House remains)	This parcel is grassed with ornamental plantings around the house. The house is located at the wetland edge.	Remove the residential structures and associated fill. Regrade to match historic conditions. Remove Himalayan blackberry on the north side and near the wetland edge. Plant open areas with sun-tolerant coniferous tree species.

Table A-1. Existing conditions and proposed mitigation actions by parcel for Wetland A17 (continued).

Sheet Number	Parcel Number	Location	Existing Conditions	Proposed Mitigation Actions
L5.3	222	Wetland / Stream	On the west side of the channel, the wetland borders the north, south, and east sides of the house. The wetland is dominated by creeping buttercup, field horsetail, and small-fruited bulrush. The east side of the channel is dominated by reed canarygrass with field horsetail and creeping buttercup. Himalayan blackberry borders the southern portion of the wetland.	Remove Himalayan blackberry and reed canarygrass on the east side. Plant willows.
		Upland (House remains)	A house is adjacent to the wetland. The upland area is lawn with a mature Douglas fir and small ornamental trees. Small ornamental shrubs are planted around the house. A compacted gravel driveway is located on the south side of the parcel.	Remove house, driveway, and associated fill. Regrade to smooth contours. Avoid damage to Douglas fir. Remove ornamental vegetation. Replant the area with native tree and shrub speci
L5.3	223	Wetland / Stream	Near the house, the wetland is dominated by lady fern, creeping buttercup, and field horsetail in the emergent layer and salmonberry and Himalayan blackberry in the shrub stratum. A 3.5 ft high fence is located parallel to the channel, behind the house.	Remove fence. Remove blackberry. Plant wetland with willows.
		Upland (House remains)	The upland consists of a house, driveway, lawn, and ornamental shrubs. At the west edge of the wetland is a mature white oak tree and horse chestnut tree. In the SE corner, there is western redcedar, swordfern, creeping blackberry, ivy, and western hazelnut. Small areas of Himalayan blackberry, field morning glory, and English ivy are present in the understory of the forest.	Remove buildings, driveway, and associated fill. Regrade to smooth contours. Remove Himalayan blackberry, field morning glory, and ivy in the understory. Replant with native shade-tolerant shrub species (e.g., swordfern). Protect white oak and chestnut.
L5.3	224	Wetland / Stream	See description for Parcel 222.	See description for Parcel 222.
		Upland (House remains)	The west portion of the property consists of a closed canopy forest of western redcedar, black cottonwood, big-leaf maple, and Douglas fir. The understory is composed of Indian plum, swordfern, with a dense coverage of Himalayan blackberry, some ivy, and English holly. A house remains on upland.	Remove structures and associated fill. Regrade to smooth contours. Control Himalayan blackberry and ivy near wetland edge. Plant shade-tolerant coniferous trees in the understory; otherwise, little planting is required on this parcel.
L5.3	225	Wetland / Stream (Garage and shed remain)	Half of the wetland is managed lawn and the other half is Himalayan blackberry and red alder trees. A garage and shed are located in the wetland.	Remove buildings and Himalayan blackberry. Plant native trees and shrubs.
		Upland (House remains)	The upland consists of a house, driveway, and lawn with ornamental shrubs next to the house. A raised concrete wall is located on the south side of the parcel, next to Parcel 226.	Remove buildings, concrete wall, and driveways. Regrade to smooth contours. Remove some ornamentals and English laurel and plant with mixed deciduous and coniferous native forest vegetation.

Table A-1. Existing conditions and proposed mitigation actions by parcel for Wetland A17 (continued).

Sheet Number	Parcel Number	Location	Existing Conditions	Proposed Mitigation Actions
L5.3	226	Wetland / Stream (Shed remains)	The wetland area is primarily vegetated with lawn. Himalayan blackberry, field horsetail, field morning glory occur in patches and along east edge of the property. A shed is located in the wetland.	Remove buildings, driveway, and Himalayan blackberry; plant with willows.
		Upland (House remains outside buffer)	The upland consists of house, driveway, and lawn with ornamental shrubs.	Remove buildings, driveway, ornamental plants, and associated fill. Regrade to smooth contours. Plant with native trees and shrubs.
L5.3	227	Wetland / Stream	The wetland vegetation consists of alder trees and Himalayan blackberry.	Remove blackberry and plant additional coniferous trees to shade out blackberry.
		Upland (No structures)	Vegetation on the site consists predominantly of coniferous forest vegetation with a small area of lawn near the house and a patch of Himalayan blackberry west of the house. English ivy is present in the south central portion of the parcel.	Remove the Himalayan blackberry and plant the area with specified trees and shrubs. Remove English ivy in the south central portion of the parcel.
L5.3	228	Wetland / Stream	Small area of wetland in SE corner of parcel.	Plant with specified native trees and shrubs.
		Upland	The site is generally forested; however, some areas near the house are dominated by Himalayan blackberry.	Remove Himalayan blackberry and interplant with native coniferous tree species.
L5.3	229	Wetland / Stream	Wetland vegetation consists of creeping buttercup, reed canarygrass, and bentgrass. Black locust saplings/suckers are also present. A fence is located between the wetland and channel.	Remove fence. Remove reed canarygrass and locust. Plant willow trees and shrubs.
		Upland (No structures)	The small area of upland is located on the parcel and consists of grass and bare ground.	Plant this small area with a shade-tolerant tree or a few shade-tolerant shrubs.
L5.3	230	Wetland / Stream	A narrow fringe of palustrine emergent wetland is located near the east edge of the parcel (refer to the description of the wetland on Parcel 229).	Remove fence and locust saplings/suckers and plant this area with willow trees and shrubs.
		Upland (House remains)	Lawn and ornamental shrubs are planted around the house. Several trees are located along the channel and elsewhere. A house, garage, and concrete driveway are also present.	Remove buildings, driveway, and associated fill. Regrade to smooth contours. Plant with native trees and shrubs.
L5.2 and L5.3	231	Wetland / Stream	The wetland vegetation includes watercress, common velvetgrass, and field horsetail. There are red alder saplings and some ornamentals on the west side. The east side of the wetland is lined with larger red alder, western redcedar, and a cherry tree.	Remove reed canarygrass and blackberry. Plant with willow trees and shrubs.
		Upland (House removed)	The parcel has been graded and hydroseeded and is dominated by clover. A tulip tree is also on the site.	Plant entire upland area with native trees and shrubs.

Table A-1. Existing conditions and proposed mitigation actions by parcel for Wetland A17 (continued).

Sheet Number	Parcel Number	Location	Existing Conditions	Proposed Mitigation Actions
L5.2 and L5.3	232	Wetland / Stream	The wetland includes a western redcedar overstory and an understory of alder saplings. The ground cover is primarily native emergent plants.	No action is necessary on this parcel.
		Upland (No structure in buffer)	The parcel is largely vegetated with an alder forest. The understory consists predominantly of native species including western hazelnut, Indian plum, and swordfern. Some blackberry cover is present on the south central property boundary. House is located outside buffer enhancement area.	Remove Himalayan blackberry in the southern portion of the site and plant the area with native trees.
L5.2	233	Wetland / Stream	The wetland contains forest and emergent areas. Red alder and large black cottonwood trees are present in the wetland. In open areas, emergent wetland vegetation consists of field horsetail, Himalayan blackberry, and yellow flag iris.	Remove Himalayan blackberry and yellow flag iris. Plar h willows and other trees and shrubs.
		Upland (House remains)	Vegetation is a mixture of lawn, ornamental shrubs, and native species (such as western hazelnut, bitter cherry, a couple of young Douglas fir). A garbage pile is located behind the house. There are two driveways on the property.	Remove garbage, buildings, driveways, concrete stairs, and associated fill. Grade to smooth contours. Remove vegetation between the house and the wetland and plant with specified native trees. Replant disturbed areas with specified trees and shrubs.
L5.2	234	Wetland / Stream	See description for Parcel 233.	See description for Parcel 233.
		Upland (House remains)	This area is mostly all lawn with no other vegetation present. Uplands contain house and driveway.	Remove buildings, driveway, and associated fill. Grade to smooth contours. Plant the open area with native sun-tolerant trees and shrubs.
L5.2	235	Wetland / Stream	Wetland vegetation consists of soft rush, small-fruited bulrush, creeping buttercup, sawbeak sedge, and field horsetail. Some Himalayan blackberry is present along and east of Water D. There is good tree cover (red alder, black cottonwood) on the east side of Water D.	Remove driveways and foundations. Plant open areas with willow trees and shrubs.
		Upland (House removed)	This area is primarily lawn with several large western redcedars are present on the north side of the parcel. A large horse chestnut is also present on the parcel. A driveway and foundation remain.	Remove driveways, foundations, and associated fill. Protect and preserve cedars. Grade to smooth contours. Plant the open area with specified native sun-tolerant trees and shrubs.
L5.2	236	Wetland / Stream	The wetland vegetation consists of common velvetgrass, field horsetail, and lady fern. Some Himalayan blackberry and field morning glory is present near Water D.	Remove Himalayan blackberry and field morning glory. Plant open and disturbed areas with willow trees and shrubs.

Table A-1. Existing conditions and proposed mitigation actions by parcel for Wetland A17 (continued).

Sheet Number	Parcel Number	Location	Existing Conditions	Proposed Mitigation Actions
		Upland (Structures remain)	This area is predominantly lawn with scattered trees including Colorado blue spruce, mature western redcedar, and fruit trees (cherry and apple). A house, garage, and driveway remain on the east.	Remove structures, driveway, and associated fill. Grade to smooth contours. Plant lawn area with sun-tolerant coniferous tree species.
L5.2	237	Wetland / Stream	The wetland vegetation consists of wet meadow areas on the south side and red alder/black cottonwood forest, on the north side (near the road). In the open areas, some blackberry is present.	Remove Himalayan blackberry. Plant open areas with willow and underplant western redcedar trees.
		Upland	The majority of the upland area consists of relatively undisturbed Douglas fir and western redcedar forest. Understory consists of salal, Indian plum, western hazelnut, and swordfern. A small area of English ivy is located in the eastern portion of the parcel. Open, hydroseeded area remains on former home site, in the central portion of the parcel. Red alder saplings are growing in the cleared and hydroseeded areas.	Remove Himalayan blackberry and English ivy. Plant the open disturbed and open areas with native sun-tolerant trees.
L5.2	238	Wetland / Stream	Himalayan blackberry, field morning glory, climbing nightshade, and field horsetail are dominant in the wetland located near the east side of the parcel.	Remove Himalayan blackberry field morning glory, climbing nightshade. Plant disturbed areas with red alder, Sitka spruce, and black cottonwood.
		Upland (Structures remain)	A house, garage, and shed remain on the parcel. Lawn and ornamental shrubs are present near the house. Large pines and hemlock trees are also present on the site.	Remove building, driveway, and associated fill. Grade to smooth contours. Protect pines and hemlocks. Plant disturbed and open areas with native sun-tolerant coniferous trees. Remove ornamental shrubs and replant the area with vine maple.
L5.2	239	Wetland / Stream	This wetland contains some mature red alder and black cottonwood trees. Various grasses, soft rush, and field horsetail occur in the understory.	Remove Himalayan blackberry. Plant disturbed areas with western redcedar. Interplant western redcedar in forested areas.
		Upland (Structures removed)	Vegetation on the site includes grasses on the old house pad with Pacific madrone, red alder, cherry laurel, and western redcedar located around the perimeter of the house. Himalayan blackberry occurs in open areas, between the house and the wetland.	Remove Himalayan blackberry and field morning glory. Plant open and disturbed areas with specified native trees and shru'
L5.2	240	Wetland / Stream	The wetland vegetation includes an overstory of red alder and understory of Himalayan blackberry, field morning glory, and bentgrass. An approximately 30-ft segment of Water D has been placed in an 18-inch culvert, at the southern portion of the site.	Remove Himalayan blackberry and field morning glory. Daylight Water D by removing the 30-ft-long culvert. Stabilize the banks by using bioengineering techniques and replanting with willow stakes. Plant disturbed areas with western redcedar and willow.
		Upland (Shed remains)	Upland portion of the parcel is grassland. Ornamental trees and shrubs occur along the perimeter. Himalayan blackberry occurs in patches.	Remove driveway and Himalayan blackberry. Plant the open areas with native tree and shrub species.

Table A-1. Existing conditions and proposed mitigation actions by parcel for Wetland A17 (continued).

Sheet Number	Parcel Number	Location	Existing Conditions	Proposed Mitigation Actions
L5.2	241	Wetland / Stream	This area has a young red alder overstory with a thick Himalayan blackberry and stinging nettle understory. Field morning glory is also present.	Remove blackberry and replant disturbed areas with native trees and shrubs.
		Upland	This area is largely grassland. Several large Douglas fir, cherry laurel, and pine trees occur near the north property line. Hazelnut and fir trees are present around the perimeter of the lot. An area of mounded soil and concrete blocks is present, behind the former house pad.	Remove blackberry and field morning glory. Remove concrete blocks and block fragments. Remove cherry laurel and plant disturbed and open areas with native trees and shrubs.
L5.1 and L5.2	242	Wetland / Stream	A narrow fringe of wetland is located on this parcel and associated with Miller Creek. The wetland contains creeping buttercup, field horsetail, and jewelweed. Common tansy and western hazelnut are located immediately adjacent to the wetland edge. Areas of blackberry, climbing nightshade, and yellow flag iris are located near and in the wetland.	Control blackberry, yellow flag iris, and climbing nigh. e. Plant native shrub species near the wetland.
		Upland (Structures removed)	Vegetation on this site is largely grass. Several trees are present near the perimeter, and cherry laurel and other ornamental species are also present.	Plant open areas with native trees and shrubs.
L5.1 and L5.2	243	Wetland / Stream	The wetland is a narrow fringe located immediately adjacent to the channel. Vegetation in the channel includes Pacific willow, creeping buttercup, and field horsetail. A few large black cottonwood trees are located adjacent to the channel. An approximately 75-ft segment of Water D, between the driveway and outbuildings, has been placed in a cement culvert.	Remove Water D from the culvert. Restore the banks of Water D by using BMPs, bioengineering techniques, and planting willow stakes.
		Upland (Structures remain)	A gravel driveway occurs within 10 ft of the stream. Patches of native and non-native trees are present in a grassy meadow. Pacific willows are located next to the stream. Small patches of blackberry are becoming established in the meadow. A house and several outbuildings are still present.	Remove structures and the gravel driveway after access is no longer needed. Remove patches of blackberry and plant the disturbed areas and the open meadow with native trees and s' s.
L5.1 and L5.2	244	Wetland / Stream	No wetland or stream was found on this parcel	None.
		Upland (Structures present)	Grasses dominate this area with areas of Himalayan blackberry and field morning glory becoming established. Cattail and other wetland plants are becoming established on recently graded and compacted areas where residential structures were recently removed. Several fruit trees are also present. There is an existing gravel driveway and several mounds of gravel.	Remove driveway, house, gravel, and associated fill. Remove blackberry and field morning glory, and plant with native trees and shrubs.

Table A-1. Existing conditions and proposed mitigation actions by parcel for Wetland A17 (continued).

Sheet Number	Parcel Number	Location	Existing Conditions	Proposed Mitigation Actions
L5.4	254	Wetland / Stream	Creeping buttercup is dominant in the wetland, with some Himalayan blackberry on the south and north sides. A Douglas fir on the east and a western redcedar on the west border the area.	Remove Himalayan blackberry. Plant trees (western redcedar) in the wetland.
		Upland (Structures removed)	The area is vegetated with grasses and scattered trees (western hemlock, black cottonwood, and several fruit trees).	Remove buildings, driveway, and associated fill. Grade to smooth contours. Plant disturbed areas with trees and shrubs.
L5.4	261	Wetland / Stream	The wetland vegetation consists of creeping buttercup, field horsetail, and skunk cabbage, but a few red alder are also present. Blackberry is also present, especially along the perimeter of the wetland. A driveway has been constructed in the wetland, at the north edge of the wetland.	Remove Himalayan blackberry from wetland. Remove the driveway on the north side, between Parcel 254R and Parcel 261 and on the south side of the wetland between Parcels 261 an 3. Plant the open and disturbed areas with willow trees and shru.
		Upland (Structures removed)	Most of the area is grass. Coniferous trees are present on the south side, with big-leaf maple, western redcedar, and Douglas fir on the north side. Red alder saplings are becoming established on the parcel.	Protect existing conifers and big-leaf maple. Plant sun-tolerant trees and shrubs in open meadow areas.

APPENDIX B

RESTRICTIVE COVENANT

MILLER CREEK MITIGATION AREA

DRAFT
10/30/00

RECORDED AT THE REQUEST OF
AND AFTER RECORDING RETURN TO:

_____
_____
_____
_____

DECLARATION OF RESTRICTIVE COVENANTS
(Miller Creek Mitigation Area)

Grantor: Port of Seattle, a Washington municipal corporation

Grantees: Port of Seattle, a Washington municipal corporation

Legal Description: _____
Official legal description attached on Exhibit A.

Assessor's Tax Parcel ID#: _____

Reference # (If applicable): N/A

This Declaration of Restrictive Covenants (this "Declaration") is made as of this _____ day of _____, ____, by the Port of Seattle, a Washington municipal corporation (the "Port") as required by the Washington State Department of Ecology ("Ecology") Order number _____ and the Seattle District Office of the U.S. Army Corps of Engineers ("Corps") Section 404 Permit Number _____, each as more particularly described in Recital C, below.

RECITALS

A. The Port is the owner of those certain real properties located in King County, Washington and described as follows: (i) the real property adjacent to or near Miller Creek (the "Miller Creek Mitigation Area"); (ii) the real property adjacent to or near Miller Creek, Lora Lake, and the former Vacca Farm (the "Miller Creek/Lora Lake/Vacca Farm Wetland and Floodplain Mitigation Area"); (iii) the real property adjacent to or near the Tyee Valley Golf Course property (the "Tyee Valley Golf Course Mitigation Area"); (iv) the real property comprising approximately 67-acres located in the City of Auburn (the "Auburn Wetland Mitigation Area"); (v) the real property adjacent to or near Des Moines Creek (the "Des Moines Creek Mitigation Area"); and (vi) the real property at and adjacent to the Tyee Detention Pond (the "Tyee Detention Pond Area") (collectively, the "Miller Creek Mitigation Area," the "Miller Creek/Lora Lake/Vacca Farm Wetland and Floodplain Mitigation Area," the "Tyee Valley Golf Course Mitigation Area," the "Des Moines Creek Mitigation Area," the "Tyee Detention Pond Area," and the "Auburn Wetland Mitigation Area" are referred to herein as the "Mitigation Sites"). This Declaration relates to the Miller Creek Mitigation Area, which is legally described in Exhibit A attached hereto and by this reference incorporated herein.

B. In connection with the construction of a third runway and other improvements at Seattle-Tacoma International Airport, the Port proposed certain mitigation activities for the Mitigation Sites that include: stream riparian/buffer enhancements, stream baseflow augmentation, floodplain and wetland enhancement, and construction of replacement wetlands.

C. In order to comply with Ecology's Order #_____ ("Ecology's Order"), and the Corps Section 404 Permit # _____ ("Corps Permit"), for the Port's mitigation activities at the Mitigation Sites, the Port has executed this Declaration regarding the Miller Creek Mitigation Area, and has executed similar Declarations for the other Mitigation Sites, to submit the Miller Creek Mitigation Area to the covenants, conditions, and restrictions herein.

NOW, THEREFORE:

1. Declaration. The Port hereby declares that the Miller Creek Mitigation Area (hereinafter, the "Mitigation Area") shall be subject to the covenants, conditions, and restrictions stated herein which shall be binding on all parties having any right, title, or interest in the Mitigation Area or any part thereof and shall inure to the benefit of each subsequent owner thereof.

2. Purpose. The purpose of this Declaration is to meet the requirements of the federal Clean Water Act and state water quality standards as set forth in Ecology's Order and the Corps Permit, and to restrict development and construction activities within the Mitigation Area.

3. Restrictive Covenants. The Mitigation Area shall be used as a natural vegetative buffer, and no development activity including clearing, grading, filling, or the construction of any building, structure, or other improvement shall occur in the Mitigation Area, except for the following:

   a. Activities authorized in the Corps/Ecology-approved Natural Resource Mitigation Plan to construct and establish the mitigation. Existing uses in the Mitigation Area may continue until the uses are removed or halted during construction of the mitigation.

   b. Wildlife management control actions pursuant to and governed by the current Wildlife Hazard Management Plan or any subsequent version of the Plan adopted by the Port in cooperation with the U.S. Department of Agriculture's Wildlife Services Program and the Federal Aviation Administration pursuant to Title 14 of the Code of Federal Regulations (Section 139.337). Prior to the adoption of any subsequent version of the Plan, the Plan shall be submitted to the Corps and Ecology for review and comment regarding potential impacts on the Mitigation Area. If during review and comment, the Corps or Ecology identifies any impacts to the functions and values of the Mitigation Area, the Port shall within 60 days submit to the Corps and Ecology a conceptual plan that compensates for the identified impacts and, within 90 days following Corps and Ecology approval of the conceptual plan, submit for approval a final compensation plan.

   c. Monitoring, maintenance, and contingency actions pursuant to Ecology's Order and the Corps Permit, including but not limited to removal of exotic, non-native, invasive vegetation to satisfy the mitigation performance standards.

   d. Construction of stormwater drainage channels as authorized in writing by the Corps and Ecology, and maintenance of those channels.

   e. Continuation, including maintenance and reconstruction, of the existing underground sanitary sewer trunk line, owned and operated by the Southwest Suburban Sewer District or its successor; and partial relocation of this line as authorized in writing by the Corps and Ecology.

f. Installation of water and air quality monitoring equipment as authorized in writing by the Corps and Ecology, and maintenance of the equipment.

g. Vegetation height control to maintain FAA required approach slopes and radar coverage.

h. Removal of trees that a certified arborist has recommended be removed to prevent a hazard to persons or property. The Port shall replant areas where trees are removed, as necessary to maintain consistency with the Corps/Ecology-approved Natural Resources Mitigation Plan.

i. Other activities authorized in writing by the Corps and Ecology.

Following any activity in the Mitigation Area, as authorized above, the Port shall restore the Mitigation Area to the condition contemplated in the Corps/Ecology-approved Natural Resource Mitigation Plan (except for any authorized structure or use that will remain in the Mitigation Area).

4. Default; Remedies. Any violation of a covenant or condition in this Declaration shall be considered a violation of Ecology's Order and the Corps Permit, and this Declaration may be enforced pursuant to the terms of Ecology's Order and the Corps Permit.

5. Binding Effect. The Declaration shall run with the land and be binding upon the Port and its successors and assigns.

6. Captions. The captions and paragraph headings contained in this Declaration are for convenience and reference only and in no way define, describe, extend, or limit the scope or intent of this Declaration, nor the intent of any provision hereof.

7. Recording. This Declaration shall be recorded in the real property records of King County.

8. No Third Party Rights. Nothing in this Declaration, express or implied, is intended to confer upon any person, other than the Port and its successors and assigns any rights or remedies under or by reason of this Declaration; provided that this Declaration may be enforced by the Corps or Ecology as described herein.

9. Governing Law. This Declaration shall be governed by and construed in accordance with the laws of the state of Washington.

EXECUTED AND EFFECTIVE as of the date first written above.

PORT OF SEATTLE, a Washington municipal corporation

By: _____
Name: _____
Its: _____

STATE OF WASHINGTON)
) ss.
COUNTY OF _____)

I certify that I know or have satisfactory evidence that _____ signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it as the _____ of the Port of Seattle, a Washington municipal corporation, to be the free and voluntary act of such municipal corporation for the uses and purposes mentioned in the instrument.

Dated this _____ day of _____, ____.

_____
(Signature of Notary)

_____
(Legibly Print or Stamp Name of Notary)
Notary public in and for the state of Washington, residing at _____
My appointment expires:_____

B

Port of Seattle

October 2, 2001

Ms. Ann Kenny
Washington Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

Re: Seattle-Tacoma International Airport
Washington Department of Ecology
§ 401 Water Quality Certification
Order #1996-4-02325
Condition F.1

Dear Ms. Kenny:

The Port of Seattle presents the attached documents to the Washington Department of Ecology in satisfaction of the above noted Order, Condition F.1. Condition F.1 requires, among other things, that the Port prepare "proposed construction BMPs to prevent interception of contaminated ground water by utility corridors and a plan to monitor potential contaminant transport to soil and ground water via subsurface utility lines".

Please review the two attached documents, *Proposed Construction BMPs To Prevent Interception of Contaminated Ground Water by Utility Corridors*, and *Plan to Monitor Potential Contaminant Transport to Soil and Ground Water via Subsurface Utility Lines*. If you have any questions or comments, please feel free to refer comments and questions to Paul Agid, 206-439-6604, agid.p@portseattle.org.

Sincerely,

Elizabeth Leavitt
Manager, Aviation Environmental Programs

xc: Agid, Newlon

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

Seattle Tacoma International Airport
§401 Water Quality Certification #1996-4-02325
Condition F.1

Proposed Construction BMPs
To Prevent Interception of Contaminated Ground Water by Utility Corridors

In accordance with the Washington State Department of Ecology (Ecology) Water Quality Certification for U.S. Army Corps of Engineers Public Notice 1996-4-02325, Condition F. 1, the Port of Seattle (Port) submits this proposal for Best Management Practices (BMPs) for prevention of migration of contaminated ground water via subsurface utility lines at the Seattle-Tacoma International Airport (STIA). A draft of this BMP proposal is due to Ecology no later than September 30, 2001.

Best Management Practices for prevention of migration of contaminated ground water by newly constructed utility corridors will consist of, and will be implemented by modification of standard utility construction design guidelines and specifications. The following construction techniques will be specified for future construction of subsurface utilities below paved areas in the principal aviation operations and maintenance area (AOMA) of STIA. Subject subsurface utilities include, but are not limited to, electrical and communications ductbanks, and pipelines for carrying fuel, water, sanitary sewage, stormwater, and Industrial Waste System drainage.

1. Standard construction specifications will be developed for application to all construction projects located in areas within the AOMA where contaminated ground water is present at the designed construction depth.

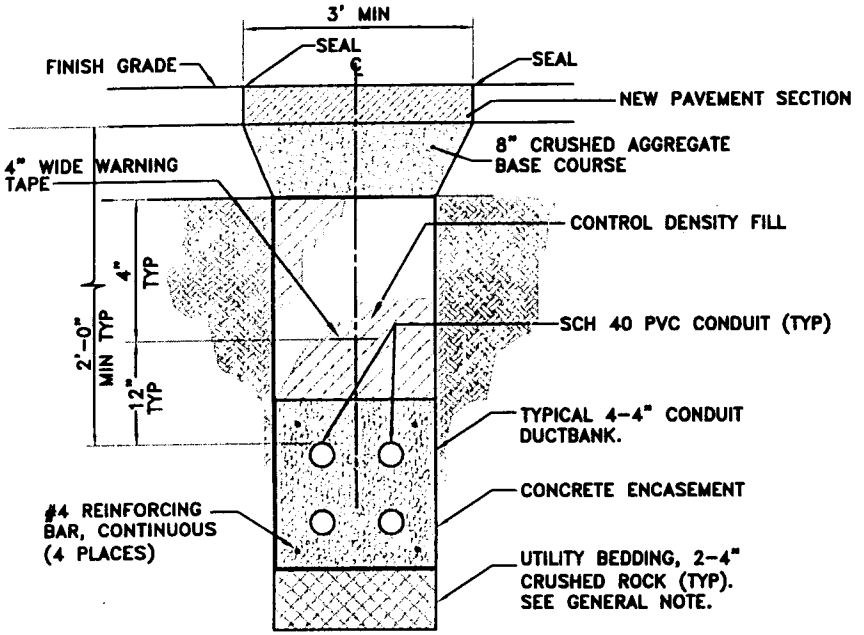
2. The standard specification will include a requirement for the contractor to dewater utility trenches and other construction excavations that contain contaminated ground water, and to appropriately manage the water removed by disposal to an appropriately licensed facility or similar option.

3. The standard specification will include a requirement that utility backfill be constructed such that any ground water present at the utility depth not be transported along the utility, within the utility backfill material acting as a preferential flow pathway. The potential for transport in backfill will be minimized by use of construction techniques and/or materials that reduce utility backfill permeability. Generic engineering designs for preventing transport will be offered as examples, such as:

    a. Construct backfill by placing controlled density fill (a lean concrete mixture), or similar low permeability material, into the entire utility trench, to the bottom of the pavement base course layer.

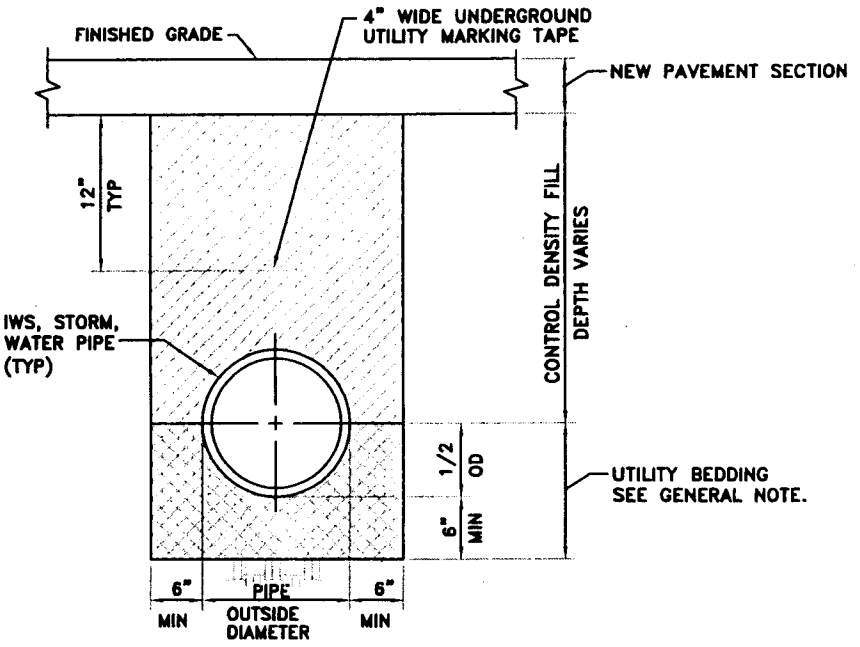
    b. Construct backfill by placing standard pipe bedding material for a maximum depth of 6" plus one-half of the diameter of the utility pipe (except as noted below); backfill the remainder of the trench to the bottom of the pavement base course layer with controlled density fill or similar low permeability material; at a maximum interval of 500' along the utility alignment, eliminate the pipe bedding material and construct full trench profile concrete dams. (Illustrations of typical utility installation construction drawings consistent with option 3.b. are provided in Figure 1.)

    Project-specific construction designs will be developed consistent with the standard specifications to meet the site-specific engineering requirements of the planned construction.



TYPICAL SECTION

TYPICAL ELECTRICAL/COMMUNICATION DUCTBANK
UNDER ALL PAVED AREAS
SCALE: NTS



TYPICAL SECTION

PIPE BEDDING AND TRENCH BACKFILL
UNDER ALL PAVED AREAS
SCALE: NTS

GENERAL NOTE

UTILITY AND DUCTBANK BEDDING MATERIAL ELIMINATED AT 500' INTERVALS AND REPLACED BY FULL DEPTH CONCRETE OR CONTROL DENSITY FILL (CDF) BARRIER.

AR 005964

FIGURE 1
TYPICAL UTILITY SECTIONS

Seattle Tacoma International Airport
§401 Water Quality Certification #1996-4-02325
Condition F.1

Plan to Monitor Potential Contaminant Transport to Soil and Ground Water via Subsurface Utility Lines

1. INTRODUCTION AND BACKGROUND

In accordance with the Washington State Department of Ecology (Ecology) Water Quality Certification (WQC) for U.S. Army Corps of Engineers Public Notice 1996-4-02325, Condition F. 1, the Port of Seattle (Port) submits this plan to monitor for potential contaminant transport via subsurface utility lines (SULs) at the Seattle-Tacoma International Airport (STIA). A draft of this Subsurface Utility Line Monitoring Plan (SUL Monitoring Plan) is due to Ecology no later than September 30, 2001.

Ecology has requested this plan in response to concerns expressed by members of the public commenting on the proposed issuance of the Water Quality Certification. The commenter assert that the permeable backfill with which subsurface utilities are sometimes constructed may act as preferred pathways for migration of contaminated ground water to the Third Runway Embankment drain layer, and from the drain layer to area surface waters.

A related document, *Draft Technical Memorandum, Analysis of Preferential Ground Water Flow Paths Relative to Proposed Third Runway, Seattle-Tacoma International Airport,* prepared by Associated Earth Sciences, Inc. dated June 19, 2001 (AESI, 2001) provides the foundation and supporting data for the development of this SUL Monitoring Plan. The SUL Monitoring Plan presents a methodology to further evaluate the nature of SULs at appropriate contaminated ground water sites and the potential that these SULs act as preferential contaminant transport pathways. The planned monitoring approach will, in a first phase, evaluate contaminated sites, associated ground water presence and flow properties, and the properties of constructed SULs. The evaluation will demonstrate the probabilities that contaminated sites could act as contaminant sources to SULs, and that SULs could act as migration pathways for those contaminants. The second phase of the monitoring program will be developed at the conclusion of the first phase evaluation. Under the second phase, the Port will develop and implement field monitoring activities that are demonstrated appropriate by results of the first phase. The second phase plan will be provided to Ecology for review and approval.

2. SITE EVALUATION

a. Ground Water in Perched Zones and in the Qva Aquifer

The SUL Monitoring Plan will focus on the potential that select contaminated sites act as sources of contamination to SULs. The typical as-built construction depth of STIA SULs is between 5 to 10 feet below ground surface. The SUL Monitoring Plan will therefore concentrate on sites that contain impacted perched ground water that could enter SULs.

Sites that contain perched ground water provide the greatest probability for SUL transport of contamination. Perched ground water occurs in isolated, discontinuous zones. Perched zones are typically found within the range of about 10 – 35 feet below ground surface. Due to the shallow depth of perched zones, perched ground water has the greatest potential to intersect SULs and move along permeable backfill material

Transport along SUL backfill of contaminated ground water in the regional Qva aquifer is improbable for several reasons:

- Ground water levels in the Qva aquifer at STIA are typically at a depth between 55 to 90 feet below ground surface, which is well below the depth of typical SULs.

- Impacted Qva ground water has been well documented and is contained within the AOMA; the maximum migration of impacted ground water is no greater than 550 feet in length from its contaminant source area.

- Ground water data generated from monitoring wells completed downgradient from known Qva impacted ground water sites are below Model Toxics Control Act (MTCA) standards and, therefore, provide a defined plume boundary.

Therefore, monitoring for contaminant transport by SULs in the Qva aquifer is not planned.

b. SUL Monitoring Plan Site Selection

Locations with contaminated ground water that may have a reasonable potential for migration by SUL are defined by the following criteria:

- Site contains perched ground water;
- Perched ground water is impacted above MTCA standards;
- SULs intersect the site footprint.

Data indicate that five sites within the STIA principal aviation operations and maintenance area (AOMA) contain impacted perched ground water that has exceeded MTCA Method A or Method B clean up standards (AESI, 2001). Sites that are impacted by previous fuel releases and contain fuel related compounds in the perched ground water system elevated above MTCA standards include the United/Continental Fuel Farm, Pan Am Avgas Tanks, Northwest Airlines Bulk Fuel Farm, and the Delta Auto Gas Cluster. In addition two areas in the AOMA, the Northwest Airlines Former Hangar Tanks and Monitoring well AGC-5 at the Delta Autogas Cluster site, represent areas that contain solvent impacted perched ground water. Each of the five sites meets the criteria listed above and are proposed for further detailed evaluation regarding shallow contaminant transport mechanisms via SULs.

3. SUBSURFACE UTILITY LINE INFORMATION

As part of previous evaluations, SULs have been identified throughout STIA and compiled on a base map (AESI, 2001). SULs that have been identified include: existing and proposed fuel lines, electric lines, Industrial Waste System (IWS) lines, sewer lines, storm drains, water lines, and Satellite Transit System (STS) and Baggage Tunnels. A number of these SULs are constructed within the boundaries of impacted perched ground water of the five sites presented in Section 2. The following additional detail will be compiled from available documentation for SULs at each of the subject sites.

a. Utility line depth – Typical utility depth is 5 to 10 feet below ground surface, with a typical maximum depth of 20 feet below ground surface. Engineering drawings will be researched to identify the as-built construction depth of each SUL intersecting the subject sites.

b. Utility line backfill composition – Information on the type of backfill material used for infill of the SUL will be compiled, if available.

c. Utility line excavation slope – The elevation of the as-built SUL excavation will be researched and information compiled, if available.

d. Construction Observations - Records will be researched to determine if observations were recorded during construction activities regarding soil or ground water contamination, saturated soil conditions, soil type, SUL condition, etc. Observations of recent capital improvement construction projects (e.g., those associated with the South Terminal Expansion Project (STEP)) will provide useful information regarding observed subsurface conditions in the vicinity of historic contaminated sites and older SULs. Available information will be summarized for each subject site.

