Guidance for Conserving Oregon's Native Turtles including Best Management Practices

the OREGON CONSERVATION STRATEGY

THE INTENT OF THIS DOCUMENT IS TO FACILITATE BETTER PROTECTION AND CONSERVATION OF OREGON'S NATIVE TURTLES AND THEIR HABITATS.

This document includes recommended **Best Management Practices (BMPs)** for protecting and conserving Oregon's two native turtle species, the western painted turtle and the western pond turtle. While there are opportunities for all Oregonians to become more knowledgeable about and participate in turtle conservation efforts, this document is intended primarily for use by natural resource and land managers, land use planners, and project managers.

The document has been peer-reviewed and the BMPs are supported by scientifically sound information. The BMPs are intended to be practical and cost-effective so that they can be readily used. Adherence to these BMPs does not necessarily constitute compliance with all applicable federal, state, or local laws.

Acknowledgements

This document was produced by the Oregon Department of Fish and Wildlife (ODFW) with significant financial and design contributions from The Port of Portland. Input and technical review was provided by the Oregon Native Turtle Working Group which is comprised of representatives from a variety of natural resource agencies, organizations, and institutions. This document arose out of a recommendation from the 2009 Native Turtle Conservation Forum, organized by the Oregon Native Turtle Working Group and hosted by the Oregon Zoo. More information about the Oregon Native Turtle Working Group can be found at: www.oregonturtles.com/

Contributors:

City of Eugene, City of Gresham, City of Portland Environmental Services, Clean Water Services, Columbia Slough Watershed Council, Metro (Natural Areas Program and Oregon Zoo), Middle Fork Willamette Watershed Council, Multnomah County Drainage District, North Clackamas Parks and Recreation District, Northwest Ecological Research Institute, Oregon Department of Fish and Wildlife, Oregon Parks and Recreation Department, Oregon State University, Oregon Wildlife (Heritage Foundation), Oregon Wildlife Institute, Port of Portland, Tualatin Hills Park & Recreation District, University of Oregon, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geological Survey, and Weyerhaeuser.

A big thank you also to the many Oregonians who reported their turtle sightings and offered their awesome photos for use in this document!

Recommended Citation:

ODFW. 2015. Guidance for Conserving Oregon's Native Turtles including Best Management Practices. Oregon Dept. of Fish and Wildlife. 99 pp.

Cover photos:

Western pond turtles basking
Photo Credit: Simon Wray

Western pond turtle
Photo Credit: ODFW

Western painted turtle
Photo Credit: Grace Alfieri

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Section 1: What are BMPS and Why are They Needed?

Best Management Practices (BMPs) are methods or techniques that have consistently shown results superior to those achieved by other means. A "best" practice can (and should) evolve as improvements are discovered through research and development and through monitoring and evaluation. This process is commonly referred to as "adaptive management".

The guidelines and BMPs in this document are intended to result in better protection and conservation of Oregon's two native turtle species, the western painted turtle *(Chrysemys picta bellii)* and the western pond turtle *(Actinemys marmorata)*. Oregon's native turtles are priority species of conservation concern because they have experienced significant population declines in many parts of their ranges and continue to be highly vulnerable to habitat loss and other anthropogenic impacts.

The BMPs have been peer-reviewed and are supported by scientifically sound information. They are intended to be practical and cost-effective so that they can be readily applied. Some recommended practices are presented as "ideal". These are the science-based recommended highest standard though are less likely to be implemented given constraints such as existing infrastructure, budget, landscape characteristics (e.g., geography, topography), and social and political influences.

While there are opportunities for all Oregonians to become more knowledgeable about and participate in turtle conservation efforts, these BMPs are intended primarily for use by natural resource managers, land managers, land use planners, and project managers.

Adherence to these BMPs does not necessarily constitute compliance with all applicable federal, state, or local laws.

If you are planning to implement a project in or near a perennial (permanent) or ephemeral (intermittent or seasonally drying) wetland, pond, lake, slough, river or other waterbody, and the project is within the known range of our native turtles, the project could affect turtles. Actions that involve ground disturbance, changes in water levels, removal of vegetation, and use of heavy equipment are only a few types of activities known to affect turtles. Just because you don't see turtles on your site doesn't mean they aren't there. Oregon's secretive native turtles hibernate during cold weather and rest (aestivate) on hot summer days, buried in the bottoms of muddy ponds or under leaf litter in shrubby or forested upland areas. They may be visible only during a narrow temperature range and on sunny days when they bask (sunbathe) on fallen trees and tree branches along the margins of rivers, lakes, and ponds.

If you have reason to believe turtles may be present on your site, consider the information in this document and contact your local Oregon Department of Fish and Wildlife (ODFW) wildlife biologist for site specific guidance. See the list of ODFW offices in Appendix A.

The good news is that each activity known to negatively affect turtles can be made to be less harmful by implementing the recommendations in this document. By implementing deliberate measures, together we can help protect and conserve Oregon's amazing native turtles!

Table 1. Example Activities that Affect Turtles

- development (e.g., roads, buildings, sewer lines, stormwater facilities)
- water management (dams, water control structures, groundwater)
- wetland draining, ditching, tiling, filling, excavation
- stream channelization, diversion, stabilization or impoundment
- discharge of untreated stormwater or wastewater
- vegetation management such as mowing and grubbing
- agricultural practices, including livestock grazing
- forestry practices including tree felling
- gravel extraction and pit / settling pond reclamation
- maintenance of constructed ponds
- removal / control of invasive species (plant and animal)
- road siting, construction, improvement, and maintenance
- trail siting, construction, and maintenance
- culvert replacement and maintenance
- fencing projects
- dredging operations and spoils disposal
- beaver dam management or removal
- herbicide applications
- release of chemical contaminants and contaminant clean-up
- planting of trees, shrubs, and ground vegetation
- wetland creation and enhancement
- stream enhancement projects, including placement of large wood
- native fish restoration projects
- upland habitat improvement projects
- wildlife viewing
- recreational activities (e.g., angling, kayaking, disc golf)
- wildlife research activities

Section 2: Native Turtles in Trouble

Worldwide, about 50 percent of all freshwater turtle species are considered threatened, more than any other animal group (Turtle Taxonomy Working Group 2014). Oregon's two freshwater turtle species, the western painted turtle and the western pond turtle (Figures 1 and 2), are identified as priority at-risk species in the Oregon Conservation Strategy (OCS), Oregon's Wildlife Action Plan and statewide framework for conserving fish and wildlife species (ODFW 2006).

Many of the habitats that our turtles depend upon (e.g., freshwater riparian, wetland, and open water areas with associated upland habitats) are also identified in the OCS as priority at-risk habitats. Key turtle habitat elements include aquatic foraging areas, shallow water hatchling rearing areas, basking structures, sparsely vegetated upland areas for nesting, and semi- to heavily vegetated upland areas for overwintering and aestivation (Figure 3).

Figure 1. Identifying Features of the Western Painted Turtle

Photo Credit: ODFW

Photo Credit: Dan Lake

Figure 2. Identifying Features of the Western Pond Turtle.

Photo Credit: ODFW

Head, neck and leg color same as top shell with flecking pattern

Carpace dark brown to olive

Carapace has smooth edge

Plastron creamy yellow usually with dark staining

Photo Credit: Ben Power

Like so many native species across America and the globe, Oregon's turtles are threatened primarily by habitat loss and degradation. Population trends and large-scale patterns of abundance of western painted and western pond turtles in Oregon are difficult to measure, but declines in abundance of both species are believed to be significant given measurable losses in habitat availability (quantity) and habitat function (quality). Habitat loss is largely due to the conversion of land for human uses (e.g., urbanization and agriculture). Habitat degradation is due in part to non-native invasive species. These changes are particularly striking in the Willamette Valley, but have occurred throughout Oregon and within the ranges of both turtle species.

Turtles are Long-Lived. Oregon's native turtles are relatively long-lived, having the potential to live 50 years or more in the wild. Western painted and western pond turtles reach sexual maturity typically between 7 and 12 years of age. As with many other turtle species, they experience naturally high rates of nest failure and hatchling/juvenile mortality. Even small increases in mortality, especially of adult female turtles, can have significant negative impacts on future turtle populations. Although improving the survival of eggs and young is considered very important, reducing the loss of adult turtles is likely even more important for maintaining viable populations into the future.

Threats to Oregon's native turtles (in no particular order) are as follows:

- habitat loss and degradation
- non-native invasive species (plants and animals)
- declines in water quality
- changes in hydrology
- altered natural disturbance regimes (floods and wildfire)
- movement barriers
- population isolation and fragmentation
- predation by habitat generalists (e.g., raccoons, coyotes, corvids)
- mortality from vehicular traffic
- illegal collection and shooting
- release of pet turtles
- harassment, injury, and mortality from domestic pets
- chemical contaminants
- disease
- climate change

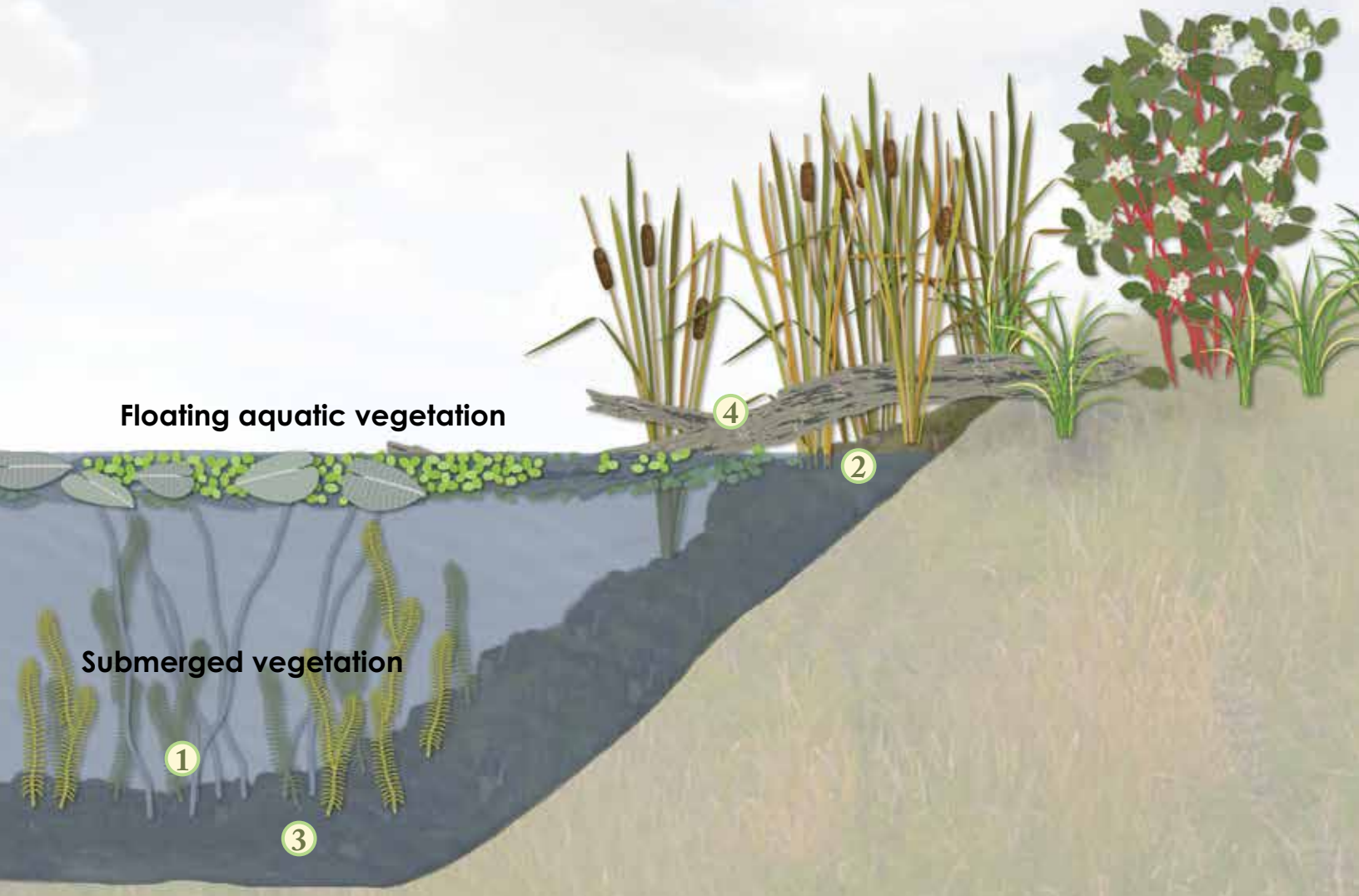
Turtles are important components of the food web. All life stages, including eggs, are important prey for a suite of natural predators (e.g., great blue heron, mink, and otter). Turtles are consumers of a variety of plant and animal material, and are beneficial scavengers. Turtles are also important culturally and are symbols of our natural heritage. Opportunities exist for all Oregonians to ensure our native turtles persist, as they are important ecologically to the overall health and biodiversity of our environment, and so they can be enjoyed by present and future generations.

If You Find A Turtle, Please Do The Following:

1. Make a written note of the exact location, date, and time of day found.
2. If possible, take a photograph of the turtle for species verification purposes.
3. As soon as possible, report this information to your local ODFW office and/or fill out the turtle sighting report form located at: www.oregonturtles.com/
4. If the turtle is in immediate danger (e.g., in the middle of a road), move it a short distance out of harm's way, pointing it in the same direction it was headed. It is not necessary to put a turtle in water as they are very terrestrial in nature.

Figure 3.

Where Turtles are Found



1. **Foraging/hiding (adults)**
   Deep water with soft, muddy bottom
2. **Foraging/hiding (juveniles)**
   Shallow water bottom
3. **Overwintering**
   Bottom of pond or in forest
4. **Basking**
   Rock and downed wood
5. **Nesting**
   Bare ground, low vegetation, sunny
6. **Aestivating**
   Moist forest/shrubs, under wood/duff

Section 3: Species Status

Native Turtles

Both the western painted turtle and the western pond turtle are classified as "Sensitive-Critical" on Oregon's State Sensitive Species List. They are priority species in the Oregon Conservation Strategy (OCS), and are categorized as "Nongame Wildlife Protected" by Oregon Administrative Rule 635-044 (see Table 2). It is unlawful for any person to hunt, trap, pursue, kill, take, catch, angle for, or have in possession, either dead or alive, whole or in part, any "Protected" nongame species.

The western pond turtle (previously known as the northwestern pond turtle) is a U.S. Fish and Wildlife Service (USFWS) "Species of Concern" throughout its range and both turtle species are classified as "Sensitive Species" by the U.S. Forest Service (USFS) and by the U.S. Bureau of Land Management (BLM) in Oregon. The Oregon Natural Heritage Program (ORNHP) ranks both species as "S2" [imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences].

