CITY OF MOUNT VERNON

Critical Areas Ordinance (CAO) Restoration Guidebook

Guidelines, Recommended Techniques, and Details for
Restoration of Waters/Wetlands and their Buffers

Operational Draft
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Critical Areas Ordinance (CAO) Restoration Guidebook
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CHAPTER I INTRODUCTION

In March of 2007 the City of Mount Vernon adopted an updated Critical Areas Ordinance (CAO), MVMC Chapter 15.40, in accordance with the Growth Management Act requirement to review and include best available science in the crafting of regulations intended to protect and enhance environmentally sensitive areas.

The purpose of this document is to provide guidance on the process and implementation measures of Chapter 15.40. The City's CAO employs an innovative approach to critical areas regulation that considers the overall landscape with respect to mitigating project impacts. It also takes into consideration the existing built environment, by allowing the applicant, in many cases, to choose between two buffer alternatives. In large part, this manual has been prepared to assist applicants and City staff in understanding and implementing the buffer alternatives.

This manual only addresses the CAO provisions that involve waters and wetlands. In particular, sections 15.40.080, 15.40.090, and 15.40.110.

HOW TO USE THIS MANUAL

This manual is organized into seven chapters. Starting with Chapter II, each chapter is intended to provide the applicant with enough information to make informed decisions about how to proceed through the process and with the subsequent design and implementation of their development project.

CHAPTER II describes the overall CAO review process. It contains four process charts and explanations of key steps and considerations. This chapter should be read first.

CHAPTER III contains a list of maps which an applicant can utilize to determine which specific CAO provisions would be applied to their project.

CHAPTER IV contains case study examples depicting different site and project circumstances and how the provisions of the CAO would be interpreted and implemented.

CHAPTER V provides a basic discussion of restoration principals and practices. It is intended to orient and to give the applicant a basic understanding of what may be involved in the restoration and enhancement of waters/wetlands and buffers for their project.

CHAPTER VI provides extensive guidance on specific critical area enhancement and restoration activities. It is basically a "how to" chapter (or tool-kit) with illustrations and discussions for a variety of restoration activities.

CHAPTER VII provides a brief description of what should be included in a monitoring program. Any restoration or enhancement of a critical area and/or its buffer will require monitoring and adaptive management over time to ensure success.

CHAPTER II CRITICAL AREAS ORDINANCE PROCESS – WATERS/WETLANDS

The following flow charts and accompanying boxed narratives are intended to provide basic guidance through the Critical Areas Ordinance review process. It is important to note that the process as shown in the flow charts is not strictly sequential; a number of the tasks can be carried out concurrently. For example, the various studies and plans can be developed together, and site visits by staff or the City Biologist and their evaluations occur concurrently with other required review and/or permitting activities.

There are four process charts within this chapter. Each chart has lettered, blue colored boxes that correspond with an explanation in the boxes on the pages immediately following the chart. The orange boxes direct the reader to another chart. In many cases, the specific section of the CAO is also referenced. The four flow charts are as follows:

CHART #1 – BASIC STEPS IN CAO REVIEW PROCESS

CHART #2 – STANDARD PROGRAM

CHART #3 – MANAGED ECOSYSTEM ALTERNATIVE

CHART #4 – REQUIRED STUDIES AND PLANS

Chart #1 Basic Steps in Critical Areas Ordinance Review Process for Waters/Wetlands

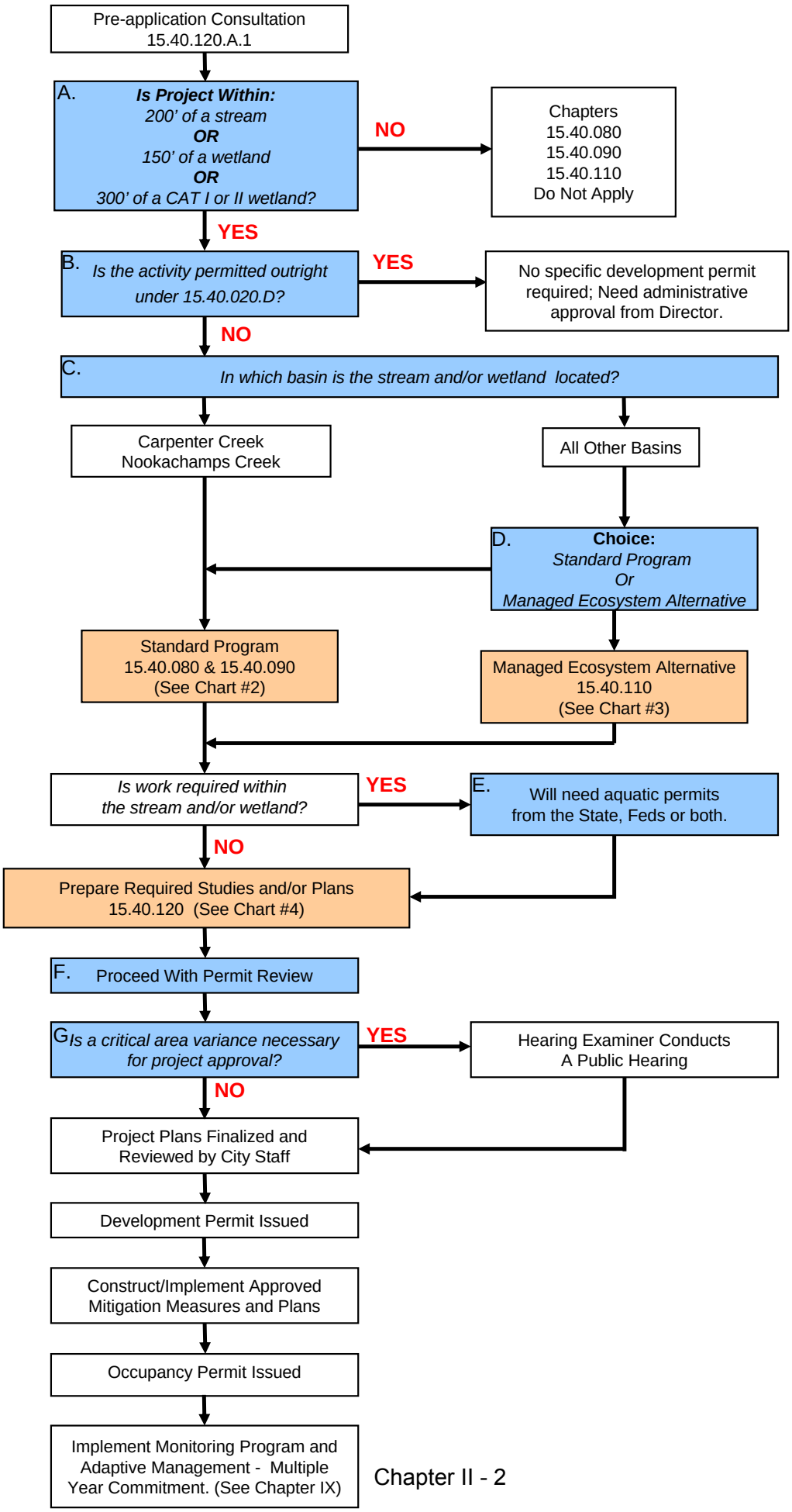


CHART #1 BASIC STEPS IN THE CRITICAL AREAS ORDINANCE REVIEW PROCESS FOR WATERS/WETLANDS

START: **DEVELOPMENT PERMIT APPLICATION**

The provisions of Chapter 15.40 apply to any project requiring a development permit that has a critical area that is on-site or within a regulated distance of the project boundaries. Building construction, grading and drainage, and subdivisions are a few examples of development permits that may be required for any given project. The critical area regulations in Chapter 15.40 are implemented as a part of the underlying project permit approval process. There is no separate critical area permit.

In preparing to submit a development permit application, it is recommended that the applicant locate the project site on the City's ***Drainage Basins and Critical Areas*** map to see if the project site might be in close proximity to, or contains, a stream or wetland. The map may be found in City Hall at the first floor customer service area of the Community and Economic Development Department (CEDD). Staff can assist in reviewing the map. The map may also be found on the City's website at www.ci.mount-vernon.wa.us.

***NOTE*:** There will be situations where access to an adjacent property will be restricted. If there is a wetland or stream located on that property it will not be possible to establish the precise location for the critical area edge. Locating the critical area edge is necessary to determine the extent to which a buffer from an off-site critical area is located on the project site, and whether the project site is within a regulated distance of a critical area. In these situations an approximate location of the critical area edge will have to suffice, based on a review of the City map noted above and/or consultation with CEDD staff. This limitation on the critical area edge location should be noted clearly on all drawings application materisl.

1.A PRE-APPLICATION CONSULTATION - 15.40.120.A.1

If a critical area is known or suspected to occur on the project site or if a critical area is within a regulated distance of the project site, the applicant is required to have a pre-application consultation with CEDD staff. The consultation is meant to help applicants identify regulatory requirements and ensure that critical area planning is integrated into the overall project design.

A site visit by staff or the City biologist may be required to determine whether there is a critical area on-site. A site visit is often required to determine presence of wetlands, since many of the wetland areas shown on City maps are approximations based on aerial photography and soils maps. City maps are updated and corrected as wetlands are located and delineated during project approvals.

In order to determine whether there is a critical area within a regulated distance of the project site, completion of a survey of the project site may be required prior to the site visit by CEDD staff or the City biologist. A survey is required for every development permit application, regardless of permit type. Surveys show precise project and site boundaries, locate existing structures, topography and other site features.

1.B PERMITTED ACTIVITIES - 15.40.020.D.4.

Some activities (enumerated in 15.40.020.D.4.a through n) are permitted within critical areas and/or their buffers without the need of a development permit. Most of these activities are permitted outright only if certain conditions are met. Refer to the applicable section of the code for conditions. These activities only require administrative approval from the Director.

1.C IDENTIFY PROJECT SUB-BASIN

For the purpose of these regulations, the City has been divided into eight stream sub-basins. The CAO provisions have been developed based on a review of the general conditions of each of the sub-basins, so an applicant must first determine which sub-basin regulations apply to their project. On the ***Drainage Basins and Critical Areas*** map, identify in which of the City's eight sub-basins the project is located.

If the project site is located within either the Carpenter Creek or Nookachamps Creek sub-basin, then use of the Standard program regulations in 15.40.080 and/or 15.40.090 is required. (See Chart #2.)

1.D CHOICE OF BUFFER REGULATIONS

If the project is located in one of the other six sub-basins, then the applicant has the option of using the Managed Ecosystem Alternative regulations in 15.40.110. These six sub-basins are

(a) Kulshan Creek,
(b) Trumpeter Creek,
(c) Maddox Creek,
(d) Britt Slough,
(e) West Mount Vernon, and
(f) Skagit River.

Buffer widths under 15.40.110 are on average narrower than those allowed under the Standard program and can be further reduced or modified. However, use of the Managed Ecosystem Alternative requires meeting several conditions including restoration and/or enhancement of degraded stream, wetland and buffer areas, upgrading stormwater facilities, monetary contributions to the City's CAO Management Fund, and a commitment to long term monitoring and maintenance. (See Chart #3.)

1.E WORK WITHIN STREAMS AND WETLANDS

If the project and/or restoration activities require work within a stream and/or wetland, then a permit and/or approval will be required from the State Department of Fish & Wildlife (WDFW) and possibly the Army Corps of Engineers (Corps). The WDFW permit is called a Hydraulics Project Approval (HPA). There are two types of HPA permits: an Individual HPA and a Pamphlet HPA.

An Individual HPA is necessary for any in-water work that cannot be performed under a Pamphlet HPA (see below), and requires a review process by WDFW prior to being issued. This applies to any work that uses, diverts, obstructs, or changes the natural flow or bed. This includes bed reconfiguration, all construction or other work waterward, under and over the ordinary high water line, including dry channels, and may include projects landward of the ordinary high water line (e.g., activities outside the ordinary high water line that will directly impact fish life and habitat, falling trees in to streams or lakes, dike construction, etc.). Examples include, but are not limited to, the following:

Stream bank protection
Construction of bridges, piers, and docks
Pile driving
Channel change or realignment
Conduit (pipeline) crossing
Culvert installation
Dredging
Gravel removal
Pond construction
Placement of outfall structures
Log, log jam, or debris removal
Installation or maintenance (with equipment) of water diversions.

If the in-water activities involve only the removal of trash and invasive or noxious weeds and they can be performed by hand, with hand tools, or with limited equipment, then only a Pamphlet HPA is required. The "pamphlet" HPA has no review process by WDFW prior to receipt of the permit. The applicant is only required to have a copy of the WDFW pamphlet ***"Aquatic Plants and Fish"*** on-site *while the work is being performed*. The pamphlet is issued by WDFW upon a written request and work may not proceed until the pamphlet has been received. Note that while the pamphlet can be viewed and downloaded from the WDFW website, a downloaded copy of the pamphlet is NOT a valid permit. The pamphlet must be requested in writing and sent.

Some weed control and other restoration activities (*e.g.*, bottom barriers, diver dredges, *etc*.) are allowed under a Pamphlet HPA only with prior approval from WDFW. Prior to preparing a mitigation plan (see chart #4), contact the regional office of the WDFW to determine whether a specific activity or activities can be performed under a Pamphlet HPA and whether prior WDFW approval is necessary.

Appendix A contains a WDFW HPA process chart to help in determining what type of HPA, if any, is required for your project.

1.F PROCEED WITH DEVELOPMENT PERMIT REVIEW

At this point in the process, studies and plans required under Chapter 15.40 have been prepared and submitted to the City for the continued processing of the underlying development permit application. In addition, monetary contributions to the CAO Management Fund (under 15.40.110), mitigation bonds and other required fees are often paid during this part of the process. Staff review of submitted studies and plans may result in the Director requesting additional information to clarify or mitigate specific critical area issues before issuing the underlying permit.

Several types of City permits such as a Planned Unit Development (PUD), subdivisions and conditional use permits require a public hearing. The Hearing Examiner will conduct the hearing and either issue a final decision or a recommendation to City Council, depending on the permit type. The Examiner can approve the permit as submitted, approve with conditions on the project, or deny the permit. If conditions of approval involve a critical area, then submitted studies and/or plans may need to be revised to reflect those conditions.

1.G VARIANCES - 15.40.130.D

An applicant may request a variance in circumstances where existing site conditions require development of project in a manner not otherwise allowed by the critical area regulations. Need for a variance will most often occur in situations where existing structures or infrastructure were originally constructed in locations that are now within regulated buffers or critical areas. In some cases even though a structure is not within a regulated buffer or critical area, other site constraints may leave no other option but to modify the buffer or critical area to accommodate the project. Even on undeveloped parcels the combination of lot size and configuration, topography, and critical area may necessitate a variance request.

A variance may be granted with the submission and approval of a critical area report (see Chart #4) and a mitigation plan (if necessary) that demonstrate the project meets all of the criteria in 15.40.130.D.3. These criteria include the following:

1. The proposal is the minimum necessary to accomplish the project purpose.
2. There is no other reasonable alternative to avoid impacting the critical area.
3. The project will not cause significant degradation of the critical area.
4. The project includes measures to minimize critical areas impacts, including limiting the magnitude or implementation of the project, using appropriate and best available technology, taking steps to avoid or reduce impacts.
5. There will be no damage to nearby public or private property and no threat to the health or safety of people on or off the property.
6. The project mitigations are based on consideration of the best available science.

There may be situations where use of the Standard Program necessitates a variance, but using the Managed Ecosystem Alternative will not. In such cases the applicant is required to utilize the Managed Ecosystem Alternative regardless of the sub-basin in which the project is located. A variance requires a public hearing. A Hearing Examiner conducts the public hearing and renders a final decision. If the project has other permits that require a public hearing, then a single hearing is conducted that combines discussion of the variance with the other issues.

Chart #2 Standard Program

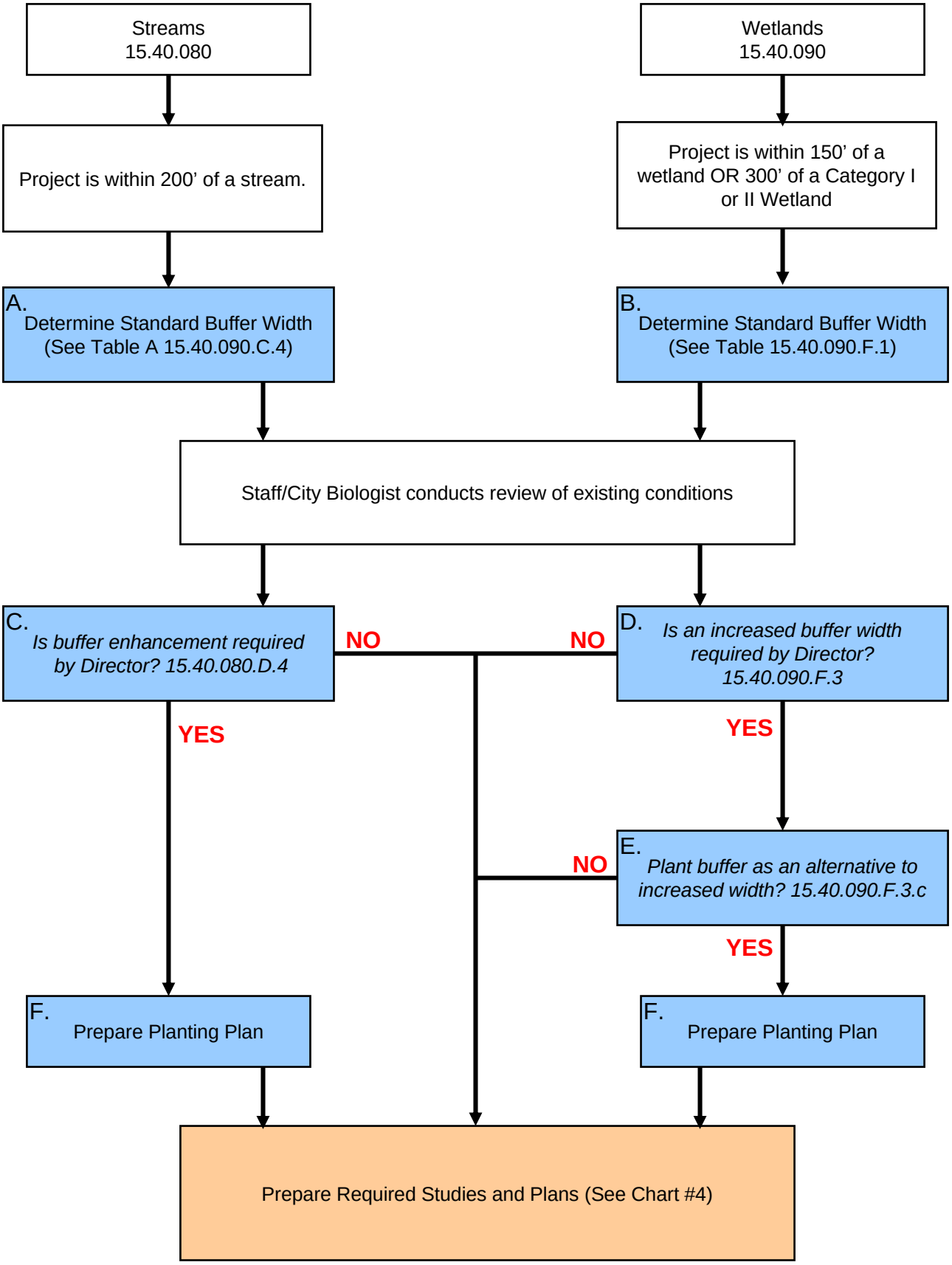


CHART #2 STANDARD PROGRAM

2.A DETERMINE STANDARD STREAM BUFFER

Streams are categorized into four types: S, F, Np and Ns. Determine the stream type on the City's ***Drainage Basins and Critical Areas*** map. This step may have already been done during the pre-application consultation.

Standard buffer widths by stream type are found on Table B (provided below) from Chapter 15.40.080.D.3. The standard buffer width may be modified by the applicant through buffer averaging or a buffer reduction under certain conditions (see Chart #4, Box 4.A). Stream buffer widths are measured from the ordinary high water mark (OHWM).

15.40.080 Table B, Water Type Standard Buffer Widths			
Water Types	Attributes	Minimum Building Setback	Buffer Width Standard
S Freshwater	Freshwater Shorelines of the State	15 feet beyond buffer	175 feet
F	Fish Habitat Waters	15 feet beyond buffer	150 feet
Np	Year-Round, Non-fish Habitat	15 feet beyond buffer	50 feet
Ns	Seasonal, Non-fish Habitat	15 feet beyond buffer	35 feet

2.B DETERMINE STANDARD WETLAND BUFFER

Wetlands are classified into four categories (I, II, III, and IV) with I being the highest quality wetlands and IV being the lowest quality. Wetland classifications are defined in Chapter 15.40.090.C. While some wetlands may have been classified during previous permit applications, most have not. Determining the wetland category will likely require a site visit and evaluation by a qualified wetland professional. If the wetland is on-site, then a delineation of the geographic extent of the wetland will also be a required part of the critical areas evaluation.

Standard buffer widths by wetland category are found on the table in Chapter 15.40.090.F.1. The standard buffer width may be modified through buffer averaging under specified conditions (see Chart #4, Box 4.E). Wetland buffer widths are measured from the delineated wetland boundary.

Standard buffer widths by wetland category (15.40.090.F.1)

Wetland Category	Standard Buffer
I	200 ft.
II	100 ft.
III	75 ft.
IV	50 ft.

2.C REQUIRED STREAM BUFFER ENHANCEMENT - 15.40.080.D.4

Where existing buffer areas provide minimal vegetative cover and cannot meet the City's water quality standards or habitat functions, buffer enhancement will be required by the Director. Buffer area vegetation is considered inadequate under one or more of the following conditions:

1. Non-native or invasive plant species provide the dominant cover.
2. Vegetation is lacking due to disturbance, and aquatic, stream, or habitat resources may be adversely affected.
3. Enhancement plantings in the buffer could significantly improve buffer functioning.

If buffer enhancement is required, then the applicant will need to prepare a Planting Plan (see Box 2.E below).

2.D REQUIRED WETLAND BUFFER INCREASE - 15.40.090.F.3

The Director may require increased buffer widths on a case-by-case basis when a larger buffer is necessary to protect wetland functions based on site-specific characteristics. This determination shall be based on one or more of the following criteria:

1. A larger buffer is needed to protect other critical areas.
2. The buffer or adjacent uplands has a slope greater than 15 percent or is susceptible to erosion, and standard erosion-control measures will not prevent adverse impacts to the wetland.
3. The buffer area has minimal vegetative cover.

The determination to require increased wetland buffer widths is done in accordance with the recommendations of an experienced, certified professional wetland scientist and the best available science.

2.E PLANTING IN LIEU OF WETLAND BUFFER INCREASE - 15.40.090.F.3.c

In lieu of increasing the buffer width where existing buffer vegetation is inadequate, implementation of a buffer Planting Plan may be a suitable substitute (see Box 2.F below). Buffer planting plans may include planting native species and removing nonnative plants. Buffer vegetation may be considered "inadequate" under one or more of the following conditions:

(1) Nonnative or invasive plant species provide the dominant cover.
(2) Vegetation is lacking due to disturbance and wetland resources could be adversely affected.
(3) Enhancement plantings in the buffer could significantly improve buffer functioning.

2.F PLANTING PLANS

Where a buffer planting plan is proposed it shall include planting densities that are in conformance with the recommendations provided in the following sections of this CAO Guidebook. Monitoring and maintenance of plants shall be required in accordance with 15.40.120.H, Monitoring and Contingency Plan.

A monitoring program shall be included as a part of the approved planting plan. To ensure that the performance standards of the approved planting plan have been met, buffer planting and enhancement shall be monitored for a minimum of five years. A longer monitoring period may be required by the City based on either the initial planting and monitoring plan or on a review of subsequent monitoring reports.

Chart #3 Managed Ecosystem Alternative

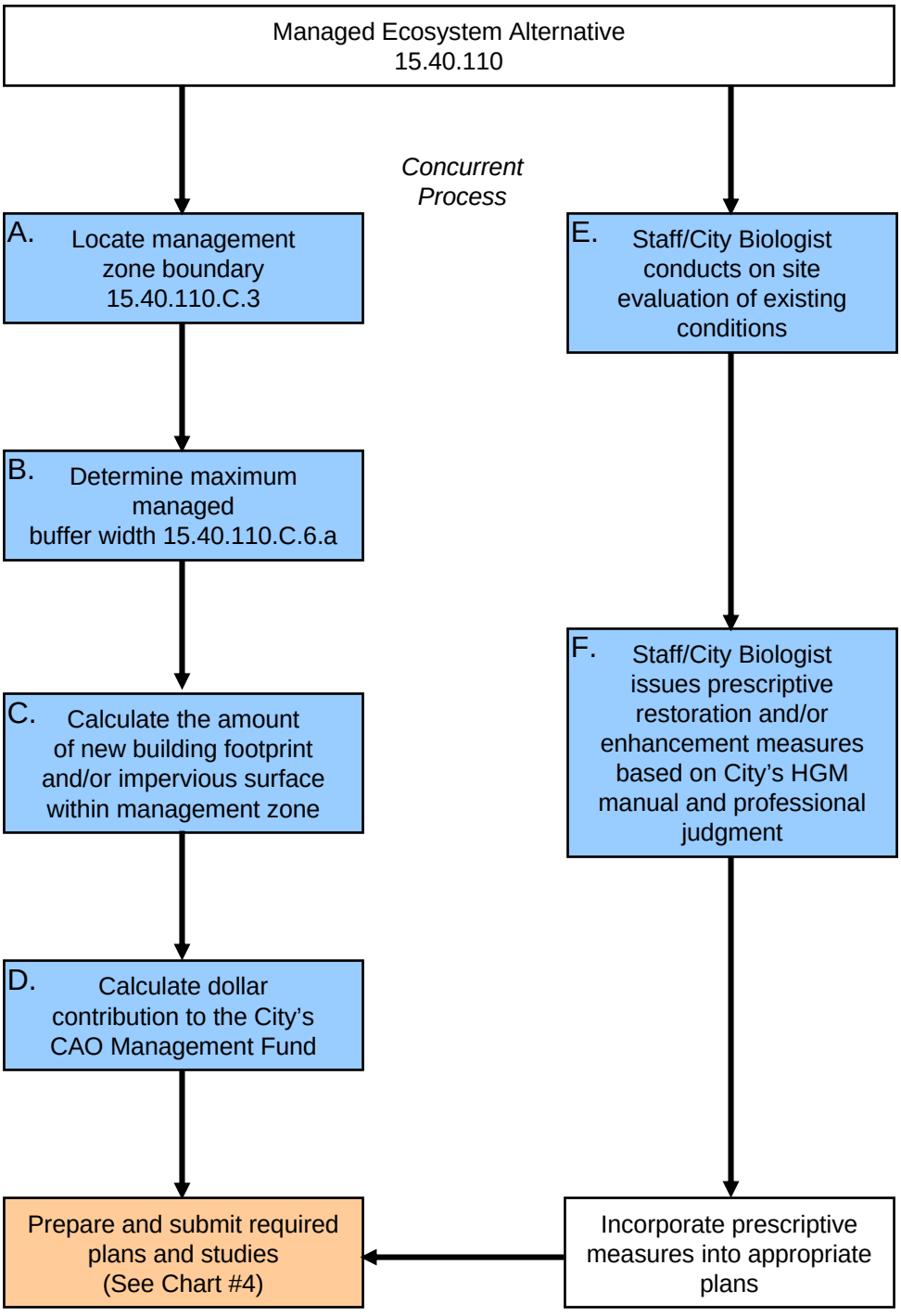
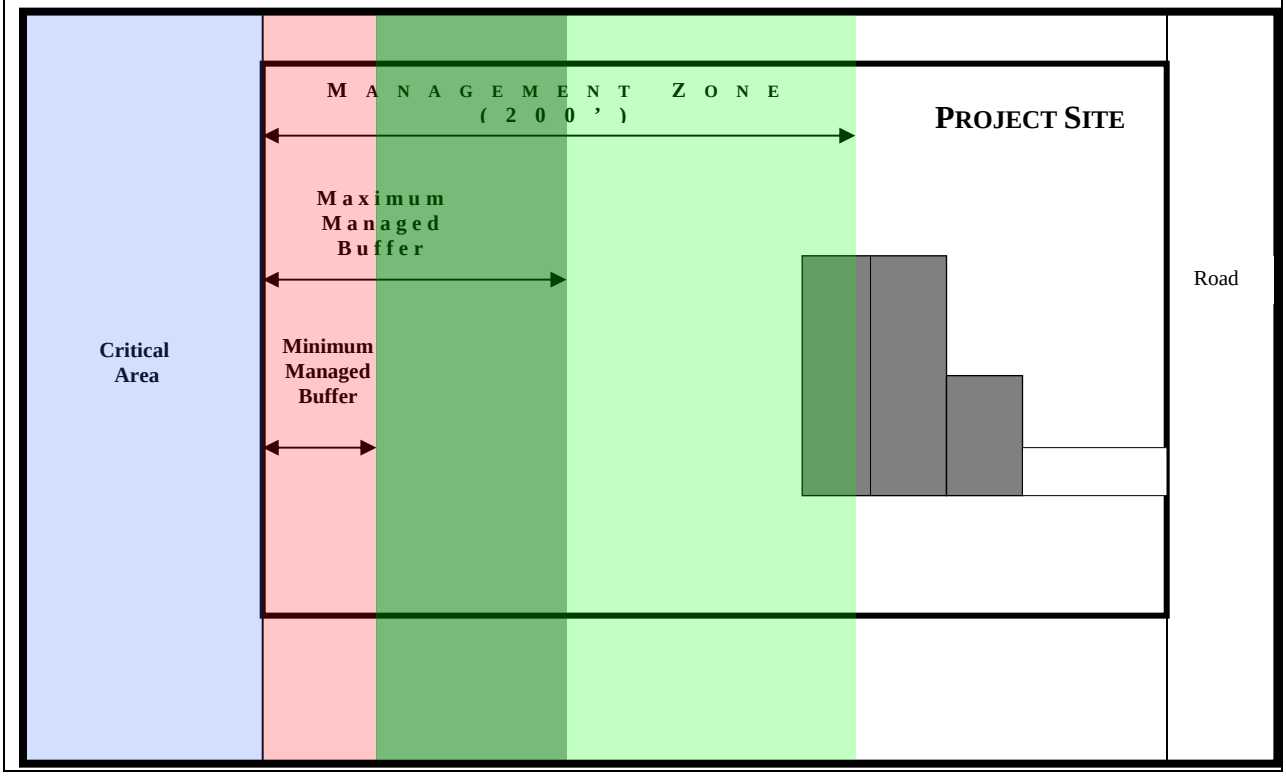


CHART #3 MANAGED ECOSYSTEM ALTERNATIVE

3.A LOCATE MANAGEMENT ZONE BOUNDARY - 15.40.110.D.3

The "Management Zone" is measured from the critical area edge to the nearest paved public street or 200 feet, whichever is less. Where the paved street bisects a critical area, the management zone is 200 feet.

The "Management Zone" includes both the maximum managed buffer and the minimum managed buffer width areas. The illustration below shows the management zone on a project site. The outer edge of the light green area is the boundary of the 200 foot "Management Zone". The outer edge of the dark green area is the limit of the Maximum Managed Buffer (see Box 3.B below). The red area represents the Minimum Managed Buffer width, which is intended to be the minimum buffer width reduction allowed in most circumstances.



3.B DETERMINE MAXIMUM MANAGED BUFFER WIDTH - 15.40.110.E

Determining standard buffer widths under 15.40.110.E requires referencing one or more City critical areas maps and may involve a site visit by City staff or Biologist. The buffer width is a function of three pieces of information:

1) *Stream Type or Wetland Category*. Stream types and wetland categories under the Managed Ecosystem Alternative are the same as those used in the Standard Program (see Chart #2, Boxes 2.A & 2.B).

2) *Gradient (15.40.110.D.7).* This is a measurement of the slope of the longitudinal profile of the stream (i.e., the slope on which the stream occurs). There are three gradients used in the regulations: Low (less than 1% slope), Medium (1% to 2%) and High (greater than 2%). Stream gradients can be looked up on the City's ***Streams by Gradient*** map or measured in the field.

3) *Natural, Closed, or Maintained System (15.40.110.D.8).* This information is an indicator of the prevailing condition of the critical area and its associated buffer. A Natural System is one that has an existing natural vegetated buffer of 50 or more feet. A Closed System is specific to streams and is one that is piped or in a completely confined structure. A Maintained System is one that is neither of the other two, and is typically a situation where the buffer area has been altered from its natural state and is maintained (such as lawn mowing) in some fashion.

Maximum and minimum managed buffer widths are found in Table A 15.40.110 for streams and Table B 15.40.110 for wetlands.

3.C CALCULATE SQUARE FEET OF NEW BUILDING FOOTPRINT AND/OR IMPERVIOUS SURFACE

This is a straightforward calculation. All of the new square footage of building footprint and other impervious surfaces that occur within the management zone are added together. The one consideration here is to keep track of where in the management zone the new structure and/or impervious surfaces are located. The reason for this is explained below in Box 3.D.

"Impervious surface" is defined in 15.40.170.A. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, lawns, and oiled, macadam or other surfaces which impede the natural infiltration and movement of water.

3.D CALCULATE DOLLAR CONTRIBUTION TO THE CAO MANAGEMENT FUND

Construction of new building footprint and new impervious surface anywhere within the Management Zone (see illustration in Box 3.A above) requires a monetary contribution to the City's Critical Area Management Fund. The amount of the contribution is based on the total square feet of new building footprint and/or impervious surface multiplied by the dollar amounts specified in Table C 15.40.110. The dollar amounts are modified depending on where within the Management Zone the construction is located, and whether or not tree canopy is being removed as part of the project.

As an example, let's assume a project occurs within the Trumpeter Creek sub-basin. The second column of Table C specifies the dollar amounts per square foot for construction that occurs in the outer portion of the Management Zone (the light green area in the illustration in Box 3.A above). The base dollar amount is $1.50 per square foot. If a portion of the new square footage involves removal of tree canopy, then the dollar amount increases to $4.00 per square foot just for the area of tree canopy removal shown in column three. Note that this measurement corresponds to the drip-line of the tree(s) to be removed.

Column four of Table 3 specifies the dollar contribution for construction that occurs within the Maximum Managed Buffer area (the dark green area on the figure above). In this case the amount is $4.00 per square foot of new structure and/or impervious surface. Note that the dollar amounts are always higher for construction that occurs within the buffer area.

3.E ON-SITE EVALUATION OF EXISTING CONDITIONS BY CITY STAFF OR BIOLOGIST

Under the Ecosystem Buffer Alternative the applicant will need to have CEDD staff or biologist perform an evaluation of existing critical area and buffer conditions. Chapter VI of this manual (Restoration Principles) provides an overview of the types of features, characteristics or processes considered in this evaluation. Review of existing conditions will provide a "functional assessment" of the existing critical area and associated buffers, which provides the baseline conditions for how critical area functions are operating on the subject site. CEDD staff or biologist will be using the companion document to this manual during their evaluation. The document is titled ***Guidebook to Assessment of Riverine, Slope and Depressional Waters/Wetland Functions*** (*i.e.,* HGM Manual) and has been developed specifically for the critical area conditions found in Mount Vernon.

3.F CITY PROVIDES PRESCRIPTIVE RESTORATION AND ENHANCEMENT MEASURES TO APPLICANT

After conducting a functional assessment the City will prescribe a set of actions necessary to restore and/or enhance existing critical area/buffer conditions. These prescriptive measures are based on site conditions, the type of project proposal, the City's HGM Manual and the Biologist's best professional judgment. Chapter VI of this manual provides examples of what these measures may entail based on four generic sets of conditions. These prescriptive measures are then incorporated into the plans required under this Chapter (see Chart #4).

Chart #4 Required Studies and Plans

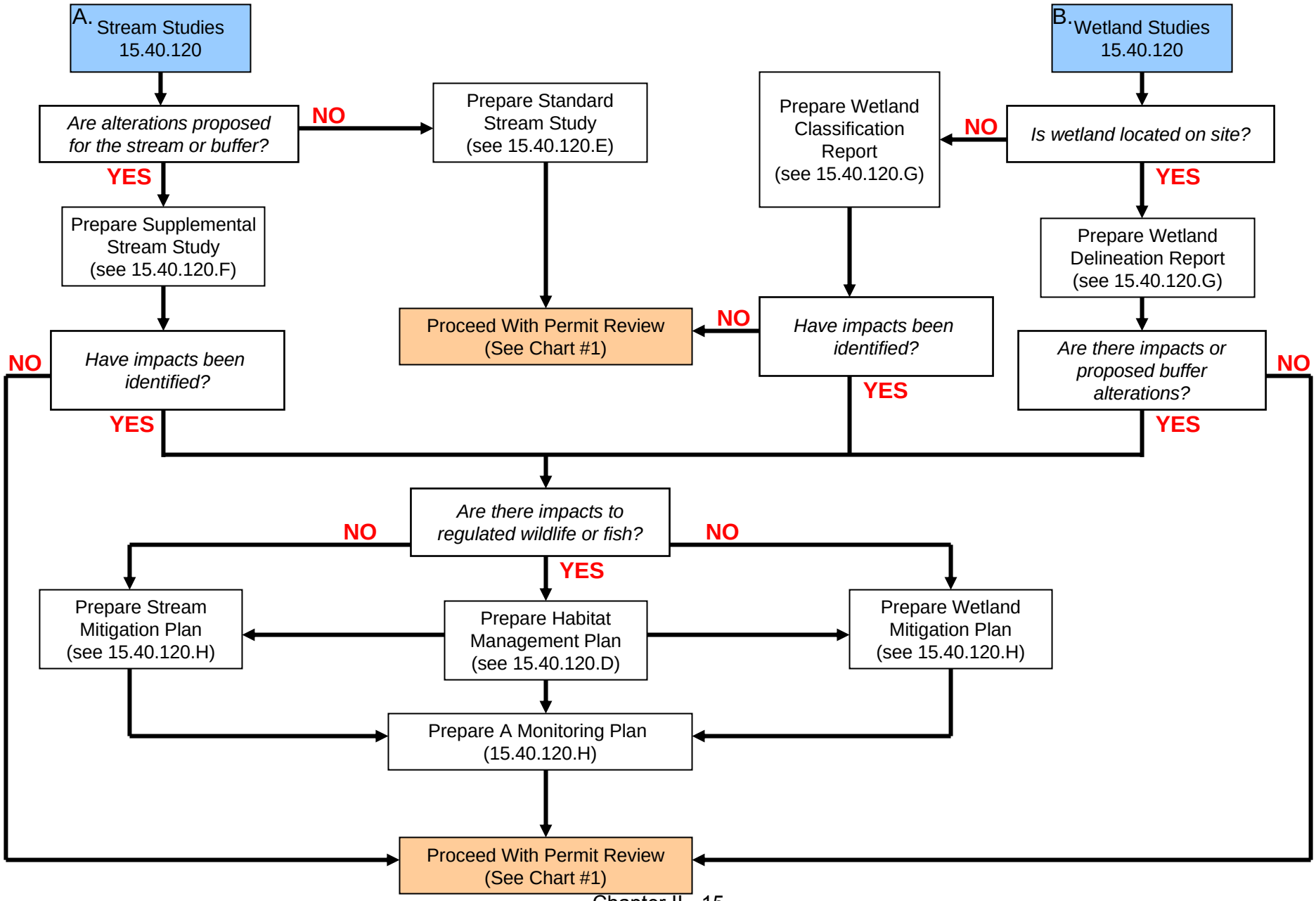


CHART #4 REQUIRED STUDIES AND PLANS

4.A STREAM STUDIES AND PLANS - 15.40.120.E AND F

In earlier steps of the process, it has been determined that the project site is within 200 feet of a stream or has a stream located on-site.