4. GEOLOGIC/GROUND WATER CONDITIONS

Existing data and field observations of the geologic and ground water conditions at each of the subject sites will be evaluated in detail in regards to its influence on potential contaminant migration pathways. Cross sections will be developed for each site to graphically depict the relationship of geologic and ground water conditions in relationship to SULs. The analysis will focus on the following elements:

a. Fill or Native Soil Types in Relation to Utility Line – The soil conditions surrounding SULs at each site will be evaluated. Interpretations will be developed based on surrounding soil borings and well logs regarding the nature of fill or native soil types. This information will be evaluated in relation to the as-built construction depth of the SULs.

b. Slope of Till or Impervious Surface – The slope of the glacial till surface or any identified impervious surface will be evaluated. The effect of the slope of the low permeability surface will be analyzed regarding its effect on the control of perched ground water flow directions.

c. Depth to Perched Ground Water – The depth to perched ground water will be compiled from shallow monitoring well water level data and observations made on associated environmental and soil boring logs. This data will be correlated to a common vertical datum to allow for the calculation of the elevation of the ground water surface.

d. Perched Ground Water Flow Direction – For each site evaluated, the perched ground water flow directions will be determined and a contour map showing the flow directions will be developed. Typical wet season and dry season perched ground water elevations will be used to determine any change in flow direction as a result of seasonal precipitation fluctuations.

e. Relationship of Perched Ground Water to Utility Line Excavation – The depth to perched ground water will be compared to the as-built excavation depth of various SULs intersecting subject sites. An evaluation will be made concerning the ability of the SULs to act as a potential contaminant transport pathway. Particular consideration will be made during the evaluation of the ability of the SULs to transport contaminant via perched ground water towards the proposed Third Runway Embankment project area.

5. Report

A report will be developed which presents the findings outlined in the SUL Monitoring Plan. The report will present graphical maps which show ground water and geological conditions in relation to SULs, tabulated information on select SULs, and an evaluation regarding the potential of the SULs to act as preferential pathways for contaminant transport. Conclusions will be developed and an appropriate scope of work and work plan for any appropriate follow-on monitoring will be developed for Ecology review and approval.

C

Port of Seattle

November 16, 2001

Ms. Ann Kenny
Washington Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

Re: Seattle-Tacoma International Airport
Washington Department of Ecology
§ 401 Water Quality Certification
Order #1996-4-02325
Condition E.3

Dear Ms. Kenny:

The Port of Seattle presents the enclosed *Third Runway Embankment Seepage and Groundwater Monitoring Plan* to the Washington Department of Ecology in satisfaction of the above noted Order, Condition E.3. Condition E.3 requires the Port to prepare for Ecology review and written approval a monitoring plan "designed to detect impacts of the fill embankment to the receiving water and ground water during fill placement and post fill placement."

Please review the plan and provide the written approval required. Please feel free to refer comments and questions to Paul Agid, 206-439-6604, agid.p@portseattle.org.

Sincerely,

E Leavitt

Elizabeth Leavitt
Manager, Aviation Environmental Programs

xc: Gillis Reavis, Martin Brown Inc.
Tom Walsh, Foster Pepper Shefelman
Jim Lynch, Stoel Rives
Michael Kenrick, Hart Crowser Inc.
C. Linn Gould, Erda Environmental
Robin Kordik, Paul Agid, Laurie Havercroft, Tom Newlon, Port of Seattle

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

THIRD RUNWAY EMBANKMENT FILL MONITORING PLAN

401 Certification Condition E.3

Port of Seattle
November 2001

TABLE OF CONTENTS

SEATTLE-TACOMA INTERNATIONAL AIRPORT
THIRD RUNWAY EMBANKMENT
SEEPAGE AND GROUNDWATER MONITORING PLAN

1.0 INTRODUCTION AND BACKGROUND

In accordance with the Department of Ecology's (Ecology) Water Quality Certification for U.S. Army Corps of Engineers Public Notice 1996-4-02325 (Amended-1), Condition E.3, "Post Construction Monitoring", dated September 21, 2001, the Port of Seattle (Port) will monitor water quality from the Third Runway Embankment. The text of Condition E.3 from the 401 Water Quality Certification is shown in Exhibit 1. A draft of this Embankment Fill Monitoring Plan (EFMP) is due to Ecology by November 20, 2001.

The Post Construction Monitoring condition requires the monitoring of both runoff and seepage from the Third Runway embankment in order to ensure that infiltrate does not "result in impacts to wetlands or other waters of the state." The monitoring of runoff from the surface of the embankment is not discussed in this EFMP. Such runoff, which is only expected to occur during large rain events, is collected and routed through detention facilities and discharged through permitted stormwater outfalls. The Port's National Pollution Discharge Elimination System (NPDES) permit (WA-002465-1) requires it to monitor surface water runoff, including runoff from industrial activities (e.g. runways and taxiways). A more detailed discussion of the NPDES monitoring program can be found in section S2 of the Port's NPDES permit and in the Port's Procedures Manual for Stormwater Monitoring. The purpose of this EFMP is, therefore, to track the quality of water that flows through the embankment and expresses itself as either seepage discharging from the bottom of the fill area or as groundwater.

Groundwater monitoring will begin in winter 2001-2002 from permanent well locations near the planned toe of the completed embankment. Groundwater monitoring will provide an understanding of background baseline water quality and will allow tracking of any changes in groundwater quality over the duration of embankment construction.

Seepage monitoring will initially be conducted at interim monitoring locations. Completion of embankment construction is expected to occur within 5-7 years after the initiation of construction permitted under the 401 Water Quality Certification. During construction, embankment seepage flowing from the drainage layer will be ephemeral, and discharge locations will be discontinuous as the embankment is modified by further construction and implementation of construction stormwater BMPs. Seepage quality monitoring during construction will, therefore, be focused on relatively stable temporary seepage locations identified at the toe of interim embankment slopes, where seepage can be observed and monitored in relatively undisturbed conditions for a period of at least 12 months. Post construction seepage monitoring

will be initiated at proposed permanent locations after final construction in those embankment areas is completed and consistent seepage is observed.

The proposed EFMP establishes a phased monitoring approach to determining the potential impacts of embankment fill on water quality. The phased approach establishes a flexible, risk-based monitoring regime that becomes increasingly conservative as potential impacts to water quality are detected. Two types of phasing are proposed for both groundwater and seepage monitoring. The first type of phase, called "tiers," provides flexibility in the location from which samples are collected. In the first tier, samples are obtained from sampling points very close to the potential source of discharge from the embankment. This provides a conservative opportunity to observe water quality constituents that could reach surface water above the applicable criteria. In the second tier, sample locations could be established further downgradient from the source of discharge, to demonstrate that attenuation and dilution mechanisms are occurring. In the last tier, the samples would be obtained from locations near the resources to be protected (i.e., the nearby creeks and wetlands). The second type of phasing, called "stages," provides similarly sequenced flexibility in data collection, analysis, and evaluation tools within each tier.

This EFMP is divided into seven sections. Following this introductory section, the embankment conceptual site flow model is described in Section 2. Groundwater monitoring that occurs during construction is discussed in Section 3. Section 4 describes monitoring of seepage from interim monitoring locations during sequential construction phases. Section 5 describes both groundwater and seepage monitoring that occurs post construction. The monitoring report and contingency plan are discussed in Sections 6 and 7 respectively. Appendix Sections A-C include the field and laboratory procedures.

2.0 EMBANKMENT CONCEPTUAL SITE AND FLOW MODEL

This section describes the embankment fill and how water is anticipated to flow through it. The embankment is designed to create an elevated, relatively flat surface upon which the Third Runway will be built. As shown on Figures 1 and 2, the total length of the embankment will extend approximately 8,700 feet, bounded by the relocated S. 154th Street to the north and extending beyond S. 176th Street to the south. The width of the fill ranges from 40 feet at its narrowest point in the south end to approximately 1,400 feet at the widest point. The east margin of the fill will abut the existing airfield; the west margin of the fill will either be sloped or bounded by a mechanically stabilized earth (MSE) wall, depending on the location. The fill thickness will range from several feet to 165 feet thick. The volume of the fill that is required for the construction of the Third Runway embankment is approximately 17 million cubic yards. Embankment soil placement is designed to be both geotechnically suitable as foundation material for the Third Runway and to accommodate infiltration of water through the fill in all seasons. Fill will consist of approximately 40 percent sand and gravel that is relatively silt-free and about 60 percent silty sand and gravel mixtures.

A bottom drainage layer, consisting of an approximate 3-foot thickness of free-draining sand and gravel, has been included in the fill embankment design (Figure 3). This drainage layer will generally be laid on the existing ground surface. The drainage layer will prevent groundwater pressures from building up within the embankment and direct groundwater flow away from the embankment fill. Water may enter drainage layer from above, due to infiltration through the embankment fill, and from below as groundwater inflow in the form of seepage from the existing slope or existing shallow groundwater discharge zones that will be buried beneath the embankment.

In accordance with the United States Fish and Wildlife Service's Biological Opinion (BO) dated May 22, 2001, the Port will provide protection for both aquatic resources and surface water quality in neighboring Miller and Walker Creeks by establishing a zone of "ultra-clean" fill directly above the drainage layer, referred to as the "drainage layer cover" (Figure 3). The soil criteria in this drainage layer cover is at Puget Sound background levels and adjusted as necessary for Practical Quantitation Limits, MTCA Method A cleanup levels, and or ecological criteria (Table 1, FWS BO, 2001). These criteria have been modified slightly in accordance with the release of the amended 401 Certification by Ecology in September, 2001.

The drainage layer cover will measure at least 40 feet thick at the face of the embankment and its top surface will slope downwards to the east at a rate of 2 percent. The overall thickness of the drainage layer cover will decrease away from the face of the embankment and will vary based on underlying topography (Figure 1). The southern section of the embankment south of S. 170th Street will be less than 40 feet high and will be composed primarily of "ultra clean" fill consistent with the requirements of the BO.

A portion of the rainfall that falls on the Third Runway embankment, plus some of the runoff from paved areas such as runways and taxiways, will infiltrate through the fill materials and percolate down to the drainage layer. As water percolates through the fill, the concentrations of dissolved constituents may potentially change due to leaching of naturally occurring minerals or other chemical constituents (if present) in the fill.

Depending on location, the water that flows through the completed embankment will (1) percolate down to the drainage layer and flow laterally to discharge from the embankment toe, or (2) percolate downward through the drainage layer and into the underlying subsoils, entering the existing body of shallow groundwater beneath the embankment (Figure 3).

The first of these flow paths may include a portion of groundwater seepage from below that will mix with the embankment seepage. The water will discharge from the drainage layer and enter collection swales or replacement drainage channels that generally run along or near to the toe of the embankment. In low areas near the MSE retaining walls, flow in the collection swales will discharge to downslope replacement drainage channels or downslope wetlands (Figure 2). Over the rest of the embankment area, flow in collection swales will be directed to stormwater detention ponds that control releases to Miller or Walker Creeks. The conveyance system is described in the Comprehensive Stormwater Management Plan (Parametrix, 2000).

The second flow path consists of embankment seepage that will percolate down through the drainage layer to the water table and mix with the natural groundwater. Along the existing slope, the uppermost water table occurs mainly in recessional or recent sands and silts that are perched on a lower-permeability layer (typically glacial till). When this water table is below the bottom of the drainage layer, water flows slowly through the perched aquifer under the embankment and discharges through or beneath wetlands to the adjacent creeks. Water percolating through the embankment that does not discharge from the drainage layer is expected to enter this zone of perched groundwater and follow the same flowpath toward the wetlands and creeks. A relatively small portion of the water in the perched aquifer leaks through the till layer and enters the regional aquifer in the underlying advance glacial deposits.

Towards or beyond the toe of the embankment (varying by location), the water table in the perched zone merges with the water table in the shallow regional aquifer (Figure 3), which flows slowly through the downslope subsoils to discharge as baseflow to the creeks. A portion of this subsurface flow helps to maintain high groundwater levels and sustain the hydrology of riparian wetlands adjacent to Miller Creek and at the headwaters of Walker Creek.

3.0 GROUNDWATER MONITORING DURING CONSTRUCTION

Groundwater monitoring during construction is expected to occur in two phases. The first phase, which will occur over the next year, will define background groundwater conditions by collection of a baseline groundwater data set. The baseline data set will be used as a reference to ascertain changes in groundwater quality as a result of embankment construction. This baseline groundwater data acquisition phase is discussed in Subsections 3.1 through 3.4. The second phase of groundwater monitoring, described in section 3.5, commences after baseline data acquisition is completed.

3.1 Baseline Groundwater Data Acquisition

Groundwater monitoring wells will be established at the toe of the future embankment (locations are described in Section 3.2). The groundwater monitoring schedule is described in Section 3.3. Monitoring data from these wells will be used to establish baseline water quality for each of the parameters listed in Section 3.4. Collected data will be evaluated and background data quality established by application of appropriate statistical methods, and will account for variability caused by seasonality or other spatial or temporal trends.

As construction of the Third Runway embankment proceeds, the baseline groundwater data set will be used to assess potential impacts to groundwater through the screening approach outlined in Section 3.5.

3.2 Groundwater Monitoring Locations

Groundwater monitoring will be conducted by taking samples from 15 shallow monitoring wells drilled in locations at or just downgradient from the toe of the future embankment (Figure 1). Locations have been selected to provide coverage of the embankment where seepage discharge is not expressed and, therefore, the majority of the flow through the embankment is entering groundwater. This approach will provide representative monitoring of groundwater quality in

areas where the water table is expected to remain below the drainage layer. Wells will be completed in the uppermost zone of continuous saturation, which is generally the perched aquifer in the surficial recessional deposits. Details concerning the proposed monitoring wells are presented in Table 1.

Some of the proposed groundwater monitoring locations utilize existing wells that were installed as part of the geotechnical investigations for the design phase of the Third Runway embankment. These wells were installed as resource protection wells meeting the requirements of Chapter 173-160 WAC, and should therefore provide acceptable monitoring points. The remaining locations will require new well installations conforming to Chapter 173-160 WAC (Part Two). Following approval of this EFMP, wells will be installed to expedite the initiation of baseline groundwater data acquisition.

To the extent possible, monitoring wells will be maintained for sampling as construction proceeds. Any wells that cannot be successfully protected against damage during construction will be appropriately abandoned and replaced as close as practical to their original location.

3.3 Groundwater Monitoring Schedule

The groundwater monitoring wells will be sampled to establish a statistical baseline for existing groundwater quality. Background sampling will be implemented on a monthly basis (following well installation) for one year to define area baseline water quality.

Following the baseline data collection period, groundwater sampling will continue on a quarterly basis to track any changes or trends in the water quality at the site. Monitoring results will be screened to identify potentially significant exceedences using a staged screening approach, as described in Section 3.5.

3.4 Groundwater Monitoring Parameters

The following constituents of concern will be screened in groundwater and embankment seepage for consistency with the specific soil fill criteria requirements outlined in Section E.1(b) of the 401 Water Quality Certification:

Antimony	Nickel
Arsenic	Selenium
Beryllium	Silver
Cadmium	Thallium
Chromium (total)	Zinc
Copper	Gasoline
Lead	Diesel
Mercury (inorganic)	Heavy Oils.

See Appendix Sections A-C for a discussion on Sampling Methods and Handling Procedures, Quality Assurance and Quality Control Procedures, and Field Documentation, respectively.

3.5 Groundwater Quality Screening Post Baseline Data Acquisition

As described above, data collected from groundwater monitoring wells over the first year of monitoring will be used to determine the area background groundwater quality of the Third Runway vicinity. Appropriate background values will be calculated and will be referred to as the baseline groundwater data set.

After the baseline groundwater data set is established, quarterly groundwater monitoring data will be evaluated using a staged approach. The approach for groundwater screening during construction is detailed in the two stages as discussed below. Results that exceed any staged screening criteria do not directly equate to adverse impacts to wetlands or other waters of the state; rather, such exceedences provide an indication that further review and analysis are warranted to protect against the occurrence of such impacts.

- Stage 1: Background. Groundwater samples collected from each monitoring well will be analyzed for thirteen metals and Total Petroleum Hydrocarbons (TPH) and compared to the baseline groundwater data set described above. If Stage 1 screening indicates significantly elevated levels for constituents of concern, Ecology will be notified, and Stage 2 of the screening process would be implemented as described below.

- Stage 2: Derivation of a site-specific dilution/attenuation factor for groundwater. As constituents in the embankment seepage move through soils and groundwater, they are subjected to physical, chemical, and biological processes that tend to reduce the original concentration of the constituent as it is transported between the embankment and the receptor point (neighboring creeks). These processes include adsorption onto soil and aquifer media, chemical transformation, biological degradation, and dilution due to mixing of the seepage with surface waters and underlying groundwater. The reduction in constituent concentrations between the toe of the embankment and the creeks can be estimated by developing a site-specific dilution/attenuation factor, or using an Ecology-published default dilution/attenuation factor, as appropriate. The Port will discuss any proposed site-specific dilution factors with Ecology prior to their implementation.

The Port may elect to establish alternative sampling locations consistent with the tiered monitoring location strategy described generally in Section 1.0, and in more detail in Section 5.1, if it is determined that groundwater quality may be changing with respect to established background groundwater conditions. The Port may also elect to skip Stage 2 of the post-baseline groundwater monitoring screening process and move directly to Tier 2 sampling if it becomes evident that sampling at locations between the embankment toe and the creeks is a more appropriate approach. The Port will discuss a proposed move to Tier 2 with Ecology prior to implementation.

4.0 SEEPAGE MONITORING DURING CONSTRUCTION

Construction of the Third Runway embankment is expected to take 5 to 7 years under current projections. Construction will be accomplished in phases defined by phase-specific construction contracts. The duration of each construction phase is generally one construction season or one year, resulting in the creation of interim embankment slopes that are underlain by the drainage layer (see Figure 3). A portion of these interim embankment slopes will be relatively undisturbed for an extended temporary period , thereby facilitating seepage monitoring during construction.

4.1 Interim Seepage Monitoring Locations

Monitoring of the embankment fill seepage during construction will be achieved by selecting representative seepage locations for sampling as construction proceeds. Seepage monitoring locations will be selected, monitored, and abandoned or dismantled as the extent and shape of the Third Runway embankment changes during construction.

At the end of each construction phase, the location and extent of interim embankment slope surfaces that will remain unchanged for the duration of at least the next construction phase (at least one year) will be identified. Seeps from these interim slopes will be observed and documented during an initial three-month reconnaissance period to confirm the presence and continuity of seepage. Representative seeps will be identified, and monitoring locations will be selected, numbered, documented, and photographed, with location and elevation surveyed by the Port. Monitoring locations may be moved if it is determined that the seepage expression changes over time.

The procedure outlined above will permit the establishment of interim seepage monitoring locations that will be available for periods of 12 months or more. As construction phases progressively reach the final embankment configuration, post-construction seepage monitoring locations within each phase will be identified as described in Section 5.2, and post construction monitoring will commence as described in Section 5.0

4.2 Interim Seepage Monitoring Schedule

Once documented, the interim seepage monitoring points will be sampled on a monthly basis. Sampling at each interim seepage monitoring location will track any changes or trends in the water quality of the seeps selected until the location is no longer available due to the initiation of the next construction phase.

4.3 Seepage Monitoring Parameters

At each interim seepage monitoring location, the same constituents will be monitored as listed in Section 3.4

4.4 Interim Seepage Quality Screening

Data evaluation will be implemented progressively in three stages to determine if seepage quality at the interim seepage monitoring locations is of potential concern. Results that exceed any staged screening criteria do not directly equate to adverse impacts to wetlands or other waters of the state; rather, such exceedences provide an indication that further review and analysis are warranted to protect against the occurrence of such impacts.

The approach for seepage screening during construction is detailed in three stages as discussed below.

- Stage 1: Surface Water Quality Criteria. Samples of seepage collected from each selected interim monitoring location will be analyzed for thirteen metals and TPH and compared to applicable freshwater ambient water quality criteria according to guidelines outlined in WAC 173-201A-40. Values will be adjusted for the Practical Quantitation Limits when necessary (Table 3). The Port may elect to screen seepage against background surface water data collected from the neighboring creeks, but will notify Ecology prior to this screening modification.

  The constituent concentrations as determined from the interim monitoring will be divided by a dilution/attenuation factor of 10 and then compared to applicable ambient surface water quality criteria. This default dilution factor is presented in NOAA's Screening Quick Reference Tables and is based on the fact that dilution is expected to occur during migration and upon discharge of groundwater to surface water. The actual dilution/attenuation factor which would occur between the seepage at the interim monitoring location, to the adjacent surface water drainage systems, and then transport to the creeks is likely to be much greater, as discussed in Stage 2 below.

- Stage 2: Derivation of site-specific dilution/attenuation factor for seepage. As constituents in the embankment seepage occurring during construction move through surface water drainage systems or through soils and groundwater, they are subjected to physical, chemical, and biological processes that tend to reduce the original concentration of the constituent during transport between the embankment and the receptor point (associated creeks). These processes include adsorption onto soil and aquifer media, chemical transformation, biological degradation, and dilution due to mixing of the seepage with surface waters and underlying groundwater. The reduction in constituent concentrations between the interim seepage monitoring locations and the creeks can be predicted by developing a site-specific dilution/attenuation factor. As an alternative to the default dilution/attenuation factor discussed in Stage 1, the Port may elect to derive a site-specific dilution/attenuation factor for application to the interim seepage monitoring results per specifications outlined in WAC 173-340-747. The Port will discuss any proposed site-specific dilution/attenuation factors with Ecology prior to their implementation.

- Stage 3: Bioassay Testing for Seepage. If the Port determines that interim seepage samples are exceeding applicable surface water quality criteria, the Port may elect to conduct aquatic bioassays on seepage samples using Ecology-approved methods. There are many circumstances in which numerical water quality criteria are exceeded in a sample, but bioassay testing shows the sample to pass standard toxicity testing criteria. This is because many naturally-occurring constituents exist, such as particulate matter, organic carbon, and inorganic ligands, that render certain potential toxicants unavailable for uptake, and hence, nontoxic. If the Port elects to conduct bioassay testing, the Port will submit a proposed bioassay testing plan to Ecology for review prior to implementation. Bioassay test results would contribute to a weight-of-evidence evaluation on the probability of impact from embankment seepage during construction on water quality.

The Port may elect to establish alternative sampling locations consistent with the tiered monitoring location strategy described generally in Section 1.0, and in more detail in Section 5.1, if it is determined that embankment seepage may be exceeding applicable water quality criteria. The Port may also elect to skip Stages 2 and 3 of the interim seepage screening process and move directly to Tier 2 sampling if it becomes evident that sampling at locations between the embankment toe and the creeks is a more appropriate approach. The Port will discuss a proposed move to Tier 2 with Ecology prior to implementation.

5.0 POST CONSTRUCTION EMBANKMENT SEEPAGE AND GROUNDWATER MONITORING

As phased construction of the Third Runway Embankment reaches completion, monitoring of embankment seepage and groundwater will continue under a tiered post construction monitoring strategy that is protective of aquatic resources. Subsection 5.1 explains the three tiered location monitoring strategy approach. Subsection 5.2 discusses the Tier 1 monitoring locations for both seepage and groundwater. The monitoring schedule and constituents to be monitored are described in Subsections 5.3 and 5.4, respectively. Finally, the approach for evaluating and comparing analytical results to applicable water quality criteria within each tier is described for seepage in Subsection 5.5.1 and for groundwater in Subsection 5.5.2.

5.1 Post Construction Tiered Location Monitoring Strategy

Ecology's goal is to ensure that the use of imported fill will not result in adverse impacts to surface waters. To achieve this goal, the Port proposes a monitoring strategy that proceeds in a three "tiered" approach. Seepage and groundwater is first collected near the toe of the embankment where samples are most likely to be representative of water flowing through the embankment (Tier 1). However, if it is determined that monitored ground water exceeds established background conditions or seepage exceeds applicable water quality criteria, new sampling locations may be situated between the embankment and associated surfaces waters to demonstrate that attenuation and dilution mechanisms are occurring (Tier 2). The third tier would involve direct surface water sampling in the associated creeks. This three-tiered approach is discussed in more detail below.

- Tier 1. For seepage monitoring, Tier 1 utilizes a conservative procedure by collecting samples of water directly discharged along the toe of the final embankment without consideration of mixing or attenuation processes that occur between the embankment and the receiving waters. Drainage layer seepage is assumed to be representative of the water percolating through the embankment fill. Monitoring and evaluation of representative seepage locations will be performed as described below in Section 5.2. The methods to evaluate the data are described in Section 5.5.1.

  For groundwater, Tier 1 groundwater monitoring wells will be those used in the baseline study (Section 3.1). The staged approach to screening groundwater data will be implemented as described below in Section 5.5.2.

- Tier 2. If it is determined over time that seepage and/or groundwater is significantly exceeding all applicable stages of the screening criteria at the toe of the embankment, then Tier 2 monitoring will be conducted. Tier 2 will consist of installing new sampling locations between the embankment and associated creeks in order to ascertain the fate of the seepage and/or groundwater as it migrates from the embankment. The selection of monitoring points in surface water locations will depend on the observed nature of the flow regime (e.g., flow directions and flow rates). In the event that Tier 2 monitoring is determined to be necessary, an EFMP addendum describing the Tier 2 monitoring locations would be submitted to Ecology for its review and approval. The staged approach to screening data in Tier 2 will be the same as for Tier 1, as described in Section 5.5.

- Tier 3. If the results of Tier 2 monitoring significantly exceed the staged screening criteria, direct monitoring of surface waters in Miller and Walker Creeks would be implemented to demonstrate protection of aquatic biota. In this case, a monitoring program would be designed to implement the Tier 3 sampling strategy under a new Tier 3 EFMP to be submitted to Ecology for its review and approval.

5.2 Tier 1 Post Construction Monitoring Locations for Groundwater and Seepage

Groundwater sampling locations will be the same as used for the groundwater monitoring program as described in Section 3.2. These locations are considered Tier 1 locations since they are directly downgradient of the embankment.

The monitoring points for embankment seepage will be placed at selected locations where seepage consistently discharges from the drainage layer at the toe of the completed embankment. Since the elevation of the drainage layer will not be uniform, and will vary with existing topography, seeps are expected to occur mainly in topographic low spots along the toe of the embankment. Monitoring points will be selected based on the seepage flow rate, proximity to the adjacent creek, and locations of flow dispersal to wetlands.

Monitoring of the embankment fill seepage will be achieved by selecting representative seepage locations for sampling under Tier 1 as each phase of final embankment construction is completed and seeps are observed.. A review of current land surface topography beneath the proposed embankment fill area has been performed to identify locations where seepage is most likely to occur. Fifteen tentative locations are shown on Figure 2. A revised list of post construction

seepage monitoring locations will be provided in a plan addendum issued following the completion of the Third Runway embankment, when the actual occurrence of seeps will be expressed. Monitoring locations will be numbered, documented, and photographed, with location and elevation surveyed by the Port. Monitoring locations may be moved if it is determined that the seepage expression changes over time or downstream hydraulic conditions change.

5.3 Post Construction Monitoring Schedule for Groundwater and Seepage

As discussed above, groundwater monitoring will occur on a quarterly basis during the construction of the embankment and remain on this same schedule once the embankment is completed. Ground water monitoring will be conducted for a period of eight years, including baseline, construction, and post-construction monitoring.

The post construction seepage monitoring period will commence, in different locations at different times, following the sequence in which final embankment construction contract phases are completed (see Section 4.1). While post construction monitoring is being conducted in completed portions of the embankment, interim seepage monitoring will continue to the extent possible in areas where construction of the final embankment is not complete.

Seepage monitoring will be performed monthly. It is possible that seeps may be dry from time to time on a seasonal or temporal basis. After one year of monthly post construction seepage monitoring, the Port may request that the monitoring interval for embankment seepage be extended to quarterly monitoring, if the data collected demonstrate that quarterly monitoring will be representative of seep constituent variability.

Seepage monitoring will be conducted for a total period of eight years, commencing upon the initiation of interim monitoring. At the end of the eight-year ground water and seepage monitoring periods, the Port and Ecology will re-evaluate the need to modify or continue the monitoring program.

5.4 Monitoring Parameters for Groundwater and Seepage

Thirteen metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury [inorganic], nickel, selenium, silver, thallium, and zinc), TPH, etc., will be analyzed for both groundwater and seepage in the same manner as previously described for the groundwater monitoring program in Section 3.4.

See Appendix Sections A-C for a discussion on Sampling Methods and Handling Procedures, Quality Assurance and Quality Control Procedures, and Field Documentation, respectively.

5.5 Tier 1 Staged Water Quality Screening

Sample analytical results from seepage and groundwater will be evaluated using a staged approach. This progressively rigorous evaluation will be used if seepage or groundwater quality at the embankment toe is determined to be of potential concern. Results that exceed the staged screening criteria applied in Tier 1 do not directly equate to impacts to wetlands or other waters of the state. Rather, such exceedances provide an indication that further review and progressive analysis is warranted.

5.5.1 Seepage Staged Screening. The staged approach for seepage screening is detailed in three stages as discussed below.

- Stage 1: Surface Water Quality Criteria. Samples of seepage collected from each selected location will be analyzed for thirteen metals and TPH and compared to applicable freshwater ambient water quality criteria according to guidelines outlined in WAC 173-201A-40. Values will be adjusted for the Practical Quantitation Limits when necessary (Table 3). The Port may elect to screen seepage against background surface water data collected from the neighboring creeks, but will notify Ecology of this screening modification.

  The constituent concentrations as determined from the Tier 1 monitoring will be divided by a dilution/attenuation factor of 10 and then compared to applicable ambient surface water quality criteria. This default dilution factor is presented in NOAA's Screening Quick Reference Tables and is based on the fact that dilution is expected to occur during migration and upon discharge of groundwater to surface water. The actual dilution/attenuation factor which would occur between the seepage at the toe of the embankment to the adjacent surface water drainage systems and then transport to the creeks is likely to be much greater, as discussed in Stage 2 below.

- Stage 2: Derivation of site-specific dilution/attenuation factor for seepage. As constituents in the embankment seepage move through surface water drainage systems or through soils and groundwater, they are subjected to physical, chemical, and biological processes that tend to reduce the original concentration of the constituent as it is transported between the embankment and the receptor point (associated creeks). These processes include adsorption onto soil and aquifer media, chemical transformation, biological degradation, and dilution due to mixing of the seepage with surface waters and underlying groundwater. The reduction in constituent concentrations between the toe of the embankment and the creeks can be predicted by developing a site-specific dilution/attenuation factor. As an alternative to the default dilution/attenuation factor discussed in Stage 1, the Port may elect to derive a site-specific dilution/attenuation factor for application to the embankment seepage monitoring results per specifications outlined in WAC 173-340-747. The Port will discuss any proposed site-specific dilution/attenuation factors with Ecology prior to their implementation.

- Stage 3: Bioassay Testing for Seepage. If the Port determines that Tier 1 seepage samples are exceeding applicable surface water quality criteria, the Port may elect to conduct aquatic bioassays on seepage samples using Ecology-approved methods. There are many circumstances in which numerical water quality criteria are exceeded in a sample, but bioassay testing shows the sample to pass standard toxicity testing criteria. This is because many naturally-occurring constituents exist, such as particulate matter, organic carbon, and inorganic ligands, that render certain potential toxicants unavailable for uptake, and hence, nontoxic. If the Port elects to conduct bioassay testing, the Port will submit a proposed bioassay testing plan to Ecology for review prior to implementation. Bioassay test results would contribute to a weight-of-evidence evaluation on the probability of impact from embankment seepage on water quality.

The Port may elect to skip Stages 2 and 3 of the Tier 1 surface water quality screening process and move directly to Tier 2 sampling if it becomes evident that sampling at locations between the embankment toe and the creeks is a more appropriate approach. The Port will discuss a proposed move to Tier 2 with Ecology prior to implementation.

5.5.2 Groundwater Staged Screening

The approach for groundwater screening after construction of the Third Runway Embankment is detailed in three stages as discussed below.

- Stage 1: Background. Groundwater samples collected from each monitoring well will be analyzed for thirteen metals and Total Petroleum Hydrocarbons (TPH) and compared to the baseline groundwater data set. If Stage 1 screening indicates significantly elevated levels for constituents of concern, the Port will notify Ecology, and Stage 2 of the screening process will be implemented as described below.

- Stage 2: Derivation of a site-specific dilution/attenuation factor for groundwater. As constituents in the embankment seepage move through soils and groundwater, they are subjected to physical, chemical, and biological processes that tend to reduce the original concentration of the constituent as it is transported between the embankment and the receptor point (neighboring creeks). These processes include adsorption onto soil and aquifer media, chemical transformation, biological degradation, and dilution due to mixing of the seepage with surface waters and underlying groundwater. The reduction in constituent concentrations between the toe of the embankment and the creeks can be estimated by developing a site-specific dilution/attenuation factor, or using an Ecology-published default dilution/attenuation factor, as appropriate. The Port will discuss any proposed site-specific dilution/attenuation factors with Ecology prior to their implementation. If Stage 2 screening indicates that significantly elevated levels for constituents of concern threaten to impact the quality of waters of the state, Ecology will be notified, and Stage 3 of the screening process would be implemented as described below.

- Stage 3: Fate and Transport Groundwater Flow Modeling. Stage 3 will utilize groundwater modeling to provide a more detailed representation of groundwater flowpaths and attenuation processes in the area within and downgradient of the embankment fill. A groundwater flow model would be established to take account of the design, structure and hydrologic properties of the as-built embankment and represent the fate and transport of specific constituents of concern through the shallow aquifers, discharging to the adjacent creeks and through riparian wetlands. The Port will discuss and agree to protocols for any proposed groundwater flow, fate and transport modeling with Ecology prior to its implementation.

6.0 MONITORING REPORT

A groundwater and seepage monitoring report will be produced annually after acquisition of the associated laboratory analytical results. The first report is scheduled for completion within 15 months of the first background groundwater sampling round. The annual report will contain both groundwater and seepage evaluations, and will include the following: (1) a data quality review, findings, and recommendations; (2) a site map showing relevant features, sampling locations, and a description of field activities; and (3) tables summarizing the analytical results. Ecology will be notified if applicable water quality criteria are exceeded as described above.

7.0 CONTINGENCY PLAN

Condition E.3 of the Water Quality Certification for U.S. Army Corps of Engineers Public Notice 1996-4-02325 (Amended-1), states: *" In the event monitoring detects exceedances of the water quality criteria in either surface or groundwater, Ecology may revise the fill criteria and/or require corrective action."* The Port will implement the required monitoring as described above, and will notify Ecology as directed.

REFERENCES

Ecology, 2001. Water Quality Certification for U.S. Army Corps of Engineers Public Notice 1996-4-02325 (Amended-1). September 21, 2001.

Ecology, 2001, Model Toxics Control Act Cleanup Regulation. WAC 173-340. Publication 94-06.

EPA, 1996. Test methods for Evaluating Solid Waste Physical/Chemical Methods EPA SW-846, Third Revision.

NOAA 1999. Screening Quick Reference Tables.

Parametrix, 2001. Comprehensive Stormwater Management Plan, Master Plan Update Improvements, Seattle-Tacoma International Airport. July 2001.

Port of Seattle. NPDES Permit No. WA-02465-1. Port of Seattle, Seattle-Tacoma International Airport. May 29, 2001.

Port of Seattle. Procedures Manual for Stormwater Monitoring. Seattle-Tacoma International Airport, Seattle, WA. Revision 6. April 22, 1999.

USFWS, 2001. Biological Opinion. Master Plan Update Endangered Species Act Consultation, Seattle Tacoma International Airport, Ref # 1-3-00-F-1420.

WAC 173-160 Minimum Standards for Construction and Maintenance of Wells.

WAC 173-201A Water Quality Standards for Surface Waters of the State of Washington.

EXHIBIT 1

Exhibit 1 – Text of Post Construction Monitoring

From the Water Quality Certification for the U.S. Army Corps of Engineers Public Notice 1996-3-02325, E. Conditions for Acceptance of Fill to be used in Construction of Port 404 Projects, 3. Post Construction Monitoring

> "The Port shall monitor runoff and seepage from Port 404 Projects where fill is placed for compliance with applicable Washington State surface water criteria. Groundwater down-gradient from the fill area shall be monitored for compliance with applicable groundwater criteria.

