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King County

**Department of Development and Environmental Services**
900 Oakesdale Avenue Southwest
Renton, Washington 98057-5212
206-296-6600 TTY 206-296-7217

# CRITICAL AREAS MITIGATION GUIDELINES

For alternate formats, call 206-296-6600.

The following information is provided to help applicants prepare and submit mitigation plans that expedite DDES review. Every mitigation must be based on an approved plan, just as all other construction must be based on an approved plan. Requirements and guidelines for mitigation plans are authorized under King County Zoning Code Title 21A, Chapter 24, and more specifically under Section 120 of that chapter.

**Section One** outlines plan requirements; maps, site plans, and other drawings.

**Section Two** outlines report requirements; project description, installation/construction details, maintenance and monitoring plans. These are textual elements that should appear on plan sheets as notes to the drawings and engineering details described in Section One.

**Section Three** contains Design Requirements (Part I); specific and additional guidelines for designing mitigations and their performance standards (Part II), and creating planting specifications (Part III).

Sections One and Two, and Part I of Section Three, contain **required, minimum** elements for compensatory mitigation plans for wetlands, streams, or buffers within unincorporated King County.

**SPECIAL REQUIREMENTS –** Each mitigation project will have unique circumstances that require special instructions beyond this outline's scope. The applicant must obtain from DDES, in writing, either instructions or waiver of this provision.

## IMPORTANT

Most mitigations are secured by a financial guarantee. For more details, see "Performance Guarantees", Paragraph 14, page 7.

**Wherever this document uses restrictive language – "must", "require", etc., the required actions must be performed or the bond will become liable for forfeiture.**

Please review this document carefully, and retain a copy for your records until your bond is released. Should you sell your property before your bond is released, you will still be obligated to perform the work. DDES therefore strongly recommends that you review Paragraph 14, PERFORMANCE GUARANTEES before selling your property, which explains transfer of this obligation to the purchaser. We want to help you avoid being obligated to perform work on property you do not own!

This document refers to "minor" projects. Minor projects are defined as follows: typically, they are in only one single-family residential lot; and are buffer enhancements <1,000 $ft^2$ or buffer restoration <500 $ft^2$.

## SECTION ONE: PLAN REQUIREMENTS

There are nine Paragraphs in this Section describing graphic components of the mitigation plan. The information specific to each Paragraph must appear on a plan sheet. As many plan sheets should be used as will make the resulting plan set legible to all reviewers, consultants, landscapers, inspectors, and other users. Plan graphics and Report text (Section Two) will probably be most legible if they appear on the same plan sheets.

### 1 VICINITY MAP

1.1 North arrow.
1.2 Driving directions from the nearest highway.
1.3 Street names/numbers.
1.4 In rural areas, distance to nearest landmarks or nearest abutting address.

### 2 MITIGATION SITE PLAN

*Scale described in Paragraph 2.1 applies to ALL plans in Section One, unless otherwise noted.*
2.1 Scale must be shown at:
2.1.1 1 inch : 20 feet if site is less than two acres; or
2.1.2 1 inch : 40 feet if site is more than two acres; and
2.1.3 1 inch : 5 feet for cross sections and typical sections.

2.2 North arrow.
2.3 Property lines, dimensions, legal proof of ownership (DDES form "Certification of Applicant Status"), and owner's address and phone.
2.4 Date map prepared, address and phone of preparer.
2.5 Plan approval block for DDES approval signature. (For plats, a mylar of the plan must be made available to DDES for signature approval of the plan by the responsible reviewer.)

### 3 GRADING PLAN

3.1 USGS topographic map 1:24,000 scale **AND** one of the following performed by a State of Washington licensed land surveyor:
3.1.1 1' contours (most projects, and all projects where grading is involved);
3.1.2 2' contours (some minor residential projects);
3.2 Four cross-sections per ¼ acre showing existing and proposed grades in 1' contours throughout the entire mitigation area including buffer, and 15' beyond buffer edge (BSBL). Where no grading is proposed, existing contours are sufficient.
3.3 The surveyed line (minor projects may submit tape-and-compass surveys) of the:
3.3.1 Wetland edge;
3.3.2 Top of bank and center line of class 1, 2 or 3 streams;
3.3.3 The buffer edge line and building setback line.
3.4 Existing trees more than 18" in diameter at breast height with identification symbol.
3.5 To expedite plan review, the following surveyed lines are strongly recommended:
3.5.1 Existing/proposed streets or other right-of-ways on or abutting the site and proper labels;
3.5.2 Existing/proposed easements on or abutting the site and proper labels;
3.5.3 Existing structures and proper labels/symbols;
3.5.4 Existing site improvements (e.g., driveways, culverts, etc.) and proper labels/symbols.

## 4 HYDROLOGIC REGIME (See Appendix A for more information)

Show both in aerial view and in cross-section, indicating seasonal water levels expected.

4.1 For existing hydrology: inflows, outflows, basin, volume, velocity, hydroperiod, and:

4.1.1 Wetlands and their buffers: Hydrogeomorphic type (depressional, riverine, etc.)

4.1.2 Streams and their buffers: Stream type, special features.

4.2 For proposed hydrology: inflows, outflows, volume, velocity, hydroperiod, and:

4.2.1 Wetlands and their buffers: Hydrogeomorphic type, and any associated structures.

4.2.2 Streams and their buffers: Stream type, special features.

4.3 Water control structures and special features to be shown in both plan and cross-section. These typically include level spreaders, weirs, leaky berms, etc.

## 5 HABITAT FEATURES

5.1 Large woody debris

5.2 Snags

5.2 Bird or bat nestboxes, etc.

## 6 EROSION CONTROL

6.1 Temporary erosion control structures; silt fences, sediment ponds, etc.

6.2 Permanent erosion control structures; bioswales, terraces, check dams, etc.

6.3 Schedule and sequencing for removal of temporary erosion control structures.

## 7 PLANTING PLANS

7.1 Keyed to and same scale as Mitigation Site Plan.

7.2 Legible, readily understandable plant key.

7.3 Planting details for trees, shrubs, herbaceous plants, and any overseeding.

7.4 Clearly show area and border of each Cowardin community and mitigation type within mitigation area, e.g., "created emergent wetland, 3800 sq. ft.; restored scrub-shrub, 4000 sq. ft.; enhanced riparian buffer, 5000 sq. ft.", etc.

7.5 Plant selection and replacement per appropriate portion of Section Three of this document.

## 8 MONITORING SITE PLAN

8.1 Permanent photo-points, at least four per project or ¼ acre, whichever is greater.

8.2 Permanent vegetation transects, at least one per plant community.

8.3 Permanent wells, staff gages, or other monitoring structures.

8.4 Outline of a monitoring plan and reference to location of entire monitoring plan, per MONITORING, in Section Two, Paragraph 11 of this document.