Standard Stream Study: A Standard Stream Study is required in two instances: 1) when the project site is located within 200 feet of a stream; or 2) when there is a stream on-site and no alterations are proposed for the stream or its buffer. Standard Stream Study requirements are outlined in 15.40.120.E. The study may be waived by the Director under the following circumstances:

1) A public road, building or other long-term barrier exists between the stream and the proposed development activity, or;

2) The stream or riparian management zone does not intrude on the applicant's lot, and based on evidence submitted, the proposal will not result in significant adverse impacts to nearby streams, or;

3) Applicable data and analysis appropriate to the project proposed exists and an additional study is not necessary.

Supplemental Stream Study: A Supplemental Stream Study is required when a site contains a stream or management zone and alterations of the stream and/or management zone are proposed, either administratively or via a variance request. Supplemental Stream Study requirements are outlined in 15.40.120.F. The study may be waived by the Director when applicable data and analysis appropriate to the project proposal already exists and additional study is not necessary.

Stream Mitigation Plan: A Stream Mitigation Plan is required when impacts have been identified within the Supplemental Stream Study. Stream Mitigation Plan requirements are outlined in 15.40.120.H. The mitigation plan may be waived by the Director when applicable data and analysis appropriate to the project proposal already exists and additional mitigation is not necessary.

Note that stream studies and mitigation plans must be prepared by a professional wetland scientist with appropriate expertise specific to the affected critical area.

4.B WETLAND STUDIES AND PLANS - 15.40.120.G

In earlier steps of the process, it has been determined that the project site is within 150 feet of any wetland, or is within 300 feet of a potential Category I or II wetland, or has a wetland located on-site.

Wetland Report Identifying Classification: An applicant is required to conduct a study to determine the classification of the wetland if the subject property or project area is within 150 feet of a wetland even if the wetland is not located on the subject property. Similarly, if there is a potential Category I or II wetland within 300 feet of a proposal, the City may require an applicant to conduct a study even if the wetland is not located on the subject property, but it is determined that alterations of the subject property are likely to impact the wetland in question or its buffer.

Wetland Report Identifying Delineation: A wetland delineation is required for any portion of a wetland located on the subject property. The exact location of the wetland edge is determined by a wetlands specialist through the performance of a field investigation using the procedures identified in 15.40.090.A.

Wetland Classification and Delineation Reports may be waived by the Director under the following circumstances:

1) A public road, building or other physical barrier exists between the wetland and the proposed activity; or,

2) The wetland or buffer does not intrude on the applicant's lot, and based on evidence submitted, the proposal will not result in significant adverse impacts to nearby wetlands regulated under this section; or,

3) Applicable data and analysis appropriate to the project proposed exists and an additional study is not necessary, consistent with current rating system and mitigation standards.

Wetland Mitigation Plan: An applicant is required to prepare a Wetland Mitigation Plan per 15.40.120.H. if impacts are identified within a Wetland Classification or Delineation Study or if a wetland buffer alteration is proposed.

A wetland mitigation plan may be waived by the Director when applicable data and analysis appropriate to the project proposal exists and an additional report is not necessary, consistent with current rating system and mitigation standards.

Note that wetland studies and mitigation plans must be prepared by a certified wetland scientist.

CHAPTER III KEY MAPS AND RESOURCES

Below is a list of maps and resources containing information that the applicant will need to determine what specific provisions of the CAO will apply to their project. They can be found on the City's website and are available for viewing in the customer service area of the Department of Community and Economic Development. All of these maps show approximate locations of property boundaries.

A. DRAINAGE BASINS AND CRITICAL AREAS MAP

This map shows the eight stream sub-basins used to implement the CAO, the location of creeks and streams, and the approximate location of known or suspected wetlands. This map should be used to make an initial determination whether a subject property contains and/or is in close proximity to a regulated stream or wetland.

B. INDIVIDUAL DRAINAGE BASIN MAPS

This set of maps provides a more detailed presentation of the information presented in the Drainage Basin and Critical Areas map above.

C. SUB-BASINS WITH STREAMS BY GRADIENT MAP

This map shows the City's creeks and streams by gradient, or percent slope. Three gradients depicted: less than 1%, between 1% and 2%, and greater than 2%. This map is necessary to help determine the Maximum and Minimum Managed Buffer widths contained in 15.40.110.

D. FISH DISTRIBUTION MAP

This map depicts the general distribution of various fish species found in the City's streams and creeks. This map is useful in determining stream type. Fish bearing streams are typed 'F' and are given a larger buffer than non-fish bearing streams.

E. FISH BLOCKAGES MAP

This map shows where there are impediments to the movement of fish along the City's streams. This map is useful in cases where removal of the blockage can be incorporated into the mitigation of an adjacent project's impacts.

F. PRIORITY HABITATS MAP

This map is developed by the Department of Fish and Wildlife and shows the general location of known or suspected State and Federal listed endangered, threatened and species of concern. Note that this map is typically not given out to the general public. City staff can reference this map to determine if an applicant's project site possibly contains or is in proximity to a regulated species.

G. ZONING MAP

This map shows the location of the City's zoning districts.

H. HGM MANUAL

The City's HGM Manual is titled *"Draft Operation Guidebook to Assessment of Riverine, Slope, and Depressional Waters/Wetlands Functions in the City of Mount Vernon, Washington; March 2008"*. This a technical manual that provides the procedures and

variables to evaluate existing waters/wetland functions, and to measure the effectiveness of mitigation projects over time. The metrics found in this manual provide a means to quantitatively compare waters/wetland functions for both on-site and off-site mitigation actions. The City uses this manual as an "accounting" methodology for the Managed Ecosystem Alternative in tracking CAO Management Fund projects. Project proponents will use this manual for the yearly reporting required for mitigation actions under the CAO.

I. Mount Vernon City Website

The City of Mount Vernon maintains its own website that contains links to the City's Municipal Code, the CAO, the maps identified above and to other environmental permitting resources. The website is continually updated as mapping and permit information is refined and updated. Go to: www.ci.mount-vernon.wa.us/

J. Permitting Resources for Washington State

There are several good sources for environmental permitting information and assistance provided by Washington State government agencies and offices. Two of the most helpful are the Governor's Office of Regulatory Assistance and the Washington Department of Ecology.

- Governor's Office of Regulatory Assistance – www.ora.wa.gov/today

  This link is an excellent starting point if the project will involve actual work within a critical area. This link can provide a project proponent with information and forms necessary to understand and start the State environmental permitting process.

- Washington Department of Ecology – www.ecy.wa.gov/

  Ecology's website is extensive and has information, studies, and rules for every aspect of Washington State's environmental resources. Included are links to other agencies with environmental permitting authority.

If a project involves the alteration of a wetland, then it will involve coordination with the Army Corps of Engineers. The Seattle District Office can be contacted at the following link, and can also provide permitting assistance and information.

- Army Corps of Engineers, Seattle District – www.nws.usace.army.mil/

CHAPTER IV CASE STUDIES: EXAMPLES OF IMPLEMENTATION

The following case studies illustrate how the Critical Areas Ordinance review process might be applied to various project proposals City staff will encounter. The cases range in complexity from a straightforward scenario to one where existing conditions prevent project development from conforming to critical area regulations. Each case study describes the site location, project circumstances and description, impacts, applicable code, and resolution. An illustration accompanies each scenario. The case studies are:

CASE STUDY #1	MR. JONES' ADDITION – EXAMPLE A
CASE STUDY #2	MR. JONES' ADDITION – EXAMPLE B
CASE STUDY #3	PUBLIC BUILDING EXPANSION
CASE STUDY #4	MR. SMITH'S FOUR LOT ALIGNMENT OPTION 1 – LARGE LOTS
CASE STUDY #5	MR. SMITHS'S FOUR LOT ALIGNMENT OPTION 2 – SHORT PLAT

CASE STUDY #1 MR. JONES' ADDITION - EXAMPLE A

LOCATION
Maddox Creek sub-basin

PROPOSED PROJECT
Mr. Jones owns an existing residence on a lot that has frontage on Maddox Creek. He has applied for a building permit to add a modest addition (10' x 30') to the side of his house.

SITE CIRCUMSTANCES
The house and proposed addition are located wholly within the 150' Standard Buffer of the stream. So, he has chosen to opt for the Managed Ecosystem Alternative outlined in Chapter 15.40.110. The house is located entirely within the Management Zone. The creek is a natural system, is classified as low gradient, and is fish bearing. The stream buffer is partially degraded. Tree canopy covers a portion of Mr. Jones' lot.

PROJECT IMPACTS
The project will add 300 square feet (10' x 30') of new building footprint within the Management Zone, but is outside the Maximum Managed buffer and will not require the removal of any trees.

APPLICABLE CODE PROVISIONS

15.40.110.C.3.a.iii - Maddox Creek

15.40.110.E.2 Table A, Buffers - natural system
- low gradient
- Type F stream

= 75 ft Maximum Managed Buffer & 37.5 ft Minimum Managed Buffer

15.40.110.E.3.a Table C - Contribution to CAO fund

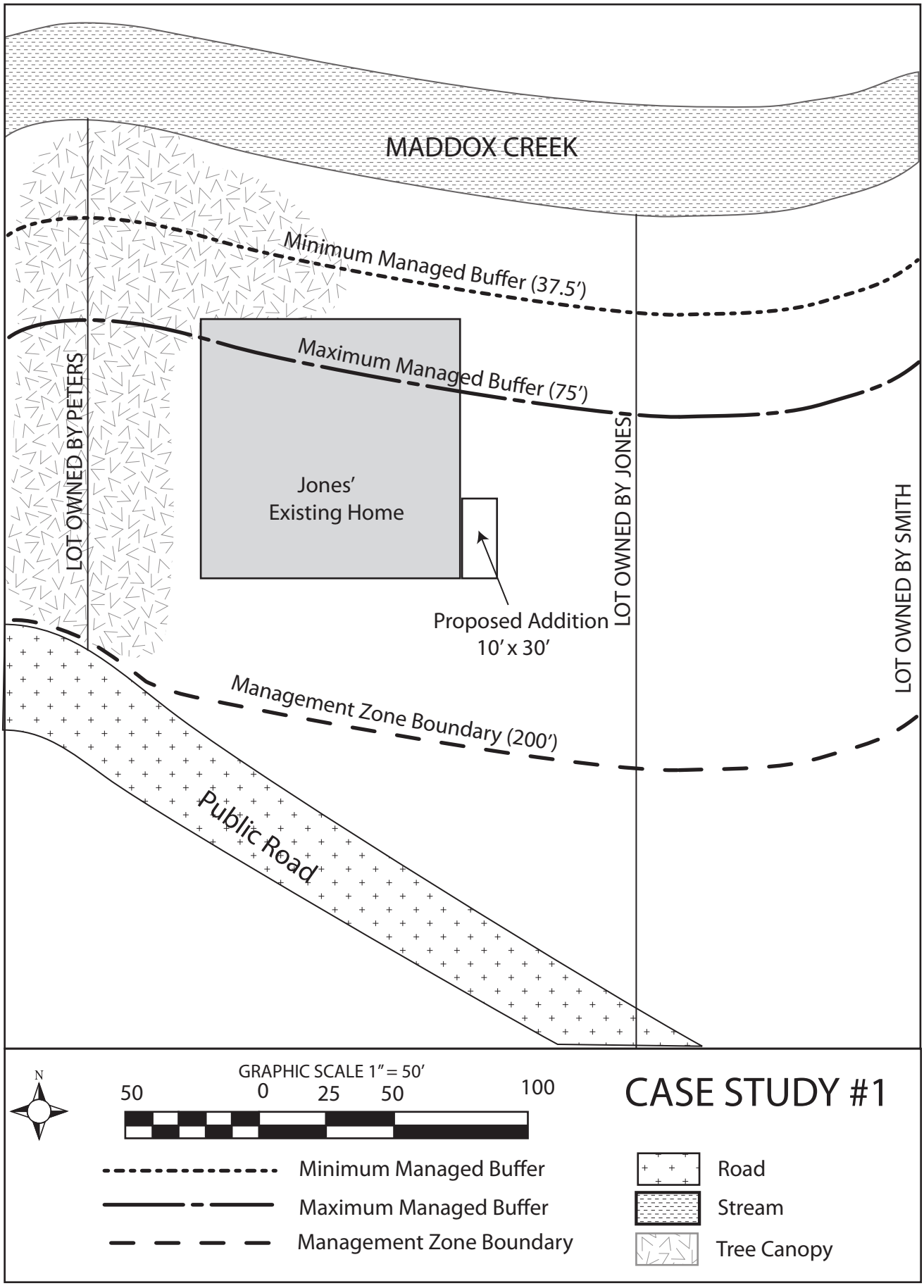
RESOLUTION

1) Mr. Jones will be required to make a payment to the CAO Management Fund in the amount of $450 (300 ft^2 x $1.50) as shown in the chart below

Project Zone	Description of Area	Cost/ft^2	Area Impacted (ft^2)	Tree canopy removal	Total Cost
Management Zone	Addition Area 1	$1.50	300	No	$450.00
TOTAL					**$450.00**

2) He will also be required to enhance the degraded portions of the stream buffer based on prescriptive measures provided by the City Biologist (*e.g.*, removal of trash, removal of weeds, planting native trees within the buffer; See Sections V and VI of this Guidebook).

3) In addition, he will also be required to upgrade on-site drainage to current City standards.


MADDOX CREEK
Minimum Managed Buffer (37.5')
Maximum Managed Buffer (75')
LOT OWNED BY PETERS
Jones'
Existing Home
Proposed Addition
10' x 30'
LOT OWNED BY JONES
LOT OWNED BY SMITH
Management Zone Boundary (200')
Public Road
N
GRAPHIC SCALE 1" = 50'
50 0 25 50 100
CASE STUDY #1
Minimum Managed Buffer
Maximum Managed Buffer
Management Zone Boundary
Road
Stream
Tree Canopy

CASE STUDY #2 MR. JONES' ADDITION - EXAMPLE B

LOCATION
Maddox Creek sub-basin

PROPOSED PROJECT
Mr. Jones just won the lottery. Mr. Jones has applied for a building permit to completely remodel his home, which includes 1,200 square foot addition to his house on two sides of the house. Since the proposed addition would intrude into the Standard stream buffer and would require a variance, he must use the Managed Ecosystem Alternative in Chapter 15.40.110.

SITE CIRCUMSTANCES
Mr. Jones owns an existing residence on a conforming lot that has frontage on Maddox Creek. The house is located entirely within the Management Zone. The creek is a natural system, is classified as a low gradient stream, and is fish bearing. The stream buffer is partially degraded.

PROJECT IMPACTS
The project will add 1,200 square feet of new building footprint within the Management Zone. Of the proposed additions, 300 square feet is located within the Maximum Managed Buffer. Approximately 375 ft^2 of tree canopy will be removed from the area within the management Zone.

APPLICABLE CODE PROVISIONS
15.40.110.C.3.a.iii Maddox Creek

15.40.110.C.4 Variance applicability

15.40.110.E.2 Table A, Buffers - natural system
- low gradient
- Type F stream

= **75 ft Maximum Managed Buffer & 37.5 ft Minimum Managed Buffer**

15.40.110.E.3.a Table C - Contribution to CAO fund

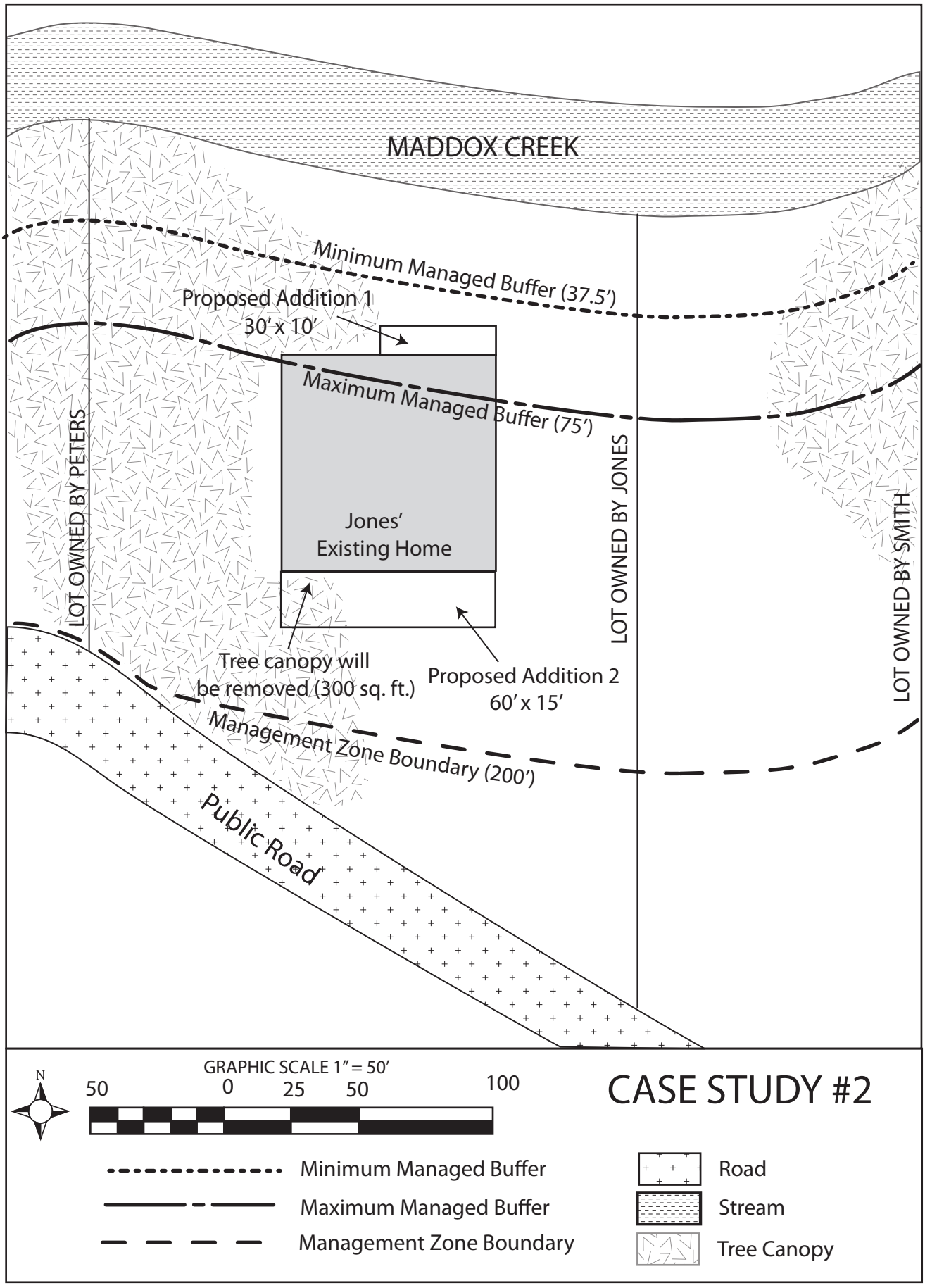
RESOLUTION

1) Mr. Jones will be required to make the following payment to the CAO Management Fund:

Project Zone	Description of Area	Cost/ft^2	Area Impacted (ft^2)	Tree canopy removal	Total Cost
Management Zone	Addition Area 2	$1.50	600	No	$900.00
Management Zone - canopy	Addition Area 2	$4.00	300	Yes	$1,200.00
Maximum Managed Buffer	Addition Area 1	$4.00	300	No	$1,200.00
TOTAL					**$3,487.50**

2) Mr. Jones will also be required to enhance the degraded portions of the stream buffer based on prescriptive measures provided by the City Biologist (*e.g.*, removal of trash, weed management, plant native trees, etc., See Chapter V and VI for examples).

3) In addition, he will also be required to upgrade on-site drainage to current City standards.


MADDOX CREEK
Minimum Managed Buffer (37.5')
Proposed Addition 1
30' x 10'
Maximum Managed Buffer (75')
LOT OWNED BY PETERS
LOT OWNED BY JONES
LOT OWNED BY SMITH
Jones'
Existing Home
Tree canopy will
be removed (300 sq. ft.)
Proposed Addition 2
60' x 15'
Management Zone Boundary (200')
Public Road
N
GRAPHIC SCALE 1" = 50'
50 0 25 50 100
CASE STUDY #2
Minimum Managed Buffer
Maximum Managed Buffer
Management Zone Boundary
Road
Stream
Tree Canopy

CASE STUDY #3 PUBLIC BUILDING EXPANSION

LOCATION
Kulshan Creek sub-basin

PROPOSED PROJECT
The City needs to expand a public building to accommodate additional office space. The lot on which this public building sits is bordered on the north and east sides by the north fork of Kulshan Creek. The proposed addition will occur along the northern portion of the building.

SITE CIRCUMSTANCES
At this location, the stream has been channelized as part of past construction activities and is moderately to highly degraded. The building is located 195 feet from the Ordinary High Water Mark (OHWM) to the north and 55 feet from the OHWM to the east. The existing paved parking lot is 9 feet from OHWM to the north and 10 feet from OHWM to the east. At this location, Kulshan Creek is a low gradient, maintained, type 'F' stream with a Category III wetland extending 1 to 2 feet above the OHWM of the stream. Tree canopy is limited to the stream and wetland area, and consists primarily of alders.

PROJECT IMPACTS
The project will add 10,000 sq. ft of new building footprint. The addition will occur within the existing paved parking area. No tree canopy will be removed and no alteration of the creek or wetland is required for the building expansion.

APPLICABLE CODE PROVISIONS

1. STANDARD BUFFER:

MVMC 15.40.090 (Table A): Approximately half of the existing building is located within the Standard buffer of 150 feet, which carries with it a required building setback of 15 feet. About two-thirds of the proposed addition would also be located within the Standard buffer. Use of the Standard buffer makes the existing building and the addition non-conforming. This would require a variance, so the applicant must now see if use of the Managed Buffer Alternative provisions would eliminate the need for a variance request.

2. MANAGED BUFFER ALTERNATIVE:

15.40.110.C.3.a.i: Kulshan Creek

15.40.110.C.4 Variance applicability

15.40.110 Table A, Buffers: - maintained system
- low gradient
- Type F stream

= 50 foot Maximum Managed Buffer & 25 foot Minimum Managed Buffer

15.40.110.E.2.c: Degraded Buffer Condition

15.40.110.E.3.a Table C: Contribution to CAO fund (see below)

Use of the Managed Buffer Alternative would eliminate the non-conformity of the existing building and proposed addition, since they would be outside of the Maximum Managed Buffer area of 50 feet. However, the existing buffer area is degraded such that it does not meet the

degraded buffer setback minimums of either 15 ft or the slope requirements (7:1) prescribed in 15.40.110.E.2.c. The Applicant must request a variance from this particular code provision, but not for the building or addition.

RESOLUTION

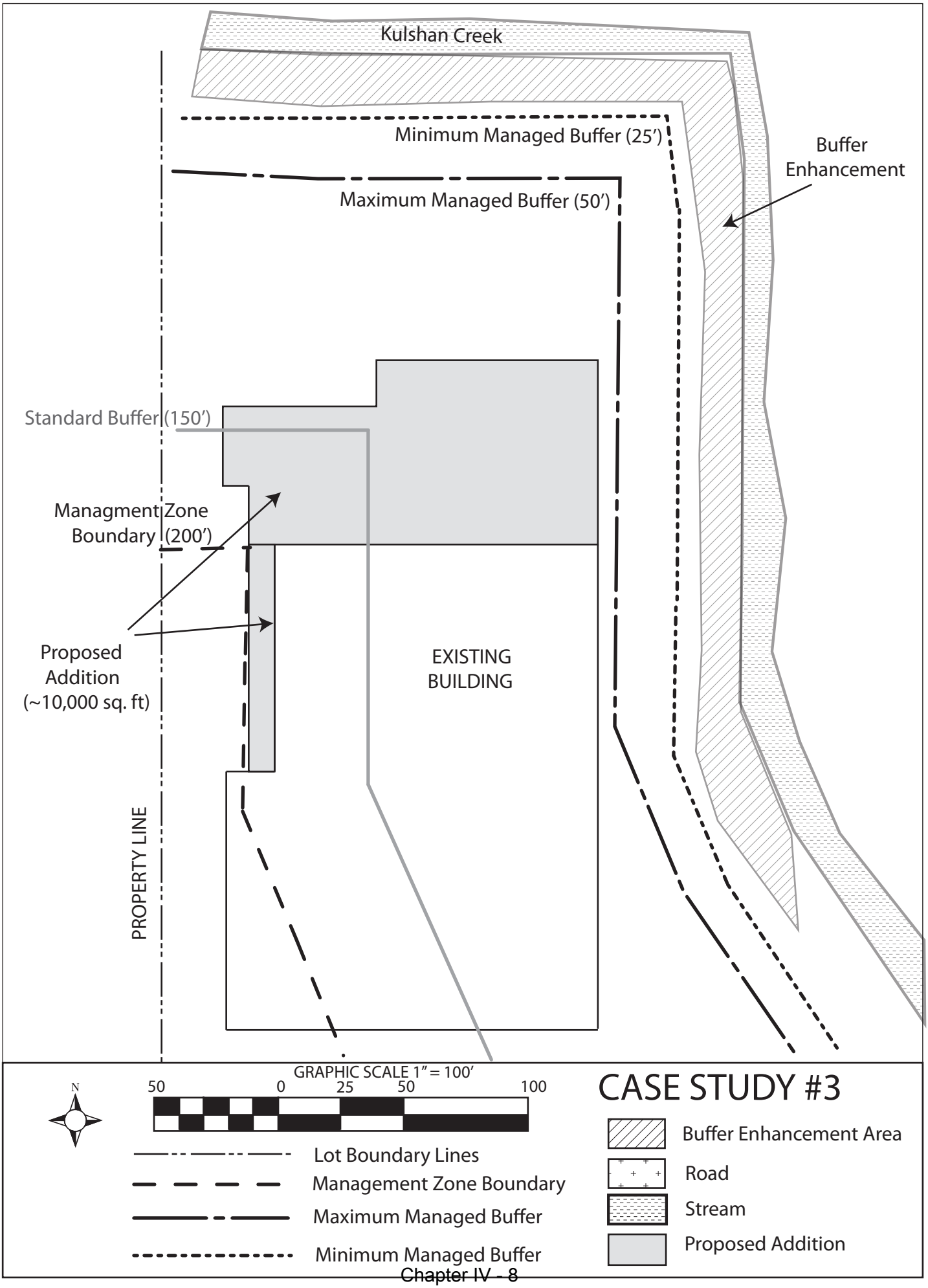
1) Since new building footprint will be added to the outer Management Zone (see illustration), the applicant will be required to make the following contribution to the CAO management fund:

Project Zone	Description of Area	Cost/ft^2	Area Impacted (ft^2)	Tree canopy removal	Total Cost
Management Zone	Addition area	$1.00	10,000	None	**$10,000**

2) To meet the variance requirements of 15.40.130, portions of the existing parking lot will be removed along the northern border of the property to provide larger buffer along the stream. There will be a net reduction of approximately 5,000 ft^2 of impervious surface on the property.

   Along the north and east sides of the property, approximately 10,000 ft^2 will be enhanced to improve faunal support/habitat, biogeochemical, hydrologic, and plant community functions. The stream corridor will be enhanced through planting of native species, removal of trash and weeds, and phased removal of alders combined with replanting of conifers.

3) The applicant will be required to install new stormwater treatment infrastructure to treat all runoff from the property before it enters the stream. This infrastructure will improve hydrology and biogeochemical functions provided by the stream.


Kulshan Creek
Minimum Managed Buffer (25′)
Buffer Enhancement
Maximum Managed Buffer (50′)
Standard Buffer (150′)
Managment Zone Boundary (200′)
Proposed Addition (~10,000 sq. ft)
EXISTING BUILDING
PROPERTY LINE
GRAPHIC SCALE 1″ = 100′
50 0 25 50 100
N
Lot Boundary Lines
Management Zone Boundary
Maximum Managed Buffer
Minimum Managed Buffer
CASE STUDY #3
Buffer Enhancement Area
Road
Stream
Proposed Addition

CASE STUDIES #4 AND #5:

Mr. Smith wants to subdivide a large parcel into four smaller lots. His existing home will remain on Lot 1. He plans to build 3 additional homes on the 3 new lots. He discusses lot alignments with his contractors and comes up with two options for lot layouts. He wants to minimize impacts to critical areas and therefore runs through calculations to compare costs and impacts from each lot layout. Case Studies #4 and #5 provide details of each layout option.

CASE STUDY #4 MR. SMITH'S FOUR LOT ALIGNMENT OPTION 1 –LARGE LOTS

LOCATION
Trumpeter Creek sub-basin

PROPOSED PROJECT
Mr. Smith owns an existing residence on a large lot. He wants to subdivide this lot into 4 smaller lots, and he plans to consider costs and benefits of several different lot alignments. In one proposed lot alignment, Mr. Smith will create four similarly sized lots.

SITE CIRCUMSTANCES
Mr. Smith's property is adjacent to a tributary of Trumpeter Creek. Approximately 75% of the property lies within the Management Zone. In this configuration, Lot 1 and 2 are nearly entirely within the Standard stream buffer of 150'. On Table A, 15.40.110.E.2, the creek is a maintained system, is classified as high gradient, and is fish bearing. The stream buffer is moderately degraded along a portion of this reach.

PROJECT IMPACTS
Lot 1 will remain unchanged with no new impervious surfaces, including structures. Three new homes are proposed, each covering 3600 ft^2 (footprint 60' x 60'). Because Lot 2 is entirely within the Standard buffer, the applicant must opt for the Managed Ecosystem Alternative to avoid a variance. In addition, development of the house on Lot 4 will involve removal of tree canopy.

APPLICABLE CODE PROVISIONS

15.40.110.C.3.a.ii: Trumpeter Creek

15.40.110 Table A, Buffers: - maintained system
- low gradient
- Type F stream

= 50 foot Maximum Managed Buffer & 25 foot Minimum Managed Buffer

15.40.110.E.3.a Table C: Contribution to CAO fund (see below)

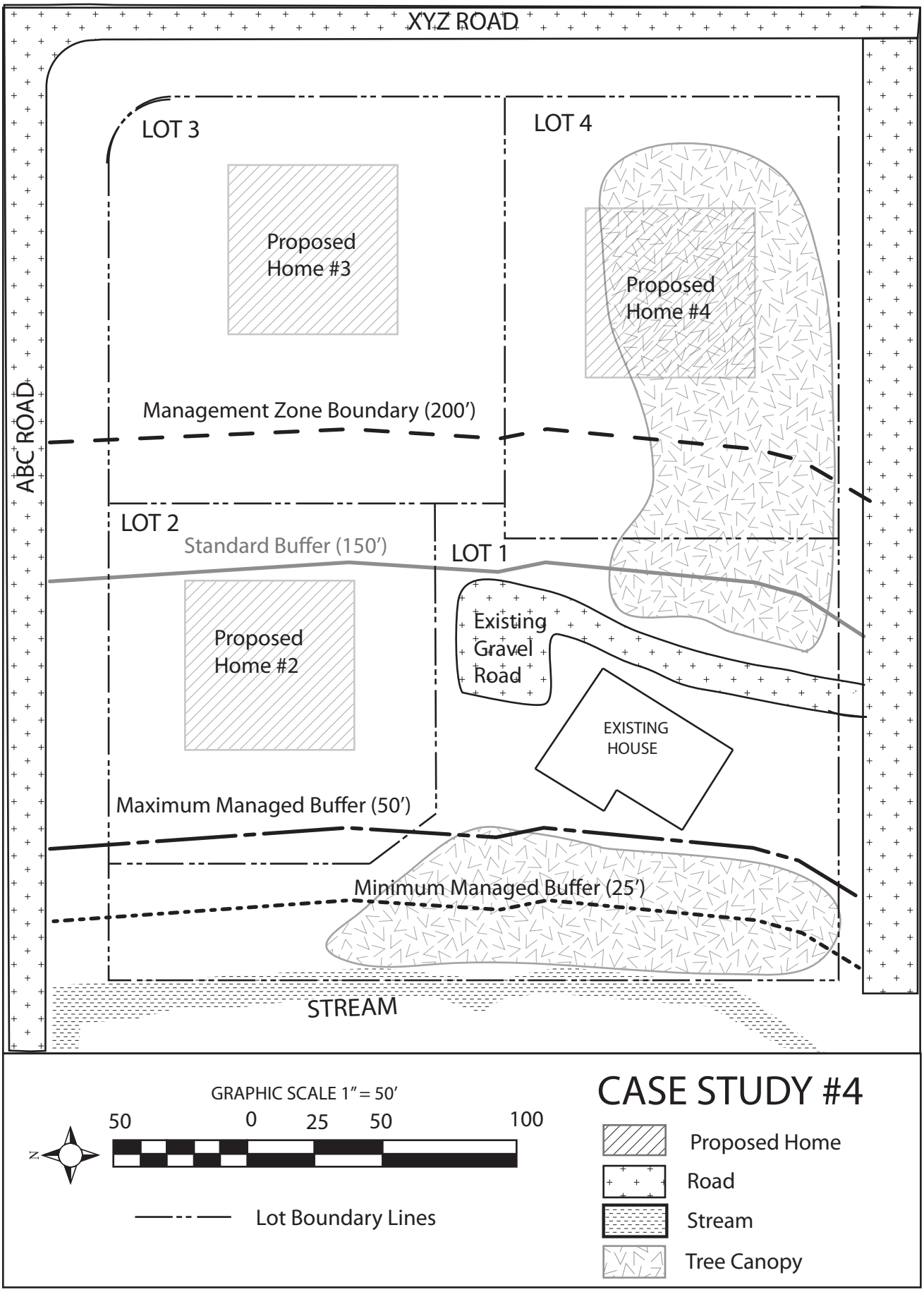
RESOLUTION OF OPTION 1

1) His required contribution will be figured based on the area extent of new impervious surfaces, which includes lawn installation and area extent of tree canopy removal within the Management Zone. For example, the proposed lawn will impact 200 ft^2 in the Maximum Managed Buffer of Lot 2; 300 ft^2 in the Management Zone for Lot 2; 200 ft^2 in the Management Zone for Lot 3; 300 ft^2 in the Management Zone for lot 4. He will be required to contribute the following amounts to the CAO Management Fund:

Zone	**Description of Area**	**Cost/ft^2**	**Area Impacted (ft^2)**	**Tree canopy removal**	**Total Cost**
Management Zone	Lot 2 house	$1.50	3,600	No	$5,400
Management Zone	Lot 2 Lawn	$1.50	300	No	$450
Maximum Managed Buffer	Lot 2 Lawn	$4.00	200	No	$800
Management Zone	Lot 3 Lawn	$1.50	200	No	$300
Management Zone	Lot 4 Lawn	$1.50	400	No	$150
Management Zone- Canopy	Lot 4 lawn	$4.00	800	Yes	$3,200
Total					**$10,300**

2) Mr. Jones will also be required to enhance the degraded portions of the stream buffer based on prescriptive measures provided in this manual, by the City Biologist (*e.g.*, removal of trash, weed management, plant native trees, etc., See Chapter V and VI for examples).

3) In addition, he will also be required to upgrade on-site storm drainage to current City standards.


XYZ ROAD
ABC ROAD
LOT 3
LOT 4
LOT 2
LOT 1
Proposed Home #3
Proposed Home #4
Proposed Home #2
Management Zone Boundary (200')
Standard Buffer (150')
Existing Gravel Road
EXISTING HOUSE
Maximum Managed Buffer (50')
Minimum Managed Buffer (25')
STREAM
GRAPHIC SCALE 1" = 50'
50 0 25 50 100
N
Lot Boundary Lines
CASE STUDY #4
Proposed Home
Road
Stream
Tree Canopy

CASE STUDY #5 MR. SMITHS'S FOUR LOT ALIGNMENT OPTION 2 – SHORT PLAT

LOCATION
Trumpeter Creek sub-basin

PROPOSED PROJECT
Mr. Smith owns an existing residence on a large lot. He wishes to subdivide this lot into 4 smaller lots, and he plans to consider costs and benefits of several different lot alignments. In the second proposed lot alignment, Mr. Smith will create three new narrow lots which all front on XYZ Road.

SITE CIRCUMSTANCES
Mr. Smith's property is adjacent to a tributary of Trumpeter Creek. Approximately 50 percent of the property lies within the Standard Buffer. The three new lots will not extend into the Standard Buffer of 150 feet. Lot 1 is entirely within the Standard Buffer. The stream buffer is moderately degraded along a portion of this reach. In addition, the creek is a maintained system, has a high gradient, and is fish bearing.

PROJECT IMPACTS
Lot 1 will remain unchanged with no new construction and no new impervious surfaces. Construction of new impervious surfaces will occur entirely outside and up-gradient from the Standard stream buffer.

