

Appendix I-D

Wetlands and Stormwater Management

SCC 30.63A.570 requires use of the following criteria for assessing the suitability of using wetlands for stormwater management, analyzing wetland hydroperiods, and designing modifications to wetlands used for stormwater management. Additional information about wetlands is available in Appendix 1-D of the *2005 Stormwater Management Manual for Western Washington*.

Wetland Assessment Criteria

These assessment criteria shall be used in order to comply with SCC 30.63A.570.

The following information is necessary to perform the required assessment:

- Boundary and area of the contributing watershed of the wetland or other landscape unit
- A complete definition of goals for the wetland and landscape unit subject to planning and management
- Existing management and monitoring plans
- Existing and projected land use in the landscape unit in the categories commercial, industrial, multi-family residential, single-family residential, duplex, agricultural, various categories of undeveloped, and areas subject to active logging or construction (expressed as percentages of the total watershed area)
- Drainage network throughout the landscape unit
- Soil conditions, including soil types, infiltration rates, and positions of seasonal water table (seasonally) and restrictive layers
- Groundwater recharge and discharge points
- Wetland category I - IV in the Dept. of Ecology's *Washington State Wetland Rating System for Western Washington*, designated as rare or irreplaceable. Refer to the Washington Natural Heritage Program database. If the needed information is not available, a biological assessment will be necessary.
- Watershed hydrologic assessment
- Watershed water quality assessment
- Wetland type and zones present, with special note of estuarine, priority peat system, forested, sensitive scrub-shrub zone, sensitive emergent zone and other sensitive or critical areas designated by Washington state or Snohomish County (with dominant plant species)
- Rare, threatened, or endangered species inhabiting the wetland
- History of wetland changes

- Relationship of wetland to other water bodies in the landscape unit and the drainage network
- Flow pattern through the wetland
- Fish and wildlife inhabiting the wetland
- Relationship of wetland to other wildlife habitats in the landscape unit and the corridors between them

Wetland category and functional scores referred to in this section are determined as per the *Washington State Wetland Rating System of Western Washington*, available at <http://www.ecy.wa.gov/biblio/sea.htmles>.

In general, the following circumstances are indicative of Category I or II wetlands:

- In its present state it is primarily an estuarine or forested wetland or a priority peat system.
- It is a rare or irreplaceable wetland type, as identified by the Washington Natural Heritage Program, the Puget Sound Water Quality Preservation Program, or Snohomish County.
- It provides critical species habitat that could be impaired by the proposed action. Critical species include those listed as threatened, endangered, or sensitive, or those designated as species of local importance. Determining whether or not the conserved species will be affected by the proposed project requires a careful analysis of its requirements in relation to the anticipated habitat changes.
- It provides a high level of many functions.

Category III wetlands may provide a moderate level of habitat functions but primarily serve water quality and quantity functions. In general, Category IV wetlands have monotypic vegetation of similar age and class, lack special habitat features, and are isolated from other aquatic systems.

The following criteria must be used to determine if a natural wetland may or may not be structurally or hydrologically engineered for control of stormwater quantity, quality, or both.

1. A wetland shall not be structurally or hydrologically engineered for runoff quantity or quality control if the wetland is classified as Category I or II, or if it is classified as Category III or IV and has any of the following characteristics:
 - significant priority peat system or forested zones that will experience substantially altered hydroperiod as a result of the proposed project;
 - regionally unusual biological community types;
 - animal habitat features of relatively high value in the region (e. g., a protected, undisturbed area connected through undisturbed corridors to other valuable habitats, an important breeding site for protected species) as exhibited by a

habitat function score of 20 or greater per the “Washington State Wetland Rating System of Western Washington;