Within 60 days after the issuance of the 401 Water Quality Certification for the Master Plan Update Improvements, the Port shall submit to Ecology for review and written approval a Surface Water and Groundwater Monitoring Plan. The monitoring plan shall be designed to detect impacts of the fill embankment to the receiving water and to the groundwater during fill placement and post fill placement. In the event monitoring detects exceedances of the water quality criteria in either surface or groundwater; Ecology may revise the fill criteria and/or require corrective action."

TABLES

Table 1 – Groundwater Monitoring Wells (Proposed)

Provisional Well ID	Approximate Coordinates	Elevation in feet above mean sea level	Estimated Perched Groundwater Level	Well Depth in feet below ground surface	Screen Length in Feet
MW-1	N 22050 E 11270	~275	~270	15	10
MW-2	N 21900 E 10792	~265	~265	12	10
MW-3	N 21365 E 10602	~265	~265	12	10
MW-4	N 20390 E 10675	~290	~280	20	10
MW-5	N 19490 E 10630	~265	~260	15	10
MW-6	N 18902 E 10588	~250	~240	20	10
MW-7	N 18480 E 10615	~230	~230	12	10
MW-8	N 18135 E 10815	~230	~230	12	10
MW-9	N 17645 E 10780	~250	~240	20	10
MW-10	N 16970 E 10848	~340	~320	35	20
MW-11	N 16212 E 10875	~360	~340	40	20
MW-12	N 15512 E 10950	~360	~340	40	20
MW-13	N 14812 E 10905	~335	~320	25	10
MW-14	N 14420 E 10900	~300	~295	15	10
MW-15	N 14005 E 10912	~310	~300	20	10

Notes: As-built well depths, elevations, and coordinates will be surveyed and provided following well drilling and installation.

Table 2 – Post-Construction Drainage Layer Seepage Monitoring Points (Tentative)

Provisional Drainage Layer Seep ID	Approximate Coordinates	Elevation in feet above mean sea level	Approximate Location
DS-1	N 22052 E 11500	~277	North Safety Area: beneath eastern part of North MSE Wall
DS-2	N 22030 E 10995	~270	North Safety Area: beneath North MSE Wall
DS-3	N 21595 E 10630	~263	North Safety Area: above Miller Creek realignment
DS-4	N 20908 E 10740	~279	North of Pond C, below 120-ft high embankment slope
DS-5	N 19942 E 10730	~276	North of Pond G, below 120-ft high embankment slope
DS-6	N 19098 E 10580	~246	South of Pond G, below 2:1 embankment slope
DS-7	N 18705 E 10565	~232	Below embankment toward northern end of West MSE Wall
DS-8	N 18342 E 10710	~227	Below northern part of West MSE Wall
DS-9	N 17878 E 10845	~225	Below central part of West MSE Wall
DS-10	N 17360 E 10762	~285	Below southern part of West MSE Wall
DS-11	N 16510 E 10922	~352	North of Pond G, below 25-ft high embankment slope
DS-12	N 16090 E 10945	~362	South of Pond G, below 10-ft high embankment slope
DS-13	N 14992 E 10930	~345	North of South MSE Wall, below 18-ft high embankment
DS-14	N 14560 E 10920	~290	Below northern part of South MSE Wall
DS-15	N 14195 E 10918	~283	Below southern part of South MSE Wall

Notes: Drainage Layer Seeps will be selected for sampling based on occurrence of seepage flows. Final coordinates and elevations will be surveyed and provided following completion of the Third Runway Embankment.

Table 3 – Methods of Analysis, Screening Criteria, and Reporting Limits

Analyte	State FW Chronic[1]	State FW Acute[1]	Lab Reporting Limit Goal	Analytical Method
Hardness in mg/L			0.2	EPA Method 6010
Alkalinity in mg/L			10	EPA Method 310.1
Total Organic Carbon in mg/L			1	EPA Method 415.1
Dissolved Organic Carbon in mg/L			1	EPA Method 415.1
Total Suspended Solids in mg/L			5	EPA Method 160.1
Dissolved Metals in µg/L				
Antimony	NA	NA	1	EPA Method 6020
Arsenic	190	360	1	EPA Method 6020
Beryllium	NA	NA	1	EPA Method 6020
Cadmium*	0.62	1.75	0.5	EPA Method 6020
Chromium (total)	10	15	1	EPA Method 6020
Copper*	6.28	8.86	1	EPA Method 6020
Lead*	1.17	30	0.5	EPA Method 6020
Mercury	0.012	2.1	0.1	EPA Method 7470
Nickel*	87	787	1	EPA Method 6020
Selenium	5	20	3	EPA Method 6020
Silver*	NA	1.05	0.5	EPA Method 6020
Thallium	NA	NA	1	EPA Method 6020
Zinc*	58	64	4	EPA Method 6020
Total Petroleum Hydrocarbons in mg/L				
Gasoline			0.2	NWTPH-G
Diesel and Heavy Oils			0.5	NWTPH-Dx

Notes:
* - Surface Water criteria are dependent on hardness assume hardness of 50 mg/L
[1] WAC 173-201A Water Quality Standards for Surface Waters of the State of Washington

Table 4 - Sample Containers, Preservative, and Holding Times

Chemical Analysis	Sample Container	Preservative [1]	Holding Time
Dissolved Metals & Hardness	1 L P	HNO_3	28/180 days [2]
Alkalinity	1 L P	None; no head space	14 days
Total Organic Carbon	250 mL AG	H_2SO_4	28 days
Dissolved Organic Carbon	250 mL AG	H_2SO_4	28 days
TPH – Gasoline	3 x 40 mL vials	HCl	14 days
TPH – Extended Diesel	1 L AG	HCl	14 days

Sample Containers: P – Plastic; AG - Amber glass

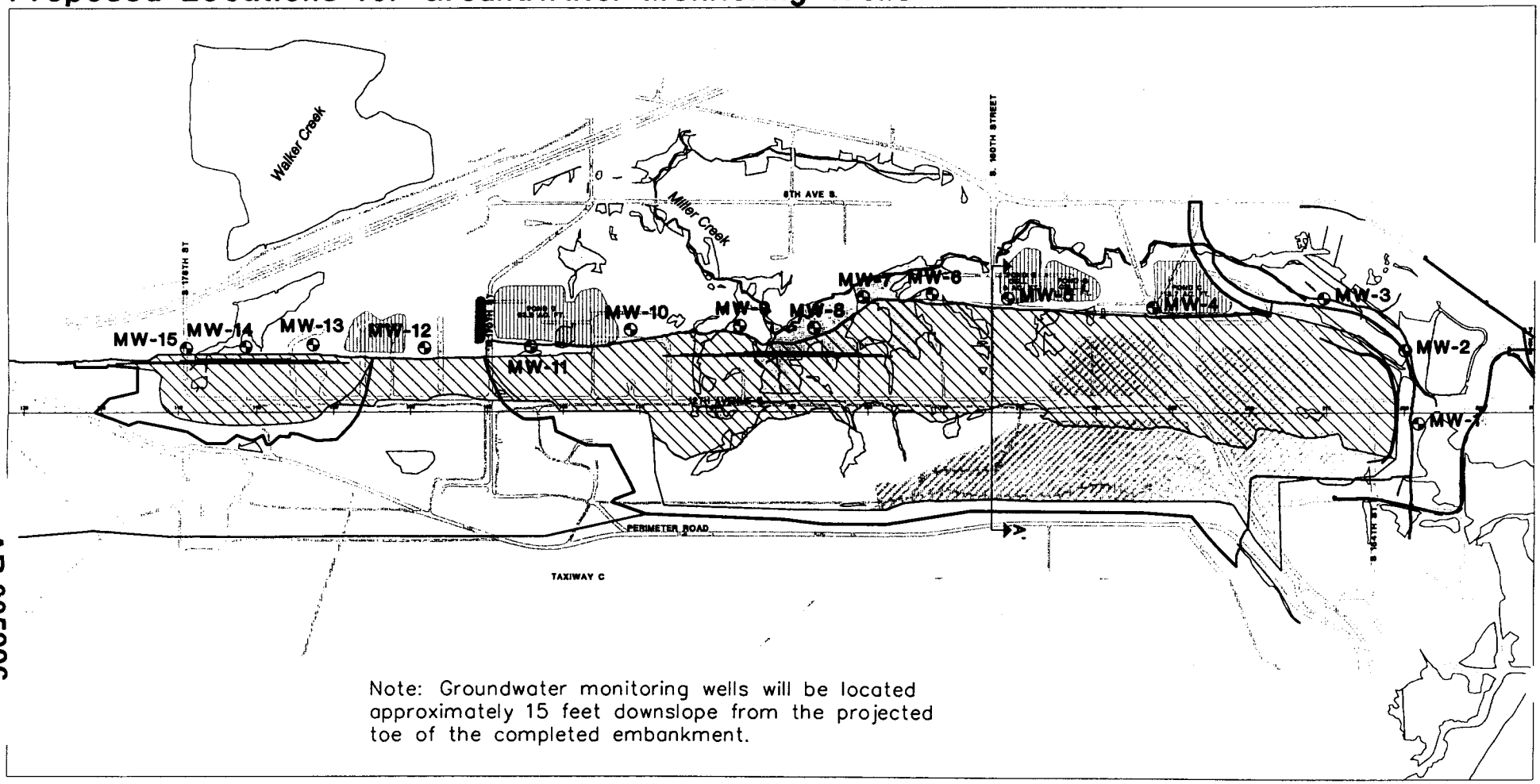
Notes:
[1] All samples shall be maintained at 4°C.
[2] Holding time for mercury/remaining metals

FIGURES

DTN 10/18/01 1=1 charlie-8.pc2 49784310

Third Runway - Embankment Seepage

Proposed Locations for Groundwater Monitoring Wells



Note: Groundwater monitoring wells will be located approximately 15 feet downslope from the projected toe of the completed embankment.

Drainage Layer Cover

Existing Embankment Fill

Maximum Extent of Drainage Layer

Wetlands

Stormwater Pond

AA' Cross Section Location and Designation (See Figure 3)

MW-7 Proposed Monitoring Well Location and Number

N

0 1000 2000

Scale in Feet

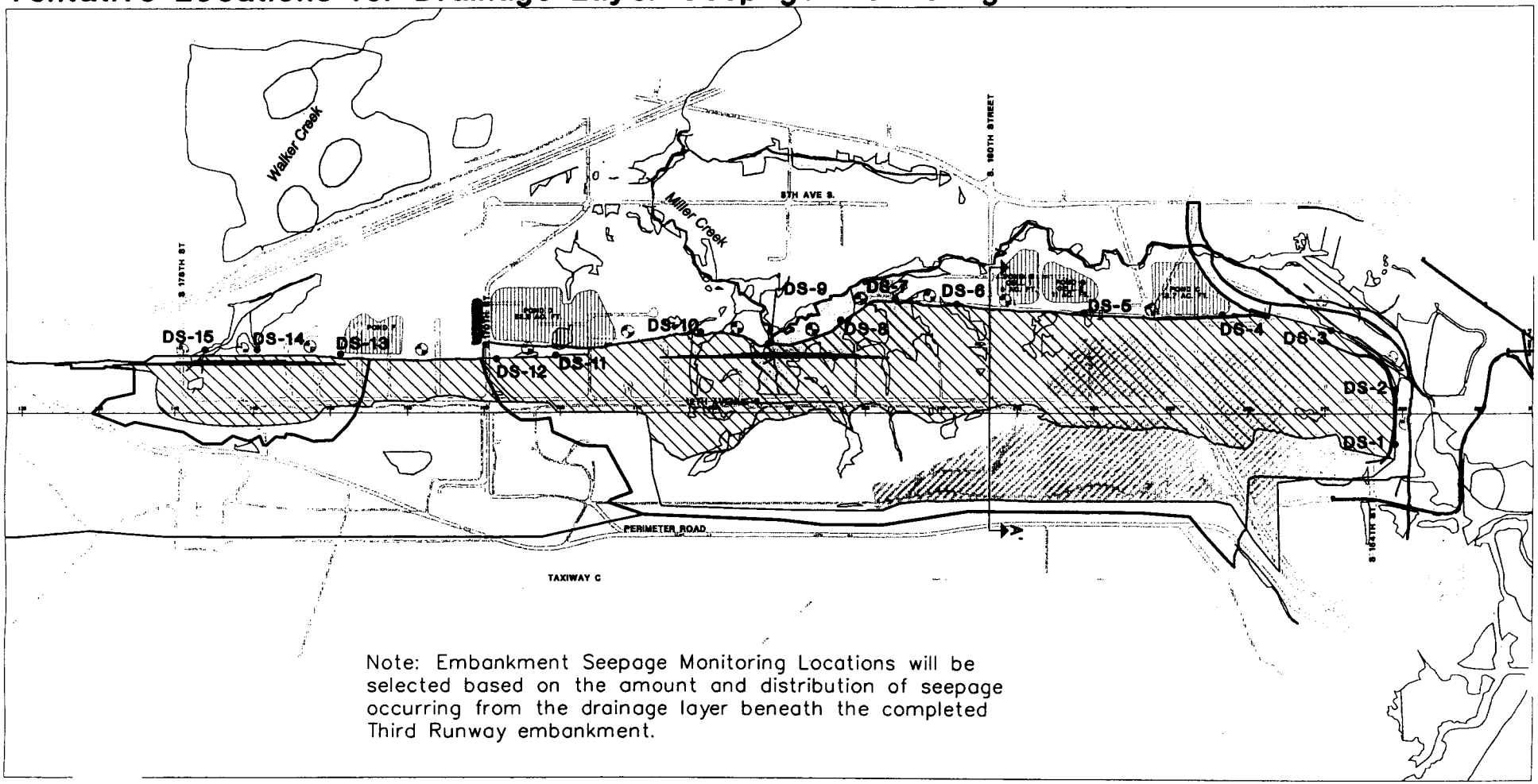
AR 005996

J-4978-43 9/01

Figure 1

Third Runway - Embankment Seepage

Tentative Locations for Drainage Layer Seepage Monitoring



Note: Embankment Seepage Monitoring Locations will be selected based on the amount and distribution of seepage occurring from the drainage layer beneath the completed Third Runway embankment.

Drainage Layer Cover

Existing Embankment Fill

Maximum Extent of Drainage Layer

Wetlands

Stormwater Pond

•DS-1 Drainage Layer Seepage Monitoring Location and Number (Tentative)

AA' Cross Section Location and Designation (See Figure 3)

Proposed Monitoring Well Location (See Figure 1)

N

0 1000 2000

Scale in Feet

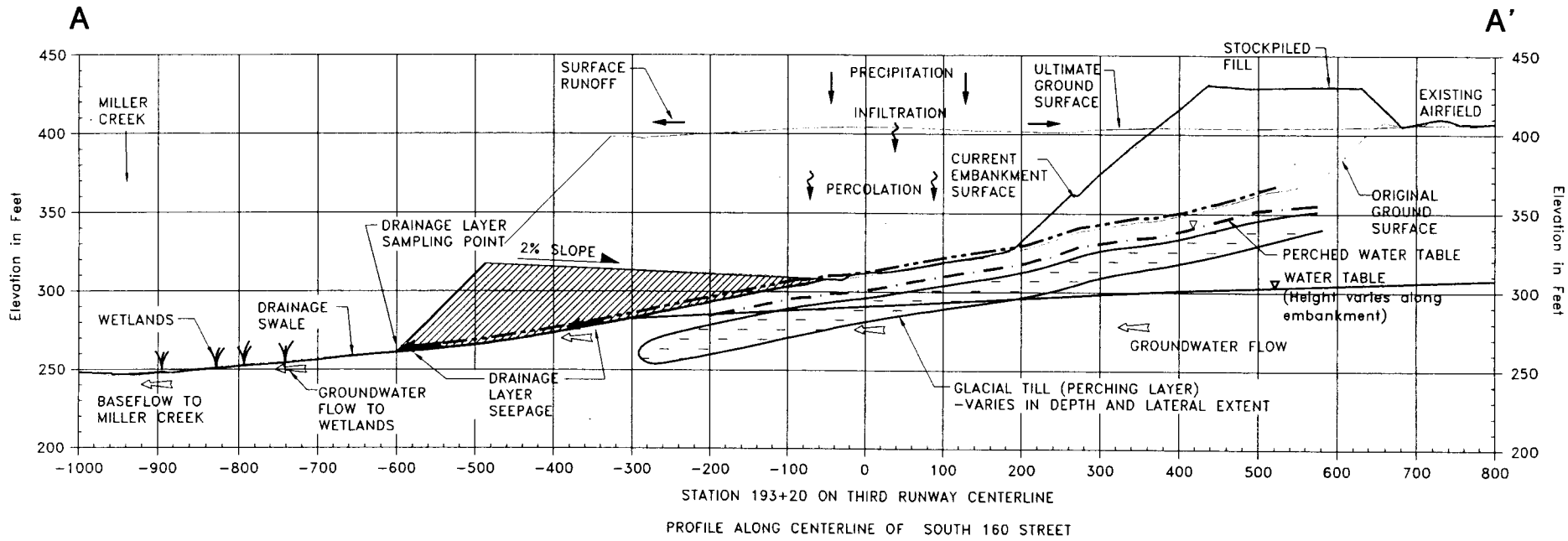
AR 005997

J-4978-43 9/01
Figure 2

DTN 11/7/01 1=1 charlie.pc2 49784309

Third Runway - Embankment Seepage

Cross Section A-A' - Conceptual Site Flow Model



Note: The conceptual model is a schematic representaation of flow paths at a typical cross-section through the Third Runway embankment. Conditions, dimensions, elevations, and details vary along the length of the embankment.

LEGEND:

Drainage Layer Cover

Drainage Layer

Horizontal Scale in Feet
0 200 400
0 100 200
Vertical Scale in Feet
Vertical Exaggeration x 2

AR 005998

J-4978-43 9/01
Figure 3

APPENDIX

APPENDIX: MONITORING PROCEDURES

A. SAMPLING METHODS AND HANDLING PROCEDURES

A.1 Groundwater Sampling.

To minimize turbidity, low-flow purging methods will be employed using a peristaltic pump system or dedicated bladder pumps to collect groundwater samples from monitoring wells. Typical flow rates range from 0.1 to 0.5 L/min, however, the flow rates utilized to purge the selected monitoring wells will be determined in the field by monitoring the water levels in each of the wells during sampling so that drawdown in the well is minimized. The general low-flow purging procedures are as listed below:

1. Measure static water level in well;
2. Turn pump on to initiate the pumping cycle and to clear any air in the discharge line;
3. Connect pump discharge tubing to the calibrated flow-through cell equipment;
4. Monitor drawdown in the well. The goal is to pump at a rate that produces minimal drawdown (e.g., typically less than 4 inches);
5. Measure the flow rate with a calibrated container (e.g., graduated cylinder); and
6. Continuously monitor in-line field parameters (listed below) during purging. Stabilization is achieved after all field parameters have stabilized for three consecutive readings. Three successive readings should be within 0.1 pH units for pH, and 10 percent for temperature, redox, and dissolved oxygen (EPA 1996).

Following stabilization, and prior to sample collection, the tubing will be disconnected from the flow-through cell. Groundwater samples will then be collected by directly filling pre-cleaned sample containers (Table 4). Dissolved organic carbon and metals samples will be collected by filtering with a 0.45 μm in-line filter. In addition, one field duplicate per sampling event will also be collected. Field observations and flow rates will be recorded on the groundwater sampling data sheet (Attachment 1).

The following field parameters will be measured prior to sample collection using appropriate field instrumentation and collection vessels.

Water level;	Temperature;
pH;	Redox Potential;
Electrical Conductivity;	Dissolved Oxygen

A.2 Sampling Methods for Embankment Seepage.

Sample collection may be aided by installing pipes to collect drainage from certain seeps. Appropriate methods will be used to estimate discharge rates. Samples will be collected using clean sampling techniques appropriately adapted from EPA 1669 methods. Field parameters will be measured prior to sample collection using appropriate field instrumentation and collection vessels. In addition, one field duplicate per sampling event will be collected. Field observations and seepage flow rates will be recorded on a seepage sampling data sheet (Attachment 1).

The following field parameters will be measured prior to sample collection using appropriate field instrumentation and collection vessels.

Water level;	Temperature;
pH;	Redox Potential;
Electrical Conductivity;	Dissolved Oxygen

A.3 Sample Labeling and Nomenclature. Sample labels will clearly indicate the sample number, date, sampler's initials, parameters to be analyzed, preservative added (if any), and any pertinent comments. Sample nomenclature will consist of the sample type (SW; ES, or GW, for surface water, embankment seepage, or groundwater, respectively), and the sampling point / Well ID number (e.g., DS-1; MW-1). The blind field duplicate will be labeled with the same sample type designation as the original sample, followed by -DUP (e.g., GW-DUP).

A.4 Chain of Custody Records. Chain of custody procedures will be employed to maintain and document sample possession. A sample is considered under a person's custody if it is in that person's physical possession, within visual sight of that person after taking physical possession, secured by that person so that the sample cannot be tampered with, or secured by that person in an area that is restricted to authorized personnel only.

Custody records completed by the sampler will accompany all shipments of samples. Each cooler will have a custody form (Attachment 2) listing the samples in the cooler. The purpose of these forms is to document the transfer of a group of samples traveling together; when the group of samples changes, a new custody record is initiated. The original custody record always travels with the samples; the initiator of the record keeps a copy.

The following procedures will be followed when using chain of custody record form(s):

1. The originator will fill in all requested information from the sample labels;
2. The person receiving custody will check the sample label information against the custody form. The person receiving custody will also check sample condition and note anything unusual under "Remarks" on the custody form;
3. The originator will sign the "Relinquished by" box and keep a copy of the custody form;
4. After delivery by a commercial carrier, the person receiving custody will sign in the "Received by" box adjacent to the "Relinquished by" box (may also be filled in by recipient as "Federal Express" or other carrier name). All signatures and entries will be dated;
5. When custody is transferred to the analytical laboratory, blank signature spaces may be left and the last "Received by" signature box used. Another approach is to run a line through the unused signature boxes;
6. In all cases, documentation shall establish that the same person receiving custody has relinquished it to the next custodian; and
7. If samples are left unattended or a person refuses to sign, this will be documented and explained on the custody form.

A.5 Sample Handling. Once collected, samples will be placed with the chain of custody form(s) in coolers for shipment to the analytical laboratory. Ice will be placed in each cooler to maintain a temperature of 4° C to meet sample preservation requirements. All samples will be delivered to the laboratory within 24 hours of collection. The following are general packaging procedures:

1. Sample labels with adhesive backing will be securely attached to each sample container;
2. Labeled sample containers will then be sealed into plastic bubble-wrap bags or Ziploc-type bags prior to being loaded into the sample coolers;
3. Insulated plastic coolers will be used as shipping containers. The drain plugs shall be taped shut (using strapping tape) on the inside and outside. Several plastic bubble-wrap sheets shall be placed on the interior bottom and sides of the coolers for shock absorption. One to three inches of Styrofoam pellet packing material may also be placed in the bottom of the coolers for additional shock absorption at the discretion of the Sampling Team Site Manager;
4. Styrofoam pellets may also be placed between sample containers to protect the containers from breakage during shipment and handling;
5. All samples requiring refrigeration will be chilled to 4° C with the addition of four bags (gallon-size Ziploc type - double bagged) of blue, cube, or block ice;
6. The paperwork intended for the laboratory will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The original custody form(s) will be included in the paperwork sent to the laboratory. If samples are sent by air transport, the air bill will be completed before the samples are handed over to the carrier;
7. Two signed custody seals will be placed over the lid of the cooler, one on the right front and one on the upper left, and covered with clear plastic tape;
8. The cooler will be securely taped shut with strapping tape wrapped completely around the cooler at least once in a minimum of two locations.
9. "Up Arrow" symbols will be placed on all four sides of cooler; and
10. The completed shipping label will be attached to the top of the cooler. The cooler will then be delivered to the overnight courier, or direct to the laboratory.

A.6 Sample Analysis Methods

The groundwater samples and field duplicates will be submitted to an analytical laboratory accredited by the WDOE for analysis under the following prescribed analytical methodologies: Dissolved Metals (Sb, As, Be, Cd, Cr, Cu, Pb, Ni, Se, Ag, Tl, Zn; EPA Method 6020; Hg: EPA Method 7470); Total Petroleum Hydrocarbons (NW-TPH-G and NW-TPH-Dx); Hardness (EPA Method 6010); Alkalinity (EPA Method 160.1); Total Suspended Soils (EPA Method 310.1); and Total and Dissolved Organic Carbon (EPA Method 415.1).

Details of analytical methods and recommended reporting limits are presented in Table 3. Sample preservation and holding time requirements are presented in Table 4. To maintain laboratory comparability, the same analytical laboratory will be used for the analysis of all

seepage sampling events to the extent possible. Analytical methods will be utilized and/or modified as necessary to appropriately measure constituents relative to the screening criteria.

B. QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality assurance/quality control procedures provide the means of controlling the precision and bias of the results. Adherence to established procedures for sample collection, preservation, and storage will minimize errors resulting from sampling and sample instability. Analytical and measurement systems must be in statistical control, which means that errors have been reduced to acceptable levels and then documented.

B.1 Field Quality Control Procedures

Field quality control procedures will include the collection of field duplicate samples and field equipment blanks.

Field Duplicates Field duplicates will be collected at a minimum of 5 percent per chemistry analytical method performed. Field duplicate relative percent differences (RPDs) will be less than 50 percent.

Filter Blanks. Filter blanks will be taken as a minimum rate of 5 percent of samples by running deionized water through the disposable filter apparatus and analyzing for all lab parameters.

Equipment Blanks. Equipment blanks will not be required since dedicated pipes, and /or pumps and tubing will be used to collect each sample.

B.2 Laboratory Quality Control Procedures

The laboratory quality control procedures used for this project will include: instrument calibration and standards as defined by EPA; laboratory blank measurements; and accuracy and precision measurements including laboratory control samples, matrix spikes, and duplicate analyses.

The laboratory quality control officer is responsible for assuring that the laboratory implements all routine internal quality assurance and quality control procedures. The laboratory quality control procedures used for this project will consist of the following, at a minimum:

1. Instrument calibration and standards as defined in EPA SW-846 (EPA 1996);
2. Laboratory blank measurements at a minimum frequency of 1 per 20 samples; and
3. Accuracy and precision measurements including laboratory control sample (LCS), matrix spike and duplicate analysis, at a minimum frequency of 1 per 20 samples. LCS and matrix spike recoveries shall be between 75 and 125 percent. Laboratory duplicate RPDs will be less than 20 percent.

C. FIELD DOCUMENTATION

All field documentation will be completed using indelible ink. A bound Field Notebook with consecutively numbered pages will be maintained by the sampling team to provide a daily record of significant events, observations, and measurements taken during the field investigation. The

field notebook is intended to provide sufficient data and observations to enable the field team to reconstruct events that occur during the project and will contain the following as a minimum:

1. Date and time of sample collection;
2. Persons present in sampling team;
3. Weather conditions, including temperature;
4. The location name and project number;
5. Location of sampling point;
6. Sample identification number;
7. Type of sample;
8. Any field measurement taken;
9. Field observations;
10. References, such as maps or photographs of the sampling site; and
11. Any procedural steps taken that deviate from those outlined in this sampling plan.

Field parameters, observations, well or sampling point condition, and flow rates will also be recorded for each well or sampling point on the sampling data form (Attachment 1).

REPORT FORM

Groundwater Sampling Data - Well I.D. _____

Project _____ Date/Time Sampled _____

Job No. _____ Tidally Influenced Yes ☐ No ☐

Project Manager _____ Well Depth in Feet _____

Field Reps. _____ Screened Interval in Feet _____

① *Purging Data/Field Measurements: All Measurements Relative to Top of Casing (TOC)*

Well Depth _____ Casing Volume in Gallons _____

Depth ot Sediment (DTS) in Feet _____ [2" diameter = x .163 gal/ft 4" diameter = x .653 gal/ft]

Depth of Water (DTW) in Feet _____ Purge Volume in Gallons _____

(DTS - DTW) _____ Actual Purge in Gallons _____

Time	No. of Gallons Purged	pH	Temp in °C	Conduct in ____	Diss. Oxygen in____	Turbidity	Comments: Quality, Recovery, Color, Odor, Sheen, Accumulated Silt/Sand
Sample							

Comments _____

	Method	Pumping Rate in GPM	Depth of Equipment in Feet
Purge			
Sample			

Bails dry? Yes ☐ No ☐

At no. of Casing Volumes _____

Purge Water Disposal Method/Volume

_____

_____

_____

② *Sampling Data*

Bottle Type	No. of Containers	Analyses	Perserv.	Filter

Total Number of Bottles _____

Duplicate Sample I.D. _____

Field Blank I.D. _____

Rinseate Sample I.D. _____

③ *Field Equipment*

Type/Brand/Serial No./Material/Units

Pump Type/Tubing Type _____ Temp/pH/E.C. Meter _____

Bailer Type _____ Water Level Probe _____

Filter Type _____ Other _____

④ *Well Conditions* OK ☐ Not OK ☐ Explain _____

D

Port of Seattle
Aviation Division

APPENDIX F
DES MOINES WAY NURSERY WETLAND RESTORATION SEATTLE-TACOMA INTERNATIONAL AIRPORT

AGENCY REVIEW
NOT FOR CONSTRUCTION

SHEET NO.	SHEET TITLE
STIA-9805-T1	TITLE SHEET
STIA-9805-C1	VICINITY MAP, SYMBOLS, NOTES AND ABBREVIATIONS
STIA-9805-C2	EXISTING CONDITIONS
STIA-9805-C3	GRADING AND DEMOLITION
STIA-9805-C4	GRADING AND DEMOLITION CROSS SECTION
STIA-9805-L1	LANDSCAPE PLAN
STIA-9805-L2	PLANTING SCHEDULE AND DETAILS

SHEET NO.	SHEET TITLE

SHEET NO.	SHEET TITLE

MAJOR CONTRACT

RECOMMENDED FOR APPROVAL

_____ DATE

_____ DATE

_____ DATE

APPROVED BY

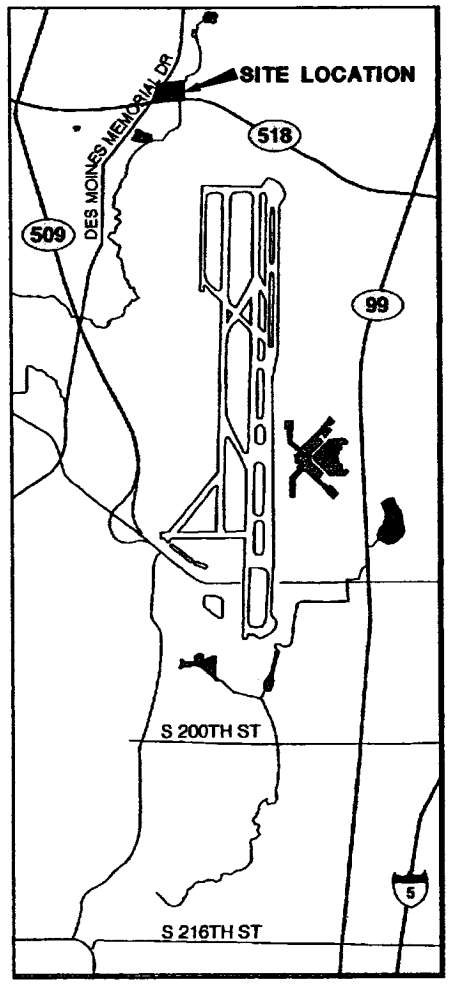
AR 006008

_____ DATE

WORK ORDER NO.	PROJECT NO.
100051	STIA-9805-T1

IMAGES:
XREFS:
FILENAME: 29120381
DATE: 11/15/01

VICINITY MAP



LEGEND

- CULVERT
- SPOT ELEVATION
- KEY NOTE NUMBER REFERENCE
- SURFACE WATER DITCH
- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING GRADE (SECTION)
- SPAWNING GRAVEL (SECTION)
- CRUSHED SURFACING BASE COURSE (SECTION)
- QUARRY SPALLS
- CONCRETE
- EMBANKMENT
- NATIVE SUBGRADE
- GRAVEL
- PAVEMENT (PLAN)
- SLOPE INDICATOR
- CONTROL POINT
- SILT FENCE
- SILT CURTAIN
- GEOTEXTILE
- EROSION CONTROL MATTING
- STRAW BALE BARRIER
- EXISTING MONITORING WELL
- CHAIN LINK FENCE
- PRIVATE PROPERTY BOUNDARY
- POINT OF INTERSECTION
- BERM
- CHANNEL CENTERLINE AND STATION
- EXISTING SANITARY SEWER LINE
- PROPOSED SANITARY SEWER LINE
- LIMIT OF CONSTRUCTION (PROJECT)
- SURVEY CONTROL POINT
- LIMIT OF RESTRICTED AREA
- EXISTING STORM DRAIN

GENERAL LEGEND

DRAWING TITLE:

PLAN
SUBTITLE
SUBTITLE
SCALE

SECTION
SUBTITLE
SUBTITLE
SCALE
SECTION NUMBER
1 / C2 — C12,A1
SHEET WHERE SECTION TAKEN FROM
MULTIPLE CROSS REFERENCES

DETAIL
SUBTITLE
SUBTITLE
SCALE
DETAIL NUMBER
2 / M1 — C12,A1
SHEET WHERE DETAIL TAKEN FROM
MULTIPLE CROSS REFERENCES

ELEVATION
SUBTITLE
SUBTITLE
SCALE
ELEVATION NUMBER
1 / E1 — C12,A1
SHEET WHERE ELEVATION TAKEN FROM
MULTIPLE CROSS REFERENCES

REFERENCE SYMBOL:

1 / C5 — SECTION NUMBER — SHEET WHERE SECTION IS SHOWN

4 / C5 — DETAIL NUMBER — SHEET WHERE DETAIL IS SHOWN

ELEVATION NUMBER
(FOR LONG CUTS)
1 / C6
SHEET WHERE ELEVATION IS SHOWN
(FOR SHORT VIEWS)

GENERAL ABBREVIATIONS

&	AND	N	NORTH/NORTHING
ACP	ASPHALT CONCRETE PAVEMENT	NO.	NUMBER
APPROX.	APPROXIMATE	N.T.S.	NOT TO SCALE
℄	CENTERLINE	O.C.	ON CENTER
CMP	CORRUGATED METAL PIPE	PP	POWER POLE
DIA	DIAMETER	R	RADIUS
E	EAST/EASTING	RCP	REINFORCED CONCRETE PIPE
EL OR ELEV	ELEVATION	S	SOUTH
EXIST	EXISTING	SD	STORM DRAIN
FT	FOOT (FEET)	S.F.	SQUARE FOOT/FEET
GAL	GALLON	SS	SANITARY SEWER
HORIZ/H	HORIZONTAL	STA	STATION
HT.	HEIGHT	TYP	TYPICAL
I.E.	INVERT ELEVATION	W/	WITH
LF	LINEAR FEET/FOOT	WD	WOODY DEBRIS
MAX	MAXIMUM	VERT/V	VERTICAL
MIN	MINIMUM		
MISC	MISCELLANEOUS		

SURVEY CONTROL POINTS

9704-2 = REBAR WITH YELLOW CAP MARKED PMX CONTROL NEAR THE SOUTHEAST CORNER OF LORA LAKE. 11.0' SOUTHERLY OF A DOUBLE TRUNK (12" & 10") ALDER TREE WHICH IS ⊙ THE TOP OF THE BANK & 21.0' NORTHWESTERLY FROM A SANITARY SEWER MANHOLE.

9704-3 = REBAR WITH YELLOW CAP MARKED PMX CONTROL NEAR THE SOUTHWEST CORNER OF LORA LAKE. 6.0' SOUTHERLY OF THE TOP OF BANK & 33.2' WEST SOUTHWEST OF A DOUBLE TRUNK (12" & 12") ALDER TREE.

9704-4 = REBAR WITH YELLOW CAP MARKED PMX CONTROL IN THE NORTHWESTERLY MARGIN OF THE DIRT ROAD THAT RUNS BETWEEN THE PUMPKIN PATCHES, ⊙ THE EASTERLY END OF A BLACKBERRY PATCH, 82' +/- EASTERLY OF THE MOST NORTHWESTERLY CORNER OF A WOODEN STORAGE SHED.

NOTE: SEE C2 FOR SURVEY CONTROL POINT COORDINATES AND ELEVATIONS.

GENERAL NOTES

1. CALL "DIG-SAFE" (1-800-425-5555) PRIOR TO COMMENCING ANY GRADING OR EXCAVATION WORK ON THE SITE.
2. INSTALLATION OF TEMPORARY EROSION AND SEDIMENT CONTROLS SHALL BE COMPLETED PRIOR TO SITE WORK.