In 2013, the Center for Biological Diversity listed the western pond turtle as one of the 10 most vulnerable, least protected reptiles in the United States. See www.biologicaldiversity.org/news/press_releases/2013/amphibians-and-reptiles-09-18-2013.html

The concern over declining populations of pond turtles throughout their range motivated a listing petition under the federal Endangered Species Act (ESA) in 1992. The petition was denied primarily due to the species' broad distribution, occurrence in human-modified environments, and lack of evidence supporting allegations of specific threats such as a lack of juvenile recruitment (USFWS 1993). In July 2012, the Center for Biological Diversity filed a petition to list the pond turtle under the federal ESA based on the following threats: habitat alteration and destruction, overutilization, disease or predation, inadequacy of existing regulatory mechanisms, and other factors (i.e., non-native turtles, chemical contaminants, and population isolation). A USFWS decision on the petition is pending.

Table 2. Status of the Western Painted & Western Pond Turtle in Oregon (as of March 2015)

Species	ODFW	USFWS	USFS	BLM	Natural Heritage State Rank
Western Painted Turtle	Sensitive - Critical, OCS Strategy Species, Protected Nongame Wildlife	-	Sensitive	Sensitive	S2 (imperiled)
Western Pond Turtle	Sensitive - Critical, OCS Strategy Species, Protected Nongame Wildlife	Species of Concern	Sensitive	Sensitive	S2 (imperiled)

Non-Native Turtles

Unfortunately, a variety of non-native turtle species occur in the wild in Oregon. Box turtles, tortoises, softshell turtles, musk and mud turtles, map turtles, eastern and midland painted turtles, cooters, red-eared and yellow-bellied sliders, and common and alligator snapping turtles have all been observed in and/or removed from the wild. To date, only two non-native turtle species are known to successfully reproduce in the wild in Oregon: the red-eared slider *(Trachemys scripta elegans)* and the common (eastern) snapping turtle *(Chelydra serpentina)*. These species (see Figures 4 and 5) are considered invasive by the State of Oregon and are highlighted as such in the Oregon Conservation Strategy. Common traits of invasive species include the ability to survive and reproduce in the wild, and known or suspected harmful effects on native species and habitats.

Unfortunately, the red-eared slider appears to be already widely established in the wild throughout western Oregon waterways and nesting has been confirmed in numerous locations. The common snapping turtle is on the Oregon Invasive Species Council's "100 Worst" list of invasive species to be prevented from establishing in Oregon. Although snapping turtles have been documented in many waterbodies throughout western Oregon, nesting has only been verified at a few locations.

Figure 4. Identifying Features of the Red-eared Slider

Photo Credit: Myron Wells

Red stripe behind eye

Yellow stripes on head, neck and legs

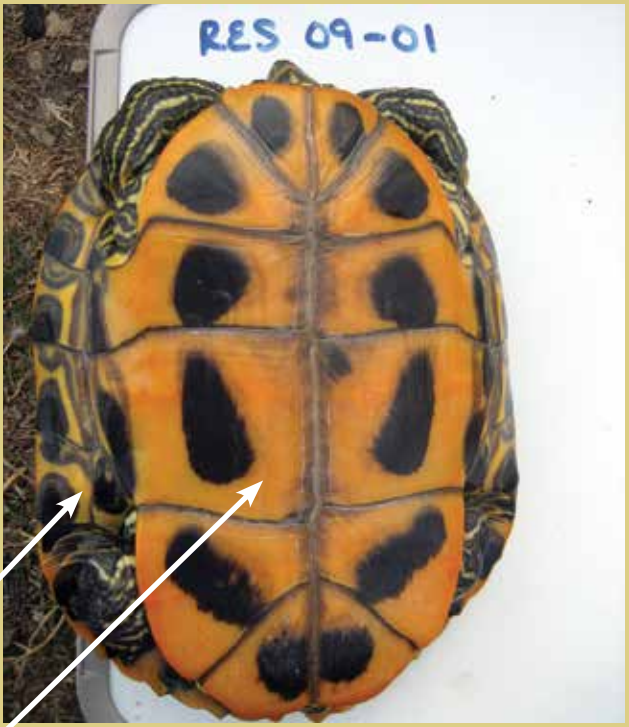


Photo Credit: Laura Guderyahn

Carpace dark brown with a serrated edge

Bridge yellow with dark blotches

Plastron yellow with dark blotches

It is illegal to release ANY non-native wildlife species into the wild. Many non-native species are invasive in nature. "Prohibited" non-native species are illegal to import, transport, buy, sell, give away, barter, or possess in Oregon without a permit from ODFW.

Non-native species deemed a threat to Oregon's native species, including the red-eared slider and the common snapping turtle, have been categorized as "Prohibited Nonnative Wildlife" (OAR 635-056) and are regulated by ODFW. It is unlawful to be in possession of (import, transport, buy, sell, give away, or barter) any live "Prohibited" non-native species, except as authorized by an ODFW Prohibited Species Permit.

Non-native species determined to pose no threat to any of Oregon's native fish and wildlife or their habitats are referred to as "Non-Controlled Nonnative Wildlife" and are legal to possess, import, transport, buy, sell, give away, or barter in Oregon. Some species of non-native wildlife have not yet been evaluated for their potential adverse effects on Oregon's native flora and fauna. Until a thorough review of a non-native species occurs by ODFW, the species is treated as a "Prohibited" species.

Non-native turtles have made their way to Oregon over the years primarily through the pet trade industry. Others entered the state as people moved to Oregon, bringing their pet turtle(s) with them. Non-native turtles have been released intentionally into local wetlands and streams while others have escaped accidentally from unsecured outdoor facilities.

Figure 5. Identifying Features of the Common Snapping Turtle

Photo Credit: ODFW

Carpace brown to black, serrated edge

Very large head and thick legs

Bumpy skin

Long serrated tail

Very small plastron compared to body size

Very large claws

Photo Credit: ODFW

If you see a turtle on your project site that may be a non-native species, call your local ODFW wildlife biologist (see Appendix A).

Oregon Native: Western Painted Turtle

(Chrysemys picta bellii)

Photo Credit: Grace Alfieri

Range in Oregon: Western painted turtles are narrowly distributed in the northern portion of the state. They are found in north-central and north-eastern Oregon, primarily in the Columbia River Basin, and in the northern portion of the Willamette River Basin. Though most known populations occur north of Salem, western painted turtles have been documented south of Eugene. Western painted turtles often co-occur with western pond turtles in aquatic habitats in northwestern Oregon.

Specific Habitat: Western painted turtles require both aquatic and terrestrial habitats. Selected aquatic habitat is typically slow-moving and shallow water, including streams, canals, sloughs, small lakes, and ponds with surface or emergent vegetation and a muddy substrate. Terrestrial habitat is used primarily for nest excavation and egg deposition. Nest sites are sparsely vegetated, often with a southern exposure and little or no overhead tree canopy, usually within 325 ft (100 m) of occupied aquatic habitat. A broad array of substrates is used for nesting. Soils are typically compact, but well-drained. Turtle nesting may occur in small open areas along trails, levees, roadbeds, fields, grasslands, stream banks, and within utility right-of-ways. Little is known of habitat use by hatchlings, but evidence suggests they use shallower aquatic habitats after spending time in and near the nest chamber. Painted turtles overwinter at the bottom of wetlands and other waterbodies, but they may also hibernate in terrestrial habitats (Gervais et al. 2009).

Threats: Factors limiting western painted turtle populations include loss of wetland and upland habitat, habitat degradation from invasive plants, and elevated predation of nests and hatchlings. Nest predation is believed to be elevated in urban environments due to greater abundance of mid-sized predators adapted to human disturbance such as raccoons, skunks, and coyotes, but there has been little quantification of these threats. Reduced nest site availability is a concern as well, particularly in urban environments. While it has been documented that introduced non-native fish species and bullfrogs eat hatchling turtles, the extent to which this occurs is unknown and the importance of this predation is not well understood. Adult turtles have few natural predators (e.g., river otter). Losses from road-kill, poaching, and other human-caused mortality are considered greater threats to adults than natural sources of mortality. With a large portion of Oregon's western painted turtle population occurring in or near urban areas, road mortality, limited connectivity between nesting, overwintering, aquatic, and dispersal habitats; competition from introduced turtle species, human disturbance from recreational uses of aquatic systems, and effects from chemicals are of particular concern. Although wetland systems are often partially protected by local, state, and/or federal land use and wetland laws, the adjacent upland areas that are crucial for reproduction are

frequently not protected. A possible threat may be the loss of genetic uniqueness because of the release of pet painted turtles, but a greater threat is from the introduction of disease from pet trade turtles and the direct competition that introduced turtles have on native species. See Gervais et al. (2009) for more information.

Oregon Native: Western Pond Turtle

(Actinemys marmorata)

Photo Credit: ODFW

Range: The western pond turtle's range extends from northwestern Baja California, Mexico, north to Puget Sound, Washington. It is restricted to areas west of the Sierra Nevada and Cascade Mountains with a few exceptions. In Oregon, the pond turtle occupies regions primarily west of the Cascades, at elevations below approximately 6,000 ft (1800 m) (Nussbaum et al. 1983). The largest populations in Oregon are found in the Willamette, Umpqua, Rogue, and Klamath River drainages.

Specific Habitat: The western pond turtle requires both aquatic and terrestrial habitats. It uses permanent and seasonal aquatic habitats including rivers, sloughs, lakes, reservoirs, ponds, and irrigation canals. The species moves onto land for nesting, overwintering, dispersal, and aestivation. Overwintering sites include shrubby/forested areas, the bottom of muddy ponds and other aquatic habitats, and undercut banks along streams. Nesting typically occurs within 325 ft (100 m) of aquatic habitat in areas with compact well-drained soil, sparse vegetation, and good solar exposure. Turtle nesting may occur in small open areas along trails, levees, roadbeds, fields, grasslands, stream banks, and within utility right-of-ways. See Rosenberg et al. (2009) for more information.

Threats: Major factors cited as limiting western pond turtle populations include loss of aquatic habitats, elevated nest and hatchling predation, reduced availability of nest habitat, and road mortality. Predation of nests may be above historical levels in human-altered landscapes due to greater abundance of medium-sized predators. Predation of hatchlings by introduced American bullfrogs and largemouth bass has been confirmed, but it is not known how often this occurs and its importance is not well understood. Road mortality is an important threat particularly in urban and recreational areas, and is one of the few known sources of mortality on valuable sexually mature adults. Release of pet turtles to natural areas is a growing threat and may result in increased competition and disease transmission. Removal of pond turtles by the public for pets may cause local declines. Connectivity between aquatic and upland habitats increasingly becomes a concern as urban and agricultural development continues to fragment landscapes. Agricultural and vegetation management activities can result in nest destruction and mortality to adults, in particular adult females. Recreational activities within or adjacent to aquatic and nesting habitats are an important concern. Turtles have been accidentally hooked by fishermen and illegal shooting of pond turtles has been documented. Research and survey work

may affect pond turtles by disrupting behavior, increasing the risk of disease transmission, and potentially influencing predator behavior.

Oregon Invasive: Red-eared Slider

(Trachemys scripta elegans)

Photo Credit: ODFW

The red-eared slider occurs naturally throughout much of the eastern United States. It historically has been and still is the most commonly sold turtle species in the pet shop industry and is farm raised in several southern states for export to foreign food and pet trade markets. Sliders have been released accidentally and intentionally in many areas outside their natural distribution, including Oregon. As a result, they are now established throughout the state and successful breeding populations have been documented in numerous locations. Adult sliders grow to about 11.5 inches (29 cm) in carapace length. Sliders are found in ponds, lakes, sloughs and quiet stretches of rivers and streams.

Sliders compete directly with Oregon's native turtles for food, basking habitat, and space. They have been implicated in the local die-off of western pond turtle populations in Washington through spread of disease. While the effects of red-eared sliders on Oregon's native turtles needs more investigation, given their distribution, relative abundance, and breeding success they are considered a threat to Oregon's native turtles. They are sympatric with both western painted and western pond turtles and it is not uncommon to find them out-numbering native turtles. Just like Oregon's native turtle species, the red-eared slider's diet consists of aquatic invertebrates, worms, snails, crayfish, small fish, and amphibian tadpoles/larvae. They also consume plant material and scavenge carrion. They need to bask regularly and are often observed using the same basking structures as Oregon's native turtles. They also use the same type of upland habitats for nesting. Being of larger body size, sliders lay more eggs than the western painted and western pond turtle, up to 25 eggs per clutch. There is anecdotal evidence that sliders lay their eggs several weeks earlier than Oregon's native turtles which may adversely affect nest predation of native turtle nests.

The red-eared slider is categorized as a "Prohibited" non-native species by ODFW because of known and/or potential harmful effects on native species (plants and animals). Red-eared sliders found in the wild should be reported to ODFW and, if possible, captured and immediately brought to ODFW. It is unlawful to have a red-eared slider without ODFW-authorization. More information can be found at: www.dfw.state.or.us/conservationstrategy/invasive_species/red-eared_slider.asp

Oregon Invasive: Common Snapping Turtle

(Chelydra serpentina)

Photo Credit: ODFW

The common (eastern) snapping turtle is native to North America east of the Continental Divide. The species is still regularly harvested in many states for food, though many are now exported to foreign food markets. Snapping turtles are also kept by some people as "unusual" pets. The species has been introduced into aquatic habitats in several parts of the Northwest, including Oregon. Common snapping turtles have been documented throughout the state, primarily in Willamette Valley ponds, wetlands and riverine systems that tend to be warmer and slower-moving (e.g., Tualatin River). That said, they have been discovered and removed from the middle reach of the Clackamas River, the Columbia River mainstem, the lower Sandy River, and the Middle and Coast Forks of the Willamette River. Although nesting has only been confirmed at a few locations to date, nesting is suspected at many of these locations. Common snapping turtles have the potential to grow up to 19 in (48 cm) in carapace length. The largest snapping turtles removed from the wild in Oregon to date measured 16.5 in (42 cm) carapace length and weighed 30 lbs (13.6 kg) and 15.5 in (39 cm) carapace length and weighed 32 lbs (14.5 kg). Snapping turtles occupy the same aquatic habitat types as Oregon's native turtles. They nest in similar upland habitat and lay many more eggs then our two native species. Mean clutch size in Oregon is 50 eggs, but clutches have been known to exceed 100 eggs. Snapping turtles are highly aquatic in nature, usually basking only on the water's surface, and making few out-of-water movements. Snapping turtles are omnivorous, eating fish, amphibians, reptiles, aquatic invertebrates, small mammals, and birds such as waterfowl, as well as plant material and carrion. Although predation of western painted and western pond turtles has not been confirmed in Oregon, it is likely as semi-aquatic turtles are a documented prey item within the snapping turtle's native range.

An Invasive Species Risk Assessment was completed for the common snapping turtle in 2010 for the Oregon Invasive Species Council. This document can be found at: www.oregon.gov/oisc/docs/pdf/snapping_turtle_ra.pdf. While the effects of common snapping turtles on Oregon's native turtles needs more investigation, given their distribution, relative abundance, and breeding success they are considered a threat to Oregon's native fish and wildlife, including turtles.