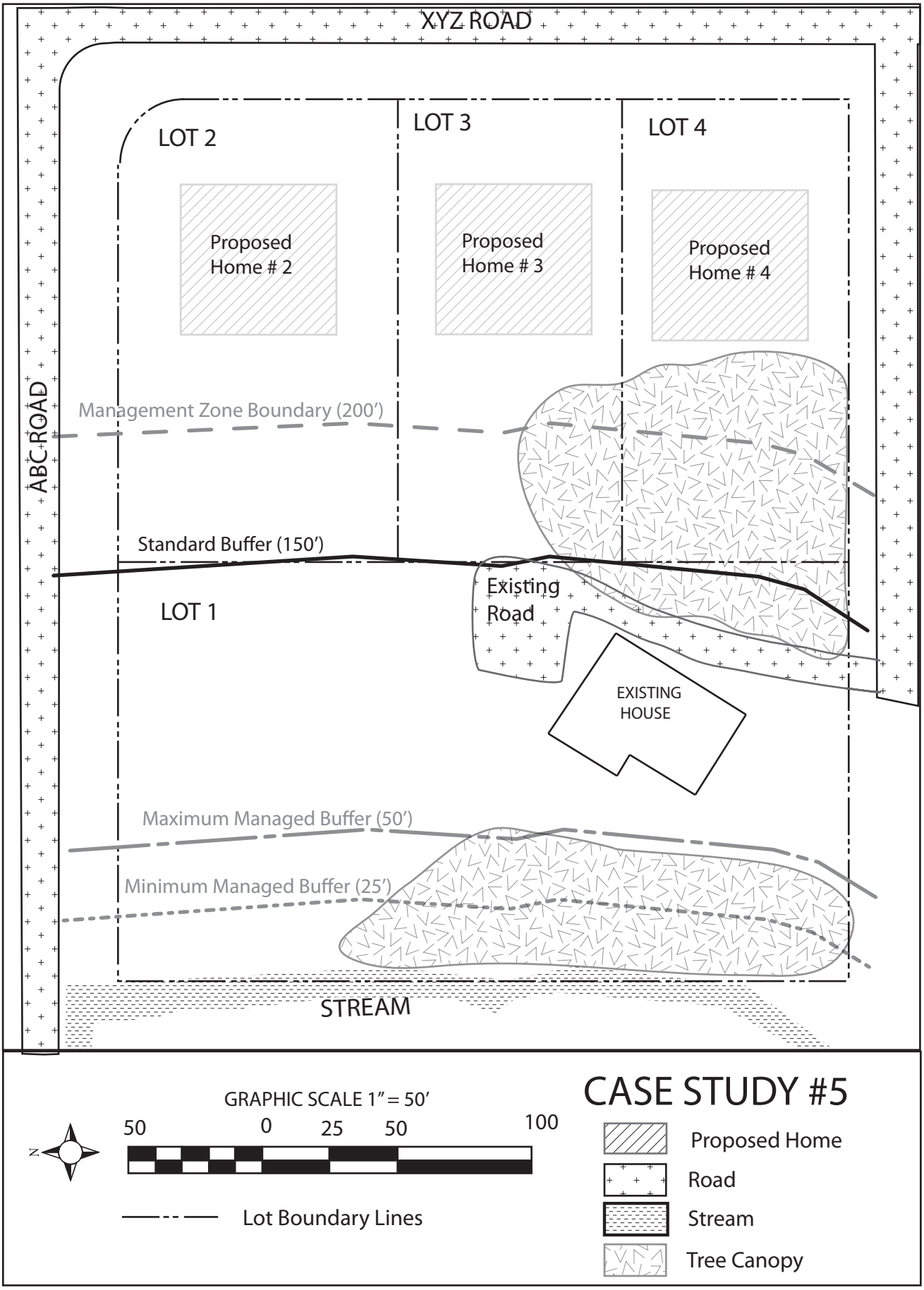
APPLICABLE CODE PROVISIONS

15.40.080.D.2

15.40.080.D.3, Table B

RESOLUTION OF OPTION 2

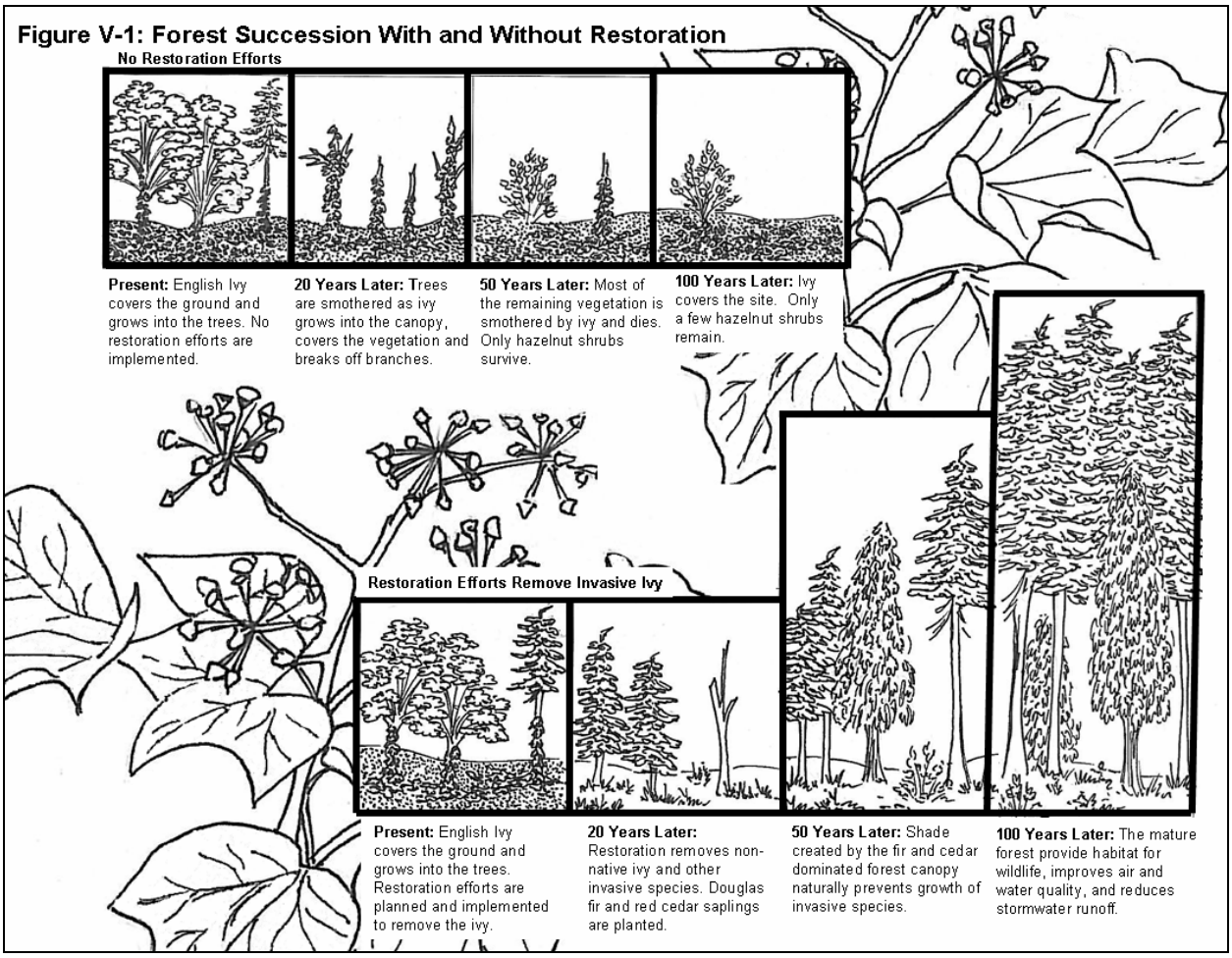
Mr. Smith will opt for the Standard buffer requirements under 15.40.080. He will be required to perform a Standard Stream Study since the three new lots are within 200 feet of the Trumpeter Creek tributary. Since no work will occur within the Standard buffer he will not be required to upgrade buffer conditions per 15.40.080.D.4. Since the Managed Ecosystem Alternative is not being used, no contribution to the CAO fund is required.


XYZ ROAD
LOT 2
LOT 3
LOT 4
Proposed Home # 2
Proposed Home # 3
Proposed Home # 4
ABC ROAD
Management Zone Boundary (200')
Standard Buffer (150')
LOT 1
Existing Road
EXISTING HOUSE
Maximum Managed Buffer (50')
Minimum Managed Buffer (25')
STREAM
GRAPHIC SCALE 1" = 50'
50 0 25 50 100
N
Lot Boundary Lines
CASE STUDY #5
Proposed Home
Road
Stream
Tree Canopy

CHAPTER V RESTORATION PRINCIPLES, GUIDELINES AND EXAMPLES

A. Introduction

Chapter V provides guidelines for developing restoration plans that are intended to reestablish desired ecological trajectories on degraded sites. Implementation of inexpensive and relatively simple restoration techniques can have a huge positive impact on a site. For example, figure V-1 below illustrates the ecological trajectory of a forest that has been invaded by English ivy under two scenarios: 1) when no restoration efforts are undertaken, and 2) when restoration is implemented to remove the ivy and plant conifers. Weed management and planting native trees have dramatic impacts on the health of the ecosystem.



B. Example Site Conditions and Needed Restoration

The following scenarios are generalized examples of the type of restoration techniques that can provide significant lift in ecosystem functions at sites that are degraded. These examples and the following sections provide a starting point for an applicant as designing suitable restoration or enhancement plans. Note that the required restoration and enhancement plan for a specific site

may differ from these examples. See Chapter VI for more details and specifications on how to carry out many of these suggested restoration and enhancement activities.

Overarching Principle: Restoration/Enhancement Practices Should be Determined According to Site Conditions and Project Goals

1. RELATIVELY INTACT SITES

The aquatic critical areas of relatively intact sites have been basically undisturbed during the past few decades. The critical area and its buffer are functioning well with respect to hydrology, biogeochemistry, plant community and faunal support (habitat). Woody debris in various stages of decay exists on the forest floor. Nearly 100% of the critical area and its buffer are covered with a dense vegetation canopy. Decomposing litter exists on forest floor. Channel and bank are stable. The channel longitudinal profile (channel gradient) is not interrupted by man-made barriers. Multiple layers (trees, shrubs, ground cover) exist in the vegetation canopy. Few non-native plants are present. Significant restoration activities and enhancement efforts are usually not necessary. Any work to enhance the site can typically be performed by hand.

Figure V-2: Photographs of relatively intact waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES ON RELATIVELY INTACT SITES:

a. Remove any man-made garbage, trash or litter.
b. Remove any non-native weeds and carry out on-going weed management.

2. SEMI-INTACT SITES

In semi-intact sites, the aquatic critical area has been basically undisturbed during the past few decades; however, some non-native plants are evident. The critical area and its buffer are functioning with respect to basic hydrology and biogeochemistry, though plant community and faunal support may be compromised due to a recent disturbance. Often a sharp boundary exists between the buffer and surrounding upland areas. The critical area and its buffer are dominated by native plant species; however, sections of the buffer have been recently disturbed and are without tree canopy and/or significant under-story. These areas are often characterized by grasses and ornamental shrubs. Weeds/invasive plants may have become established at the site, but are not yet extensive. Multiple layers (trees, shrubs, herbs) exist in the vegetation canopy across most of the site. While significant restoration is not necessary, enhancement of the disturbed sections of the buffer will improve ecosystem functioning. A key element of restoration efforts is to ensure that invasive, non-native species do not become established within or along the edge of relatively intact, pristine buffers. In most cases enhancement or restoration activities (*e.g.*, planting) can be performed by hand.

Figure V-3: Photographs of semi-intact waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES ON SEMI-INTACT SITES:

a. Remove any man-made garbage, trash or litter.
b. A high priority activity is to remove non-native/invasive plant species from the critical area and the upland buffer. This likely will involve on-going management to control and prevent new invasions.
c. Replant disturbed parts of the critical area and buffer with native trees, shrubs, and ground cover.
d. In some cases, woody debris piles and/or microdepressions can be installed to improve habitat structure.

3. MODERATELY DEGRADED SITES

In moderately degraded sites, the critical area and its buffer have had some recent and moderate to extreme disturbance. There my be trash throughout the site. Non-native/invasive plants have become established, but are not yet dominant. Most buffer functions (hydrology, biogeochemistry, plant community, faunal support/habitat) have been impacted to some degree; however, on-site water quality appears to be acceptable. Remnants of historic hydrological processes exist, but they have been partially interrupted. Stream channels may have been highly altered or channelized. The buffer plant community has been significantly altered with non-native and ornamental plant species, and much of the canopy has been removed, leaving grasses and in many cases bare, compacted earth. Slope stability may be an issue. Invasive plants dominate some patches. Human use of the area is evident. Restoration and enhancement is necessary to re-establish ecosystem structure and functions. It is likely that some activities will require motorized equipment (e.g., small track hoes on dozers), but much of the work can still be accomplished manually.

Figure V-4: Photographs of moderately degraded waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES ON MODERATELY DEGRADED SITES:

a. Remove any accumulated litter and trash.
b. A first priority activity is to re-establish hydrological and biological processes where they have been interrupted. For example, stabilize slopes and soils and/or remove any barriers to fish or flow within the channel.
c. Remove weeds/invasive plants.
d. Plant native trees, shrubs and herbs within the critical area and its buffer to increase native plant species while removing invasive plants. Increase conifers within forests that are dominated by deciduous trees such as alders. All planting efforts must be monitored and maintained at least annually over several years to ensure success of the new plants.
e. Introduce large wood to the channel. Increase habitat structure by installing woody debris piles, microdeprssions, snags, etc.

4. HIGHLY DEGRADED SITES

In highly degraded sites, the critical area has been disturbed and/or has been significantly impacted by adjacent development and human activities. Trash accumulation may be significant, including such things as car bodies and parts, metal barrels, etc. Water quality is or has been impacted by nearby land uses and poor stormwater control. Non-native/invasive plant species are well established and dominate much of the critical area. Grading for development in the immediate area may have resulted in topographic changes that have severely impacted hydrologic and biochemical processes.

In highly degraded sites, buffer functions are highly impacted and many functions are missing. There is essentially no intact plant community and most if not all of the canopy is missing. Non-native/invasive plant species are well established and in some cases are dominating upland habitat, smothering trees and completely covering available habitat area. Significant restoration activities are necessary to re-establish buffer functions and the health of the aquatic critical area.

Figure V-5: Photographs of highly degraded waters/wetlands.

Figure V-5 (continued): Photographs of highly degraded waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES:

a. Remove accumulated trash, garbage, refuse and any contaminants. This may require special handling and/or remediation if the site is contaminated by hazardous materials.
b. Conduct large scale removal of weeds, invasive and/or noxious plant species. Mechanical disturbance (*i.e.*, grading) may be done to completely remove all weeds, before installing plants on the site. Topsoil may be replaced on highly disturbed sites. On-going monitoring and maintenance will be required to prevent reinvasion by non-native species.
c. Significant earth moving may be necessary to re-establish hydrologic connectivity between the critical area and its buffer and the surrounding upland area. Barriers within the channel may need to be removed or slopes may need to be graded and stabilized.
d. Re-establish a diverse native plant community by planting native trees, shrubs, and herbs. Increase conifers. Plantings will require regular monitoring to ensure success.
e. Introduce large wood to the channel. Increase habitat structure by installing woody debris piles, microdeprssions, snags, *etc*.

The majority of degraded sites can be restored using some combination of trash removal, weed management, moderate earthwork, planting native species, installing large wood. Chapter VI provides specifications to guide the reader through these processes. Because planting of native species is integral in the restoration process, steps to design a successful restoration are described in detail below.

D. Example Process for Planning a Riverine Wetland Buffer Restoration

1. Planting Plan: Process Overview

Native plants have adapted over thousands of years to the weather, soils, and topography of Puget Sound. Well-established native plant cover provides habitat for wildlife and fish, improves soil stability and prevents invasion by non-native, undesirable weeds. This section describes some methods to re-establish native vegetation in buffer enhancement projects. In designing a restoration project, it is necessary to determine the appropriate species or a suite of species that is suited to the physical characteristics of the site. Important factors to consider when choosing species for a site include the proximity to a wetland, frequency of and amount of inundation, and amount of shade and sun. Appendix B provides a list of native plant species suitable for restoration planting in Mount Vernon buffers and waters/wetlands. In order to maximize success of restoration efforts, planting decisions must be tailored to the site's particular microhabitats. For example, some species can tolerate continuously moist soil periodic to frequent flooding, while other species are not able to withstand even a day of flooding. Consult a native plant nursery, master gardener, landscape architect or the Washington Native Plant Society for more detailed information on specific plant choices for your site. Native plant nurseries can be identified through the Washington Native Plant Society (http://www.wnps.org/landscaping/nurserylist.html) or in a local phone book.

The following pages provide an example showing how to determine planting needs for a degraded site and how to utilize information provided in other sections of this guidebook. Note that the City biologist may be able to assist with this process, or will review this plan.

In general, the process consists of answering the following questions:

Q1) What is the desired future plant community type?
Q2) What is a typical percent coverage by trees and shrubs for this community type?
Q3) How many trees and shrubs will be needed to plant this site in Year 1?
  a. Determine the spacing for trees and shrubs.
  b. Determine the number of acres that trees and shrubs should cover.
  c. Calculate the number of plants that should be planted on the project site.
Q4) How much ground cover should be planted?
Q5) What is the desired species composition suitable for the project site?
Q6) What plant materials (e.g., bare root, plug, 1 gallon pot) will be selected?
Q7) How shall the plants be installed?

This CAO Restoration Guidebook contains information necessary to help answer each of these questions. The following pages take the reader through this process.

2. Restoration Planning Tools

Planting plans include a list of native species that are appropriate for the site conditions and specifications for how, where and what densities these species should be laid out on the ground. Table V-1 below is a list of the various plant communities that occur in Mount Vernon. Greater

detail about these plant communities, such as plant type, common and scientific name, wetland indicator status, type of plant material and on-center spacing distances (Table V-2), is included in tables V-3 through V-7. The plant community can be selected based on location, hydrology, and other site characteristics. The city biologist, an environmental consultant, or native plant nursery staff can assist with selecting the appropriate plant materials. All species selected for planting in restoration sites should be native species (Appendix B).

Table V-1: Five Example Plant Communities for Mount Vernon Waters/Wetlands and Their Buffers

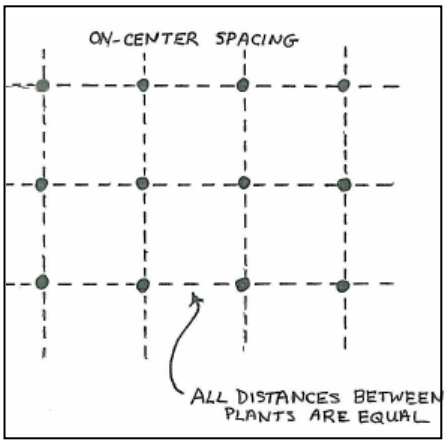
Plant Community	Plant Community Type	Typical Location	Table to Reference
A	Scrub-Shrub Forested Wetland	Depressional Wetland	V-3
B	Floodplain Forested Wetland	Above the channel and Across to the Adjacent Hillslope	V-4
C	Riparian-Upland Transitional Forest	Depressional and Riverine Wetland Buffer	V-5
D	Hillslope Scrub-Shrub Forested Wetland	Hillslope Wetland	V-6
E	Western Hemlock Hillslope Forest	Hillslope Wetland Buffer	V-7

Planting Density Calculation

Plant layouts can be designed based on the desired number of stems per acre or the desired spacing between plants. Table V-2 can be used to convert between plant spacing and plant density (stems per acre). This table is useful in determining the number of plants that will be needed for a given area in the restoration project. See Chapter V, Section D-3 for more information on using Table V-2. Note that while plant densities and numbers are calculated using on-center spacing, plants should be not be installed in straight lines.

Table V-2: Calculation of planting densities based on plant spacing using On-Center Spacing

Spacing (ft)	Density (plants/acre)
1	43,560
1.5	19,360
2	10,890
2.5	6,970
3	4,840
3.5	3,556
4	2,723
4.5	2,151
5	1,742
5.5	1,440
6	1,210
6.5	1,031
7	889
7.5	774
8	681
8.5	603
9	538
9.5	483
10	436
10.5	395
11	360
11.5	329
12	303
15	194
25	70
50	17
75	8
100	4
150	2
200	1

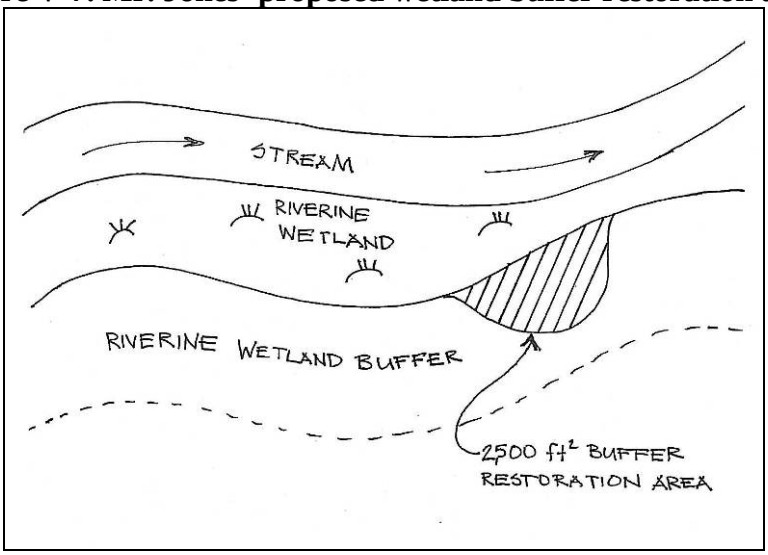


3. PROPOSED PROJECT EXAMPLE

Mr. Jones opts for the Managed Ecosystem Alternative. To mitigate for impacts of choosing the narrower buffer, he plans to restore a degraded portion of the riverine wetland buffer along Maddox Creek (such as shown in Figure V-6). The proposed restoration area covers 2,500 ft^2 (V-7). This site is completely covered by non-native/invasive Himalayan blackberry (*Rubus discolor*). He plans to remove the Himalayan blackberry and replant a native plant community. The blackberries will be removed mechanically using a small loader tractor. The site will then have bare mineral soil. In the following pages, planted to establish a native plant community.

Figure V-6. Himalayan blackberry dominates this landscape.

Figure V-7. Mr. Jones' proposed wetland buffer restoration area.

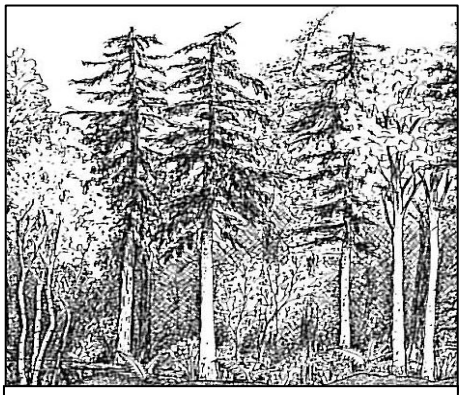


4. EXAMPLE PROCESS TO DETERMINE PLANTING REQUIREMENTS FOR MR. JONES' SITE

Q1. ***What is the desired future plant community?***

Five example community types that are suited to the Mount Vernon area are provided in Table V-1. Each community consists of a suite of native species. Tables V-3 through V-7 provide species lists and planting specifications for each of these five community types.

Using the example communities in Table V-1, the plant community type for the Mr. Jones' restoration area is Riparian-Upland Transitional Forest (Plant Community C). This community type was selected because the restoration area is located in a riverine wetland buffer. This area is the transition zone between the riverine wetland and the upland community.



Riparian upland transitional forest 25 years following restoration planting.

Q2. ***What is a typical percent coverage by trees and shrubs for this community type?***

Typical tree and shrub coverage percents are listed for each community in Tables V-3 through V-7,

Planting specifications for the Riparian-Upland Transitional Forest at Mr. Jones' site will aim for vegetation coverage of about 70% trees and 30% shrubs.

Q3. ***How many trees and shrubs will be needed to plant this site in Year 1?***

Suggested On-Center (OC) spacing is provided for each species listed in the five plant communities. Table V-2 allows calculation of the number of plants that will be needed for each species according to the area of the project site. Use Tables V-3 through V-7 for example plant community composition and Table V-2 to determine the required number of trees and shrubs (plants/acre) as described below.

a. Determine the desired spacing (e.g., on-center spacing) for trees and shrubs.

The last column in Tables V-3 through V-7 provides suggested on-center spacing for each species. If the project site covers one acre, approximately 303 plants will be needed if 12 foot spacing is desired (See Table V-2). Similarly, if the project site covers one acre, approximately 4,480 shrubs will be needed to attain 3 foot spacing.

b. Determine the number of acres that trees and shrubs should cover.

Mr. Jones knows that his planting area is 2500 ft^2. He has decided that the Riparian Upland Transitional forest should be planted to attain approximately 70% coverage by trees and 30% coverage by shrubs. He calculates the area (in acres) that will be planted with trees and with shrubs by multiplying the project area by the percent coverage for each strata and converting to acres (1 acre = 43,560 square feet).

Area coverage of trees:

$$2500\,ft^2 \times 0.70 = 1750\,ft^2$$

$$1750\,ft^2 \times \frac{1 acre}{43{,}560\,ft^2} = 0.0402 acres$$

Area coverage of shrubs:

$$2500\,ft^2 \times 0.30 = 750\,ft^2$$

$$750\,ft^2 \times \frac{1 acre}{43{,}560\,ft^2} = 0.0172 acres$$

c. Using the values determined in steps a. and b., calculate the number of plants that should be planted at the project site.

After calculating the areal coverage desired for each stratum, Mr. Jones determines the rotal number of plants he will need for his project site. In Question 5, he will decide how many plants of each species he will purchase.

Total number of trees:

$$\frac{303 stems}{1 acre} \times 0.0402 acres = 12 stems$$

Total number of shrubs:

$$\frac{4{,}840 stems}{1 acre} \times 0.0172 acres = 83 stems$$

Q4. ***How many herbs should be planted?***

Because blackberries currently dominate the site and no tree canopy cover exists, it may be difficult to successfully establish herbs at this time. No herbs will be planted at Mr. Jones' project site. A long term restoration plan for Mr. Jones' site could include planting herbs after the trees and shrubs become established and the blackberries are under control. If ground cover will be planted, determine the desired area coverage and required number of plants in the same manner as for trees and shrubs, as listed in Question 3.

Q5. ***What is the desired species composition?***

Tables V-3 through V-7 provide suggested species composition for a range of community types suited to the City of Mount Vernon. These species lists are starting points and should be adapted to the project site conditions. Restoration plans should include a table which is similar to Table V-8.

For Mr. Jones' site, the species he chooses to plant will align with species in Plant Community C- Riparian Upland Transitional Forest (Table V-4). His restoration plan includes Table V-8 with species tailored to the particular site. In Question 3c, Mr. Jones determined that he needs to plant 12 trees and 83 shrubs on his project site. For the 12 trees, Mr. Jones selected an approximately equal number each of the 5 tree species (either 2 or 3 plants of each species) and an equal number of the shrub species (9 individuals of each species), except vine maple which suggested to be planted at a lower density in this community.

Table V-8. Example planting specifications for Mr. Jones' riverine wetland buffer restoration project.

Type	Common Name	Scientific Name	WIS	Plant Material	On Center Spacing (ft)	Number of Plants
T	Western red cedar	*Thuja plicata*	FAC	Plug/ bare root/container	12	3
T	Western hemlock	*Tsuga heterophylla*	FACU-	Plug/ bare root/ container	12	2
T	Douglas fir	*Pseudotsuga menziesii*	FACU	Plug/ bare root/ container	12	3
T	Sitka spruce	*Picea sitchensis*	FAC	Plug/ bare root/ container	12	2
T	Big leaf maple	*Acer macrophyllum*	FAC	Plug/ bare root/ container	12	2
S	Indian plum	*Omeleria cerasiformis*	FACU	1 gallon pot	3	9
S	Vine maple	*Acer circinatum*	FAC-	1 gallon pot	9	2
S	Red huckleberry	*Vaccinium parvifolium*	Not listed	1 gallon pot	3	9
S	Stink currant	*Ribes bracteosum*	FAC+	1 gallon pot	3	9
S	Red elderberry	*Samucus racemosa*	FACU	1 gallon pot	3	9
S	Serviceberry	*Amelanchier alnifolia*	FACU	1 gallon pot	3	9
S	Hawthorn	*Crataegus douglasii*	FAC	1 gallon pot	3	9
S	Bitter cherry	*Prunus emarginata*	FACU	1 gallon pot	3	9
S	Beaked hazelnut	*Corylus cornuta*	FACU	1 gallon pot	3	9

Q6. ***What plant materials (e.g., bare root, plug, 1 gallon pot) will be selected?***

Plant material suggestions for each species are provided in Tables V-3 through V-7. Table V-8 provides plant materials chosen for Mr. Jones' site.

Q7. ***How should the plants be installed?***

Recommended techniques and procedures for planting are described in Section VI. Methods for planting each type of plant material (*i.e.*, plugs, bare root, gallon pot, live stakes) are described. In order to ensure maximum survival rates of the installed plants, they must be installed correctly. The restoration site should be monitored and maintained for at least five years, which includes weeding several times each year and replanting any plants that do not survive.

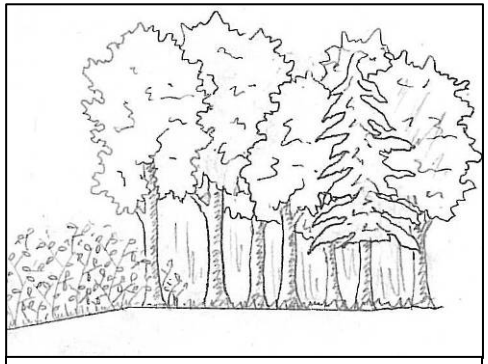
Table V-3. Plant Community A: Scrub-shrub Forested Wetland

Typical Landscape Position: Depressional wetland

Typical percent coverage by trees and shrubs? Approximate Tree coverage = 30%, Approximate Shrub coverage = 70%

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Black cottonwood	*Populus trichocarpa*	FAC	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
S	Red-osier dogwood	*Cornus sericea*	FACW	stakes	1-1.5
S	Black twinberry	*Lonicera involucrata*	FAC+	1 gallon pot	3
S	Pacific ninebark	*Physocarpus capitatus*	FACW-	1 gallon pot	3
S	Snowberry	*Symphoricarpos albus*	FACU	1 gallon pot	3
S	Salmonberry	*Rubus spectabilis*	FAC+	1 gallon pot	3
S	Hooker's willow	*Salix hookeriana*	FACW-	stakes	1-1.5
S	Pacific willow	*Salix lasiandra*	FACW+	stakes	1-1.5
S	Scouler willow	*Salix scouleriana*	FAC	stakes	1-1.5
S	Sitka willow	*Salix sitchensis*	FACW	stakes	1-1.5
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Baldhip rose	*Rosa pisocarpa*	FAC	1 gallon pot	3
S	Nootka rose	*Rosa nutkana*	FAC	1 gallon pot	3

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status



Schematic of scrub-shrub forested wetland 25 years after restoration planting.

Table V-4. Plant Community B: Floodplain Forest

Typical Landscape Position: above channel across to adjacent hillslope

Typical percent coverage by trees and shrubs*: 70% Tree coverage, 30% Shrub coverage*

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Sitka spruce	*Picea sitchensis*	FAC	plug, bare root, or container	12
T	Red alder	*Alnus rubra*	FAC	plug, bare root, or container	12
T	Western hemlock	*Tsuga heterophylla*	FACU-	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
S	Vine maple	*Acer circinatum*	FAC-	1 gallon pot	9
S	Indian plum	*Omelaria cerasiformis*	FACU	1 gallon pot	3
S	Redosier dogwood	*Cornus sericea*	FACW	stakes	1-1.5
S	Hooker's willow	*Salix hookeriana*	FACW-	stakes	1-1.5
S	Pacific willow	*Salix lasiandra*	FACW+	stakes	1-1.5
S	Scouler willow	*Salix scouleriana*	FAC	stakes	1-1.5
S	Sitka willow	*Salix sitchensis*	FACW	stakes	1-1.5
S	Red huckleberry	*Vaccinium parvifolium*	Not listed	1 gallon pot	3
S	Stink currant	*Ribes bracteosum*	FAC+	1 gallon pot	3
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Baldhip rose	*Rosa pisocarpa*	FAC	1 gallon pot	3
S	Nootka rose	*Rosa nutkana*	FAC	1 gallon pot	3
G	Salal	*Gaultheria shallon*	FACU*	1 gallon pot	1.5
G	Sword fern	*Polystichum munitum*	FACU	1 gallon pot	1.5

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status

Floodplain forest community 25 years after planting.

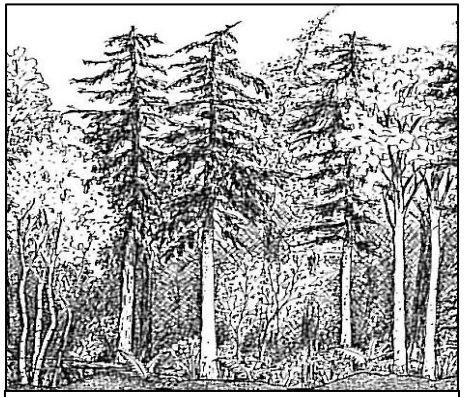
Table V-5. Plant Community C: Riparian-Upland Transitional Forest

Typical Landscape Position: depressional and riverine wetland buffer.

Typical percent coverage by trees and shrubs*: 80% Tree coverage, 20% Shrub coverage*

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
T	Western hemlock	*Tsuga heterophylla*	FACU-	plug, bare root, or container	12
T	Douglas fir	*Pseudotsuga menziesii*	FACU	plug, bare root, or container	12
T	Sitka spruce	*Picea sitchensis*	FAC	plug, bare root, or container	12
T	Big leaf maple	*Acer macrophyllum*	FAC	plug, bare root, or container	12
S	Indian plum	*Omelaria cerasiformis*	FACU	1 gallon pot	3
S	Vine maple	*Acer circinatum*	FAC-	1 gallon pot	9
S	Red huckleberry	*Vaccinium parvifolium*	Not listed	1 gallon pot	3
S	Stink currant	*Ribes bracteosum*	FAC+	1 gallon pot	3
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Serviceberry	*Amelanchier alnifolia*	FACU	1 gallon pot	3
S	Hawthorn	*Crataegus douglasii*	FAC	1 gallon pot	3
S	Bitter cherry	*Prunus emarginata*	FACU	1 gallon pot	3
S	Beaked hazelnut	*Corylus cornuta*	FACU	1 gallon pot	3

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status



Riparian upland transitional forest 25 years following restoration planting.

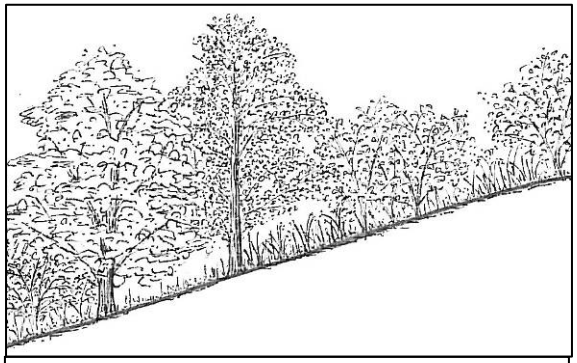
Table V-6. Plant Community D: Hillslope Scrub-Shrub Forest

Typical Landscape Position: Hillslope wetland

Typical percent coverage by trees and shrubs*: 30% Tree coverage, 70% Shrub coverage*

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Black cottonwood	*Populus fremontii*	FAC	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
S	Red-osier dogwood	*Cornus sericea*	FACW	stakes	1-1.5
S	Black twinberry	*Lonicera involucrata*	FAC+*	1 gallon pot	3
S	Pacific ninebark	*Physocarpus capitatus*	FACW-	1 gallon pot	3
S	Snowberry	*Symphoricarpos albus*	FACU	1 gallon pot	3
S	Salmonberry	*Rubus spetabilis*	FAC+	1 gallon pot	3
S	Hooker's willow	*Salix hookeriana*	FACW-	stakes	1-1.5
S	Pacific willow	*Salix lasiandra*	FACW+	stakes	1-1.5
S	Scouler willow	*Salix scouleriana*	FAC	stakes	1-1.5
S	Sitka willow	*Salix sitchensis*	FACW	stakes	1-1.5
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Baldhip rose	*Rosa pisocarpa*	FAC	1 gallon pot	3
S	Nootka rose	*Rosa nutkana*	FAC	1 gallon pot	3

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status



Hillslope scrub-shrub forest 25 years after restoration planting.

Table V-7. Plant Community E: Western Hemlock Hillslope Forest

Typical Landscape Position*: Hillsope wetland buffer*
Typical percent coverage by trees and shrubs*: 70% Tree coverage, 30% Shrub coverage*

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Douglas fir	*Pseudotsuga menziesii*	FACU*	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
T	Western hemlock	*Tsuga heterophylla*	FACU-	plug, bare root, or container	12
S	Vine maple	*Acer circinatum*	FAC-	1 gallon pot	9
S	Indian plum	*Omelaria cerasiformis*	FACU	1 gallon pot	3
S	Fool's huckleberry	*Menziesia ferruginea*	FACU+	1 gallon pot	3
S	Red huckleberry	*Vaccinium parvifolium*	Not listed	1 gallon pot	3
S	Wood Rose	*Rosa gymnocarpa*	FACU	1 gallon pot	3
S	Alaska blueberry	*Vaccinium alaskense*	Not listed	1 gallon pot	3
S	Beaked hazelnut	*Corylus cornuta*	FACU	1 gallon pot	3
G	Bunchberry	*Cornus canadensis*	FAC-	1 gallon pot	3
G	Salal	*Gaultheria shallon*	FACU*	1 gallon pot	1.5
G	Cascade Oregon-grape	*Berberis nervosa*	Not Listed	1 gallon pot	1.5
G	sword fern	*Polystichum munitum*	FACU	1 gallon pot	1.5

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status

CHAPTER VI RECOMMENDED TECHNIQUES AND SPECIFICATIONS FOR BUFFER ENHANCEMENT AND RESTORATION

Restoration opportunities that will satisfy the Alternative Ecosystem Approach to buffer protection can be easily defined, simple to accomplish, and inexpensive. Using this guide, individuals can quickly begin to identify a restoration plan for their site. For small scale construction and development plans, individuals can usually identify a restoration plan that they can discuss with the city biologist or planning staff to determine an approved project plan. For more complex projects and situations with extensive buffer impacts, a private consultant and/or the city biologist likely will be needed to assist in developing a plan for buffer restoration and enhancement that is sufficient to mitigate the proposed buffer impacts.

The following sections provide a listing of the most common restoration and enhancement activities. The techniques and specifications for implementation of the activities described below are already endorsed by the City of Mount Vernon, but additional techniques can always be added to this list. This document does not present all of the potential restoration and enhancement activities that are or will be acceptable for work in buffers. Please discuss any other restoration or enhancement ideas with the planning staff.

Generally, a combination of the procedures listed below will be required to reach restoration goals. The activities listed below flow roughly from simple and inexpensive activities. For example, removal of trash is a first step in buffer enhancement, while slope stabilization through brush layering is a more comprehensive restoration project.

A. REFUSE REMOVAL

PURPOSE

At many sites, one of the most important first steps to restoration is to remove the garbage, remnant construction materials, large dirt piles, and/or other refuse piles. Refuse can release toxic chemicals, create an unsightly landscape, smother desirable vegetation, and lead to further degradation of a site.

Discarded battery found within a riparian buffer.

SPECIFICATIONS

Determine whether the debris can be dealt with by hand or whether mechanical equipment is necessary due to the bulk or mass of the refuse. Ensure that appropriate physical protection is worn while removing the garbage to prevent injury, because debris in urban/suburban settings often includes contaminants, sharps, *etc*. The waste must be disposed of properly. Be sure to separate any hazardous materials (chemicals, antifreeze, batteries, electronic equipment, *etc*.) from other debris. Hazardous materials should be handled with great care and sent to appropriate facilities such as the Skagit County Household Hazardous Waste Collection Center.

B. WEED MANAGEMENT

1. Integrated and Adaptive Weed Management Strategies

Weeds can grow or reproduce aggressively, be unsightly, and limit growth of other desirable plants by blocking light or using up the available nutrients in the soil. Weeds can be invasive, noxious, and/or non native plants. Some weeds can easily become dominant on disturbed sites due to their rapid rate of reproduction, ease of establishment, and rapid germination. Depending on the severity of the displacement of other plants, these species can be defined as noxious weeds or invasive weeds.

A "noxious weed" is any plant designated by a State or county government as injurious to public health, agriculture, recreation, wildlife, or property. Invasive vegetation is defined as any plant species listed as an obnoxious weed on the Skagit County Noxious weed list. Invasive plants include not only noxious weeds, but also other plants that are not native to this country. Some invasive plants can produce significant changes to vegetation composition or structure or ecosystem function. In the City of Mount Vernon, some of the common noxious weed species include English ivy, Himalayan blackberry, reed canary grass, Japanese knotweed, Scotch broom, and purple loosestrife.

A ***weed*** is a plant that is considered to be a nuisance in a garden, lawn, or natural area.

A ***noxious weed*** is any plant species listed on the state or county noxious weed list

An ***invasive weed*** is a plant species that reproduces rapidly and out competes native species. These species are listed as obnoxious weeds on the Skagit County Noxious weed list.

In many restoration projects, weeds are managed rather than eradicated. Weed management strategies aim to minimize negative impacts weeds may have without necessarily eliminating them entirely. Weed management strategies should develop a healthy ecosystem that has reduced likelihood of additional weed invasions, prevents spread and reproduction of weeds that are present, and minimizes competition of weeds with beneficial species. Effective weed management strategies are marked by proactive and on-going control efforts that can shift efforts and vary through time to optimize control as conditions change in a variable environment.

2. List of Weeds and Specific Control Recommendations

The Skagit County Weed Control Board maintains a list of weed species that are subject to control in the county. In addition, other weed species, such as Himalayan blackberry, may be particularly problematic at restoration sites within the City of Mount Vernon, and control of these weeds of concern is recommended in restoration sites where native plants are getting established. In the following sections, five common, problem weed species and their control measures are described in detail. Section three provides general specifications for methods of weed control.

a. Himalayan blackberry (*Rubus discolor*) is a highly invasive plant that effectively outcompetes native understory plants and prevents establishment of shade intolerant trees. This invasive

blackberry, with large, widespread root masses, and dense vegetation, competes with native plants for nutrients, water, and sunlight. Himalayan blackberry is easily recognizable by sprawling and trailing, angular canes with hooked prickles. Leaves are large, round to oblong and densely toothed, and are oriented in sets of 3 to 5. Blackberry shrubs are commonly found growing along wetland margins but are typically daughter plants off of a main cane.

Removal techniques can include hand pulling, mowing, grading, or herbicide use depending on site conditions and size of the weed infestation. For small infestations, which cover less than 200 square feet, hand-pulling or digging up of the entire root mass is recommended. Isolated plants should be removed immediately to prevent their spread. Hand pulling can be accomplished by cutting the main stems with pruners and digging up the root ball to ensure regrowth does not occur. Manual control may be most successful immediately after rain softens the soil and in naturally loose soils where the root mass can easily be removed. The site should be monitored throughout the growing season, and new sprouts should be removed as they appear.