AR 006009

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES: Vicinit\Map\appendixB
XREFS:
DATE: 11/14/01 FILENAME: 291203BC1

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./ARCH.: P. FENDT
DESIGNED BY: J. LEAVITT/K. LUDWA
DRAWN BY: PJT/SRM
SCALE: AS SHOWN
DATE: NOVEMBER 2001
CHECKED BY: -
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: DES MOINES WAY NURSERY WETLAND RESTORATION

SHEET TITLE: VICINITY MAP, SYMBOLS, NOTES AND ABBREVIATIONS

WORK ORDER NO.: -
CONSULTANT'S NO.: 291203BC1
PORT OF SEATTLE NO.: STIA-9805-C1

APPENDIX F

DES MOINES WAY NURSERY

WETLAND NB
0.66 ACRE

WETLAND N9
0.08 ACRE

WETLAND N10
0.13 ACRE

FOOTBRIDGE

JAPANESE GARDEN

MILLER CREEK

EXISTING DITCH

DES MOINES MEMORIAL DRIVE

SR 518 RAMP

SR 518

Brush

Brush

280

290

300

310

320

270

260

250

240

N

SCALE 40 0 40 80 FEET

AR 006010

AGENCY REVIEW
NOT FOR CONSTRUCTION

NAMES:
XREFS: 291203BBA P0S-001 P0S-002 P0S-006 P0S-007 LA
FILENAME: 291203BC2
DATE: 11/16/01

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR: P. FENDT
DESIGNED BY: J. KELLEY
DRAWN BY: S. NEWELL
SCALE: 1"=40'
DATE: NOVEMBER 2001
CHECKED BY: S. HARRIS
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED BY:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: DES MOINES WAY NURSERY WETLAND RESTORATION

SHEET TITLE: EXISTING CONDITIONS

WORK ORDER NO. –
CONSULTANT'S NO. 291203BC2
PORT OF SEATTLE NO. STIA-XXXX-C2

APPENDIX F

AR 006011

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES:
XREFS: 291203BBA POS-C01 POS-C02 POS-C04 POS-C07 291203BDE
FILENAME: 291203BC3
DATE: 11/16/01

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.: P. FENDT
DESIGNED: J. KELLEY
DRAWN BY: S. NEWELL
SCALE: 1"=40'
DATE: NOVEMBER 2001
CHECKED BY: S. HARRIS
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D

NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

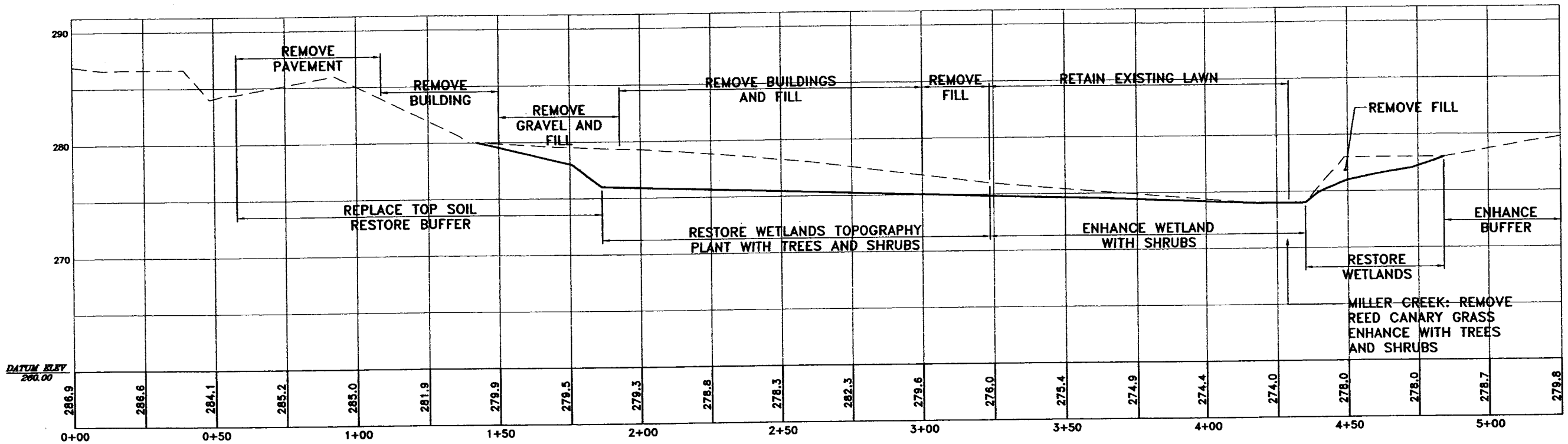
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: DES MOINES WAY NURSERY WETLAND RESTORATION

SHEET TITLE: GRADING AND DEMOLITION

WORK ORDER NO.:
CONSULTANT'S NO.: 291203BC3
PORT OF SEATTLE NO.: STIA-XXXX-C3

APPENDIX F



SECTION

EXISTING AND PROPOSED GRADE
SCALE: H. 1"=20', V. 1"=5'

A
C2

AR 006012

AGENCY REVIEW
NOT FOR CONSTRUCTION

20 0 20 40
SCALE FEET

IMAGES:
XREF'S:
DATE: 11/16/01 FILENAME: 291203BC4

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.: P. FEHOT
DESIGNED BY: J. KELLEY
DRAWN BY: S. MEWELL
SCALE: AS SHOWN
DATE: NOVEMBER 2001
CHECKED BY: S. HARRIS
APPROVED BY: P. FEHOT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED:
DRAWN BY:
SCALED:
DATED:
CHECKED BY:
APPROVED BY:

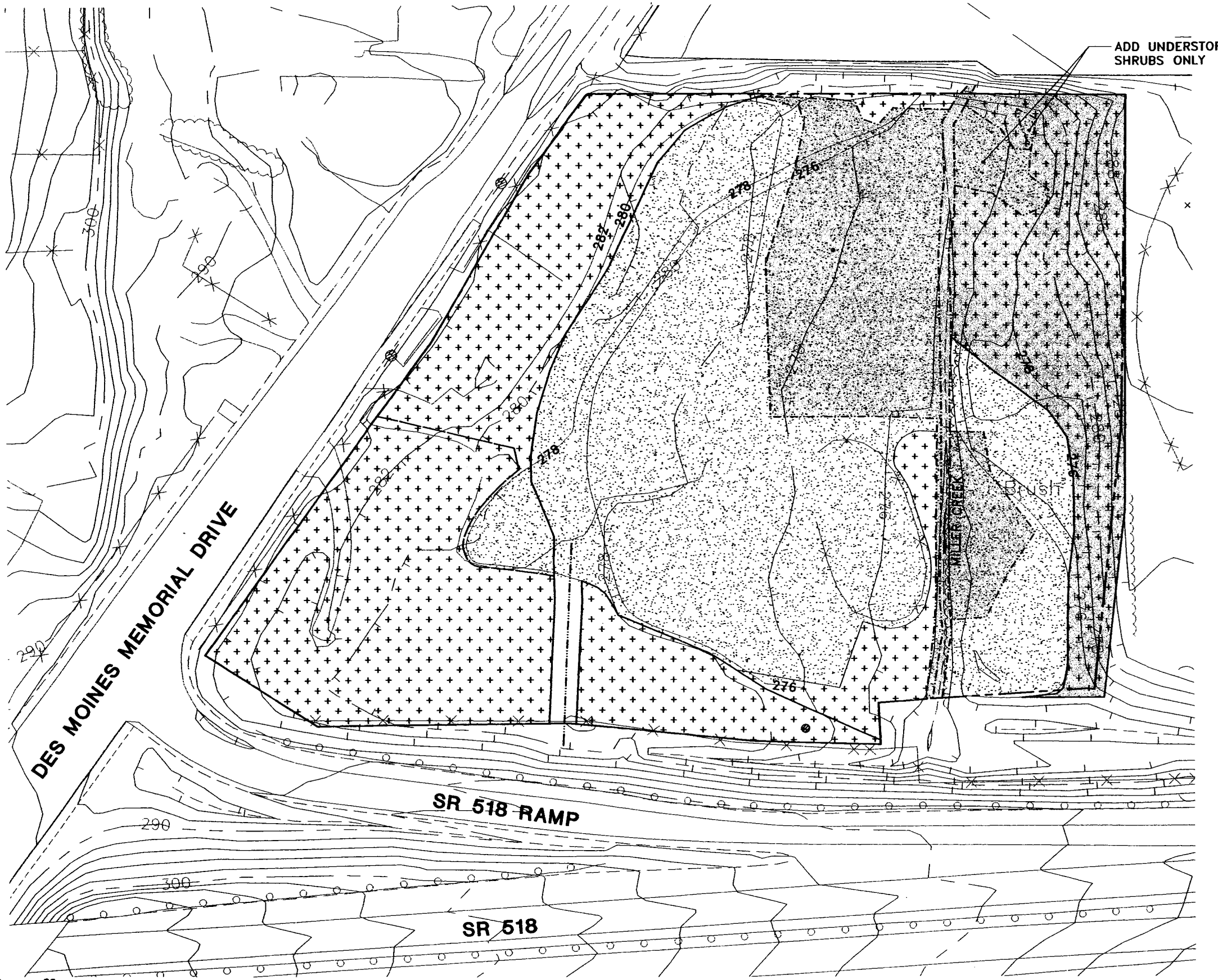
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: DES MOINES WAY NURSERY WETLAND RESTORATION

SHEET TITLE: DEMOLITION AND GRADING CROSS SECTION

WORK ORDER NO.: –
CONSULTANT'S NO.: 291203BC4
PORT OF SEATTLE NO.: STIA-XXXX-C4

APPENDIX F



LEGEND

- WETLAND BOUNDARY
- WETLAND RESTORATION
- WETLAND ENHANCEMENT
- UPLAND BUFFER
- UPLAND BUFFER – REMOVE BLACKBERRY AND ADD ENHANCEMENT PLANTINGS
- PROPERTY BOUNDARY
- DITCH
- 286 EXISTING CONTOUR
- 286 PROPOSED CONTOUR

40 0 40 80
SCALE FEET

AR 006013

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES:
XREFS: 291203BBA POS-C01 POS-C02 POS-C06 POS-C07 291203BE LA
FILENAME: 291203BL1
DATE: 11/16/01

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR/MGR: P. FENDT
DESIGNED BY: J. KELLEY
DRAWN BY: S. NEWELL
SCALE: 1"=50'
DATE: NOVEMBER 2001
CHECKED BY: S. HARRIS
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: DES MOINES WAY NURSERY WETLAND RESTORATION

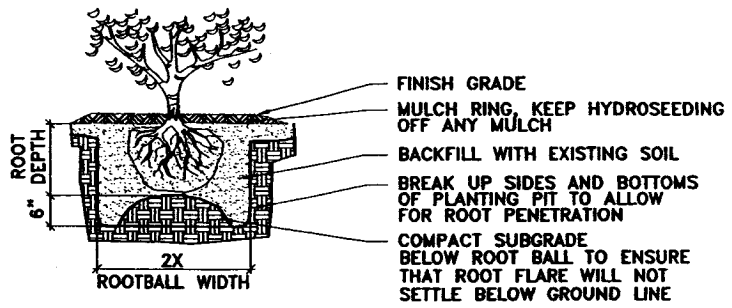
SHEET TITLE: LANDSCAPE PLAN

WORK ORDER NO.: –
CONSULTANT'S NO.: 291203BL1
PORT OF SEATTLE NO.: STIA-XXXX-L1

DES MOINES WAY NURSERY WETLAND RESTORATION

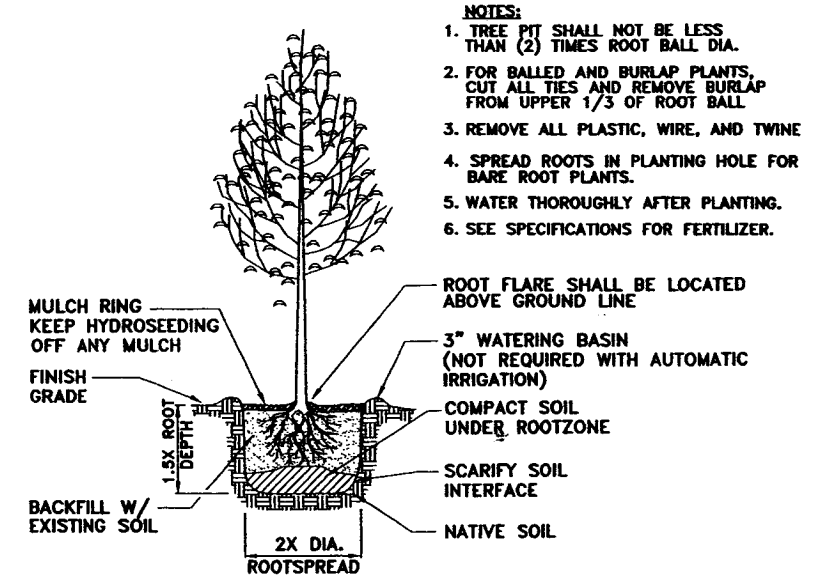
Symbol	Botanical Name / Common Name	Size	Density (Plants Per Acre)	Condition / Remarks
	WETLAND RESTORATION/ENHANCEMENT			
	Trees		80	
	Picea sitchensis/Sitka spruce *	3'–4' ht		– Container or B&B. Rooting to sides and bottom of can or burlap.
	Thuja plicata/western redcedar *	3'–4' ht.		
	Shrubs - Single Species Groups of 3 to 7		2,100	
	Physocarpus capitatus/Pacific ninebark	1 gal.		– Container. Rooting to sides and bottom of can. Live stakes shall be 36"–48" ht., 1/2"–1" dia., with a minimum of 10 viable, undamaged buds on each stake. 3–4 buds shall be below grade.
	Salix lucida spp. lasiandra/Pacific willow	1gal/Live stake		
	Salix scouleriana/Scoulers willow	1gal/Live stake		
	Salix sitchensis/Sitka willow	1gal/Live stake		
	Spiraea douglasii/hardhack spiraea	1 gal.		– Space 4.5' O.C. typical.
	UPLAND BUFFER ZONE			
	Trees		280	
	Abies grandis / grand fir	4'–6' ht.		– Container or B&B. Rooting to sides and bottom of can or burlap.
	Acer macrophyllum / big leaf maple	4'–6' ht.		
	Alnus rubra/red alder	2 gal.		
	Picea sitchensis/Sitka spruce *	3'–4' ht		
	Populus trichocarpa/black cottonwood	4'–6' ht.		
	Pseudotsuga menziesii/douglas fir	3'–4' ht.		
	Thuja plicata/western redcedar *	3'–4' ht.		
	Tsuga heterophylla/western hemlock *	3'–4' ht.		
	Shrubs - Single Species Groups of 3 to 7		2,100	
	Acer circinatum/vine maple	2 gal.		– Container. Rooting to sides and bottom of can.
	Rosa nutkana/Nootka rose	1 gal.		– Space 4.5' O.C. typical.
	ENHANCED EXISTING WETLAND		2,100	
	Shrubs			
	Acer circinatum/vine maple	2 gal.		– Container. Rooting to sides and bottom of can. Live stakes shall be 36"–48" ht., 1/2"–1" dia., with a minimum of 10 viable, undamaged buds on each stake. 3–4 buds shall be below grade.
	Philadelphus lewisii/mock orange	1 gal.		
	Rosa nutkana/Nootka rose	1 gal.		
	Rosa pisocarpa/Clustered rose	1 gal.		
	Salix lucida spp. lasiandra/Pacific willow	1gal/Live stake		
	Salix scouleriana/Scoulers willow	1gal/Live stake		
	Salix sitchensis/Sitka willow	1gal/Live stake		

* Western redcedar, Western hemlock and Sitka spruce shall be planted in a second planting phase, to follow year-3 monitoring. These plants shall be located by the wetland biologist in locations where partial shade and favorable soil moisture are present.

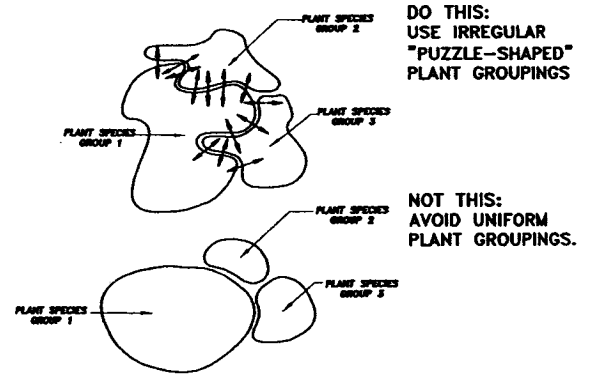


DETAIL SHRUB PLANTING (TYPICAL) — 3 TYP

NOTES:
1. TREE PIT SHALL NOT BE LESS THAN (2) TIMES ROOT BALL DIA.
2. FOR BALLED AND BURLAP PLANTS, CUT ALL TIES AND REMOVE BURLAP FROM UPPER 1/3 OF ROOT BALL
3. REMOVE ALL PLASTIC, WIRE, AND TWINE
4. SPREAD ROOTS IN PLANTING HOLE FOR BARE ROOT PLANTS.
5. WATER THOROUGHLY AFTER PLANTING.
6. SEE SPECIFICATIONS FOR FERTILIZER.



DETAIL TREE PLANTING (TYPICAL) — 2 TYP



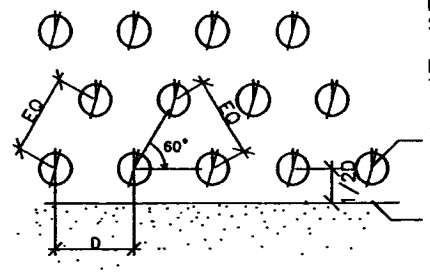
DETAIL SHAPES OF PLANTING MASSES N.T.S. — 5 TYP

NOTE:
ALL SHRUB SPACING SHALL BE EQUIDISTANT UNLESS OTHERWISE SPECIFIED

DISTANCE (D) ON CENTER AS REQUIRED TO MEET PLANTS PER ACRE STANDARD.

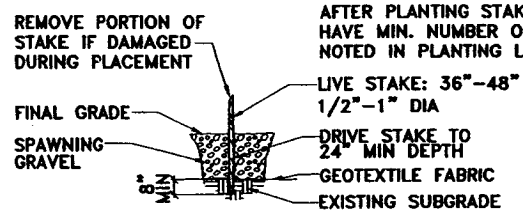
START FIRST ROW OF PLANTING AT 1/2 THE PERPENDICULAR SPACING BETWEEN ROWS

EDGE OF PLANTING AREA



DETAIL TRIANGULAR SHRUB SPACING (TYPICAL) — 4 TYP

NOTE:
AFTER PLANTING STAKE MUST HAVE MIN. NUMBER OF BUDS NOTED IN PLANTING LEGEND



DETAIL LIVE STAKE PLANTING N.T.S. — 6 TYP

NOTES:

1. Preserve and protect all trees and shrubs not designated for removal. Provide, erect, and maintain barricades necessary to prevent access to areas within drip lines of existing trees. Allow no vehicular or pedestrian traffic, or stacking and/or storage of construction materials within barricades.
2. For each planting zone Contractor shall lay out a 10,000 s.f. test plot, in which the positions of all plants shall be staked with flags that are color coded to represent specific species. Layout for each zone shall be inspected and approved prior to commencement of planting. Approved staking shall serve as the plant layout standard for the remainder of each zone.
3. Shrub masses shall consist of multiple single-species groups (see detail 5). Contractor shall ensure that these single-species groups have a variety of sizes and shapes, and that shrub masses have a variety of species. See planting schedule for numbers of plants in single-species groups.
4. Hydroseed all planting areas. Re-seed areas that are disturbed by subsequent work. Keep hydroseeding off any mulch circles except where needed to protect roots of conifers.

AR 006014

AGENCY REVIEW NOT FOR CONSTRUCTION

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.: P. FENDT
DESIGNED: M. HAFS
DRAWN BY: PJT/SRN
SCALE: AS SHOWN
DATE: NOVEMBER 2001
CHECKED BY:
APPROVED BY: –

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: DES MOINES MEMORIAL WAY NURSERY WETLAND RESTORATION

SHEET TITLE: PLANTING SCHEDULE AND DETAILS

WORK ORDER NO. 100051
CONTRACT'S NO. 291203BL2
PORT OF SEATTLE NO. STIA-9805-L2

IMAGES: XREF'S:
FILENAME: 291203BL2
DATE: 11/14/01

APPENDIX N
DES MOINES WAY NURSERY MITIGATION PROJECT

DES MOINES WAY NURSERY MITIGATION PLAN
SEATTLE-TACOMA INTERNATIONAL AIRPORT
MASTER PLAN UPDATE IMPROVEMENTS

Prepared for

PORT OF SEATTLE
Seattle-Tacoma International Airport
P.O. Box 69727
Seattle, Washington 98168-0727

Prepared by

PARAMETRIX, INC.
5808 Lake Washington Blvd. N.E., Suite 200
Kirkland, Washington 98033-7350

November 2001
556-2912-001 (03)

APPENDIX N

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

Page

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Seattle Tacoma International Airport Master Plan Update improvements directly affect streams and wetlands, and the *Natural Resource Mitigation Plan Master Plan Update Improvements Seattle Tacoma International Airport* (NRMP) has been prepared to mitigate these impacts.

This report describes additional wetland mitigation (restoration and enhancement), upland buffer restoration, stream enhancement, and stream buffer restoration as additional supplemental mitigation. The additional mitigation (5.79 acres) has been planned at the request of the US Army Corps of Engineers (ACOE) to further assure the no net loss of wetland functions result from the Master Plan Update projects.

2. DES MOINES WAY NURSERY MITIGATION PROJECT

This section describes on-site mitigation activities at Des Moines Way Nursery. The mitigation is designed to restore and enhance physical and biological functions in Miller Creek riparian wetlands and associated buffers areas. This mitigation supplements other on-site mitigation described in the NRMP that are designed to compensate for unavoidable project impacts to wetland, stream, and hydrologic functions. In developing this plan, the Port of Seattle (Port) used agency guidance to identify in-basin mitigation activities that will compensate for project impacts to wetland and stream functions. Elements of the mitigation plan are specifically targeted to restore in-basin functions that will be impacted by the project, and include sediment and nutrient retention (water quality), organic carbon production and export, and aquatic habitat functions (e.g., instream aquatic habitat and riparian habitat for fish and amphibians).

The mitigation plan will result in increased functional performance of the wetlands, streams, and buffers at mitigation site relative to their degraded existing conditions. For example, wetlands currently dominated by non-native ornamental vegetation and turf grasses will be restored to shrub and forested systems containing a greater diversity of native species and habitats. Along with nutrient and sediment retention, instream habitat and non-avian wildlife habitat functions will be improved relative to existing conditions.

The mitigation plan is based upon Ecology guidance (Ecology 1994). The mitigation plan, goals, and objectives are introduced first (Section 3), followed by a description of the project site (Section 4), including existing ecological conditions, the rationale for selecting the project, and constraints on the proposed mitigation. Next the mitigation design is described in detail (Section 5), with reference to figures and the plan sheets in Appendices F of the NRMP where detailed design drawings are provided. Performance standards and monitoring requirements describe how the project will be monitored during a 15-year post-construction period (Section 6). Legal protection of the site is described in Section 7, and maintenance and contingency actions are described in Section 8. The final report section (Section 9) describes the specific construction steps, methods, and sequencing required to implement the mitigation design.

3. MITIGATION GOALS AND PERFORMANCE STANDARDS

In reviewing project impacts to wetlands and the ecological benefits provided by on-site mitigation, the ACOE requested that the Port increase on-site mitigation by enhancing and restoring riparian wetlands. The Des Moines Way Nursery site was selected to achieve this general goal.

The goal of the Des Moines Way Nursery site mitigation is to increase the hydrologic linkages between historic wetlands and to Miller Creek without creating habitat for birds that pose a threat to aircraft safety. This goal will be accomplish by:

- Restoring historic topography, hydrology, and vegetation communities.
- Enhancing the floodplain, wetland, and stream functions by restoring forested, riparian, and upland buffers.
- Grading and replanting the emergent wetland (lawn) area to reduce or eliminate habitat for waterfowl and flocking birds.

The specific objectives and design criteria to achieve these wetland mitigation goals are listed in Table N-1.

Table N-1. Mitigation goals, design objectives, and design criteria for the Des Moines Way Nursery wetland restoration project.

Goals and Design Objectives	Actions
Increase hydrologic linkages between historic wetlands and Miller Creek	
Remove existing commercial and residential uses from the wetland, riparian, and upland areas of the Des Moines Way Nursery site.	Eliminate commercial and residential activities and remove existing structures and fill from the restoration site.
Restore wetland hydrology to filled wetlands. Improve hydrology in emergent (lawn) wetlands.	Remove ditches and drains from lawn areas. Remove fill from historic wetlands. Grade restored wetlands to elevations that restore wetland hydrology.
	Install large woody debris (LWD) in Miller Creek to improve stream habitat conditions.
Restore wetlands and riparian areas with native trees and shrubs.	Restore 2.20 acres of wetland with native vegetation. Enhance 0.86 acre of existing wetland with native vegetation.
	Plant native shrub species in the wetland area at a density greater than 2,100 per acre. Intersperse native trees in the area at densities of 80 trees per acre.
	Plant upland and riparian buffer areas with native trees at densities of 280 per acre. Plant understory shrubs in these areas at densities of 2,100 per acre.

4. MITIGATION SITE DESCRIPTION

4.1 LOCATION AND GENERAL DESCRIPTION

The Des Moines Way Nursery site is located at the northeast quadrant of the intersection of State Route (SR) 518 and Des Moines Memorial Drive (Figure N-1). The site is bounded by private property to the north and east, Des Moines Memorial Drive to the west, and the right-of-way (ROW) for SR 518 to the south. The east side of the site is bordered by baseball fields on land owned by the Port of Seattle.

Miller Creek flows through from north to south through about the eastern third of the site. The topography on either side of the stream channel rises gradually to elevations of 284-ft mean sea level in the western portion of the site and more steeply to 287 ft in the eastern portion of the site. Much of the eastern portion of the site, and portions that border Des Moines Memorial Drive appear to have up to several ft of fill that has been placed on historic wetlands.

A landscape nursery business is located in the northwest portion of the site. The nursery contains parking areas, a retail store, several storage buildings, and a graveled outdoor retail area. A residence and associated lawn, gardens, and landscaping are located in the southwest portion of the site (Figure N-2).

4.2 ECOLOGICAL CONDITIONS

Ecological conditions important to the mitigation design are summarized in this section.

4.2.1 Soils

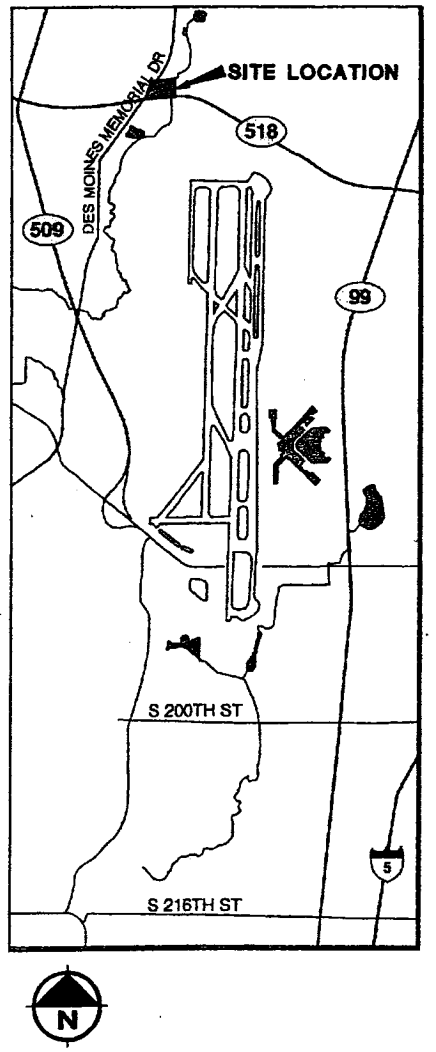
Soils on the project site were mapped as Everett, Norma, Rifle peat and Indianola soil series by the 1952 *Soil Survey of King County, Washington* (USDA 1952). The Everett gravely sandy loam soil type is mapped in north and central portion of the site. These soils typically form on rolling and hilly upland areas and terraces at elevations below 500 ft. Norma fine sandy loam is mapped in the northwest portion of the site (currently occupied by the nursery operation) and is identified a hydric (wetland) soil by the *Hydric Soils of Washington* (USDA 1991). These soils occur in glacial basins and depressions that have been modified by erosion and deposition. A small portion of Rifle peat is mapped in the south central portion of the site. Rifle peat is distributed in depressions throughout occurring in flat bottom positions or swampy areas marginal to streams and lakes. The Indianola soil series occurs in the southwest portion of the site, where an existing residence and orchard is present. The *Soil Survey of King County Area Washington* (Snyder et. al. 1973) excluded the Nursery site from soil mapping, but the peat area was mapped by Rigg (1958) as the Miller Creek Peat Area, which was estimated to be 56 acres in size.

Results of on site investigations show that soils on the site consists of fill soils throughout developed areas and along the east side of the site. Peat and/or muck soils are present in much of the lawn area located in the north central portion of the site. A gravelly loamy sand soil is present along the southern portion of the site.

4.2.2 Upland Vegetation

A variety of native and non-native plant species occur on the site (Table N-2). Upland areas on the Des Moines Way Nursery site primarily consist of retail development, mowed lawn, vegetable

VICINITY MAP



LEGEND

- CULVERT
- 265 SPOT ELEVATION
- 1 KEY NOTE NUMBER REFERENCE
- SURFACE WATER DITCH
- 265 EXISTING CONTOUR
- 265 PROPOSED CONTOUR
- EXISTING GRADE (SECTION)
- SPAWNING GRAVEL (SECTION)
- CRUSHED SURFACING BASE COURSE (SECTION)
- QUARRY SPALLS
- CONCRETE
- EMBANKMENT
- NATIVE SUBGRADE
- GRAVEL
- PAVEMENT (PLAN)
- SLOPE INDICATOR
- N 8100 / E 5800 CONTROL POINT
- S S SILT FENCE
- SILT CURTAIN
- GEOTEXTILE
- EM EROSION CONTROL MATTING
- STRAW BALE BARRIER
- P-1 EXISTING MONITORING WELL
- X CHAIN LINK FENCE
- PRIVATE PROPERTY BOUNDARY
- POINT OF INTERSECTION
- BERM
- 7+00 CHANNEL CENTERLINE AND STATION
- SS EXISTING SANITARY SEWER LINE
- SS PROPOSED SANITARY SEWER LINE
- LIMIT OF CONSTRUCTION (PROJECT)
- SURVEY CONTROL POINT
- LIMIT OF RESTRICTED AREA
- SD EXISTING STORM DRAIN

GENERAL LEGEND

DRAWING TITLE:

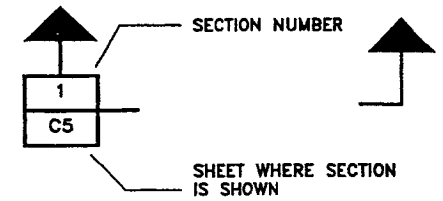
PLAN
SUBTITLE
SUBTITLE
SCALE

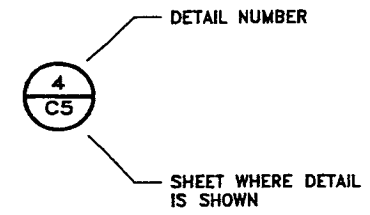
SECTION
SUBTITLE
SUBTITLE
SCALE

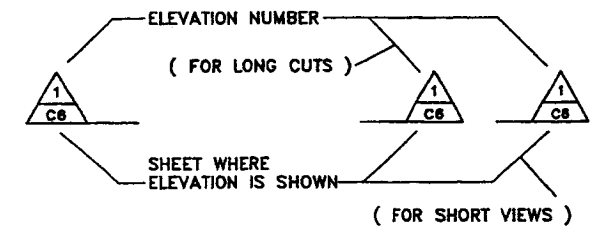
DETAIL
SUBTITLE
SUBTITLE
SCALE

ELEVATION
SUBTITLE
SUBTITLE
SCALE

REFERENCE SYMBOL:







GENERAL ABBREVIATIONS

&	AND	N	NORTH/NORTHING
ACP	ASPHALT CONCRETE PAVEMENT	NO.	NUMBER
APPROX.	APPROXIMATE	N.T.S.	NOT TO SCALE
℄	CENTERLINE	O.C.	ON CENTER
CMP	CORRUGATED METAL PIPE	PP	POWER POLE
DIA	DIAMETER	R	RADIUS
E	EAST/EASTING	RCP	REINFORCED CONCRETE PIPE
EL OR ELEV	ELEVATION	S	SOUTH
EXIST	EXISTING	SD	STORM DRAIN
FT	FOOT (FEET)	S.F.	SQUARE FOOT/FEET
GAL	GALLON	SS	SANITARY SEWER
HORIZ/H	HORIZONTAL	STA	STATION
HT.	HEIGHT	TYP	TYPICAL
I.E.	INVERT ELEVATION	W/	WITH
LF	LINEAR FEET/FOOT	WD	WOODY DEBRIS
MAX	MAXIMUM	VERT/V	VERTICAL
MIN	MINIMUM		
MISC	MISCELLANEOUS		

SURVEY CONTROL POINTS

9704-2 = REBAR WITH YELLOW CAP MARKED PMX CONTROL NEAR THE SOUTHEAST CORNER OF LORA LAKE. 11.0' SOUTHERLY OF A DOUBLE TRUNK (12" & 10") ALDER TREE WHICH IS ● THE TOP OF THE BANK & 21.0' NORTHWESTERLY FROM A SANITARY SEWER MANHOLE.

9704-3 = REBAR WITH YELLOW CAP MARKED PMX CONTROL NEAR THE SOUTHWEST CORNER OF LORA LAKE. 6.0' SOUTHERLY OF THE TOP OF BANK & 33.2' WEST SOUTHWEST OF A DOUBLE TRUNK (12" & 12") ALDER TREE.

9704-4 = REBAR WITH YELLOW CAP MARKED PMX CONTROL IN THE NORTHWESTERLY MARGIN OF THE DIRT ROAD THAT RUNS BETWEEN THE PUMPKIN PATCHES, ● THE EASTERLY END OF A BLACKBERRY PATCH, 82' +/- EASTERLY OF THE MOST NORTHWESTERLY CORNER OF A WOODEN STORAGE SHED.

NOTE: SEE C2 FOR SURVEY CONTROL POINT COORDINATES AND ELEVATIONS.

GENERAL NOTES

1. CALL "DIG-SAFE" (1-800-425-5555) PRIOR TO COMMENCING ANY GRADING OR EXCAVATION WORK ON THE SITE.
2. INSTALLATION OF TEMPORARY EROSION AND SEDIMENT CONTROLS SHALL BE COMPLETED PRIOR TO SITE WORK.