Snapping turtles found in the wild should be reported to ODFW. Because of the potential for them to inflict a painful and damaging bite, only experienced turtle handlers should attempt to capture snapping turtles. Any captured snapping turtles should be immediately brought to ODFW. It is unlawful to have a snapping turtle without ODFW-authorization. More information on the invasive snapping turtles can be found at: www.dfw.state.or.us/conservationstrategy/invasive_species/snapping_turtle.asp

Section 5: Turtle Activity Through the Seasons

Spring (March – April)

- In the early spring, turtles emerge from hibernation to begin foraging for food. Turtles that overwintered on land and hatchling turtles that have emerged from the nest move to aquatic habitats.
- Turtles bask on logs, rocks, banks, and floating vegetation, especially when water temperatures are cool. Snapping turtles usually only surface bask.
- Many sexually mature turtles engage in courtship and mating activities.

Summer (May – August)

- Gravid females lay their eggs. Nesting activity peaks in June and July, but has been observed from mid-May through early September. Turtles typically nest between late afternoon and late morning when light is low, however, turtles have been observed nesting at all hours of day and night, and in a variety of weather conditions. Once eggs are deposited in the ground, turtles leave the nesting area and in most cases return to the water. There is no parental care of eggs or young.
- Eggs incubate in soil warmed by the summer sun. Turtle gender is determined by the temperature of the egg during incubation.
- During periods of hot, dry weather, typically in mid to late summer (after nesting), turtles spend less time basking. Some enter a state of dormancy called aestivation, becoming inactive at the bottom of wetlands and other waterbodies, or on land in cool forested or shrubby habitats under leaf litter and decayed logs.

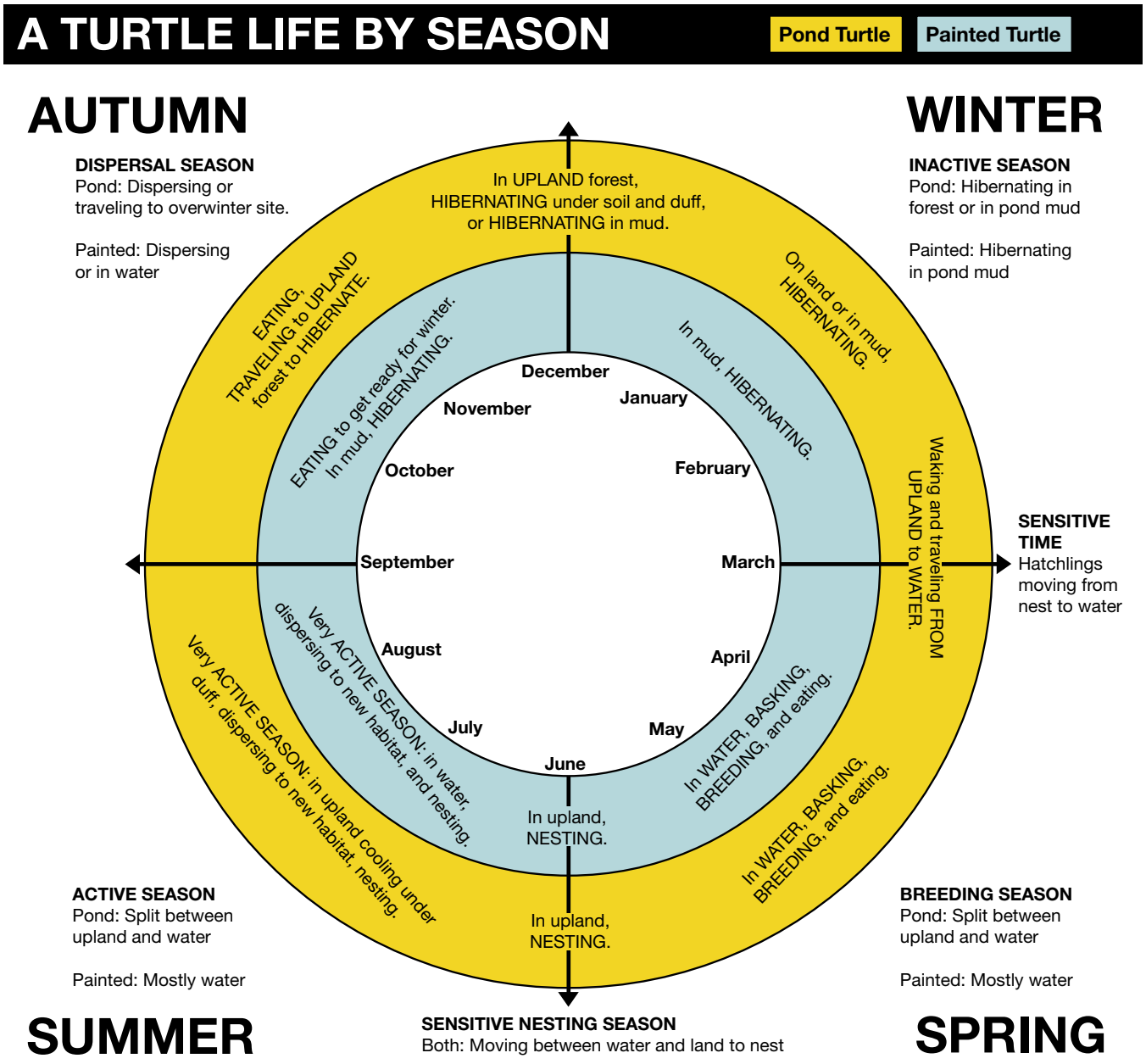
Autumn (September – October)

- Eggs typically hatch in September and October, about 75 days after being laid, though development may take up to 125 days depending on weather conditions and site-specific nest characteristics (e.g., amount of solar radiation a nest receives). Eggs hatch sooner in warm, sunny conditions compared to cool, cloudy conditions. Eggs that don't get enough warmth or are subject to frequent or extended periods of inundation may have lower hatching success or may not hatch at all.
- Fully-formed hatchling turtles survive on the yolk sac, which is slowly absorbed as they grow. Some hatchlings emerge from their nests in the fall and move to water, although most overwinter in their nests and emerge the following spring.
- Courtship and mating occurs.
- Turtles forage, storing up winter fat reserves.
- Turtles move to hibernation habitats (aquatic or upland) in mid to late fall.

Winter (November – February)

- Turtles hibernate and are inactive during the winter months.
- During spells of unseasonably warm and sunny weather in winter months, some turtles emerge from hibernation to bask. They then return to their overwintering locations.

Figure 6. Annual Activity Cycle of Oregon's Native Turtles



What Is Aestivation?

Aestivation is the summer equivalent of hibernation. It is a form of torpor, dormancy, or "sleep". Animals that aestivate do so to escape harsh conditions in their environment. Aestivation is most prevalent in reptiles and amphibians and is a strategy to avoid over-heating or dehydration. Reptiles use 90-95% less energy when they are aestivating. In Oregon, western pond turtles are known to aestivate on land during periods of hot dry weather; western painted turtles may also aestivate on land though it has not yet been confirmed. Aestivation is often triggered by the drying up of aquatic habitat. Terrestrial habitats including shrubby or forest edge habitat under leaf litter, grassy vegetation, logs or shrubs are selected. Typically, aestivation occurs within 500 ft (150 m) of aquatic areas. Periods of aestivation vary among individuals, lasting only a couple of days to several weeks.

Section 6: Turtle Conservation Goals

All Oregonians can participate in the protection and conservation of western painted and western pond turtles. The Oregon Conservation Strategy, Oregon's statewide conservation framework, recommends several conservation actions to address threats and limiting factors. Conservation assessments completed for both species (Gervais et al. 2009 and Rosenberg et al. 2009) also outline recommended actions to achieve turtle conservation goals. Turtle conservation goals are as follows:

- Improve quality of aquatic and terrestrial habitats.
- Improve and create nesting habitat, hatchling habitat, and basking structures.
- Increase connectivity between known turtle populations.
- Reduce road-related mortality.
- Reduce illegal collection / removal from the wild by the public.
- Manage recreation near turtle-use areas to reduce disturbance.
- Reduce or eliminate populations of introduced and invasive animal species, especially red-eared slider, snapping turtle, American bullfrog, largemouth bass, carp, and nutria.
- Reduce or eliminate the release of pet turtles to maintain genetic integrity and prevent introduction of disease.
- Develop and implement a larger-scale research and survey strategy to assess and monitor turtle populations.
- Develop and implement species conservation plans to facilitate effective coordination conservation actions across all land ownerships and jurisdictions.

A western pond turtle hatchling emerging from the nest chamber.

Photo Credit: Dan Rosenberg

Section 7:
General BMPS for Conserving Native Turtles

The following Best Management Practices (BMPs) are general in nature and are intended to be a starting point for achieving over-arching turtle conservation goals. Site-specific BMPs should be developed for and tailored to a specific project with input from a professional wildlife biologist knowledgeable about turtle ecology and/or ODFW's local wildlife biologist.

1. **Create and enhance habitat for Oregon's native turtles,** including connections between aquatic and terrestrial habitats that provide turtles with safer options for moving across the landscape. See the Creating and Enhancing Turtle Habitat section (Section 8) for information on habitat elements and features needed by turtles and recommended creation and enhancement techniques.
2. **Avoid direct modifications to waterbodies and waterways** (e.g., clearing, channelizing, filling, draining, ditching, tiling, excavating) except when habitat restoration is the goal and long-term benefits will outweigh short-term impacts.
3. **Avoid altering hydrology of and causing increased sedimentation rates into waterbodies, except for short-duration actions that are linked to habitat restoration efforts.** For example:
    a. Minimize net increases in impervious surface.
    b. Minimize soil compaction.
    c. Design storm water management plans to minimize long-term hydrologic changes to native turtle habitat (often by maximizing infiltration).
    d. Treat all stormwater before it is discharged into turtle habitat.
    e. Ensure adequate recharge of groundwater.
4. **Avoid or minimize disturbance from public access or other human activities** in and around wetlands, especially wetlands known to support turtles and other special status species. If public access is allowed, design access routes and features to minimize disturbance to basking and nesting turtles, and other wildlife. For example, creatively use shrub plantings to minimize line-of-sight disturbance while also providing targeted public access and viewing opportunities where deemed least impactful.

A western painted turtle basking.

Photo Credit: Patrick Birkle

5. **Provide native vegetation buffers around wetlands and other waterbodies,** especially those supporting native turtles, ideally 1,320 ft (400 m) wide. Allow some areas of open canopy to allow solar exposure for turtle basking and nesting habitat. A site-specific buffer design is often necessary since every site is unique and both vegetated and open areas are desirable.
6. Where adequate buffers are not feasible or are not provided, **utilize seasonal "no-entry" restrictions to minimize human-related disturbances** in key turtle habitats (nesting, overwintering) or during turtle nesting season.
7. Consider placing wetlands and other waterbodies supporting breeding populations of turtles in **permanent conservation ownership or easements to protect the site in perpetuity. Include associated buffers and adjacent upland habitats in the easement area.** These sites likely have high existing biological diversity and can achieve broader fish and wildlife conservation goals.

What is a Habitat Buffer?

A "buffer" is commonly used to describe a zone or area adjacent to or surrounding an important habitat feature such as a stream, wetland, or known wildlife breeding / nest site. While the buffer often provides valuable habitat itself, it is mainly intended to protect the integrity of the important habitat feature. Buffers may be even or irregular in shape and wider or narrower in some locations. Buffers are delineated and managed in a manner to protect and conserve the important habitat resource values and functions from adjacent land uses and/or threats, for example human development, roads, and pollution (chemical, light, noise). Study and debate on effective buffer widths are on-going, but in summary, recommended widths are dependent on resource protection goals and site-specific condition. When it comes to buffer widths, the general rule is wider is better and something is better than nothing.

This western painted turtle was one of eight observed at a mitigation wetland site.

Photo Credit: James Cook

Section 8:
Creating and Enhancing Habitat for Turtles

Turtle habitat creation and enhancement efforts should focus on the following eight essential elements critical for turtle survival and success:

- sunlight
- nesting habitat
- aquatic habitat
- basking structures
- aestivation habitat
- overwintering habitat
- close proximity of aquatic and terrestrial habitat components
- safe movement corridors between aquatic and terrestrial habitats

Below is more specific information on the eight essential turtle habitat elements and BMPs when providing for each.

Sunlight

Because they are ectotherms, turtles need periods of direct sun exposure for proper digestion, to maintain shell health, and to regulate body temperature. Sun exposure is also critical to reproductive success and recruitment. Warmth from direct sunlight is needed for proper formation of eggs inside female turtles and for embryo development after eggs are laid. Warmth from direct sunlight triggers emergence of hatchlings from the nest chamber and movement to aquatic habitat. Warmth from sunlight also stimulates turtles to come out of hibernation in the springtime and begin foraging for food.

Aquatic and upland areas that are completely shaded are not likely to be used by turtles, except when hibernating or aestivating. Tree and shrub planting in riparian/wetland buffer zones to increase shade is often a tool used to meet water quality requirements and fish habitat restoration goals. Though there are many ecological benefits to heavily shaded, vegetated riparian areas, it is also beneficial to leave a portion of the riparian/wetland buffer area in a more open or early successional habitat condition, particularly on south- and southwest-facing aspects, for turtles and other species that require these open, sunny areas for part of their life cycle (e.g., pond-breeding amphibians, native bees). For more information on creating and enhancing nesting habitat for turtles, see the Nesting Habitat section below. General ideas and suggested techniques to create and maintain proper sunlight conditions for turtles are as follows:

1. **Create sunny areas along the edges of ponds and other waterbodies** where they are currently lacking by trimming vegetation or selectively removing trees and shrubs. Target northerly edges and other areas that have the potential to receive the most sunlight. Trees can be girdled to promote snag creation and eventual input of large wood.
2. **For projects involving re-vegetation of riparian areas, other aquatic habitats, and nearby upland slopes, allow some areas to remain completely to partly open and sunny** to provide basking and nesting opportunities for turtles.

Western painted turtles basking in the sun.

Photo Credit: Linda Vanoudehaegen

Western pond turtles basking in the sun.

Photo Credit: Keith Kohl

A western pond turtle basking.

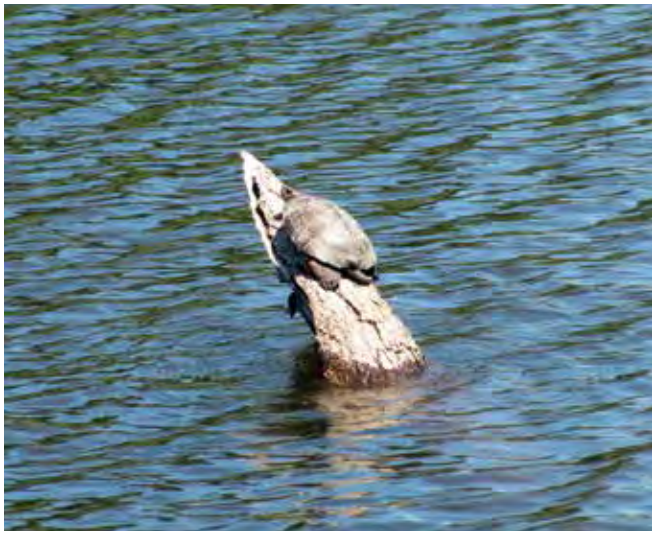


Photo Credit: USFWS

3. **Restore natural disturbance regimes (e.g., flooding, fire) to the extent practicable to create and maintain early successional habitat features.** Periodic disturbance from flooding and fire (wild or prescribed) creates and maintains bare ground and early successional vegetative conditions. Promoting and allowing herbivory and dam building activity by American beaver are an excellent means to this end. In the absence of periodic flooding and fire, disturbance regimes can be mimicked, though nothing can truly imitate natural disturbance processes.