- the presence of protected commercial or sport fish; or
 - configuration and topography that will require significant modification that may threaten fish stranding.
2. A wetland can be considered for structural or hydrological modification for runoff quantity or quality control if both criteria (a) and (b) below are met:
- a. The wetland is classified as Category III with a habitat function score less than 20 or is classified as Category IV, and all of the following conditions are met:
- any functions lost through hydrologic or structural modification in a Category III or IV wetland would have to be mitigated pursuant to Chapter 30.62 SCC, 30.62A SCC, or other applicable code provisions;
 - the wetland lies in the natural routing of the runoff; and
 - the wetland allows runoff discharge at the natural location.
- b. One or more of the following conditions exist:
- the wetland has been previously disturbed by human activity, as evidenced by agriculture, fill, ditching, and/or introduced or invasive weedy plant species;
 - the wetland has been deprived of a significant amount of its water supply by draining or previous urbanization, and stormwater runoff is sufficient to augment the water supply (for example, a wetland that has experienced an increased summer dry period, especially if the drought has been extended by more than two weeks);
 - construction for structural or hydrologic modification in order to provide runoff quantity or quality control will disturb relatively little of the wetland;
 - the wetland can provide the required storage capacity for quantity or quality control through an outlet orifice modification to increase storage of water, rather than through raising the existing overflow (orifice modification is preferred);
 - under existing conditions the wetland experiences a relatively high degree of water level fluctuation and a range of velocities (for example, a wetland associated with substantially flowing water, rather than one in the headwaters or entirely isolated from flowing water; or
 - the wetland is threatened by potential impacts exclusive of stormwater management, and could receive greater protection if acquired for a stormwater management project rather than left in existing ownership.

Hydroperiod Analysis and Design Criteria

These hydroperiod analysis and design criteria shall be used to comply with SCC 30.63A.570.

Hydroperiod analysis and stormwater mitigation design shall be based on the following information:

- Existing and potential stormwater pollution sources
- Existing and projected land use contributing to the wetland
- Existing and projected wetland hydroperiod characteristics
- Wetland bathymetry
- Inlet and outlet locations and hydraulics
- Landscape unit soils, geologic and hydrogeologic conditions
- Wetland type and zones present
- Presence of breeding populations of native amphibian species
- Presence of forest and wetland obligate bird species
- Presence of fish species

Protection of wetland plant and animal communities depends on controlling the wetland's hydroperiod, meaning the pattern of fluctuation of water depth and the frequency and duration of exceeding certain levels, including the length and onset of drying in the summer. A hydrologic assessment is required to measure or estimate elements of the hydroperiod under existing predevelopment and anticipated postdevelopment conditions. This assessment shall be performed by a licensed Civil Engineer with the aid of a qualified hydrologist or hydrogeologist and a biologist. Postdevelopment estimates of watershed hydrology and wetland hydroperiod must include the cumulative effect of all anticipated watershed and wetland modifications. This analysis hypothesizes a fluctuating water stage over time before development that could fluctuate more, both higher and lower after development; these greater fluctuations are termed stage excursions.

Hydroperiod limits applicable to all zones within all wetlands over the entire year

The following hydroperiod limits apply to all zones within all wetlands over the entire year:

- The limits on the frequency and duration of excursions, as well as on overall water level fluctuation, after development shall not exceed 6 inches or 15 cm. in height over a 48 hour period based on a continuous runoff model analysis of the drainage flowing to the wetland. Monitoring of the wetland water surface elevation shall occur at least 8 times during the wet season prior to development to establish the existing condition. The hydrologic model used to predict future conditions must be calibrated to the hydrologic data collected at the site and tested by running the model for the period of monitoring. The model will be considered an adequate representation of the system only if the results from the model deviate less than +/-15 percent of the actual values for the stage of the wetland duration of at least 8 times during the wet season sampling days.
- The total dry period (when pools dry down to the soil surface everywhere in the wetland) does not increase or decrease by more than two weeks in any year.
- Alterations to watershed and wetland hydrology that may cause perennial wetlands to become vernal are avoided.

