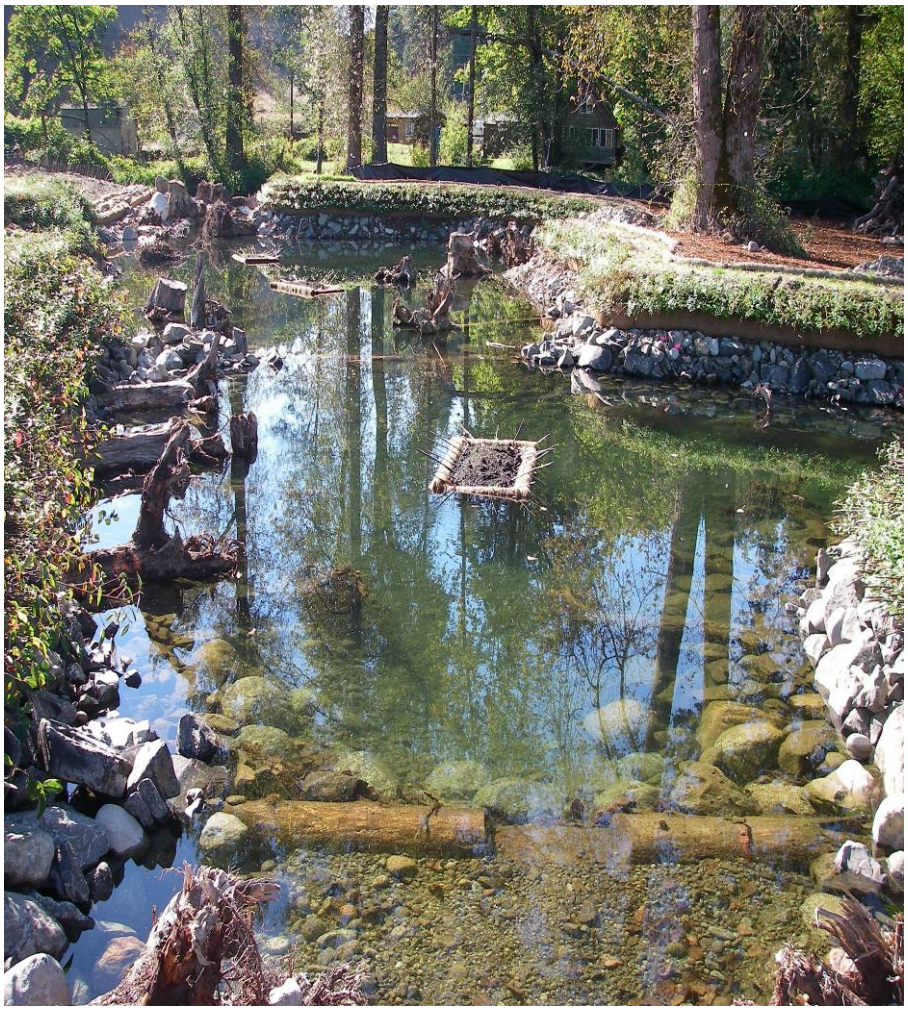
WSDOT Guidance on Wildlife Habitat Structures In Wetland Mitigation Sites



Washington Department of Transportation

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WSDOT Guidance on
Wildlife Habitat in Wetland Mitigation Sites

Wetlands and adjacent uplands provide numerous habitat niches for wildlife. Wildlife habitat structures added to wetland mitigation sites are intended to jump start habitat complexity and species richness functions until natural conditions and environmental forces mature and shape the site to create self-sustaining wildlife habitat. The wildlife habitat also adds "functional lift" to the assessed value of a created site; thereby, providing a higher quality site within a constrained area. Wildlife may use these structures to locate mates, nest, and forage, as well as protection from the weather and predators. The reader should keep in mind that the basic goal for creating wetlands and habitat structures is to promote a self-sustaining food web.