Nesting Habitat

Suitable nesting habitat is essential for turtle reproduction and protection and maintenance of nesting habitat is critical to the survival of turtle populations (Bury et al. 2012). Turtles nest in areas with abundant sun exposure and little or no shrub or overhead tree canopy cover that would shade the nesting site. Nesting sites tend to have sparse, low-growing vegetation consisting of patchy grass and forbs, but bare soil is preferable. Turtles will nest wherever sufficient sun is perceived, but most turtles select south or southwest facing aspects. While turtles will nest on steep slopes, nests are usually located on slopes less than 15 percent. Soil types at known turtle nest sites vary, but typically include a high clay content, sandy loam, and gravelly cobble. Most nesting occurs within 325 ft (100 m) of occupied aquatic habitat. Although the majority of nest sites are within 164 ft (50 m), this may be a function of habitat encroachment by the built environment. Pond turtles have been documented nesting 1318 ft (402 m) from occupied aquatic habitat (Rosenberg et al. 2009) and painted turtles have been documented nesting 820 ft (250 m) from occupied aquatic habitat (Gervais et al. 2009). Some female turtles exhibit nest site fidelity, though this may correlate more to limited availability and accessibility of

suitable nesting habitat. Ideal suitable nesting habitat is in relatively close proximity to aquatic habitat, above the annual high water level. While turtle eggs and hatchlings can tolerate some degree of inundation during high-water events, hatching and post-hatching emergence survival rates are higher at sites that are inundated for a shorter period of time or not at all. Ideal nest sites are safely accessible by female turtles (e.g., no roads in between aquatic and nesting areas), provide some hiding cover from potential predators, and are subject to occasional, but not frequent and significant, ground and vegetation disturbance. Areas managed specifically for turtle nesting habitat ideally would have restricted public access at least during turtle nesting season.

Recommended BMPs for creating and enhancing nesting areas are:

1. **Protect and maintain known turtle nesting areas. Create new areas of nesting habitat.** Protecting and maintaining nesting areas is a top priority in turtle conservation efforts. Known turtle nesting areas should be protected from actions that would otherwise make the habitat unsuitable or subject nesting females, developing eggs, or emerging young to increased levels of predation, human related mortality, and illegal collection. Create and maintain areas of bare ground with low-growing sparse vegetation and little or no overhead tree canopy that receive full solar exposure, preferably south-facing. It is best to add to existing nesting habitat or to create nesting habitat near known nesting areas to increase the likelihood that females will use the nest site immediately.

Figure 7. Characteristics of Suitable Turtle Nesting Habitat.

Photo Credit: ODFW

Target areas that are flat or gently sloping within 325 ft (100 m) and no farther than 656 ft (200 m) from wetlands and other waterbodies occupied by turtles; targeted areas should rarely flood. Generally, the closer the nesting area is to turtle aquatic habitat the better. When managing a site for native turtles or multi-species benefits, certain areas ideally would be designated and managed specifically for turtle nesting and formalized in a site management plan.

To create new areas of turtle nesting habitat at this site, vegetation was removed and the ground scraped.

Photo Credit: ODFW

Creating New Nesting Habitat.

Creation of new nesting habitat typically involves removal of tree and/or shrub cover. Vegetation removal should be conducted in a manner that minimizes unintended harmful impacts to other protected species such as migratory birds and their active nests. After removal of vegetation, the ground will likely need to be disturbed through scarification methods (e.g., scraping with equipment or hand tools) to create areas of bare ground. Removal of the surface material from the site may help reduce the invasive plant seedbed.

2. **Consider bringing in soil to create or enhance nesting areas**. Depending on site-specific conditions, it may be helpful to import soil. Any imported material should be clean and weed-free. Ideally the material would be washed to minimize translocation of invasive pant species. Till / mix small gravels into the soil to loosen it up and help keep vegetation down. Adding a layer of fine gravels or clay soil can further suppress vegetation growth. Sandy soils, which do not promote the formation of nest chambers well, can be amended with native silt loam to improve substrate conditions. See Table 3 for recommended soil / substrate mix for turtle nesting areas.

Table 3. Recommended Turtle Nesting Soil / Substrate Mix	
Soil/Substrate Type*	**Percent of Total Mix**
Fine Clay	25 or less
Loam	25
Sand	25 - 50
Small Aggregate	25 or less

* Use of native (on-site) soils is preferable to prevent introduction of different weeds and soil microbes. Ideal aggregate (gravel) size is ¼ in (0.6 cm) minus (rounded if available), but expert recommendations range from ¾ in (2 cm) to 1/8 in (0.3 cm). The purpose of the aggregate is to aid in weed suppression.

Importing material to create nesting habitat.

Photo Credit: City of Portland Environmental Services

Inspecting the imported nesting material.

Photo Credit: City of Portland Environmental Services

Properly installed silt fencing can help prevent nesting material from accidentally entering adjacent wetlands during construction.

Photo Credit: City of Portland Environmental Services

Turtle nesting habitat one year post-construction shows minimal plant growth.

Photo Credit: ODFW

Soil Amendment Tips.

When importing fill, ideally deposit in mounds measuring at least 20 ft x 20 ft (6 m x 6 m) and ranging from 12 in (30 cm) to 36 in (91 cm) deep. A larger area of suitable nesting habitat is generally better than a single smaller one, but multiple nesting areas are better than a single area. Locate nest mounds on flat or gently sloped ground with no overhead tree cover in areas that receive full or nearly full sun.

An intact turtle nest.

Photo Credit: City of Portland Environmental Services

An excavator is used to move the nesting material into place.

Photo Credit: Calapooia Watershed Council

Before enhancement, this site was infested with invasive plants and lacked basking structures and nesting habitat.

Photo Credit: Calapooia Watershed Council

A close-up of imported nest material.

Photo Credit: ODFW

3. **If planting in turtle nesting areas,** only plant herbaceous species that reach less than 2 ft (0.5 m) in height, such as native bunchgrasses and wildflowers. These species naturally leave bare areas between plants. See Appendix C for a list of recommended plants. Aim for no more than 40 percent low-growing herbaceous plant cover. Ideally woody vegetation would not be planted at all on areas targeted for turtle nesting, but if required, plant only shrubs and plant sparsely, i.e., not more than 15-20 per acre (6-9 per hectare). A few shrubs may offer cover for gravid females and hatchlings that emerge from the nest. The ideal species mix will depend on site-specific conditions including soil type. Avoid species that spread quickly, especially those that have extensive root systems or are rhizomatous.

A female western pond turtle in suitable nesting habitat.

Photo Credit: Matthew Wolfe Greer

4. **Withhold irrigation on sites being managed for nesting habitat** to reduce and/or delay plant growth and keep plants sparse and lower in stature. Frequent irrigation could delay embryonic development and result in lowered egg hatch rates.

5. **Maintain nesting areas to retain suitability through time.** In the absence of natural disturbance regimes (flood or fire), turtle nesting habitat almost always requires some level of active maintenance to preserve ideal vegetation characteristics. Exceptions are sites considered highly disturbed already, for example gravel fill areas, dredge spoils sites, and road shoulders where soils tend to be amended, compacted and regularly disturbed. These types of sites are not prone to vegetative growth. Periodic (e.g., every 2-3 years) scraping, raking, spraying with herbicides, hand-pulling, mowing, or controlled grazing can be used to maintain patches of bare ground, keep vegetation height low, keep out reed canarygrass and other encroaching weeds, and remove shrubs and trees that will eventually shade the area. Maintain nesting habitat so that overall herbaceous cover is no more than 40 percent. Total shrub canopy cover should be no more than 20 percent and tree canopy cover no more than 10 percent. Smaller areas of turtle nesting habitat ideally would have no shrub or tree cover.

6. **Time creation, enhancement, and maintenance of nesting areas with turtles in mind.** New nesting areas in currently unsuitable habitat can be created at any time, but ideally would be completed by early May so the area is available to gravid females of the year for egg laying. Enhancement and maintenance of existing nesting areas or areas where nesting is suspected should

be timed to avoid impacts to already laid eggs, hatchlings overwintering in the nest, emerged hatchlings present near the nest, and nesting females. This timeframe is generally from April 1 through May 15. That said, turtles could be encountered even during this period so be on the lookout for turtles whenever working in suitable nesting habitat. Another option is to temporarily preclude females from nesting in the area scheduled to be enhanced. This can be achieved by using exclusion fencing such as silt fencing or by placing hardware cloth over the areas to discourage nesting attempts. The hardware cloth should be flush with the ground, firmly staked, and checked occasionally to prevent unintended entrapment of other wildlife. Ideally, nesting habitat would be monitored by a qualified wildlife biologist to try to determine turtle response (use) to creation, enhancement, and maintenance efforts. Coordinate with your local ODFW wildlife biologist. Consider also using remote wildlife cameras to detect turtle nesting activity.

Periodic scraping is one method to maintain nesting habitat suitability.

Photo Credit: Patrick Blanchard

How Much Nesting Habitat do Turtles Need?

There is no specific minimum amount of suitable nesting habitat required by an individual female western painted or western pond turtle. It only takes one small spot of suitable nesting habitat within the larger terrestrial habitat framework. That said, a larger area of suitable nesting habitat is considered better than a smaller area and multiple areas of suitable nesting habitat are better than a single area. More suitable habitat translates into more nesting opportunity for gravid females. More nesting habitat reduces nest density which likely dilutes nest predation. Nests spread out over a larger area also potentially increases the total number of hatchlings produced. Nesting habitat is considered one of the main limiting factors for Oregon's native turtles.

A predated turtle nest.

Photo Credit: ODFW

Close-up of a turtle egg shall fragment.

Photo Credit: Metro

A female western painted turtle observed nesting on June 25, 2013 at 6 pm.

Photo Credit: Dan Lake

Aquatic Habitat

Oregon's native turtles will use a variety of different types of waterbodies, from natural wetlands and riverine off-channel areas to former gravel pits and sewage treatment ponds. However, there are known habitat features that need to be present in order for a particular aquatic area to be considered suitable for turtles. The key features that relate to suitability for turtles are waterbody size, water depth, substrate, food availability, and hiding cover. Partial to full exposure of the aquatic habitat to sunlight is another key feature; this is addressed above. Basking structures are also important and are addressed below.

This remnant permanent wetland is an example of suitable aquatic habitat occupied by turtles. It has ample food, hiding cover, and natural wood basking structures.

Photo Credit: NERI

This off-channel slough is occupied by native turtles.

Photo Credit: Metro

This emergent wetland has been affected by adjacent agricultural practices, but it is occupied by native turtles.

Photo Credit: NERI

Another example of a remnant permanent wetland occupied by turtles.

Photo Credit: ODFW

A western pond turtle in swift riverine habitat.

Photo Credit: Eric Olson

A western pond turtle in an oxbow pond.

Photo Credit: ODFW

1. **Focus habitat improvement efforts in small to medium-sized waterbodies.** Large bodies of water are generally not as suitable for turtles as smaller waterbodies. Large waterbodies tend to have lower mean water temperatures than smaller waterbodies and lack vegetative cover and basking habitat beyond the immediate shoreline. Waterbodies that tend to be relatively warm year-round or warm for part of the year generally provide higher quality turtle habitat.

2. **Provide a range of water depths and water temperatures.** Turtles need both shallow water and deeper water areas to meet requirements of various life stages. Shallow water areas (less than 6 in [15 cm]) that are sunny, sheltered from the wind, and have a mixture of submerged and emergent aquatic vegetation contribute to ideal habitat conditions for hatchling turtles. Deeper areas are needed by larger turtles. When designing new wetlands or restoring existing wetlands, include side slope ratios ranging from 5:1 to 10:1 and about 50% of the waterbody area has a maximum depth of 6.5 ft (2 m) during mean water flows and a minimum 3 to 4 ft. (1 to 1.2 m) during annual low water conditions. It is desirable to allow some wetland areas to dry completely during the low water season, but some permanent water at least 3 to 4 ft. (1 to 1.2 m) deep should be present

year-round. Suitable turtle aquatic habitats offer some areas of quieter, slowly flowing or static water.

Shallow water can provide young turtles with warmer water, ample hiding cover, and easier foraging opportunity.

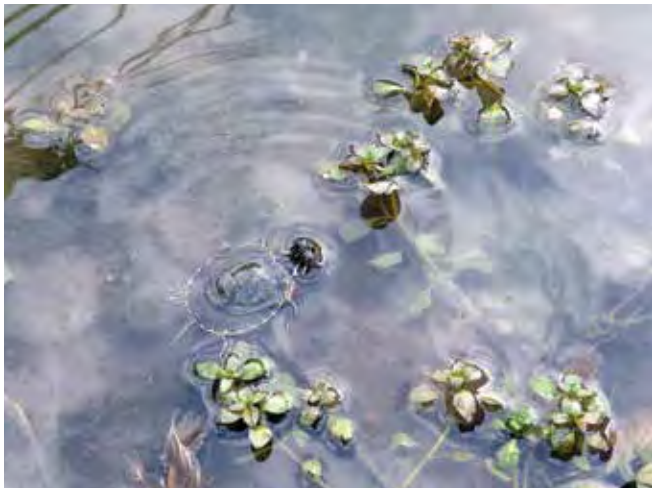


Photo Credit: ODFW

3. **Improve aquatic vegetation conditions.** Promote and plant (if necessary) native floating, emergent, and submergent plant species to provide food and hiding cover for turtles and their prey. Small turtles will sometimes bask atop floating vegetation. Emergent vegetation provides hiding cover. Control non-native invasive plants and combat algal blooms by addressing the cause of the problem (see Invasive Species and Dredging, Filling and Pond Management in Section 12 for more information).

What do Turtles Eat?

Oregon's native turtles are omnivorous, eating a variety of plants and animals such as worms, aquatic invertebrates, tadpoles, fish, and submergent and emergent vegetation. They are also scavengers, eating carrion when it is available. Turtles tend to be more carnivorous in hatchling and juvenile stages of development.

A western painted turtle surface basking.

Photo Credit: Patrick Blanchard

4. **Consider removing pond liners, rip rap, and concrete to improve turtle access to bottoms of waterbodies and promote plant growth.** Turtles that do not overwinter in upland habitats bury themselves in soft, muddy bottoms of ponds and other waterbodies. A good layer of sediment, leaves, and other organic matter also provides rooting substrate for emergent and submergent plants and is important habitat for the suite of aquatic invertebrates that turtles prey upon. Many natural waterways have been altered as historic water conveyance methods included rip-rapping and lining streams with concrete. Many man-made ponds are lined with bentonite or thick plastic barriers to prevent water seepage. Ideally these artificial surfaces and bottoms would be eliminated to improve habitat suitability for turtles, though this may not be preferred if removal of the liner would result in loss of the aquatic habitat altogether.