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional hydroperiod limits applicable to all zones of priority peat wetlands over the entire year

In addition to the requirements set forth above for all wetlands, the following hydroperiod limit applies to all zones of priority peat wetlands over the entire year:

- the duration of stage excursions above the predevelopment stage does not exceed 24 hours in any year.

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional hydroperiod limits and design criteria applicable to wetlands inhabited by breeding native amphibians from February 1st through May 31st

In addition to the requirements set forth above for all wetlands, the following hydroperiod limits and design criteria apply to amphibian breeding zones in wetlands inhabited by breeding native amphibians from February 1st through May 31st:

- the magnitude of stage excursions above or below the predevelopment stage should not exceed 8 cm for more than 24 hours in any 30-day period;
- avoid decreasing the sizes of the open water and aquatic bed zones;
- avoid increasing the channelization of flow. Do not form channels where none exist, and take care that inflows to the wetland do not become more concentrated and do not enter at higher velocities than accustomed. If necessary, concentrated flows can be uniformly distributed with a flow-spreading device such as a shallow weir, stilling basin, or perforated pipe. Velocity dissipation can be accomplished with a stilling basin or rip-rap pad;
- limit the post-development flow velocity to < 5 cm/s (0.16 ft/second) in any location that had a velocity in the range 0-5 cm/s in the pre-development condition; and
- avoid increasing the gradient of wetland side slopes.

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional hydroperiod limits applicable to wetlands inhabited by fish

In addition to the requirements set forth above for all wetlands, the following design criteria apply to wetlands inhabited by fish:

- Protect fish habitats by avoiding water velocities above tolerated levels (selected with the aid of a qualified fishery biologist to protect fish in each life stage when they are present), siltation of spawning beds, etc. Habitat requirements vary substantially among fish species. If the wetland is associated with a larger water body, contact the Department of Fisheries and Wildlife to determine the species of concern and the acceptable ranges of habitat variables.
- If stranding of protected commercial or sport fish could result from a structural or hydrologic modification for runoff quantity or quality control, develop a strategy to avoid stranding that minimizes disturbance in the wetland (e. g., by making provisions for fish return to the stream as the wetland drains, or avoiding use of the facility for quantity or quality control during fish presence).

If the analysis shows greater than these levels of stage excursion and impact to the wetland, one or more of the following management strategies shall be used to stay within the prescribed limits:

- reduction of the level of development;
- increasing runoff infiltration;
- increasing runoff storage capacity without dredging or filling.

Additional Guidance Information

The following information may be useful but is not explicitly required by Snohomish County code.

Guidelines for the Protection of Specific Biological Communities

1. For wetlands inhabited by forest bird species:
 - Retain areas of coniferous forest in and around the wetland as habitat for forest species.
 - Retain shrub or woody debris as nesting sites for ground-nesting birds and downed logs and stumps for winter wren habitat.
 - Retain snags as habitat for cavity-nesting species, such as woodpeckers.
 - Retain shrubs in and around the wetland for protective cover. If cover is insufficient to protect against domestic pet predation, consider planting native bushes such as rose species in the buffer.
2. For wetlands inhabited by wetland obligate bird species:
 - Retain **forested zones**, sedge and rush meadows, and deep open water zones, both without vegetation and with submerged and floating plants.
 - Retain shrubs in and around the wetland for protective cover. If cover is insufficient to protect against domestic pet predation, consider planting native bushes such as rose species in the buffer.
 - Avoid introducing **invasive weedy plant species**, such as purple loosestrife and reed canary grass.
 - Retain the buffer zone. If it has lost width or forest cover, consider re-establishing forested buffer area at least 30 meters (100 ft) wide.
 - If human entry is desired, establish paths that permit people to observe the wetland with minimum disturbance to the birds.