8.5 Contact address and phone of person or organization under signed contract to carry out construction supervision and subsequent implementation of the monitoring plan over the monitoring period.

8.6 The following paragraph must be included verbatim in every plan under "Monitoring": "Up to 20% of any stratum can be composed of desirable native volunteers when measuring cover. No more than 10% cover of non-native or other invasives, e.g., Himalayan blackberry, Japanese knotweed, evergreen blackberry, reed canary grass, Scots broom, English ivy, morning glory, etc. is permissible in any monitoring year. Bond holders are encouraged to maintain mitigation sites within these standards throughout the monitoring period, to avoid corrective measures."

## 9 MAINTENANCE SITE PLAN

9.1 Clearly marked access points for ongoing maintenance activities.

9.2 Source and layout of temporary irrigation system.

9.3 Outline of a maintenance plan per MAINTENANCE, in Section Two, Paragraph 12 of this document.

9.4 Contact address and phone of person or organization under signed contract to carry out the maintenance plan over the monitoring period.

## SECTION TWO: REPORT REQUIREMENTS

Report shall be included on one or more plan sheets, adjacent to plan graphics as necessary to increase legibility and comprehensibility. The following elements are required:

### 1 EXECUTIVE SUMARY

1.1 Demonstrate that mitigation sequencing was followed, i.e., how impacts have been avoided, reduced, or minimized. This step is necessary to comply with state and federal laws and regulations.
1.2 Describe unavoidable impacts that will be offset by the mitigation.
1.3 Compare square footage of impacted critical area to square footage of mitigation area.
1.4 Describe functions of impacted area and compare to mitigation area.
1.5 Describe how mitigation area will be an improvement upon impacted area.

### 2 GOALS

A goal is a broad statement of what you intend to accomplish through the mitigation project. This should be an overview of the intended results and should include a list of the major wetland or stream functions to be achieved. Describe the goal(s) of the mitigation, e.g., "to create 0.5 acre of emergent wetland". Typical goals are detailed in Section Three, Part II. Each goal has corresponding Objective(s) Performance Standard(s), and Monitoring Method(s).

### 3 OBJECTIVES

Objectives are specifics of the goal. Describe the objective(s) of each goal, e.g., "to add five plant species in comparison to adjacent emergent wetland"; "to increase sediment retention within 0.5 acre of emergent wetland". Typical objectives are detailed in Section Three, Part II.

### 4 PERFORMANCE STANDARDS

Performance standards are measurable, quantifiable indicators of mitigation performance relative to objectives and goals. Performance Standards should be keyed to Reference Standards in "Reference Standards of Depressional Flow-Through Wetlands in the Puget Lowlands of Western Washington" (*Azous et al. 1998)* or other thorough reviews of existing area streams or wetlands in good condition. Describe the performance standard(s) of each objective, e.g., "five additional plant species will each comprise >15% cover within the created emergent wetland at year three". Typical vegetation, soil, and hydrology performance standards are set forth in Section Three, Part II.

### 5 MONITORING METHODS

Monitoring methods assess the performance standards. Describe the method of monitoring individual performance standards, e.g., "visual observation along permanent transects at 1m radii". Include reference to field methods and analysis used, e.g., "Braun-Blanquet releves". Recommended field data forms are: "Washington Wetland Delineation Manual" routine or intermediate method determination sheets for vegetation, soils, hydrology. The "Results" page (see Appendix B) must be included in every monitoring report.

### 6 CONTINGENCIES

Include the following language verbatim: "If there is a significant problem with the mitigation achieving its performance standards, the Bond-holder shall work with King County to develop a Contingency Plan. Contingency plans can include, but are not limited to: regrading, additional plant installation, erosion control, modifications to hydrology, and plant substitutions of type, size, quantity, and location. Such Contingency Plan shall be submitted to County by December 31 of any year when deficiencies are discovered."

## 7 HYDROLOGY

Refer to Appendix A for methods of matching pre-developed contributing basin flow quantities and durations, post-development. Applicants must demonstrate that detailed hydrologic calculations and analysis have been performed by a qualified civil engineer with experience in wetland mitigation design. Mitigation design must be driven by the results of these detailed hydrologic calculations and analysis.

## 8 DESIGN

Mitigation design is key to mitigation success. See the appropriate portion of Section Three of this document when designing your mitigation plan.

## 9 INSTALLATION

For most projects, installation occurs in three phases, each followed by DDES inspection. Installation cannot proceed from one phase to the next without successful DDES inspection. DDES must receive notice that Construction phase of Installation has begun by the date noted on your Restoration Bond, generally within 60 days of bonding.

9.1 Pre-Construction

9.1.1 Defines limits of work and limits of grading.

9.1.2 Locates TESC structures and any other structures in the approved plan.

9.1.3 Any other work required by DDES.

9.1.4 Inspection verifies limits, structure location, etc.

9.2 Construction

9.2.1 Every site must be deconsolidated and soil amended. Receipts for labor and materials must be provided to inspector.

9.2.2 Site must be staked at 20' intervals along required contours (see Section One, Paragraph 3 for required contours).

9.2.3 Where grading is called for, performed as designed and within limits of grading.

9.2.4 Where structures are called for, must be installed as located and designed.

9.2.5 Where engineered structures are to be installed, installation must be supervised by a qualified engineer, whose qualifications must be supplied to the inspector.

9.2.6 Inspection verifies soils deconsolidated and amended, elevations, structure placement, etc.

9.2.7 Once approved, DDES must be notified within 30 days that installation has been completed.

9.3 Installation

9.3.1 Mitigation must be installed according to the approved mitigation plan.

9.3.2 Installation must be supervised by a qualified biologist, whose qualifications must be supplied to the inspector.

9.3.3 Inspection to verify that all plants are installed according to design, and in good health. Nursery invoices must be provided to inspector. Once approved, monitoring period begins.

## 10 AS-BUILT PLANS

Field conditions can differ from design expectations. Where field conditions require minor changes to approved plan, those changes must be documented and submitted to DDES for approval. As-Builts must be as comprehensive as the original plan. Monitoring period begins when the As-Built plan has been approved, which then becomes the approved mitigation plan for future inspection purposes.

## 11 MONITORING

11.1 Monitoring period is typically five years from successful installation inspection.

11.2 Monitoring period may be extended at DDES discretion if final inspection shows mitigation has not achieved performance standards, until performance standards have been met.

11.3 Every project must be monitored yearly throughout the monitoring period.

11.4 Monitoring reports must be submitted to DDES by October 31 of every year throughout the monitoring period, starting in the year of successful Installation Inspection.