This document provides guidance on habitat structure and site design in Western Washington with suggestions for experimental designs based on best professional judgment. Aspects of this document may be applicable to other roadside restoration projects such as stream relocation and restoration. A wetland mitigation site can include a few or all of the structural elements, depending on the need, size, location, and functions of the impacted wetlands. Project budget, wetland mitigation rating (category), and buffer widths may also influence the number and type of habitat structures for any given mitigation site.

Mitigation Site Location:

1. Select a site that will connect to existing habitat corridors and/or quality habitat areas. It is undesirable to create isolated habitat "islands". The site should augment wildlife movement and contribute to their life history and survival.
2. Select a mitigation site that will maximize adjacent land features. Expand existing wildlife corridors and functions by increasing the corridor width and habitat complexity.
3. Be cognizant of existing and future development within the mitigation site area which could fragment habitat corridors or diminish the effectiveness of the proposed habitat structures.
4. Some sites which fulfill wetland mitigation requirements may not always be appropriate for some species that cannot successfully and safely use the site. Site selection intended to purposefully attract wildlife should be located to avoid creating hazards to animals drawn in by the habitats.

General Guidance for Habitat Structures:

1. Salvage, recycle, and incorporate materials made available by construction and import foreign materials only when necessary. Identify and mark existing on-site material for salvage and coordinate with the design and construction offices to appropriately stockpile supplies and storage sites.
2. Each habitat feature should require little or no maintenance. This design recommendation reduces costs and human presence in the site.

3. Work with the region wildlife biologist to identify target species and appropriate habitat structures.
4. Assess the surrounding land use to determine what structures are appropriate for the desired species:
    a. A site that is surrounded by roadways may be deleterious to ground dwelling species such as small and large mammals. Therefore, in this situation, avoid habitats that may be particularly attractive to these animals.
    b. Augment existing habitat that surrounds the site rather than replicating existing features. If several perch trees are expected to be retained near the project then it would be redundant to add perch posts. However, if the adjacent property is slated for development, then temporary redundancy in structures may be desirable.
    c. Grade the site to mimic natural conditions, including ephemeral pools, but minimize fish entrapment and bull frog use. High flows encroaching into the site from nearby streams and lakes should drain out as the water recedes.
    d. Locate the site to complement adjacent land use features. It is inefficient and inappropriate to create habitat "islands" rather the site should facilitate wildlife movement and contribute to their life history and survival by contributing to existing habitats.
    e. Be cognizant of future development within the project area that could fragment habitat corridors or diminish the effectiveness of the proposed habitat structures.
5. Increase habitat functions by combining structures for multiple species, such as incorporating a perch log with branches into rock piles. Rocks should completely surround the log which is securely held in place at approximately 45 degrees.
6. Create perch points for song birds. These are prominent twigs or log ends above the supporting piles that provide the bird with a view of the surrounding area from which they can vocalize territorial bounds, attract mates, and avoid predation.
7. Secure structures that may be subject to intermittent inundation to minimize movement.
8. Generally, the bigger the structure, the better. This may have diminishing returns on extraordinarily sized structures. Keep in mind that structures are meant to resemble naturally occurring sizes, shapes, and distributions. Cost and material availability should be considered when exceeding the recommended minimum. If additional material is available from project construction, then coordinate with the region wildlife biologist and design office for guidance on increasing the habitat size or quantities.
9. Inspect habitat structures during construction to verify appropriate locations and construction methods. Early coordination with the construction office may be useful to catch design and construction problems.

Habitat Structures:

Brush piles:

1. *Intent*: Brush piles are meant to mimic dense thickets where a tree in a forest has fallen and created clumped, horizontal structures with understory vegetation.
2. *Target species*: Small mammals, amphibians, reptiles, predatory species, and passerine-sized birds.
3. *Location*: In upland sites with little or no chance of being surrounded by water.
4. *Quantity*: At least six brush piles per acre.
5. *Construction*: Wood accumulated by clearing live vegetation and downed trees should be salvaged and incorporated into piles. The center of the pile should be supported with substantial woody material (e.g. rootwads) to create and maintain loft. Stem sizes should be randomly mixed from twigs to large logs using any woody species available; however, conifers will likely last longer than other species. Branch tips or log ends should be directed skyward to create perch points. The piles should be approximately 20 feet wide by 10 feet high. Larger piles may have diminishing returns. There should be interstitial spaces in the brush pile unless stated otherwise on the plan sheets. Brush piles should be constructed by stacking the material and not dumped from a truck.
6. *Suitable example*:

Rock piles:

1. *Intent*: To mimic accumulations as might occur in rocky areas along streams, outcrops, and talus fields. The rocks absorb daytime heat and slowly release it during the cooler night.
2. *Target species*: The heated rocks provide a relatively stable thermal source and will attract ectothermic reptiles for nesting and foraging. Rock piles with sufficient mass may serve as reptile overwintering sites. Small mammals, particularly rodents, will forage, nest, and receive some protection from predators in rock piles. Rodents in turn may also serve as a food source for predatory species such as weasels, mink, snakes, and coyotes.
3. *Location*: Rock piles should be placed in upland sites with little or no chance of being inundated by water. If there are slopes in the site it may be beneficial to bury half the pile into them, particularly south facing slopes.
4. *Quantity*: It is recommended to have at least five rock piles per acre.
5. *Construction*: Rocks should be cleaned and sized from two inch diameter to two man rock (approximately two square feet) with some jagged edges. Jagged edges are used by molting reptiles and provide secure footing for small mammals. It is important to maintain a variety of interstitial spaces not exceeding six inches. The piles should be at least five feet diameter and four feet tall. Partially bury piles below the ground surface in upland areas. A perch log can be added to expand habitat opportunities for birds. If large rocks are encountered on site they may be grouped and partially buried to create burrows (approximately one square foot or greater) for larger species such as coyotes.
6. *Suitable example*:

Raptor perch poles:

1. *Intent*: To replace or augment vertical structures.
2. *Target species*: Large bodied birds, such as hawks, eagles, and osprey, as well as bats and invertebrates. As the poles deteriorate they become attractive to primary excavating species such as pileated woodpeckers. Exfoliating bark may provide day roosts for bats. Eventually the rotting wood becomes attractive to insects which in turn provide forage opportunities to birds and bats. When the poles topple they then become habitat for ground dwelling species.
3. *Location*: Uplands to provide alternate perch sites and viewing opportunities.
4. *Quantity*: There should be a minimum of three per acre; however, consideration must be give to existing perch structures. If suitable perch trees have been retained in the site or remain adjacent to the mitigation site then it may be unnecessary to provide perch poles.
5. *Construction*: The poles should be conifer tree trunks and have at least three naturally occurring side branches, at least two of which should be near the top. Manufactured side branches are not appropriate due to the varying construction techniques and insufficient results at replicating the intended habitat need. Ensure that at least 30 feet of the stem is above ground, at least 75 percent of the bark intact, and predator guard encircling the stem. Bat and bird houses can be attached to the upper third of the stem to provide cavities immediately.
6. *Suitable example*:

Nest platform:

1. *Intent*: To provide a base upon which birds can build nests and perch.
2. *Target species*: These are most attractive to osprey, which are a long-lived species and, once established, often return to nest in the same site for many years.
3. *Location*: The platform should be exposed (e.g. not under or within the canopy of a tree) and within 0.5 miles of large fresh or marine water; preferably with a commanding view of the water.
4. *Quantity*: One platform per site due to large home ranges for the target species.
5. *Construction*: Flat, either circular or square constructed of untreated plywood or cedar boards and stoutly supported and offset near the top of a tall pole or topped tree. The plywood should be marine grade or exterior and all other wood should be cedar. It should be capable of supporting at least 200 pounds of accumulated nest material. Square platforms should be four-foot square dimensions (e.g. hardwood pallets). Circular platforms should have a diameter of at least four feet. The platform edges must have a three-inch tall rim with gaps to help contain nest material but allow water to flow off. Prep the platforms with attractant sticks to simulate old nest material. The platform should be at least 30 feet above the surrounding ground but taller is preferred. Try to keep the underground portion of the support pole above the water table to reduce premature rotting. Bat houses may be attached to the upper third of the pole to double up the usage and encircle the lower stem with a predator guard. Attach an offset perch board opposite and above the platform for attending adults.
6. *Suitable example*:

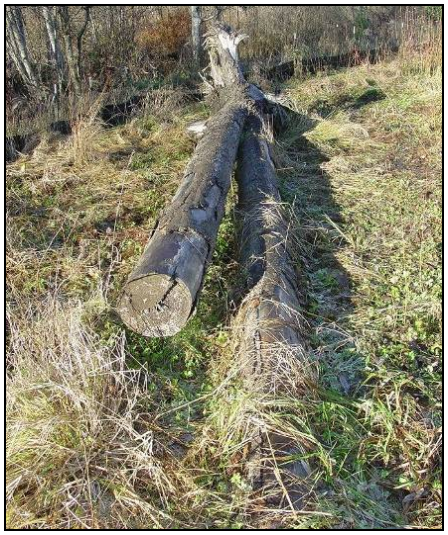
Photo by James Kaiser

Snags:

1. *Intent*: To provide decadent vertical wood elements typical of a mature forest.
2. *Target species*: A variety of insects and smaller birds, particularly woodpeckers and other cavity nesters. These structures will benefit a number of insectivorous surface feeding species.
3. *Location*: Uplands, wetlands, and riparian zones. Snags may help provide erosion and debris control in riparian embankments.
4. *Quantity*: It is recommended to install as many as possible. There should be at least two stems with multiple branches of varying length, 16-inch diameter, and 20 feet tall or greater per acre, which could serve the functions of the raptor perch.
5. *Construction*: Upland and wetland snags: Snags should have at least 75 percent of the bark attached. Conifer species and larger diameter stems may last longer but any species and diameter is appropriate. Stem heights above ground can vary between 5 to 30 feet, or greater. These may double as perch poles, depending on the need and site conditions. Straight-up vertical installation is not necessary but the log should be sufficiently supported to avoid easily tipping over. Freshly cut black cottonwood can be placed in riparian areas to provide habitat for water-associated birds and small mammals. These may also serve a dual function of bank stabilization and LWD recruitment when placed in parallel rows along river banks.
6. *Suitable examples*:

Coarse woody debris (CWD):

1. *Intent*: To mimic toppled trees which create structure, water retention, and organic soil inputs as well as the habitat complexity usually present in upland sites.
2. *Target species*: Most small mammals, particularly mice, voles, and shrews, as well as amphibians, and ground nesting birds. As the structures decay they are colonized by fungi and insects which, in turn, provide food for larger animals.
3. *Location*: Primarily in uplands but these also provide habitat functionality in wetlands. As a rule of thumb CWD should be randomly scattered throughout a site. Install habitat structures close to each other so small mammals will be less exposed to predators as they travel between structures.
4. *Quantity*: As many as possible.
5. *Construction*: Can be quite varied for their size, shape, and arrangement and may include log stems, logs with rootwads, and rootwads. Log stems should have 75 percent tightly adhered bark and lie roughly horizontal on the ground. The portion of the log that lies on the soil should be longitudinally V-notched three inches deep to create small mammal tunnels and promote fungal growth. Lateral V-notches will allow additional access. Longitudinal slices into the ends will create amphibian and insect habitat niches. Larger diameter stems and conifer species will last longer but all species greater than six inches diameter may be used. Several stems with or without rootwads may be crisscrossed. Create depressions in the soil next to the rootwads to temporarily pond stormwater (i.e. to mimic lifted soil where the roots of the tree once were embedded.) and use logs that are as long as possible. Short pieces should be combined into piles or incorporated into bush piles. Distribute the logs throughout the site to minimize travel distances between structures for small mammals. Single stems without rootwads should be associated with other habitat structures (such as crisscrossed or incorporated into a rock pile) rather than individually distributed.
6. *Suitable examples*: (Log with bark attached and Rootwad with soil depression)



Large woody debris (LWD):