AGENCY REVIEW
NOT FOR CONSTRUCTION

IMAGES: VicinityMap AppendixB
XREFS:
DATE: 11/14/01 FILENAME: 29120301

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

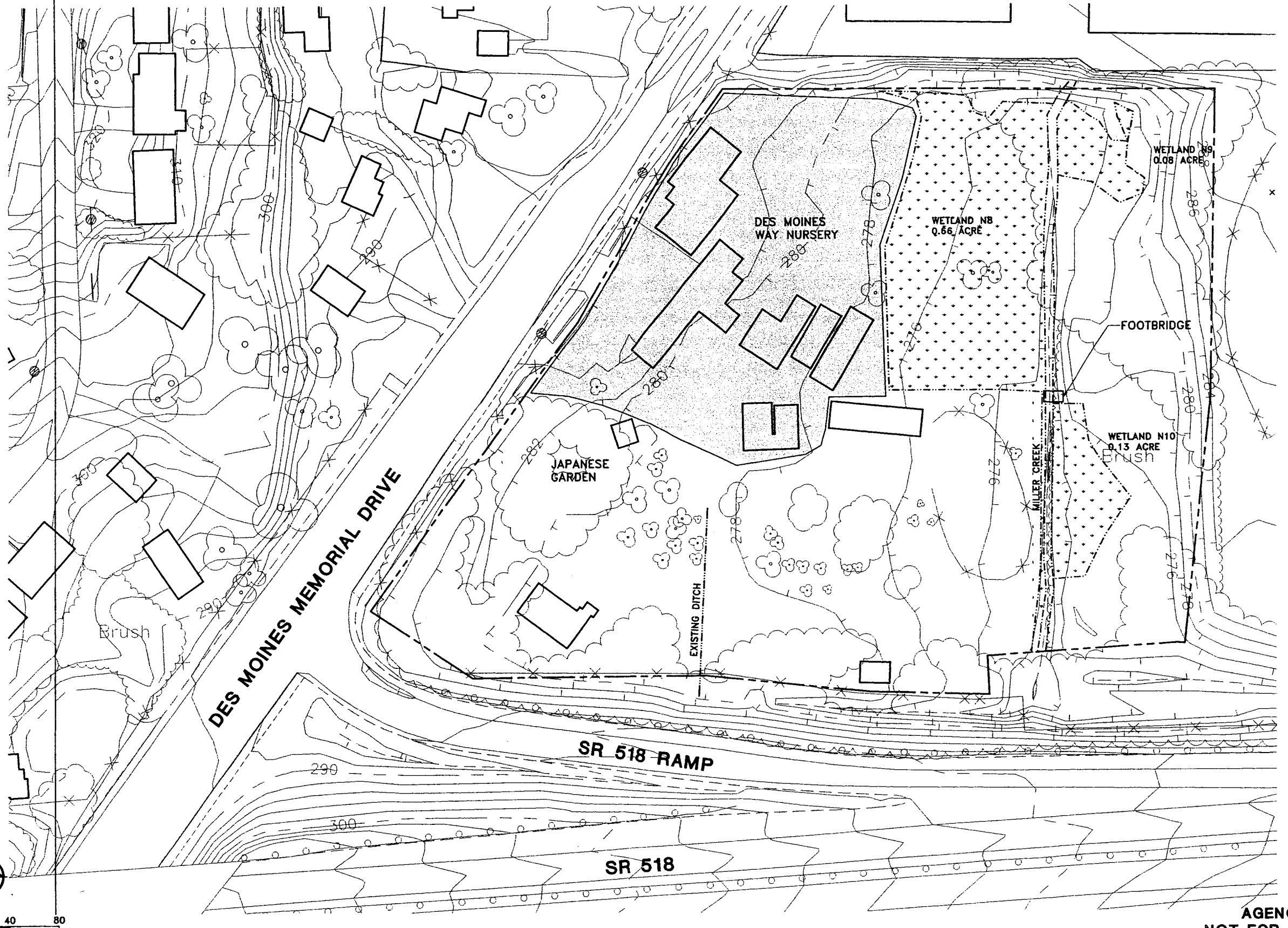
PROJECT ENGR./AREA: P. FENDT
DESIGNED: J. LEAVITT/K. LUDWA
DRAWN BY: PJT/SRH
SCALE: AS SHOWN
DATE: NOVEMBER 2001
CHECKED BY:
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

Figure N-1.
Location of the Des Moines Way Nursery Mitigation Area.

AR 006023



AR 006024

AGENCY REVIEW
NOT FOR CONSTRUCTION

CALL 48 HOURS
BEFORE YOU DIG
1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./ARCH.	P. FENDT
DESIGNED BY	J. KELLEY
DRAWN BY	S. NEWELL
SCALE	1"=40'
DATE	NOVEMBER 2001
CHECKED BY	S. HARRIS
APPROVED BY	P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

IMAGES:
XREF'S: 291203B8A POS-C01 POS-C02 POS-C06 POS-C07 LA
DATE: 11/15/01 FILENAME: 291203B02

Figure N-2.
Existing Conditions on the Des Moines Way Nursery Mitigation Area.

gardens, ornamental landscaping, blackberry thickets, and immature black cottonwood forest. Dense Himalayan blackberry thickets occur on upland fill along the western portion of the property.

Table N-2 Plant species present on the Des Moines Way Nursery site.

Common Name	Scientific Name	Indicator Status	Non-Native (x)
TREES			
black cottonwood	*Populus balsamifera* ssp. *trichocarpa*	FAC	
red alder	*Alnus rubra*	FAC	
Douglas fir	*Pseudotsuga menziesii*	FACU	
SHRUBS			
Himalayan blackberry	*Rubus discolor*	FACU	x
salmonberry	*Rubus spectabilis*	FAC+	
Scot's broom	*Cytisus scoparius*	UPL	x
Sitka willow	*Salix sitchensis*	FACW	
Pacific willow	*Salix lucida* ssp. *lasiandra.*	FACW	
HERBS			
American vetch	*Vicia americana*	FAC	x
bedstraw	*Galium* sp.	FACU	
bentgrass	*Agrostis* sp.	FAC	x
bittersweet nightshade	*Solanum dulcamara*	FAC+	x
bluegrass	*Poa* sp.	FAC	x
bracken fern	*Pteridium aquilinum*	FACU	
Canada thistle	*Cirsium arvense*	FACU+	x
clover	*Trifolium* sp.	FAC	
colonial bentgrass	*Agrostis capillaris (tenuis)*	FAC	x
common velvet-grass	*Holcus lanatus*	FAC	x
creeping bentgrass	*Agrostis stolonifera*	FAC	x
creeping buttercup	*Ranunculus repens*	FACW	x
curly dock	*Rumex crispus*	FAC	x
dandelion	*Taraxacum officinale*	FACU	x
fescue	*Festuca* sp.	NL	
field horsetail	*Equisetum arvense*	FAC	
fireweed	*Epilobium ciliatum*	FACW-	
giant mannagrass	*Glyceria grandis*	OBL	
Kentucky bluegrass	*Poa pratensis*	FAC	x
orchardgrass	*Dactylis glomerata*	FACU	x
perennial ryegrass	*Lolium perenne*	FACU	x
quackgrass	*Agropyron repens*	FACU	x
red clover	*Trifolium pratense*	FACU	x
red fescue	*Festuca rubra*	FAC+	
redtop	*Agrostis gigantea (alba)*	FAC	x
reed canarygrass	*Phalaris arundinacea*	FACW	x
smartweed	*Polygonum sp.*	FACW-OBL	
soft rush	*Juncus effusus*	FACW	
tall fescue	*Festuca arundinacea*	FAC-	x
thistle	*Cirsium* sp.	FACU	x
white clover	*Trifolium repens*	FACU+	x

4.2.3 Forest, Shrub, and Emergent Wetland Vegetation

Three wetlands (Wetlands N8, N9, and N10) and one stream (Miller Creek) are located on the Des Moines Way Nursery site. The three wetlands are located in the eastern portion of the site and are associated with Miller Creek. The following sections describe the wetlands, associated uplands, and stream habitats located on site.

4.2.3.1 Wetlands

Field investigations of the Nursery site to identify and delineate wetlands occurred on October 10, 2001. During this field investigation the project area was inspected for wetland characteristics using the wetland delineation methodology described in the *Wetland Delineation Report Master Plan Update improvements Seattle-Tacoma International Airport* (Parametrix 2000a).

Subsequent to the field investigation, ACOE staff (Gail Terzi and Muffy Walker) examined the wetland and upland conditions on the site. This evaluation included examinations of fill soils, native upland soils, native wetland soils, natural and managed vegetation types, and hydrologic conditions. Several areas of shallow surface drains (pipe and ditches) and the ditched channel of Miller Creek were also examined. On October 11, 2001, the ACOE confirmed the wetland boundaries. Following these evaluations, the wetland boundaries were mapped and surveyed by licensed surveyors (see Figure N-2).

Three riparian wetlands were mapped on the site. Hydrologic, soil, and vegetation data documenting the wetland delineation were collected and are provided on wetland delineation data sheets in Attachment A. The wetlands are described in detail below.

Wetland N8

USFWS Classification: PEM **Wetland Data Plots: 1W**
Size: 0.66 acre **Upland Data Plot: 3U-2**

Wetland N8 is a palustrine emergent wetland, located in the north central portion of the site, and on the west side of Miller Creek. The wetland extends south as a narrow fringe of riparian wetland along the west side of the Miller Creek channel (see Figure N-2).

Soil: Soils within the wetland were mapped by the 1952 Soil Survey of King County, Washington (USDA 1952) as Everett gravelly sandy loam. Everett gravelly sandy loam typically forms on rolling and hilly upland areas and terraces at elevations below 500 ft.

Soil observed at Data Plot 1W was black (10YR 2/1) loam from 0 to 6 inches in depth. From 6 to 18 inches in depth, the soil consisted of olive gray (5Y 5/2) silty clay with common course yellowish brown (10YR 5/8) mottles. Soils observed on the site did not match the description of the Everett soil type, and more closely matched soils classified as peat or muck. The low chroma color and high organic content meet the criteria for hydric soils.

Vegetation: The majority of the vegetation within this wetland consists of mowed grass species. Dominant plant species present (Data Plot 1W) are common velvetgrass (*Holcus lanatus*) with lesser amounts of red fescue (*Festuca rubra*). Scattered plants of dock (*Rumex* ssp.) and rush (*Juncus* sp.) also occur in the wetland. Small red alder (*Alnus rubra*) trees, Himalayan blackberry (*Rubus discolor*), salmonberry (*Rubus spectablis*), and reed canarygrass (*Phalaris arundinacea*)

dominate the northeast corner of the wetland. Despite the ongoing disturbance (mowing) that occurs in the wetland, the area is dominated by hydrophytic vegetation and meets the wetland vegetation criterion.

Hydrology: During the site investigation, soil saturation was observed in portions of the wetland. Remaining portions were assumed to have wetland hydrology based upon the presence of hydric soil indicators, topographic position, and hydrophytic vegetation. Hydrology in the wetland appears to be maintained by a high groundwater table and precipitation.

Upland: Typical upland areas next to Wetland N8 consist of a gravel storage area to the west, a steep fill slope and block wall covered with blackberry to the north, lawn and garden areas to the south, and an area of bare soil that is disturbed by remote-controlled model race cars. Vegetation identified within upland areas (Data Plot 3U-2) consist of common velvetgrass and quackgrass (*Agropyron repens*) with lesser amounts of dandelion (*Taraxacum officinale*) and hairy-cat's ear (*Hypocharis radicata*).

Upland soils observed at Data plot 3U-2 are a very dark brown (10YR 2/2) loam from 0 to 12 inches in depth. From 12 to 18 inches, soil was dark brown (10YR 3/3) silt loam. These soils do not meet any hydric soil criteria. No evidence of wetland hydrology was present within this area. Some gravel storage areas to the west of the wetland occur on buried hydric soil, which is present at 10 to 24 inches beneath the fill.

Wetland N9

USFWS Classification: PFO **Wetland Data Plots: 2W**
Size: 0.08 acre **Upland Data Plot: 2U**

Wetland N9 is located on the east side of Miller Creek, in the northeast portion of the site. This is a palustrine forested wetland.

Soil: Soil within this wetland was mapped as Everett gravelly sandy loam (USDA 1952). Soils observed during the field investigation were black (10YR 2/1) sandy loam with a high percentage of organic matter in the upper 15 inches. From 15 to 18 inches, the soil was very dark brown (10YR 2/2) with common coarse black mottles (10YR 2/1). The lower portion of the soil horizon contained a high percentage of fibrous organic matter. In addition, a very strong sulfidic odor was present. Soils identified in the field did not match the mapped soil types, and meet the criteria for hydric soil based on their low chroma color and high organic matter.

Vegetation: Dominant vegetation within the wetland includes a tree canopy of red alder, with Sitka willow (*Salix sitchensis*) and Himalayan blackberry dominating the shrub stratum. Lesser amounts of salmonberry are also present. Giant horsetail (*Equicetum telmatiea*) and lady fern (*Athyrium filix-femina*) are dominant in the herbaceous layer. The dominant plants on the site are adapted to wetland conditions, and the hydrophytic vegetation criterion is met.

Hydrology: During the October 2001 site visit, the soils were saturated at a 15-inch depth. Wetland hydrology is presumed to be present based upon the presence of hydric soil indicators, topographic position, and hydrophytic vegetation. During the typically wet period in the early portion of the growing season, it is highly probable that the groundwater table is several inches higher, and saturation extends to the surface. Hydrology in the wetland appears to be maintained by a high groundwater table and precipitation.

Upland: Upland areas immediately north, east, and south of Wetland N9 contained forest vegetation. Dominant canopy species was red alder with Himalayan blackberry, and lesser amounts

of beaked hazelnut (*Corylus cornuta*) in the shrub layer. Giant horsetail was dominant in the herbaceous layer with swordfern (*Polystichum munitum*) and English ivy (*Hedera helix*) also present. This vegetation was not dominated by wetland adapted species, and the hydrophytic vegetation criterion is not met.

Soils in the upland area, from 0 to 12 inches in depth, were dark grayish brown (10YR 4/2) gravelly loam. Below 12 inches the soil profile (10YR 5/1) consisted of gravelly loam with clay inclusions. The soil profile appeared to be imported fill material due to the presence of mixed gravel sizes and clay inclusions. Soil colors in the surface horizons do not meet the hydric soil criteria, and no indicators of wetland hydrology were found.

Wetland N10

USFWS Classification: PEM **Wetland Data Plots: 3W**
Size: 0.13 acre **Upland Data Plots: 3U-1, 3U-2**

Wetland N10 is a 0.13-acre palustrine emergent wetland located in the southeast portion of the site. The wetland is located on the east side of Miller Creek.

Soil: Everett sandy loam was mapped in this portion of the site (USDA 1952). On-site field investigation revealed that from 0 to 10 inches in depth, the soil was dark gray (10YR 4/1) loam and from 10 to 18 inches the soil was gray (10YR 6/1) silt loam. Layers of diatomaceous earth were present below 10 inches. Soils identified in the field did not match the mapped soil types.

Vegetation: The majority of this wetland contains palustrine emergent vegetation with reed canarygrass being the dominant plant species. Lesser amounts of common horsetail and Himalayan blackberry were also present within the wetland.

Hydrology: As with the Wetlands N8 and N9, precipitation and a high groundwater table support wetland hydrology within this wetland. No standing water was observed in this soil test pit, however oxidized rhizospheres were observed, therefore indicators of wetland hydrology were present.

Upland: Data plots 3U-1 and 3U-2 characterizes the upland areas next to Wetland N10. Refer to Wetland N9 for a description of Data Plot 3U-2. Vegetation identified at Data Plot 3U-1 was dominated by Himalayan blackberry and reed canarygrass. Other species in this area included red alder, Scot's broom (*Cytisus scoparius*), evergreen blackberry (*Rubus laciniatus*), common velvetgrass, and dandelion.

Soils from 0 to 18 inches in depth were dark brown (2.5Y 4/3) sandy loam with crushed rock. Similar to Data Plot 2U, these soils appeared to include imported fill material.

4.2.4 Wetland Classification

These wetlands are all riparian to Miller Creek, and are classified by the Department of Ecology (Ecology 1993) as Class III wetlands (Attachment B).

4.2.5 Stream

Miller Creek flows from north to south across the site in a linear channel. The stream is in a shallow ditched channel that is approximately 6 to 10 ft wide. The streambed substrate consists primarily of cobble sized rock. The northern and extreme southern portion of the channel banks are vegetated with red alder deciduous forest communities, while over most of the site, the channel banks are vegetated with reed canarygrass, or mowed lawn. The NRMP (Section 5.1) and the

Biological Assessment (Parametrix 2000b) provide detailed information on the distribution of fish and aquatic habitat descriptions of Miller Creek.

The ordinary high water mark of the stream was flagged and surveyed during October 2001, and is accurately portrayed on Figure N-2.

Hydrologic evaluations of the creek, the Miller Creek Regional Detention Facility located south of SR 518, and the two 48-inch culverts that cross SR 518 demonstrate the creek generally stays within the excavated channel banks during flood events. (Attachment C provides flood evaluation and channel cross-section details.)

4.3 RATIONALE FOR SELECTION

The Des Moines Way Nursery site allows restoration and enhancement of significant wetland functions in proximity to, and in the same basin as project impacts to wetlands and streams. Similar to the Vacca Farm mitigation area, the site is located upstream of impacts to wetlands, and thus the benefits to the stream are realized throughout the project area.

Mitigation at this site provides the opportunity to restore wetland hydrology and wetland habitat to areas that historically were wetlands, but have altered hydrology due to prior agricultural activities and ongoing commercial or residential land uses. Because the existing wetlands are riparian to Miller Creek restoration and enhancement will increase the linkage between the wetlands, riparian areas, and upland buffers with the creek and aquatic habitat.

4.4 CONSTRAINTS

No constraints have been identified that would preclude implementing this plan on the Nursery site. A small Japanese garden is present on west edge of the site, adjacent to Des Moines Memorial Drive. This area may be excluded from demolition and preserved. A 15-ft sewer easement is present along the north, east, and southeast property boundaries. These easements and Japanese Garden (if retained) are peripheral to the riparian enhancement, wetland enhancement, and wetland restoration and will not interfere with the desired ecological functions for the site.

5. WETLAND RESTORATION DESIGN

Mitigation actions at the Des Moines Way Nursery site (Table N-3) are designed to enhance or restore approximately 5.79 acres of upland, aquatic, and riparian habitats. Mitigation actions will enhance riparian and channel conditions in over 450 linear ft of Miller Creek, remove fill from wetlands, restore functions to three degraded wetlands, and restore natural vegetation to poorly vegetated riparian and upland buffers. These actions will enhance fish habitat in Miller Creek, improve water quality (provide shade, ameliorate elevated water temperatures, increase dissolved oxygen, provide inputs of organic matter, improve sediment retention, and remove potential sources of fertilizer or pesticide inputs), and enhance the diversity and complexity of wetland habitats. The mitigation project has also been designed to reduce the potential wildlife hazards that currently exist on the site, in order to be consistent with FAA Advisory Circular 150/5200-33.

Table N-3 Summary of wetland and buffer mitigation areas at Des Moines Way Nursery.

Mitigation	Wetland Area (acres)
Wetland Restoration (remove fill from mapped hydric soil areas)	2.20
Wetland Enhancement (enhancing the functions in Wetlands N8, N9, and N10)	0.86
Buffer Enhancement	2.73
Total Restoration Area	**5.79**

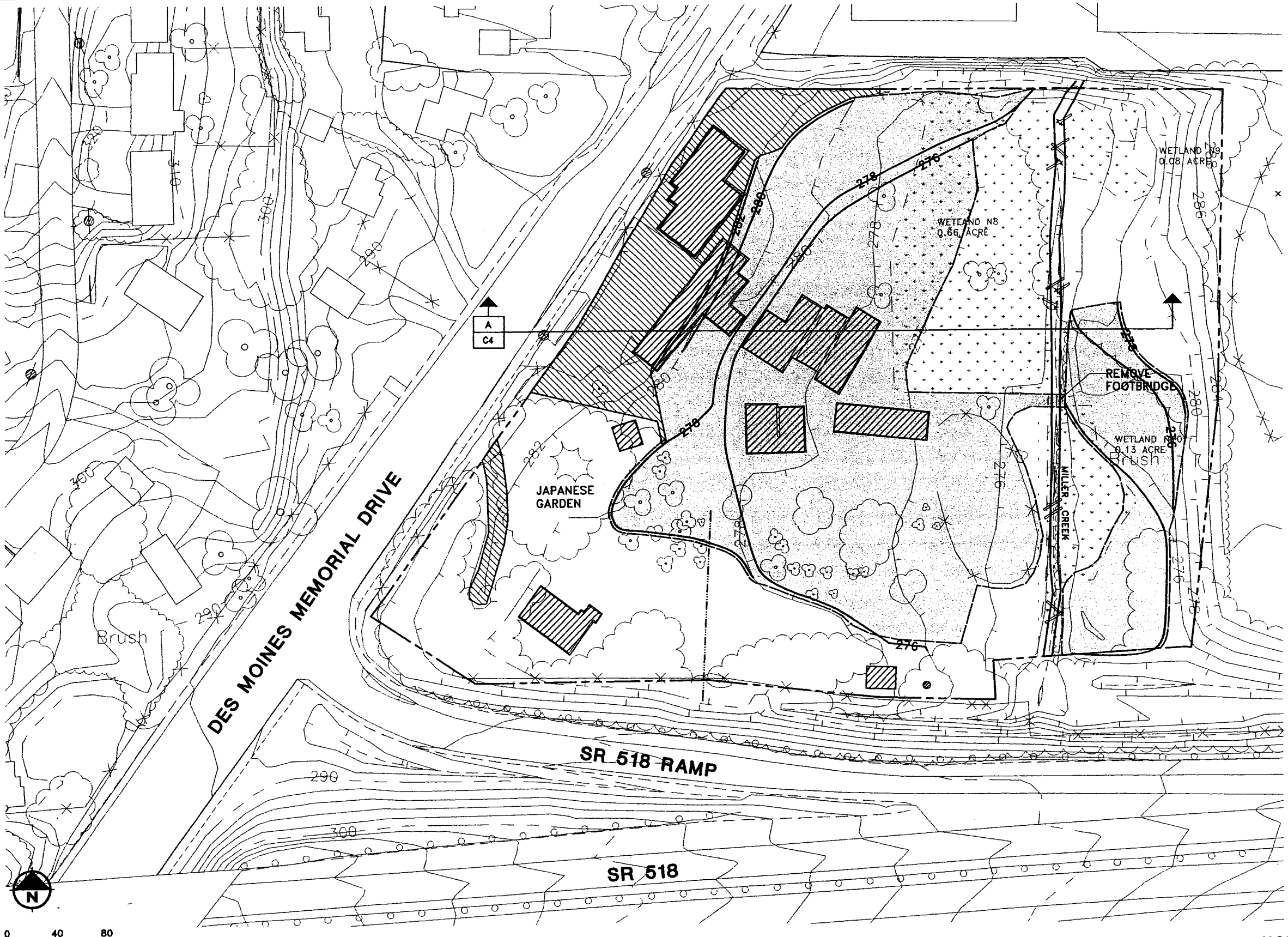
Des Moines Way Nursery contains areas which historically were wetland but have altered hydrology due to prior agricultural activities, residential development, filling, and commercial nursery operation developments. The wetland restoration activities will restore wetland hydrology by removing existing drainage features and excavating fill material to bring seasonal groundwater levels to at least within 10 inches of the soil surface. Existing forested, shrub, and emergent wetlands (Wetlands N8, N9, and N10) will be enhanced by planting native shrubs in areas that are currently dominated by mowed lawn (Wetlands N8 and N10), Himalayan blackberry (portions of Wetland N10), or lack native understory shrubs (Wetland N9). These actions will enhance hydrologic and water quality functions at the Des Moines Way Nursery site, as well as reduce the volume of eroded soil, pesticide, and fertilizer runoff reaching Miller Creek from gardens, parking lots, and retail areas on the site.

To protect aquatic habitat in Miller Creek and protect and enhance functions of existing wetlands, on-site forested buffers will be established and enhanced. An upland-forested buffer area will be established along the perimeter of the wetland restoration and enhancement. The buffers (and protective fencing) will reduce human intrusion into the wetlands and riparian zone, screen riparian habitats from human activity, and protect water quality and aquatic habitat. The forested buffers will also support ecological functions in the adjacent wetland and stream ecosystems.

The mitigation design is presented below. Specific details on construction sequencing and construction methods for the project are included in the implementation section for the project (Section 9).

5.1 GRADING DESIGN

The Des Moines Way Nursery site will be graded to restore wetland hydrology (Figure N-3). Prior to grading, existing structures and fences will be removed from the site and existing ditches and



AGENCY REVIEW
NOT FOR CONSTRUCTION

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR: P. FENDT
DESIGNED: J. KELLEY
DRAWN BY: S. NEWELL
SCALE: 1"=40'
DATE: NOVEMBER 2001
CHECKED BY: S. HARRIS
APPROVED BY: P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

IMAGES:
XREF'S: 291203BOA POS-C01 POS-C02 POS-C06 POS-C07 291203BOE
FILENAME: 291203BC3
DATE: 11/16/01

Figure N- 3.
Demolition and Grading Plan for Wetland Restoration.

AR 006031

drains will be filled or removed to restore site hydrology. The mitigation design objectives for the restoration require grading about 2.20 acres of the site to elevations between 276 and 278 ft. Figure N-4 shows a cross section of the site which depicts existing and proposed grades.

Following demolition and grading, all disturbed areas will be examined to determine if topsoil conditions are favorable for plant establishment. In upland areas where demolition has occurred, soils will be examined for compaction, and loosened or tilled as necessary. Following demolition, where exposed soils are fill material or native subsoils, organic matter amendments will be added and tilled into the soil. If necessary, prepared topsoil will be tilled into the subgrade prior to planting. Newly graded slopes will be tracked at right angles to the contour to reduce soil erosion.

In wetland areas, a careful examination of the soil profile will be made to determine the presence of buried hydric soils, and to establish the wetland restoration surface in the A horizon of the original soil. If this horizon is not present, over excavation and amendment with native soils excavated from wetlands at the Vacca Farm site or in Wetland 37 will be made.

Immediately after grading, the wetland planting zones will be hydroseeded with a native grass mix to establish understory plants in these zones. All other areas that have been graded will be hydroseeded with a seed mixture designed to prevent soil erosion and sedimentation to Miller Creek (Table N-4). The seed mixture will stabilize any exposed soils that will not be brought to final grade or permanent vegetation cover within 30 days of exposure. This seed mix should be applied during the period between April 1 through June 30 and September 1 through October 31. If seeding occurs between June 1 and September 30, irrigation may be required to ensure germination and establishment.

Table N-4. Proposed seed mix for erosion control.

Scientific Name	Common Name	Percent by Weight
Agrostis alba	Redtop	10
Lolium multiflorum	Annual rye	40
Festuca rubra var. commutata	Chewings red fescue	40
Trifolium repens	White clover	10

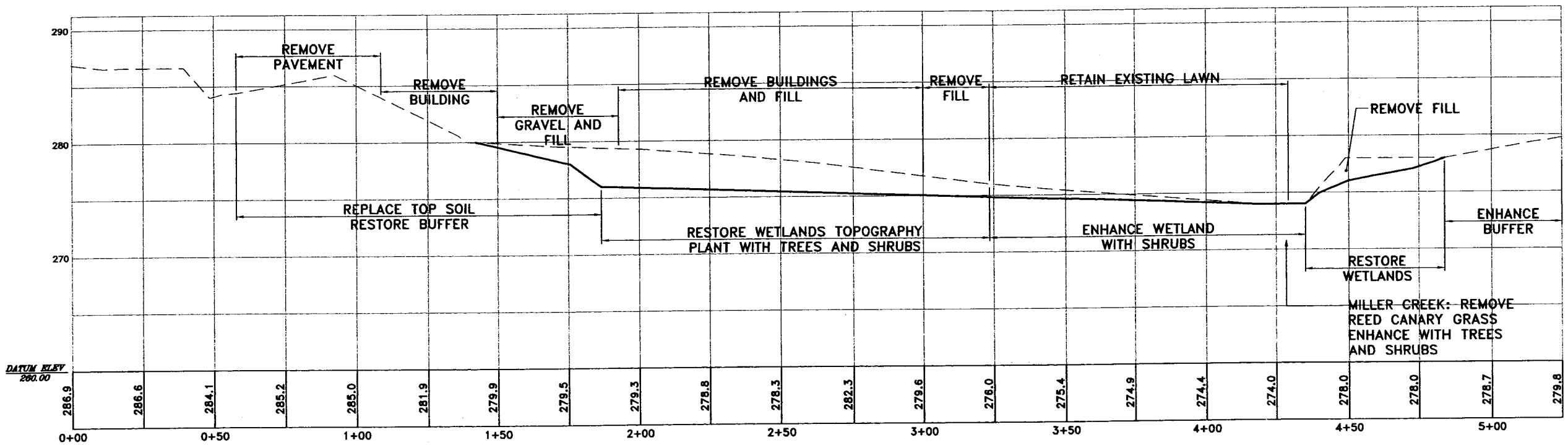
All soils left exposed for greater than 48 hours from October 1 through March 31 (or greater than 7 days from April 1 through September 30) will be covered with jute matting or other appropriate BMPs.

5.2 EXPECTED HYDROLOGY

The high groundwater table in the wetlands on the Des Moines Way Nursery site suggests that post-construction hydrology will result in soils that are saturated to the surface from the onset of sufficient autumn rains through mid-spring (April). This hydrologic pattern would support the shrub and forest vegetation planned for the site.

5.3 WILDLIFE CONSIDERATIONS

Flocking birds, raptors, and waterfowl pose the greatest concern for aircraft safety at STIA. Therefore, a landscape planting approach has been developed to aid in deterring these species from using the new mitigation sites as foraging areas or roost sites. Guidance obtained from Port wildlife managers and information gathered through literature searches have directed development of the planting plan. For example, Lyon and Caccamise (1981) found that roost stands for European



SECTION A

EXISTING AND PROPOSED GRADE
SCALE: H. 1"=20', V. 1"=5'

C2

IMAGES: XREFS:

20 0 20 40
SCALE FEET

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph:(425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.	P. FENDT
DESIGNED BY:	J. KELLEY
DRAWN BY:	S. NEWELL
SCALE:	AS SHOWN
DATE:	NOVEMBER 2001
CHECKED BY:	S. HARRIS
APPROVED BY:	P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

DATE: 11/16/01 FILENAME: 29120BC4

AGENCY REVIEW
NOT FOR CONSTRUCTION

AR 006033

Figure N-4.
Cross Section of the Wetland Restoration Area.

starlings were generally composed of deciduous trees 18 to 35 years of age with stem densities greater than 290 trees per acre (average of about 700 trees per acre). The minimum roost size was 0.32 acre, although the average was about 4.5 acres. Conclusions from this study indicate that these birds typically select roost sites composed of dense stands of young trees that allow the birds to roost in a compact formation, and also provide some thermal protection after leaf fall.

Waterfowl typically prefer to forage in open areas, such as open water, emergent marshes, or mowed lawn, because their view of potential predators is unobstructed. An obstructed view is perceived as dangerous and waterfowl will not typically forage in such an area. Therefore, the planting plan will focus on installing dense shrubs with scattered small trees to obstruct views and landing paths. This strategy will also exclude waterfowl during the winter by creating a dense barrier of stems to cover standing water that is likely to be present.

Geese or waterfowl exclusion measures will likely be necessary during the initial years of the mitigation because the site will be dominated by low vegetation and will be fairly open. Geese exclusion measures will include dense planting of trees and shrubs on the restoration site and the elimination of areas of open, ponded water. During the monitoring period, geese exclusion may also include physical barriers to prevent geese from landing or entering the site.

5.4 LANDSCAPE PLAN

5.4.1 Planting Plan

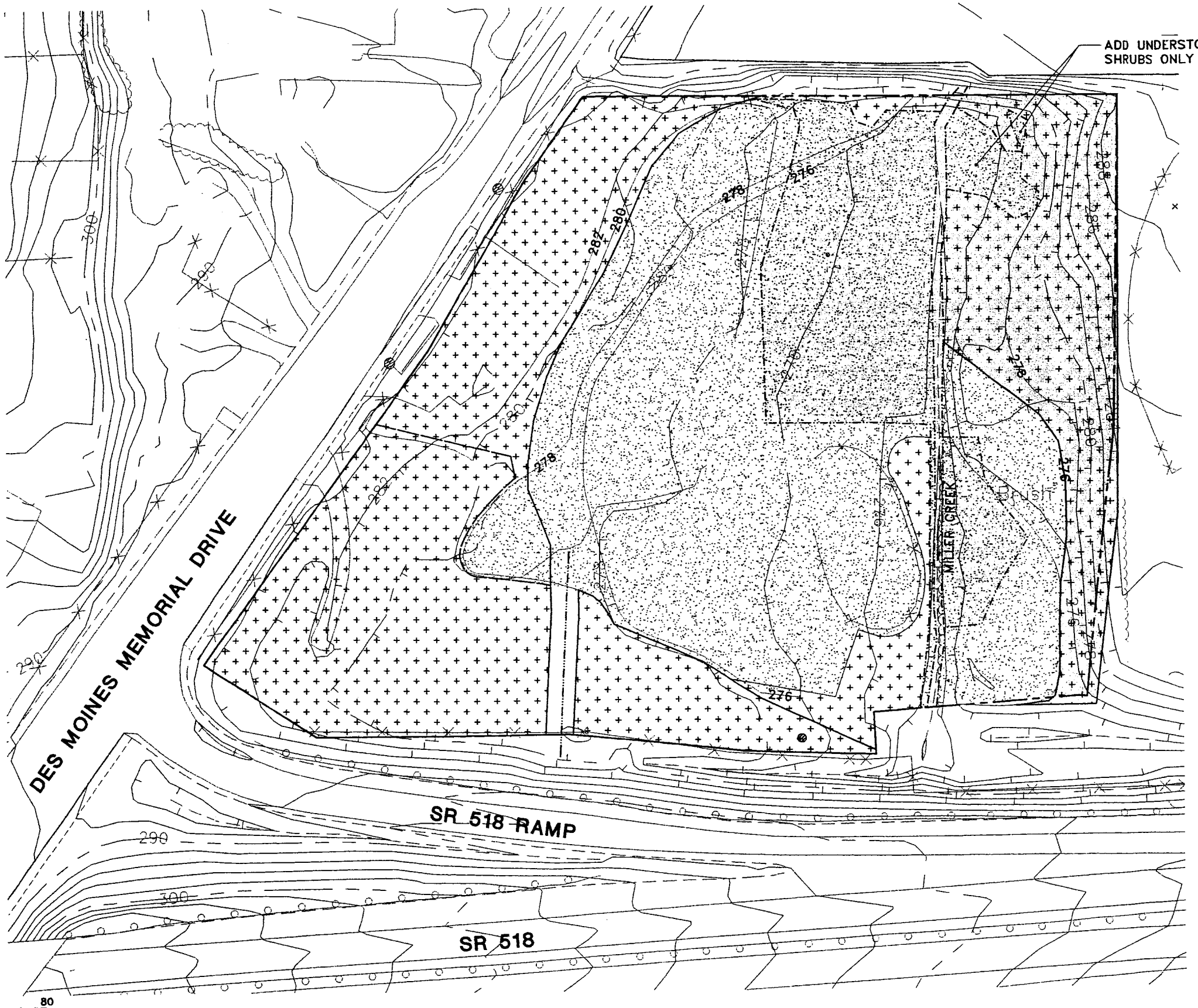
Three planting zones are planned for the mitigation area (Figure N-5). The planting zones for the mitigation are designated for the wetland restoration zone, the wetland enhancement zone, and for the upland/riparian buffer zone. To minimize wildlife hazards, all the planting plans for the in-basin mitigation actions are designed to be unattractive to flocking birds and waterfowl. Plants used in the in-basin mitigation areas produce few fruits, berries, or nuts (Table N-5).

The landscape plan for the area shows that planting conifer trees will be phased. It is anticipated that these conifers would be planted in a second planting phase coincident with replacement plantings that may be required to meet the performance standard for plant survival. The trees will be positioned such that they receive some shade from adjacent plants (trees, shrubs, and groundcover). For the first growing season following this planting, soil moisture conditions will be examined closely, and the use of the temporary irrigation system may be used to reduce mortality and promote growth.

5.4.1.1 Existing Wetlands to be Enhanced

Removing non-native invasive species in selected areas and infill planting with native tree and shrub species will occur in portions of the upland buffer, wetlands, and along much of the riparian area. The enhancement plan for these areas will promote native vegetation by replacing lawn, blackberry and reed canarygrass with tree and shrub species (primarily willows) to create a native shrub/tree community and to reduce cover of non-native species. Planting densities for infill tree planting will be greater than 250 stems per acre and for shrub planting will be greater than 1,700 individuals per acre. Infill planting densities are slightly lower than planting densities in cleared and/or graded areas because some native vegetation already exists in areas to be infill planted.

The enhancement of existing wetlands also includes placing several pieces of large woody debris (LWD) in Miller Creek, as shown in Figure N-5. Woody debris will be placed instream to enhance retention of organic matter in the stream, and improve invertebrate habitat. Over time, this debris



LEGEND

- WETLAND BOUNDARY
- WETLAND RESTORATION
- WETLAND ENHANCEMENT
- UPLAND BUFFER
- UPLAND BUFFER – REMOVE BLACKBERRY AND ADD ENHANCEMENT PLANTINGS
- PROPERTY BOUNDARY
- DITCH
- 286 EXISTING CONTOUR
- 286 PROPOSED CONTOUR

AGENCY REVIEW
NOT FOR CONSTRUCTION

CALL 48 HOURS BEFORE YOU DIG 1-800-424-5555

Parametrix, Inc.
5808 Lk. Washington Blvd. NE
Kirkland, WA 98033
Ph: (425) 822-8880
"Quality Service Through Employee Ownership"

PROJECT ENGR./MGR.	P. FENDT
DESIGNED BY:	J. KELLEY
DRAWN BY:	S. NEWELL
SCALE:	1"=50'
DATE:	NOVEMBER 2001
CHECKED BY:	S. HARRIS
APPROVED BY:	P. FENDT

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

IMAGES:
XREFS: 291203BBA POS-C01 POS-C02 POS-C06 POS-C07 291203BDE LA
FILENAME: 291203SL1
DATE: 11/15/01

AR 006035

Figure N-5.
Planting Plan for the Des Moines Way Nursery Mitigation Area.

Table N-5. Proposed plant list for mitigation projects at the Des Moines Way Nursery site.