11.5 All monitoring reports must contain Methods, Results, Analysis, and Recommendations.

11.6 Minimum required elements of monitoring reports are:

11.6.1 Report on plant survival, vigor, aerial coverage, etc. from every plant community. Each transect shall detail herb, shrub, and tree aerial cover at radii of 1m, 5m, and 10m respectively, using the Braun-Blanquet releve method or other acceptable field method;

11.6.2 Report on site hydrology, including extent of inundation, saturation, depth to groundwater, function of any hydrologic structures, inputs, outlets, etc.;

11.6.3 Report on slope condition, site stability, any structures or special features;

11.6.4 Report on buffer conditions, e.g., surrounding land use, use by humans, wild and domestic creatures, etc.;

11.6.5 Report on wildlife, including amphibians, avians, and others as required by County;

11.6.6 Report on soils, including texture, Munsell color, rooting, and oxidized rhizospheres;

11.6.7 Report on and receipts for off-site disposal of any dumping, weeds, or invasive plants;

11.6.8 Report on and receipts for any structural repair or replacement; and

11.6.9 At least 18 4"x6" color photographs taken from permanent photo-points as shown on Monitoring Plan Map.

11.7 Any deficiency discovered during any monitoring OR inspection visit must be corrected within 60 days.

11.8 All monitoring reports will be followed by DDES inspection to verify report findings.

## 12 MAINTENANCE

12.1 During Year One, every failed planting must be replaced.

12.2 During Year One, and during the first year after any replacement planting, plantings must receive 1" of water at least once weekly June 15-September 15, inclusive.

12.3 Other Maintenance must be done twice every year for the length of monitoring period. Weeding and removal **MUST** be performed within the following constraints: **Use no herbicides or pesticides whatsoever**, and **All work to be performed by hand wherever possible, and with the lightest possible equipment where such use is imperative.**

12.3.1 **WEEDING:** Trees and shrubs must be weeded to the dripline, and mulch maintained at 3" depth. Weed herbaceous plantings as necessary (flowers, ferns, etc.).

12.3.2 **REMOVAL:** All litter, dumping, and non-native vegetation must be removed, e.g., Himalayan blackberry, reed canary grass, evergreen blackberry, Scots broom, English ivy, morning glory, Japanese knotweed, etc., and properly disposed of off-site. Receipts must be sent to DDES.

12.3.3 **STRUCTURES:** Damaged or missing fences, posts, signs, habitat or hydrology structures must be repaired or replaced. Receipts must be sent to DDES.

## 13 CONTINGENCY PLAN

Should any monitoring report reveal the mitigation has failed in whole or in part, and should that failure be beyond the scope of routine maintenance, the applicant must submit a Contingency Plan. This Plan may range in complexity from a list of plants substituted, to cross-sections of proposed engineered structures. Once approved, it may be installed, and will replace the approved mitigation plan. If the failure is substantial, DDES will likely extend the monitoring period for that mitigation.

## 14 PERFORMANCE GUARANTEES

14.1 If the applicant seeks a development permit that is contingent on the performance of a mitigation project, two options are available:

14.1.1 The mitigation may be installed and the monitoring period successfully completed before any development permit work is begun, OR

14.1.2. More typically, applicant must provide a Restoration Bond or assignment of funds per King County procedures.

14.2 Once the mitigation plan is approved, a Bond Quantity Worksheet will be completed based on all elements of the mitigation plan. The total cost, plus contingency fees, will be the amount of the Restoration Bond the applicant is required to provide.

14.3 Note that approved Bond will include required start date for mitigation construction.

14.4 Bonds are eligible for reduction to Maintenance status as soon as three years after successful installation inspection, providing that it also meets project goals as described in Paragraph 2, Section Two.

14.5 Should the property be sold before the bond is released, you can transfer your obligation. If the purchaser posts an equivalent bond, and acknowledges responsibility for all details of the approved Mitigation Plan, DDES will release your bond and end your obligation. This is the only way to end the obligation to complete the mitigation.

## 15 APPENDICES (ATTACH THESE TO SUBMITTED MITIGATION PLAN)

15.1 Copy of the critical area delineation, study, or report, and other technical documents that support the proposed plan.

15.2 Copies of signed monitoring and maintenance contracts for the length of the monitoring period.

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# SECTION THREE: DESIGN GUIDELINES

This section is divided into three parts: I: Design Requirements; II: Design Guidelines; and III: Planting Specifications. This section amplifies the Washington State Department of Ecology's "Guidelines for Developing Freshwater Mitigation Plans and Proposals."

Mitigations may consist of mosaics – emergent wetlands intermixed with shrub and forested wetlands. Performance goals, standards of success, and planting densities should be applied to relevant portions of the mitigation.

This document is based on two types of knowledge: first, inspection of wetland mitigations in King County, and analysis of success and failure; second, on the best science with which DDES staff is familiar. Much information contained herein is derived from "Reference Standards for Depressional Flow-Through Wetlands in the Puget Lowlands of Western Washington," Azous et al., 1998, DDES, Renton, WA. If you have information, published in professional peer-review journals, that contradicts this document, please apprise us of it. After careful review, we will revise our guidelines accordingly.

The following examples are typical of over 90% of all wetlands and buffers in King County for which mitigations might be designed. Some obvious communities have been excluded, such as bogs. Unusual situations will require unusual mitigations, and will be evaluated on a case-by-case basis. This document is meant to guide the design of most mitigation plans.

## PART I: DESIGN REQUIREMENTS

**Every mitigation plan must be guided by the following parameters:**

### 1 VEGETATION

1.1 All plants specified must be native to the Puget lowlands of Western Washington;

1.2 Shade-dependent species (as defined by DDES publication "Habitat Worksheet", Appendix C) are to be specified only where shade exists at time of planting;

1.3 No bare-root material shall be specified in anaerobic soil conditions (typically where plants will be inundated for more than two weeks through the growing season).

1.4 Plant selection and placement should be guided by moisture, light, and other habitat needs – see the appropriate portion of Part II of this Section for more details.

### 2 SOILS

2.1 Plans for wetlands, streams, and/or their buffers must specify that soils be deconsolidated to a minimum depth of 12" where trees or shrubs are planted; to 6" depth where grasses or emergents are planted.

2.2 All plans must specify that soils be amended. Typical amendments on compacted subsoil: 2" of coarse sand and 4" of vegetative compost spread over entire area.

2.3 Peat shall not be used to amend soils.

2.4 See the appropriate portion of Part II of this Section for more details.

### 3 HYDROLOGY

3.1 When designing for wetlands, streams, or their buffers, all plans must be designed for demonstrated hydrology.

3.2 Hydrologic calculations for both existing and proposed wetland or stream must be included with all mitigation designs. See Appendix A, "Wetland Hydrology Management Guidelines" for calculating hydrologic budgets.

3.3 See the appropriate portion of Part II of this Section for more details.

### 4 SLOPES

4.1 No slope in buffer shall be graded steeper than 20% (5:1).

4.2 No slope in wetland shall be graded steeper than 10% (10:1).

4.3 Permissible grades in streams and steep slope areas will be decided on a case-by-case basis.

### 5 STRUCTURES

5.1 Mitigations must be enclosed by a permanent fence at least 4' high, with Critical Area signs (available from DDES) mounted on every 100', or one per lot. A split-rail or round post-and-rail fence is sufficient for this purpose. Other fence types may be proposed.