At sites with larger infestations, the blackberry can be removed with weed-eaters, brush mowers, or machetes. Mowing should not be done on soils that are highly susceptible to compaction or erosion, or where soils are very wet. Ideally, the root ball should also be dug up and removed, as blackberry can resprout from a root mass. If the root ball is not removed, mowing may need to reoccur several years in a row to eliminate blackberry. In densely invaded sites, large-scale mechanical disturbance such as grading with heavy machinery can be used to remove blackberries. Mowing with large machinery can be very effective in controlling blackberries but may also harm desirable plants in the area. Whenever large dense areas of blackberry are removed, the bare areas created must be stabilized and seeded, mulched, and/or re-vegetated with native vegetation to prevent erosion and reinvasion of blackberries and other weeds. Follow-up management including yearly spot control for returning seedlings or re-growth and replanting of native plants must be done.

Control can be achieved by cutting the canes down to the ground. Blackberry roots can not withstand the anaerobic soil conditions without the supporting canes (King County Noxious Weed Control Program 2005).

Figure VI-1: Photograph of landscape overrun with blackberries.

b. English ivy (Hedra helix) is widely cultivated for landscaping purposes, but it easily escapes cultivation and becomes a weed by propagating in locations where it was not planted. Ivy forms thick mats which can smother herbs, trees and shrubs (see Figure V-1). Morphology of ivy plants differs for juvenile and mature individuals. Ivy plants exhibit the juvenile form for approximately 10 years, with light green leaves having 3 to 5 deep lobes, somewhat hairy shoots which can produce adventitious roots, and no flowers. Mature ivy plants have dark green leaves with slight or no lobes, produce flowers on vertical stems, and do not produce adventitious roots.

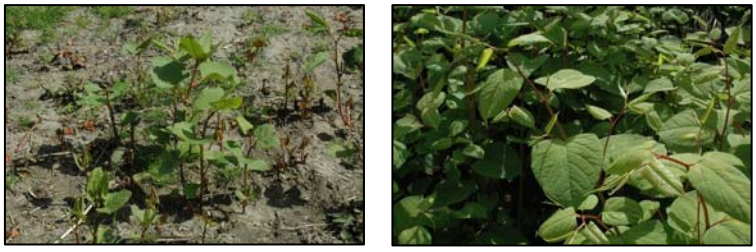
Although it is labor intensive, control of ivy can often be most effective through manual efforts. Hand pulling and digging up all shoots, leaves, and roots can result in complete removal of all plant material that is not easily accomplished with other methods. Alternatively, on flat sites, ivy may be eliminated by covering it with 8 inch thick layer of mulch. Herbicide use is not generally recommended control English ivy.

Cuttings from ivy plants will desiccate and die after about a week of exposure to sunlight. Alternatively, covering the cuttings with a tarp or packing them in black plastic bags can prevent them from re-sprouting. The disposal method is crucial for weed management. All stems must be removed from soil contact as fragments may be able to grow roots.

c. Japanese knotweed (*Polygonum cuspidatum*) is a fast-growing, stout plant with upright bamboo like stems that grows to heights between 3 and 16 feet tall. There are two similar knotweed species, Himalayan (*Polygonum polystachyum*) and giant knotweed (*Polygonum sachalinense*), which can both hybridize with Japanese knotweed. The stems are often partially red or appear speckled with red. Small white or greenish flowers bloom at the bases of the leaves in July and August. Leaves are large and may be somewhat heart shaped. Japanese knotweed is a perennial plant that can persist through hard frosts in winter. Once it becomes established, knotweed is difficult to eliminate due to its extensive root system that may be more than 25 feet away from the parent plant and 7 feet below the surface. Knotweed can spread vegetatively; a small plant fragment can form a new plant colony. Following cutting, mowing, and digging, knotweed can resprout and grow quickly.

The most successful mechanical and manual control of Japanese knotweed require frequent and persistent control techniques that effectively starve the root system. Cutting of all surface vegetation should occur early and often in Spring, and be repeated several times each season until the plants are entirely removed. If using a mower or weed-eater, set the blade as close to the ground as possible and rake all remaining vegetation fragments to be dried away from soil. Mow at least every 2 to 3 weeks from March through August. Digging of the entire plant including all root material can be very effective, but the site must be checked repeatedly throughout the season for new sprouts. Be sure to collect and dry all plant material immediately so that it does not re-sprout at the site or elsewhere.

Figure VI-2: Photographs of Japanese knotweed.



d. Reed canary grass (*Phalaris arundinaceae*) is a large, coarse grass that can grow to 2 to 6 feet tall. By forming new plants from its root structure, reed canary grass forms dense stands that tend to prevent other plants from growing where it has become established. Reed canary grass is commonly found in and near wetlands, but it does not persist in areas with standing water for extended periods. A major distinguishing characteristic of reed canary grass is prominent, ¼ inch long, rounded ligule (membrane at the base of the leaf which surrounds the stem). Young inflorescences are green or slightly purple, and become tan to light brown as they mature. Inflorescences, which form in June or July, extend high above the leaves.

Hand removal may be feasible in small stands. Hand cutting may be most effective while the plant is in flower. Mowing may be successful at controlling the spread of reed canary grass by removing seed heads before the seeds mature. This allows other native plants to successfully compete with the new growth. Mowing should recur two times during the growing season (once in early summer, and once before the seeds mature in the fall) to promote the re-growth of native species. Mowing closely followed by planting of live willow stakes can effectively decrease reed canary grass growth and can help change the site to a shrub or tree dominated community.

e. English holly (*Ilex aquifolium*) is a broadleaf evergreen which was introduced to the United States as an ornamental shrub. English holly becomes a large, dense shrub with seeds that may widely spread by birds. Holly plants quickly displace natives in the forest understory. Due to their attractive foliage and red berries, people often retain them in the landscape.
English holly can be removed by cutting the stem or, if the plant is small, digging it up from the ground. Because English holly does not have the same type of adventitious roots as species like English ivy, it is not necessary to take the same care with root removal (King County Natural Resources and Parks 2002). However, cutting an established tree at the base generally results in resprouting from the stump.

3. Weed Management Procedures

a. Hand pulling

PURPOSE

Hand pulling, similar to weeding in the garden, is generally suitable for small scale infestations of weeds. This method of weed removal requires frequent, persistent, and long term maintenance activities. Hand pulling allows site and species specific control, has a low impact to desirable vegetation, results in immediate plant removal, and is inexpensive on a small scale.

SPECIFICATIONS

Weeding by hand is most effective when the entire plant including the roots is removed from the ground. Native plants in the surrounding area should be left undisturbed as they can compete with and help minimize new weed growth and also provide habitat for wildlife.

When necessary, hand cutters or “weed whackers” can be used in addition to hand pulling. Since some weeds (such as Japanese knotweed) can form roots easily from small fragments of the

original plant, the plants and roots should be bagged, allowed to dry completely, burned, or deposited into a landfill. Special care should be taken to not spread fragments or seeds around the site or to other locations during pulling and transport.

If extensive areas are bare following hand pulling, the area should be mulched and/or planted quickly stabilize the soils. Methods for planting and a list of potential species are included in section IV.C.

LIMITATIONS

Hand pulling is slow and labor intensive. Therefore, it may not be practical for controlling large infestations. In addition, some species such as Himalayan blackberry cannot feasibly be pulled by hand. Creation of plant fragments and facilitation of seed dispersal can occur with hand pulling and should be avoided as it may increase the spread of the weeds in the future. Removal of weeds from aquatic areas should be done with great care to avoid negative impacts to water quality.

b. Competitive Exclusion

PURPOSE

The goal of weed management through competitive exclusion is to establish desirable vegetation that can compete with and reduce the growth and success of undesirable weeds. In a stable, self-sustaining ecosystem with a dense canopy native species, weeds are not likely to thrive or become dominant. In a healthy ecosystem, weeds are typically excluded because they cannot compete successfully against the well-established native species. In other words, the resources that the weeds need are not available when the environment is healthy and functioning properly.

SPECIFICATIONS

Broad scale seeding or planting of a cover crop can discourage reinvasion of weeds on relatively bare ground. Weed management through competitive exclusion is accomplished by establishment of a healthy forest community by planting native trees, shrubs, and herbs.

LIMITATIONS

Weed management through competitive exclusion will work only if the weeds are not yet well established. Frequent monitoring and maintenance will be needed to ensure that weeds do not become dominant.

c. Large-Scale Mechanical Removal

PURPOSE

When weeds are already well established or dominate a site, large scale mechanical removal may be necessary. Large scale mechanical removal consists of grading or tilling the site with large machinery to remove all weeds from the site. This large disturbance must be followed immediately with seeding or planting with native plants and erosion control methods.

SPECIFICATIONS

Large scale weed removal should never be conducted in, around, or near streams, rivers or wetlands unless all necessary permits have been obtained. A stormwater pollution prevention plan and a grading permit may be required before mechanical removal of weeds can occur.

To conduct large scale, mechanical weed management, the entire site may need to be mowed and graded. The site is then either stripped to a depth of at least one foot or buried under two feet or more of clean fill to prevent regrowth of existing weeds. The site should be graded appropriately to include microdepressions and other surface microtopography that will help promote a healthy ecosystem. On the newly barren soil, stabilization must be implemented immediately such as through planting a dense cover crop that will discourage reinvasion by weeds or through placement of coir cloth (a biodegradable netting), straw, or mulch suited to the scale of the disturbance. Disking and plowing prepares the site for formal planting. A suite of native species tailored to the site should be planted in the appropriate season. Frequent monitoring and weed management must be carried out to prevent reinvasion of weeds.

LIMITATIONS

Ensure that appropriate permits are attained prior to commencing large scale mechanical removal of weeds. Slope stabilization procedures, such as installation of coir cloth, may be necessary to prevent massive soil erosion. Installation of the native vegetation protects the slope by reducing surface soil erosion since root systems of plants serve to anchor the soil while also intercepting rainfall to minimize erosion.

d. Chemical Control

PURPOSE

Herbicide use should be considered only as a last option in weed management. Herbicides can be harmful to humans and the environment if they are not applied correctly and in the appropriate amounts. Only some types of herbicide are acceptable for use in weed management of buffers near riparian or aquatic ecosystems as most herbicides can cause damage to fish, aquatic communities and water quality. This guide does not recommend the use of herbicides for restoration projects within the City of Mount Vernon.

SPECIFICATIONS

If herbicide use is prescribed, it must be done in accordance with federal and state law. The applicator should be appropriately trained and must wear the necessary protective clothing. Herbicide use should be minimized so that only the amount that is necessary to control the weeds should be applied. Only the minimum mixing ratio that can gain control of the weeds should be used. Following initial herbicide use, a management plan should include hand pulling or physical control of weeds rather than continued herbicide usage. Herbicides should be applied through spot treating rather than broad application.

LIMITATIONS

Most herbicides are not approved for use in or near aquatic ecosystems such as streams, rivers, or wetlands. Herbicides can harm beneficial, native plants as well as the undesirable weeds.

C. PLANTING AND MANAGEMENT OF PLANT COMMUNITIES

Native plants have adapted over thousands of years to the weather, soils, and topography of Puget Sound. Well-established native plant cover provides habitat for wildlife and fish, improves soil stability and prevents invasion by non-native, undesirable weeds. This section describes some methods to re-establish native vegetation in buffer enhancement projects.

1. List of Native Plants

In designing a restoration/revegetation project, determine the appropriate species or a suite of species that is suited to your particular site depending on the physical characteristics of the habitat within your site. Important factors to consider when choosing species for a site include the proximity to a wetland, frequency of inundation, and amount of shade and sun. Appendix B provides a list of native plant species suitable for restoration planting in Mount Vernon buffers and waters/wetlands. However, in order to maximize success of restoration efforts, planting decisions must be tailored to the particular location. For example, some species can tolerate periodic to frequent flooding while other species are not able to withstand even a day of flooding. Please consult a native plant nursery, master gardener, landscape architect or the Washington Native Plant Society for more detailed information on specific plant choices for your site.

Native plant nurseries can be identified through the Washington Native Plant Society (http://www.wnps.org/landscaping/nurserylist.html) or your local phone book.

2. Live Stakes

PURPOSE

Live stakes are used in many planting and bioengineering techniques, including general willow and alder planting, live siltation, brush layering, and fascines. Live staking is a simple and natural method to stabilize slumping materials and to “pin” sods and mesh to a slope. Live

stakes can be inserted into silty, erodable soils in the spring and the cuttings can grow over the summer, producing roots that help bind unstable materials to decrease future erosion. Species that can be installed as cuttings include willows and shrub dogwoods.

SPECIFICATIONS

Table VI-3 lists common species planted as cuttings within Western Washington. Cuttings should harvested from living trees or shrubs. Each stake should be ½ to 2 inches in diameter and about 3 feet in length. Side branches must be removed entirely but bark should not be damaged. Large pruning shears can be used to make smooth and even stem bases on each stake. Stakes should be trimmed and left inundated for approximately 12 hours immediately prior to planting. Live stakes are often cut and installed while they are dormant.

The stake should be placed in the ground with the buds pointing upwards. About four-fifths of the length of the stake should be below ground and angled downstream. The cutting can be gently tapped into the soil or a metal bar can be used to make a pilot hole to minimize damage to the cutting during installation. Stakes should be randomly placed (rather than in a straight line) with two to four stakes per square yard.

When preparing for construction and planting at a restoration site, only enough material to use in one day should be cut. Prior to construction or planting, cuttings should be protected from direct sunlight, drying out, and heat. The cuttings should be stored in water or moist soil until they can be planted. Immediately before planting, stakes or branches can be cut to appropriate lengths and side branches can be removed.

Table VI-3: Common species which can be planted as live stakes in Western Washington

Scientific Name	Common Name
Salix sitchensis	Sitka willow
Salix lucida (lasiandra)	Pacific willow
Salix scouleriana	Scouler's willow
Salix hookeriana v. piperi	Hooker's/Piper's willow
Salix hookeriana	Hooker's willow
Populus balsamifera	Black cottonwood
Cornus sericea	Red-osier dogwood

LIMITATIONS

Only some species are able to be grown efficiently through live cuttings. Seeds, plugs or seedlings should be transplanted to establish other species.

Figure VI-4: Illustration on how to prepare live stake cuttings.

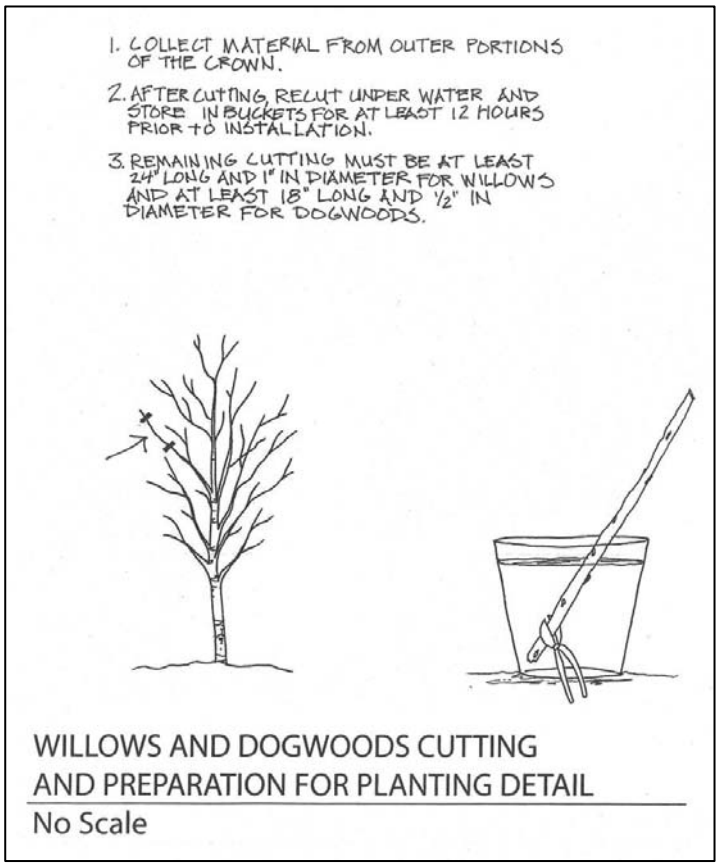
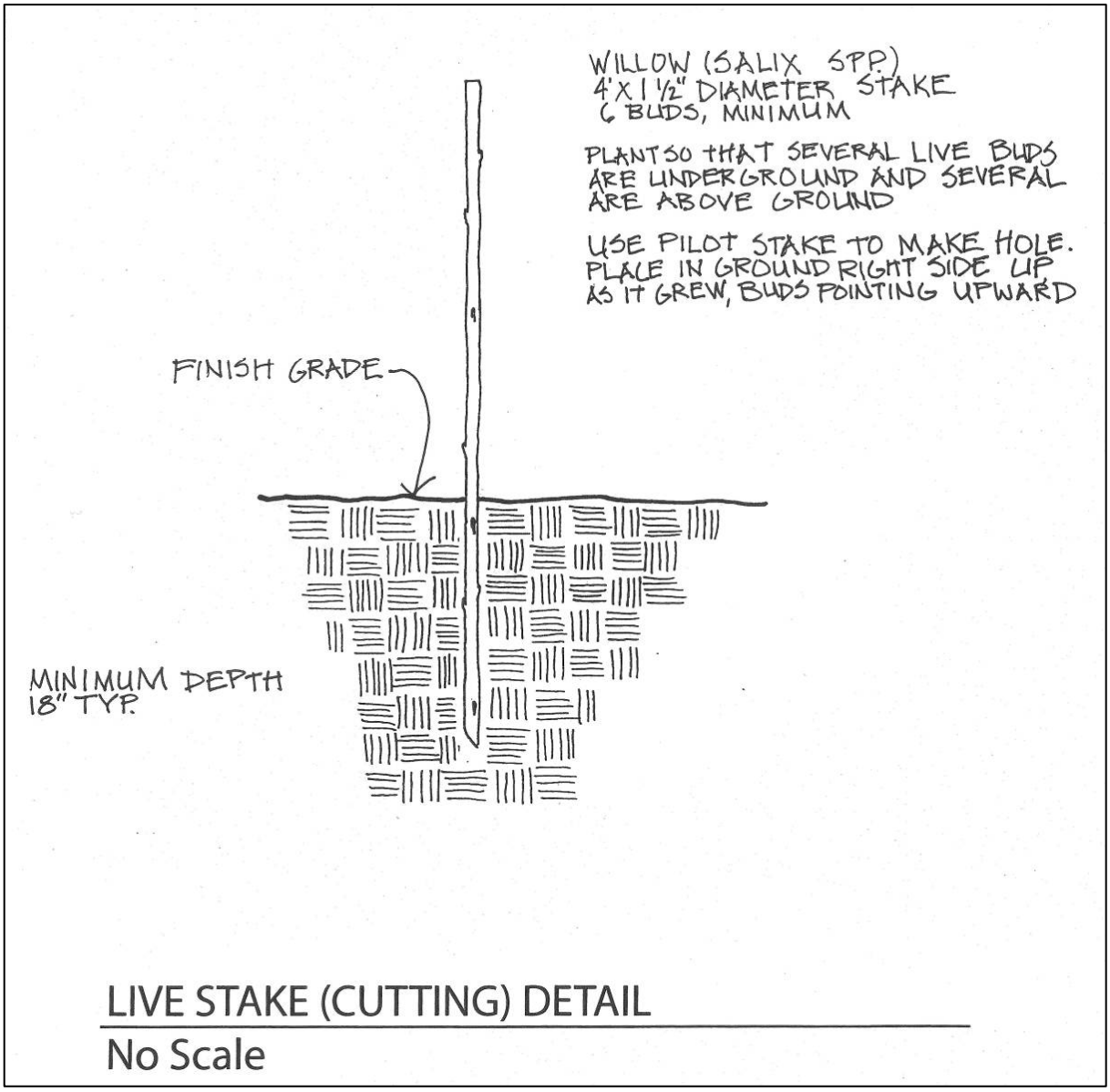


Figure VI-5: Illustration on how to plant live stake cuttings.



3. Rhizome Planting

PURPOSE

Rhizomes are the creeping, underground stems possessed by some plant species (including many wetland plants) that allow rooting and production of new shoots and leaves at each node. Planting rhizomes of some species will often result in more rapid success in revegetation of these species than planting from seed.

SPECIFICATIONS

Planting rhizomes directly into mud is generally most successful. If the soil is dry, dig holes so that the rhizome is supported and roots can hang slightly lower. The base of the rhizome should be in complete contact with the soil, and the top of the rhizome should be just below the surface of the soil. Rhizomes should generally be placed 6 to 20 inches apart.

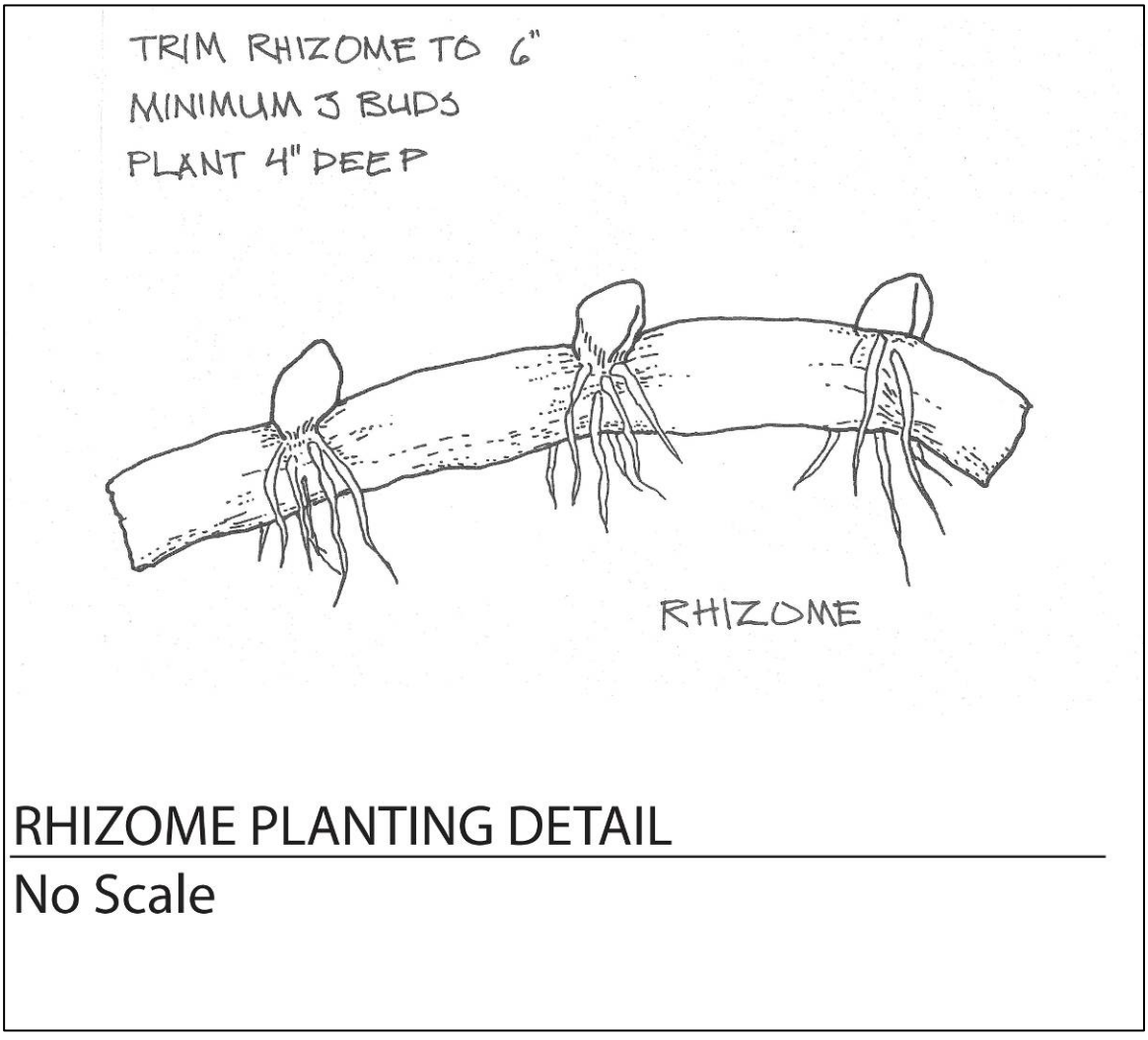
LIMITATIONS

Only some species can effectively propagate through rhizomes.

ADDITIONAL NOTES

The volume of the rhizome cutting may be related to its tendency to root and grow; therefore if propagation material is abundant, plant larger pieces of rhizome. A minimum of 3 buds should be present on each cutting.

Figure VI-6: Illustration on how to prepare rhizome cuttings.



4. Herb, Grass and Fern Planting

PURPOSE

Herbs, forbs, grasses, sedges, rushes, and ferns can be planted on a site as vegetation mats, plugs, sprigs, or flats, through direct seeding, and with transplants (single plants).

SPECIFICATIONS

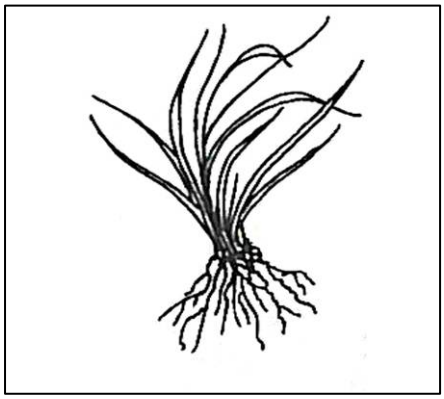
When working with transplants, plugs, sprigs and mats, it is essential that you keep the plant material, particularly roots, constantly moist and away from direct sunlight and wind immediately after harvesting, while transporting the vegetation to the site, and during planting. If harvesting plants from a nearby site, you should remove and prepare only the vegetation that can be planted on the same day as harvesting.

Select native plant species that are adapted to the microclimate at the location of planting. For example, some species are adapted to withstand or thrive with frequent flooding, while other species can not survive in saturated soils. Your native plant supplier should be able to assist you with selecting appropriate species for your location.

a) Plug Planting

Plug planting is a relatively inexpensive method to establish vegetation on a site. Plugs are best used as a supplementary method to intersperse a variety of species to a site. Plug planting can be used to increase diversity and abundance of wetland emergent herbs, sedges, and rushes where the soil is saturated or inundated. As with transplanting young plants, the species and planting locations must be carefully tailored to the site. Mortality of plugs may be high if careful planting procedures are not followed.

Figure VI-7: Plug illustration.

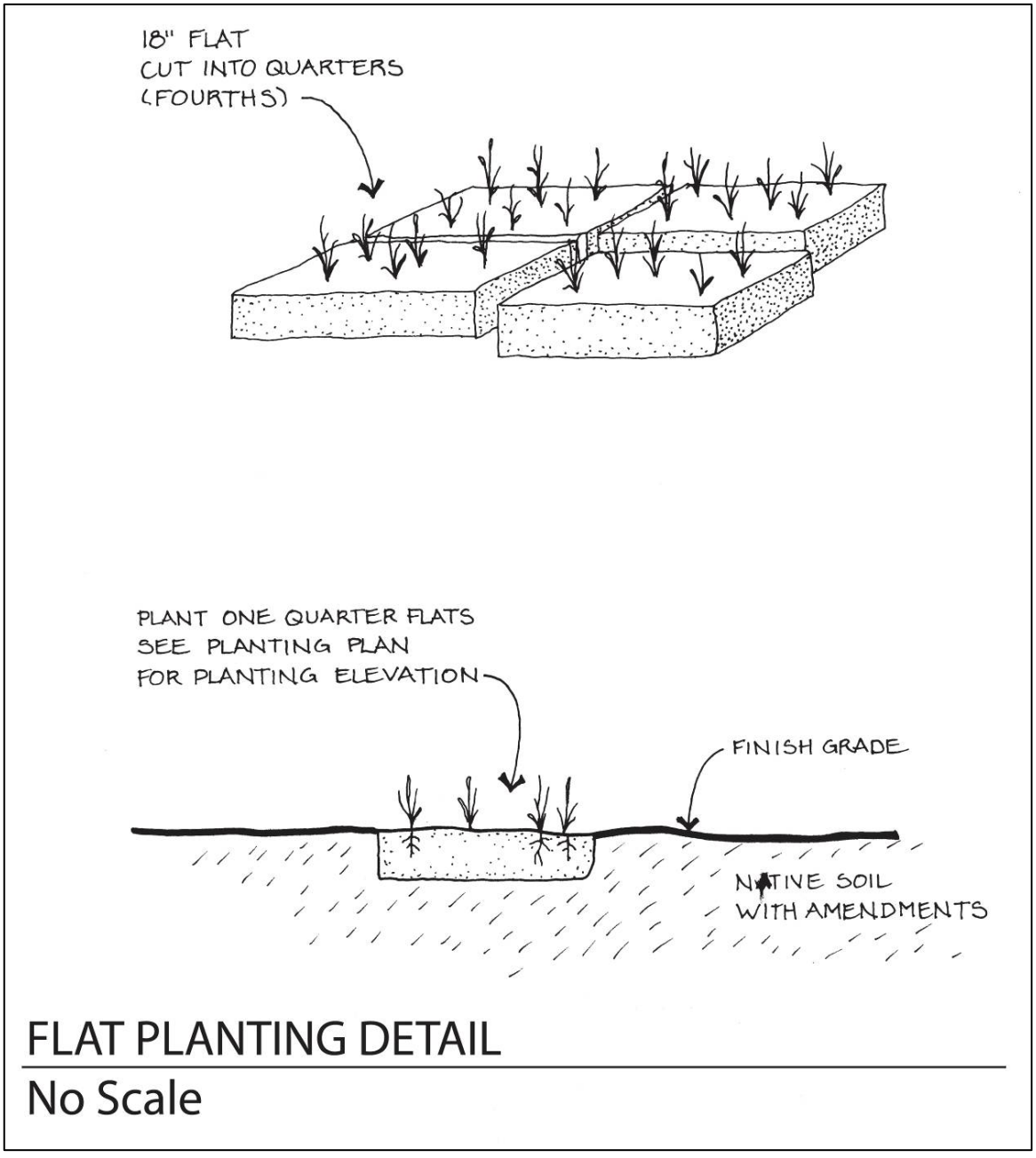


Plugs should remain moist and be watered prior to transplanting. Plugs should be placed into bare patches. If bare patches do not exist, an areas approximately 1 ft^2 should be cleared prior to planting. A small shovel or dibble can be used to make holes that are the same size as the plug, as good root to soil contact must be established for each plant to survive. The plug can be placed in the hole so that the surface of the plug is slightly below the surface of the soil. Pinch the soil above the plug to ensure that the plug is contained and shielded from drying out. Plugs can be protected from grazing damage using clean, rinsed cardboard milk cartons.

b) Flat Planting (mats)

Dig a shallow level hole or trench that is approximately the same length, width and depth as the portion of the flat that you will plant. Divide an 18 inch flat approximately into quarters and plant the entire section so that it is level with the original soil surface. Be sure that there is a good connection between the edges of the flat and the native soil so the roots on the edges of the mat will not dry out. Generously water the installed sections of the flat in to the soil.

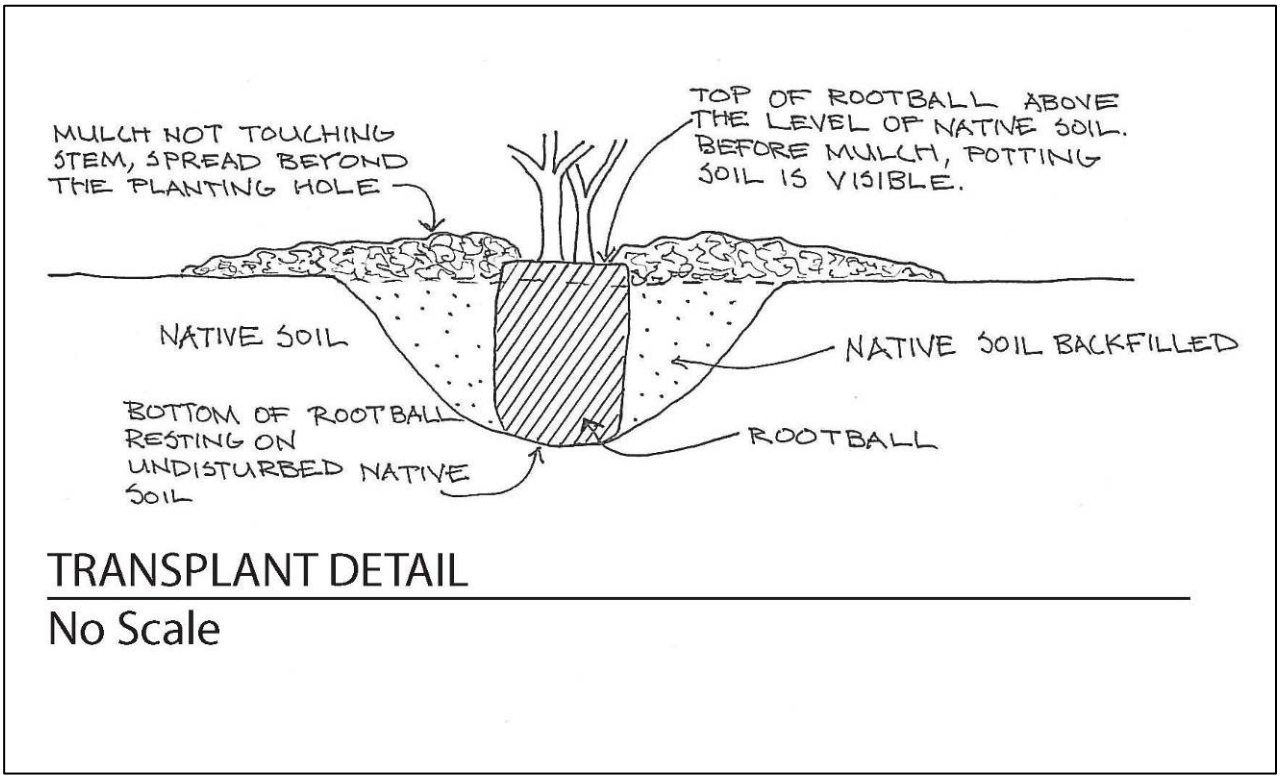
Figure VI-8: Illustration on how to plant flats.



c) Transplanting Pots

To plant herbs, grasses or shrubs grown in pots (i.e., 1-gallon), dig a hole that is approximately as deep as the root system of the transplant and at least twice as wide. Remove the plant from the pot and place it in the hole. Ensure that the base of the stem of the transplant is either flush or slightly above the surrounding soil surface. Backfill the hole with amended native soil and tamp lightly around the root ball of the transplant. Apply a small amount of slow release osmocote fertilizer to assist growth of the transplant. Add mulch around the plant to retain moisture and reduce weed growth.

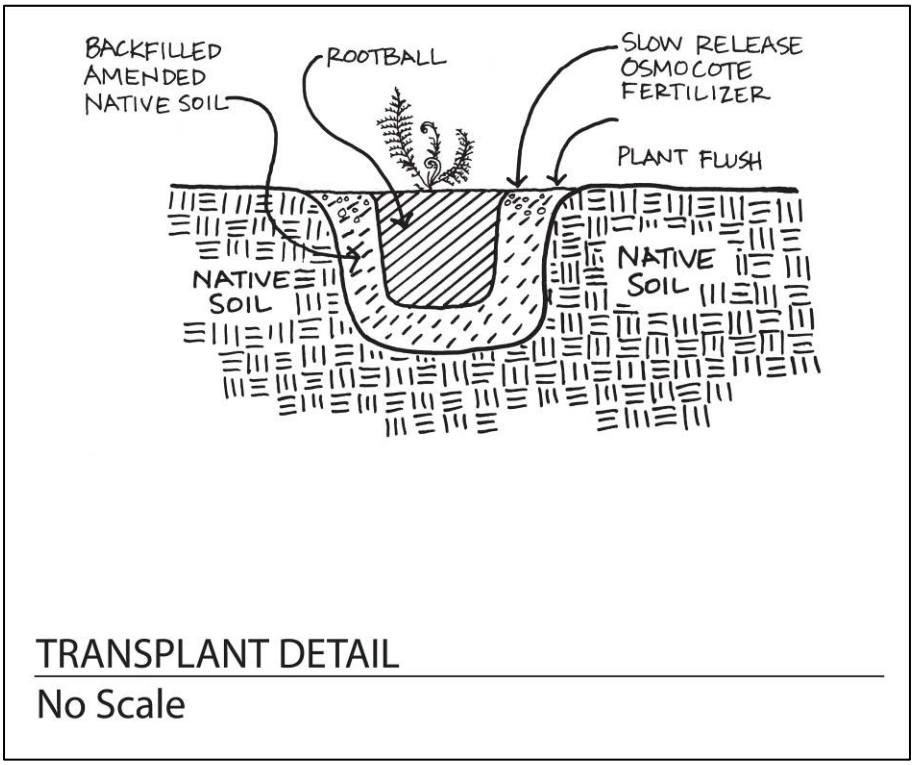
Figure VI-9: Illustration on how to transplant herbs, grasses or shrubs grown in pots.



d) Planting Herbs in Compacted or Poor Soils

If the soils are highly compacted or poor quality, planting may be more successful if the initial hole is larger and deeper than the plant.

Figure VI-10: Illustration on planting herbs in compacted or poor soils.



5. Planting Trees and Shrubs

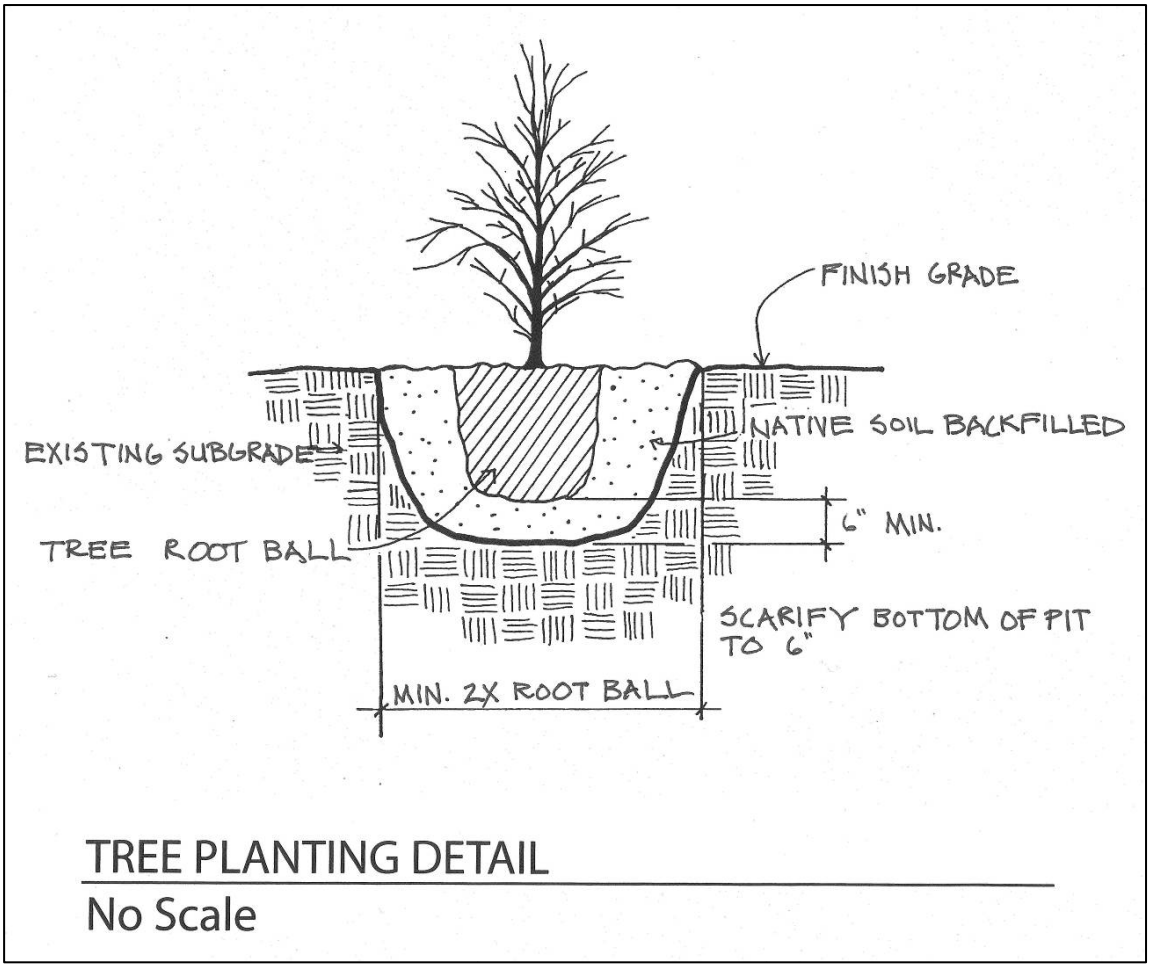
PURPOSE

Seedling or sapling trees and shrubs can be planted in order to quickly attain the desired habitat structure.