Rising Waters – Turtles and High Water Events.

Water levels often rise during winter months. Prolonged high-water events in conjunction with high water velocities may dislodge turtles from underwater hibernation sites (muddy bottoms, overhanging banks), sweeping them downstream. Information is lacking on the short- and long-term effects of such events, though turtles are likely more subject to predation and increased energetic costs compared to being undisturbed. These events could cause turtles to emerge from hibernation in spring with lower-than-normal fat reserves.

Basking Structures

Basking is a critical life function of Oregon's turtles. Ideally there would be ample natural sources of various sized downed wood to provide needed habitat features for turtles, other wildlife, and fish. When lacking, wood can be brought in and placed strategically while still managing standing trees for future natural recruitment. Placed wood should be properly sized for a particular site to provide appropriate habitat and to maintain flood flow capacity. Secure installed wood where deemed necessary to protect downstream structures. Placement of some types of basking structures may be considered in-water work and should be done within ODFW in-water guidelines aimed at protecting native fish. Oregon Department of State Lands (DSL) and U.S. Army Corps of Engineer (ACOE) wetland rules may apply. Contact your local ODFW fish biologist for assistance in regards to in-water work and fish, and your local DSL coordinator for help determining if a DSL/ACOE permit is required. A permit is not required from DSL for the placement of large wood, boulders, and spawning gravels provided the material is placed consistent with the *"Guide to Placing Large Wood and Boulders"* (DSL/ODFW 2010). arcweb.sos.state.or.us/pages/rules/oars_100/oar_141/141_085.html

1. **Maintain existing basking structures whenever possible.** If the basking structure is a discarded vehicle tire or other trash item that turtles are known to use and that's all that is available to them, then leaving it in place is reasonable until it can be replaced with a natural basking structure.

Western pond turtles basking.

Photo Credit: Tom Ten Pas

2. **Place large wood in wetlands, stream channels, sloughs and other waterbodies** to serve as turtle basking structures. Place wood in locations that receive full to partial sun exposure. Wood with the root wad intact is preferred. Place logs and root wads at a variety of angles and water depths, with some parallel to the shoreline, but the majority perpendicular and extending from the bank out into the open water. Wood can be piled to create complexity, cover from predators, and varied basking opportunities at different water levels. Work with a qualified hydraulic engineer and stream restoration biologist to ensure proper placement of wood and protection of downstream resources and infrastructure, if any.

Basking structures being added to a habitat restoration project.

Photo Credit: ODFW

3. **Don't forget about smaller turtles.** Small turtles need small sized basking structures. Place smaller diameter logs and limbs and lower profile woody material in shallow water where there is ample hiding cover nearby. Fall trees crown-in to provide smaller diameter basking branches as well as complex cover for protection from predators. Consider solar exposure and location of nesting area(s).

Smaller pieces of wood with branches benefit small turtles.

Photo Credit: Multnomah County Drainage District

How Many Basking Structures Do Turtles Need?

There is no specific number of basking structures required by turtles. Generally, "more is better" and "some is better than none". Also, the bigger the structure, generally the better, though this may have diminishing returns on extraordinary sized structures. While some biologists have recommended spacing basking structures about 20 ft (6 m) apart, they can be installed closer together or farther apart. Site-specific characteristics of the waterbody should be considered. Ideally, imported structures should resemble naturally occurring sizes, shapes, and distributions. Increasing the number of basking structures available to turtles provides them with more basking opportunity and potentially less conflict over finding space, especially in areas that receive the most solar exposure.

4. **Float logs in ponds and other slow-moving waters.** Floating logs can also be placed in a sunny location in the center of a waterbody, close to the deepest part of the pond. Anchor logs to maintain their position in the center of the waterbody and away from the shoreline. Ideally, floated logs should be 8 to 20 in (20 to 50 cm) diameter and a minimum of 6 ft (2 m) long with bark and limbs attached. Root wads may or may not be attached.

A western pond turtle using a piece of floated wood anchored to the bottom of a pond.

Photo Credit: Douglas Grenz

5. **Place large wood in the floodplain and upland areas.** Pieces of wood and logs in the floodplain may enter stream systems during high-water events, providing habitat elements downstream in the future. Wood placed in upland areas will decay, enhancing soil conditions and building duff, the top layer of vegetation and soil which over time will benefit aestivating and overwintering turtles, plus many other species of wildlife and fish.

Wood of various sizes place in upland areas benefits a variety of wildlife including turtles.

Photo Credit: City of Portland Environmental Services

6. **Incorporate brush piles and rocks into aquatic habitat enhancement projects.** Place brush piles and rocks near shorelines and in shallow areas. Brush piles provide hiding cover for turtles and their prey, and rocks serve as basking sites for turtles. Though brush piles are typically short-term habitat structures, they can still provide important habitat functions for turtles and many other species of wildlife.

In addition to large wood, large rocks and rock piles serve as basking habitat.

Photo Credit: ODFW

Artificial Basking Structures.

Sometimes natural wood is not readily available, access to the waterbody is challenging, or it is cost prohibitive to place natural wood basking structures. In these situations, artificial structures can provide value to turtles. Artificial structures should be designed and deployed to prevent accidental drowning of turtles. Other considerations may apply and should be discussed with your local ODFW wildlife biologist. See Appendix D for photos and design specifications of example artificial basking structures.

Red-eared sliders using an artificial basking structure.

Photo Credit: Patrick Blanchard

7. **Use artificial or man-made basking structures if natural wood is not available.** See Appendix D for recommended designs for artificial basking platforms
8. **Last, but definitely not least … Promote (and then tolerate) beaver activity.** Beaver damming and foraging habits naturally provide turtles with an abundance of basking material. Trees and shrubs felled by beaver also provide turtles with important hiding cover. Ideally beaver presence and activity would be encouraged and managed with turtles in mind.

Beaver herbivory and damming activity naturally provides turtles of all sizes with an abundance of basking structures.

Photo Credit: ODFW

Aestivation Habitat

Some turtles enter a state of dormancy during periods of hot, dry weather. Some turtles burrow themselves into muddy bottoms or over-hanging banks of ponds while others seek refuge in upland habitats. Shrubby areas and forests with understory shrubs and ample leaf litter that are relatively close to aquatic habitats, provide cool, moist spots for turtles during periods of prolonged heat.

1. **Maintain and promote soft muddy areas in wetlands, ponds, and other waterbodies.** Turtles bury themselves into soft substrate to hide from potential predators and for aestivation.
2. **Protect and maintain existing vegetated areas near suitable aquatic turtle habitats.** Control non-native invasive vegetation as needed and plant native deciduous shrubs and trees to provide leaf litter. With the exception of invasive plant control, do not remove fallen leaves, tree branches, or other organic material near aquatic habitats.
3. **Maintain vegetated buffers around and adjacent to ponds, wetlands, and other waterbodies.** Promote a variety of native deciduous plant species near wetlands and other waterbodies as leaves create the conditions needed by turtles seeking to overwinter on land. Balance with provision of open, early successional habitats (nesting habitat).

Overwintering Habitat

Turtles hibernate during winter months. Some turtles bury themselves in the soft, muddy bottoms of ponds, wetlands, and other waterbodies while others overwinter in upland habitats. Hibernating turtles live off stored fat reserves and oxygen saturated in their blood. While some subspecies of painted turtles have been documented

overwintering on land it is thought that most of Oregon's western painted turtles use aquatic habitats for hibernation. There is indication that some western painted turtles in the Portland metro area overwinter on land (Guderyahn pers. comm. 2014). Western pond turtles have been documented overwintering in aquatic habitats as well as in upland habitats up to 1640 ft (500 m) from aquatic habitat. Turtles that overwinter on land take cover under shrub and leaf litter, sometimes digging down a few inches into the top layer of duff. They do not eat during hibernation. During hibernation, a turtle's core temperature becomes similar to the ambient (surrounding) temperature and their metabolic rate slows down. Emergence from hibernation is triggered by warmer temperatures, usually when air temperature is about 60° F (15.6° C) for at least three days in a row. Suggested methods to improve overwintering habitat for turtles are as follows:

1. **Maintain and promote soft muddy areas in ponds, wetlands, and other waterbodies** known to support turtles. Mud with ample leaf litter and other organic material insulates turtles against extreme temperatures.
2. **Maintain areas of permanent water that are 4 - 6 ft (1.2 -2 m) deep through turtle hibernation months.** Turtles overwintering in aquatic habitats need water that persists throughout the duration of hibernation, from about November through March. Water can fluctuate somewhat, but ideally would get no shallower than 4 ft (1.2 m).
3. **Maintain vegetated buffers around and adjacent to ponds, wetlands, and other waterbodies** known to support turtles. Promote a variety of deciduous native plants near wetlands and other waterbodies as leaves create the conditions needed by turtles seeking to overwinter on land.

A turtle (a red-slider turtle) observed basking on a sunny day in early March. Note the muddy carapace – a sign the turtle overwintered at the bottom of a wetland.

Photo Credit: Anonymous

This western pond turtle was observed crossing a road on October 10, 2012 heading from the South Umpqua River to a forested slope, likely to overwinter. Despite missing its right hind foot it moved quickly. A part of its tail was also missing and an old injury to its carapace was evident.

Photo Credit: Lloyd Stiewig

Habitat Proximity

Most turtles remain in relatively small areas known as a home range, yet they sometimes make long-distance movements to colonize suitable habitat or to find new mates (dispersal). Changes in water levels often trigger overland movements. Male turtles tend to move farther distances than female and juvenile turtles. Some juvenile turtles have been reported traveling back and forth frequently between low-flow portions of aquatic riverine habitats and adjacent ponds. Distribution and arrangement of suitable aquatic and terrestrial habitats are key to self-sustaining populations and the survival of Oregon's native turtles.

1. **Protect and maintain suitable aquatic and terrestrial turtle habitats where they exist near each other.** It is more ecologically and financially effective to protect suitable habitat that already exists rather than to attempt to re-create it.

An example of suitable aquatic and terrestrial habitat in close proximity.

Photo Credit: ODFW

What Should I Do if I Come Across an Aestivating or Hibernating Turtle?

Do not intentionally disturb aestivating or hibernating turtles. If you come across a turtle in this state, re-cover with leaf litter or other readily available organic material and leave the immediate area. Stay at least 25 ft [8 m] away from an aestivating or hibernating turtle. Call your local ODFW wildlife biologist for advice if this is not possible or if you have additional concerns. Note that most aestivating or hibernating turtles are very difficult to spot since they often completely cover themselves with mud, leaf litter, etc. and are likely to be discovered only if unearthed or if caught in the act of covering themselves. To prevent or minimize the chance of coming across an aestivating or hibernating turtle, avoid vegetation management or other potentially disturbing activities in turtle habitats when the temperature is more than 90° F (32° C) and during winter months.

This remnant wetland site is nestled between nearby residences and a pedestrian trail atop an old railroad grade/utility right-of-way. It provides all the habitat components needed by the reproducing population of western painted turtles present at the site.

Photo Credit: Patrick Blanchard

2. **When creating new turtle habitat, site aquatic and terrestrial habitats in close proximity,** ideally immediately adjacent to or within 500 ft (150 m) of one another. For example if constructing a wetland, site near existing suitable terrestrial habitat. Provide safe habitat connectors.
3. **Avoid constructing new barriers such as fences and public trails between aquatic and terrestrial habitats.** If fences must be installed between habitats, leave a gap of at least 4 in (10 cm) at the fence bottom to allow turtle movement between habitats.
4. **If trails are to be built near suitable turtle habitat, site and design as per the guidelines outlined in the Trail Construction and Maintenance section below (Section 12).** Avoid and minimize potential conflict between trails and turtles by implementing recommended BMPs.

Safe Movement Corridors

Turtles are instinctual animals known to use the same routes to get where they need to go. Turtles move easily through sparse grasses and wildflowers, though they can and will navigate through dense shrub and forest habitats with logs and other woody material. Shrubs, trees, and downed wood provide needed shade and moisture for turtles moving on hot summer days. As habitat has become more fragmented, movement has become more challenging for many wildlife species, including turtles. Culverts, roads, Jersey barriers, railroad tracks, and fences pose major challenges to turtles and can result in their injury or death. Adult female turtles are especially vulnerable as they often need to cross these hazards en route to suitable nesting habitat. Addressing barriers to fish and wildlife movement is a Key Conservation Issue in the Oregon Conservation Strategy (ODFW 2006) and a concern of many conservation partners.

1. **Identify and protect existing movement corridors that provide safe travel for turtles between aquatic and terrestrial habitats, especially nesting sites.** Contact your local ODFW wildlife biologist for assistance if necessary.

Safe movement corridors are especially important for vulnerable hatchlings like this western pond turtle observed moving from the nest habitat to aquatic habitat.

Photo Credit: Dan Rosenberg

2. **Incorporate habitat connectors / movement corridors into project designs.** Provide suitable landscape linkages to allow movements of turtles between important seasonal habitats. This may mean utilizing elevated board walks instead of traditional trail material, incorporating culvert underpasses at retaining walls, or avoiding an intact and natural connector between seasonal key habitat elements.
3. **Identify hazards to movement for example areas of turtle road mortality and implement actions to remove threat or prevent and minimize risk of injury and mortality.** For example, provide turtle underpasses; low, vegetated earthen berms that direct turtles to a safer route; or short buried fence to exclude turtles from dangerous areas.

This snapping turtle was killed while trying to cross I-84 in the Columbia River Gorge.

Photo Credit: ODFW

Section 9: Determining if Turtles are Present

Since turtles often aren't visible, particularly at certain times of the year, it is important to do the following if your planned project or activity is located within the range of the western painted or western pond turtle:

1. **Obtain existing data on turtle presence / sightings in *and near* the project area.** It is important to consider turtle occurrence information beyond the immediate project area since turtles may go unnoticed at a particular site and because they are quite mobile. Request occurrence information from the Oregon Biodiversity Information Center (ORBIC orbic.pdx.edu/) and contact ODFW for data on historic and recent turtle sightings within 2 mi (3.2 km) of the project area. Remember that lack of turtle presence / sighting data does not necessarily mean turtles are absent.
2. **Use an ODFW-recommended turtle habitat assessment tool** (see Appendix E for example tools) to identify suitable turtle habitats (foraging, basking, nesting, aestivating, and overwintering/ hibernating) at and near the project site. Look beyond the immediate project footprint as turtles are mobile and the project area may provide for only a portion of their habitat requirements.
3. **Conduct visual surveys for turtles in aquatic habitats,** if deemed necessary. See Appendix F for recommended survey protocols and data forms, and contact your local ODFW wildlife biologist for technical assistance.

Visual surveys for turtles are one of the best methods for determining if turtles are present at a site.

Photo Credit: Patrick Blanchard

This predated turtle nest was found during a search for turtle nests.