5.2 Some minor projects may substitute Critical Area signs mounted on posts set into the ground at 100' intervals.

## PART II: DESIGN GUIDELINES

Every mitigation plan must establish goals, objectives, and performance standards. Every plan should be specific to mitigation goals and to demonstrated hydrology[1]. The following are boilerplate goals, objectives, and performance standards that mitigation plans must follow.

Like all boilerplate, there will be times when exceptions must be made – DDES requires that all exceptions be based on careful, documented, well-referenced research. Performance standards are those aspects of a wetland or buffer mitigation that will be verified by DDES inspection. Mitigations that do not meet performance standards will be notified that they are in violation, and will have 60 days to correct all violations or be liable to bond forfeiture.

Vegetation standards are typically based on both cover and survival. Non-native and other invasives – Himalayan blackberry, Japanese knotweed, evergreen blackberry, reed canary grass, Scots broom, English ivy, morning glory, etc. – may only comprise up to 10% cover in any given stratum.

Desirable native volunteers like alder and cottonwood may count for up to 20% of cover in any stratum. But species diversity is important – where desirable native volunteers cover more than 20% of any stratum, a contingency mitigation plan must be created and implemented that restores the mitigation site to the designed level of diversity. Applicants are strongly encouraged to design mitigation plans that propose achievable goals, and that carefully prepare and maintain the mitigation to ensure those goals are met.

*The following are typical goals, objectives, and performance standards for the creation or restoration of typical Cowardin communities.*

### 1 GOAL: CREATE/RESTORE A PALUSTRINE EMERGENT (PEM) WETLAND OF X ACRES

Typical performance goal for these wettest areas is a meadow-like expanse of sedges, rushes, grasses, and herbs – there may be five or ten trees or shrubs like cottonwood, willow, red-osier dogwood, per acre on hummocks of higher ground, or there may be none.

1.1 Vegetation performance standards (FAC, FACW, or OBL species):

1.1.1 Emergent Cover: 60% by Year One, 80% by Year Three, 90-100% by Year Five;

1.1.2 Shrub or sapling tree Cover: (where specified) 10% cover by Year Three; AND

1.1.3 100% survival by Year One, EITHER 85% survival by Year Three OR demonstrate that species diversity and distribution mimic reference standard wetlands.

1.2 Hydrology performance standards:
1"-4" inundation March 1 through May 15, on average. *This plant community requires stable hydroperiod,* i.e., no spiky inputs as from pavements, roofs, etc.

1.3 Soil performance standards:

1.3.1 Soil deconsolidated to at least 6" depth (measured at installation).

1.3.2 Soil to contain at least 45% organic matter by bulk density (verified by invoices).

[1] For example, hydroperiod is crucial. Where water depth is appropriate for a Palustrine Emergent (PEM) community, but hydroperiod will be flashy, i.e., there will be spiky inputs from, roads, roofs, etc., research shows that spiky inputs produce emergent communities dominated by invasives like reed canary grass. Best practice in this situation might be to design a vigorous Palustrine Scrub-Shrub (PSS) community. This and other hydrology references are from Puget Sound Wetlands and Stormwater Management Research Program, a 10-year study, presented at the conference "Wetlands and Urbanization: Implications for the Future" on September 26, 1996.

## 2 GOAL: CREATE/RESTORE A PALUSTRINE SCRUB-SHRUB (PSS) WETLAND OF X ACRES

Typical performance goal for these wetter areas is a dense thicket of shrubs, such as willows, twinberry, red-osier dogwood, etc.

2.1 Vegetation performance standards (FAC, FACW, or OBL species):

2.1.1 Emergent Cover (where specified): 60% by Year One, 80% by Year Three, 90% by Year Five;

2.1.2 Shrub or sapling tree cover by Year Three -- >60%; 85% by Year Five AND

2.1.3 100% survival by Year One, EITHER 85% survival by Year Three OR demonstrate that species diversity and distribution mimic reference standard wetlands. Hardshack (*Spiraea douglasii)* shall not comprise more than 10% of cover.

2.2 Hydrology performance standards:
2"-12" inundation March 1 through May 15, on average. *This plant community can tolerate a flashy hydroperiod.*

2.3 Soil performance standards:

2.3.1 Soil deconsolidated to at least 12" depth (measured at installation).

2.3.2 Soil to contain at least 30% organic matter by bulk density (verified by invoices).

## 3 GOAL: CREATION OF A PALUSTRINE FORESTED (PFO) WETLAND OF X ACRES

The performance goal for these wet areas is the creation of mature, forested wetlands with herb, shrub (sub-canopy), and tree layers.

3.1 Vegetation performance standards (FACU-, FAC, FACW, or OBL species):

3.1.1 Emergent Cover: 60% by Year One, 80% by Year Three, 90% by Year Five;

3.1.2 Shrub or sapling tree cover by Year Three -- >60%; 85% by Year Five AND

3.1.3 100% survival by Year One, 85% survival by Year Three.

3.2 Hydrology performance standards:
Saturation between soil surface and 12" depth March 1 through May 15, on average. *This plant community requires a stable hydroperiod.*

3.3 Soil performance standards:

3.3.1 Soil deconsolidated to at least 12" depth (measured at installation).

3.3.2 Soil to contain at least 30% organic matter by bulk density (verified by invoices).

## 4 GOAL: CREATION OF A BUFFER OF X ACRES

The performance goal for these areas is to create a dense forest that will protect wetland from human encroachment and provide wildlife habitat.

4.1 Vegetation Performance Standards (UPL, FACU, or FAC species):

4.1.1 Emergent Cover: 60% by Year One, 80% by Year Three, 90% by Year Five

4.1.2 Shrub or sapling tree cover by Year Three: >60%; AND

4.1.3 100% survival by Year One, 85% survival by Year Three

4.2 Hydrology performance standards:
Not applicable, but note that slopes must be 20% or gentler to allow interaction between wetland and upland.

4.3 Soil performance standards:

4.3.1 Soil deconsolidated to at least 12" depth (measured at installation)

4.3.2 Soil to contain at least 20% organic matter by bulk density (verified by invoices).

## PART III: PLANTING SPECIFICATIONS

Planting types and densities should be specific to demonstrated hydrology and site conditions. The following densities should enable mitigations to meet their performance standards. Quantities are average, based on container-grown material – divisions, slips, cuttings, and bare-root materials require higher planting densities to compensate for lower survival rates. Rough equation to correlate is: 1'-3' = 1 gal.; 2'-4' = 2 gal.; 4'-6' = 5 gal. Planting densities only give figures for total plants per area – plants should be placed in random, naturalized clusters. The following minimum acceptable densities per plant community are:

**1 EMERGENT (PEM) WETLANDS (FAC, FACW, OR OBL SPECIES) ARE TO BE PLANTED TO:**

1.1 Emergents 1' O.C., or one per square foot of area (this assumes 10" plug or 4" pot); OR

1.2 Emergents 18" O.C., or 0.444 per square foot of area, if supplemented by overseeding of native emergents or graminoids as appropriate.