SPECIFICATIONS

Identify the microsite conditions (i.e. frequency of flooding, elevation, amount of shade) for the tree species you plan to install. The current amount of shade, and the frequency of inundation and saturation should be considered when choosing a species to plant at a particular site. To plant a tree, prepare a hole that is wider and deeper than the root ball. Scarify the bottom of the hole and place the transplant into the hole with backfill covering over the root material. Ensure that the stem is covered with soil just to its base, completely covering the root system but no farther. Compress the soil gently around the root system. Water new transplants generously to decrease transplant shock. Provide appropriate protection (i.e., tree shelters) from wildlife herbivores which could visit the site (see Section VI-C.9).

Figure VI-11: Illustration on how to plant trees and shrubs.



6. Tree staking

PURPOSE

Staking is occasionally required to help a transplanted tree as it is becoming established. Most trees do not need to be staked, and staking should be done with great care so as to not do more long term damage than good to the newly planted tree.

SPECIFICATIONS

Stakes should be aligned at right angles to the prevailing winds so that the tree can move back and forth without hitting itself on the stake. Place stakes as low as possible, and less than 2/3 the height of the tree. Keep the stakes 12 to 18 inches away from the trunk so that the roots have room to stretch out. Use a flexible material such as garden tape or a piece of an old pair of panty hose to loosely tie the tree to the stake so that the trunk can gain strength from movement and develop the correct trunk taper. Remove the stake when roots have become established in the native soil within one growing season or at most within a year.

Figure VI-12: Illustration on how to plant and stake a tree.

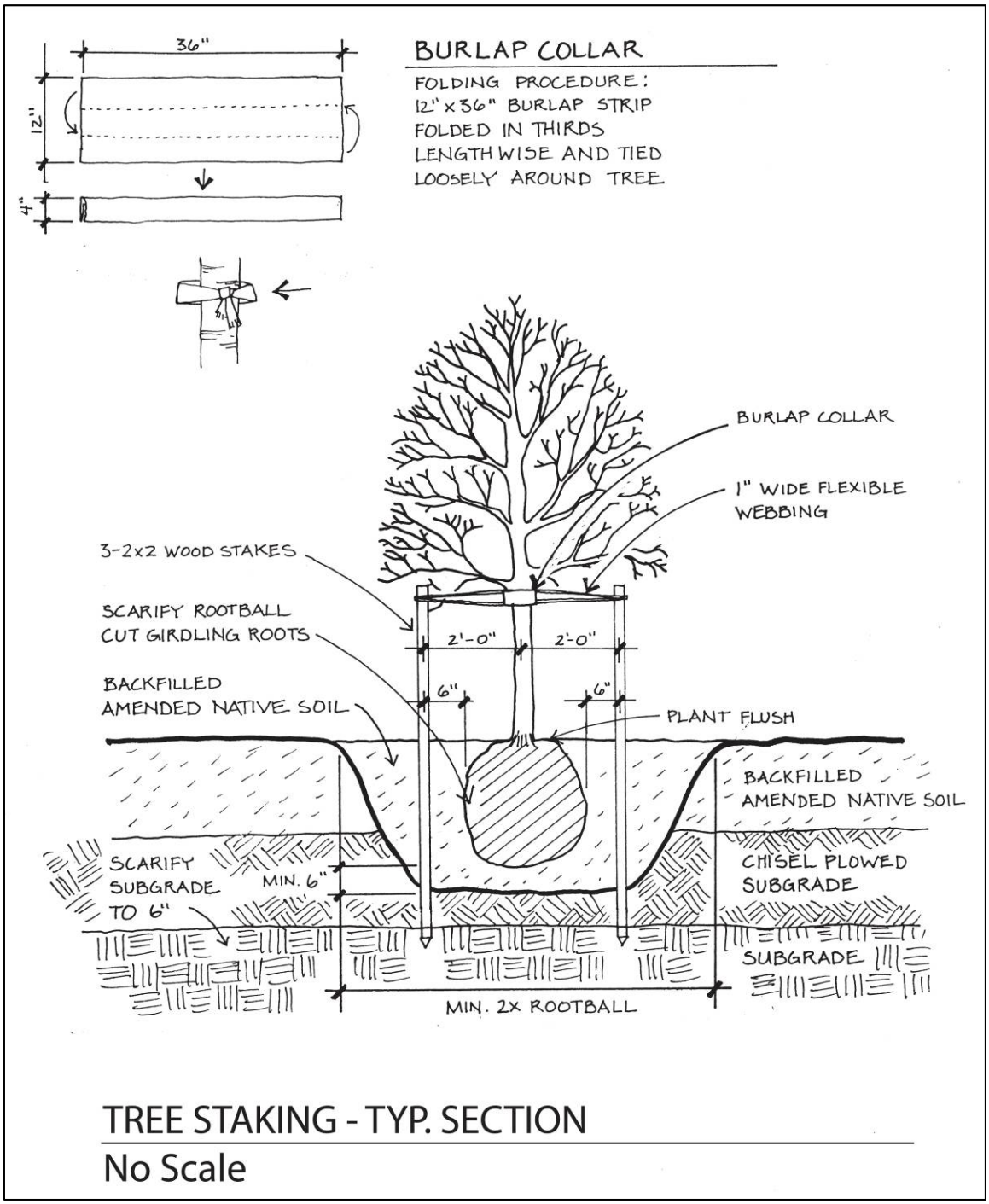
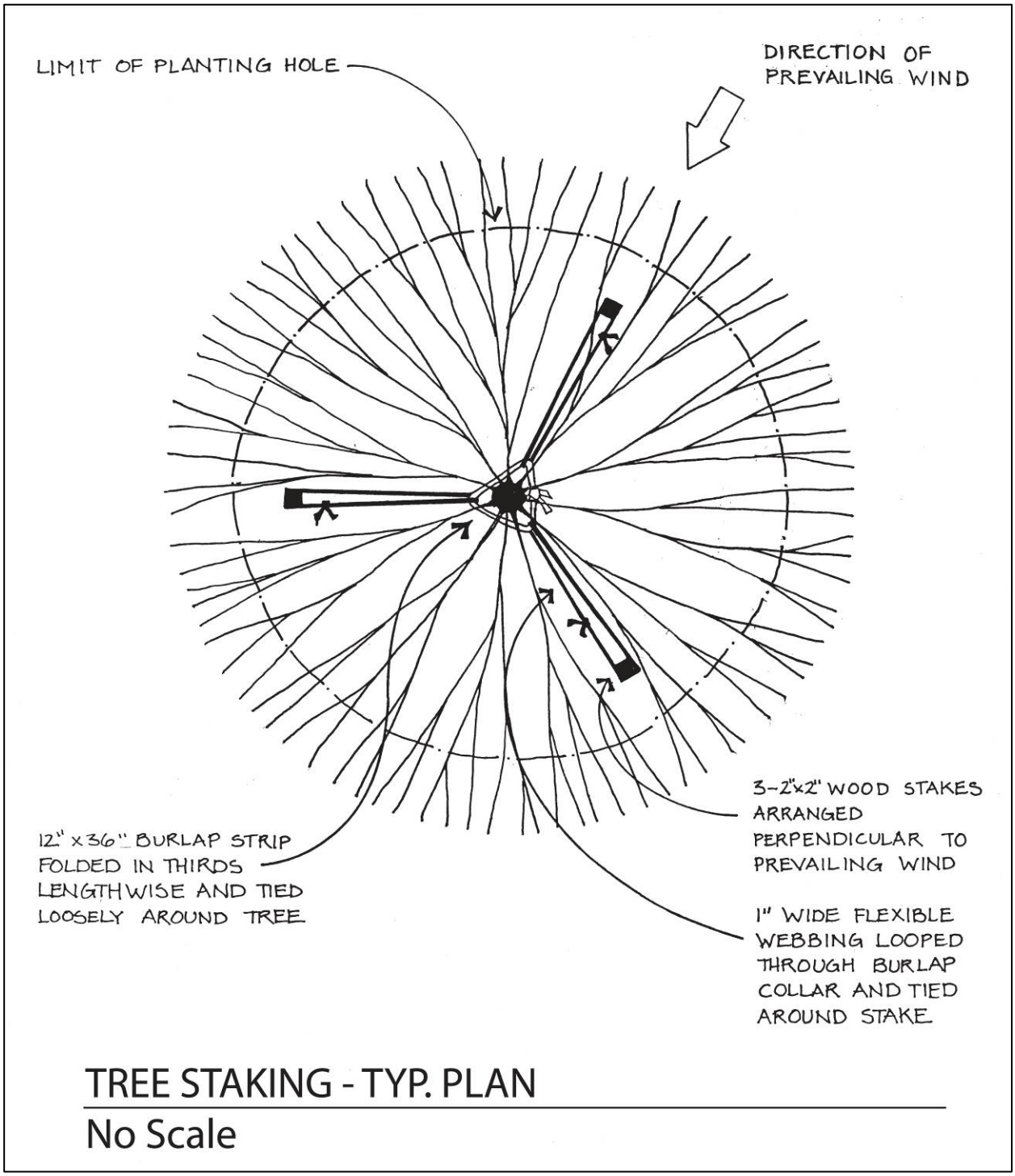


Figure VI-13: Illustration of an overhead view of tree staking.



7. Protection for new transplants

a. Mulch

PURPOSE

Mulch is simply a protective layer of a material that is spread on top of the soil. Organic mulch is composed of grass clippings, straw, bark chips, or similar materials. Mulch protects the soil and allows water to seep into the soil rather than immediately run off. Mulch inhibits invasive plants from taking over a site again and, as the mulch degrades, it adds nutrients to the soil to increasing plants' chances of survival.

SPECIFICATIONS

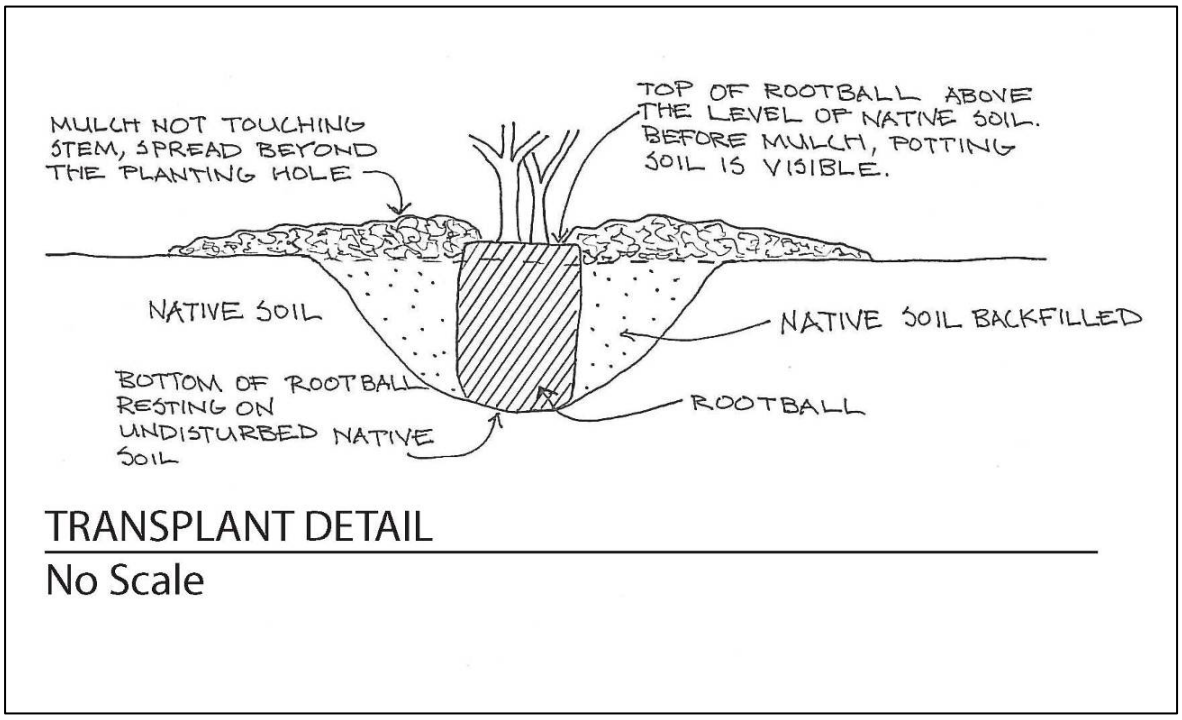
Mulch is applied by spreading desired material in a thin layer on the soil. Weeds should be clipped or pulled and removed prior to installation of mulch. Weeds should not stick out from above the mulch layer. The National Resource Conservation service (NRCS) provides information comparing various types of mulch that can be used (www.nrcs.usda.gov). Do not place mulch within the first inch or two around the trunk of trees and shrubs.

Table VI-4: Information about various types of mulch for protecting new transplants.

Material	**Apply**	**Notes**
Bark mulch	2 - 4"	Smaller chips are easier to spread, especially around small plants. Excellent for use around trees, shrubs. When spreading mulch around trees, keep the mulch an inch or two away from the trunk. A couple inches of mulch is adequate. There is no need to apply the mulch 6 or 8 inches high, as often is seen.
Wood chips	2 - 4"	Similar to bark mulch. If using fresh wood chips that are mixed with a lot of leaves, composting may be beneficial.
Leaves	3 - 4"	Best to chop and compost before spreading. If using dry leaves, apply about 6 inches.
Grass clippings	2 - 3"	Thicker layers tend to compact and rot, becoming quite slimy and smelly. Add additional layers as clippings decompose. Do not use clippings from lawns treated with herbicides.
Compost	3 - 4"	Excellent material for enriching soil.

Information from NRCS: http://www.nrcs.usda.gov/FEATURE/backyard/mulching.html

Figure VI-14: Illustration describing how to place mulch around new transplants.



b. Tree Protectors

PURPOSE

Tree protectors (*a.k.a*. tree shelters) effectively prevent browsing on new plants by herbivores such as deer, rabbits, gophers, and other rodents. Tree protectors are typically placed around newly planted trees, shrubs, and herbs in areas frequented by herbivores. Shelters can also help reduce weed competition and water loss due to wind. Tree shelters have been shown to greatly increase the survival rate of young seedlings.

SPECIFICATIONS

Tree shelters are tubes made of recycled polyethylene or a biodegradable material that can be wrapped around or placed over seedlings. Tree shelters come in a variety of heights (i.e. 3, 4 or 5 feet in length). Lighter colored shelters should be used in partial light situations.

Tree shelters should be installed when the seedlings are planted to help decrease transplant shock and minimize risk of herbivores grazing on the new plants. Specific installation procedures will depend on the type of tube selected. The necessary height of the tube can be determined by figuring the highest browse level by herbivores present at the site. Shorter tubes are effective for rodents and small mammals while tubes must be at least 4 feet tall to prevent browsing by deer. In general, the tube is placed over the seedling and secured in place with a bamboo or pointed wooden stake. Stakes should penetrate into the ground at least 8 inches and extend about 4

inches above the uppermost tie, but not exceed the length of the tube. The tube can be tied loosely to the stake using zip ties or other fastener. The tube should be pushed at least 2 inches into the ground. Periodic readjustment and replacement of tubes will be necessary. Most tubes are biodegradable within 2 to 5 years and should not be removed before that time period.

Figure VI-15: Illustration describing how to install a tree protector.

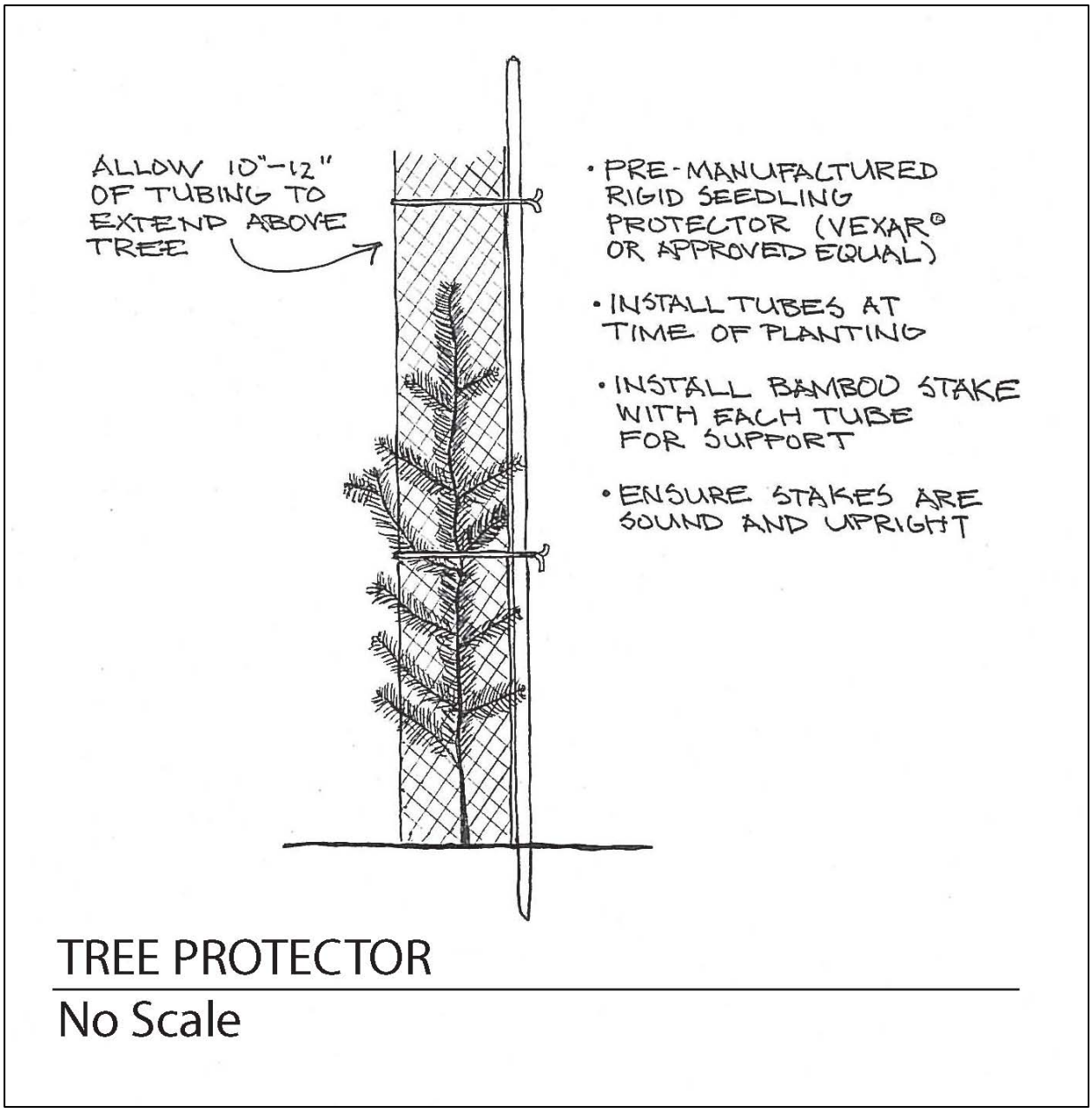
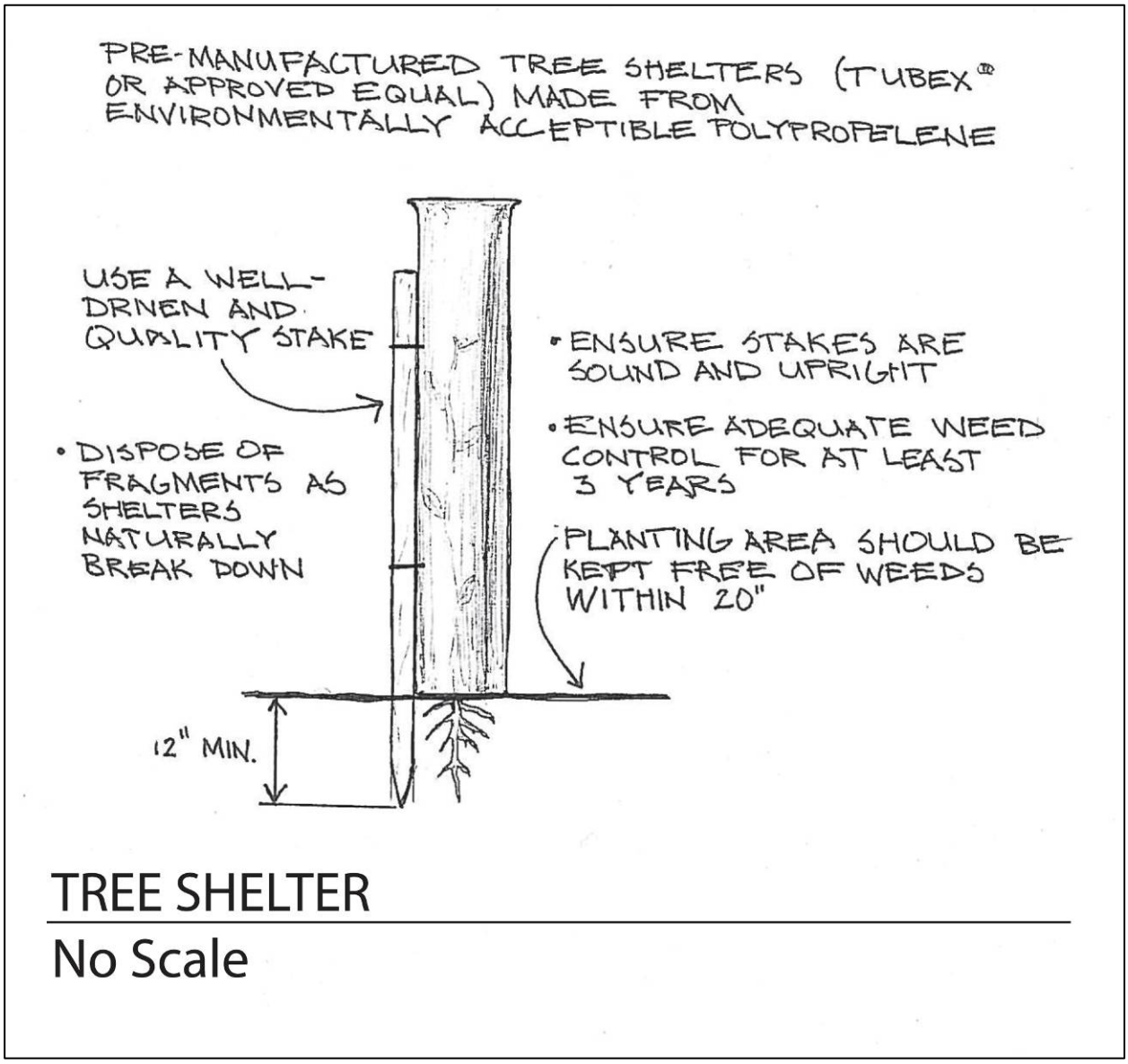


Figure VI-16: Illustration on how to install a pre-manufactured tree shelter.



D. MICROTOPOGRAPHY, WOOD, AND HABITAT STRUCTURE

1. Down Wood

PURPOSE

Down wood provides shelter and foraging habitat for many species of birds. By leaving down wood in place or even importing wood from construction or logging sites, you can enhance your natural landscape. In addition, as down wood decomposes, it helps to enrich the soil with nutrients. Down wood may also help to reduce soil erosion and collect debris on sloped soils.

SPECIFICATIONS

Down wood is an easy procedure that can quickly create habitat structure. Creation of down wood is as easy as leaving fallen trees or branches in place or importing intact logs, trunks, or branches from another location to your site. If you find another location with down wood suitable for your site such as at a nearby park, you must obtain the appropriate permission to collect fallen wood material from other locations before removing it from the site.

2. Standing Wood (Snags)

PURPOSE

Standing wood, or snags, provide foraging and nesting opportunities for many native insect-eating bird species such as nuthatches, woodpeckers, and wrens. Many native songbirds are cavity-nesters, meaning they excavate their own nest holes or use abandoned cavities in dead or dying trees. Large snags can provide nesting habitat for large birds including hawks and eagles.

SPECIFICATIONS

Creation of snags can be as easy as leaving dead trees that do not present a hazard standing in place to the more complex protocol of importing and installing dead logs at a site. Alternatively, if suitable trees are not present on-site, a log can be secured in the soil with a portion protruding above ground.

3. Brush Piles (Above and Below Ground)

PURPOSE

Brush piles provide foraging and nesting habitat for a variety of birds, reptiles, and mammals. Brush piles attract insects that provide an important food source for these animals. As brush piles decompose with time, they replenish nutrients and provide organic matter to the soil.

SPECIFICATIONS

While haphazard piles of limbs, leaves, and twigs may be used by wildlife, a carefully constructed brush pile will provide a much more useful habitat. The goal is to create ground-level pathways into the brush with internal spaces where creatures can find places to perch safely off the ground.

Brush piles can be constructed either with a pallet or a teepee form. The pallet brush pile is constructed with a base of stacked tree tops, tree stumps, old Christmas trees, and limbs with leaves and twigs placed on top. The teepee form brush pile consists of several log layers that are placed at right angles to each other. For construction of the teepee, the logs are about 6 feet long and should be placed about 10 inches apart within each layer. The teepee version uses about eight 6- to 8-foot untrimmed branches arranged in a teepee fashion, either standing alone or over a tree stump. When completed a brush pile can be between 4 and 6 feet tall and about 10 to 15 feet in diameter.

When creating brush piles, they should not be isolated from other potential habitat and cover. They should be close to existing shrubs or trees. The piles should be well-drained and should not be placed on frequently flooded soils. Brush piles will naturally decay with time and they should be inspected annually to ensure stability of the structure and determine whether a new pile should be constructed.

LIMITATIONS

Some neighborhoods and locations do not allow large brush piles to be constructed or do not allow the brush piles to be in sight. Brush piles are flammable. Keep them away from buildings and trees. Be sure they remain undisturbed so as to provide intended habitat function. Children and pets should, therefore, be kept off the brush piles.

4. Small Microdepressions

PURPOSE

Microdepressions are shallow, gently sloping low spots in the topography. Microdepressions create habitat structure and increase community diversity relative to completely flat or nearly level ground. Construction of a microdepression is often paired with construction of a small mound using the soil that was removed from the depression. These small depressions and corresponding mounds are typically about 10 feet wide and about 25 feet long. Since microdepressions can often retain water, species adapted to frequent saturation or inundation must be selected.

SPECIFICATIONS

Sedges, rushes and willows are often planted in and near microdepressions. Species that are more adapted to frequent saturation or inundation should be selected for planting at the lowest elevation in a microdepression. Species should be planted in one or more rings according to elevation within the microdepression as well as on the associated mound (if applicable).

Table VI-5 provides suggested species that can be planted within the depression and on the mound and an example planting layout using a subset of these species is illustrated below.

Microdepression Planting

Mound species

Oregon ash	*Fraxinus latifolia*
Western red cedar	*Thuja plicata*
Douglas fir	*Pseudotsuga menziesii*
Paper birch	*Betula papifera*
Western hemlock	*Tsuga heterophylla*
Red huckleberry	*Vaccinium parvifolium*
Salal	*Gaultheria shallon*
Pacific (red) willow	*Salix lasiandra*
Red osier dogwood	*Cornus sericea*
Red elderberry	*Sambucus racemosa*

Depression species

Hardhack spirea	*Spiraea douglasii*
Bog birch	*Betula glandulosa*
Sitka sedge	*Carex sitchensis*
Slough sedge	*Carex obnupta*
Baltic rush	*Juncus balticus*
Small-fruited bulrush	*Scirpus microcarpus*
Water parsley	*Oenanthe sarmentosa*

Figure VI-17: Illustration of microdepressions from an overhead and horizontal view.

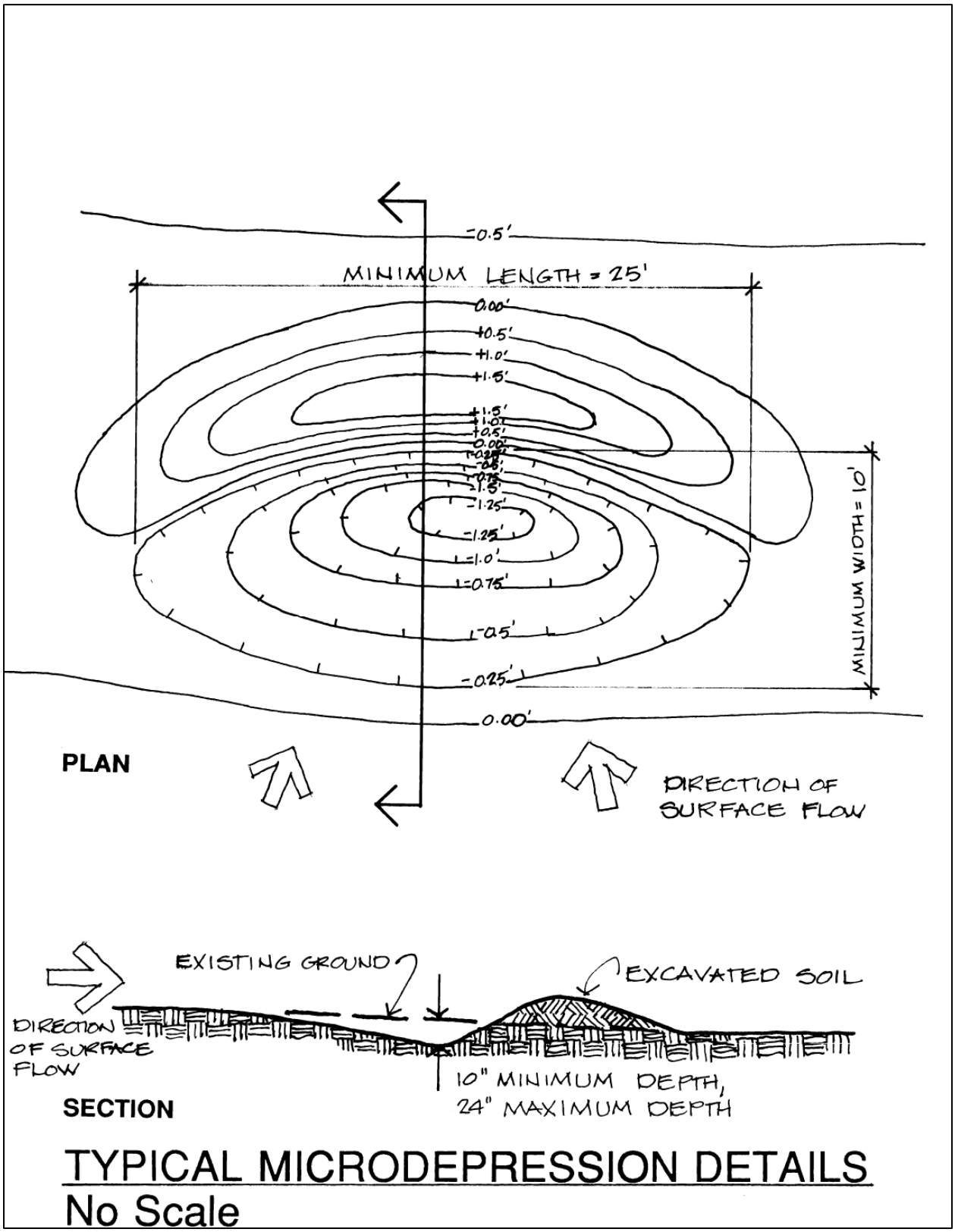
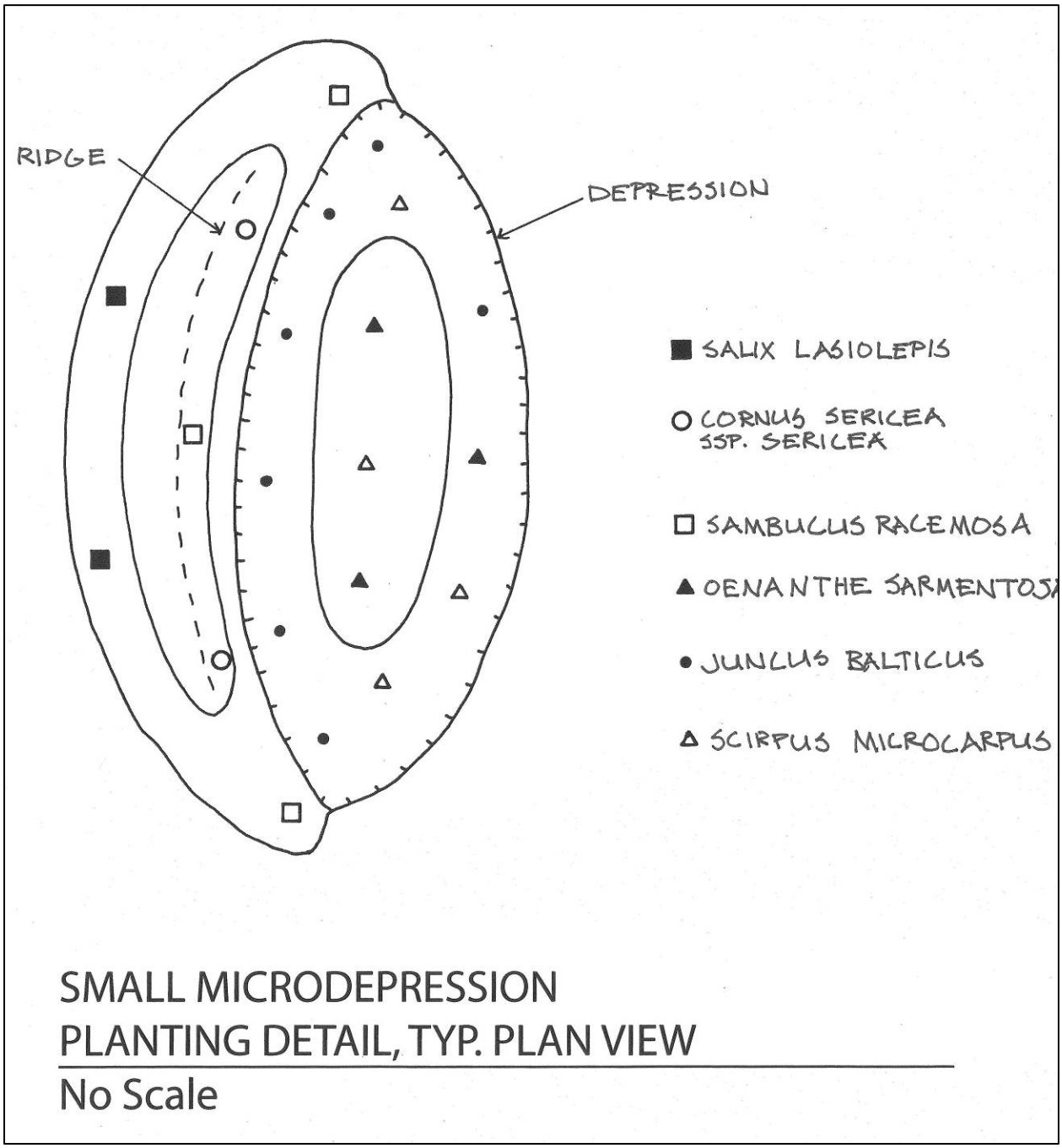


Figure VI-18: Planting recommendations for a microdepression.



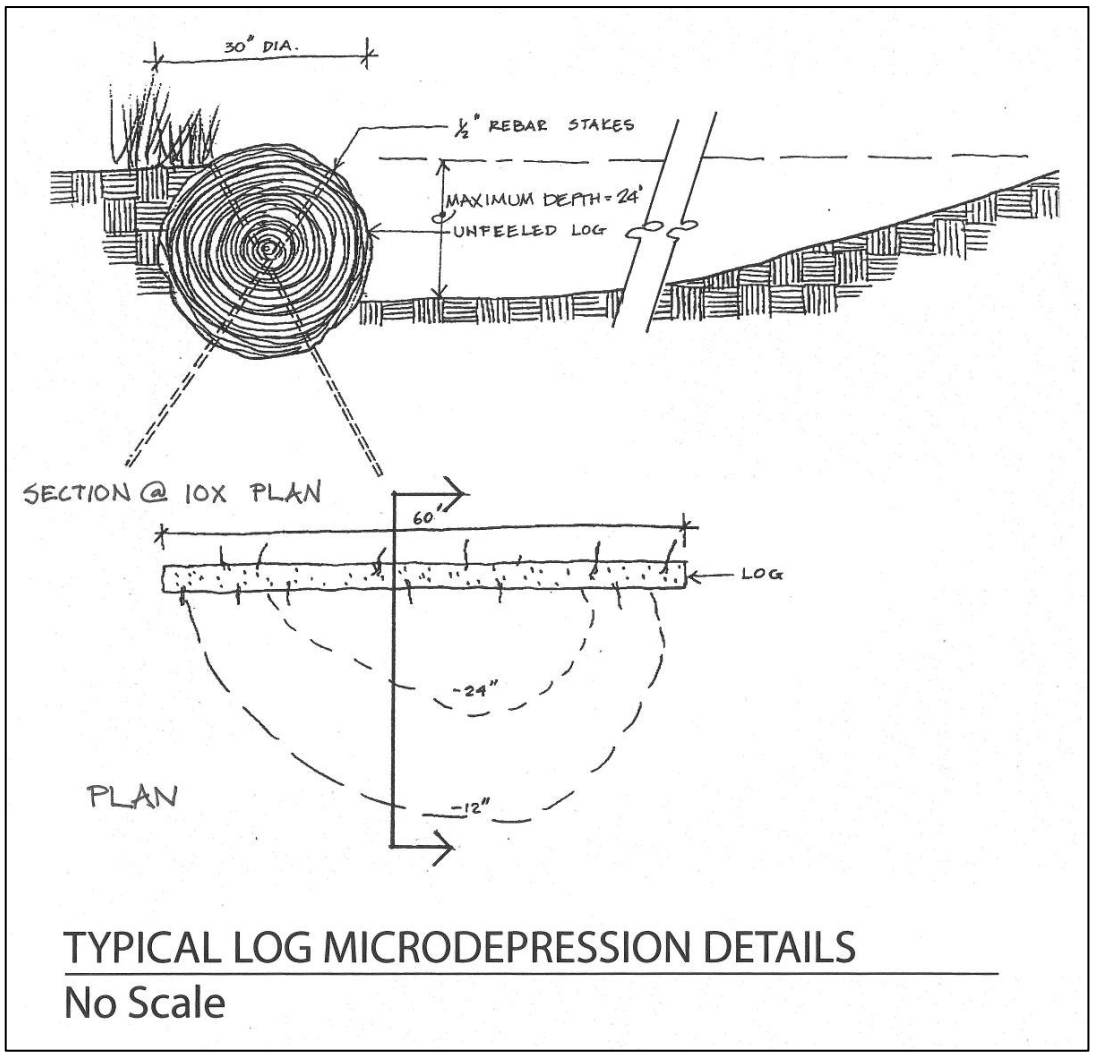
5. Down Wood Within Microdepressions

PURPOSE

Placing woody debris within a microdepression can improve habitat quality for birds and mammals. This type of microdepression is created using the trunk of a tall tree (~ 30 inch diameter) as one edge of the depression. As the tree decomposes, it provides nutrients, habitat structure, and shelter for a variety of animals.