Scientific Name	Common Name	Size and Condition [a]	Spacing (ft/on center)	Planting Zone		
				Wetland Restoration	Wetland Enhancement	Upland/ Riparian Buffer
Trees						
Abies grandis	Grand Fir	2 – 4' in 2 gal.	10 to 15			X
Acer macrophyllum	Big leaf maple	2 – 4' in 2 gal.	10 to 15			X
Alnus rubra	Red alder	2 – 4' in 2 gal.	10 to 15	X		X
Picea sitchensis	Sitka spruce	2 – 4' in 2 gal.	10 to 15	X		
Populus trichocarpa	Black cottonwood	2 – 4' in 2 gal.	10 to 15	X		X
Pseudotsuga menziesii	Douglas fir	3 – 4' in 2 gal.	10 to 15			X
Thuja plicata	Western redcedar	3 – 4' in 2 gal.	10 to 15	X		X
Tsuga heterophylla	Western hemlock	3 – 4' in 2 gal.	10 to 15			X
Shrubs						
Acer circinatum	Vine maple	2 gal.	4 to 6		X	X
Philadephus lewisii	Mock orange	2 gal.	4 to 6		X	
Physocarpus capitatus	Pacific ninebark	2 gal.	4 to 6	X		
Rosa nutkana	Nootka rose	2 gal.	4 to 6	X	X	X
Rosa pisocarpa	Clustered rose	2 gal.	4 to 6	X		
Salix hookeriana	Hooker willow	live stake[b]	4 to 5	X		
Salix lucida	Pacific willow	live stake[b]	4 to 5	X	X	
Salix sitchensis	Sitka willow	live stake[b]	4 to 6	X	X	
Salix scouleriana	Scouler's willow	live stake[b]	4 to 5	X	X	
Spiraea douglasii	Hardhack spiraea	2 gal.	4 to 5	X		
Grasses						
Agrostis exarata	Spike bentgrass	Seed		X	X	
Beckmannia syzigachne	Slough grass	Seed			X	
Calamagrostis canadensis	Canada reed	Seed		X	X	
Deshampsia cespitosa	Tufted hairgrass	Seed		X	X	

Table N-5. Proposed plant list for mitigation projects at the Des Moines Way Nursery site (continued).

Scientific Name	Common Name	Size and Condition [a]	Spacing (ft/on center)	Planting Zone		
				Wetland Restoration	Wetland Enhancement	Upland/ Riparian Buffer
Upland Hydroseed		Seed				X
Sedges and Rushes						
Carex amplifolia	Ample-leafed sedge	Seed		X	X	
Carex practicola	Meadow sedge	Seed			X	
Carex stipata	Sawbeaked sedge	Seed		X	X	
Scirpus cyperinus	Wool-grass	Seed		X	X	
Other Herbaceous						
Aster subspicatus	Douglas aster	Seed		X		
Solidago canadensis	Canada goldenrod	Seed		X		

[a] Depending on availability and season, plant condition may be substituted.

[b] Live stake material will typically be used in the wetland restoration and enhancement plantings. Live stakes will range from 12 inches to 24 inches on center and will typically be planted during late fall, winter, or spring.

could restore natural channel forming processes to the site and promote floodplain development and organic matter export functions.

Woody debris will generally be placed as spanning log structures (see NRMP Appendix B, Sheet C10 for placement details). The locations of logs are shown in Figure N-3, and minor field modifications may be made to optimize the benefits and to provide non-structural anchoring of LWD.

5.4.1.2 Wetland Restoration

In wetland restoration areas, a herbaceous ground cover will be established by hydroseeding a native grass, sedge and forb hydroseed mix (see Table N-4), following grading and prior to planting with woody trees and shrubs. The hydroseed mix will contain seeds and a wood fiber mulch and tackifier to stabilize soils and enhance germination. Plant species included in the mix are designed to provide for rapidly germinating species that can provide initial cover, as well as later germinating species that will add to the cover and species diversity of the herbaceous vegetation of the floodplain communities.

Newly restored wetlands will be planted with native tree and shrub wetland plant communities following grading. The landscape plan for the wetland restoration area will include shrubs planted in dense patches to provide a continuous shrub cover, with western redcedar and some Sitka spruce trees interspersed in the shrub planting (see Figure N-5).

Wetland restoration plantings will be placed in newly graded areas on each side of Miller Creek between elevations 274 and 280 ft. Installed tree densities will be at least 280 stems per acre. Installed shrub densities will be greater than 2,100 individuals per acre.

5.4.1.3 Wetland Enhancement

In wetland enhancement areas, existing lawn will be planted with native tree and shrub wetland plant communities following grading. The landscape plan for the wetland restoration area will include shrubs in dense patches to provide a continuous shrub cover, with a variety of native wetland shrub species (see Figure N-5).

Wetland enhancement plantings will be placed in wetlands dominated by existing lawn grasses on located on each side of Miller Creek generally between elevations 272 and 274 ft. Installed shrub densities will at least 2,100 individuals per acre.

In limited areas, existing wetlands contain some native tree and shrub vegetation. In these areas, enhancement will consist of adding wetland understory shrub plantings after removing blackberry and/or reed canarygrass.

Also, in limited areas, patches of reed canarygrass dominate the existing wetland. In these locations, prior to planting shrubs, reed canarygrass would be controlled by mowing and herbicide treatment (see Section 4.2 of the NRMP for information on weed control).

5.4.1.4 Upland Buffers

Upland buffers (see Figure N-5) are located east, west, and south of the mitigation site. These areas will be planted with species adapted to seasonally wet upland soil conditions. Upland buffers will typically be located above approximately the 278-ft elevation. The landscape plan for the upland area will focus on densely planting trees and shrubs to protect the mitigation area from surrounding land uses and restrict ground foraging birds (including waterfowl). Installed tree densities will be at

least 280 stems per acre. Installed shrub densities will be greater than 2,100 individuals per acre. The planting scheme in the upland areas will place coniferous and deciduous tree species in patches to create a mixed canopy.

5.4.2 Planting Approach

Planting will occur whenever possible in late fall (October to November) or early spring (March or April), when soil moisture and plant conditions are optimal for installing plants. However, it may not always be possible or desirable to plant only during the winter months. For example, soils could be frozen or too wet at times during the winter months, limiting the amount of planting that can take place.

Trees of varying heights (between approximately 36 and 48 inches) will be planted to provide height diversity, and trees and shrubs will be planted in a mosaic of species and heights to simulate natural patchiness. Trees and shrubs will be planted at densities sufficient to attain the performance standards identified in Section 6. A landscape architect or wetland scientist will be on-site to observe placement and installation of the plant material to ensure that plants are installed according to the planting plan and specifications.

6. MONITORING AND PERFORMANCE STANDARDS

The Des Moines Way Nursery mitigation site will be monitored to be consistent with the approach and schedules outlined in Section 4 of the NRMP. Specific performance standards and contingency measures for the site are included in Table N-6. Interim cover targets and invasive, non-native plant species to be monitored and controlled on the mitigation site are included in Tables N-7 and N-8, respectively. The general monitoring schedule for the site is provided in Table N-8. Monitoring objectives specific to the Des Moines Way Nursery site are designed to evaluate the functioning of the restored and enhanced wetland plant communities (Table N-9).

Monitoring for hazard wildlife will also be conducted at the Des Moines Way Nursery site, as described in Section 4 of the NRMP.

6.1 WETLAND HYDROLOGY

Groundwater hydrology will be monitored at the mitigation site for a 15-year period following completion of all mitigation construction. The primary purpose of monitoring groundwater levels is to verify that shallow groundwater is present to support restored wetland areas and that seasonal groundwater levels are sufficient to support the wetland plant communities on the site. Groundwater hydrology will be monitored consistent with the methods and approach outlined in Section 4 of this document.

6.2 VEGETATION MONITORING

Vegetation will be monitored in all planting zones at the mitigation site to verify that performance standards are being met, and to develop contingency measures as necessary (see Tables N-6 and N-9). Vegetation monitoring will be consistent with the approach, methods, and schedules provided in Section 4 of the NRMP.

Table N-6. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Des Moines Way Nursery.

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
Provide approximately 2.73 acres of vegetated buffer in upland wetland and riparian buffers. Establish native vegetation along channel banks and the riparian zone of the channel.	Establish 2.73 acres of native shrub/forested riparian zone and upland buffers with an average tree density of at least 280 stems/acre and shrub density of at least 2,100 individuals per acre in monitoring years 3, 8, and 15. At Year 1, survival of planted stock will be 100%. Average survival of planted trees and shrubs in the first 3 monitoring years shall be at least 80%; cover of native species will be 80% by year 15[a]. Cover of non-native invasive species[b] will be no greater than 10% during any monitoring year. In monitoring years 3, 8, and 15, the numbers of plant species in the mitigation area shall not decline by more than 10% from the number originally planted.	Vegetation sampling (plots, transects, or plotless techniques) to measure stem density plant cover, count live and dead plants, and measure cover of non-native invasive species will occur.	Install additional plants if necessary. Identify substitute native species that are adapted to site conditions. Eliminate or reduce the abundance of non-native invasive species. Install protective collars to reduce herbivore damage.
Densely plant woody vegetation in riparian areas along Miller Creek to cover the open stream channel and reduce use of the area by waterfowl.	Canopy cover extending over the creek channel will be 80 percent by the end of the monitoring period.	Vegetation sampling to determine tree and shrub cover over the portion of the channel below the ordinary high water mark (OHWM).	Add additional plants if areas of exposed stream channel are present.
Remove fill and restore wetland hydrology to 2.20 acres of historic wetlands and hydric soil.	Grading and fill removal will result in 2.20 acres of wetlands that occur on buried hydric soils. This area will experience a water table within 10 inches of the soil surface for at least the period from March 1 to April 15.	Soil analysis to determine presence of buried hydric soil horizons. Hydrologic monitoring of soil saturation and shallow groundwater conditions.	Regrade restoration area if wetland hydrology criteria are not met. Amend soils with peat or muck soils (excavated from other planned construction at the Vacca Farm site or Wetland 37) if native surface horizons have been removed from filled areas.

Table N-6. Final performance standards, evaluation approaches, and contingency measures for mitigation projects at Des Moines Way Nursery (continued).

Design Criteria	Performance Standard	Evaluation Approach	Contingency Measures
Plant native trees, shrubs and herbaceous (see Tables N-4 and N-5) species in restored wetlands at tree densities of greater than 280 trees per acre (trees include willow species) and shrub densities of greater than 2,100 per acre. Intersperse native conifers in this area.	At year 1, survival of planted stock will be 100%. Shrub and tree survival will average at least 80% in the first 3 monitoring years. In monitoring years 3, 8, and 15, at least 280 trees per acre (including willow species) and 2,100 shrubs/acre will remain. Percent cover of native species will be at least 80% by year 15[a]. In newly planted areas, non-native invasive[b] species cover will be no more than 10% in all monitoring years. In monitoring years 3, 8, and 15, the numbers of plant species in the mitigation area shall not decline by more than 10% from the number originally planted.	Vegetation sampling (plots, transects, or plotless techniques) will be conducted to measure vegetation cover and diversity.	If standards are not met: • Select species that are better adapted to existing hydrologic conditions. • Install additional plant material. • Install protective collars to reduce herbivore damage. • Control/reduce non-native invasive species.
Enhance instream habitat in Miller Creek by adding LWD.	A minimum of 6 instream pieces of LWD greater than 12 inches in diameter will be present within the OHWM of the creek channel.	Visual inspection.	Additional woody debris will be added and stabilized if required.
Plant the riparian areas with native trees, shrubs, and grasses to deter waterfowl.	Percent cover of native herbaceous species will be at least 80% by year 15[b].	Vegetation sampling (plots, transects, or plotless techniques) to estimate canopy cover.	See above.
Enhance existing forested wetland native shrubs to provide a diverse understory. Total density of native shrubs will be at least 1,700 individuals per acre.	At Year 1, survival of planted stock will be 100%. Average survival of planted stock will be at least 80% in the first 3 monitoring years. In monitoring years 3, 8, and 15, shrub density will be at least 1,700 shrubs per acre. In areas where existing wetland is being enhanced, percent cover of non-native invasive[b] species in the understory will be no more than 10% during any monitoring year. In years 3, 8, and 15, the number of plant species present will not decrease by more than 10% from the number installed at baseline.	See above.	See above.

[a] See Table N-7 for interim cover targets (i.e., from year 3 to year 15).

[b] See Table N-8 for a list of invasive, non-native species to be monitored and controlled on the mitigation site.

Table N-7. Performance standards for vegetation cover (minimum percent) by vegetation zone and monitoring year.

	Vegetation Zone				
			Emergent		
Monitoring Year	Forest[a]	Shrub[a]	Hydroseed	Planted	Invasive Species
0	-	-	0	0	<10
1	-	-	50	10	<10
2	-	-	60	20	<10
3	10	10	70	30	<10
5	25	40	80	50	<10
7	40	65	80	70	<10
10	80	80	80	80	<10
12	80	80	80	80	<10
15	80	80	80	80	<10

[a] Vegetation cover will not be monitored in forest and shrub plant communities during monitoring year 0, 1, or 2. During these years, plant survival performance will be monitored and at year 3, survival must be 80 percent of the original numbers planted. Invasive plant species cover will be monitored during all monitoring years.

Table N-8 Invasive plant species that will be monitored and controlled on the mitigation sites.

Scientific Name	Common Name
Convolvulus sepium	Hedge bindweed
Cytisus scoparius	Scotch Broom
Lythrum salicaria	Purple loosestrife
Phalaris arundinacea	Reed canarygrass
Polygonum cuspidatum	Japanese knotweed
Polygonum sachalinense	Sachaline
Rubus discolor	Himalayan blackberry
Rubus lacinatus	Evergreen blackberry

Table N-9. Monitoring schedule for wetland restoration and enhancement at Des Moines Way Nursery.

Feature	Activity	Timing	Data Collection Year												
			0	1	2	3	4	5	6	7	8	9	10	12	15
Hydrology	Measure the maximum depth and approximate duration of inundation.	Monthly	X	X	X	X									
		Once during winter, late spring/early summer, and fall					X	X	X	X	X	X	X	X	X
	Measure depth to groundwater.	Monthly	X	X	X	X									
		Once during winter, late spring/early summer, and fall					X	X	X	X	X	X	X	X	X
Establishment of Vegetation	Calculate percent plant survival.	Once late spring to early summer	X	X	X	X									
	Vegetation mapping.	Once in late spring to early summer	X	X		X		X		X			X	X	X
Achieve an early successional wetland plant community	Measure tree/shrub cover.	Once in late spring to early summer in year 3, 5, 7, 10				X		X		X			X	X	X
	Photographic documentation and walk-through survey.	Once in spring	X	X	X	X		X		X			X	X	X
	Wetland delineation	Early spring						X					X		X

AR 006044

7. SITE PROTECTION

The Port will execute and file a restrictive covenant on the mitigation area that will prevent development or other detrimental activities from occurring on the site. Copies of proposed restrictive covenants are included in Appendix G of the NRMP. Fencing approved by ACOE, as shown in Appendix P of the NRMP will protect the perimeter of the mitigation site. Permanent signs that clearly designate the area as a protected wetland mitigation site will also mark site perimeters. Signs will be inspected regularly and maintained in good condition by the Port.

8. MAINTENANCE AND CONTINGENCY PLANS

Routine maintenance tasks (e.g., maintaining irrigation systems, removing trash, mulching, mowing) and adaptive management contingency measures (e.g., re-planting, weed control) will be implemented consistent with the approach outlined in Section 4 of the NRMP. If the Des Moines Way Nursery site does not meet performance standards during the monitoring period, contingency measures will be implemented using the adaptive management approach outlined in Section 4 of the NRMP. Specific contingency measures are provided for each performance standard in Table N-6.

Meeting the performance standards for non-native invasive species at Des Moines Way Nursery will likely require implementation of contingency measures during the 15-year monitoring period. Potential invasive species of concern at the Des Moines Way Nursery site include, but are not limited to, reed canarygrass, Himalayan blackberry, Japanese knotweed (*Polygonum cuspidatum* or *P. sachalinense*), and purple loosestrife (*Lythrum salicaria*). These species are a concern because they already occur at Des Moines Way Nursery and may be difficult to eliminate, or because propagules of these plants are likely to continuously re-invade the site from upstream aquatic sources or from the surrounding area. Successfully establishing native vegetation on the site will be a key component in reducing and controlling invasive species in the long term at the mitigation site. In the short term (i.e., during the 15-year monitoring period), contingency measures specified in Table N-6 will be implemented as necessary to control invasive species on the site.

Possible contingency measures that may be implemented to reduce hazard wildlife attractants specific to Des Moines Way Nursery are included in Table N-6. Contingencies include eliminating areas of standing water on the floodplain by planting shrubs or minor regrading to eliminate depressions. Measures to control wildlife hazards will be consistent with the Port's WHMP approach described in Section 4 of the NRMP.

Examples of the types of contingency actions that may need to be implemented at Des Moines Way Nursery include:

- If invasive species cover is greater than specified in the performance standards, or if native plant survival is reduced by competition with non-native invasive species, then invasive species removal and/or control will be implemented.
- Replacement plants will be installed if survival is less than 80 percent in the first 3 years.
- If plant species exhibit greater than 20 percent mortality within the first 3 years, site conditions would be re-evaluated to determine whether the conditions could support the species. If the site cannot support the original plant species, then those species may be replaced with species of similar form and function and tolerance to hydrologic conditions on the site.
- If standing water persists on the site for extended periods such that waterfowl use of the site is regular, then corrective actions will be taken to plant densely with shrubs or create positive flow of surface water off the site to Miller Creek.

9. IMPLEMENTATION OF THE DES MOINES WAY NURSERY MITIGATION PROJECT

The Des Moines Way Nursery Project would be implemented when permit approvals for the Master Plan Update Projects are received. This section describes the implementation process and sequence for the project.

9.1 GENERAL CONSTRUCTION SEQUENCING

Construction of the Des Moines Way Nursery projects could begin during the 2002 construction season, but the actual schedule is dependent on receipt of federal, state, and local permits (Table N-10). Demolition, excavation and grading are expected to occur during the dry time of the year, taking approximately 15 weeks. This work would begin in early summer and be completed by early October.

Table N-10. Proposed implementation timeline for Des Moines Way Nursery mitigation projects[a].

	Year 1[a]												Year 2					
Project/Activity	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
Pre-construction meeting				X														
TESC, Site Preparation				X	X													
Building Demolition				X	X	X	X											
Mass grade restoration areas							X	X										
Fine grade restoration areas add topsoil								X	X									
Install LWD in Miller Creek									X									
Install irrigation system									X	X								
Install monitoring wells										X								
Hydroseed graded areas										X								
Closeout (remove construction debris and equipment, staging areas, access roads, etc.)										X								
Install plants in wetland restoration and enhancement areas, install buffer plants.[b]										X	X	X						
Produce as-built drawings													X					
Conduct baseline monitoring													X					
Begin maintenance/monitoring period													X					

[a] Year one starts with the first construction season following issuance of permits and 6-month minimum plant procurement period. Implementing mitigation projects may vary from this proposed schedule depending upon coordination with other Master Plan Update projects, contract obligations, and the timing of final approvals.

[b] Plant procurement for all projects will be started 6 to 12 months prior to the anticipated planting date to ensure that plants in the specified quantities and species are available by the scheduled planting date. Planting will be phased such that coniferous species will be planted following the third year of monitoring if located in open-sunny areas. Under planting conifers in existing forested areas may occur during early planting phases.

9.1.1 Demolition, Site Preparation, and Grading

Earthwork for this phase includes site preparation (including building demolition), installation of sediment and erosion control measures, dewatering if necessary, grading, installation of irrigation, and site stabilization following grading. Building demolition in this these areas may be completed before this project is started, consistent with Port policy on security and safety.

9.1.1.1 Site Preparation and Erosion Control

No work will begin until a Temporary Erosion and Sedimentation Control (TESC) plan is implemented, or until any protected or restricted access areas (e.g., wetlands or streams) have been flagged and/or fenced. The TESC plan includes installation of silt fences around the existing wetlands to be enhanced and Miller Creek. Silt fences will also be placed to protect areas downslope of demolition areas.

TESC measures include placing silt fence around work areas and staging areas, and placing straw bales at key locations within the project limits. Clearing and brush removal will be limited to only those work areas that the contractor is scheduled to begin within the following 2 weeks. Areas where stormwater runoff will concentrate and collect, if any, would include construction sedimentation ponds.

Prior to the start of grading, construction access, staging, and stockpile areas will be set up. Temporary access routes and staging areas identified on the western side of the site will be set up and flagged. The site will be cleared of debris (e.g., existing tile drains, drainage pipe, trash, structures, etc.).

9.1.1.2 Dewatering

Grading and excavation will occur during the summer and early fall months when seasonally high groundwater is not present. There are no deep excavations or other conditions expected that could require dewatering.

9.1.1.3 Installation of Temporary Irrigation and Site Stabilization

Temporary irrigation will be installed following grading to provide flexibility in plant installation and to maximize successful establishment, survival, and early growth of hydroseeded cover crops and plant stock. The irrigation system will be used to ensure plant survival and growth during the initial stages of plant establishment. The system will be designed so that above-ground portions can be removed after a few years, when the option to use irrigation will no longer be needed. Irrigation will use municipal water purchased by the Port. Application rates will be at rates that are less than agronomic rates, but sufficient to reduce plant mortality and to promote growth during dry periods.

Once the wetland restoration area has been graded and elevations have been established and verified by field survey, the temporary irrigation system will be installed. This system will be used to provide flexibility in the planting schedule, provide contingencies against periods of dry weather during the first few growing seasons, and to maximize plant survival and growth during the first years following planting. Irrigation is a standard feature of wetland mitigation construction in the Puget Sound Lowlands due to the region's pronounced summer drought. Irrigation will be designed for the entire area; however, it may not be necessary in some areas. If, following grading, the wetland scientist determines that irrigation is not needed in some areas, it will not be installed.

Municipal water will be used for irrigation. It is anticipated that the irrigation system would be used for the months of June through September, but actual timing will be dependent on weather and soil

moisture conditions. Water will be applied at rates less than agronomic rates typically used for crop production, but sufficient to promote high growth rates and to reduce plant mortality.

The irrigation should expedite establishment of shrub cover and shade on the site, production of biomass, vertical habitat structure to reduce waterfowl use, and organic litter production. This will help reduce temporal impacts. In upland buffers that contain well-drained soils, earlier and more frequent use may be required. The irrigation system will be decommissioned and all aboveground parts removed at the direction of the wetland scientist following once plant survival standards have been met.

The site will be stabilized following completion of grading and prior to the onset of winter rains. A hydroseed mix designed to provide temporary erosion control and a weed barrier will be applied to the graded areas by mid-September.

9.1.2 Establish Native Vegetation on the Site

It is anticipated that mitigation site will be planted the first fall (i.e., October or November) following grading. Stem collars or other herbivore deterrents may be installed on plants to reduce damage from rodents and other herbivores.

Plant material used in the mitigation will be obtained from commercial nurseries. Nurseries will be required to certify that the plant material is legally procured and from the appropriate geographic sources. Plant material used for mitigation will be grown in the area that is bounded on the north by the Fraser River Valley of British Columbia, on the east by the 1,000-ft elevation of the Cascades, on the west by the 1,000-ft elevation in the Olympic or Coast ranges, and on the south by the Willamette Valley.

9.1.3 Construction Steps

The following sections outline the construction and post-construction steps necessary to implement the Mitigation Plan for the site.

9.1.3.1 General Conditions

- On award of the contract, the contractor will provide the Port with any required pre-construction submittals, work plans, and schedules.
- A pre-construction meeting will be held with the contractor, architect/engineer, and wetland scientist to review submittals, work plans, schedules, and permit conditions.
- The contractor will be responsible for ensuring that the work is performed in compliance with all permit conditions and shall maintain a copy of permits on-site.
- Work will be coordinated to avoid re-entry and damage to areas that have previously been planted; work will be conducted so that no other work will impact completed landscape work.
- Areas where any landscape work has been completed will be off limits to all vehicular traffic, and pedestrian traffic will be strictly limited.
- All site work will be performed in accordance with permit conditions; any instream work or work below the ordinary high water mark (OHWM) will take place only during the allowable work times, consistent with HPA permit conditions (i.e., July 15 to September 15).

- Plant procurement shall be coordinated with the grading and irrigation installation schedules and be completed 6 to 12 months prior to the scheduled planting season to ensure that plants are available in the quantities and species required by the planting plan.

9.1.3.2 Site Preparation

- Establish vertical and horizontal site controls and maintain through construction to record drawings.
- Identify and flag limits of work for mitigation site.
- Identify staging areas and temporary access/haul roads.
- Implement TESC plan; install TESC measures for grading and demolition areas.
- Identify and flag sewer manholes and sewer easement.
- Install fencing (orange barrier) around areas to be protected (e.g., existing wetlands, outlet ditches, sewer manholes).
- Maintain security of the site through construction.
- Establish temporary access.
- Implement a spill control plan and identify fueling areas.
- Demolish buildings and other facilities. (Buildings may be demolished by the Port and then stabilized before construction of the mitigation project.)
- Establish staging and stockpile areas.

9.1.3.3 Clearing, Excavation, and Grading

- Clear and grub the site.
- Install LWD in the stream
- Remove weeds (e.g., grub out blackberry and reed canarygrass; apply herbicide if appropriate per specifications) and clear brush in buffer enhancement areas.
- Mass and fine grade the restoration area.

9.1.3.4 Irrigation and Landscaping

- Install and test irrigation system.
- Apply hydroseed to graded portion of the floodplain.
- Plant enhancement, restoration, and buffer zones.

9.1.3.5 Closeout

- Complete site cleanup by removing temporary haul/access roads, TESC items, and staging areas.
- Remove construction equipment and debris.
- Hydroseed and/or install plants in temporary staging areas or access roads within the mitigation site boundaries.

- Hydroseed erosion control mix in temporary staging areas/access roads outside the mitigation boundaries.

9.1.3.6 Record Drawings, Monitoring, and Maintenance

- Produce record drawings (including grading, LWD placement, and planting).
- Complete a baseline report, including record drawings and final monitoring plan (e.g., locations of monitoring plots, baseline conditions).
- Begin compliance monitoring during the first growing season after all grading and planting are complete; submit annual monitoring reports for 15-year monitoring period.
- Conduct maintenance (e.g., weed management, WHMP) and implement any necessary contingency measures to meet performance standards.

10. REFERENCES

Ecology (Washington State Department of Ecology). 1993. Washington state wetlands rating system. Publication 93-74. Olympia, Washington.

Ecology (Washington State Department of Ecology). 1994. Guidelines for developing freshwater wetlands mitigation plans and proposals. Olympia, Washington.

FAA (Federal Aviation Administration). 1997. Hazardous wildlife attractants on or near airports. Advisory Circular, 150/5200-33.

Lyon, L.A. and D.F. Caccamise. 1981. Habitat selection by roosting black birds and starlings: management implications. *Journal of Wildlife Management*, 45:435-443.

Parametrix. 2000a. Wetland delineation report for Seattle-Tacoma International Airport master plan update improvements. Prepared by Parametrix for the Port of Seattle. Kirkland, Washington.

Parametrix. 2000b. Biological assessment for Seattle-Tacoma International Airport master plan update improvements. Prepared by Parametrix for the Port of Seattle. Kirkland, Washington.

Rigg, G. B. 1958. Peat resources of Washington. Washington Division of Mines and Geology. Bulletin No. 44.

Snyder, D.E., G.P. Philip, and R.F. Russell. 1973. Soil survey of King County area, Washington. United Sates Department of Agriculture, Soil Conservation Service. In cooperation with the Washington agricultural experiment station.

USDA (U.S. Department of Agriculture). 1952. Soil survey, King County, Washington. Series 38, No. 31. In cooperation with the Washington Agricultural Experiment Station and the Washington State Planning Council.

USDA (U.S. Department of Agriculture), Soil Conservation Service. 1991. Hydric soils of the United States. U.S. Department of Agriculture, Soil Conservation Service. Miscellaneous Publication No. 1491.

ATTACHMENT A

WETLAND DELINEATION DATA SHEETS

Parametrix, Inc.

Data Plot #: 1W
Wetland: N8

WETLAND DETERMINATION
(Modified from: 1987 COE Wetlands Delineation Manual)

Project/Site: Des Moines Way Nursery
Date: 10/10/01
Applicant/Owner: Port of Seattle
County: King
Investigator: M. Louther, B. Kleindl
State: WA
☑ 1987 Method ☐ 1989 Method
Community ID: PEM
Field Plot ID: 1W

Do Normal Circumstances exist on the site? Yes X No ____
Is the site significantly disturbed (Atypical Situation)? Yes ____ No X
Is the area a potential Problem Area? Yes ____ No X

Remarks (Explain sample location, disturbances, problem areas):
This data plot is located west of Miller Creek, in lawn east of the plant nursery.

VEGETATION (✔Dominant species are checked)

	Plant Species	% Cover	Stratum	Indicator
1.	Festuca spp.	15	Herb	
✔ 2.	Holcus lanatus	95	Herb	FAC
3.	Scirpus spp.	Tr	Herb	
4.	Rubus spectabilis	Tr	Shrub	FAC+

Percent of **Dominant Species** that are OBL, FACW, or FAC (except FAC-). Include species noted (*) as showing morphological adaptations to wetlands. "T" indicates trace. 100

Remarks (Describe disturbances, relevant local variations, seasonal effects, etc.):
The vegetation meets the hydriohytic criteria for wetlands.

HYDROLOGY

Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gage
____ Aerial Photograph
____ Other
X No Recorded Data Available

Wetland Hydrology Indicators (Describe in Remarks):
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Saturated in Upper 18 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
X Drainage Patterns in Wetlands

Field Observations:
Depth of Surface Water: 0 (in.)
Depth to Free Water in Pit: 0 (in.)
Depth to Saturated Soil: >18 (in.)

Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water-Stained Leaves
____ Local Soil Survey Data
____ Other (Explain in Remarks)

Remarks (As relevant, describe recent precipitation, hydrologic modifications, local variations, etc.):
The presence of hydric soil and hydrophytic vegetation can be used to infer the presence of wetland hydrology.

DRAFT

Parametrix, Inc.

Data Plot #: 1W
Wetland: N8

Project/Site: Des Moines Way Nursery Date: 10/10/01

SOILS

Soil Survey Data:

Map Unit Name: Everett gravelly sandy loam (1952) Drainage Class: ____

Field Observations Confirm Mapped Type?

Taxonomy (Subgroup): not developed in 1952 Yes ___ No X NA ___

Profile Description:

Depth (Inches)	Horizon Designation	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Rhizospheres, etc.
0-6		10 YR 2/1	none	none	Loam
6-18		5 Y 5/2	10 YR 5/8	common, coarse, predominant	silty clay

Hydric Soil Indicators:

___	Histosol	___	Listed on Local Hydric Soils List
___	Histic Epipedon	___	Listed on State Hydric Soils List
___	Sulfidic Odor	___	Listed on National Hydric Soils List
___	Probable Aquic Moisture Regime	___	Aquic Moisture Regime
___	Reducing Conditions	___	Organic Streaking in Sandy Soils
X	Gleyed or Low-Chroma Colors	X	Mottles
___	High Organic Content in Surface Layer	___	Other (Explain in Remarks)

Remarks (Describe soil disturbances, local variations, etc.):

Hydric soil indicatiors are present within the rooting zone.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ___

Hydric Soils Present? Yes X No ___

Wetland Hydrology Present? Yes X No ___

Is this Sampling Point Within a Wetland? Yes X No ___

Remarks (If applicable, explain any differences between 1987 and 1989 delineation results):

Vegetation and hydrology of the area have been altered by ditching and plowing. Wetland hydrology is presumed by the presence of hydric soil and wetland vegetation. The three wetland parameters are present and the area is considered wetland.

DRAFT

Parametrix, Inc.

Data Plot #: 2U
Wetland: N9

WETLAND DETERMINATION

(Modified from: 1987 COE Wetlands Delineation Manual)

Project/Site: Des Moines Way Nursery
Date: 10/10/01
Applicant/Owner: Port of Seattle
County: King
Investigator: M. Louther, B. Kleindl
State: WA
☑ 1987 Method ☐ 1989 Method
Community ID: Upland
Do Normal Circumstances exist on the site? Yes X No ____
Field Plot ID: 2U
Is the site significantly disturbed (Atypical Situation)? Yes ____ No X
Is the area a potential Problem Area? Yes ____ No X

Remarks (Explain sample location, disturbances, problem areas):
The data plot is located south of Loop 2, on the east side of Miller Creek.

VEGETATION (✔Dominant species are checked)

		Plant Species	% Cover	Stratum	Indicator
✔	1.	Equisetum arvense	20	Herb	FAC
	2.	Hedera helix	10	Herb	NL
	3.	Polystichum munitum	10	Herb	FACU
✔	4.	Rubus discolor	30	Shrub	FACU
✔	5.	Alnus rubra	95	Tree	FAC
	6.	Corylus cornuta	10	Tree	FACU

Percent of **Dominant Species** that are OBL, FACW, or FAC (except FAC-). Include species noted (*) as showing morphological adaptations to wetlands. "T" indicates trace. 75

Remarks (Describe disturbances, relevant local variations, seasonal effects, etc.):
The wetland vegetation criterion is met.

HYDROLOGY

Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gage
____ Aerial Photograph
____ Other
X No Recorded Data Available

Wetland Hydrology Indicators (Describe in Remarks):
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Saturated in Upper 18 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands

Field Observations:
Depth of Surface Water: 0 (in.)
Depth to Free Water in Pit: 0 (in.)
Depth to Saturated Soil: >18 (in.)

Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water-Stained Leaves
____ Local Soil Survey Data
____ Other (Explain in Remarks)

Remarks (As relevant, describe recent precipitation, hydrologic modifications, local variations, etc.):
There is no evidence of wetland hydrology. The area appears to have been filled.

DRAFT

Parametrix, Inc.

Data Plot #: 2U
Wetland: N9

Project/Site: Des Moines Way Nursery Date: 10/10/01

SOILS

Soil Survey Data:

Map Unit Name: Everett gravelly sandy loam (1952) Drainage Class: _____

Field Observations Confirm Mapped Type?

Taxonomy (Subgroup): not developed in 1952 Yes ____ No X NA ____

Profile Description:

Depth (Inches)	Horizon Designation	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Rhizospheres, etc.
0-12	A*	10 YR 4/2	none	none	gravelly, loam
12-18	fill	10 YR 5/1	none	none	gravelly loam

Hydric Soil Indicators:

____	Histosol	____	Listed on Local Hydric Soils List
____	Histic Epipedon	____	Listed on State Hydric Soils List
____	Sulfidic Odor	____	Listed on National Hydric Soils List
____	Probable Aquic Moisture Regime	____	Aquic Moisture Regime
____	Reducing Conditions	____	Organic Streaking in Sandy Soils
X	Gleyed or Low-Chroma Colors	____	Mottles
____	High Organic Content in Surface Layer	X	Other (Explain in Remarks)

Remarks (Describe soil disturbances, local variations, etc.):

The soil is fill material with hydric soil inclusions; however the area does not meet hydric soil criteria.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soils Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is this Sampling Point Within a Wetland?

Yes ____ No X

Remarks (If applicable, explain any differences between 1987 and 1989 delineation results):

Only one out of the three parameters satisfy the crierion, therefore this area is not considerd to be wetland.

DRAFT

Parametrix, Inc.

Data Plot #: 2W
Wetland: N9

WETLAND DETERMINATION

(Modified from: 1987 COE Wetlands Delineation Manual)

Project/Site: Des Moines Way Nursery
Date: 10/10/01
Applicant/Owner: Port of Seattle
County: King
Investigator: M. Louther, B. Kleindl
State: WA
☑ 1987 Method ☐ 1989 Method
Community ID: PFO
Field Plot ID: 2W

Do Normal Circumstances exist on the site? Yes X No ____
Is the site significantly disturbed (Atypical Situation)? Yes ____ No X
Is the area a potential Problem Area? Yes ____ No X

Remarks (Explain sample location, disturbances, problem areas):
This Data Plot is located on the east side of the Miller Creek channel in Loop 2.

VEGETATION (✔Dominant species are checked)

		Plant Species	% Cover	Stratum	Indicator
✔	1.	Athyrium filix-femina	20	Herb	FACW
✔	2.	Equisetum arvense	20	Herb	FAC
	3.	Solanum dulcamara	Tr	Herb	FAC+
✔	4.	Rubus discolor	50	Shrub	FACU
	5.	Rubus spectabilis	5	Shrub	FAC+
✔	6.	Alnus rubra	95	Tree	FAC
	7.	Salix sitchensis	10	Tree	FACW

Percent of **Dominant Species** that are OBL, FACW, or FAC (except FAC-). Include species noted (*) as showing morphological adaptations to wetlands. "T" indicates trace. 75

Remarks (Describe disturbances, relevant local variations, seasonal effects, etc.):
Greater then 50% of the dominant species are FAC or wetter; therefore the wetland vegetation criterion is met.