**2 SHRUB (PSS) WETLANDS (FAC, FACW, OR OBL SPECIES) ARE TO BE PLANTED TO:**

2.1 Shrubs 5' O.C., or 0.04 per square foot of area; (this assumes 2 gal. size);

2.2 **Plus** herbs and groundcovers 4' O.C., or 0.063 per square foot of area; (10" plug or 4" pot);

2.3 **Plus** overseeding with native emergents, graminoids, or sterile ryegrass as appropriate.

**3 FORESTED (PFO) WETLANDS (FACU- TO FACW SPECIES) ARE PLANTED TO**

3.1 EITHER:

3.1.1 Trees 9' O.C., or 0.012 per square foot of area; (this assumes 2-5 gal. size) – such trees are to be at least 50% conifers;

3.1.2 **Plus** shrubs 6' O.C., or 0.028 per square foot (this assumes 1-2 gal. size);

3.1.3 **Plus** herbs and groundcovers 4' O.C., or 0.063 per square foot of area (10" plug or 4" pot);

3.1.4 **Plus** overseeding with native emergents, graminoids, or sterile ryegrass as appropriate.

3.2 OR: The Simple, Two-Step Process

3.3 Plant alders, cottonwood, willows (other seral species, e.g., big-leaf maple, Doug fir, as appropriate to site) at densities of 8' O.C., or 0.016 per square foot (assumes 2 gal. size); plus overseed with clover, low-growing non-invasive grasses, lupines, etc.;

3.3.1 After three years or greater than 85% survival, underplant with:

3.3.2 Conifers (e.g., Sitka spruce, cedar, hemlock, yew, Doug fir in a wetter-to-drier continuum) 12' O.C., .007 per square foot of area, (this assumes 2-5 gal.size);

3.3.3 **Plus** shade-tolerant or dependent sub-canopy species (e.g., Indian plum, vine maple, etc.) 9' O.C., .012 per square foot of area, (assumes 1-2 gal.size);

3.3.4 **Plus** shade-tolerant and dependent herbs and groundcovers (e.g., waterleaf, trillium, *Smilacina*, etc.), 4' O.C. or 0.063 per square foot of area (10" plug or 4" pot), plus overseed with native herbs and grasses.

**4 BUFFERS (UPL, FACU, OR FAC SPECIES)**

4.1 Are to be planted as for Forested Wetlands, except:

4.2 See Site Placement in Habitat Worksheet, Appendix C – best species for this area are those marked WB (wetter buffer) and DB (drier buffer).

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# Appendix A

## WETLAND HYDROLOGY MANAGEMENT GUIDELINES

The Puget Sound Wetlands & Stormwater Management Research Program[1] has developed guidelines for managing wetland hydroperiods post-development. These guidelines have, however, proven to be difficult to translate into engineering requirements for development proposals. In order to resolve these problems, the following technical guidelines have been developed.

These guidelines provide methods for determining pre-development wetland hydrology and designing surface water conveyance systems to maintain this hydrology post-development. Two methods have been developed, a simple method using the King County Runoff Time Series (KCRTS) hydrologic program and a more accurate method using calibrated Hydrologic Simulation Program – Fortran (HSPF).

The "Basic" analysis is applied to wetlands that have low to moderate functions. A "High Value" analysis has been developed for wetlands that have high functions. Wetland functions may be determined by the utilizing the "Wetland and Buffer Functions: Semi-Quantitative Assessment Methodology."[2] This method establishes three groups of wetland functions. Group 1 are roughly "low" functioning wetlands while Groups 2 and 3 are "moderate" and "high" functioning wetlands.

1. Basic Analysis (HSPF w/Regionalized Parameters, or KCRTS)

   This analysis does not model the wetland hydraulics, but instead matches the project's hydrologic contribution to the wetland. The basic analysis is performed with the full historical runoff files as statistics will be performed on partial water years, which the reduced 8-year runoff files were not designed for. The basic analysis should be combined with BMP's (e.g. dispersion, infiltration, energy dissipation, etc.) designed to closely match the transport characteristics of the existing site's hydrologic contributions to the wetlands. (i.e. do flows from the existing site enter the wetland via concentrated surface flow, as interflow, or combination of both?).

   a) determine the wetland contributing basin area, and soil and landcover types.
   b) determine the pre-development probability of flow exceedence (flow durations) for different periods of the water year, as described below in Time Period of Interest.
   c) determine the post-development probability of flow exceedence (flow durations) for the same time periods used in b. Different site development scenarios should be analyzed to determine the optimum developed site configuration.
   d) determine the optimum developed site conditions which best match the pre-development frequency of exceedence.
      i) modifying the post-development contributing basin area (bypass increased volumes around wetland).
      ii) increased forest retention.
      iii) infiltrate/disperse increased runoff volumes.

TIME PERIOD OF INTEREST

Group 1 wetlands, perform analysis seasonally with Spring and Summer being of primary concern to maintaining wetland functions. Spring is defined as February 1 through May 31, Summer is June 1 through August 31, Fall is September 1 through November 30, and Winter is December 1 through January 31. Seasons may be adjusted based on specific wetland characteristics. (e.g. bogs may have a different critical season than lakes).

Group 2 wetlands not required to perform High Value Analysis: (Time period shorter than seasonal during critical season(s)). Perform partial-year duration analysis for each month during the wetlands critical season(s), use seasonal time step for remainder of the year. The shorter time period will better match the existing, time variable, hydrologic contributions from the site. The time period could be reduced further to a minimum of 1 week, which would essentially analyze flow durations on a storm-by-storm basis. An initial goal of matching the majority of partial-year flow durations should be used. Final determination as to the optimum site configuration will be agreed to through the engineering plan review process, in conjunction with review by county and/or private wetlands biologists.

The increased number of data points resulting from a shorter time period will likely require more judgment as to the optimum developed site configuration, as it is likely that different storm types will produce variable changes in runoff response under different land use assumptions (e.g., a thunderstorm may produce little to no runoff under existing conditions. A fixed structure set to bypass the increased runoff from that storm may divert too much volume during a long duration winter storm). In other words, it is likely that a project will not be able to match, to the same level, the partial-year flow durations for all time periods, and therefore judgment must be applied.

Proposals to modify the wetland hydraulics (storage or discharge) to control impacts should perform a calibrated HSPF analysis to measure fluctuations, as described in 2 below.