SPECIFICATIONS
A log microdepression is created by placing a felled log within a shallow excavated depression. Ideally the log should be approximately 60 feet long and the entirety of the depression will be about 60 feet wide. Seeding or planting should be done within the microdepression.

Figure VI-19: Illustration describing construction of a lob microdepression.



E. SLOPE AND SOIL STABILIZATION AND BIOENGINEERING

1. Wattle Installation on a Slope

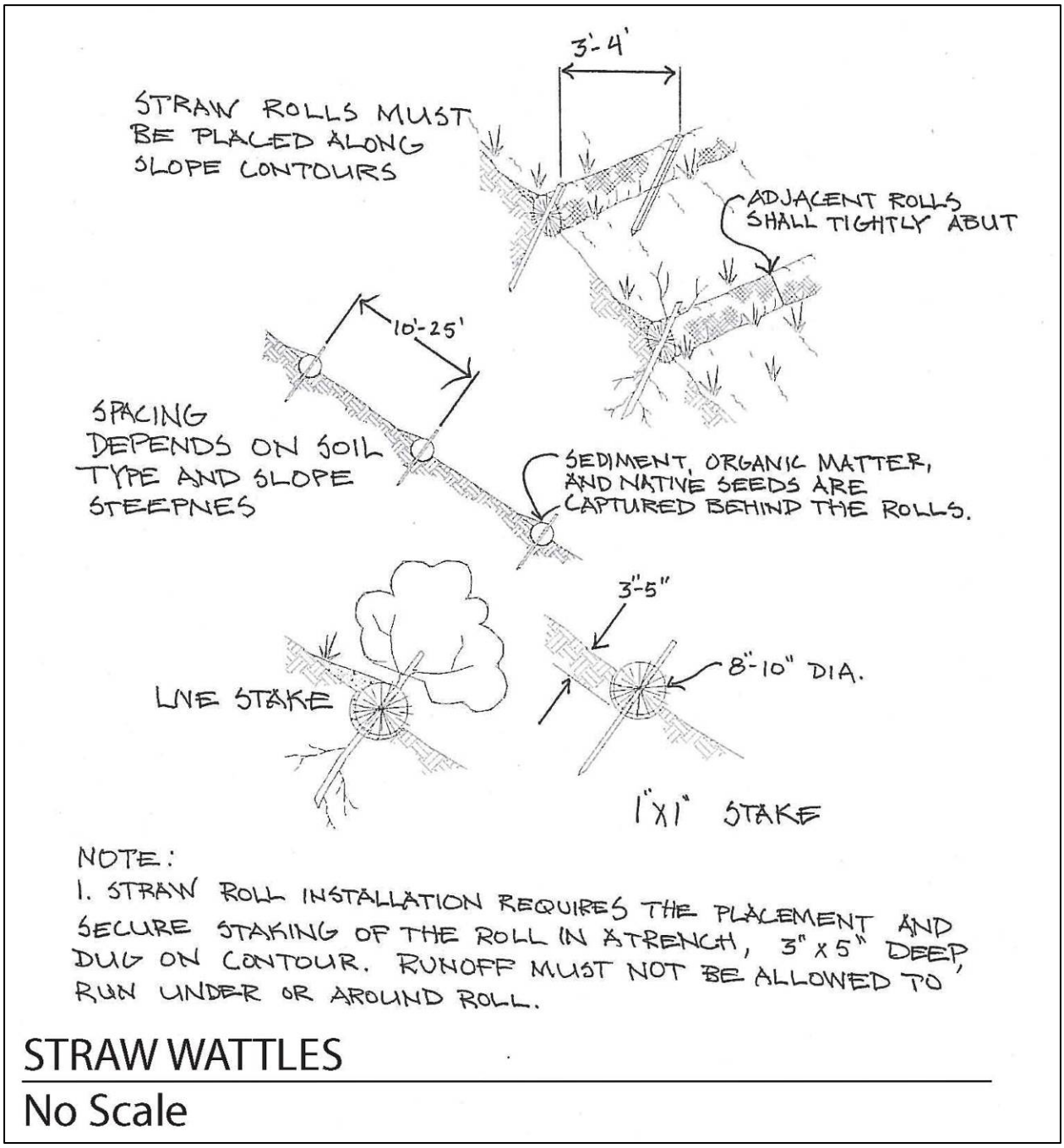
PURPOSE

Straw wattles provide temporary erosion control on slopes. They consist of straw wrapped in biodegradable tubular encasing material creating rolls that are 8 to 10 inches in diameter and 25 to 30 feet in length. Wattles are installed in shallow trenches and staked parallel to the contour of the slope. Wattles decrease erosion and transport of sediment from a site by reducing flow velocities, spreading out the flow of rill and sheet runoff, and retaining sediment.

SPECIFICATIONS

Straw wattles may be installed along the contour of slopes which may have a tendency to erode. They are often installed after large scale mechanical disturbances occur on slopes. Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle. Wattles may require maintenance to ensure they are in contact with the soil and thoroughly entrenched, especially after significant rainfall on steep or sandy soils. Inspect the slope after significant storms. Repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Figure VI-20: Illustration describing straw wattle installation.



2. Coir Roll

PURPOSE

Coir rolls are coconut fiber (coir) logs that provide a growth medium for new plantings, increase swale, shoreline or slope stabilization, assist in erosion control through slowing surface water movement and trapping sediment. As they are biodegradable and recycled, coir logs are an environmentally friendly alternative to rip rap, concrete stabilization structures and are more durable than hay bales. They provide surface protection that allows vegetation to become established around them. The biodegradable material typically lasts between 4 and 6 years. They are manufactured by a variety of suppliers and can be installed either as unplanted or planted logs.

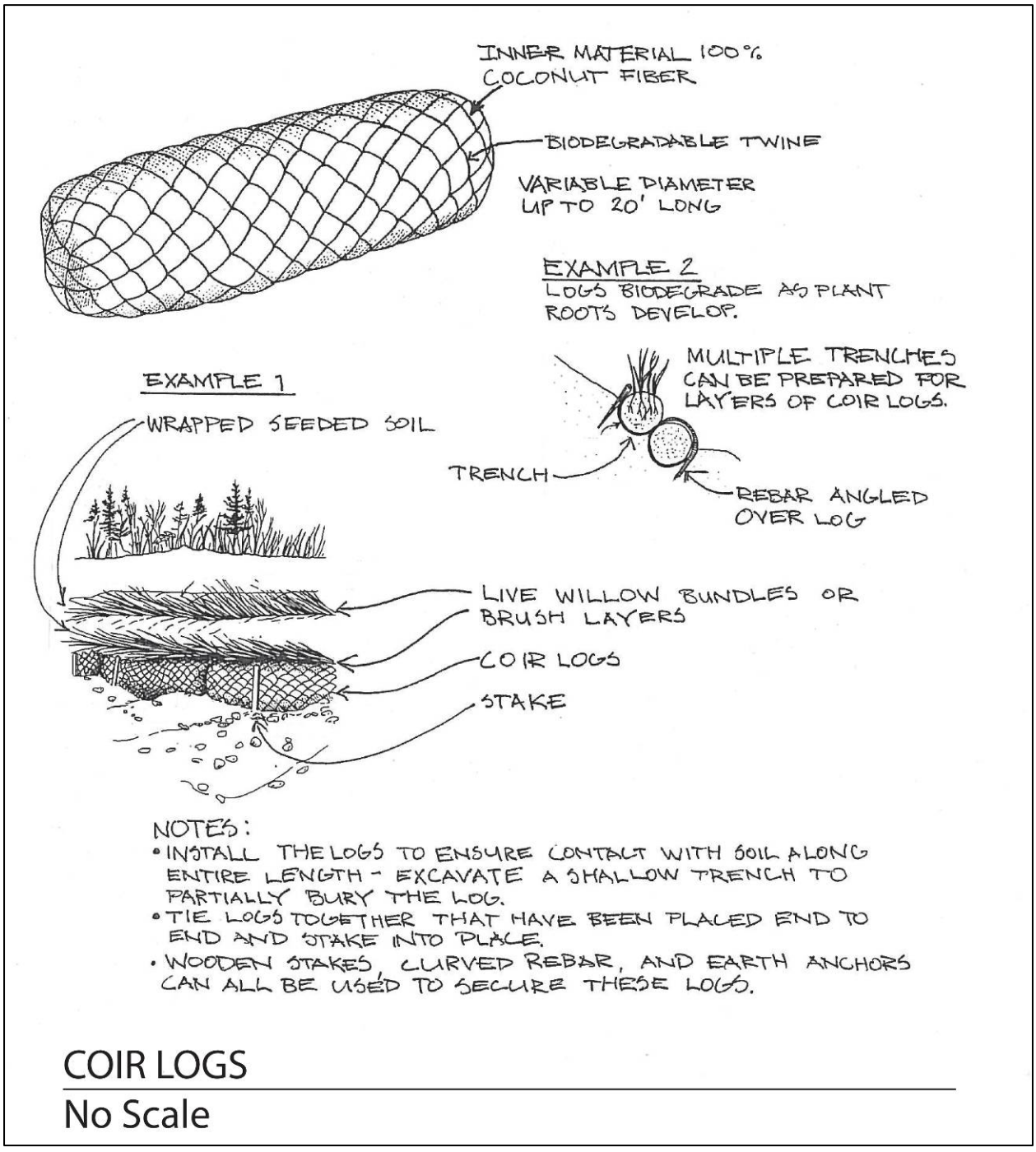
SPECIFICATIONS

Coir rolls are generally used along slope contours, in swales, at stream bank edges, and shorelines. Each 20 foot long roll should be anchored in a minimum of four to six locations using 2" x 2" wooden stakes that are 12 to 24 inches long or more depending on the site conditions.

LIMITATIONS

Coil logs are often used as shoreline stabilization. Appropriate permits must be attained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-21: Coir Roll Illustration.



3. Brush Layering

PURPOSE

Brush layering is an inexpensive and effective soil stabilization method to establish vegetation over large areas. Along streambanks, brush layering provides immediate habitat for fish.

SPECIFICATIONS

Benches or terraces that are at least 18 inches deep are dug along the contour of a slope beginning at the toe of the slope and moving upwards. The trench for the second terrace, and each subsequent terrace, must be spaced between 3 and 6 feet above the previous trench. Only short segments of ditches should be dug at a time in areas that may be prone to bank failure. The horizontal surface, or platform of each trench, should be angled upwards at least 10 degrees. Dormant cuttings with branches still attached are placed onto the platform with ¼ of their total length protruding from the slope surface so that at least ¾ of their length will be covered with soil. The branches can be placed crosswise (rather than completely parallel) to each other to allow maximum stabilization after backfilling with soil. Cuttings of a variety of species and a range of thicknesses or age classes should be intermixed within each brush layer. Young rooted plants may be combined with dormant cuttings in alternating layers or within the same layer.

Dig benches starting at the toe of the slope so that the lowest ditch can be filled easily with excess soil from the next ditch constructed upslope. Brush layering can be combined with other revegetation and streambank stabilization techniques. Live stakes can be interspersed between layers for higher density revegetation. The toe of the slope along stream banks should be further stabilized with live siltation, rootwads, coir logs, or tree revetments. Do not conduct work within waters or wetlands without first obtaining appropriate permits.

LIMITATIONS

Appropriate permits must be obtained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-22: Illustration describing brush layering – section view.

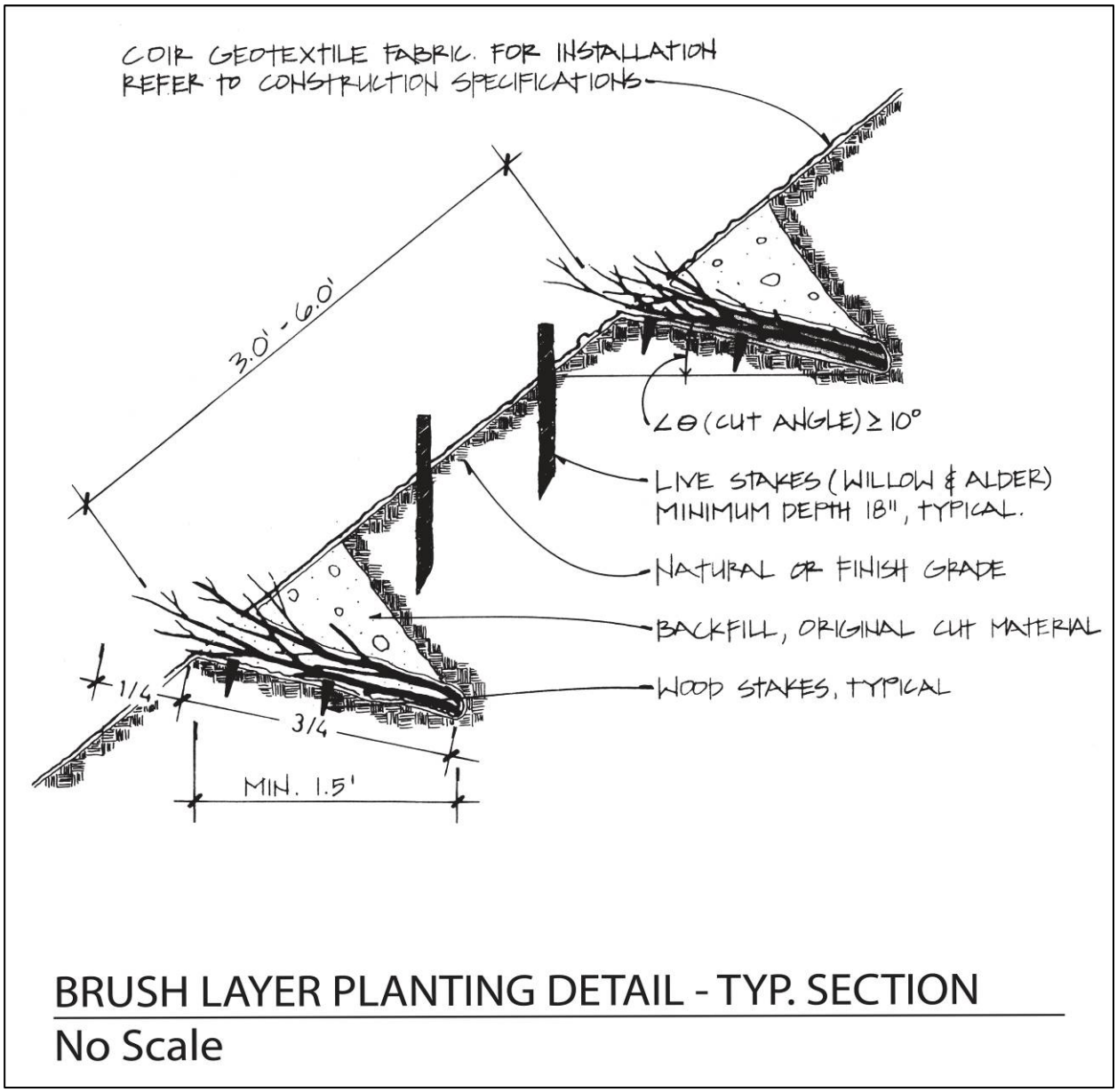
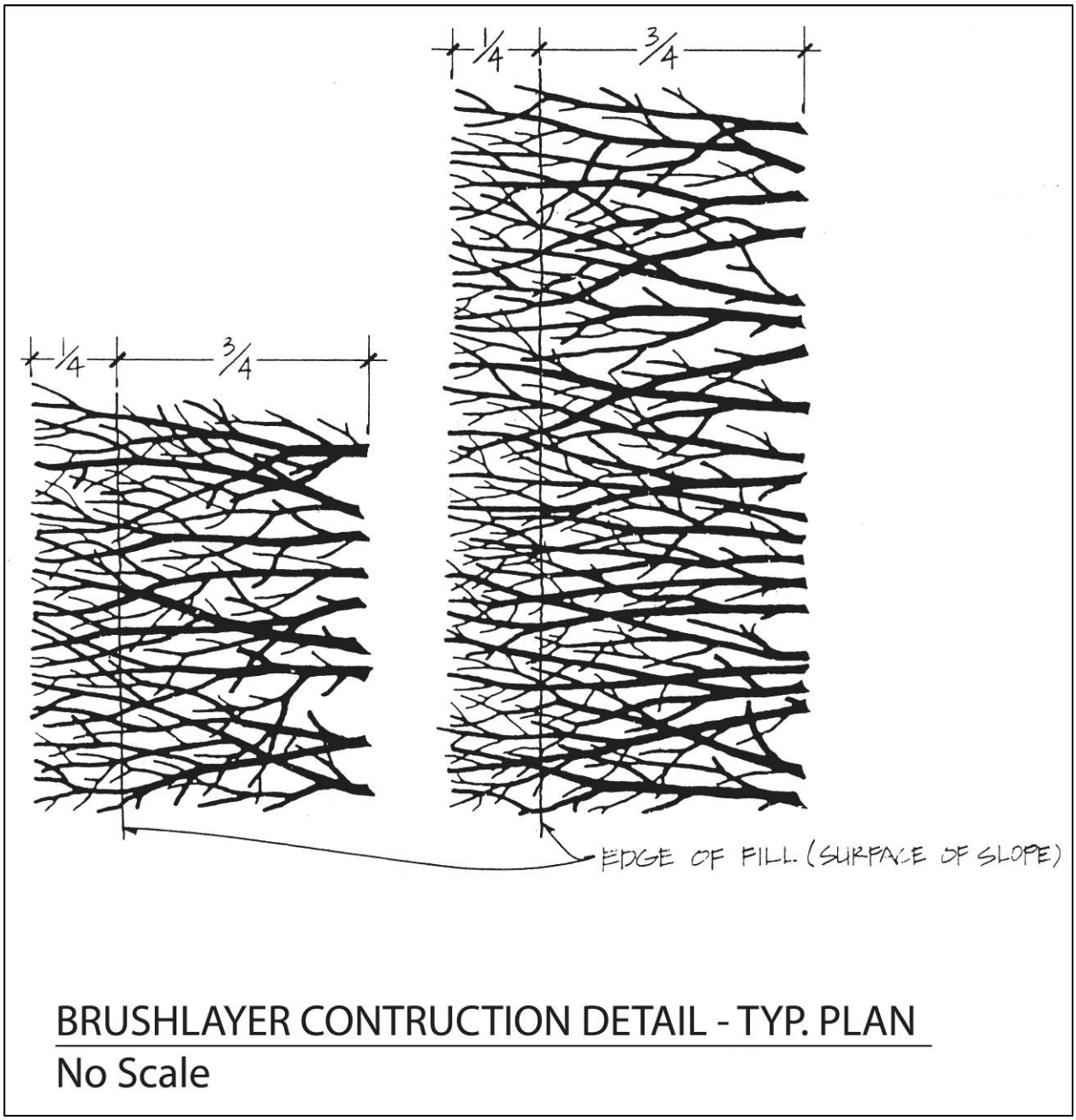


Figure VI-23: Illustration describing brush layering – section view.



4. Grass Rolls

PURPOSE

Grass rolls consist of sod chunks that are aligned tightly and held together within biodegradable fabric tied with twine and anchored in place with stakes (in low flow environments) or with earth anchors (in higher energy areas). Grass rolls are used where seeding is not practical due to fluctuating water levels and in areas with low to moderate flows. This revegetation technique also aids in erosion control and provides moderate structural stability. These rolls are used effectively using sedges in wetland restoration. Be sure to acquire all necessary permits before conducting work in waters or wetlands.

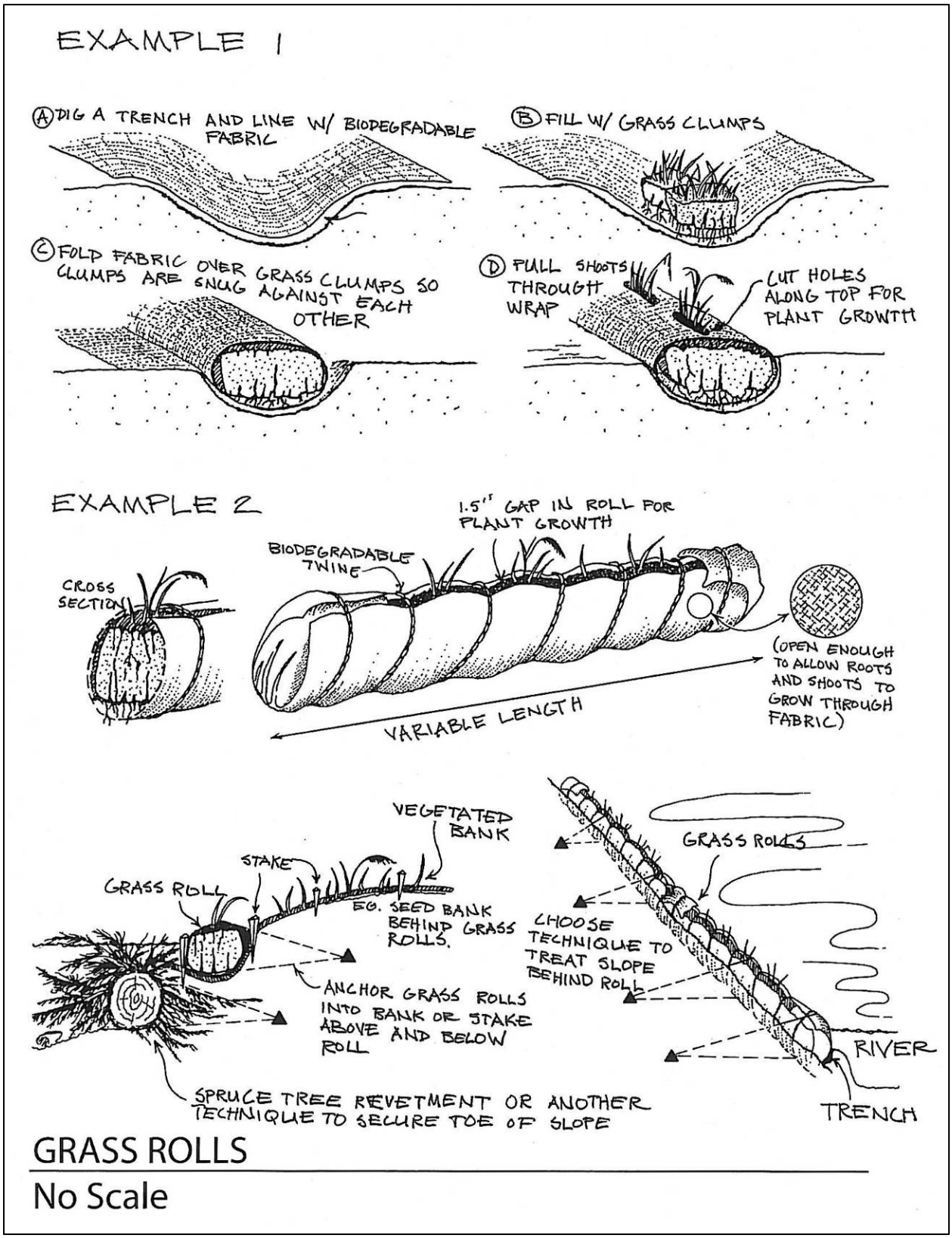
SPECIFICATIONS

Grass rolls are constructed using biodegradable fabric, clumps of sod composed of grasses and/or sedges, and twine. A shallow trench should be dug along the contour of a slope slightly above the Ordinary High Water (OHW) level where the grass roll will be placed. The biodegradable fabric should be placed flat on the ground across the trench. Place medium sized chunks of grass and/or sedge sod containing soil around the roots into the trench. Wrap the biodegradable fabric loosely over the sod and tie the sod rolls every few inches with twine. Be sure to allow the leaf blades (sod shoots) to protrude from the top of the roll by cutting slits in the fabric where necessary.

LIMITATIONS

Grass rolls should not be used in areas with high pedestrian or recreation use as grasses and sedges are sensitive to foot traffic. Access to new plantings should be minimized to aid in revegetation success or elevated walkways must be constructed to reduce disturbance. Appropriate permits must be obtained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-24: Illustration describing how to build and install a grass roll.



5. Live Bundle (Fascine)

PURPOSE

Live bundles consist of a stack of dormant branches bound together to create log-like structures that will quickly root to provide plant cover. They serve to revegetate and stabilize slopes, secure the toe of streambanks, and provide a transition from one revegetation technique to another. They provide immediate physical protection to a site prior to plant growth.

SPECIFICATIONS

Native dormant branches are collected in 6 to 8 inch diameter bundles and bound together with untreated, biodegradable twine into a log-like structure. Specifically, tie several ½- to 2- inch diameter, 3- to 4-foot long branches together. Orient the cut ends of the branches in opposite directions to make a uniform diameter bundle. Tie the bundle at multiple locations approximately every 1 to 2 feet with biodegradable twine. Each completed bundle should be between 5 and 10 feet in length by overlapping branches continuously to the desired length.

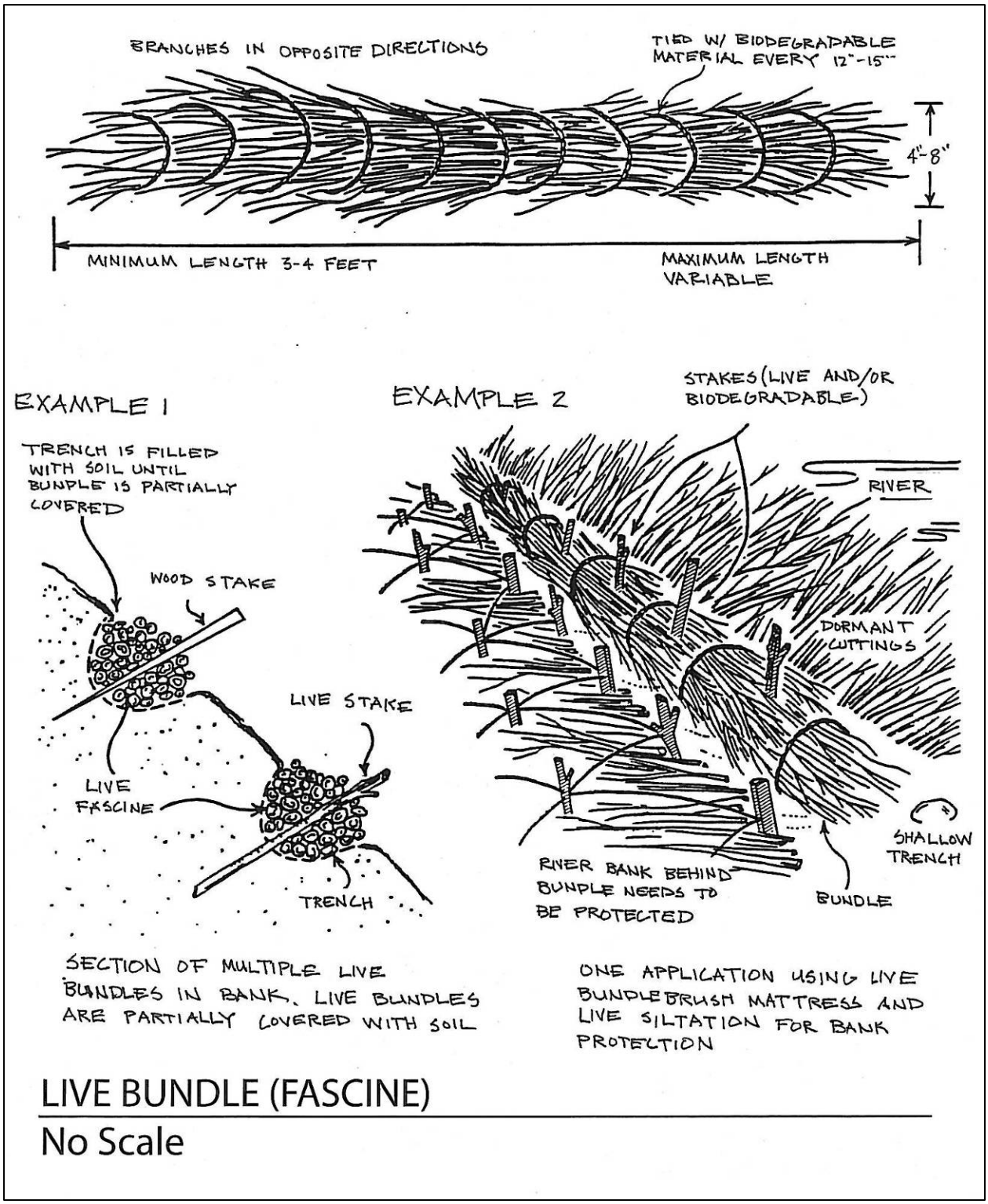
To install the bundle, dig shallow trench along the contour of a slope. The trench should slope downward and back into the slope so that about ¾ of the bundle will lie below the soil surface. Lay the bundle into this trench and compact the soil by tamping and/or watering. To secure the bundles in place, 2-foot long live willow stakes or untreated, wooden stakes should be driven through the bundle and into the slope every 2 to 3 feet. Stakes should be driven so that less than 3 inches of the stake remains above the fascine. Additional live willow stakes can be placed downslope of the bundle for added support, especially on steep slopes. By using dormant branches, the bundle should be able to grow so the bundle should not be completely covered with soil.

Multiple bundles can be used on a restoration site. Depending on site conditions and the restoration design, the bundles can be placed (1) end-to-end to form a continuous line along the contour, (2) staggered to reduce surface erosion potential, or (3) upturned in a concave orientation with the ends pointing upward on a slope

LIMITATIONS

Appropriate permits must be obtained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-25: Construction and installation of a live bundle.



6. Coir Cloth / Willow Stake Bioengineering

PURPOSE

Coir fiber matting is a biodegradable netting which is often installed on bare slopes where live stakes will be planted. Coir fiber matting provides temporary erosion control to resist the forces of running water until the vegetation can become established and slows weed recruitment.

SPECIFICATIONS

To install the coir cloth, create a smooth soil surface by removing stones, dirt clods, and debris that may prevent contact of the entire matting with the soil. Lay the mat directly on the smoothed, graded slope. Ensure that the matting lies smoothly and loosely on the soil surface by unrolling the matting without stretching it. Bury the top edge of the matting in a narrow trench that is 6 to 12 inches deep, cover it with soil and tamp firmly. When more than one roll of coir cloth is used on the slope, overlap 6 to 12 inches of the edge of the upper roll over the buried end of the second lower roll. Place 12 to 24 inch long wooden stakes cut at an angle or staples 1 to 3 feet apart as anchors to hold down the edges and junctions of mats.

Prepare live stakes (see Section VII.C.4 for more detail). The basal end of the stakes should be cut at an angle to facilitate insertion into the soil, but the top should be blunt so that it can be tamped into the soil. Stakes should be driven through the coir cloth approximately 3 to 4 feet apart. Orient the stakes with the buds pointing upward perpendicularly to the slope. Tamp approximately ¾ of the length of the stake into the ground. Trim the upper 1 to 2 inches of the finished live stake to remove the area that may have been damaged from tamping.

LIMITATIONS

Coir cloth must be monitored for wear and tear until vegetation becomes established. Minimal foot or equipment traffic should be conducted over the coir cloth if the soil is wet.

Figure VI-26: Construction of bioengineering with coir cloth and live willow stakes.

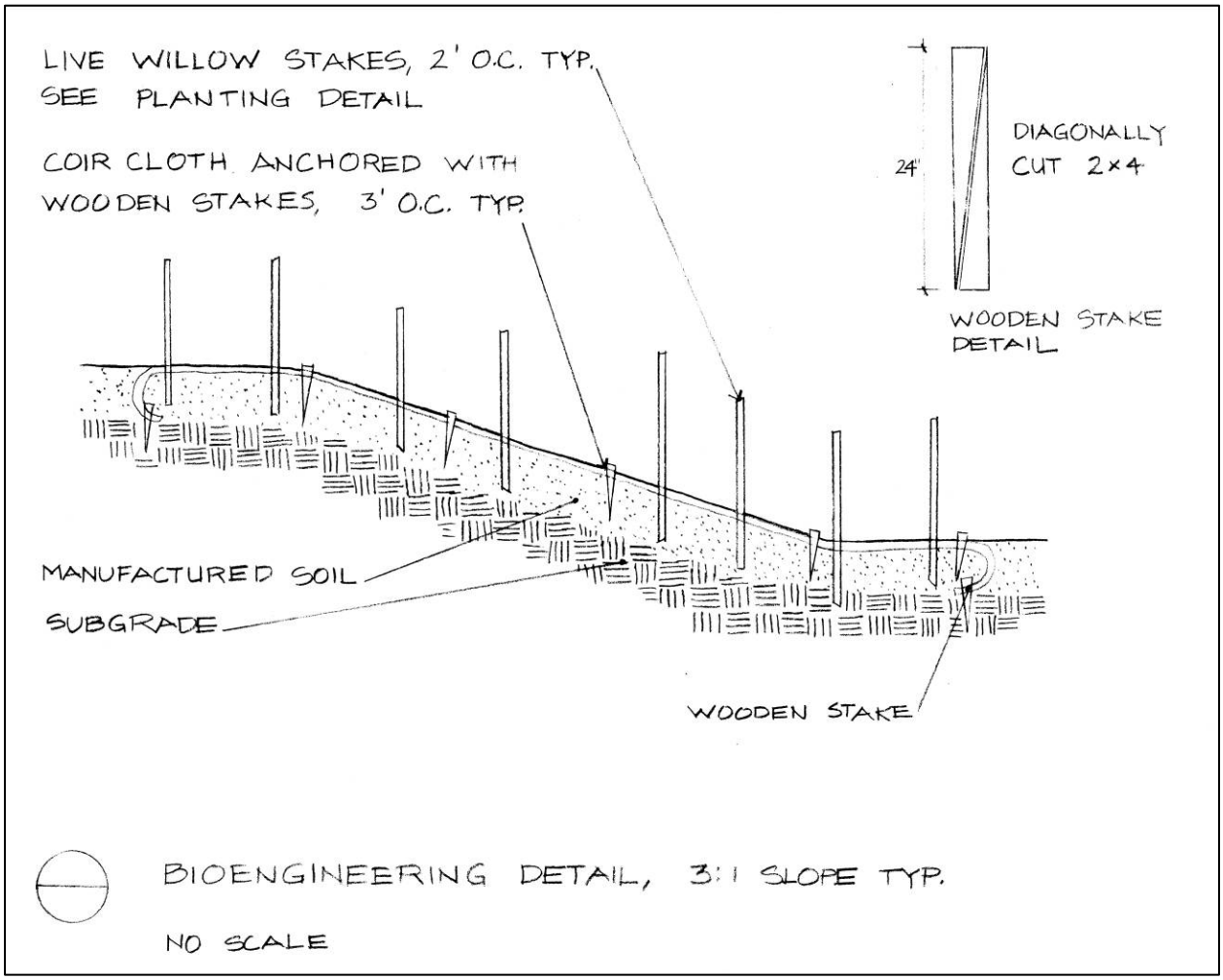
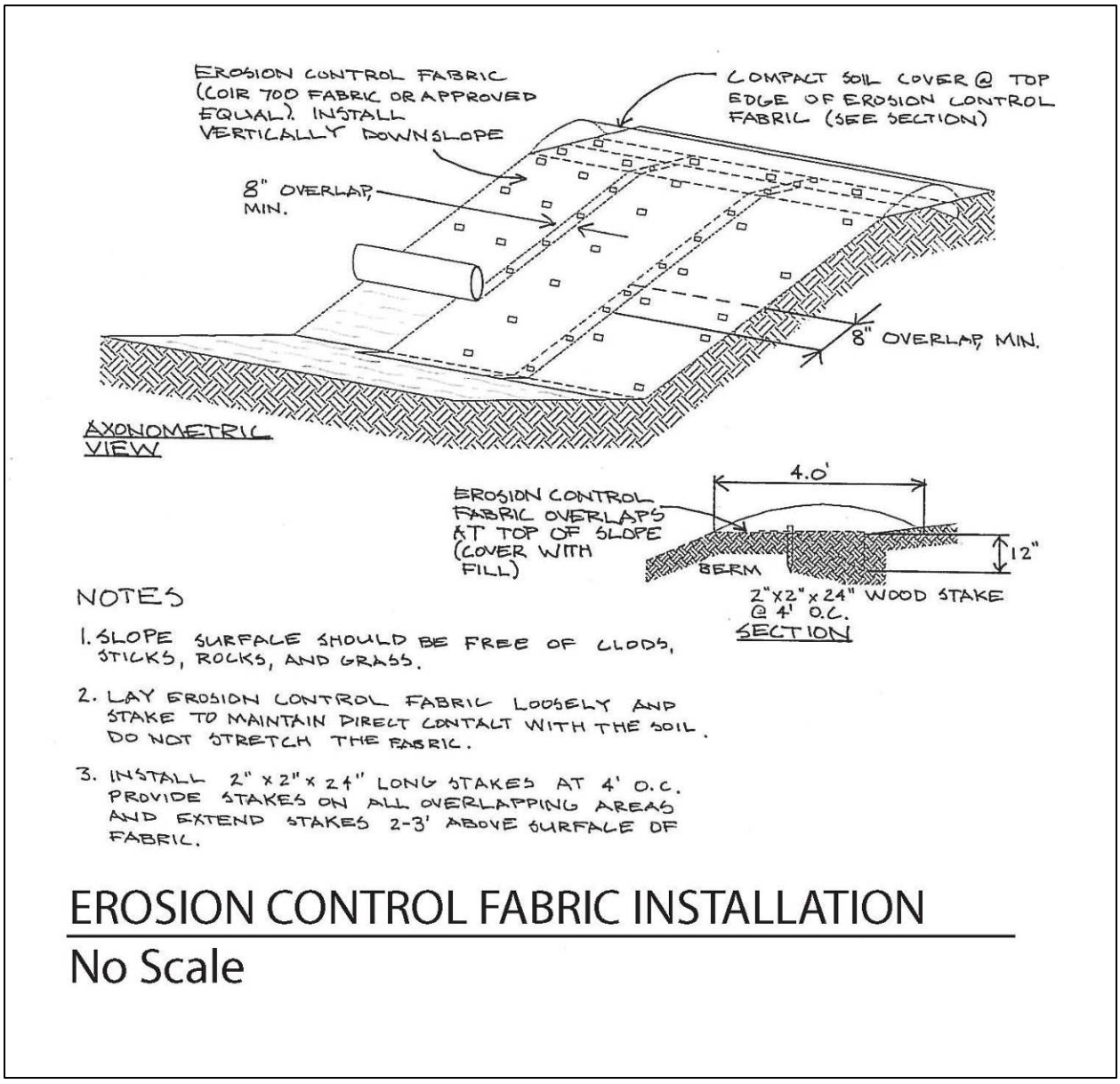


Figure VI-27: Illustration describing how to install erosion control fabric.



7. Vegetated Geogrid Slope Stabilization

PURPOSE

A vegetated geogrid consists of brush layers and encapsulated soil lifts providing structure for a stable, steep slope. Geogrid material is flexible synthetic mesh composed of a variety of plastics and manmade fibers that are manufactured specifically for slope stabilization and earth retention and are not affected by the chemicals found in most soil environments. The woven and stretched material is designed to allow soil and rock to mesh with the material to "lock" it into place and reinforce soil on a slope. Slope stabilization using a geogrid can provide a steeper than normal slope face that can be naturally landscaped.