Wetlands Guidance Appendix 2: Definitions

Baseline sampling	Sampling performed to define an existing state before any modification occurs that could change the state.
Bioengineering	Restoration or reinforcement of slopes and stream banks with living plant materials.
Buffer	The area that surrounds a wetland and that reduces adverse impacts to it from adjacent development.
Constructed wetland	A wetland intentionally created from a non-wetland site for the sole purpose of wastewater or stormwater treatment. These wetlands are not normally considered Waters of the United States or Waters of the State.
Degraded (disturbed) wetland (community)	A wetland (community) in which the vegetation, soils, and/or hydrology have been adversely altered, resulting in lost or reduced functions and values; generally, implies topographic isolation; hydrologic alterations such as hydroperiod alteration (increased or decreased quantity of water), diking, channelization, and/or outlet modification; soils alterations such as presence of fill, soil removal, and/or compaction; accumulation of toxicants in the biotic or abiotic components of the wetland; and/or low plant species richness with dominance by invasive weedy species
Enhancement	Actions performed to improve the condition of an existing degraded wetland, so that functions it provides are of a higher quality.
Estuarine wetland	Generally, an eelgrass bed; salt marsh; or rocky, sandflat, or mudflat intertidal area where fresh and salt water mix. (Specifically, a tidal wetland with salinity greater than 0.5 parts per thousand, usually semi-enclosed by land but with partly obstructed or sporadic access to the open ocean).
Forested communities (wetlands)	In general terms, communities (wetlands) characterized by woody vegetation that is greater than or equal to 6 meters in height; in these guidelines the term applies to such communities (wetlands) that represent a significant amount of tree cover consisting of species that offer wildlife habitat and other values and advance the performance of wetland functions overall.

Functions	The ecological (physical, chemical, and biological) processes or attributes of a wetland without regard for their importance to society (see also Values). Wetland functions include food chain support, provision of ecosystem diversity and fish and wildlife habitat, flood flow alteration, groundwater recharge and discharge, water quality improvement, and soil stabilization.
Hydrodynamics:	The science involving the energy and forces acting on water and its resulting motion.
Hydroperiod	The seasonal occurrence of flooding and/or soil saturation; encompasses the depth, frequency, duration, and seasonal pattern of inundation.
Invasive weedy plant species	Opportunistic species of inferior biological value that tend to out-compete more desirable forms and become dominant; applied to non-native species in these guidelines.
Landscape unit	An area of land that has a specified boundary and is the locus of interrelated physical, chemical, and biological processes.
Modification, Modified (wetland)	A wetland whose physical, hydrological, or water quality characteristics have been purposefully altered for a management purpose, such as by dredging, filling, forebay construction, and inlet or outlet control.
On-site	An action (here, for stormwater management purposes) taken within the property boundaries of the site to which the action applies.
Polishing	Advanced treatment of a waste stream that has already received one or more stages of treatment by other means.
Predeveloped condition, or Predevelopment condition	Predeveloped condition or predevelopment condition means a fully-forested condition (soils and vegetation) of second-growth forest to which the Western Washington Hydrologic Model (WWHM) is calibrated, unless reasonable, historic information is provided that indicates the site was prairie prior to Euro-American settlement. See SCC 30.91P.258)
Pre-treatment	An action taken to remove pollutants from runoff before it is discharged into another system for additional treatment.

Priority peat systems

Unique, irreplaceable fens that can exhibit water pH in a wide range from highly acidic to alkaline, including fens typified by Sphagnum species, Rhododendron groenlandicum (Labrador tea), Drosera rotundifolia (sundew), and Vaccinium oxycoccos (bog cranberry); marl fens; estuarine peat deposits; and other moss peat systems with relatively diverse, undisturbed flora and fauna. Bog is the common name for peat systems having the Sphagnum association described, but this term applies strictly only to systems that receive water income from precipitation exclusively.

Redevelopment

(See SCC 30.91R.070) The creation or addition, of new impervious surfaces on already substantially developed site that has 35 percent or more of existing impervious surface coverage where the creation or addition of impervious surfaces; the ground area expansion of a building footprint or addition or replacement of a structure; structural development including construction, installation or expansion of a building or other structure; replacement of impervious surface that is not part of a routine maintenance activity; and land disturbing activities that must meet the redevelopment thresholds. Overlay projects are routine maintenance and shall not be considered redevelopment. Construction which cuts and subsequently repairs existing impervious surface including trenching or utility installation or maintenance which is outside critical areas is considered routine maintenance.