HYDROLOGY

Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gage
____ Aerial Photograph
____ Other
X No Recorded Data Available

Wetland Hydrology Indicators (Describe in Remarks):
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
X Saturated in Upper 18 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
X Drainage Patterns in Wetlands

Field Observations:
Depth of Surface Water: 0 (in.)
Depth to Free Water in Pit: 0 (in.)
Depth to Saturated Soil: 15 (in.)

Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water-Stained Leaves
____ Local Soil Survey Data
X Other (Explain in Remarks)

Remarks (As relevant, describe recent precipitation, hydrologic modifications, local variations, etc.):
There is no standing water in hole; however the soil is saturated at 15" in depth.

DRAFT

Parametrix, Inc.

Data Plot #: 2W
Wetland: N9

Project/Site: Des Moines Way Nursery Date: 10/10/01

SOILS

Soil Survey Data:

Map Unit Name: Everett gravelly sandy loam (1952) Drainage Class: _____

Field Observations Confirm Mapped Type?

Taxonomy (Subgroup): not developed in 1952 Yes ____ No X NA ____

Profile Description:

Depth (Inches)	Horizon Designation	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Rhizospheres, etc.
0-15		10 YR 2/1	none	none	Sandy Loam
15-18+		10 YR 2/2	10 YR 2/1	coarse common faint	soils have high organic content with fibric matter

Hydric Soil Indicators:

____	Histosol	____	Listed on Local Hydric Soils List
____	Histic Epipedon	____	Listed on State Hydric Soils List
X	Sulfidic Odor	____	Listed on National Hydric Soils List
____	Probable Aquic Moisture Regime	____	Aquic Moisture Regime
____	Reducing Conditions	____	Organic Streaking in Sandy Soils
X	Gleyed or Low-Chroma Colors	X	Mottles
____	High Organic Content in Surface Layer	____	Other (Explain in Remarks)

Remarks (Describe soil disturbances, local variations, etc.):
Sulfidic odor in this soil test pit is very strong.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soils Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is this Sampling Point Within a Wetland? Yes X No ____

Remarks (If applicable, explain any differences between 1987 and 1989 delineation results):
All three wetland criteria have been satisfied, therefore this area is considered to be a wetland.

DRAFT

Parametrix, Inc.

Data Plot #: 3U-1
Wetland: N10

WETLAND DETERMINATION
(Modified from: 1987 COE Wetlands Delineation Manual)

Project/Site: Des Moines Way Nursery
Date: 10/10/01
Applicant/Owner: Port of Seattle
County: King
Investigator: M. Louther, B. Kleindl
State: WA
☑ 1987 Method ☐ 1989 Method
Community ID: Upland
Do Normal Circumstances exist on the site? Yes ___ No X
Field Plot ID: L3 U-1
Is the site significantly disturbed (Atypical Situation)? Yes ___ No X
Is the area a potential Problem Area? Yes ___ No X

Remarks (Explain sample location, disturbances, problem areas):
The plot is located in lawn area on the east side of the creek, near the foot bridge.

VEGETATION (✔Dominant species are checked)

		Plant Species	% Cover	Stratum	Indicator
	1.	Holcus lanatus	10	Herb	FAC
✔	2.	Phalaris arundinacea	30	Herb	FACW
	3.	Taraxacum officinale	Tr	Herb	FACU
	4.	Cytisus scoparius	10	Shrub	NL
✔	5.	Rubus discolor	20	Shrub	FACU
	6.	Rubus laciniatus	5	Shrub	FACU+
	7.	Alnus rubra	5	Tree	FAC

Percent of **Dominant Species** that are OBL, FACW, or FAC (except FAC-). Include species noted (*) as showing morphological adaptations to wetlands. "T" indicates trace. 50

Remarks (Describe disturbances, relevant local variations, seasonal effects, etc.):
Less then 50% of the dominant plant species are rated FAC or wetter, therfore the wetland vegetation criterion is not satified.

HYDROLOGY

Recorded Data (Describe in Remarks):
___ Stream, Lake, or Tide Gage
___ Aerial Photograph
___ Other
X No Recorded Data Available

Wetland Hydrology Indicators (Describe in Remarks):
Primary Indicators:
___ Inundated
___ Saturated in Upper 12 inches
___ Saturated in Upper 18 inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands

Field Observations:
Depth of Surface Water: 0 (in.)
Depth to Free Water in Pit: 0 (in.)
Depth to Saturated Soil: > 18 (in.)

Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 inches
___ Water-Stained Leaves
___ Local Soil Survey Data
___ Other (Explain in Remarks)

Remarks (As relevant, describe recent precipitation, hydrologic modifications, local variations, etc.):
No indicators of wetland hydrology are present in this area.

DRAFT

AR 006060

Parametrix, Inc.

Data Plot #: 3U-1
Wetland: N10

Project/Site: Des Moines Way Nursery Date: 10/10/01

SOILS

Soil Survey Data:

Map Unit Name: Everett gravelly sandy loam (1952) Drainage Class: _____

Field Observations Confirm Mapped Type?

Taxonomy (Subgroup): not developed in 1952 Yes ____ No X NA ____

Profile Description:

Depth (Inches)	Horizon Designation	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Rhizospheres, etc.
0-18		2.5 Y 4/3	none	none	Sandy loam w/crushed rock

Hydric Soil Indicators:

____ Histosol
____ Histic Epipedon
____ Sulfidic Odor
____ Probable Aquic Moisture Regime
____ Reducing Conditions
____ Gleyed or Low-Chroma Colors
____ High Organic Content in Surface Layer

____ Listed on Local Hydric Soils List
____ Listed on State Hydric Soils List
____ Listed on National Hydric Soils List
____ Aquic Moisture Regime
____ Organic Streaking in Sandy Soils
____ Mottles
____ Other (Explain in Remarks)

Remarks (Describe soil disturbances, local variations, etc.):
No evidence of hydric soil indicators are present.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes ____ No X
Hydric Soils Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is this Sampling Point Within a Wetland? Yes ____ No X

Remarks (If applicable, explain any differences between 1987 and 1989 delineation results):
None of the wetland indicators are present.

DRAFT

Parametrix, Inc.

Data Plot #: 3U-2
Wetland: N10

WETLAND DETERMINATION

(Modified from: 1987 COE Wetlands Delineation Manual)

Project/Site: Des Moines Way Nursery
Date: 10/10/01
Applicant/Owner: Port of Seattle
County: King
Investigator: M. Louther, B. Kleindl
State: WA
☑ 1987 Method ☐ 1989 Method
Community ID: Upland
Field Plot ID: L3 U2

Do Normal Circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical Situation)? Yes ____ No X
Is the area a potential Problem Area? Yes ____ No X

Remarks (Explain sample location, disturbances, problem areas):
The data plot is located in lawn on the west side of Miller Creek.

VEGETATION (✔Dominant species are checked)

		Plant Species	% Cover	Stratum	Indicator
✔	1.	Agrostis spp.	50	Herb	IAC
	2.	Holcus lanatus	5	Herb	FAC
	3.	Hypochaeris radicata	Tr	Herb	FACU
	4.	Taraxacum officinale	Tr	Herb	FACU

Percent of **Dominant Species** that are OBL, FACW, or FAC (except FAC-). Include species noted (*) as showing morphological adaptations to wetlands. "T" indicates trace. 50

Remarks (Describe disturbances, relevant local variations, seasonal effects, etc.):
Less then 50% of the dominant plant species are rated FAC or wetter, therfore the wetland vegetation criterion is not satified.

HYDROLOGY

Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gage
____ Aerial Photograph
____ Other
X No Recorded Data Available

Wetland Hydrology Indicators (Describe in Remarks):
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Saturated in Upper 18 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands

Field Observations:
Depth of Surface Water: 0 (in.)
Depth to Free Water in Pit: 0 (in.)
Depth to Saturated Soil: 0 (in.)

Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water-Stained Leaves
____ Local Soil Survey Data
____ Other (Explain in Remarks)

Remarks (As relevant, describe recent precipitation, hydrologic modifications, local variations, etc.):
No indicators of wetland hydrology are present in this area.

DRAFT

Parametrix, Inc.

Data Plot #: 3U-2
Wetland: N10

Project/Site: Des Moines Way Nursery Date: 10/10/01

SOILS

Soil Survey Data:

Map Unit Name: Everett gravelly sandy loam (1952) Drainage Class: _____

Field Observations Confirm Mapped Type?

Taxonomy (Subgroup): not developed in 1952 Yes ____ No X NA ____

Profile Description:

Depth (Inches)	Horizon Designation	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Rhizospheres, etc.
0-12		10 YR 2/2	none	none	Loam
12-18		10 YR 3/3	none	none	Silt loam

Hydric Soil Indicators:

____ Histosol
____ Histic Epipedon
____ Sulfidic Odor
____ Probable Aquic Moisture Regime
____ Reducing Conditions
____ Gleyed or Low-Chroma Colors
____ High Organic Content in Surface Layer

____ Listed on Local Hydric Soils List
____ Listed on State Hydric Soils List
____ Listed on National Hydric Soils List
____ Aquic Moisture Regime
____ Organic Streaking in Sandy Soils
____ Mottles
____ Other (Explain in Remarks)

Remarks (Describe soil disturbances, local variations, etc.):
No hydric soil indicators are present, therefore soils do not meet hydric soil criteria.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes ____ No X
Hydric Soils Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is this Sampling Point Within a Wetland? Yes ____ No X

Remarks (If applicable, explain any differences between 1987 and 1989 delineation results):
None of the wetland indicators are present.

DRAFT

AR 006063

Parametrix, Inc.

Data Plot #: 3W
Wetland: N10

WETLAND DETERMINATION

(Modified from: 1987 COE Wetlands Delineation Manual)

Project/Site: Des Moines Way Nursery
Date: 10/10/01
Applicant/Owner: Port of Seattle
County: King
Investigator: M. Louther, B. Kleindl
State: WA
☐ 1987 Method ☐ 1989 Method
Community ID: PEM
Field Plot ID: L-3W

Do Normal Circumstances exist on the site? Yes ____ No X
Is the site significantly disturbed (Atypical Situation)? Yes ____ No X
Is the area a potential Problem Area? Yes ____ No X

Remarks (Explain sample location, disturbances, problem areas):
The data plot is located on the east side of Miller Creek, in wetland Loop #3. A portion of the wetland is mowed.

VEGETATION (✔Dominant species are checked)

		Plant Species	% Cover	Stratum	Indicator
	1.	Equisetum arvense	1	Herb	FAC
✔	2.	Phalaris arundinacea	95	Herb	FACW
	3.	Rubus discolor	1	Shrub	FACU

Percent of **Dominant Species** that are OBL, FACW, or FAC (except FAC-). Include species noted (*) as showing morphological adaptations to wetlands. "T" indicates trace. 100

Remarks (Describe disturbances, relevant local variations, seasonal effects, etc.):
Greater then 50% of the dominant species are FAC or wetter; therefore the wetland vegetation criterion is met.

HYDROLOGY

Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gage
____ Aerial Photograph
____ Other
X No Recorded Data Available

Wetland Hydrology Indicators (Describe in Remarks):
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Saturated in Upper 18 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
X Drainage Patterns in Wetlands

Field Observations:
Depth of Surface Water: 0 (in.)
Depth to Free Water in Pit: 0 (in.)
Depth to Saturated Soil: > 18 (in.)

Secondary Indicators (2 or more required):
X Oxidized Root Channels in Upper 12 inches
____ Water-Stained Leaves
____ Local Soil Survey Data
____ Other (Explain in Remarks)

Remarks (As relevant, describe recent precipitation, hydrologic modifications, local variations, etc.):
Wetland hydrology is assumed due to the presence of hydric soil conditions, oxidized rhizopheres, and the presence of hydrophtic vegetation.

DRAFT

Parametrix, Inc.

Data Plot #: 3W
Wetland: N10

Project/Site: Des Moines Way Nursery Date: 10/10/01

SOILS

Soil Survey Data:

Map Unit Name: Everett gravelly sandy loam (1952) Drainage Class: _____

Field Observations Confirm Mapped Type?

Taxonomy (Subgroup): not developed in 1952 Yes ____ No X NA ____

Profile Description:

Depth (Inches)	Horizon Designation	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Rhizospheres, etc.
0-10		10 YR 4/1	none	none	loam
10-18		10 YR 6/1	none	none	silt with diatomaceous earth inclusions

Hydric Soil Indicators:

____ Histosol	____ Listed on Local Hydric Soils List
____ Histic Epipedon	____ Listed on State Hydric Soils List
____ Sulfidic Odor	____ Listed on National Hydric Soils List
____ Probable Aquic Moisture Regime	____ Aquic Moisture Regime
____ Reducing Conditions	____ Organic Streaking in Sandy Soils
X Gleyed or Low-Chroma Colors	____ Mottles
____ High Organic Content in Surface Layer	____ Other (Explain in Remarks)

Remarks (Describe soil disturbances, local variations, etc.):

Hydric soil indicators are present.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soils Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is this Sampling Point Within a Wetland? Yes X No ____

Remarks (If applicable, explain any differences between 1987 and 1989 delineation results):

All three wetland criterion are met.

DRAFT

ATTACHMENT B

WETLAND RATING FORMS FOR WETLANDS N8, N9, AND N10 ON THE DES MOINES WAY NURSERY SITE

Wetlands Rating Field Data Form

Background Information:

Name of Rater: Marti Louther Affiliation: Parametrix Date: Oct 13, 2001

Name of wetland (if known): Wetland N9

Government Jurisdiction of wetland: City of SeaTac

Location: 1/4 Section: _____ of 1/4 S: _____ Section: 20 Township: 23N Range: 4E

Sources of Information: (Check all sources that apply)

Site visit: X USGS Topo Map: ____ NWI map: ____ Aerial Photo: X Soils survey: X

Other: ___ Describe: _____

When The Field Data form is complete enter Category here: 3

Q.1. High Quality Natural Wetland

Circle Answers

Answer this question if you have adequate information or experience to do so. If not find someone with the expertise to answer the questions. Then, if the answer to questions 1a, 1b and 1c are all NO, contact the Natural Heritage program of DNR.

1a. Human caused disturbances.

Is there significant evidence of human-caused changes to topography or hydrology of the wetland as indicated by any of the following conditions? Consider only changes that may have taken place in the last 5 decades. The impacts of changes done earlier have probably been stabilized and the wetland ecosystem will be close to reaching some new equilibrium that may represent a high quality wetland.

1a1. Upstream watershed > 12% impervious.	Yes: go to Q.2
1a2. Wetland is ditched and water flow is not obstructed.	Yes: go to Q.2
1a3. Wetland has been graded, filled, logged.	(Yes: go to Q.2)
1a4. Water in wetland is controlled by dikes, weirs, etc.	Yes: go to Q.2
1a5. Wetland is grazed.	Yes: go to Q.2
1a6. Other indicators of disturbance (list below)	Yes: go to Q.2
	No: go to 1b.

_____

_____

_____

_____

1b Are there populations of non-native plants which are currently present, cover more than 10% of the wetland, and appear to be invading native populations? Briefly describe any non-native plant populations and Information source(s):_____	YES: go to Q.2 No: go to 1c.
1c. Is there evidence of human-caused disturbances which have visibly degraded water quality. Evidence of the degradation of water quality include: direct (untreated) runoff from roads or parking lots; presence, or historic evidence, of waste dumps; oily sheens; the smell of organic chemicals; or lifestock use. Briefly describe:	YES: go to Q.2 NO: Possible Cat. I contact DNR
Q.2. Irreplaceable Ecological Functions: Does the wetland: ⊕ have at least 1/4 acre of organic soils deeper than 16 inches and the wetland is relatively undisturbed; OR [IIf the answer is NO because the wetland is disturbed briefly describe: Indicators of disturbance may include: - Wetland has been graded, filled, logged; - Organic soils on the surface are dried-out for more than half of the year; - Wetland receives direct stormwater runoff from urban or agricultural areas.]; OR ⊕ have a forested class greater than 1 acre; OR ⊕ have characteristics of an estuarine system; OR ⊕ have eel grass, floating or non-floating kelp beds?	(NO to all: go to Q.3) YES go to 2a YES: Go to 2b YES: Go to 2c YES: Go to 2d
2a. Bogs and Fens Are any of the three following conditions met for the area of organic soil? 2a.1. Are Sphagnum mosses a common ground cover (>30%) and the cover of invasive species (see Table 3) is less than 10%? Is the area of sphagnum mosses and deep organic soils > 1/2 acre? Is the area of sphagnum mosses and deep organic soils 1/4-1/2 acre? 2a.2. Is there an area of organic soil which has an emergent class with at least one species from Table 2, and cover of invasive species is < 10% (see Table 3)? Is the area of herbaceous plants and deep organic soils > 1/2 acre? Is the area of herbaceous plants and deep organic soils 1/4-1/2 acre?	YES: Category I YES: Category II NO: Go to 2a.3 YES: Category I YES: Category II NO: Go to 2a.3

2a.3. Is the vegetation a mixture of only herbaceous plants and Sphagnum mosses with no scrub/shrub or forested classes? Is the area of herbaceous plants, Sphagnum, and deep organic soils > 1/2 acre? Is the area of herbaceous plants, Sphagnum, and deep organic soils 1/4-1/2 acre?	YES: Category I YES: Category II NO: Go to Q.3.
Q.2b. Mature forested wetland. 2b.1. Does 50% of the cover of upper forest canopy consist of evergreen trees older than 80 years or deciduous trees older than 50 years? ***Note:*** The size of trees is often not a measure of age, and size cannot be used as a surrogate for age (see guidance). 2b.2. Does 50% of the cover of forest canopy consist of evergreen trees older than 50 years, AND is the structural diversity of the forest high as characterized by an additional layer of trees 20'-49' tall, shrubs 6' - 20', tall, and a herbaceous groundcover? 2b.3. Does < 25% of the areal cover in the herbaceous/groundcover or the shrub layer consist of invasive/exotic plant species from the list on p. 19?	YES: Category I NO: Go to 2b.2 YES: Go to 2b.3 NO: Go to Q.3 YES: Category I NO: Go to Q.3
Q.2c. Estuarine wetlands. 2c1. Is the wetland listed as National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park, or Educational, Environmental or Scientific Reserves designated under WAC 332-30-151? . . . . . 2c.2. Is the wetland > 5 acres; . . . . . . ***Note:*** If an area contains patches of salt tolerant vegetation that are 1) less than 600 feet apart and that are separated by mudflats that go dry on a Mean Low Tide, or 2) separated by tidal channels that are less than 100 feet wide; all the vegetated areas are to be considered together in calculating the wetland area. or is the wetland 1-5 acres; . . . . . . or is the wetland < 1 acre?.	YES: Category I NO: Go to 2c.2 YES: Category I YES: Go to 2c.3 YES: Go to 2c.4

2c.3. Does the wetland meet at least 3 of the following 4 criteria: . . . . . - minimum existing evidence of human related disturbance such as diking, ditching, filling, cultivation, grazing or the presence of non-native plant species (see guidance for definition); - surface water connection with tidal saltwater or tidal freshwater; - at least 75% of the wetland has a 100' buffer of ungrazed pasture, open water, shrub or forest; - has at least 3 of the following features: low marsh; high marsh; tidal channels; lagoon(s);woody debris; or contiguous freshwater wetland.	YES: Category I NO: Category II
2c.4. Does the wetland meet all of the four criteria under 2c3. (above)?. .	YES: Category II NO: Category III
Q.2d. Eel Grass and Kelp Beds. 2d.1. Are eel grass beds present?.	YES: Category I NO: go to 2d.2
2d.2. Are there floating or non-floating kelp bed(s) present with greater than 50% macro algal cover in the month of August or September?	YES: Category I NO: Category II
Q.3. Category IV wetlands. 3a. Is the wetland: less than 1 acre and, hydrologically isolated and, comprised of one vegetated class that is dominated (> 80% areal cover) by one species from Table 3 (page 19) or Table 4 (page 20)	YES: Category IV NO: go to 3b
3b. Is the wetland: less than two acres and, hydrologically isolated, with one vegetated class, and > 90% of areal cover is any combination of species from Table 3 (page 19)	YES: Category IV NO: go to 3c
3c. Is the wetland excavated from upland and a pond smaller than 1 acre without a surface water connection to streams, lakes, rivers, or other wetland, and has < 0.1 acre of vegetation.	YES: Category IV NO: go to Q.4

Q.4. Significant habitat value.

Answer all questions and enter data requested.

4a. Total wetland area

Estimate area, select from choices in the near-right column, and score in the far column:

Enter acreage of wetland here: 0.08 acres, and source: Survey

Circle scores that qualify

acres	points
> 200	6
40- 200	5
10 - 40	4
5 - 10	3
1 - 5	2
0.1 - 1	1
(< 0.1	0)

4b. Wetland classes: Circle the wetland classes below that qualify:

Open Water: if the area of open water is > 1/4 acre

Aquatic Beds: if the area of aquatic beds > 1/4 acre,

Emergent: if the area of emergent class is > 1/4 acre,

Scrub-Shrub: if the area of scrub-shrub class is > 1/4 acre,

Forested: if area of forested class is > 1/4 acre,

Add the number of wetland classes, above, that qualify, and then score according to the columns at right.

e.g. If there are 4 classes (aquatic beds, open water, emergent & scrub- shrub), you would circle 8 points in the far right column.

# of classes	Points
(1	0)
2	3
3	6
4	8
5	10

4c. Plant species diversity.

For each wetland class (at right) that qualifies in 4b above, count the number of different plant species you can find that cover more than 5% of the ground. You do not have to name them.

Score in column at far right:

e.g. If a wetland has an aquatic bed class with 3 species, an emergent class with 4 species and a scrub-shrub class with 2 species you would circle 2, 2, and 1 in the far column.

Note: Any plant species with a cover of > 5% qualifies for points within a class, even those that are not of that class.

Class	# species in class	Points
Aquatic Bed	1	0
	2	1
	3	2
	> 3	3
Emergent	1	0
	2-3	1
	4-5	2
	> 5	3
Scrub-Shrub	1	0
	2	1
	3-4	2
	> 4	3
Forested	1	0
	2	1
	3-4	2
	(> 4	3)

4d. Structural diversity.
If the wetland has a forested class, add 1 point if each of the following classes is present within the forested class and is larger than 1/4 acre:

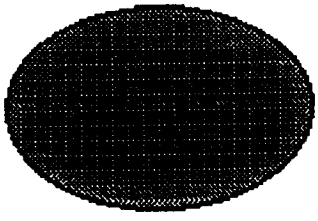
-trees > 50' tall	YES - 1
-trees 20'- 49' tall	YES - 1
-shrubs	YES - 1
-herbaceous ground cover	YES - 1

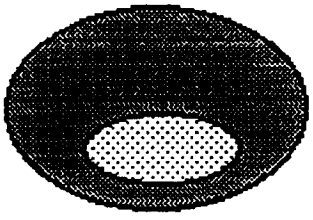
wetland is only 0.08 acres; therefore none apply.

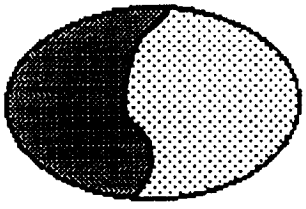
Also add 1 point if there is any "open water" or "aquatic bed" class immediately next to the forested area (ie. there is no scrub/shrub or emergent vegetation between them). — YES - 1

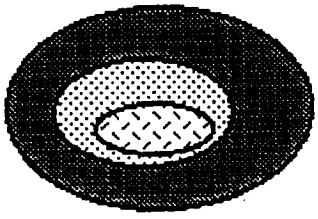
4e. Decide from the diagrams below whether interspersion between wetland classes is high, moderate, low or none? If you think the amount of interspersion falls in between the diagrams score accordingly (i.e. a moderately high amount of insterspersion would score a 4, while a moderately low amount would score a 2)

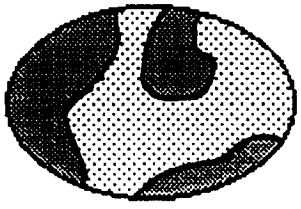
High - 5
Moderate - 3
Low - 1
(None - 0)

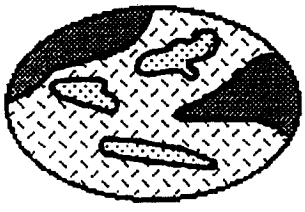

none


low


low


moderate


moderate


high

4f. Habitat features.
Answer questions below, circle features that apply, and score to right:

Is there evidence that the open or standing water was caused by beavers	YES = 2
Is a heron rookery located within 300'?	YES = 1
Are raptor nest/s located within 300'?	YES = 1
Are there at least 3 standing dead trees (snags) per acre greater than 10" in diameter at "breast height" (DBH)?.	YES = 1
Are there at least 3 downed logs per acre with a diameter > 6" for at least 10' in length?	YES = 1
Are there areas (vegetated or unvegetated) within the wetland that are ponded for at least 4 months out of the year, and the wetland has not qualified as having an open water class in Question 4b. ?	YES = 2

4g. Connection to streams. (Score one answer only.) 4g.1. Does the wetland provide habitat for fish at any time of the year AND does it have a perennial surface water connection to a fish bearing stream.	YES = 6
4g.2 Does the wetland provide fish habitat seasonally AND does it have a seasonal surface water connection to a fish bearing stream.	YES = 4
4g.3 Does the wetland function to export organic matter through a surface water connection at all times of the year to a perennial stream.	(YES = 4)
4g.4 Does the wetland function to export organic matter through a surface water connection to a stream on a seasonal basis?	YES = 2
4h. Buffers. Score the existing buffers on a scale of 1-5 based on the following four descriptions. If the condition of the buffers do not exactly match the description, score either a point higher or lower depending on whether the buffers are less or more degraded.	
Forest, scrub, native grassland or open water buffers are present for more than 100' around 95% of the circumference.	Score = 5
Forest, scrub, native grassland, or open water buffers wider than 100' for more than 1/2 of the wetland circumference, or a forest, scrub, grasslands, or open water buffers for more than 50' around 95% of the circumference.	Score = 3
Forest, scrub, native grassland, or open water buffers wider than 100' for more than 1/4 of the wetland circumference, or a forest, scrub, native grassland, or open water buffers wider than 50' for more than 1/2 of the wetland circumference.	Score = 2
No roads, buildings or paved areas within 100' of the wetland for more than 95% of the wetland circumference.	Score = 2
No roads, buildings or paved areas within 25' of the wetland for more than 95% of the circumference, or No roads buildings or paved areas within 50' of the wetland for more than 1/2 of the wetland circumference.	(Score = 1)
Paved areas, industrial areas or residential construction (with less than 50' between houses) are less than 25 feet from the wetland for more than 95% of the circumference of the wetland.	Score = 0

4i. Connection to other habitat areas: Select the description which best matches the site being evaluated. -Is the wetland connected to, or part of, a riparian corridor at least 100' wide connecting two or more wetlands; or, is there an upland connection present >100' wide with good forest or shrub cover (>25% cover) connecting it with a Significant Habitat Area?	YES = 5
- Is the wetland connected to any other Habitat Area with either 1) a forested/shrub corridor < 100' wide, or 2) a a corridor that is > 100' wide, but has a low vegetative cover less than 6 feet in height?	(YES = 3)
-Is the wetland connected to, or a part of, a riparian corridor between 50 - 100' wide with scrub/shrub or forest cover connection to other wetlands?	YES = 3
- Is the wetland connected to any other Habitat Area with narrow corridor (<100') of low vegetation (< 6' in height)?	YES = 1
- Is the wetland and its buffer (if the buffer is less than 50' wide) completely isolated by development (urban, residential with a density greater than 2/acre, or industrial)?	YES = 0
Now add the scores circled (for Q.5a - Q.5i above) to get a total. **Is the Total greater than or equal to 22 points?** (11 pts.)	**YES = Category II** **(NO = Category III)**

Wetlands Rating Field Data Form

Background Information:

Name of Rater: Mark Louther Affiliation: Parametrix, Inc. Date: Oct 13, 2001

Name of wetland (if known): Wetlands N8 & N10

Government Jurisdiction of wetland: City of SeaTac, WA

Location: 1/4 Section: _____ of 1/4 S: _____ Section: 20 Township: 23N Range: 4E

Sources of Information: (Check all sources that apply)

Site visit: X USGS Topo Map: ____ NWI map: ____ Aerial Photo: X Soils survey: X

Other: ___ Describe: _____

When The Field Data form is complete enter Category here: 3

Q.1. High Quality Natural Wetland

Circle Answers

Answer this question if you have adequate information or experience to do so. If not find someone with the expertise to answer the questions. Then, if the answer to questions 1a, 1b and 1c are all NO, contact the Natural Heritage program of DNR.

1a. Human caused disturbances.

Is there significant evidence of human-caused changes to topography or hydrology of the wetland as indicated by any of the following conditions? Consider only changes that may have taken place in the last 5 decades. The impacts of changes done earlier have probably been stabilized and the wetland ecosystem will be close to reaching some new equilibrium that may represent a high quality wetland.

1a1. Upstream watershed > 12% impervious.	Yes: go to Q.2
1a2. Wetland is ditched and water flow is not obstructed.	Yes: go to Q.2
1a3. Wetland has been graded, filled, logged.	(Yes:) go to Q.2
1a4. Water in wetland is controlled by dikes, weirs, etc.	Yes: go to Q.2
1a5. Wetland is grazed.	Yes: go to Q.2
1a6. Other indicators of disturbance (list below)	Yes: go to Q.2
Wetland is mowed with kitchen gardens located in a portion of it.	No: go to 1b.

1b Are there populations of non-native plants which are currently present, cover more than 10% of the wetland, and appear to be invading native populations? Briefly describe any non-native plant populations and Information source(s):_____	YES: go to Q.2 No: go to 1c.
1c. Is there evidence of human-caused disturbances which have visibly degraded water quality. Evidence of the degradation of water quality include: direct (untreated) runoff from roads or parking lots; presence, or historic evidence, of waste dumps; oily sheens; the smell of organic chemicals; or lifestock use. Briefly describe:	YES: go to Q.2 NO: Possible Cat. I contact DNR
Q.2. Irreplaceable Ecological Functions: Does the wetland: ⊕ have at least 1/4 acre of organic soils deeper than 16 inches and the wetland is relatively undisturbed; OR [IIf the answer is NO because the wetland is disturbed briefly describe: Indicators of disturbance may include: - Wetland has been graded, filled, logged; - Organic soils on the surface are dried-out for more than half of the year; - Wetland receives direct stormwater runoff from urban or agricultural areas.]; OR	(NO to all: go to Q.3) YES go to 2a
⊕ have a forested class greater than 1 acre; OR ⊕ have characteristics of an estuarine system; OR ⊕ have eel grass, floating or non-floating kelp beds?	YES: Go to 2b YES: Go to 2c YES: Go to 2d
2a. Bogs and Fens Are any of the three following conditions met for the area of organic soil? 2a.1. Are Sphagnum mosses a common ground cover (>30%) and the cover of invasive species (see Table 3) is less than 10%? Is the area of sphagnum mosses and deep organic soils > 1/2 acre? Is the area of sphagnum mosses and deep organic soils 1/4-1/2 acre? 2a.2. Is there an area of organic soil which has an emergent class with at least one species from Table 2, and cover of invasive species is < 10% (see Table 3)? Is the area of herbaceous plants and deep organic soils > 1/2 acre? Is the area of herbaceous plants and deep organic soils 1/4-1/2 acre?	YES: Category I YES: Category II NO: Go to 2a.3 YES: Category I YES: Category II NO: Go to 2a.3

2a.3. Is the vegetation a mixture of only herbaceous plants and Sphagnum mosses with no scrub/shrub or forested classes? Is the area of herbaceous plants, Sphagnum, and deep organic soils > 1/2 acre? Is the area of herbaceous plants, Sphagnum, and deep organic soils 1/4-1/2 acre?	YES: Category I YES: Category II NO: Go to Q.3.
Q.2b. Mature forested wetland. 2b.1. Does 50% of the cover of upper forest canopy consist of evergreen trees older than 80 years or deciduous trees older than 50 years? ***Note:*** The size of trees is often not a measure of age, and size cannot be used as a surrogate for age (see guidance). 2b.2. Does 50% of the cover of forest canopy consist of evergreen trees older than 50 years, AND is the structural diversity of the forest high as characterized by an additional layer of trees 20'-49' tall, shrubs 6' - 20', tall, and a herbaceous groundcover? 2b.3. Does < 25% of the areal cover in the herbaceous/groundcover or the shrub layer consist of invasive/exotic plant species from the list on p. 19?	YES: Category I NO: Go to 2b.2 YES: Go to 2b.3 NO: Go to Q.3 YES: Category I NO: Go to Q.3
Q.2c. Estuarine wetlands. 2c1. Is the wetland listed as National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park, or Educational, Environmental or Scientific Reserves designated under WAC 332-30-151? . . . . . 2c.2. Is the wetland > 5 acres; . . . . . . ***Note:*** If an area contains patches of salt tolerant vegetation that are 1) less than 600 feet apart and that are separated by mudflats that go dry on a Mean Low Tide, or 2) separated by tidal channels that are less than 100 feet wide; all the vegetated areas are to be considered together in calculating the wetland area. or is the wetland 1-5 acres; . . . . . . or is the wetland < 1 acre?.	YES: Category I NO: Go to 2c.2 YES: Category I YES: Go to 2c.3 YES: Go to 2c.4

2c.3. Does the wetland meet at least 3 of the following 4 criteria: . . . . . - minimum existing evidence of human related disturbance such as diking, ditching, filling, cultivation, grazing or the presence of non-native plant species (see guidance for definition); - surface water connection with tidal saltwater or tidal freshwater; - at least 75% of the wetland has a 100' buffer of ungrazed pasture, open water, shrub or forest; - has at least 3 of the following features: low marsh; high marsh; tidal channels; lagoon(s);woody debris; or contiguous freshwater wetland.	YES: Category I NO: Category II
2c.4. Does the wetland meet all of the four criteria under 2c3. (above)?. .	YES: Category II NO: Category III
Q.2d. Eel Grass and Kelp Beds. 2d.1. Are eel grass beds present?.	YES: Category I NO: go to 2d.2
2d.2. Are there floating or non-floating kelp bed(s) present with greater than 50% macro algal cover in the month of August or September?	YES: Category I NO: Category II
Q.3. Category IV wetlands. 3a. Is the wetland: less than 1 acre and, (YES) hydrologically isolated and, (NO) comprised of one vegetated class that is dominated (> 80% areal cover) by one species from Table 3 (page 19) or Table 4 (page 20)	YES: Category IV NO: go to 3b
3b. Is the wetland: less than two acres and, hydrologically isolated, with one vegetated class, and > 90% of areal cover is any combination of species from Table 3 (page 19)	YES: Category IV NO: go to 3c
3c. Is the wetland excavated from upland and a pond smaller than 1 acre without a surface water connection to streams, lakes, rivers, or other wetland, and has < 0.1 acre of vegetation.	YES: Category IV NO: go to Q.4

Q.4. Significant habitat value.

Answer all questions and enter data requested.

4a. Total wetland area

Estimate area, select from choices in the near-right column, and score in the far column:

Enter acreage of wetland here: 0.66 acres, and source: Survey (N8)
0.13 ac " " Survey (N10)

Circle scores that qualify

acres	points
> 200	6
40- 200	5
10 - 40	4
5 - 10	3
1 - 5	2
0.1 - 1	(1)
< 0.1	0

4b. Wetland classes: Circle the wetland classes below that qualify:

Open Water: if the area of open water is > 1/4 acre

Aquatic Beds: if the area of aquatic beds > 1/4 acre,

Emergent: if the area of emergent class is > 1/4 acre,

Scrub-Shrub: if the area of scrub-shrub class is > 1/4 acre,

Forested: if area of forested class is > 1/4 acre,

Add the number of wetland classes, above, that qualify, and then score according to the columns at right.

e.g. If there are 4 classes (aquatic beds, open water, emergent & scrub- shrub), you would circle 8 points in the far right column.

# of classes	Points
(1	0)
2	3
3	6
4	8
5	10

4c. Plant species diversity.

For each wetland class (at right) that qualifies in 4b above, count the number of different plant species you can find that cover more than 5% of the ground. You do not have to name them.

Score in column at far right:

e.g. If a wetland has an aquatic bed class with 3 species, an emergent class with 4 species and a scrub-shrub class with 2 species you would circle 2, 2, and 1 in the far column.

Note: Any plant species with a cover of > 5% qualifies for points within a class, even those that are not of that class.