Photo Credit: ODFW

Section 10: Planning and Designing Projects with Turtles in Mind

Consideration of potential impacts to turtles and their habitats, particularly to known or suspected nesting sites, ideally would be deliberated early in the project planning and design phases. This way the project can avoid and minimize negative impacts to turtles during the implementation stage.

1. **If modification of known occupied or suitable turtle habitat is planned or may occur, contact your local ODFW wildlife biologist** to discuss options and recommended methods to avoid and minimize negative impacts to turtles, including avoidance of direct mortality of native turtles in compliance with OAR 635-044.
2. **Site new major infrastructure (e.g., paved roads) ideally at least 1,650 ft (500 m) away from a known turtle population and suitable turtle habitats.** It is generally recommended that minor infrastructure (e.g., picnic table) be sited at least 500 ft (150 m) from known turtle populations.
3. **For projects involving existing infrastructure located within 1,650 ft (500 m) of known turtle populations and suitable turtle habitats, provide and maintain buffers of native vegetation, ideally at least 500 ft (150 m) wide.** Incorporate partially vegetated buffers adjacent to turtle habitats to provide visual and auditory buffers, reducing disturbance to turtles. Vegetated buffers can also protect turtles by discouraging human access to these areas. Native rose, tall Oregon grape, stinging nettle, and Douglas hawthorn are particularly effective.
4. **Site and design projects to minimize habitat fragmentation and maintain connectivity** to nearby habitats. **Incorporate crossing structures** such as underpasses and fencing to minimize road mortality and barriers to turtle movement.
5. **Design projects to minimize the impacts of contaminants on turtles.** Consider potential sources of environmental pollutants and exposure pathways that might put turtles at risk. Develop contingency plans to prepare for the possibility of a chemical release and consider developing monitoring plans.
6. **Design projects to maintain and protect natural hydrologic regimes.** The productivity of waterways, wetlands, and associated upland habitats is dependent upon periodic water fluctuations such as flooding and seasonal drying.
7. **If fencing is part of the project design, select a fencing style with turtles in mind.** Use fencing that does not restrict turtle movement unless otherwise recommended by ODFW (i.e., it may be desirable to restrict turtle movements to and from an area). Fencing should provide at least a 4 in (10 cm) space from the ground to the bottom of the fence. If using a fence design that has periodic gaps at the bottom, gaps should be no less than 4 in (10 cm) high and 10 in (25 cm) wide, and not more than 82 ft (25 m) apart. Many other species of wildlife need wider, higher, and/or closer gaps to facilitate movement.

One type of turtle friendly fence.

Photo Credit: Port of Portland

8. **Consider human access and types of human activities** when siting and designing projects. Turtles and their habitats can be affected by the overuse of an area by people engaged in recreational activities. Easy access into an area can disturb turtles and damage habitat. Human access can also lead to introduction of non-native invasive species (plants and animals). Consider options to manage public access (land and water) to minimize negative affects to turtles.
9. **Consider project timing and turtle activity cycles.** Time and conduct project activities with turtles in mind and in a manner that will avoid and minimize disturbance, injury and/or mortality of turtles, particularly during nesting season.
10. **Identify suitable nesting habitat on and near the project site, including staging areas.** Evaluate potential impacts to nesting habitat from the planned action. If possible, modify the planned project to avoid and minimize impacts to suitable turtle nesting habitat.

When and Where Can Turtles Be Encountered?

Turtles may be encountered at any time of the year on land or in the water, moving or not moving (see Figure 6). Since turtles utilize different habitats at different times of the year, it is important to consider the timing of various project activities. While individual turtle activity can be variable and affected by environmental factors such as weather, there are known and predictable seasons of typical turtle behavior, habitat needs and usage, as well as activity and breeding patterns. Turtles are generally active from early April through late October. Both species typically hibernate from November through March. Under certain environmental conditions some western pond turtles hibernate and aestivate in upland habitats. Although western painted turtles are considered more aquatic in nature than pond turtles and overwintering and aestivation on land has not been confirmed in Oregon, it is suspected and a real possibility. Known overwintering and aestivation sites are usually within 500 ft (150 m) of aquatic foraging habitat. Eggs are buried in the ground on land, usually within 325 ft (100 m) of aquatic foraging habitats; pond turtle nests have been documented up to 1,318 ft (402 m) from water in the Willamette River Basin (Rosenberg et al. 2009). Research indicates western painted turtles tend to nest closer to water than western pond turtles, though they have been documented nesting 820 ft (250 m) away from water (Gervais et al. 2009). Hatchlings can be encountered on land or in the water.

Western painted turtles have been observed nesting in this mowed field situated between the Willamette River and several oxbow wetland ponds.

Photo Credit: ODFW

This female western painted turtle was observed nesting on the side of a gravel trail on June 11, 2014.

Photo Credit: Vaughn Roden

11. **Conduct visual turtle surveys and turtle nest searches to obtain more information about turtle presence, use, and needs/opportunities at your project site.** Attempt to locate obvious or suspected turtle nests (intact or predated). Incorporate information into project siting and design.

Turtle Nesting Habitat.

Suitable turtle nesting habitat is characterized by areas with low to sparse vegetation with compact soils and ample solar exposure (little to no overhead tree canopy). Proximity to aquatic habitats is an important factor. A broad range of substrates are used for nesting, from recent fill comprised of a gravel/sand mixture to loamy soils with a high clay component. Floodplains, roadsides, levees, pastures, backyard lawns, and landscaped areas are all known to be used by females for nesting. Turtles have even been documented successfully nesting in the middle of compact gravel roads and in the middle of wood-chipped recreation trails. Solar radiation is a key factor as embryo development is dependent on the amount of sunlight received. Medium to tall shrubs shade out otherwise suitable nesting habitat. Infestations of the non-native invasive reed canarygrass can also shade out nest sites and form thick mats that are impenetrable to even the strongest female turtles. Generally, turtle nesting habitat is located above the high water mark and in areas not prone to flooding. While flooding or inundation with water can cause nest failure and hatchling mortality, some periodically inundated turtle nests are still successful.

Searching for evidence of turtle nesting activity.

Photo Credit: ODFW

A predated turtle nest found along a fence.

Photo Credit: Port of Portland

12. When planning to conduct work in suitable nesting habitat, **place silt fencing or other barriers around nesting habitat in late April to early May to prevent turtles from nesting in the project area.** If the site is a known turtle nesting area, periodically check the silt fencing for turtle hatchlings (from the previous nesting season) that may still be in the process of moving to aquatic habitats. Alternatively, use a fence design that allows hatchling passage while restricting movement of adult turtles into the area.

13. **Determine if turtle capture and relocation efforts prior to or during project construction are necessary to avoid and minimize harm.** Contact ODFW early in the planning process for input and to obtain a permit, if needed.

These western painted turtles were captured and relocated from a waterbody before heavy equipment conducted channel reconstruction.

Photo Credit: Port of Portland

Turtle Capture and Relocation – Is It Necessary?

In some cases, ODFW may determine that it is necessary to capture and move turtles to prevent or minimize disturbance, injury and/or mortality from a planned action. The intent and process is similar to the fish salvage process, which is commonly employed on projects involving in-water work. Capture and moving of turtles triggers the need for a permit from ODFW. Wildlife capture, holding, transport, and relocation efforts involve determining ahead of time what species are likely to be encountered (based on habitat types present and species occurrence information). It is recommended that trained personnel conduct a thorough search for wildlife within the project work zone immediately prior to and during project implementation. Collected wildlife should be put in suitable containers for release at ODFW-designated locations. Wildlife capture activities are to be recorded and subsequently reported to ODFW as a condition of the permit. Contact your local ODFW office prior to conducting habitat-altering project activities to determine the need for / to obtain an ODFW Wildlife Capture, Holding, Transport, and Relocation (CHTR) Permit.

14. **Use your project as an opportunity to create and enhance habitat for turtles.** For example, if your project is within the known range of our native turtles and suitable nesting habitat is currently lacking, incorporate turtle habitat elements into the project design and budget. See recommended habitat creation and enhancement techniques in Section 8.

Section 11: Turtles During Project Contstruction and Operational Phases

The following additional BMPs are suggested to avoid and minimize negative impacts to turtles during the construction and operational phases of a project.

1. **Avoid temporary changes to the hydrology or sedimentation rates** of waterbodies supporting turtles. Avoid ground disturbances within 500 ft (150 m) of native turtle habitat, or within 165 ft (50 m) of waterways that flow to native turtle habitat. In addition, the following actions are recommended:

   a. Locate temporary work areas, staging areas, and access routes outside of waterbodies and at least 165 ft (50 m) from waterbodies if possible.

   b. If possible, construct stormwater management infrastructure prior to all other project components to control stormwater and sediment.

   c. Properly install silt fencing around work areas, with regular inspection and maintenance.

   d. Use jute matting, weed-free native straw, mulch berms, or other natural fiber erosion control products on disturbed areas immediately after project completion to minimize erosion; avoid use of non-biodegradable materials.

   e. Promptly re-vegetate areas of temporary disturbance with native species.

2. **Mark confirmed turtle nests with temporary flagging and surround with silt fence, etc. to protect from disturbance** (e.g., crushing by heavy equipment). Known nest sites should not be disturbed unless otherwise authorized by ODFW permit. Install silt fencing such that it does not shade the nest site. Temporary nest markers and barricades should be removed as soon as possible after the project is complete to minimize possible attraction of predators. There may be times when potential nesting areas must be disturbed and a suitable barrier to turtle access cannot be installed (see #3 below). Nesting can be prevented by installing a barrier directly to the ground (e.g., cyclone or woven wire fencing), but this is suitable only for small areas. Contact your local ODFW wildlife biologist for advice.

A western painted turtle nest temporarily marked with flagging.

Photo Credit: ODFW

3. **Avoid injuring or disturbing native turtles during construction activities in or near occupied habitat.** In addition, the following action is recommended:

    a. Work with a qualified biologist to install an appropriate barrier to keep turtles out of an active site. Install silt fence after hatchlings have left nest sites and before nesting season. Inspect daily to locate turtles moving along the fence (inside or outside. If a turtle is found moving along the silt fencing, implement conditions outlined in the ODFW Wildlife Capture, Holding, Transport, and Relocation (CHTR) Permit or contact your local ODFW wildlife biologist for direction. The turtle should be moved out of the work zone and into suitable habitat nearby.

OR, do both b and c below.

    b. Have work areas inspected by a qualified biologist experienced with turtles before and during construction.

    c. Seasonally restrict certain construction activities.

4. **Avoid introductions of invasive non-native species to waterbodies** by implementing the following measures:

    a. Thoroughly wash construction equipment off-site before use.

    b. Use only native plant species and weed-free mulches, gravels, and soils for landscaping.

    c. Conduct weed treatment for the first two years after construction to intercept invasive plants that inadvertently come in with equipment, soil, etc.

5. **For large-scale projects in known turtle areas, consider implementing the project in multiple phases, preferably with each phase no longer than six weeks in duration.** Some projects may affect all habitat occupied by a population of turtles. In this case, consider conducting the project in multiple phases (in either time or space) so the turtles have a place to go to escape impacts.

6. **Designate work paths to and from the staging area and work site(s) to reduce unnecessary ground disturbance.** Mark off areas not necessary for access to or for construction of the project with temporary flagging tape or construction fencing.

7. **Locate project staging areas and other construction related support features (e.g., concrete truck washout area, and equipment fueling stations) at least 165 ft (50 m) from waterbodies and suitable turtle nesting habitat.** Develop areas for concrete washout, waste containment, and designated vehicle and equipment fueling areas. Develop spill prevention and response plans and BMPs.

8. **If small engine equipment such as pumps for temporary water management must be used within 165 ft (50 m) of a waterbody, place in a leak-proof container** to contain spills from broken fuel lines or accidental spills during refueling.

9. **Monitor for turtle presence and activity during project activities.** Monitoring should be conducted by a qualified wildlife biologist familiar with the site and with turtle ecology. See Appendix F for recommended survey protocols or contact your local ODFW wildlife biologist for a suggested turtle visual survey and turtle habitat evaluation protocols.

10. **Construction staff and other on-the-ground personnel with the potential to encounter turtles should be made aware of possible turtle presence** and be familiar with native / non-native turtle identification, applicable turtle protocols, and permit requirements in the event a turtle is encountered.

11. **If turtles or turtle nests are encountered during construction,** immediately stop work and contact your local ODFW wildlife biologist. If an ODFW Wildlife CHTR Permit has been obtained, implement the turtle capture and relocation protocol described in the permit conditions.

Western painted turtle hatchlings accidentally unearthed during a habitat restoration project.

Photo Credit: Laura Guderyahn

Hatching Eggs - A True Turtle Story

In early September 2013, ODFW was contacted by a Washington County homeowner who found turtle eggs in his backyard. The nest site was in a grass lawn about 25 feet from a stream with current beaver activity. The homeowner had been digging a trench for a retaining wall and had unearthed 20 white, ovoid shaped eggs. He knew they were turtle eggs because his shovel had cut through one egg, exposing a tiny turtle inside. ODFW obtained the turtle eggs which the homeowner had buried in dirt inside a 5-gallon bucket. The homeowner had not kept the opened egg with tiny turtle, so turtle species could not be confirmed at first. Based on the number of eggs and the fact that red-eared slider nesting had been confirmed nearby two years earlier, ODFW suspected that the eggs had been laid by a red-eared slider, a non-native invasive species. ODFW staff decided to open one of the 19 eggs to determine species, information needed to guide the next steps. One egg was removed from the bucket, but before it could be opened by hand, a hatchling red-eared slider emerged on its own, with a partial egg yolk still present on its plastron! The remaining 18 eggs were removed from the dirt and all hatched within five minutes.

12. **Eliminate construction related pitfall hazards such as trenches which can entrap turtles and other small animals.** Cover pits, trenches, etc. to prevent entrapment. Provide ramps (e.g., a rough board) to allow wildlife that does enter the hole to exit on its own.

13. **Manage vegetation** with turtles in mind. Turtles are vulnerable when they move to and from upland habitats to nest, aestivate, and overwinter. When conducting landscaping, mowing or other vegetation work, be careful not to injure turtles or destroy habitat with vehicles, power tools, and other equipment. Remember that leaf litter, downed wood, and other "messy" features make good habitat. Retain native plants to the extent possible.

14. **Retain existing native cover (hiding habitat)** where it exists when controlling invasive non-native plants or replanting areas. Native bunchgrass or shrub growth should be promoted in riparian areas.

15. **Increase areas of shrub cover near aquatic habitats** suitable for turtles to use as aestivation and overwintering sites. Ensure that plantings do not shade out suitable basking sites and leave some areas unplanted to provide suitable nesting habitat.

16. **Consider monitoring the effectiveness of BMP actions taken.** Provide ODFW with feedback on successes and lessons learned. Effectiveness monitoring and evaluation is a necessary component of adaptive management.

When To Contact Your Local ODFW Office:

- If you need help determining if there may be turtles on your site
- If you think you will need to handle or move turtles
- If you would like advice about improving turtle habitat
- If you unexpectedly find turtles during project implementation

Disease – What's the Big Deal?