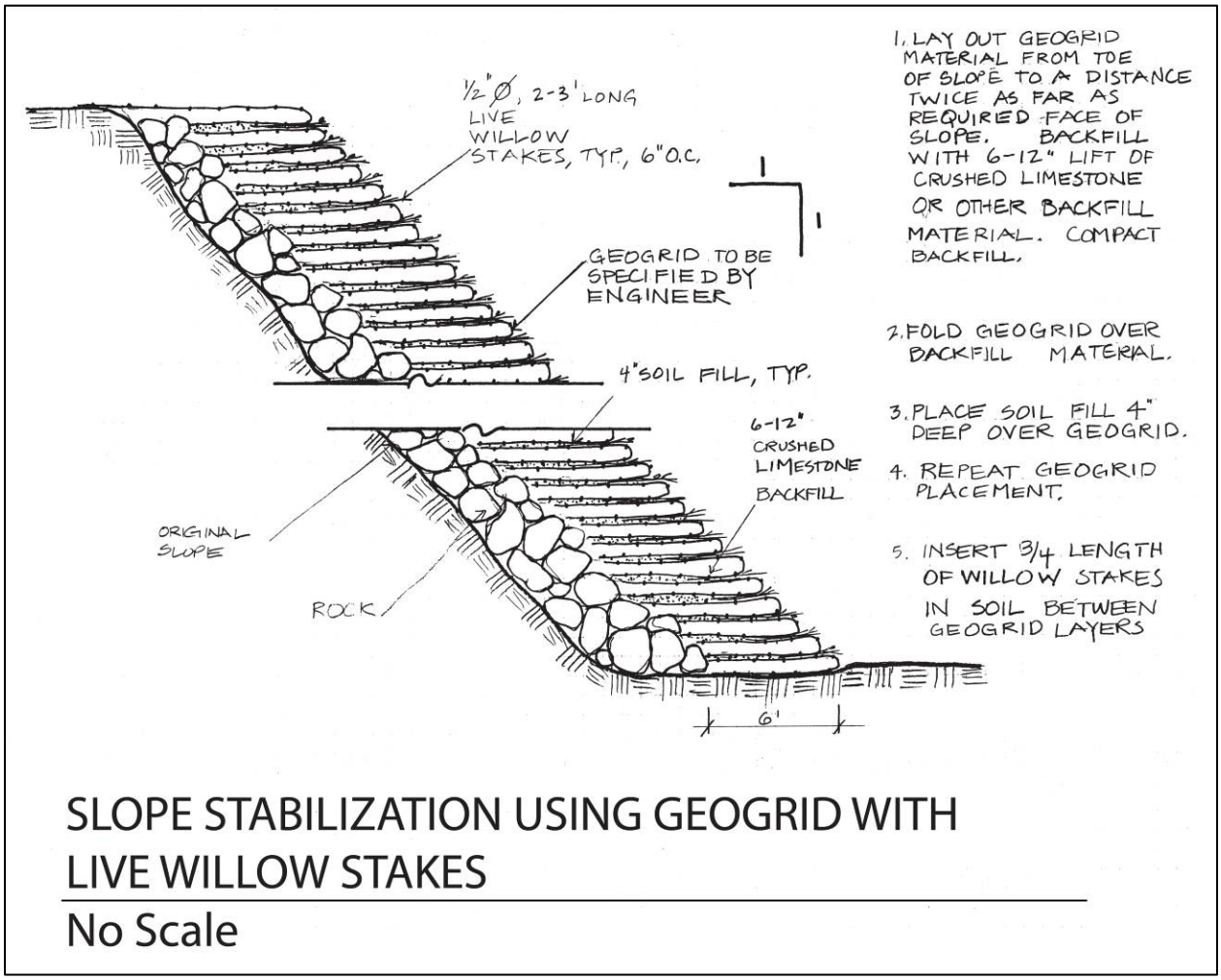
SPECIFICATIONS

As this is a soil bioengineering project, consult with an experienced and qualified individual (engineer, environmental consultant, etc.) for this type of work. In general, the vegetated geogrid slope stabilization consists of geogrid material that is secured around layers of soil. Coarse rock or drainage panels are generally placed vertically along the back side (native eroding slope or cut bank) to allow movement of groundwater into the reinforced portion of the slope, and to prevent buildup of hydrostatic pressure behind the constructed, stabilized slope. Geogrid layers become sequentially shorter as they progress up the slope to create a slope with the desired gradient. As the slope is being formed, a layer of live stakes is placed between each pair of geogrid encased soil layers. Live stakes will take root quickly and increase the internal stability of the reinforced slope. Backfill material suitable for encasing in the geogrid should be chosen with guidance from an experienced professional.

LIMITATIONS

Geogrid installation can provide good slope structure, but is labor intensive, time consuming and can be expensive to install. However, it provides immediate slope stabilization and rapid vegetative cover. It looks better than traditional slope stabilization techniques, and it provides habitat for a variety of animals. Appropriate permits must be obtained if this work will be conducted within the regulated areas of waters or wetlands. An engineer or consultant should assist in determining a safe slope gradient for your location.

Figure VI-28: Illustration describing geogrid slope stabilization.



8. Sediment Fence

PURPOSE

A sediment fence is used to prevent coarse suspended sediment from leaving the site in sheet flow to natural drainage ways or storm drains. Sediment fences provide a physical barrier that slows water, causing deposition of suspended particles. These barriers also promote sheet flow and discourage formation of eroded gullies.

SPECIFICATIONS

Sediment fences should be installed along the contour of a slope where the topography is sufficiently flat to allow storage of runoff water without overtopping the fence. The sediment fence consists of a 2 foot or higher vertical geotextile fabric fence that is braced by steel or wood posts spaced 6 feet or less apart and may be supported by a mesh wire backing for extra strength (posts are often spaced approximately 8 feet apart if wire mesh backing is used). These fences should never be installed across channels, streams, or ditches.

a. Standard Sediment Fence

Standard sediment fences are used when the area draining to the fence is on a gentle or shallow slope (i.e. 4H:1V or less). Standard sediment fences should be installed if they are expected to be in place for five months or less. If the area draining to the fence is expected to produce light to moderate sediment loads, the standard sediment fence may be installed. If any of these conditions are not met, construction of a heavy duty sediment fence should be considered.

b. Heavy Duty Sediment Fence

Heavy duty sediment fences are used when the slope of the area draining to the fence is moderately steep. The heavy duty sediment fence is installed using the standard sediment fence installed with steel “T-posts”. A wire mesh is installed behind the geosynthetic filter fabric to provide additional strength and support. While the heavy duty sediment fence is more rugged than the standard sediment fence, it should only be left in place for eight months or less. If the area draining to the fence is expected to produce more than moderate sediment loads, additional slope stabilization procedures should be installed in addition to the heavy duty sediment fence.

LIMITATIONS

Sediment fences should not be left in place for more than about 8 months. Sediment fences should never be installed across channels, streams, or ditches.

Figure VI-29: Standard sediment fence construction.

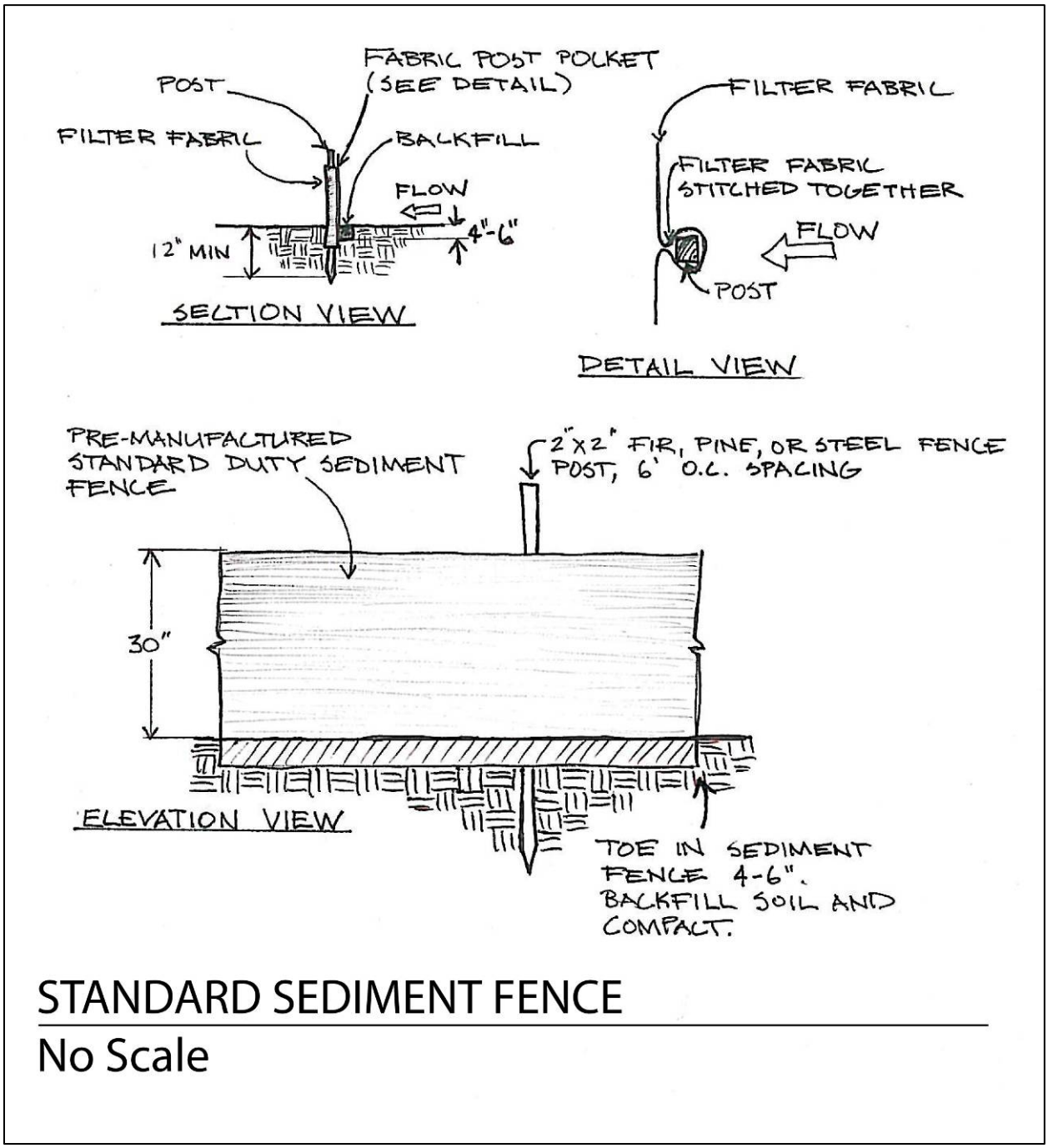
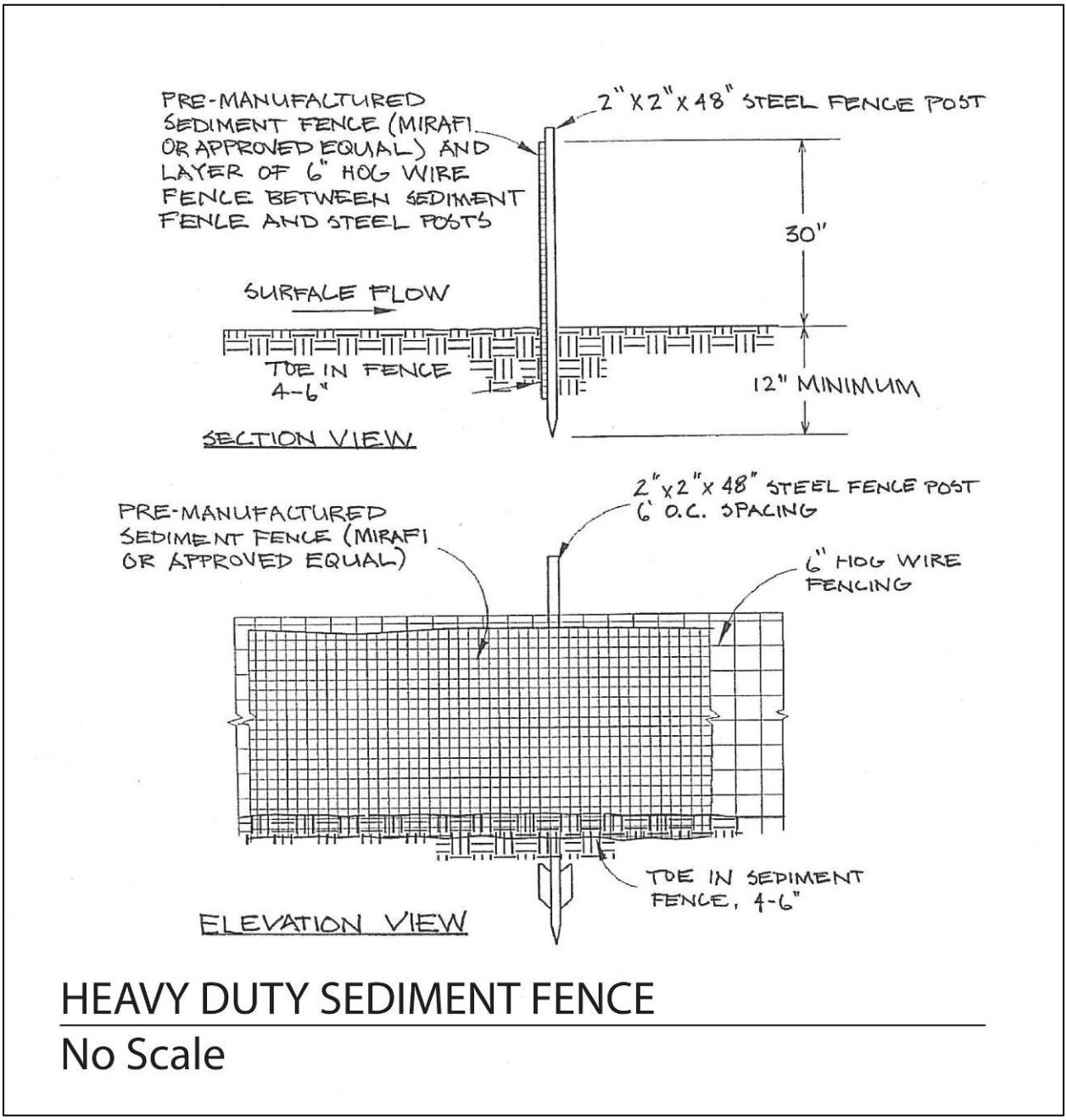


Figure VI-30: Heavy duty sediment fence construction.



9. Goose fencing

PUROPOSE

Geese can be a nuisance and may decimate a restoration site by foraging on newly established plants. If they are present in large flocks, they may alter the nutrient dynamics. Goose fencing serves to "irritate" the geese by preventing easy access between grassy areas and the water.

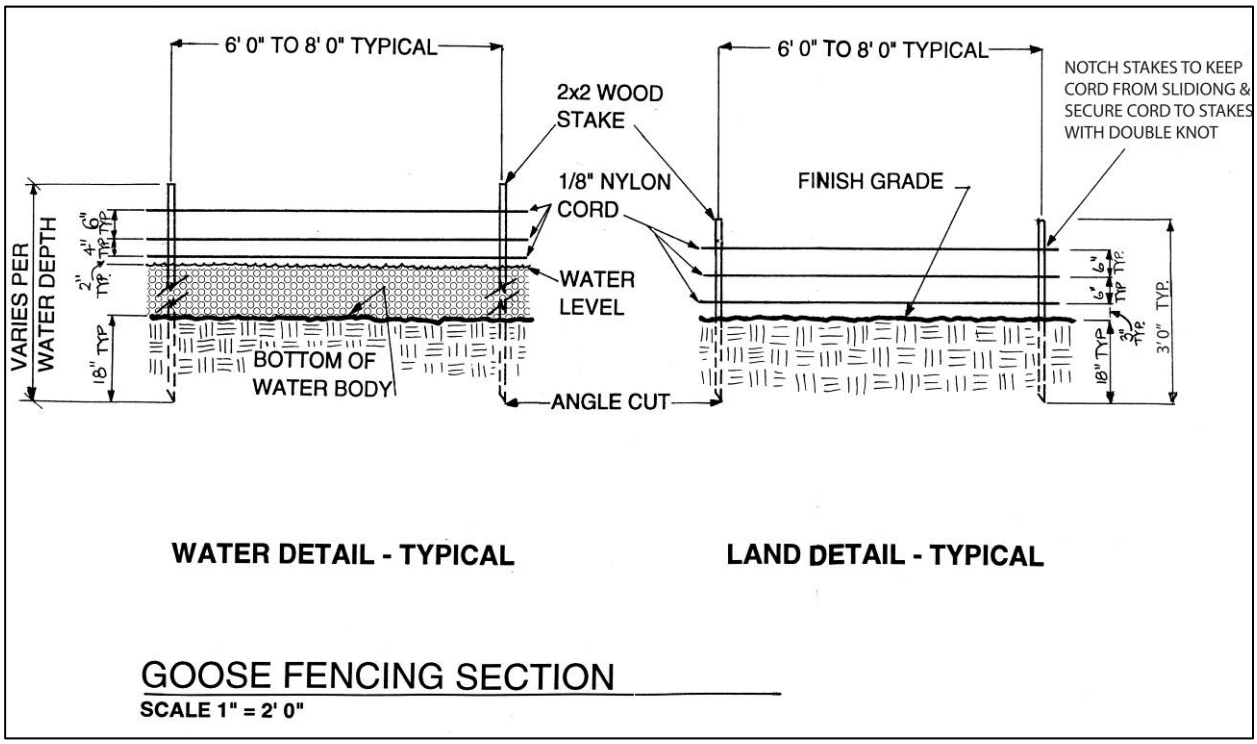
SPECIFICATIONS

The most effective fencing to protect against geese consists of stakes connected by 2 or 3 nylon cords or strings at approximately 2, 4 and 6 inches off the ground. Goose fencing should be located at edge of a water body along the shore/water interface or immediately upslope from the waters' edge. Geese typically prefer short or cut grass areas for ease of grazing while maintaining ability to easily detect predators.

LIMITATIONS

Goose fencing must be maintained regularly.

Figure VI-31: Installation and construction of goose fencing – section view.



CHAPTER VII MONITORING PROGRAMS

A. INTRODUCTION

Any enhancement, restoration, or mitigation plan requires monitoring through time to ensure that the plan is achieving the desired critical area and buffer functions. Therefore, a monitoring program must be included as an integral part of any enhancement, restoration, or mitigation plan.

B. MINIMUM SUBMITTALS FOR A MONITORING PROGRAM

The following items should be included in any monitoring program:

ESSENTIAL ELEMENTS OF A MONITORING PROGRAM

A. INTRODUCTION
- 1. Purpose of Project
- 2. Site Characteristics
  - a. Location and Context
  - b. Size
  - c. Description
- 3. Regulatory Requirements (Federal, State, and Local)

B. PROJECT SPECIFICATIONS
- 1. Articulation of Overall Project Goals
- 2. Articulation of Project Standards and Targets
  - a. Reference Standards
  - b. Project Target(s)
  - c. Project Standards
- 3. Success Criteria
- 4. Adaptive Management Strategy and Contingency Measures

C. MONITORING PERIOD SPECIFICATIONS
- 1. Define "Time Zero"
- 2. Establish Baseline
- 3. Establish Monitoring Interval and Frequency

D. ASSESSING FUNCTIONS OVER TIME
- 1. Hydrology
- 2. Bio-geochemistry
- 3. Plant Community
- 4. Faunal Support

Technical terms are defined in Table VII-1, and the process of establishing a monitoring program is described in the following section.

Table VII- 1. Definition of Terms Used in the Monitoring Plan

Reference Standards	Conditions exhibited by a group of reference waters/wetlands that correspond to the highest level of functioning (highest sustainable capacity) across the suite of functions of the subclass.
Site Potential	The highest level of functioning possible given local constraints of disturbance history, land use, or other factors. Site potential may be equal to or less than levels of functioning established by reference standards.
Project Target	The level of functioning identified or negotiated for a restoration or creation project. This target must be based on reference standards and/or site potential and be consistent with restoration or creation goals. Project targets are used to evaluate whether a project is developing toward reference standards and/or site potential.
Project Standards	Performance criteria and/or specifications used to guide the restoration or creation activities towards the project target. Project standards should include and specify reasonable contingency measures if the project target is not being achieved.

C. ESTABLISHING A MONITORING PROGRAM

The goal of a monitoring program is to document the success of the buffer, stream, or wetland functional restoration and to prepare for the implementation of contingency measures, should the need arise. Monitoring, including any necessary maintenance such as weed control and planting, should generally be conducted at least annually for a period of five, ten, or more years depending on the site.

The restoration design process should include a clear articulation of project goals which should be stated in the monitoring program report. Most restoration and enhancement projects have multiple goals. For example, project goals could include restoration of native forest, stabilization of a slope in a riparian buffer, or habitat improvement in a wetland buffer.

Project targets and standards should be established based on the path that will achieve the stated goal. Project targets and standards are often organized in functional categories such as Hydrology, Biogeochemistry, Plant Community and Faunal Support. The monitoring design should include methods to quantify and document each Project Target and Project Standard and identify criteria for success (See examples in Section VII. D).

In case Project Standards and/or Success Criteria are not met, an adaptive management strategy with contingency measures should be established in the monitoring plan. In the event of failure to achieve a Project Standard, immediate (i.e., within two weeks) consideration of the recommended contingency measure(s) should occur and be implemented. If the recommended contingency measure(s) does/do not make sense for reasons such as timing for planting, unforeseen circumstances, etc. then immediate development and consideration of logical

alternative contingency measure(s) should occur. If contingency measures are implemented, they should be reported in the yearly Monitoring Report. Example Project Target, Standards, Success Criteria, and Contingency Measures are provided below.

D. EXAMPLE PROJECT TARGETS, PROJECT STANDARDS, SUCCESS CRITERIA AND CONTINGENCY MEASURES

The following project targets pertain to fictitious example restoration project. The restoration plan for this example includes grading to create a slope with the desired gradient, excavating several microdepressions to increase surface variation (microtopography), and planting trees, shrubs and native grasses. The following four project targets, organized according to function, are examples which might be included in the monitoring plan for this project.

1) Hydrology Function

Example Project Target: Increase long and short term storage of flood flows in waters and wetlands within the mitigation area

Project Standards:

a. Maintain cross-sectional area and geometry of microdepressions, and
b. Maintain longitudinal slope between microdepressions, and
c. Establish and maintain 95 percent native tree and shrub canopy cover within the microdepressions after three full growing seasons from time zero
d. Establish and maintain 95 percent canopy coverage of seeded native grass species within the microdepression areas at the end of one full growing season from time zero

Success Criteria:

a. Stable cross-sectional area and geometry of microdepressions, and
b. Stable longitudinal slope between microdepressions, and
c. Achievement and maintenance of 95 percent tree and shrub canopy cover within microdepressions after three full growing seasons from time zero, and
d. Achievement and maintenance of 95 percent canopy coverage of seeded native grass species within the excavated microdepression areas at the end of one full growing season from time zero

Recommended Contingency Measures:

a. Re-excavate microdepressions to design dimensions
b. Reconstruct longitudinal slope between microdepressions and stabilize with large wood
c. Replant trees and shrubs in gaps to achieve target canopy coverage.
d. Re-seed gaps to achieve target ground coverage.

2) Biogeochemistry Function

Example Project Target: Increase elemental cycling on the floodplain within the mitigation area

Project Standards:

a. Maintain cross-sectional area and geometry of microdepressions, and
b. Maintain longitudinal slope between microdepressions, and
c. Establish and maintain 95 percent survival of planted trees and shrubs within the mitigation area at the end of 3 full growing seasons from time zero, and
d. Establish and maintain 95 percent canopy coverage of seeded native grass species within the mitigation area at the end of one full growing season from time zero.

Success Criteria:

a. Stable cross-sectional area and geometry of microdepressions, and
b. Stable longitudinal slope between microdepressions, and
c. Achievement and maintenance of 95 percent tree and shrub canopy cover within microdepressions after three full growing seasons from time zero
d. Achievement and maintenance of 95 percent canopy coverage of seeded native grass species within the excavated microdepressions at the end of one full growing season from time zero.

Recommended Contingency Measures:

a. Re-excavate microdepressions to design dimensions
b. Reconstruct and stabilize longitudinal slope between microdepressions with large wood
c. Replant trees and shrubs in gaps to achieve target canopy coverage.
d. Re-seed gaps to achieve target ground coverage.

3) Plant Community Function

Example Project Target: Establish and maintain a native plant community within the mitigation area

Project Standards:

a. Establish and maintain 95 percent survival of planted trees and shrubs within the mitigation area at the end of 3 full growing seasons from time zero, and
b. Establish and maintain 50 percent canopy coverage of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero, and
c. Establish and maintain 95 percent canopy coverage of seeded native grass species within the mitigation area at the end of one full growing season from time zero

Success Criteria:

a. Achievement and maintenance of 95 percent tree and shrub survival within the mitigation area after three full growing seasons from time zero.
b. Achievement and maintenance of 50 percent canopy coverage of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero.
c. Achievement and maintenance of 95 percent canopy coverage of seeded native grass species within the mitigation area at the end of one full growing season from time zero.

Recommended Contingency Measures:

a. Replant trees and shrubs in mitigation area to achieve target survival.
b. Replant trees and shrubs in mitigation area to achieve target canopy coverage.
c. Re-seed mitigation area to achieve target ground coverage.

4) Faunal Support Function

Example Project Target: Increase vertical and horizontal habitat structure within the mitigation area

Project Standards:

a. Establish and maintain 95 percent survival of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero, and
b. Establish and maintain 50 percent canopy coverage of planted trees and shrubs within the mitigation at the end of 5 full growing seasons from time zero, and
c. Exclude livestock grazing from the mitigation area for a period of 5 years via fencing.

Success Criteria:

a. Achievement and maintenance of 95 percent tree and shrub survival within the mitigation area after three full growing seasons from time zero.
b. Achievement and maintenance of 50 percent canopy coverage of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero.
c. Exclusion of domestic livestock from the mitigation area for at least five years.

Recommended Contingency Measures:

a. Replant trees and shrubs in mitigation area to achieve target canopy coverage.
b. Replant trees and shrubs in mitigation area to achieve canopy coverage.
c. Maintain, improve or replace fencing to preclude any grazing by domestic livestock.

E. IMPLEMENTING THE MONITORING PROGRAM

A monitoring program begins with Baseline (Time Zero) Monitoring. Permanent photo points that can be revisited each year should be established. In each photo, be sure to include a reference point (and/or take GPS coordinates) and an object or person for scale, so that comparisons can be made through time from each location. Topographic surveys, soil profiles, and/or vegetation cover and planting specifications should be recorded. Conduct monitoring annually, at a minimum, or more often depending on the regulatory requirements from federal, state, and local jurisdictions of the project.

APPENDIX A

HPA PERMIT PROCESS

Version 1.3, 6/13/2006
Reviewed: 8/28/2006

Hydraulic Project Approval (HPA)

Environmental Permitting Services

Application Phase	Applicant	Washington Department of Fish and Wildlife (WDFW)	Public or Other Interested Party

Start

Applicant reviews activities requiring an HPA permit (triggering mechanisms) (A)

- not required → **No Permit Required**
- required →

Does project qualify for the Streamlined Process for Fish Habitat Enhancement Projects? (B)

- **No**
- **Yes** → Streamlined Process for Fish Habitat Enhancement Projects (C)

Applicant submits State Environmental Policy Act (SEPA) compliance documents to SEPA Lead Agency (D)

Applicant prepares and submits Joint Aquatic Resource Application Form (JARPA) and Notice of Compliance with SEPA to Washington Department of Fish and Wildlife (WDFW) (E)

Review and Decision Phase			

WDFW reviews application for completeness (F) — Variable

- **Complete**
- **Incomplete** → (revision) back to JARPA

WDFW may conduct a site visit; evaluate HPA status; determine appropriate mitigation (G) — 45 days

- **Approve** → **Permit Issued**
- **Deny** (H) → **Permit Denied**

Applicant conducts project (I) — Varies

Appeal Phase			

Applicant can request appeal to ruling (J) — 30 Days

Third party can request appeal to ruling — 30 Days

Legend: (A) =Hyperlink → =Progression → =Revision ⋯→ =Optional

For more information on this or any permitting process visit http://www.ora.wa.gov or call the Washington State Office of Regulatory Assistance at (800) 917-0043.

APPENDIX B

NATIVE PLANT SPECIES SUITABLE FOR RESTORATION PLANTING IN MOUNT VERNON WATERS/WETLANDS AND BUFFERS

Appendix B: Native Plant Species Suitable for Restoration Planting in Mount Vernon Waters/Wetlands and Buffers

Latin Name	Common English Name	NWI Indicator Status
Trees		
Abies amabilis	Pacific silver fir	FACU
Abies grandis	Grand fir	FACU-
Acer glabrum	Douglas maple	FAC
Acer macrophyllum	Big leaf maple	FACU
Alnus rubra	Red alder	FAC
Alnus sinuata	Sitka alder	Not listed
Arbutus menziesii	Madrone	Not listed
Betula papyrifera	Paper birch	FAC*
Chamaecyparis nookatensis	Alaska cedar	Not listed
Cornus nuttallii	Pacific dogwood	Not listed
Corylus cornuta	Hazelnut	FACU
Fraxinus latifolia	Oregon Ash	FACW
Picea sitchensis	Sitka spruce	FAC
Pinus contorta	Shore Pine	FAC
Pinus monticola	Western white Pine	FACU
Populus balsamifera ssp. trichocarpa	Black cottonwood	FAC
Picea sitchensis	Sitka spruce	FAC
Prunus emarginata	Bitter cherry	FACU
Pseudotsuga menziesii	Douglas fir	FACU*
Pyrus fusca	Crabapple	Not listed
Quercus garryana	Oregon white oak	Not listed
Rhamnus purshiana	Cascara	Not listed
Taxus brevifolia	Pacific yew	NI (FAC-)
Thuja plicata	Western red cedar	FAC
Tsuga heterophylla	Western hemlock	FAC+

Latin Name	Common English Name	NWI Indicator Status
Shrubs		
Acer circinatum	Vine maple	FAC-
Amelanchier alnifolia	Serviceberry	FACU
Arctostaphylos columbiana	Bristly manzanita	Not listed
Arctostaphylos nevadensis	Kinnikinnik	Not listed
Arctostaphylos uva-ursi	Bearberry	FACU-
Berberis aquifolium	Tall Oregongrape	Not listed
Berberis nervosa	Cascade Oregongrape	Not listed
Cassiope mertensiana	White mountain heather	FACU+
Ceanothus sanguineus	Redstem ceanothus	UPL
Cladothamnus pyroliflorus	Copperbush	Not listed
Cornus canadensis	Bunchberry	FAC
Cornus sericea ssp. sericea	Red stem dogwood	FACW+
Cornus stolonifera	Red-osier dogwood	Not listed
Corylus cornuta	Hazelnut	FACU
Crataegus douglasii	Black hawthorn	FAC
Empetrum nigrum	Crowberry	FAC
Gaultheria shallon	Salal	FACU*
Holodiscus discolor	Ocean spray	NI
Juniperus communis	Mountain juniper	Not listed
Juniperus scopulorum	Rocky Mountain juniper	Not listed
Kalmia occidentalis	Western swamp laurel	Not listed
Ledum glandulosum	Trapper's tea	FACW+
Ledum groenlandicum	Labrador tea	OBL
Linnaea borealis	Twinflower	FACU-
Loiseleuria procumbens	Alpine azalea	Not listed
Lonicera ciliosa	Orange honeysuckle	Not listed
Lonicera hispidula	California honeysuckle	Not listed
Lonicera involucrata	Four line honeysuckle	FAC+*
Lupinus arboreus	Tree lupine	Not listed
Menziesia ferruginea	Fool's huckleberry	FACU+
Myrica gale	Sweet gale	OBL
Oemleria cerasiformis	Indian plum	FACU
Oplopanax horridum	Devil’s club	FAC+

Latin Name	Common English Name	NWI Indicator Status
Pachistima myrsinites	Mountain box	Not listed
Philadelphus lewisii	Mock-orange	Not listed
Phyllodoce empetriformis	Red mountain heather	FACU*
Phyllodoce glanduliflora	Yellow heather	FACU*
Physocarpus capitatus	Ninebark	FACW-
Potentilla fruticosa	Shrubby cinquefoil	Not listed
Prunus subcordata	Klamath plum	Not listed
Pyrus fusca	Western crabapple	FACW
Rhamnus purshiana	Cascara	FAC-
Rhododendron albiflorum	White rhododendron	FACU
Rhododendron macrophyllum	Western rhododendron	Not listed
Rhododendron occidentale	Western azalea	Not listed
Ribes bracteosum	Stink currant	FAC+
Ribes divaricatum	Coast black gooseberry	FAC*
Ribes howellii	Maple-leaf currant	Not listed
Ribes lacustre	Prickly currant	FAC+
Ribes sanguineum	Red-flowered currant	Not listed
Rosa gymnocarpa	Wood rose	FACU
Rosa nuktana	Nootka rose	FAC
Rosa pisocarpa	Clustered rose	FAC
Rubus idaeus	Red raspberry	FACU
Rubus leucodermis	Blackcap	Not listed
Rubus nivalis	Snow bramble	Not listed
Rubus parviflorus	Thimbleberry	FAC-
Rubus spectabilis	Salmon berry	FAC+
Rubus ursinus	California blackberry	FACU
Salix commutata	Variable willow	
Salix hookeriana	Hooker’s willow	FACW+
Salix lasiandra	Pacific willow	FACW+
Salix planifolia	Diamond leaf willow	OBL
Salix scouleriana	Scouler willow	FAC
Salix sessilifolia	Soft-leaved willow	FACW
Salix sitchensis	Sitka willow	FACW
Sambucus cerulea	Blue elderberry	FACU
Sambucus racemosa	Red elderberry	FACU

Latin Name	Common English Name	NWI Indicator Status
Shepherdia canadensis	Buffalo berry	NI
Sorbus scopulina	Cascade mountain-ash	FACU
Sorbus sitchensis	Sitka mountain-ash	Not listed
Spiraea betulifolia	Birch-leafed spirea	FAC*
Spiraea densiflora	Rosy spirea	Not listed
Spiraea douglasii	Hardhack	FACW
Spiraea pyramidata	Pyramid spiraea	Not listed
Symphoricarpos albus	Common snowberry	FACU
Symphoricarpos mollis	Creeping snowberry	Not listed
Vaccinium alaskense	Alaska blueberry	NI
Vaccinium deliciosum	Cascade huckleberry	Not listed
Vaccinium membranaceum	Mountain huckleberry	FACU+
Vaccinium ovalifolium	Oval-leafed huckleberry	UPL
Vaccinium ovatum	Evergreen huckleberry	Not listed
Vaccinium oxycoccos	Wild cranberry	Not listed
Vaccinium parvifolium	Red huckleberry	Not listed
Viburnum edule	Highbush cranberry	FACW
Sedges and Rushes		
Carex obnupta	Slough sedge	OBL
Carex stipata	Sawbeak sedge	OBL
Carex utriculata	Beaked sedge	OBL
Juncus acuminatus	Tapered rush	OBL
Juncus balticus	Baltic rush	FACW+
Juncus effusus	Soft rush	FACW
Juncus ensifolius	Dagger leaf rush	FACW
Scirpus acutus	Hardstem bulrush	OBL
Scirpus microcarpus	Small-fruited bulrush	OBL
Grasses		
Alopecurus aequalis	Short-awn foxtail	OBL
Calamagrostis canadensis	Bluejoint reedgrass	FACW+
Deschampsia caespitosa	Hairgrass	FACW
Festuca idahoensis	Idaho fescue	FACU*
Festuca rubra var. rubra	Red fescue	FAC+
Glyceria striata	Fowl mannagrass	OBL

Latin Name	Common English Name	NWI Indicator Status
Glyceria grandis	Reed mannagrass	Not listed
Hordeum brachyantherum	Meadow barley	FACW-
Ferns & Fern Allies		
Adiantum pedatum	Maidenhair fern	Not listed
Aspidotus densa	Indian's dream fern	Not listed
Asplenium trichomanes	Maidenhair spleenwort	FACU
Athyrium distentifolium	Alpine lady fern	Not listed
Athyrium felix-femina	Lady fern	FAC+
Blechnum spicant	Deer fern	FAC+
Botrychium multifidum	Leathery grape-fern	FAC
Botrychium virginianum	Virginia grape-fern	FAC*
Cheilanthes gracillima	Lace fern	Not listed
Cryptogramma crispa	Parsley fern	Not listed
Cystopteris fragilis	Fragile fern	FACU
Dryopteris exspansa	Shield fern	FACW
Gymnocarpium dryopteris	Oak fern	FAC*
Lycopodium alpinum	Alpine clubmoss	FAC
Lycopodium annotinum	Stiff clubmoss	FAC
Lycopodium clavatum	Running clubmoss	FAC
Lycopodium complanatum	Ground cedar	FAC
Lycopodium obscurum	Groundpine	Not listed
Lycopodium selago	Fir clubmoss	Not listed
Pityrogramma triangularis	Gold-back fern	Not listed
Polypodium glycyrrhiza	Licorice fern	Not listed
Polypodium hesperium	Western polypody	Not listed
Polystichum imbricans	Christmas-fern	Not listed
Polystichum munitum	Sword fern	FACU
Pteridium aquilinium	Bracken fern	FACU
Selaginella wallacei	Wallace's selaginella	Not listed
Thelypteris limbosperma	Mountain fern	Not listed
Woodsia oregana	Oregon woodsia	Not listed
Woodsia scopulina	Rocky Mtn. woodsia	Not listed

Latin Name	Common English Name	NWI Indicator Status
Herbs & Forbs		
Achillea millefolium	Yarrow	NI
Aruncus dioicus	Goat's beard	FACU+
Dicentra formosa	Bleeding heart	FACU*
Geum macrophyllum	Big-leaf avens	FACW+
Heracleum lanatum	Cow parsnip	FAC+
Linnaea borealis	Twinflower	FACU-
Lysichiton americanum	Skunk cabbage	OBL
Maianthemum dilatatum	Wild lily of the valley	FAC
Mimulus guttatus	Yellow monkey flower	OBL
Oenanthe sarmentosa	Water parsley	OBL
Petasites frigidus	Coltsfoot	FACW-
Smilacina racemosa	Large false Solomon's seal	Not Listed
Smilacina stellata	False Solomon's seal	Not Listed
Tiarella trifoliata	Foamflower	FAC-
Tolmiea menziesii	Piggy-back plant	FAC
Viola glabella	Smooth yellow violet	FAC

APPENDIX C

WETLAND ASSESSMENTS AND RATING FORMS

"WETLAND DETERMINATION DATA FORM – WESTERN MOUNTAINS, VALLEYS AND COASTAL REGION"; ARMY CORPS OF ENGINEERS, 2008.

This form is required by the Army Corps when submitting any application that involves a suspected regulated wetland. The purpose of the form is to provide the information necessary to determine if there is in fact a wetland on a project site.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: _____ City/County: _____ Sampling Date: _____

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____ Hydric Soil Present? Yes _____ No _____ Wetland Hydrology Present? Yes _____ No _____	**Is the Sampled Area within a Wetland?** **Yes _____ No _____**
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		
% Bare Ground in Herb Stratum _____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Wetland Non-Vascular Plants[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes _____ No _____**

Remarks:

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

"WETLAND RATING FORM – WESTERN WASHINGTON, VERSION 2"; DEPARTMENT OF ECOLOGY, JULY 2006.

The Department of Ecology Wetland Rating Forms is used to determine the category of wetland on a project site. Determining wetland category (e.g. Category I, Category III) is necessary in order to identify which performance criteria (e.g. buffers) will be used in regulating the subject wetland. These forms must be filled out and submitted as part of any wetland permitting process.