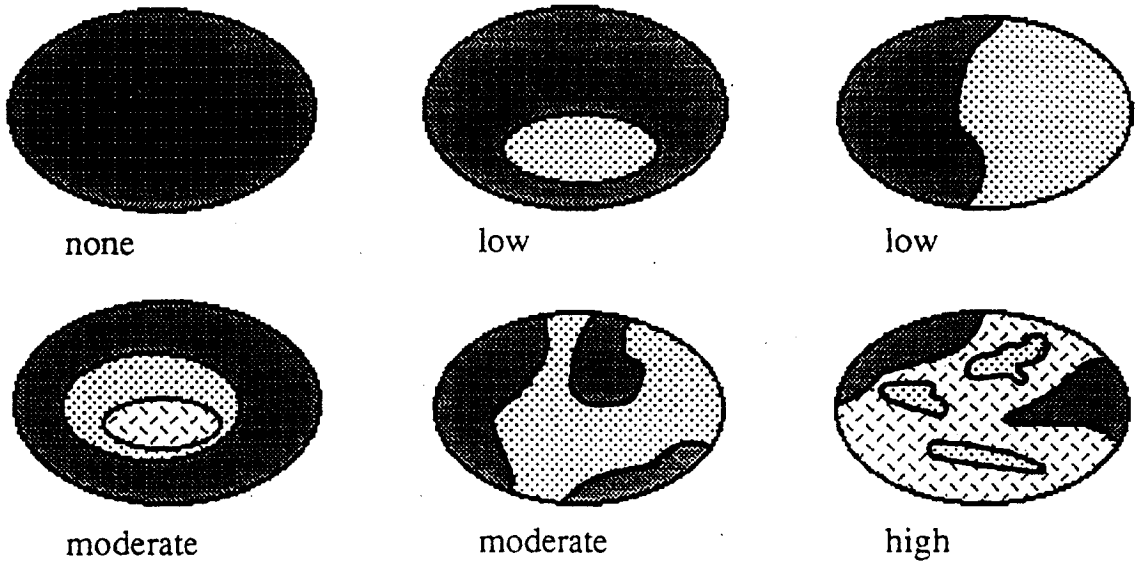
Class	# species in class	Points
Aquatic Bed	1	0
	2	1
	3	2
	> 3	3
Emergent	1	0
	2-3	1
	4-5	2
	(> 5	3)
Scrub-Shrub	1	0
	2	1
	3-4	2
	> 4	3
Forested	1	0
	2	1
	3-4	2
	> 4	3

4d. Structural diversity.
If the wetland has a forested class, add 1 point if each of the following classes is present within the forested class and is larger than 1/4 acre:

-trees > 50' tall	YES - 1
-trees 20'- 49' tall	YES - 1
-shrubs	YES - 1
-herbaceous ground cover	(YES - 1)
Also add 1 point if there is any "open water" or "aquatic bed" class immediately next to the forested area (ie. there is no scrub/shrub or emergent vegetation between them).	YES - 1

4e. Decide from the diagrams below whether interspersion between wetland classes is high, moderate, low or none? If you think the amount of interspersion falls in between the diagrams score accordingly (i.e. a moderately high amount of insterspersion would score a 4, while a moderately low amount would score a 2)

High - 5
Moderate - 3
Low - 1
(None - 0)



none | low | low

moderate | moderate | high

4f. Habitat features.
Answer questions below, circle features that apply, and score to right:

Is there evidence that the open or standing water was caused by beavers	YES = 2
Is a heron rookery located within 300'?	YES = 1
Are raptor nest/s located within 300'?	YES = 1
Are there at least 3 standing dead trees (snags) per acre greater than 10" in diameter at "breast height" (DBH)?.	YES = 1
Are there at least 3 downed logs per acre with a diameter > 6" for at least 10' in length?	YES = 1
Are there areas (vegetated or unvegetated) within the wetland that are ponded for at least 4 months out of the year, and the wetland has not qualified as having an open water class in Question 4b. ?	YES = 2

4g. Connection to streams. (Score one answer only.) 4g.1. Does the wetland provide habitat for fish at any time of the year AND does it have a perennial surface water connection to a fish bearing stream.	YES = 6
4g.2 Does the wetland provide fish habitat seasonally AND does it have a seasonal surface water connection to a fish bearing stream.	YES = 4
4g.3 Does the wetland function to export organic matter through a surface water connection at all times of the year to a perennial stream.	(YES = 4)
4g.4 Does the wetland function to export organic matter through a surface water connection to a stream on a seasonal basis?	YES = 2
4h. Buffers. Score the existing buffers on a scale of 1-5 based on the following four descriptions. If the condition of the buffers do not exactly match the description, score either a point higher or lower depending on whether the buffers are less or more degraded.	
Forest, scrub, native grassland or open water buffers are present for more than 100' around 95% of the circumference.	Score = 5
Forest, scrub, native grassland, or open water buffers wider than 100' for more than 1/2 of the wetland circumference, or a forest, scrub, grasslands, or open water buffers for more than 50' around 95% of the circumference.	Score = 3
Forest, scrub, native grassland, or open water buffers wider than 100' for more than 1/4 of the wetland circumference, or a forest, scrub, native grassland, or open water buffers wider than 50' for more than 1/2 of the wetland circumference.	Score = 2
No roads, buildings or paved areas within 100' of the wetland for more than 95% of the wetland circumference.	Score = 2
No roads, buildings or paved areas within 25' of the wetland for more than 95% of the circumference, or No roads buildings or paved areas within 50' of the wetland for more than 1/2 of the wetland circumference.	(Score = 1)
Paved areas, industrial areas or residential construction (with less than 50' between houses) are less than 25 feet from the wetland for more than 95% of the circumference of the wetland.	Score = 0

4i. Connection to other habitat areas: Select the description which best matches the site being evaluated. -Is the wetland connected to, or part of, a riparian corridor at least 100' wide connecting two or more wetlands; or, is there an upland connection present >100' wide with good forest or shrub cover (>25% cover) connecting it with a Significant Habitat Area?	YES = 5
- Is the wetland connected to any other Habitat Area with either 1) a forested/shrub corridor < 100' wide, or 2) a a corridor that is > 100'wide, but has a low vegetative cover less than 6 feet in height?	YES = 3
-Is the wetland connected to, or a part of, a riparian corridor between 50 - 100' wide with scrub/shrub or forest cover connection to other wetlands?	(YES = 3)
- Is the wetland connected to any other Habitat Area with narrow corridor (<100') of low vegetation (< 6' in height)?	YES = 1
- Is the wetland and its buffer (if the buffer is less than 50' wide) completely isolated by development (urban, residential with a density greater than 2/acre, or industrial)?	YES = 0

Now add the scores circled (for Q.5a - Q.5i above) to get a total.

Is the Total greater than or equal to 22 points? (13 pts)

YES = Category II

(NO = Category III)

ATTACHMENT C

HYDRAULIC ANALYSIS OF MILLER CREEK AT THE DES MOINES CREEK NURSERY SITE

DES MOINES WAY NURSERY
HEC-RAS HYDROLOGIC ANALYSIS SUMMARY

INTRODUCTION

A HEC-RAS model was assembled in order to evaluate the hydraulics of Miller Creek through the Des Moines Way Nursery site. HEC-RAS calculates water surface profiles and channel hydraulics for one-dimensional, steady and unsteady flow, and the results are presented in this attachment. This analysis indicates that wetland hydrology on the nursery site is not typically maintained by Miller Creek

METHODOLOGY

The cross-sectional data of the creek channel was based on survey data collected in the field during October 2001 using a level instrument and rod. The cross-sectional data was augmented with data in the overbank area from previous aerial mapping and additional field survey.

A frequency analysis was performed on simulated flow data from an existing HSPF hydrologic model of the Miller Creek basin in order to obtain peak flow rates for the nursery site reach (RCHRES 33). The HSPF model is based on 1994 land cover conditions. The HEC-RAS model was run in the steady state mode using the peak flows summarized below.

Table 1: Flow Frequency Analysis Summary

Return Frequency	Peak Flow (cfs)
Annual	13.0
2-year	32.1
10-year	60.0
25-year	77.2
100-year	107.2

The model was run with two different downstream boundary conditions: one with normal depth based on channel slope and the other with the Miller Creek Detention Facility (MCDF) in overflow (water surface elevation 274.5).

RESULTS

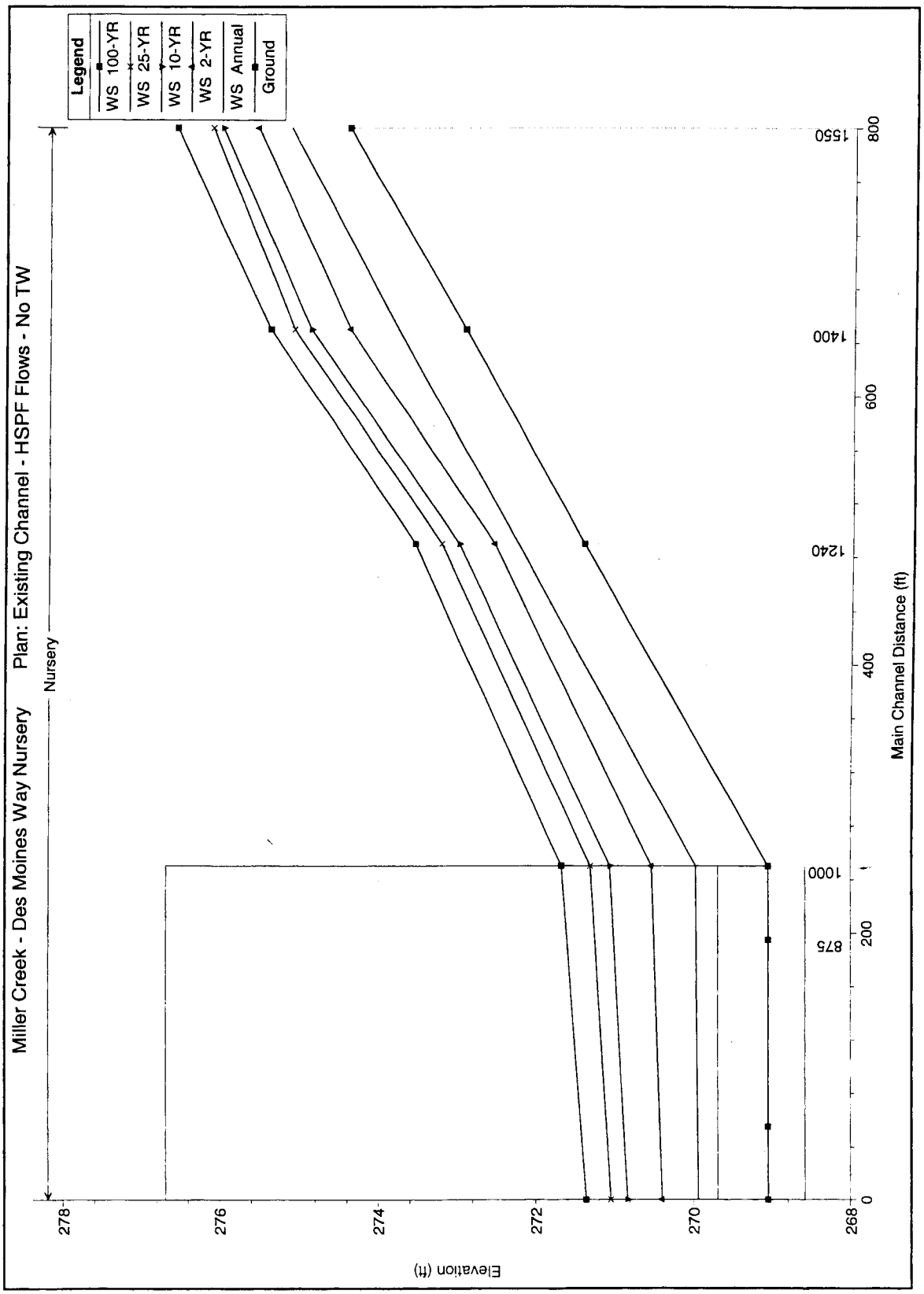
The results show that the water surface elevation of the reach of Miller Creek through the Des Moines Way Nursery site is highly dependent on the tailwater condition in the MCDF. With normal downstream water surface elevation, the creek begins to overtop the banks between the 2-year and 10-year peak flow rate. The maximum extent of ponding is approximately 50 feet wide at the 100-year return frequency. With the MCDF at flood stage, the creek backwaters overtop the banks ponding in a zone approximately 80 feet wide for the 100-year peak flow rate.

Table 2: Simulated Water Surface Elevation with Normal Tailwater

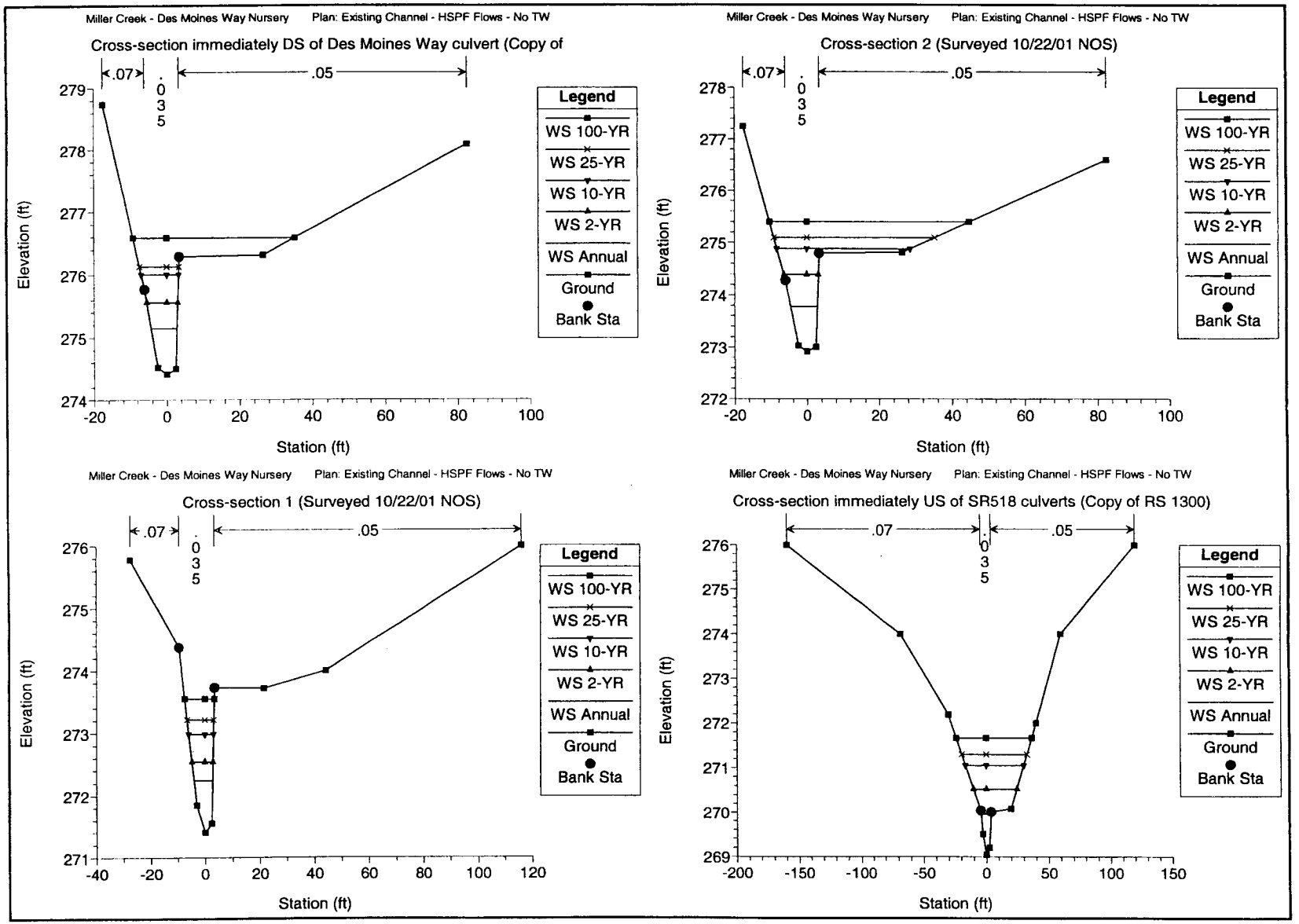
River Station	Min. Channel Elevation (ft)	Left Overbank Elevation (ft)	Right Overbank Elevation (ft)	Water Surface Elevation 2-Year (ft)	25-Year (ft)	100-Year (ft)
750	269.05	271.38	271.38	270.40	271.05	271.36
1000	269.05	270.04	270.01	270.53	271.30	271.67
1240	271.40	274.37	273.73	272.54	273.21	273.55
1400	272.92	274.28	274.80	274.39	275.10	275.40
1550	274.41	275.77	276.29	275.56	276.13	276.59

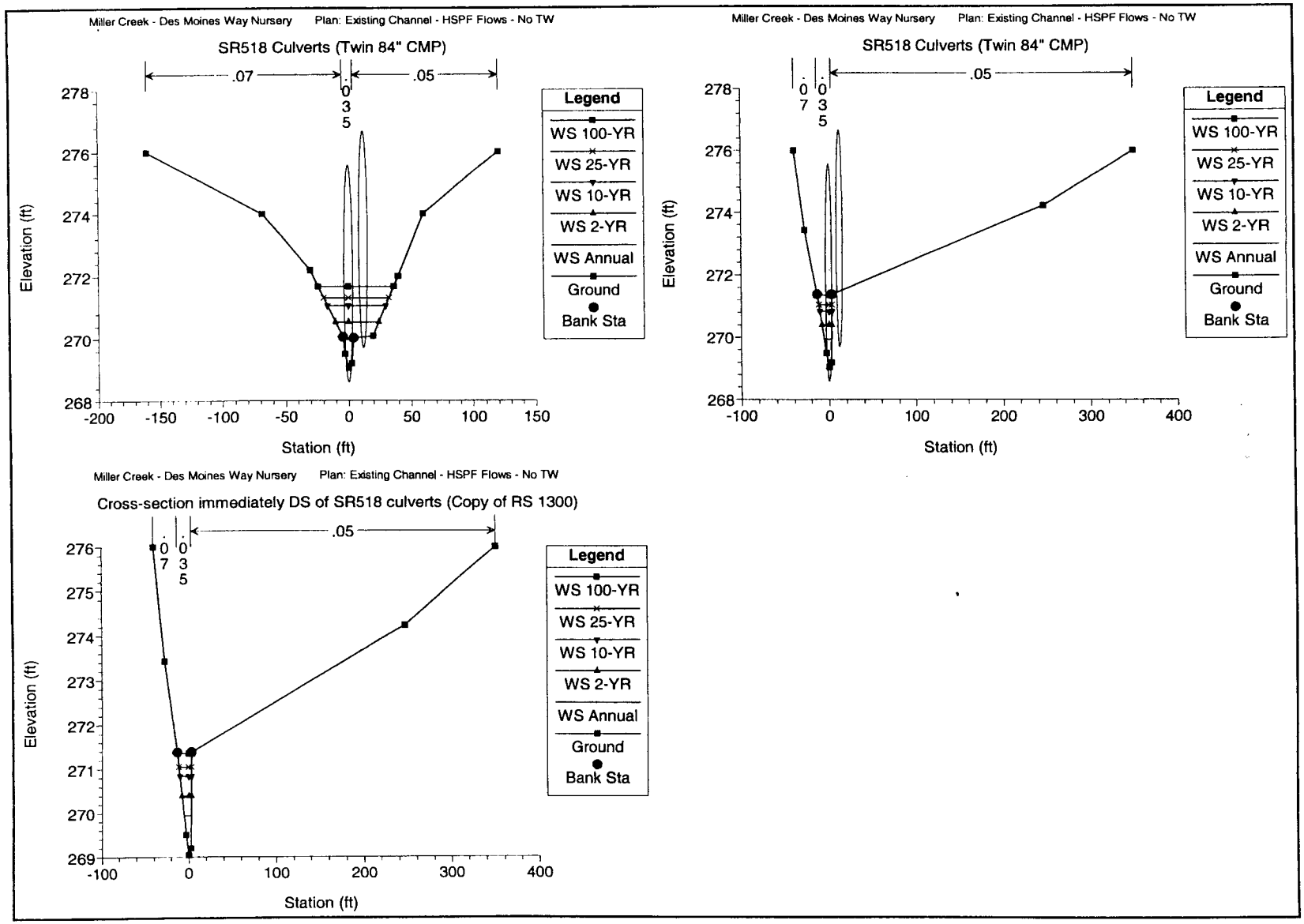
Table 3: Simulated Water Surface Elevation with Flood Stage Tailwater

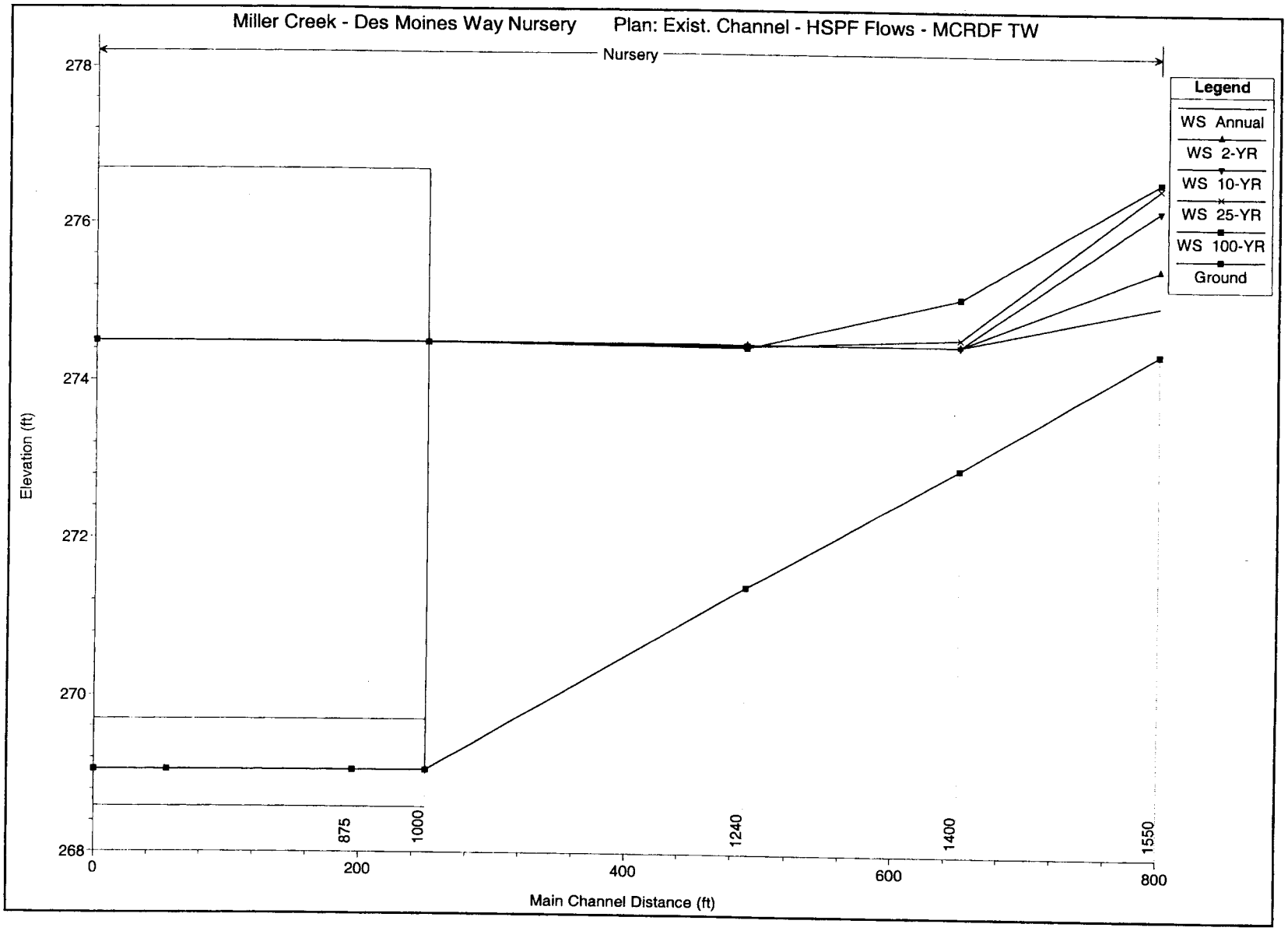
River Station	Min. Channel Elevation (ft)	Left Overbank Elevation (ft)	Right Overbank Elevation (ft)	Water Surface Elevation 2-Year (ft)	25-Year (ft)	100-Year (ft)
750	269.05	271.38	271.38	274.50	274.50	274.50
1000	269.05	270.04	270.01	274.50	274.50	274.50
1240	271.40	274.37	273.73	274.50	274.48	274.46
1400	272.92	274.28	274.80	274.50	274.59	275.10
1550	274.41	275.77	276.29	275.48	276.51	276.59

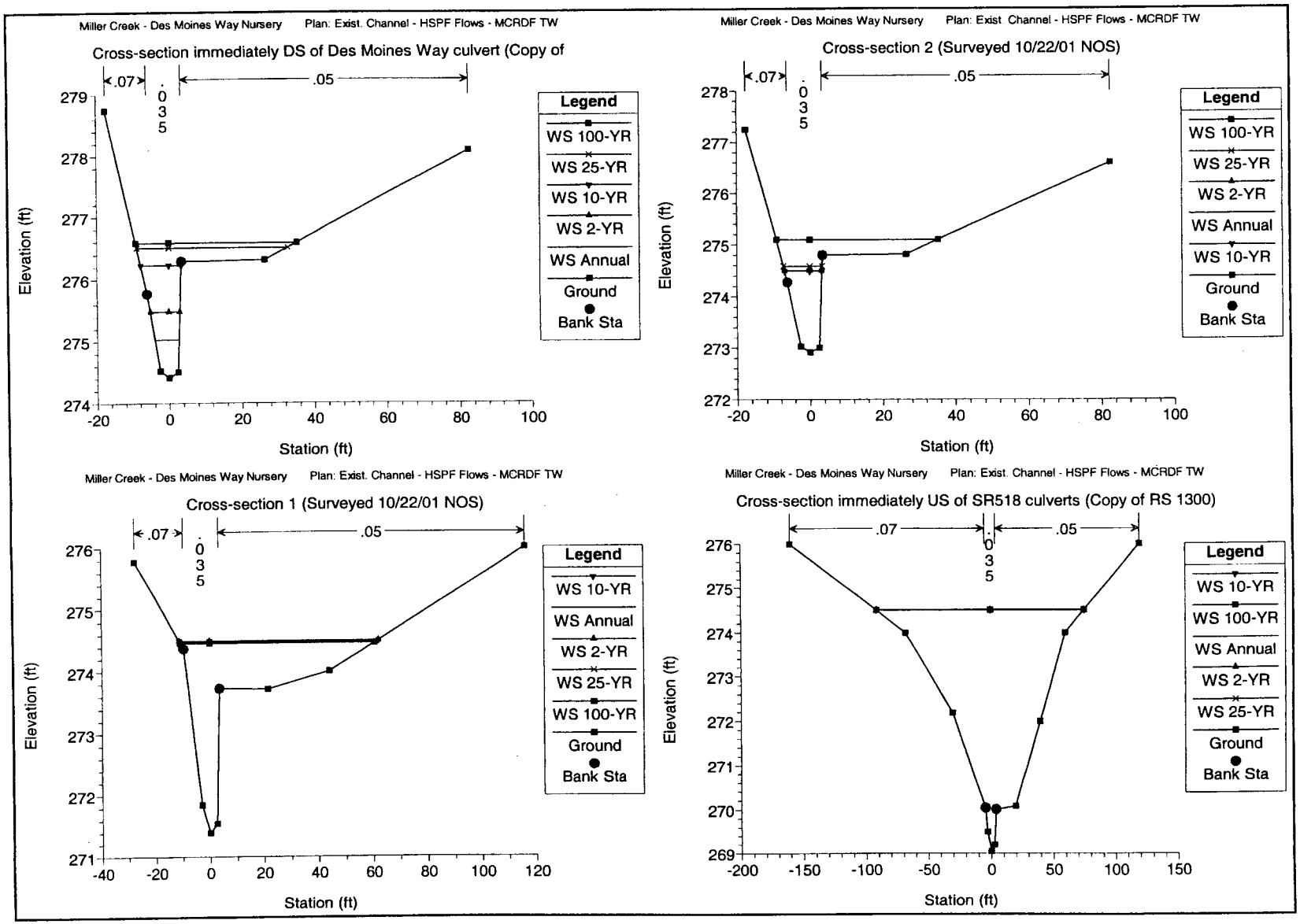

Miller Creek - Des Moines Way Nursery
Plan: Existing Channel - HSPF Flows - No TW
Nursery
Legend
WS 100-YR
WS 25-YR
WS 10-YR
WS 2-YR
WS Annual
Ground
Elevation (ft)
278
276
274
272
270
268
0
200
400
600
800
875
1000
1240
1400
1550
Main Channel Distance (ft)

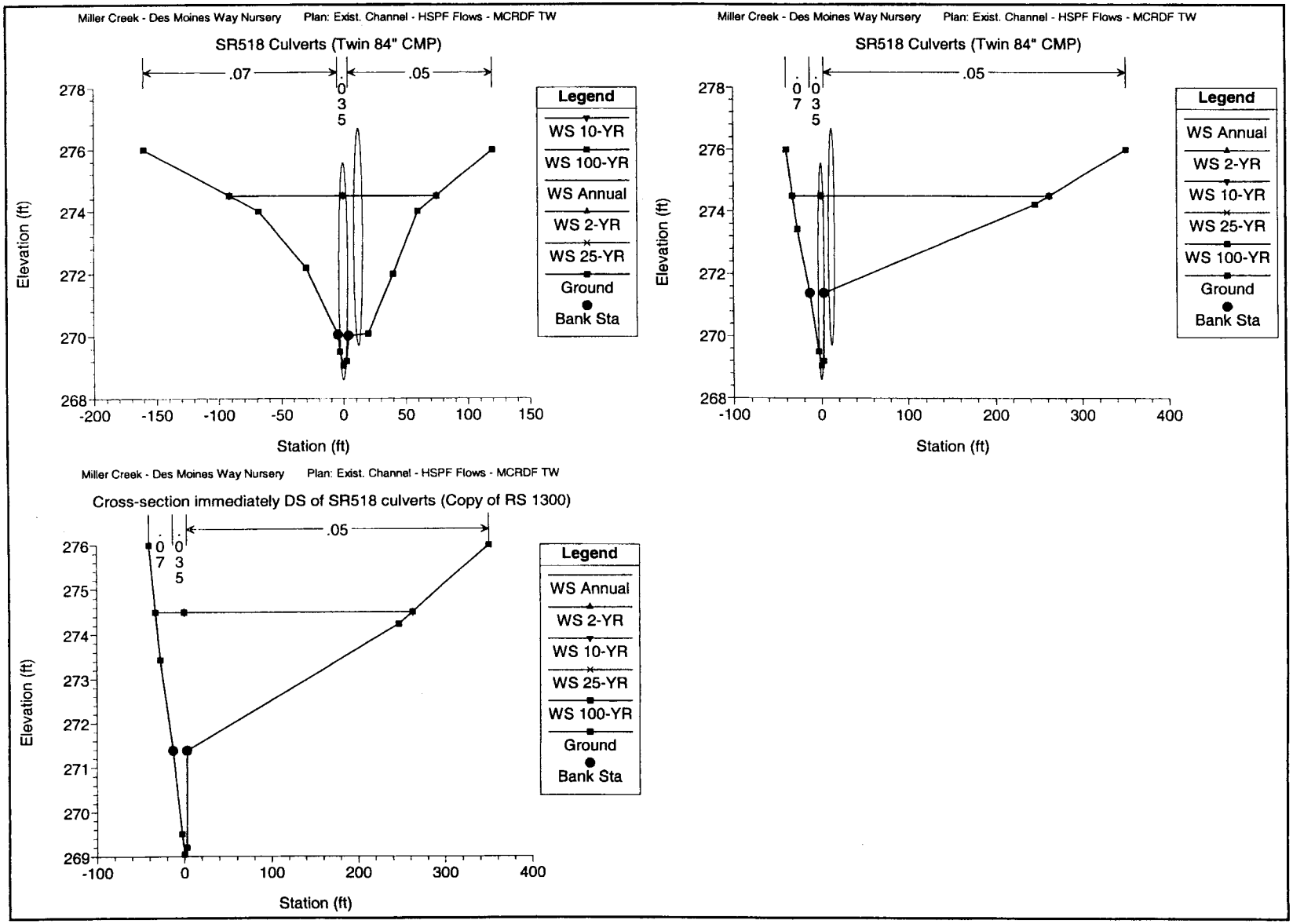
AR 006086


Miller Creek - Des Moines Way Nursery Plan: Existing Channel - HSPF Flows - No TW
Cross-section immediately DS of Des Moines Way culvert (Copy of
.07
.035
.05
Elevation (ft)
Station (ft)
Legend
WS 100-YR
WS 25-YR
WS 10-YR
WS 2-YR
WS Annual
Ground
Bank Sta
Miller Creek - Des Moines Way Nursery Plan: Existing Channel - HSPF Flows - No TW
Cross-section 2 (Surveyed 10/22/01 NOS)
Miller Creek - Des Moines Way Nursery Plan: Existing Channel - HSPF Flows - No TW
Cross-section 1 (Surveyed 10/22/01 NOS)
Miller Creek - Des Moines Way Nursery Plan: Existing Channel - HSPF Flows - No TW
Cross-section immediately US of SR518 culverts (Copy of RS 1300)


Miller Creek - Des Moines Way Nursery Plan: Existing Channel - HSPF Flows - No TW
SR518 Culverts (Twin 84" CMP)
.07
.05
.03
.05
Elevation (ft)
Station (ft)
Legend
WS 100-YR
WS 25-YR
WS 10-YR
WS 2-YR
WS Annual
Ground
Bank Sta
Miller Creek - Des Moines Way Nursery Plan: Existing Channel - HSPF Flows - No TW
SR518 Culverts (Twin 84" CMP)
.07
.05
.03
.05
Elevation (ft)
Station (ft)
Legend
WS 100-YR
WS 25-YR
WS 10-YR
WS 2-YR
WS Annual
Ground
Bank Sta
Miller Creek - Des Moines Way Nursery Plan: Existing Channel - HSPF Flows - No TW
Cross-section immediately DS of SR518 culverts (Copy of RS 1300)
.07
.03
.05
Elevation (ft)
Station (ft)
Legend
WS 100-YR
WS 25-YR
WS 10-YR
WS 2-YR
WS Annual
Ground
Bank Sta


Miller Creek - Des Moines Way Nursery
Plan: Exist. Channel - HSPF Flows - MCRDF TW
Nursery
Legend
WS Annual
WS 2-YR
WS 10-YR
WS 25-YR
WS 100-YR
Ground
Elevation (ft)
278
276
274
272
270
268
875
1000
1240
1400
1550
0
200
400
600
800
Main Channel Distance (ft)


Miller Creek - Des Moines Way Nursery Plan: Exist. Channel - HSPF Flows - MCRDF TW
Cross-section immediately DS of Des Moines Way culvert (Copy of
.07
.035
.05
Elevation (ft)
Station (ft)
Legend
WS 100-YR
WS 25-YR
WS 10-YR
WS 2-YR
WS Annual
Ground
Bank Sta
Miller Creek - Des Moines Way Nursery Plan: Exist. Channel - HSPF Flows - MCRDF TW
Cross-section 2 (Surveyed 10/22/01 NOS)
Miller Creek - Des Moines Way Nursery Plan: Exist. Channel - HSPF Flows - MCRDF TW
Cross-section 1 (Surveyed 10/22/01 NOS)
Miller Creek - Des Moines Way Nursery Plan: Exist. Channel - HSPF Flows - MCRDF TW
Cross-section immediately US of SR518 culverts (Copy of RS 1300)


Miller Creek - Des Moines Way Nursery Plan: Exist. Channel - HSPF Flows - MCRDF TW
SR518 Culverts (Twin 84" CMP)
.07
.035
.05
Elevation (ft)
Station (ft)
Legend
WS 10-YR
WS 100-YR
WS Annual
WS 2-YR
WS 25-YR
Ground
Bank Sta
Miller Creek - Des Moines Way Nursery Plan: Exist. Channel - HSPF Flows - MCRDF TW
SR518 Culverts (Twin 84" CMP)
.07
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Annual
WS 2-YR
WS 10-YR
WS 25-YR
WS 100-YR
Ground
Bank Sta
Miller Creek - Des Moines Way Nursery Plan: Exist. Channel - HSPF Flows - MCRDF TW
Cross-section immediately DS of SR518 culverts (Copy of RS 1300)
.07
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Annual
WS 2-YR
WS 10-YR
WS 25-YR
WS 100-YR
Ground
Bank Sta