1. *Intent*: In aquatic environments logs in the stream bed create channel complexity, direct water flow, control erosion, and provide forage and cover for aquatic species.
2. *Target species*: Most aquatic species, including amphibians and fish, will be attracted to the diverse habitat provided by adding wood to a stream channel.
3. *Location*: A hydrologist should be consulted for constructability. Logs may be cross-laced in mid-channel while rootwads with stems are often used to create a complex bank armoring. Generally, at least a portion of the wood should be in the water during low flow and securely held into position. An occasional long stem can span the water providing a dry path between banks.
4. *Quantity*: Each site is unique and it is recommended to consult a hydrologist and stream ecologist. Streams with high energy may require larger key pieces.
5. *Construction*: All key LWD should be secured to avoid drifting and be able to recruit smaller pieces of wood. The bark should be tightly intact on at least 75 percent of each log. There are numerous options for placing wood in the stream channel. There are also several information guidelines for the preferred quantities, installation, and sizes and this document will refer the reader to these sources:
    a. Stream Habitat Restoration Guidelines – Washington Department of Fish and Wildlife: http://wdfw.wa.gov/hab/ahg/shrg/index.htm
    b. A Guide to Placing Large Wood in Streams http://www.nww.usace.army.mil/html/offices/op/rf/SLOPES/WoodPlacmntGuide1995%5B1%5D.pdf
    c. Method Manual for the Large Woody Debris Survey – Timber Fish and Wildlife Program: http://www.nwifc.wa.gov/tfw/documents/TFW_Large_Woody_Debris.pdf
6. *Suitable example*:

Bat houses:

1. *Intent*: To replace and augment seasonal use roost sites for colonies and solitary bats.
2. *Target species*: There are potentially 11 species of bats in Western Washington that may use artificial structures for day or night roosts. Colonies rarely exceed a few hundred animals and occupied sites typically range from 1-100 individuals. During the winter months, bats in Washington hibernate or migrate out of the state and no bats are expected to use the habitats from October to March.
3. *Location*: Consult a biologist familiar with bat roost requirements for proper bat box placement. Bark on raptor perches and a snag is expected to provide foraging opportunities for birds as well as roosting opportunities for bats. Bat chamber-houses may be attached to the upper third of the perch and snag. Rocket style bat house are supported on their own posts and may be located in uplands or wetlands. The following applies to the proper placement of any style of bat house;
    a. The site should be sunny for approximately six hours. It is important for the house to receive the first sun light of the morning to warm up as soon as possible but not overheat in the late afternoon. The house should be large enough to allow the animals to adjust positions with the changing thermal conditions.
    b. Be a minimum of 15 feet above the ground.
    c. Clear of vegetation below the house for an unhindered flight path.
    d. Be within 0.5 miles of, and preferably adjacent to, water for nourishment and foraging on insects.
    e. Attach directly to large thermally stable structures such as concrete bridges. Check with the appropriate personnel before doing so.
    f. It is recommended to place predator shields around the supporting poles below the houses, particularly where there may be free-ranging domestic cats. Placing the houses over water may reduce predators.
4. *Quantity*: Two per acre may be sufficient. Two chamber houses can be placed on opposing sides of bird perch poles. Having a combination of rocket and chamber houses distributed throughout the site may yield the best results.
5. *Construction*: There are numerous sources of commercially constructed bat houses ranging from single to multiple chambers in a variety of designs and sizes. Constructing a bat house is not difficult but requires specific design and installation guidelines to be attractive to bats. Three commonly used designs include: chamber, rocket box, and Oregon wedge. Regardless of design, it is recommended that they be water tight and a dark color to absorb heat. Bats in Washington are not particularly numerous; therefore, two smaller structures per acre may be most appropriate. There are several information sources for the preferred installations and this document will refer the reader to these.
    a. Bat Conservation International http://www.batcon.org/home/default.asp
    b. Bats Northwest http://www.batsnorthwest.org/

6. *Suitable examples*:

Chamber house

Rocket box
Photo by Russell Link

Bird houses:

1. *Intent*: To create or replace lost nesting habitat.
2. *Target species*: Native birds
3. *Location*: Generally, bird houses and nest platforms are mounted on individual poles but may also be attached to trees, snags, or perch poles. These may be in upland, wetlands, or estuarine environments. Holes may be drilled near the top of snags. Open boxes or improved ledges should be located on the upper quarter of an open cliff face, shear surface, or bridge but not over water or on top of large flat surfaces, such as a tower roof.
4. *Quantity*: The quantity and style of bird houses depends on the target species. Designs vary considerably; therefore a biologist should be consulted on the appropriate design for the site.
5. *Construction*: Bird houses requiring annual maintenance are generally not recommended; however, several bird nest designs require little or no maintenance. Holes drilled in snags are attractive to several bird species; however, the hole should not compromise the structural integrity of the stem. Wire nest platforms are bowl-shaped and secured in a tree crotch. Snag holes, houses, and platform sizes and shapes are highly variable and are often species specific. The entrances, color, and design should be optimized to minimize use by invasive species such as English house sparrows, European starlings, and rock pigeons. There are numerous information sources for appropriate efforts on bird houses and species specific designs. Regional biologists and local special interest birding groups should be consulted to provide detailed assistance.
    a. Seattle Audubon: http://www.seattleaudubon.org/
    b. Falcon Research Group: http://www.frg.org/frg/index.html
    c. The Purple Martin Conservation Association: http://www.purplemartin.org/
6. *Suitable example*:

Peregrine nest box
Photo by Martin Muller

Ponds:

1. *Intent*: To provide pools for all wildlife, particularly aquatic-dependant species. Riparian edges will attract passerine birds and waterfowl.
2. *Target species*: Native amphibian, turtle, and bird (cedar waxwing, flycatchers, common yellowthroat, black-head grosbeak, and pond ducks) species. Snakes may forage on prey species attracted to ponds. It is assumed that invertebrate species will colonize the pond as the site matures.
3. *Location*: The ponds can be isolated or hydrologically connected to streams; however, keep in mind to grade the pond to avoid fish entrapment. Stream side channel pockets resembling a small pond are a variation of the intended purpose. Avoid creating suitable habitat in areas dominated by invasive species such as non-native turtle species (including snapping turtles and sliders) and bullfrogs.
4. *Quantity*: The number and sizes of ponds is often dictated by the wetland mitigation requirements therefore it is not appropriate for this document to provide guidance for this feature. If the number of ponds is an option then it is recommended to provide a mosaic of smaller ponds rather than a single large one.
5. *Construction*: Ponds may have a complexity of woody debris and live thin-stemmed vegetation. The ponds should dry out for at least two weeks during late July and August to reduce the establishment of a bullfrog population. In urban areas, persistent year round water should be avoided to reduce pestilent waterfowl; however, in rural areas year round water may be desirable where the likelihood of bull frogs is less likely. Isolated ponds should have a variety of depths whereas ponds hydrologically connected to fish bearing streams should be graded to drain as flood waters recede. Ponds should be shaded as much as possible to keep the water cool and minimize water temperature variation. Sandy soils surrounding the pond or used to construct islands within the pond may provide turtle egg laying habitat. Flowering and fruit bearing vegetation should be within sight of the pond and preferable at the waters edge.
6. *Suitable example*:

Site managers should expect alteration to plantings and structures by wildlife. Pestilent and invasive species are often attracted to wetland mitigation sites. Design considerations may limit problems with unwanted species, but seldom will an enhanced habitat be free of them. Occasionally, it may be necessary to dissuade, exclude, and perhaps eliminate destructive species. Wildlife can create unexpected changes to the intended design, but these conditions are not necessarily unwanted.

For example, native species like beaver are well-recognized for their role in building and maintaining a species-rich wetland plant and animal community. Their activities contribute to diverse habitat conditions that attract many species and provide an aesthetic quality. In these cases, it may be necessary to implement contingency actions or modify performance criteria for these unexpected, but desirable, conditions.