2. High Value Analysis (Calibrated HSPF) Group 3 wetlands. Use combination of existing MDP procedures and PSWSMRP guidelines to analyze wetland water level fluctuations.
   a) determine the water level fluctuation (WLF) for the wetland by gaging the wetland for 1 year. Use a combination of groundwater wells and crest-stage gages or continuous recording gages.
   b) survey the topography of the wetland at a minimum of 1 foot contours
   c) perform a stage excursion analysis for 72-hour intervals
   d) limit stage excursions post-development using the PSWSMRP guidelines.

Note: Comparisons of existing and proposed conditions should be done based on calibrated simulations. Many of the errors in the analysis (e.g. reservoir hydraulics) will cancel (to a large extent) if both conditions are simulated.

References

[1] Homer, Richard R., S.S. Cooke, K.O. Richter, A. L. Azous, L.R. Reinelt, B.L. Taylor, K.A. Ludwa, and M. Valentine. 1966. Wetlands and Urbanization: Implications for the Future. Chapter 15. Puget Sound Wetlands & Stormwater Management Research Program.

[2] Cooke, Sarah Spear. May 1996. Wetland and Buffer Functions: Semi-Quantitative Assessment Methodology. Cooke Scientific Services. Seattle, WA.

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Renton, Washington 98057-5212

# Appendix B

**Location of impacted wetland** County _____ City _____ State _____
USGS Quad _____ NWI Quad _____

**Location of impacted wetland** County _____ City _____ State _____
USGS Quad _____ NWI Quad _____

Summary of project, including wetland functions impacted and mitigated

Acres of wetland impacted (Cowardin classification)
Aquatic bed _____ Emergent _____ Forested _____
Open Water _____ Scrub Shrub _____

Other impacts to Streams _____ Lakes _____ Estuaries _____ Coastal Waters _____

Acres of wetland mitigation (Cowardin classification)

| Restoration | | Creation | | Enhancement | |
|---|---|---|---|---|---|
| Open Water | | Open Water | | Open Water | |
| Aquatic Bed | | Aquatic Bed | | Aquatic Bed | |
| Emergent | | Emergent | | Emergent | |
| Scrub Shrub | | Scrub Shrub | | Scrub Shrub | |
| Forested | | Forested | | Forested | |
| Total | | | | | |

Is preservation being proposed as part of the plan? ☐ Yes ☐ No
If yes, _____ acres of wetland will be preserved
and _____ acres of upland buffer and/or _____ acres of riparian corridor.

Buffers for mitigation site
Maximum width _____ ft; Minimum width _____ ; TOTAL buffer area _____ acres.

Water regime at mitigation site
Source of water? Ground Water _____ Rain Water _____ Surface water _____
Owners of water rights? _____

| | Existing | Proposed |
|---|---|---|
| Average winter outflow (cfs) | | |
| Average spring outflow (cfs) | | |
| Average summer outflow (cfs) | | |
| Average fall outflow (cfs) | | |

Soil Surface will be saturated at the surface or flooded for _____ months per year.

Estimated time to reach Performance Standards _____ yrs.

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# Appendix C: Habitat Worksheet

**Project Name** _____

**Project Number** _____

**Location** _____

**Contact Name** _____

LIGHT NEEDS*
SI = Shade Intolerant ST = Shade Tolerant
SD = Shade Dependent HA = Highly Adaptable

SITE PLACEMENT**
DB = Drier Buffer WB = Wetter Buffer
WE = Water's Edge SS = Saturated Soils SW = Shallow Water

Habitat requirements derived from: *Flora of the PNW* (Hitchcock & Cronquist); *Plants of the PNW Coast* (Pojar & MacKinnon); Wetland Plants of Western WA (Cooke); Guidelines for Bank Stabilization Projects and Surface Water Design Manual (King County); Proceedings of the Puget Sound Wetlands and Stormwater Management Research Study (9/26/96); and DDES field observations.

| **Trees** | | | | | | |
|---|---|---|---|---|---|---|
| Scientific Name | Common Name | Indicator Status | Max Ht. | Light Needs* | Site** Placement | Comments |
| *Abies grandis** | grand fir | FACU- | 125 | SI-ST | DB | Best conifer for soil binding roots |
| *Acer macrophyllum* | big leaf maple | FACU + (FAC) | 100 | SI-ST | WB, DB | Seral/sprouter – shallow rooter |
| *Alnus rubra* | red alder | FAC | 80 | SI-ST | WB, DB | Seral, sprouter & spreader |
| *Arbutus menziesii* | Pacific madrone | UPL | 80 | SI | DB | Likes drier, coastal: slow-grower |
| *Betula papyrifera* | paper birch | FACW | 80 | SI | WE, SS | Saturated soils |
| *Fraxinus latifolia* | Oregon ash | FACW | 80 | SI-ST | WE, SS | Requires flat, damp soils |
| *Picea sitchenis** | Sitka spruce | FAC | 230 | SI | WE, SS | Wettest conifer |
| *Pinus contorta** | Shore pine | FAC | 60 | HA | WE, WB, DB | Tolerates poor soil |
| *Pinus monticola** | Western white pine | FACU- (FACW) | 120 | SI | WB, DB | NOT with 900' of *Ribes* spp.! |
| *Populus tremuloides* | quaking aspen | FAC+ | 75 | SI | DB | Seral in montane |
| *Populus trichocarpa* | black cottonwood | FAC | 200 | HA | WE, SS, WB | Seral; sprouter |
| *Prunus emarginata* | bitter cherry | FACU | 50 | SI | DB | Tree form has heavily pubescent leaves |
| *Pseudotsuga menziesii** | Douglas fir | FACU | 300 | SI | WB,DB | Driest confier-seral, fast grower |
| *Taxus brevifolia** | Pacific yew | NI (FAC-) | 80 | ST-SD | WB | Very slow growing |
| *Thuja plicata** | western red cedar | FAC | 230 | SD | SS, WE, WB | Basic to PNW & wetlands |
| *Tsuga heterophylla** | western hemlock | FACU- | 200 | SD | DB | Dry conifer |