WETLAND RATING FORM – WESTERN WASHINGTON
Version 2 - Updated July 2006 to increase accuracy and reproducibility among users

Name of wetland (if known): _____ Date of site visit: _____

Rated by_____ Trained by Ecology? Yes__No___ Date of training_____

SEC: ___ TWNSHP: ____ RNGE: ____ Is S/T/R in Appendix D? Yes___ No___

Map of wetland unit: Figure ____ Estimated size _____

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II___ III___ IV___

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	
Score for Hydrologic Functions	
Score for Habitat Functions	
TOTAL score for Functions	

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply___

Final Category (choose the "highest" category from above)

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		Wetland HGM Class used for Rating	
Estuarine		**Depressional**	
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above		Check if unit has multiple HGM classes present	

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	YES	NO
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered **animal or plant** species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered **animal** species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category I Natural Heritage Wetlands (see p. 19 of data form).		
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		
SP4. *Does the wetland unit have a local significance in addition to its functions*? For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Classification of Wetland Units in Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
NO – go to 2 **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe NO – Saltwater Tidal Fringe (Estuarine)**

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is rated as an **Estuarine** wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
NO – go to 3 **YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet both** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;
___At least 30% of the open water area is deeper than 6.6 ft (2 m)?
NO – go to 4 **YES –** The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
____The water leaves the wetland **without being impounded**?
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*
NO - go to 5 **YES –** The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

____ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

NO - go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 **YES –** The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM clases. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTIONS** - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
D	**D 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	***(see p.38)***
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet (*permanently flowing*) points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 (*If ditch is not permanently flowing treat unit as "intermittently flowing"*) Provide photo or drawing	**Figure** ___
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	**Figure** ___
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	**Figure** ___
D	**Total for D 1** *Add the points in the boxes above*	
D	**D 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft — Untreated stormwater discharges to wetland — Tilled fields or orchards within 150 ft of wetland — A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging — Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other_____ **YES** multiplier is **2** **NO** multiplier is **1**	***(see p. 44)*** multiplier _____
D	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	

D	**Depressional and Flats Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation	**Points** (only 1 score per box)
	D 3. Does the wetland unit have the <u>potential</u> to reduce flooding and erosion?	***(see p.46)***
D	D 3.1 Characteristics of surface water flows out of the wetland unit Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 (*If ditch is not permanently flowing treat unit as "intermittently flowing"*) Unit has an unconstricted, or slightly constricted, surface outlet (*permanently flowing*) points = 0	
D	D 3.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a "headwater" wetland" points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft points = 0	
D	D 3.3 Contribution of wetland unit to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	
D	**Total for D 3** *Add the points in the boxes above*	
D	**D 4. Does the wetland unit have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* — Wetland is in a headwater of a river or stream that has flooding problems — Wetland drains to a river or stream that has flooding problems — Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems — Other_____ **YES** multiplier is **2** **NO** multiplier is **1**	***(see p. 49)*** multiplier _____
D	**TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 ***Add score to table on p. 1***	

	Riverine and Freshwater Tidal Fringe Wetlands WATER QUALITY FUNCTIONS - Indicators that wetland functions to improve water quality	**Points** (only 1 score per box)
R	**R 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	***(see p.52)***
R	R 1.1 Area of surface depressions within the riverine wetland that can trap sediments during a flooding event: Depressions cover >3/4 area of wetland points = 8 Depressions cover > 1/2 area of wetland points = 4 If depressions > ½ of area of unit draw polygons on aerial photo or map Depressions present but cover < 1/2 area of wetland points = 2 No depressions present points = 0	**Figure** ___
R	R 1.2 Characteristics of the vegetation in the unit (areas with >90% cover at person height): Trees or shrubs > 2/3 the area of the unit points = 8 Trees or shrubs > 1/3 area of the unit points = 6 Ungrazed, herbaceous plants > 2/3 area of unit points = 6 Ungrazed herbaceous plants > 1/3 area of unit points = 3 Trees, shrubs, and ungrazed herbaceous < 1/3 area of unit points = 0 Aerial photo or map showing polygons of different vegetation types	**Figure** ___
R	*Add the points in the boxes above*	
R	**R 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150ft — Untreated stormwater discharges to wetland — Tilled fields or orchards within 150 feet of wetland — A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging — Residential, urban areas, golf courses are within 150 ft of wetland — The river or stream linked to the wetland has a contributing basin where human activities have raised levels of sediment, toxic compounds or nutrients in the river water above standards for water quality — Other_____ **YES** multiplier is **2** **NO** multiplier is **1**	***(see p.53)*** multiplier _____
R	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from R 1 by R 2 ***Add score to table on p. 1***	

Comments

R	**Riverine and Freshwater Tidal Fringe Wetlands** HYDROLOGIC FUNCTIONS - Indicators that wetland functions to reduce flooding and stream erosion	**Points** (only 1 score per box)
	R 3. Does the wetland unit have the <u>potential</u> to reduce flooding and erosion?	***(see p.54)***
R	R 3.1 Characteristics of the overbank storage the unit provides: *Estimate the average width of the wetland unit perpendicular to the direction of the flow and the width of the stream or river channel (distance between banks). Calculate the ratio: (average width of unit)/(average width of stream between banks).* If the ratio is more than 20 points = 9 If the ratio is between 10 – 20 points = 6 If the ratio is 5 - <10 points = 4 If the ratio is 1 - <5 points = 2 If the ratio is < 1 points = 1 Aerial photo or map showing average widths	**Figure** ___
R	R 3.2 Characteristics of vegetation that slow down water velocities during floods: *Treat large woody debris as "forest or shrub". Choose the points appropriate for the best description.* (polygons need to have >90% cover at person height NOT Cowardin classes): Forest or shrub for >1/3 area OR herbaceous plants > 2/3 area points = 7 Forest or shrub for > 1/10 area OR herbaceous plants > 1/3 area points = 4 Vegetation does not meet above criteria points = 0 Aerial photo or map showing polygons of different vegetation types	**Figure** ___
R	*Add the points in the boxes above*	
R	**R 4. Does the wetland unit have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. *Note which of the following conditions apply.* — There are human structures and activities downstream (roads, buildings, bridges, farms) that can be damaged by flooding. — There are natural resources downstream (e.g. salmon redds) that can be damaged by flooding — Other_____ *(Answer NO if the major source of water to the wetland is controlled by a reservoir or the wetland is tidal fringe along the sides of a dike)* **YES** multiplier is **2** **NO** multiplier is **1**	***(see p.57)*** multiplier _____
R	**TOTAL - Hydrologic Functions** Multiply the score from R 3 by R 4 ***Add score to table on p. 1***	

Comments

	Lake-fringe Wetlands WATER QUALITY FUNCTIONS - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
L	**L 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	***(see p.59)***
L	L 1.1 Average width of vegetation along the lakeshore *(use polygons of Cowardin classes)*: Vegetation is more than 33ft (10m) wide points = 6 Vegetation is more than 16 (5m) wide and <33ft points = 3 Vegetation is more than 6ft (2m) wide and <16 ft points = 1 Vegetation is less than 6 ft wide points = 0 Map of Cowardin classes with widths marked	**Figure** ___
L	L 1.2 Characteristics of the vegetation in the wetland: *choose the appropriate description that results in the highest points, and do not include any open water in your estimate of coverage. The herbaceous plants can be either the dominant form or as an understory in a shrub or forest community. These are not Cowardin classes. Area of Cover is total cover in the unit, but it can be in patches. NOTE: Herbaceous does not include aquatic bed.* Cover of herbaceous plants is >90% of the vegetated area points = 6 Cover of herbaceous plants is >2/3 of the vegetated area points = 4 Cover of herbaceous plants is >1/3 of the vegetated area points = 3 Other vegetation that is not aquatic bed or herbaceous covers > 2/3 unit points = 3 Other vegetation that is not aquatic bed in > 1/3 vegetated area points = 1 Aquatic bed vegetation and open water cover > 2/3 of the unit points = 0 Map with polygons of different vegetation types	**Figure** ___
L	*Add the points in the boxes above*	
L	**L 2. Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in the lake water, or polluted surface water flowing through the unit to the lake. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Wetland is along the shores of a lake or reservoir that does not meet water quality standards — Grazing in the wetland or within 150ft — Polluted water discharges to wetland along upland edge — Tilled fields or orchards within 150 feet of wetland — Residential or urban areas are within 150 ft of wetland — Parks with grassy areas that are maintained, ballfields, golf courses (all within 150 ft. of lake shore) — Power boats with gasoline or diesel engines use the lake — Other_____ **YES** multiplier is **2** **NO** multiplier is **1**	***(see p.61)*** multiplier _____
L	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from L1 by L2 ***Add score to table on p. 1***	

Comments

L	**Lake-fringe Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce shoreline erosion	**Points** (only 1 score per box)
L	**L 3. Does the wetland unit have the <u>potential</u> to reduce shoreline erosion?**	***(see p.62)***
L	L 3 Distance along shore and average width of Cowardin classes along the lakeshore (**do not** include aquatic bed): *(choose the highest scoring description that matches conditions in the wetland)* > ¾ of distance is shrubs or forest at least 33 ft (10m) wide points = 6 > ¾ of distance is shrubs or forest at least 6 ft. (2 m) wide points = 4 > ¼ distance is shrubs or forest at least 33 ft (10m) wide points = 4 Vegetation is at least 6 ft (2m) wide (any type except aquatic bed) points = 2 Vegetation is less than 6 ft (2m) wide (any type except aquatic bed) points = 0 Aerial photo or map with Cowardin vegetation classes	**Figure ___**
L	*Record the points from the box above*	
L	**L 4. Does the wetland unit have the <u>opportunity</u> to reduce erosion?** Are there features along the shore that will be impacted if the shoreline erodes? *Note which of the following conditions apply.* — There are human structures and activities along the upland edge of the wetland (buildings, fields) that can be damaged by erosion. — There are undisturbed natural resources along the upland edge of the wetland (e.g. mature forests other wetlands) than can be damaged by shoreline erosion — Other_____ **YES** multiplier is **2** **NO** multiplier is **1**	***(see p.63)*** multiplier _____
L	**TOTAL - Hydrologic Functions** Multiply the score from L 3 by L 4 ***Add score to table on p. 1***	

Comments

S	**Slope Wetlands** WATER QUALITY FUNCTIONS - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
S	**S 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	***(see p.64)***
S	S 1.1 Characteristics of average slope of unit: Slope is1% or less *(a 1% slope has a 1 foot vertical drop in elevation for every 100 ft horizontal distance*) points = 3 Slope is 1% - 2% points = 2 Slope is 2% - 5% points = 1 Slope is greater than 5% points = 0	
S	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES = 3 points NO = 0 points	
S	S 1.3 Characteristics of the vegetation in the wetland that trap sediments and pollutants: *Choose the points appropriate for the description that best fits the vegetation in the wetland. Dense vegetation means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 inches.* Dense, uncut, herbaceous vegetation > 90% of the wetland area points = 6 Dense, uncut, herbaceous vegetation > 1/2 of area points = 3 Dense, woody, vegetation > ½ of area points = 2 Dense, uncut, herbaceous vegetation > 1/4 of area points = 1 Does not meet any of the criteria above for vegetation points = 0 Aerial photo or map with vegetation polygons	**Figure ___**
S	**Total for S 1** *Add the points in the boxes above*	
S	**S 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150ft — Untreated stormwater discharges to wetland — Tilled fields, logging, or orchards within 150 feet of wetland — Residential, urban areas, or golf courses are within 150 ft upslope of wetland — Other_____ **YES** multiplier is **2** **NO** multiplier is **1**	***(see p.67)*** multiplier _____
S	**TOTAL - Water Quality Functions** Multiply the score from S1 by S2 ***Add score to table on p. 1***	

Comments

S	**Slope Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream erosion	**Points** (only 1 score per box)
	S 3. Does the wetland unit have the <u>potential</u> to reduce flooding and stream erosion?	***(see p.68)***
S	S 3.1 Characteristics of vegetation that reduce the velocity of surface flows during storms. *Choose the points appropriate for the description that best fit conditions in the wetland. (stems of plants should be thick enough (usually > 1/8in), or dense enough, to remain erect during surface flows)* Dense, uncut, **rigid** vegetation covers > 90% of the area of the wetland. points = 6 Dense, uncut, **rigid** vegetation > 1/2 area of wetland points = 3 Dense, uncut, **rigid** vegetation > 1/4 area points = 1 More than 1/4 of area is grazed, mowed, tilled or vegetation is not rigid points = 0	
S	S 3.2 Characteristics of slope wetland that holds back small amounts of flood flows: The slope wetland has small surface depressions that can retain water over at least 10% of its area. YES points = 2 NO points = 0	
S	*Add the points in the boxes above*	
S	**S 4. Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Is the wetland in a landscape position where the reduction in water velocity it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows? *Note which of the following conditions apply.* — Wetland has surface runoff that drains to a river or stream that has flooding problems — Other_____ *(Answer NO if the major source of water is controlled by a reservoir (e.g. wetland is a seep that is on the downstream side of a dam)* **YES** multiplier is **2** **NO** multiplier is **1**	***(see p. 70)*** multiplier _____
S	**TOTAL - Hydrologic Functions** Multiply the score from S 3 by S 4 ***Add score to table on p. 1***	

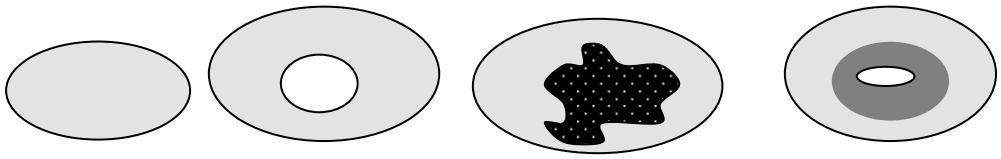
Comments

These questions apply to wetlands of all HGM classes. HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat	**Points** (only 1 score per box)
H 1. Does the wetland unit have the <u>potential</u> to provide habitat for many species?	
H 1.1 <u>Vegetation structure</u> ***(see p. 72)***	**Figure** ___
Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres. ____Aquatic bed ____Emergent plants ____Scrub/shrub (areas where shrubs have >30% cover) ____Forested (areas where trees have >30% cover) *If the unit has a forested class check if:* ____The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon *Add the number of vegetation structures that qualify. If you have:* 4 structures or more points = 4 3 structures points = 2 2 structures points = 1 1 structure points = 0 Map of Cowardin vegetation classes	
H 1.2. <u>Hydroperiods</u> ***(see p. 73)***	**Figure** ___
Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods) ____Permanently flooded or inundated — 4 or more types present points = 3 ____Seasonally flooded or inundated — 3 types present points = 2 ____Occasionally flooded or inundated — 2 types present point = 1 ____Saturated only — 1 type present points = 0 ____ Permanently flowing stream or river in, or adjacent to, the wetland ____ Seasonally flowing stream in, or adjacent to, the wetland ____ ***Lake-fringe wetland* = 2 points** ____***Freshwater tidal wetland* = 2 points** Map of hydroperiods	
H 1.3. <u>Richness of Plant Species</u> ***(see p. 75)*** Count the number of plant species in the wetland that cover at least 10 ft^2. (*different patches of the same species can be combined to meet the size threshold)* *You do not have to name the species.* *Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle* If you counted: > 19 species points = 2 *List species below if you want to:* 5 - 19 species points = 1 < 5 species points = 0	

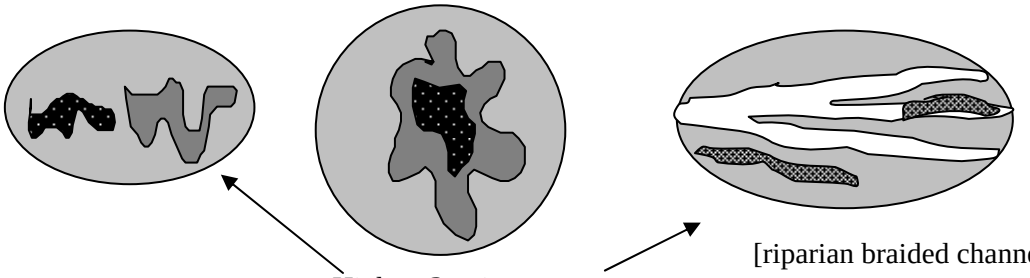
Total for page _____

H 1.4. Interspersion of habitats ***(see p. 76)*** **Figure ___**

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.



None = 0 points Low = 1 point Moderate = 2 points



High = 3 points [riparian braided channels]

NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

H 1.5. Special Habitat Features: ***(see p. 77)***

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

____Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).

____Standing snags (diameter at the bottom > 4 inches) in the wetland

____Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

____Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*

____At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated.*(structures for egg-laying by amphibians)*

____ Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% *stated in early printings of the manual on page 78 is an error*.

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

Comments

H 2. Does the wetland unit have the opportunity to provide habitat for many species?	
H 2.1 Buffers ***(see p. 80)*** *Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."* — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer**.** (relatively undisturbed also means no-grazing, no landscaping, no daily human use) **Points = 5** — 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference. **Points = 4** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4** — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference, . **Points = 3** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3** **If buffer does not meet any of the criteria above** — No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2** — No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing, or lawns are OK. **Points = 2** — Heavy grazing in buffer. **Points = 1** — Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland **Points = 0**. — Buffer does not meet any of the criteria above. **Points = 1** Aerial photo showing buffers	**Figure ___**
H 2.2 Corridors and Connections ***(see p. 81)*** H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? (*dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor*). YES = **4 points** (*go to H 2.3*) NO = go to H 2.2.2 H 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? YES = **2 points** (*go to H 2.3*) NO = H 2.2.3 H 2.2.3 Is the wetland: within 5 mi (8km) of a brackish or salt water estuary OR within 3 mi of a large field or pasture (>40 acres) OR within 1 mi of a lake greater than 20 acres? YES = **1 point** NO = **0 points**	

Total for page_____

H 2.3 Near or adjacent to other priority habitats listed by WDFW ***(see p. 82)***

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

These are DFW definitions. Check with your local DFW biologist if there are any questions.

____**Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.8 ha (2 acres).

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Old-growth forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age.

____**Mature forests:** Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Prairies:** Relatively undisturbed areas (as indicated by dominance of native plants) where grasses and/or forbs form the natural climax plant community.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%.

____**Urban Natural Open Space**: A priority species resides within or is adjacent to the open space and uses it for breeding and/or regular feeding; and/or the open space functions as a corridor connecting other *priority habitats*, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and is surrounded by urban development.

____**Estuary/Estuary-like:** Deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5ppt. during the period of average annual low flow. Includes both estuaries and lagoons.

_____**Marine/Estuarine Shorelines**: Shorelines include the intertidal and subtidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g., cliffs, snags, mature trees, dunes, meadows) that are important to shoreline associated fish and wildlife and that contribute to shoreline function (e.g., sand/rock/log recruitment, nutrient contribution, erosion control).

If wetland has **3 or more** priority habitats **= 4 points**

If wetland has **2** priority habitats = **3 points**

If wetland has **1** priority habitat **= 1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

H 2.4 Wetland Landscape *(choose the **one** description of the landscape around the wetland that best fits*) ***(see p. 84)*** There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	
TOTAL for H 1 from page 14	
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ___	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

SC 2.0 Natural Heritage Wetlands ***(see p. 87)*** Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species. SC 2.1 Is the wetland unit being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)* S/T/R information from Appendix D ___ or accessed from WNHP/DNR web site ___ YES____ – contact WNHP/DNR (see p. 79) and go to SC 2.2 NO ___ SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species? YES = Category I NO ____not a Heritage Wetland	**Cat. I**
SC 3.0 Bogs ***(see p. 87)*** Does the wetland unit (**or any part of the unit**) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.*** 1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)? Yes - go to Q. 3 No - go to Q. 2 2. Does the unit have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond? Yes - go to Q. 3 No - Is not a bog for purpose of rating 3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)? Yes – Is a bog for purpose of rating No - go to Q. 4 NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog. *1.* Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?* 2. YES = Category I No___ Is not a bog for purpose of rating	**Cat. I**

SC 4.0 Forested Wetlands *(see p. 90)* Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.* — **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more. NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter. — **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth. YES = Category I NO ___not a forested wetland with special characteristics	**Cat. I**
SC 5.0 Wetlands in Coastal Lagoons *(see p. 91)* Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* YES = Go to SC 5.1 NO___ not a wetland in a coastal lagoon SC 5.1 Does the wetland meets all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than 1/10 acre (4350 square feet) YES = Category I NO = Category II	**Cat. I** **Cat. II**

SC 6.0 Interdunal Wetlands ***(see p. 93)*** Is the wetland unit west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? YES - go to SC 6.1 NO __ not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula- lands west of SR 103 • Grayland-Westport- lands west of SR 105 • Ocean Shores-Copalis- lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger? YES = Category II NO – go to SC 6.2 SC 6.2 Is the unit between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? YES = Category III	**Cat. II** **Cat. III**
Category of wetland based on Special Characteristics *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered NO for all types enter "Not Applicable" on p.1	

"MINIMUM SUBMITTAL REQUIREMENTS FOR AN HGM FUNCTIONAL ASSESSMENT REPORT"; CITY OF MOUNT VERNON, MARCH 2008.

An HGM Functional Assessment Report is required whenever there is restoration and/or enhancement of waters/wetlands as part of project mitigation. The forms that follow provide the minimum submittal requirements for these reports. The functional assessment provides the exiting baseline conditions for a critical area site. These baseline conditions are used to identify remedial actions for mitigation purposes, and to provide a basis for comparison over time to asses how well or whether restoration plans are meeting their project targets.

Appendix A. Minimum Submittal Requirements

***Note**: The user has the option to use these 7 worksheets or to present this information in their own format according to their preference. Regardless of the format chosen, be sure that all required information is included in the report.*

REQUIRED WORKSHEET #1: OFFICE PREPARATION

Minimum Submittal Requirements for an HGM Functional Assessment Report

Identify the documents that were collected and reviewed by the assessment team. Include a detailed description of each document (e.g., citation, date, scale, quadrangle name, etc.). If possible, attach copies of each document.

USGS survey, state, county, and other maps (at various scales):
1._____
2._____
3._____

Air photos and other imagery:
1._____
2._____
3._____

Relevant geotechnical, soils, or environmental reports:
1._____
2._____
3._____

Correspondence, construction plans and specifications, *etc*. on the proposed project:
1._____
2._____
3._____

Relevant published literature:
1._____
2._____
3._____

Other documents:
1._____
2._____
3._____

REQUIRED WORKSHEET #2: BOUNDING OF PROPOSED PROJECT AREA AND GEOGRAPHIC EXTENT OF WATERS/WETLANDS

Minimum Submittal Requirements for an HGM Functional Assessment Report

Bound, stratify, and complete mapping of the proposed project area and/or sub-project areas. Confirm and refine all preliminary mapping in the field. This includes:

a. Delineation of the proposed project boundaries.
b. Delineation of the geographic extent of waters/wetlands within the proposed project area.
c. Determination of the proportion(s) and type(s) of waters/wetlands within the project area.
d. Determination of the proportion of waters/wetlands that fall into the subclasses of waters/wetlands addressed by and not addressed by this Operational Draft Guidebook.
e. Estimation of the geographic extent and type of proposed project impact(s)(i.e., preliminary, secondary, and/or cumulative effects).

Location of the Proposed Project: _____

Sub-basin (Watershed) of the Proposed Project: _____

1. Area of proposed project: _____(sq. ft.)

2. Area of waters/wetlands within the proposed project area: _____(sq. ft.)

3. Total estimated area of water/wetlands and their buffers that will be impacted by the project: _____(sq. ft.)

PRE-FIELD MEASUREMENTS:

6. General description of the type of impacts to waters/wetlands in the proposed project area expected as a result of the proposed project: _____
_____
_____
_____

FIELD MEASUREMENTS:

7. Provide Rationale/Criteria for Identification and Delineation of Waters/Wetlands identified above:
_____
_____
_____
_____

8. Method used to estimate areas listed above: _____
_____
_____
_____
_____
_____

REQUIRED WORKSHEET #3: BOUNDING OF PROPOSED PROJECT AREA AND GEOGRAPHIC EXTENT OF WATERS/WETLANDS

Minimum Submittal Requirements for an HGM Functional Assessment Report

Map or cartoon that includes preliminary delineation of the proposed project area (and/or sub-project areas), aerial extent of waters/wetlands, and estimated areas that will be impacted by the proposed project.

REQUIRED WORKSHEET #4: BOUNDING OF PROPOSED PROJECT AREA AND GEOGRAPHIC EXTENT OF WATERS/WETLANDS

Minimum Submittal Requirements for an HGM Functional Assessment Report

Based on field observations and/or measurements, edit original map or cartoon. The map or cartoon should include a delineation of the proposed project area and/or sub-project areas, aerial extent of waters/wetlands, and estimated areas that will be impacted by the proposed project.

REQUIRED WORKSHEET #5: PRELIMINARY HGM CLASSIFICATION
Minimum Submittal Requirements for an HGM Functional Assessment Report

Identify and document the rationale used for recognizing HGM subclasses of riparian ecosystems in City of Mount Vernon within the proposed project area (or sub-project areas). Show how the project assessment area satisfies the subclass definition provided in the Dichotomous Key (see below). Specifically, include a discussion of the site.

Wetland subclass(es) in the Project Assessment Area:_____

1a. The project assessment area does not support and/or is not adjacent or contiguous with a jurisdictional water/wetland as defined in the City of Mount Vernon CAO at 15.40.090.B.1 - 3 and 15.40.110.A.1.....**Project assessment area is not a water/ wetland, or adjacent to, or contiguous with a waters/wetland. Guidebook not applicable.**

1b. The assessment area is adjacent to and/or contiguous with a water/wetland as defined in the City of Mount Vernon CAO at 15.40.090.B.1 - 3 and 15.40.110.A.1.....**2**

2a. Water/wetland is associated with a stream channel or channel system and/or an active floodplain.....**3 (Riverine Wetland Class)**

3a. Stream channel (longitudinal) slope <1%.....**Low Gradient Skagit River Riverine (Dune-ripple, pool-riffle reach)**

3b. Stream channel (longitudinal) slope 1-2%.....**Low Gradient Riverine (Pool-riffle, plain bed reach)**

3c. Stream channel (longitudinal) slope >2-8%.....**Moderate Gradient Riverine (Plain bed, step-pool reach)**

3d. Stream channel (longitudinal) slope 8-25%.....**Steep Gradient Riverine (Cascade reach)**

2b. Water/wetland is not associated with a stream channel or channel system and/or active floodplain.....**4**

4a. Water/wetland is located on a hillslope or, if it exists on nearly level terrain, the water/wetland exhibits sloped surface water or shallow subsurface (groundwater) profile.....**5 (Slope Wetland Class)**

5a. Water/wetland is located on a hillslope ≤ 200 feet from a stream channel and has a past, present, or future hydrologic connection..... **Slope River Proximal**

5b. Water/wetland is located on a hillslope >200 feet from a stream channel and does not have a past, present or future hydrologic connection with a stream channel.....**Slope**

4b. Water/wetland is located in a topographic depression. Water/Wetland is not located on a hillslope or, if it exists on nearly level terrain, the water/wetland does not exhibit a sloped surface water or shallow subsurface (groundwater) profile….....**6 (Depressional Wetland Class)**

6a. Depression is closed and does not have a permanent or seasonal surface or shallow subsurface drainage outlet.....**Closed Depression**

6b. Depression is open and has one or more permanent and/or seasonal surface or shallow subsurface drainage outlets.....**Flow-Through Depressions**

REQUIRED WORKSHEET #6a: RIVERINE WETLAND VARIABLE SCORE SHEET

Minimum Submittal Requirements for an HGM Functional Assessment Report

Score each of the variables listed on the attached variable score sheet. Separate field forms should be completed for different site conditions (i.e., existing site conditions, proposed site conditions, etc.). On each variable score field form, identify the site conditions that the variable scores are based on. If the scores are based on proposed site conditions, provide a detailed description of the proposed conditions and/or assumptions that were made. Be sure to record rationale or comments on the decision for each variable score.

Site Name: _____ Date: _____

HGM Subclass: _____ Team:_____

UTM Coordinates: _____Northing _____ Easting

Variable scores based on (*circle one*): ***Existing Site Conditions*** ***Proposed Site Conditions***

	Variable	Measurement	Variable Score	Rationale / Comments for Scoring
1	$V_{BARRIER}$			
2	$V_{FLOODTREE}$			
3	V_{FPAXS}			
4	$V_{GEOFORM}$			
5	V_{HERB}			
6	V_{INLW}			
7	$V_{KEYPIECE}$			
8	V_{LITTER}			
9	$V_{LONGPROF}$			
10	V_{NATIVE}			
11	$V_{OFFCHANWOOD}$			
12	$V_{PATCHAREA}$			
13	$V_{PATCHLATCON}$			
14	$V_{PATCHLONGCON}$			
15	$V_{PATCHNUMBER}$			
16	V_{ROADS}			
17	$V_{RIPBUFFWIDTH}$			
18	V_{SED}			
19	V_{SHADE}			
20	V_{SHRUB}			
21	$V_{SLOPETREE}$			
22	$V_{SOILINTEG}$			
23	V_{STRATA}			
24	V_{TREE}			

REQUIRED WORKSHEET #7a: RIVERINE WETLAND FUNCTIONAL SCORE SHEETS

Minimum Submittal Requirements for an HGM Functional Assessment Report

Calculate the Functional Capacity Indexes (FCI's) for each of the functions listed on the attached functional score field forms. The assessment team members, in the field, should review the calculations and preliminary assessment results. Separate functional score field forms should be completed for each set of scored variables (i.e., based on existing site conditions, proposed site conditions, etc.). Be sure to record rationale or comments on the FCI for each function.

Indices of Functions for Low, Moderate, and Steep Gradient Riverine Waters/Wetlands in Mount Vernon, Washington

Function	Formulae	Functional Capacity Index	Rationale / Comments for Scoring Functional Capacity Index
A. Hydrology			
1. Surface and Ground Water Storage and Exchange	$(V_{FPAXS} + V_{SOILINTEG})/2$		
2. Surface Water Flow	$[V_{FPAXS} + (V_{TREE} + V_{SHRUB} + V_{HERB})/3 + V_{LONGPROF}]/3$		
3. Channel Migration	$(V_{FPAXS} + V_{INLW} + V_{KEYPIECE} + V_{TREE} + V_{SHRUB})/5$		
B. Biogeochemistry			
4. Cycling of Elements and Compounds	$[V_{OFFCHANWOOD} + V_{LITTER} + (V_{SOILINTEG} + V_{SED})/2 + (V_{TREE} + V_{HERB} + V_{SHRUB})/3]/4$		
5. Detention of Imported Elements and Compounds	$(V_{RIPBUFFWIDTH} + (V_{SOILINTEG} + V_{SED})/2 + (V_{HERB} + V_{SHRUB} + V_{TREE})/3)/3$		
6. Detention of Particulates	$[(V_{TREE} + V_{SHRUB} + V_{HERB})/3 + V_{SED} + V_{GEOFORM} + V_{FPAXS}]/4$		
7. Organic Carbon Export	$[(V_{TREE} + V_{SHRUB} + V_{HERB})/3 + V_{SOILINTEG}]/2$		

REQUIRED WORKSHEET #7a: RIVERINE WETLAND FUNCTIONAL SCORE SHEETS (cont.)

Function	Formulae	Functional Capacity Index	Rationale / Comments for Scoring Functional Capacity Index
C. Plant Community			
8. Plant Community	**For Steep Gradient waters/wetlands use:** $[(V_{SHRUB} + V_{TREE})/2 + V_{SLOPETREE} + V_{NATIVE} + V_{STRATA}]/4$ **For Low & Moderate Gradient waters/wetlands use:** $[(V_{SHRUB} + V_{TREE})/2 + V_{FLOODTREE} + V_{NATIVE} + V_{STRATA}]/4$		
9. Detrital Biomass	$(V_{LITTER} + V_{OFFCHANWOOD} + V_{KEYPIECE} + V_{INLW})/4$		
D. Faunal Support			
10. Spatial Structure of Habitats	**For Steep Gradient waters/wetlands, use:** $((V_{SHRUB} + V_{HERB})/2 + V_{STRATA} + V_{NATIVE} + V_{RIPBUFFWIDTH} + V_{LONGPROF})/5$ **For Low & Moderate Gradient waters/wetland, use:** $((V_{TREE} + V_{SHRUB} + V_{HERB})/3 + V_{NATIVE} + V_{STRATA} + V_{RIPBUFFWIDTH} + V_{GEOFORM} + V_{LONGPROF})/6$		
11. Interspersion andConnectivity of Habitats	$[V_{FPAXS} + (V_{PATCHNUMBER} + V_{PATCHAREA})/2 + (V_{PATCHLONGCON} + V_{PATCHLATCON})/2 + V_{ROADS}]/4$		
12. Anadromous & Resident Fish Habitat	**For Steep Gradient waters/wetlands, use:** $[V_{BARRIER} + (V_{KEYPIECE} + V_{INLW})/2 + (V_{FPAXS} + V_{SHADE} + V_{TREE})/3]/3$ **For Moderate Gradient waters/wetlands, use**: $\{V_{BARRIER} + [V_{FPAXS} + V_{SHADE} + (V_{SLOPETREE} + V_{FLOODTREE}/2)]/3 + V_{GEOFORM} + V_{KEYPIECE} + V_{INLW}\}/5$ **For Low Gradient waters/wetlands, use**: $[V_{BARRIER} + (V_{FPAXS} + V_{SHADE} + V_{FLOODTREE})/3 + V_{GEOFORM} + V_{KEYPIECE} + V_{INLW}]/5$		

REQUIRED WORKSHEET #6b: SLOPE AND SLOPE RIVERINE PROXIMAL WETLAND VARIABLE SCORE SHEET

Minimum Submittal Requirements for an HGM Functional Assessment Report

Score each of the variables listed on the attached variable score sheet. Separate field forms should be completed for different site conditions (i.e., existing site conditions, proposed site conditions, etc.). On each variable score field form, identify the site conditions that the variable scores are based on. If the scores are based on proposed site conditions, provide a detailed description of the proposed conditions and/or assumptions that were made. Be sure to record rationale or comments on the decision for each variable score.

Site Name: _____ Date: _____

HGM Subclass: _____ Team:_____

UTM Coordinates: _____Northing _____ Easting

Variable scores based on (*circle one*): ***Existing Site Conditions*** ***Proposed Site Conditions***

	Variable	Measurement	Variable Score	Rationale / Comments for Scoring
1	$V_{BUFFWIDTH}$			
2	$V_{BUFFCOND}$			
3	$V_{BUFFCONTIG}$			
4	V_{HERB}			
5	V_{LWOOD}			
6	V_{LITTER}			
7	V_{MICRO}			
8	V_{NATIVE}			
9	$V_{PATCHAREA}$			
10	$V_{PATCHLATCON}$			
11	$V_{PATCHNUMBER}$			
12	V_{SHRUB}			
13	$V_{SOILINTEG}$			
14	V_{STRATA}			
15	V_{SUBOUT}			
16	V_{SURFIN}			
17	V_{TREE}			

REQUIRED WORKSHEET #7b: SLOPE AND SLOPE RIVERINE PROXIMAL WETLAND FUNCTIONAL SCORE SHEETS

Minimum Submittal Requirements for an HGM Functional Assessment Report

Calculate the Functional Capacity Indexes (FCI's) for each of the functions listed on the attached functional score field forms. The assessment team members in the field, should review the calculations and preliminary assessment results. Separate functional score field forms should be completed for each set of scored variables (i.e., based on existing site conditions, proposed site conditions, etc.). Be sure to record rationale or comments on the FCI for each function.

Indices of Functions for Slope and Slope Riverine Proximal Waters/Wetlands in Mount Vernon, Washington

Function	Formulae	Functional Capacity Index	Rationale / Comments for Scoring Functional Capacity Index
A. Hydrology			
1. Surface and Subsurface Water Storage and Exchange	$[V_{SOILINTEG} + (V_{TREE} + V_{SHRUB} + V_{HERB})/3) + V_{MICRO} + (V_{SURFIN} + V_{SUBOUT})/2]/4$		
2. Landscape Hydrologic Connections	$[(V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3 + V_{SOILINTEG} + V_{SURFIN} + V_{MICRO} + V_{SUBOUT}]/5$		
B. Biogeochemistry			
3. Cycling of Elements and Compounds	$[V_{LWOOD} + V_{LITTER} + (V_{TREE} + V_{HERB} + V_{SHRUB})/3 + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3]/4$		
4. Retention and Detention of Particulates	$[(V_{TREE} + V_{SHRUB} + V_{HERB})/3) + V_{MICRO} + V_{SURFIN} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3]/4$		
5. Organic Carbon Export	$[V_{LITTER} + (V_{TREE} + V_{SHRUB} + V_{HERB})/3 + V_{SOILINTEG} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3]/4$		
C. Plant Community			
6. Plant Community	$[(V_{SHRUB} + V_{HERB} + V_{TREE})/3 + V_{NATIVE} + V_{STRATA}]/3$		
7. Detrital System	$[V_{LITTER} + V_{LWOOD} + (V_{TREE} + V_{SHRUB} + V_{HERB})/3]/3$		
D. Faunal Support			
8. Spatial Structure of Habitats	$[(V_{TREE} + V_{SHRUB} + V_{HERB})/3 + V_{STRATA} + V_{MICRO} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3]/4$		
9. Interspersion and Connectivity of Habitats	$[(V_{PATCHNUMBER} + V_{PATCHAREA})/2 + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3 + V_{PATCHLATCON}]/3$		

REQUIRED WORKSHEET #6c: DEPRESSIONAL WETLAND VARIABLE SCORE SHEET

Minimum Submittal Requirements for an HGM Functional Assessment Report

Score each of the variables listed on the attached variable score sheet. Separate field forms should be completed for different site conditions (i.e., existing site conditions, proposed site conditions, etc.). On each variable score field form, identify the site conditions that the variable scores are based on. If the scores are based on proposed site conditions, provide a detailed description of the proposed conditions and/or assumptions that were made. Be sure to record rationale or comments on the decision for each variable score.

Site Name: _____ Date: _____

HGM Subclass: _____ Team:_____

UTM Coordinates: _____Northing _____ Easting

Variable scores based on (*circle one*): ***Existing Site Conditions*** ***Proposed Site Conditions***

	Variable	Measurement	Variable Score	Rationale / Comments for Scoring
1	$V_{BUFFWIDTH}$			
2	$V_{BUFFCOND}$			
3	$V_{BUFFCONTIG}$			
4	V_{HERB}			
5	V_{LITTER}			
6	V_{NATIVE}			
7	V_{OUT}			
8	$V_{PATCHAREA}$			
9	$V_{PATCHNUMBER}$			
10	$V_{SEDIMENT}$			
11	V_{SHRUB}			
12	$V_{SOILINTEG}$			
13	V_{STRATA}			
14	V_{TREE}			

REQUIRED WORKSHEET #7c: DEPRESSIONAL WETLAND FUNCTIONAL SCORE SHEETS

Minimum Submittal Requirements for an HGM Functional Assessment Report

Calculate the Functional Capacity Indexes (FCI's) for each of the functions listed on the attached functional score field forms. The assessment team members, in the field, should review the calculations and preliminary assessment results. Separate functional score field forms should be completed for each set of scored variables (based on existing site conditions, proposed site conditions, etc.). Be sure to record rationale or comments on the FCI for each function.

Indices of Functions for Depressional Waters/Wetlands in Mount Vernon, Washington

Function	Formulae	Functional Capacity Index	Rationale / Comments for Scoring Functional Capacity Index
A. Hydrology			
1. Surface & Shallow Subsurface Water Storage & Exchange	$[V_{SOILINTEG} + V_{OUT} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3 + (V_{HERB} + V_{SHRUB} + V_{TREE})/3]/4$		
B. Biogeochemistry			
2. Cycling of Elements and Compounds	$[V_{SEDIMENT} + V_{SOILINTEG} + V_{LITTER} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3]/4$		
3. Retention and Detention of Particulates	$[V_{OUT} + V_{SEDIMENT} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3]/3$		
4. Retention and Detention of Imported Elements & Compounds	$[V_{SOILINTEG} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3]/2$		
C. Plant Community			
5. Plant Community	$[(V_{SHRUB} + V_{HERB} + V_{TREE})/3 + V_{NATIVE} + V_{STRATA}]/3$		
6. Detrital System	$[V_{LITTER} + V_{SOILINTEG} + (V_{TREE} + V_{SHRUB} + V_{HERB})/3]/3$		
D. Faunal Support			
7. Spatial Structure of Habitats	$[(V_{TREE} + V_{SHRUB} + V_{HERB})/3 + V_{STRATA} + (V_{BUFFWIDTH} + V_{BUFFCONTIG} + V_{BUFFCOND})/3 + (V_{PATCHAREA} + V_{PATCHNUMBER})/2]/4$		