Disease transmission is a concern, for fish and wildlife, plants, and people. Certain species are known to harbor certain diseases (endemic and foreign) or are considered at-risk or vulnerable to specific pathogens. It is known that some turtles host Ranavirus spp., Herpesvirus spp. and Mycoplasma spp. These infectious pathogens are potentially transmitted by sympatric non-native turtles that have been released into the wild. It is believed that the red-eared slider and other pet trade turtles present a serious threat to the health and survival of Oregon's native turtles, in particular on the fringes of their ranges where species and habitats are generally less resilient. There is an association between some infectious diseases and lower body weight (i.e., poorer body condition). To prevent disease transmission, it is recommended that all project and survey equipment be disinfected before and after use at each project site. Clothing, hands, and footwear (e.g., wading boots) should also be cleaned and disinfected. Refer to the Partners in Amphibian and Reptile Conservation (PARC) www.parcplace.org/ and the United States Geological Survey (USGS) www.usgs.gov/ disease prevention protocols for projects involving amphibians, many of which also apply to turtles. If conducting turtle capture and relocation, disease transmission will be addressed in the Conditions section of the ODFW issued Wildlife Capture, Holding, Transport, and Relocation Permit. There are also disease concerns for human handling turtles since turtles are known reservoirs for Salmonella spp. This is of particular concern with regard to zoonotic risk of disease for humans who come into contact with pet and wild turtles shedding the bacteria or with contaminated pond habitats.

Road Construction and Maintenance

Roads fragment habitat and affect turtle movement patterns. Roads along waterways bisect connections between aquatic and upland habitats which turtles travel between. But since turtles are known to cross roads both wide and narrow, the most significant implication of roads is road mortality. Adult females moving to upland nesting areas to lay eggs are particularly vulnerable to and affected by road mortality. Turtles are found on roads and are hit by cars annually. Most turtles hit by moving vehicles sustain such severe injuries that they do not survive rehabilitative treatment. Road shoulders often provide excellent turtle nesting habitat and may attract gravid turtles. Females attempting to nest in these hazardous areas are especially at risk. To prevent and minimize the potential harmful effects of roads on turtles, the following BMPs are recommended in addition to the general BMPs above:

1. **Minimize the extent (length and width) of new roads**, especially through undeveloped land. Prevent or minimize road kill of turtles migrating between seasonal habitats by **locating new roads and infrastructure 1,650 ft (500 m) away from key turtle areas.**

This sub-adult western painted turtle was hit by a car while attempting to cross a road.

Photo Credit: Metro

2. **For new and existing roads, provide and maintain undeveloped areas (buffers)** between habitat and roads to minimize disturbance, ideally at least 500 ft (150 m) wide.
3. **Avoid and minimize road construction activities in key turtle areas** from mid-May to mid-July when movement of female turtles is highest, or implement measures to prevent turtles from entering the work zone.
4. **Install silt fencing in road construction areas** to prevent turtles, including nesting females, from entering the work zone. Consider turtle activity cycles (see Figure 6) when timing silt fence installation. Bury silt fences into the ground 6 in (15 cm) to prevent turtles from moving underneath the fence. Monitor regularly. Remove fencing after work is complete.
5. **Treat stormwater run-off** from roads before it enters waterbodies. Untreated stormwater run-off is recognized as a main source of contamination, particularly in urban settings.
6. **Design street lighting to comply with dark-sky standards to avoid and minimize negative impacts on nearby habitat values.** Artificial light can disturb and alter wildlife behavior including movement patterns. Direct artificial light away from key turtle areas.
7. **Where road shoulders provide suitable turtle nesting habitat, conduct road shoulder maintenance activities (e.g., mowing, grading) with turtles in mind.** Near key turtle areas, avoid or minimize activities from mid-May to mid-July. If this is not possible, have a person search for turtles in the path of machinery and be prepared to move turtles out of harm's way.

An example of a stream crossing with ample terrestrial movement area.

Photo Credit: Port of Portland

8. **Construct bridges or oversized, natural bottom culverts** where water and stream channel crossings occur so that streams and other waterbodies are not constrained and turtles and other wildlife can move more freely. Size culverts for a 100-year flood event or greater. Ideally, bridges, and culverts would provide a dry area on at least one side of the channel with a soft earthen substrate and low stature vegetation even during high water conditions.
9. **Incorporate properly placed turtle tunnels or other under-crossing structures** to facilitate safe turtle movement. These can be designed to benefit many other wildlife species simultaneously. Depending on the length of the under-crossing, it may be necessary to provide daylight to facilitate use by turtles and other wildlife. Tunnels should include a soft earthen substrate and low stature vegetation or other hiding cover.

A turtle under-crossing structure with grated daylight features.

Photo Credit: ODFW

The Story of a Turtle Under-Crossing.

In 2004, the Port of Portland constructed a wildlife under-crossing to provide safe passage for turtles and other wildlife moving between two wetlands. The wetlands had been separated by a paved road and a railroad line serving a busy industrial area in Portland. The structure has provided safe passage for turtles and many other wildlife species.

10. **Install wings to funnel turtles to culverts or other under-crossings** and away from road beds and project work activities. Incorporate other design elements from *"Best Practices Manual: Wildlife Vehicle Collision Reduction Study."* (Huijser, M.P. et al. 2008). Be aware that most projects have unique elements that need to be addressed specifically.

A western painted turtle using a turtle under-crossing.

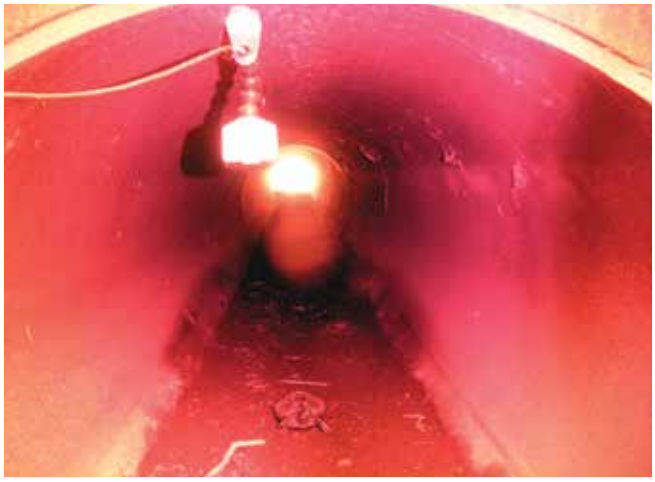


Photo Credit: Port of Portland

11. **Consider installing a remote wildlife camera** to evaluate the efficacy of crossings in providing safe passage and landscape connectivity for turtles and other wildlife. Consider partnering with a wildlife researcher to conduct a turtle movement or other needed study.
12. As a reminder, use your project as an opportunity to **create or enhance habitat for turtles on your project site.** See recommended turtle habitat creation and enhancement ideas and techniques in Section 8.

What about "Wildlife Crossing" Signs?

While not a bad idea, signs to warn motorists about wildlife presence in a particular area have been proven to be largely ineffective. Motorists pay little attention to signs, especially ones that they encounter on a regular basis. They may notice them when new, but the sign quickly fades into the background and goes unnoticed. Flashing signs, or signs with regularly updated messages, are more successful at affecting motorist behavior and reducing wildlife collisions.

Culvert Cleaning, Repair and Replacement

Turtles are known to overwinter in culverts and use them for passage or resting at other times of the year. The following actions are recommended when conducting culvert work:

1. **If you encounter a native turtle while cleaning or replacing culverts in winter, postpone your activities until spring, if possible.** Contact your local ODFW wildlife biologist to report your turtle sighting or for advice if the culvert work cannot be postponed.
2. **If you encounter a turtle in a culvert at other times of the year,** contact ODFW for advice. If the turtle is a native species and in immediate danger, move it to the closest similar habitat out of harm's way within the same stream corridor, either immediately upstream or downstream, whichever has the highest quality turtle habitat. Because some turtles exhibit high site fidelity and are quite mobile, take measures (e.g., exclusion fencing) to prevent moved turtles from re-entering the work area. Report your turtle encounter to your local ODFW wildlife biologist and complete the on-line turtle sighting report form located at: www.oregonturtles.com/
3. **When replacing or modifying culverts, use wildlife-friendly designs.** Refer to Metro's Wildlife Crossings Handbook (Metro 2009) and contact ODFW for input on specifications for turtles and other priority species in the project area, including native migratory fish for which passage must be provided unless waivered or exempted by ODFW. A handbook written by the Federal Highway Administration can be found at: www.cflhd.gov/programs/techDevelopment/wildlife/documents/01_Wildlife_Crossing_Structures_Handbook.pdf and more

information is located here: www.fhwa.dot.gov/environment/critter_crossings/main.cfm

This natural bottom culvert that allows some movement of terrestrial wildlife.

Photo Credit: City of Portland Environmental Services

A close-up of the elevated walkway provided on one side of the above culvert.

Photo Credit: City of Portland Environmental Services

4. Be aware that **slopes and banks near culverts and bridges often provide suitable turtle nesting habitat** as these sites often include gravel fill which suppresses vegetation growth. Take action to avoid disturbance to turtle nests and nesting turtles. Create and enhance turtle nesting habitat (see Section 8).

Suitable nesting habitat on the filled toe of an overpass slope.

Photo Credit: Port of Portland

Turtles and Steep Slopes.

Turtles are excellent climbers. Strong legs and sharp claws help them grip the ground, enabling them to climb even the steepest gradient slopes. Still, gradual slopes are easier for turtles to climb, so when grading or re-contouring, incorporate 3:1 sloped banks at least. Even better are 5:1 slopes.

Dredging, Filling and Pond Management

Periodic dredging of man-made ponds or waterways used for water conveyance may be deemed necessary to achieve or maintain certain uses or site conditions. Waterway dredging can benefit turtles by increasing available aquatic habitat or improving water depth profiles. On the other hand, development actions resulting in the permitted filling of water features or jurisdictional wetlands results in habitat loss. Artificially managed ponds such as those used for irrigation or private angling often become choked with unwanted vegetation and fill with sediment due to adjacent land practices. De-watering, dredging, filling, and other pond management activities can be detrimental to turtles, putting them at risk of injury or even death. Turtles can be crushed by heavy equipment or smothered by

material (excavated or fill). During pond / waterway de-watering, some turtles will exit the waterbody via terrestrial habitats while other turtles for whatever reason(s) will stay, burying themselves in the pond bottom substrate. If turtles are known or suspected at your site, here are some ways to prevent and reduce the chances of negatively affecting turtles as well as enhancing the pond to provide important habitat for native turtles:

1. **If de-watering, dredging, or filling a waterbody, obtain a Wildlife Capture, Holding, Transport, and Relocation (CHTR) Permit from ODFW** when turtles are known to be or likely present. ODFW may authorize turtle trapping to facilitate removal of turtles from a site. The Wildlife CHTR Permit will specify temporary holding or relocation of turtles to a specific site. Conduct turtle capture and relocation efforts in coordination with fish salvage and amphibian capture/relocation efforts where it makes sense. An ODFW Fish Salvage Permit is required when conducting fish salvage activities (e.g., seining, electro-shocking).

Implement measures to avoid burying turtles during permitted wetland fill projects.

Photo Credit: ODFW

2. **Conduct de-watering, dredging, and filling activities when turtles are NOT hibernating.** Turtles can more easily move out of harm's way during their active seasons which is generally April through October.

3. **If de-watering or suction dredging, screen nozzles to avoid sucking up (entraining) turtles, including hatchlings.** Conduct regular checks to ensure no turtles are stuck to the screen. Conduct more frequent checks if hatchling turtles are likely to be present.

Pump screens should exclude turtles and be checked often.

Photo Credit: ODFW

4. **When de-watering a waterbody known or suspected to harbor turtles, leave the drained waterbody undisturbed and free of any wildlife exclusion fencing for at least two days (48 hours) before dredging or filling** to allow any turtles present to leave overnight on their own when human presence/activity is low. It may be more appropriate to install silt fencing to keep turtles within the project area if adjacent areas are inappropriate for turtle dispersal (i.e., the work site is next to a busy road). In this case, turtles should be captured and relocated to an ODFW designated site.

A stockpile of wood for habitat enhancement projects.

Photo Credit: Sarah Wilson

Altered waterways and man-made ponds can provide suitable habitat for turtles. These areas are often subject to periodic dredging or other actions which put turtles at risk.

Photo Credit: Angelique Orman

5. **When dredging, if possible, remove and stockpile existing basking structures such as logs and tree branches prior to work.** Replace basking structures after dredging is completed.
6. **Have a wildlife biologist knowledgeable about turtles on the work site throughout de-watering, soil removal, and fill activities** to monitor for turtles potentially missed during the initial turtle capture and relocation effort.
7. **Utilize dredged material on-site to create new or enhance existing turtle nesting habitat when possible.** Consider amending soil to suppress plant re-growth (see Table 3 in Section 8).
8. **Dispose of dredged sediment in piles ideally no more than 6 in (15 cm) deep** to avoid smothering turtle nests and to allow any turtles buried in the material to dig themselves out. Conduct regular visual checks for turtles trapped in disposed dredge material prior to any heavy equipment driving over it to prevent crushing turtles.
9. **When dredging, start at one end of the waterbody and slowly move to the other side** so that turtles can move out of the way on their own.
10. **Minimize the need for dredging or other artificial pond management types of actions by addressing the source of the problem** (i.e., altered hydrology from man-made impoundments/dams, nutrient loading, soil erosion, high water temperatures, lack of vegetation, etc.). For example, restore natural hydrologic regimes where and when possible, increase riparian buffers widths, promote American beaver activity, and use bio-swales to treat stormwater.
11. **If control of pond aquatic vegetation is planned, implement control techniques when turtles are inactive.** Mechanical techniques are generally preferred over chemical techniques. When removing unwanted vegetation (e.g., algae blooms or non-native invasive plants), stage removal over space and time to reduce adverse impacts to turtles through immediate and total loss of food and hiding cover. Search removed vegetation for trapped turtles.

Consider turtles when mechanically removing invasive vegetation.

Photo Credit: Multnomah County Drainage District

12. **Increase the attractiveness of the pond to native turtles.** Add basking structures, plant native vegetation along the edges of the pond, create a nesting area, and grade the banks. Many former irrigation ponds have steep-sided banks. Grading to lessen steep slopes can make it easier for turtles to enter and exit the pond. It also creates more shallow water habitat that young turtles need. See Section 8 for more detailed information on creating and enhancing habitat for turtles. Do not introduce non-native species (e.g., largemouth bass, *Gambusia affinis* (mosquitofish), carp, and American bullfrog) that predate upon turtles, alter the food web, and/or degrade habitat.

Native floating vegetation is food and hiding cover for turtles.