*All plant prices from Fourth Corner Nurseries, Sound Native Plants, Storm Lake Growers, and Wabash Natives (containers); and Abundant Life and Frosty Hollow (seeds).*

| **Shrubs** | | | | | | |
|---|---|---|---|---|---|---|
| Scientific Name | Common Name | Indicator Status | Max Ht. | Light Needs* | Site** Placement | Comments |
| *Acer circinatum* | vine maple | FAC- | 25 | SD | WB, DB | Needs canopy shade or lots of moisture |
| *Amelanchier alnifolia* | Serviceberry | FACU | 20 | SI | DB | Edge-loving |
| *Berberis aquifolium* | tall Oregon grape | UPL | 7 | SD | DB | Dry sites |
| *Berberis nervosa* | short Oregon grape | UPL | 4 | ST-SD | DB | Drier sites |
| *Cornus stolonifera* | red-osier dogwood | FACW+ | 20 | ST | WE, SS, WB | Takes sun if has lots of moisture |
| *Corylus cornuta* | Hazelnut | FACU | 15 | ST | DB | Good wildlife habitat |
| *Crataegus douglasii* | black hawthorn | FAC | 20 | SI | WB, DB | Typically on meadow hummocks |
| *Gaultheria shallon* | salal | FACU | 7 | ST-SD | DB | Basic forest groundcover |
| *Holodiscus discolor* | ocean spray | NI | 10 | SI-ST | DB | Drought-tolerant, edge-loving |
| *Lonicera involucrata* | black twinberry | FAC+ | 10 | SI-ST | WE, SS, WB | Takes sun if has lots of moisture |
| *Myrica gale* | sweetgale | OBL | 6 | SI | WE, SS | Common in scrub-shrub wetlands |
| *Oemleria cerasiformis* | Indian plum | FACU | 15 | SD | WB, DB | Sub-canopy |
| *Oplopanax horridus* | Devil's club | FAC+ | 7 | ST | WE, WB | Needs good drainage, forms thickets |
| *Philadelphus lewisii* | mock orange | NI | 10 | SI-ST | WB, DB | Likes streams, good drainage |
| *Physocarpus capitatus* | Pacific ninebark | FACW- | 20 | SI-ST | WB, DB | Needs good drainage |
| *Prunus virginiana* | choke cherry | FACU | 20 | | DB | Native to the whole US |
| *Pyrus fusca* | western crabapple | FACW | 35 | SI-ST | WE, WB | Edges – most of value in streamside control |
| *Rhamnus purshiana* | cascara | FAC- | 30 | ST-SD | WB, DB | Found in most wetlands |
| *Ribes bracteosum* | stink currant | FAC | 10 | ST | WB, DB | Transition |
| *Ribes lacustre* | prickly currant | FAC+ | 7 | ST | WB, DB | Can take drought |
| *Ribes sanguineum* | red-flowering currant | NI | 7 | SI | WB, DB | Doesn't form thickets! |
| *Rosa gymnocarpa* | Wood rose | FACU | 7 | ST | DB | Tough, hardy |
| *Rosa nutkana* | Nootka rose | FAC (OBL) | 10 | ST | SS, WB | Rapid volunteer on damp soil |
| *Rosa pisocarpa* | clustered rose | FAC (FACW) | 7 | ST | WE, SS, WB | Will hybridize with nootka rose |
| *Rubus leucodermis* | black raspberry | NI | 10 | ST | DB | Good buffer planting |
| *Rubus parviflorus* | thimbleberry | FAC- | 10 | SI | DB | Seral groundcover in clear-cuts, drought tolerant |
| *Rubus spectabilis* | salmonberry | FAC+ | 15 | HA | WE, WB, DB | Takes sun if has lots of moisture |
| *Salix geyeriana* | Geyer willow | FACW+ | 15 | SI | SW, WE | Likes inundation, sluggish water, wet meadows |
| *Salix hookeriana* | Hooker's willow | FACW- | 20 | SI | SW, WE, SS | Only found < 5 mi. from coast |
| *Salix lasiandra* | Pacific willow | FACW+ | 50 | HA | WE, SS, WB | Common, tolerant, prefers riparian |
| *Salix scouleriana* | Scouler willow | FAC | 35 | ST | SS, WB, DB | Upland & wetland |
| *Salix sitchensis* | Sitka willow | FACW | 25 | HA | WE, SS, WB | Common, tolerant |
| *Sambucus racemosa* | red elderberry | FACU | 20 | HA | WB, DB | Rapid grower, tolerates sun, seral on clear-cuts |
| *Sorbus sitchensis* | Cascade mountain ash | FACU | 15 | SI-ST | WB, DB | Montane, not to be mistaken for *S. aucuparia* |
| *Symphoricarpos albus* | snowberry | FACU | 7 | SI | WB, DB | Common, tolerant |
| *Vaccinium ovatum* | evergreen huckleberry | UPL | 5 | SD | DB | Prefers mature shade |
| *Vaccinium parvifolium* | red huckleberry | NI (FACU) | 13 | SD | DB | Requires lots of organic matter |

| **Sedges and Rushes** | | | | | | |
|---|---|---|---|---|---|---|
| Scientific Name | Common Name | Indicator Status | Max Ht. | Light Needs* | Site** Placement | Comments |
| *Carex comosa* | Bristly sedge | OBL | 2' | SI | SW, WE, SS | Rare in King County |
| *Carex lenticularis* | Shore sedge | FACW+ | 3' | SI | WE, SS | From shore to high mountains |
| *Carex lyngbyei* | Lyngby sedge | OBL | 3' | SI | SW, WE, SS | Coastal only |
| *Carex obnupta* | Slough sedge | OBL | 4.5' | ST | SW, WE, SS | Extremely common, coast to Cascade crest |
| *Carex rostrata (utriculata)* | Beaked sedge | OBL | | SI-ST | SW, WE, SS | Common |
| *Carex stipata* | Sawbeak sedge | OBL | 3' | SI-ST | SW, WE, SS | Lowland to mid-montane |
| *Eleocharis acicularis* | Spikerush | OBL | 0.5' | SI | SW, WE | Rhizomatous, lowland to mid-montane |
| *Eleocharis palustris* | Common Spikerush | OBL | 0.5' | SI | SW, WE | Rhizomatous, coastal to mid-montane |
| *Juncus acuminatus* | Tapered rush | OBL | 2' | SI | SW, WE | Tolerant |
| *Juncus articulatus* | Jointed rush | OBL | 2' | SI | SW, WE | Tolerant |
| *Juncus effusus (var. pacificus)* | Soft rush | FACW | 3' | SI-ST | SW, WE, SS | Weedy, common, hardy – often invasive |
| *Juncus ensifolius* | Dagger leaf rush | FACW | 2' | SI | SW, WE, SS | Lowland to mid-montane, lovely flowers & foliage |
| *Juncus oxymeris* | Pointed rush | FACW+ | 3' | SI | SW, WE, SS | Lowland |
| *Scripus acutus* | Hardstem bulrush | OBL | 6' | SI | SW, WE | Tolerates up to 3' of water; common, hardy |
| *Scripus maritimus* | Saltmarsh bulrush | OBL | 4.5' | SI | SW, WE | Coastal only |
| *Scripus microcarpus* | Small-fruited bulrush | OBL | 4.5' | SI-ST | SW, WE, SS | Lowland to mid-montane, very common |