Regional

An action (here, for stormwater management purposes) that involves more than one discrete property.

Restoration

Actions performed to reestablish wetland functional characteristics and processes that have been lost by alterations, activities, or catastrophic events in an area that no longer meets the definition of a wetland.

**Source control
best management
practices(BMPs)**

See SCC 30.91S.521. Structures, equipment, supplies or operations intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants.

Stage excursion

A post-development departure, either higher or lower, from the water depth existing under a given set of conditions in the pre-development state.

Structure

The components of an ecosystem, both the abiotic (physical and chemical) and biotic (living).

**Threatened, or
endangered species**

(See SCC 30.91T.054) State and federally listed species. State species are listed under chapter 232-12 WAC. Federal species are listed under the Endangered Species Act of 1973.

**Treatment best
management practices
(BMPs)**

Actions that remove pollutants from runoff through one or more physical, chemical, biological mechanisms.

**Unusual biological
community types**

Assemblages of interacting organisms that are relatively uncommon regionally.

Values

Wetland processes or attributes that are valuable or beneficial to society (also see Functions). Wetland values include support of commercial and sport fish and wildlife species, protection of life and property from flooding, recreation, education, and aesthetic enhancement of human communities.

Vernal wetland

A wetland that has water above the soil surface for a period of time during and/or after the wettest season but always dries to or below the soil surface in warmer, drier weather.

Wetland obligate

A biological organism that absolutely requires a wetland habitat for at least some stage of its life cycle.

Wetlands

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include, but are not limited to swamps, marshes, bogs, and similar areas, as well as artificial wetlands intentionally created from non-wetland areas to mitigate for conversion of wetlands, as permitted by the county. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to irrigation and drainage ditches, grass-lined biofiltration swales, canals, detention facilities, wastewater treatment facilities, farm ponds and landscaping amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. The detailed methodology for wetland delineation is contained in Washington State Wetlands Identification and Delineation Manual Washington State Department of Ecology, Publication #96-94, March 1997 Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands. See SCC 30.91W.060

Wetlands Guidance Appendix 3: Native and Recommended Noninvasive Plant Species for Wetlands in the Puget Sound Basin

Caution: Extracting plants from an existing wetland donor site can cause a significant negative effect on that site. It is recommended that plants be obtained from native plant nursery stocks whenever possible. Collections from existing wetlands should be limited in scale and undertaken with care to avoid disturbing the wetland outside of the actual point of collection. Plant selection is a complex task, involving matching plant requirements with environmental conditions. It should be performed by a qualified wetlands botanist. Refer to *Restoring Wetlands in Washington* by the Washington Department of Ecology for more information.

Plants preferred in freshwater wetlands

Open water zone

- Tamogeton species (pondweeds)
- Nymphaea odorata (pond lily)
- Brasenia schreberi (watershield)
- Nuphar luteum* (yellow pond lily)
- Polygonum hydropiper (smartweed)
- Alisma plantago-aquatica* (broadleaf water plantain)
- Ludwigia palustris (water purslane)
- Menyanthes trifoliata (bogbean)
- Utricularia minor, U. vulgaris (bladderwort)

Emergent zone:

- Carex obnupta, C. utriculata, C. arcta, C. stipata, C. vesicaria C. aquatilis, C. comosa, C. lenticularis (sedge)
- Scirpus atricinctus (woolly bulrush)
- Scirpus microcarpus* (small-fruited bulrush)
- Eleocharis palustris*, *E. ovata* (spike rush)
- Epilobium watsonii* (Watson's willow herb)
- Typha latifolia* (common cattail) (Note: This native plant can be aggressive but has been found to offer certain wildlife habitat and water quality improvement benefits; use with care.)
- Veronica americana*, *V. scutellata* (American brookline, marsh speedwell)