| **Grasses** | | | | | | |
|---|---|---|---|---|---|---|
| Scientific Name | Common Name | Indicator Status | Max Ht. | Light Needs* | Site** Placement | Comments |
| *Alopecurus aequalis* | Short-awn foxtail | OBL | | SI-ST | SW, WE, SS | Often submerged |
| *Alopecurus geniculatus* | Water foxtail | OBL | 1.5' | SI-ST | SW, WE, SS | Often submerged, tolerant |
| *Beckmannia syzigachne* | American sloughgrass | OBL | 2' | SI | WE, SS | Good wildlife forage, lowland to mid-montane |
| *Calamagrostis canadensis* | Bluejoint reedgrass | FACW+ | | | WE, SS, WB | Rhizomatous, coastal to mid-montane |
| *Cinna latifolia* | Wood reed | FACW | 6' | ST | WE, SS, WB | Coastal to sub-alpine |
| *Deschampsia caespitosa* | Tufted hairgrass | FACW | 2' | SI | WE, SS, WB | Common, keystone species in wet meadows |
| *Elymus glaucus* | Blue wildrye | FACU | 2' | SI | DB | Very drought-tolerant, good wildlife forage |
| *Festuca idahoenis* | Idaho fescue | FACU* | 2.5' | SI | DB | Drought-tolerant |
| *Festuca rubra var. rubra* | Red fescue | FAC+ | 2.5' | SI | SS, WB | Common tolerant |
| *Glyceria borealis (occidentalis)* | Northern mannagrass | OBL | 4' | ST | WE, SS | Tolerates up to 3' of water |
| *Glyceria elata* | Tall mannagrass | FACW+ | 4.5' | SD | WE, SS, WB | Prefers streamside |
| *Panicum occidentale* | Western panic-grass | FACW | | SI | WE, SS, WB | Coastal to sub-alpine |

| **Ferns** | | | | | | |
|---|---|---|---|---|---|---|
| Scientific Name | Common Name | Indicator Status | Max Ht. | Light Needs* | Site** Placement | Comments |
| *Athyrium filix-femina* | lady fern | FAC | 3 | ST | SW, WB | Very common, tolerant |
| *Blechnum spicant* | deer fern | FAC+ | 2 | SD | WB | Needs shade, moisture |
| *Dryopteris expansa* | shield fern | FACW | 2 | SD | WE, SS, WB | Likes muddy soil |
| *Polystichum munitum* | western sword fern | FACU | 5 | ST | DB | PNW basic; needs shade or moisture |
| *Pteridium aquilinium* | bracken | FACU | 4 | SI | DB | Seral on disturbed areas |

| **Herbs and Groundcovers** | | | | | | |
|---|---|---|---|---|---|---|
| Scientific Name | Common Name | Indicator Status | Max Ht. | Light Needs* | Site** Placement | Comments |
| *Achillea millefolium* | Yarrow | NI | 1' | SI | DB | Self-seeds, robust, tolerant |
| *Anaphalis margaritacea* | Pearly everlasting | NI | 1' | SI | DB | Robust, tolerant |
| *Arctostaphylos uva-ursi* | Kinnikinnick | FACU- | 1' | SI | DB | Slow grower – likes dry stony soil |
| *Aruncus dioicus* | Goat's beard | FACU+ | 2' | ST | WB, DB | Streamside |
| *Caltha palustris* | Marsh marigold | OBL | 9" | ST | SW, WE | Coastal |
| *Dicentra formosa* | Bleeding heart | FACU* | 18" | ST-SD | WB, DB | Very common, tolerant |
| *Epilobium angustifolium* | Fireweed | NI | 4' | SI | DB | Seral on clear-cuts, common, tolerant |
| *Fragaria chiloensis* | Coast strawberry | NI | 6" | SI | DB | Rapid spreader, evergreen |
| *Geum macrophyllum* | Big-leaf avens | FACW- | 3' | ST | WE, SS, WB | Common |
| *Heracleum lanatum* | Cow parsnip | FAC+ | 6' | ST | WE, SS, WB | Likes riparian, self-seeds |
| *Hydrophyllum tenuipes* | Pacific waterleaf | NI (FAC) | 12" | ST-SD | WB, DB | Wet forest groundcover |
| *Linnaea borealis* | Twinflower | FACU- | 6" | ST | DB | Usually in forests, but seral on clear-cuts |
| *Lupinus polyphyllus* | Big-leaf lupine | FAC+ | 3' | SI | DB | Seral, common, tolerant |
| *Lysichiton americanum* | Skunk cabbage | OBL | 10" | SD | SW, WE | Totemic plant, like cedar |
| *Maianthemum dilatatum* | Wild lily of the valley | FAC | 14" | ST | WB, DB | Rapid spreader |
| *Mimulus guttatus* | Yellow monkey flower | OBL | 3' | SI | WE, SS, WB | Forms sheets near seeps |
| *Myosotis laxa* | Small forget-me-not | OBL | 15" | ST | WE, SS | Uncommon, pretty |
| *Oenanthe sarmentosa* | Water parsley | OBL | 3' | ST | SW, WE, SS | Common, hardy, good amphibian habitat |
| *Osmorhiza chiloensis* | Sweet cicely | NI | 6" | ST-SD | DB | Very common in PNW forest |
| *Oxalis oregana* | Wood-sorrel | NI | 9" | ST | WB, DB | Very rapid spreader, robust, highly tolerant |
| *Petasites frigidus* | Coltsfoot | FACW- | 20" | ST | WE, SS, WB | Rhizomatous, good spreader |
| *Polygonum persicaria* | Lady's thumb | FACW | 3' | SI-ST | SW | Many species in this genus, good amphibian habitat |
| *Potentilla fruticosa* | Bush potentilla | FAC- | 3' | SI | DB | Montane, pretty |
| *Smilacina stellata* | Solomon's Star | FAC- | 18" | ST | WB | Forms drifts near streams |
| *Stachys cooleyae* | Great betony | FACW | 4' | SI-ST | WB | Common |
| *Tellima grandiflora* | Fringecup | NI | 2' | ST | DB | Common, tolerant |
| *Tiarella trifoliata* | Foamflower | FAC- | 2' | ST | DB | Common, tolerant |
| *Tolmiea menziesii* | Piggy-back plant | FAC | 30" | SD | WB | Forms drifts near streams |
| *Viola glabella* | Stream violet | FACW+ | 7" | SI-ST | WB | Common, rapid spreader |

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900 Oakesdale Avenue Southwest
Renton, Washington 98057-5212

# Appendix D

## RESULTS

FG No. _____ Permit No. _____ Project Name _____

Inspector _____ Date _____

Special Conditions:

I. Summarize how mitigation compares to standards of success.
A. Vegetation:

B. Hydrology: _____

C. Other: _____

Corrective actions needed?

II. Summarize how well the buffer protects the mitigation

Corrective actions needed?

III. Does mitigation function like a wetland or stream in any stage of seral progression? If so, how? If not, what overall corrective actions would make it do so?

IV. What other notes would you make that these forms do not include?