Mentha arvensis (field mint)

Lycopus americanus, *L. uniflora* (bugleweed or horehound)

Angelica species (angelica)

Oenanthe sarmentosa (water parsley)

Heracleum lanatum (cow parsnip)

Glyceria grandis, *G. elata* (manna grass)

Juncus acuminatus (tapertip rush)

Juncus ensifolius (daggerleaf rush)

Juncus bufonius (toad rush)

Mimulus guttatus (common monkey flower)

Scrub-shrub zone

Salix lucida, *S. rigida*, *S. sitchensis*, *S. scouleriana*, *S. pedicellaris* (willow)

Lysichiton americanus (skunk cabbage)

Athyrium filix-femina (lady fern)

Cornus sericea (redstem dogwood)

Rubus spectabilis (salmonberry)

Physocarpus capitatus (ninebark)

Ribes species (gooseberry)

Rhamnus purshiana (cascara)

Sambucus racemosa (red elderberry) (occurs in wetland-upland transition)

Lonicera involucrata (black twinberry)

Oemleria cerasiformis (Indian plum)

Stachys cooleyae (Stachy's horsemint)

Prunus emarginata (bitter cherry)

Forested zone:

Populus balsamifera, ssp. *trichocarpa* (black cottonwood)

Fraxinus latifolia (Oregon ash)

Thuja plicata (western red cedar)

Picea sitchensis (Sitka spruce)

Alnus rubra (red alder)

Tsuga heterophylla (hemlock)

Acer circinatum (vine maple)

Maianthemum dilatatum (wild lily-of-the-valley)

Ivzula parviflora (small-flower wood rush)

Torreyochloa pauciflora (weak alkaligrass)

Ribes species (currants)

Bog:

Sphagnum species (sphagnum mosses)

Rhododendron groenlandicum (Labrador tea)

Vaccinium oxycoccos (bog cranberry)

Kalmia microphylla, ssp. *occidentalis* (bog laurel)

Exotic plants that should NOT be introduced to existing, created, or constructed freshwater wetlands

English ivy

Reed canarygrass

Purple loosestrife

Yellow iris

Ilex aquifolia (holly)

Impatiens glandulifera (policeman's helmet)

Lotus corniculatus (birdsfoot trefoil)

Lysimachia thyrsiflora (tufted loosestrife)

Myriophyllum species (water milfoil, parrot's feather)

Polygonum cuspidatum (Japanese knotweed)

Polygonum sachalinense (giant knotweed)

Rubus discolor (Himalayan blackberry)

Tanacetum vulgare (common tansy)

Native plants that should not be introduced to existing, created, or constructed freshwater wetlands

Soft rush

Poison hemlock

Potentilla palustris (Pacific silverweed)

Bittersweet nightshade

Ranunculus repens (creeping buttercup)

Wetlands Guidance Appendix 4: Comparison of Water Chemistry Characteristics In Sphagnum Bog And Fen Versus More Typical Wetlands

Water Quality Variable	Typical Wetlands	<i>Sphagnum</i> Bogs and Fens
PH	6 - 7	3.5 - 4.5
Dissolved oxygen (mg/L)	4 - 8	Shallow surface layer oxygenated, anoxic below
Cations	Divalent Ca, Mg common	Divalent Ca, Mg uncommon; Univalent Na, K predominant
Anions	HCO ₃ ⁻ , CO ₃ ²⁻ predominant	Cl ⁻ , SO ₄ ²⁻ predominant; almost no HCO ₃ ⁻ , CO ₃ ²⁻ (organic acids form buffering system)
Hardness	Moderate	Very low
Total phosphorus (µg/L)	50 - 500	5 - 50
Total Kjeldahl nitrogen (µg/L)	500 - 1000	~ 50

Wetland Protection Guidelines References

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