Photo Credit: Simon Wray

Trail Construction and Maintenance

Trails fragment habitat, affect turtle movement patterns, and subject turtles to increased levels of disturbance and higher risk of illegal collection and mortality. Turtles are wary of people on foot and their accompanying dogs, and may leave important and otherwise suitable habitat once a trail is created. On the other hand, trails and trail shoulders can provide attractive turtle nesting habitat. Trails located on old railroad beds, under utility corridors, atop levees and dikes, on gravelly shoulders of asphalt paved trails, and in other places where ground vegetation is generally sparse and overhead vegetation is lacking can provide suitable turtle nesting habitat, a main limiting factor for Oregon's native turtles.

The BMPS included in Sections 10 and 11 above apply, but here are some additional considerations:

1. **When considering construction of new trails, location is crucial.** Keep new trails out of key turtle areas. New trails ideally would be sited at least 1,650 ft (500 m) away from key turtle areas to prevent and minimize disturbance to turtles. If this is not possible, site trails the farthest distance from key turtle areas as the project design allows.
2. **Minimize the extent (length and width) of new trails.** A smaller project footprint generally has less impact.
3. **In wetland areas, elevated boardwalk trail designs generally have fewer impacts on turtles than other designs.** Design and site trails so that hydrology is not altered and turtle movement within and between suitable habitats (aquatic and upland) is not impeded.
4. **Use existing corridors or right-of ways** when siting new trails whenever possible.

A trail near known native turtle habitat.

Photo Credit: ODFW

5. **Install silt fencing during trail construction or maintenance** to prevent turtles, including nesting females, from entering the work zone. Monitor regularly. Remove fencing after work is complete, as applicable regulations and/or erosion control BMPs dictate, and depending on weather conditions.
6. **For existing trails, provide and maintain buffers** around key turtle areas of at least 500 ft (150 m) between habitats and trails to minimize disturbance.
7. **Conduct trail construction and maintenance activities (e.g., mowing, grading) with turtles in mind.** Avoid or minimize activities from mid-May to mid-July. If this is not possible, have someone walk ahead of maintenance equipment to look for turtles on or near the trail and be ready to move them out of harm's way.
8. **Use fencing and/or vegetative plantings** to keep people on designated trails. Fencing may be more appropriate as temporary deterrents while plants are getting established and, in some cases, to keep turtles away from or off of trails. Vegetation and certain fence styles can act as both visual and sound buffers benefiting turtles by protecting them from disturbances, but they can also be movement barriers to turtles moving between aquatic and terrestrial habitats.

This female red-eared slider was found on a bike-pedestrian trail adjacent to a wetland area during the early evening on July 2nd. The chain link fence restricted her movement to nearby nesting habitat.

Photo Credit: Hasso Hering

9. **Restrict presence of dogs** in known key turtle areas. Dogs can disturb, severely injure, and even kill turtles. Restrict off-leash dogs and coordinate with the appropriate law enforcement entity to enforce leash laws.

An off-leash dog digging in known native turtle nesting area.

Photo Credit: ODFW

The carapace wounds on this western painted turtle were caused by a pet dog. Thankfully the dog owner brought the turtle to an ODFW-licensed wildlife rehabilitation facility for treatment and care.

Photo Credit: Audubon Soc. of Portland's Wildlife Care Center

10. **Treat stormwater run-off** from asphalt trails before discharge into turtle habitats.

11. **When building and promoting water trails, provide ample basking logs for turtles.** Install educational signage to encourage paddlers to enjoy turtles from a distance to reduce disturbance to basking turtles. Also, to encourage reporting of turtle sightings using www.oregonturtles.com/

A paddler on a water trail in suitable turtle habitat.

Photo Credit: NERI

Refer to Metro's **Green Trails: Guidelines for Environmentally Friendly Trails Handbook** (2004) for more great ideas on how to plan, design, construct and maintain trails so that impacts to natural resources are kept to a minimum.

12. **Use your project as an opportunity to create and/or enhance habitat for turtles.** See recommendations in Section 8.

Vegetation Management, Agriculture and Forestry Operations

Forestry operations, farming, mowing, and other vegetation management activities can have both positive and negative effects on turtles. For example, turtles have been documented nesting in farmed fields, yet some practices such as tilling are known to unearth turtle eggs. Mowing equipment and other heavy machinery used for vegetation management can inadvertently injure or kill turtles since they are unable to move quickly out of the path of vehicles, with or without blades. Vegetation management in upland habitats can affect the quality of overwintering, aestivation, and nesting habitat for turtles. Vegetation management in aquatic habitats can affect the quality of turtle forage, hiding cover, and basking structure. Certain forestry practices can be employed to promote healthier forests including provision of standing dead and dying trees, and downed wood. Turtles can benefit from actions related to agriculture and forest management, if done properly and with turtles in mind.

1. **Conduct forestry operations in a manner that does not injure or kill turtles** that are/may be present in the work area. Time harvest to avoid hibernating or aestivating turtles. Use forest management practices to promote healthier stand conditions and provision of standing dead and dying trees, and downed wood of various sizes.

2. **Mow and brush-hog vegetation only as needed. Implement "the right plant for the right location" approach** to minimize need for on-going maintenance, increase resource savings (personnel time, fuel, and equipment costs) and decrease emissions of methane, CO2 and other greenhouses gases. Avoid use of mowers, brush hogs and similar equipment in upland areas at times when turtles may be hibernating or

aestivating. Have someone walk ahead of equipment to look for turtles and be ready to move them out of harm's way.

3. **Manage larger areas on a rotational basis** with no more than one-third (1/3) of the site impacted (e.g., mowed) in any given year.
4. **Mow at a lower gear and speed** to allow turtles to move out of the way. Have someone walk ahead of equipment to look for turtles and be ready to move them out of harm's way.

This adult female red-eared slider was killed by a routine mowing operation atop a managed levee. She was likely in the process of nesting or on the move to find a nesting site. Numerous turtle nests were found near the carcass.

Photo Credit: ODFW

5. **Mow in a set pattern (e.g., upland to lowland in successive rows) to allow turtles and other wildlife to move out of the way and in a safe direction.** Consider site characteristics as well as adjacent factors such as habitat and roads.
6. Injuries to turtles can be avoided or minimized by setting the height of the mowing deck or **using a sickle bar set at least 10 in (25 cm) off the ground. When closer mowing is unavoidable use a hand-held string trimmer or hand-cutting methods if possible.** Ideally mechanical masticators such as "brush hogs" would be avoided in areas where and when turtles are likely on land.
7. **Immediately prior to tree felling, mowing, or use of other large heavy equipment, conduct visual searches for turtles** in work areas where turtles are known to occur or may be present based on habitat suitability. Have someone walk approximately 20 ft (6 m) in front of the mower or other equipment to look for turtles. Any turtles encountered should be removed from the path of vehicles or heavy equipment and out of harm's way. This practice can benefit other wildlife too. Technically, an ODFW Wildlife Capture, Holding, Transport, and Relocation Permit is required when turtle (native or non-native) encounters are anticipated and relocation efforts are planned. This is to ensure that appropriate and biologically sound actions are taken.
8. **If you accidentally injure a turtle during mowing or other vegetation management activity, transport it immediately to the nearest ODFW-licensed wildlife rehabilitation facility** or contact your local ODFW office for other instructions. A list of ODFW-licensed wildlife rehabilitation facilities can be found at: www.dfw.state.or.us/wildlife/rehabilitation/docs/wildlife_rehabilitators.pdf

If you find a turtle in the path of mowing equipment or other vehicle, move the turtle out of harm's way by placing it outside the work area and headed in the same direction it was headed when observed. Then call your local ODFW wildlife biologist to report your turtle encounter and discuss whether or not future turtle encounters are likely and if you need an ODFW Wildlife Capture, Holding, Transport, and Relocation Permit.

9. **Consider using livestock grazing as a management tool** to create or maintain turtle habitat. When managed properly, grazing can delay natural plant succession. Control invasion of fast-growing invasive plant species to provide or maintain suitable nesting habitat for turtles. Duration, timing, and intensity of grazing needs to be managed to prevent undue risk of turtle mortality from trampling.

10. When felling trees, **leave various sized pieces of large wood on-site in both upland and aquatic areas** to provide habitat for turtles, other wildlife, and fish. On land, woody material may be used by turtles in conjunction with overwintering and aestivating sites. Wood placed in and along water's edges provides basking opportunities and the ability for turtles to escape and hide from predators or perceived threats. Consider seasonal changes in water levels when placing wood.

11. **Retain forest floor leaf litter, downed wood, and snags** where they exist. These materials are important for present and future turtle overwintering, aestivation, and basking habitats.

This western pond turtle hatchling was one of several discovered hibernating under wooden boards left on the ground. Natural down wood was lacking in the area.

Photo Credit: USFWS

12. **Control of aquatic vegetation can negatively affect turtles.** Aquatic vegetation provides food and hiding cover for turtles. Floating vegetation also serves as basking habitat for small turtles. When considering techniques to manage unwanted aquatic vegetation (e.g., algae blooms) in man-made ponds or other altered waterbodies, consider possible impacts to turtles before taking action. The best long-term management options are ones that address root causes for the nuisance situations (e.g., nutrient loading, lack of shade, low water flow). If the decision is made to control aquatic vegetation, do so in a manner that avoids or minimizes negative impacts to turtles, such as removing only a portion of the vegetation per year. Contact your local ODFW wildlife biologist for additional advice.

A waterbody choked with invasive plants and thick with algae.

Photo Credit: ODFW

Non-Native Invasive Species Control

Non-native invasive plants and animals can make it more difficult for turtles to thrive, via direct competition, predation, and habitat degradation. Released pets are sources of disease and can compete with native wildlife and degrade their habitats. While native turtles have been found co-existing alongside non-native species (e.g., carp, red-eared sliders, yellow flag iris), negative effects have been documented and/or are suspected. In many circumstances invasive animal removal is nearly impossible or not deemed cost effective. Limited resources make it necessary to prioritize invasive animal removal or control efforts and explore opportunities to work with local partners and citizen volunteers to implement control and prevention efforts.

1. **Control invasive plants,** particularly reed canarygrass, which makes nesting habitat unsuitable or difficult for gravid females to access. If you aren't sure what plants are invasive, contact your local Soil and Water Conservation District, Weed Management Board, or Watershed Council. Replace non-native plants with native plant species endemic to the area.

Reed Canarygrass: Bad News for Turtles.

Reed canarygrass, a non-native invasive plant, forms dense mats that are essentially an impenetrable barrier to nesting female turtles. Fibrous roots can also trap turtle hatchlings in soil below.

2. **Control invasive animals.** Feral pigs, nutria, bullfrogs, carp, largemouth bass, *Gambusia affinis* (mosquitofish), and other non-native animals can degrade habitat conditions by decreasing water quality, disrupting food webs, competing for resources, and causing direct mortality to Oregon's native turtles through predation and spread of disease. Turtle hatchlings have been documented inside the stomachs of bullfrogs. Contact your local ODFW office for recommended techniques and any requirements for controlling invasive animals.

American bullfrogs are known to consume turtle hatchlings.

Photo Credit: Ray Temple

ODFW's invasive species factsheet on the American bullfrog

Photo Credit: ODFW

STOP!

Before you conduct invasive wildlife removal, contact your local ODFW office for guidance on species identification, effective control techniques, options for disposal, and if an ODFW permit is required.

3. **Do not intentionally release non-native fish, wildlife, or plants (including aquaria species) into waterbodies.** It is unlawful, can be cruel to the animals, and wreaks havoc on our ecosystems. Take actions to prevent releases, such as posting educational signs at main public access points (e.g., boat ramps, viewing platforms) to inform the public of the harmful effects of invasive species as well as applicable regulations.
4. **Report sightings of non-native turtles in the wild to your local ODFW office or contact ODFW** to report your capture and coordinate immediate transport of the turtle to ODFW. If you see a red-eared slider or other non-native turtle in the wild call ODFW for advice on removing them. A permit is required to possess and transport live sliders and many other non-native turtle species. Fill out a turtle sighting report form located at: www.oregonturtles.com/

ODFW dug up this red-eared slider nest after a citizen submitted an on-line turtle sighting report and attached a photo of a female slider laying the eggs.

Photo Credit: ODFW

This snapping turtle was observed nesting in a landscaped area near a commercial business park on June 7, 2012 at 9:30 am.

Photo Credit: Jamieson English

Snapping turtle eggs (n = 47) dug up after the female snapping turtle finished nesting.

Photo Credit: Kyle Spinks, Tualatin Hills Park & Recreation District

5. **Before stocking a pond with game fish** (as defined by OAR and as authorized by an ODFW Fish Transport Permit), ***Gambusia* spp. (mosquitofish), or other non-native fish,** consider impacts to native turtles and other native wildlife (e.g., amphibians).

Figure 8. Turtle ID Quiz: What turtle species is this? See Appendix B for the answer.

Photo Credit: William Egan

Section 13: Other Things to Know

How to Properly Handle a Turtle

It is safe to say that no turtle "enjoys" being handled and some tolerate it more than others. There are ways to make it less stressful for the animal and safer for you. Ideally, and if time allows, put on a clean, unused pair of thin non-absorbent gloves before handling a turtle. Pick up the turtle using both hands, one on each side of the shell, between the front and back legs. Smaller turtles may be picked up with one hand. Hold the turtle firmly and keep the plastron (bottom shell) parallel to and facing the ground, and the turtle's head facing away from your body. Do not pick up a turtle by its tail and do not keep a turtle on its back any longer than necessary as it can suffocate in this position. It is normal for a turtle to draw in its head, limbs and tail when picked up. Many will exhale quickly, making a hissing sound - this is a defensive mechanism. Other turtles may not withdraw into their shells or hiss, but will thrash and flail with all four legs trying to free themselves. Turtles also have sharp claws and many release urine as a self-defense mechanism. Oregon's native turtles rarely bite, but all turtles have powerful jaws and sharp beak-like mouths that can inflict a painful bite in self-defense.

** *Additional Safety Note: Extreme caution should be used when around snapping turtles as they have exceptionally powerful jaws that can inflict a serious wound. Snapping turtles also have very long claws that can cause lacerations. They have very long necks that can extend to both sides and above their body. Snapping turtles tend to "snap" their mouths in self-defense. ODFW does not recommend handling snapping turtles.*

One way to safely hold a turtle.

Photo Credit: ODFW

Turtle: Male or Female?

There are several distinct external differences between male and female turtles, but these features usually are not obvious until the turtle reaches sexual maturity. For males this is typically when they reach 4-5 in (10-13 cm) in length; for females it is 6-7 in (15- 8 cm). Turtle have a hole or vent which is called the "cloaca" located on the underside of their tail. On male turtles, the cloaca is located further away from the body, closer to the tip of the tail. On female turtles, the cloaca is closer to the body near edge of the plastron (bottom shell). Male turtles have thicker and longer tails in caparison to the tails of female turtles. The front claws of a male turtle are longer than a female turtle's claws. When viewing a turtle from the side, a male turtle has a low, more slender profile compared to a female's higher domed carapace and more rounded appearance. A deeper body cavity is needed by the female turtle to house eggs. Males usually have a slightly concave (curved inward) plastron while females are flat or slightly convex.

Tail length and position of cloacal opening are two ways to distinguish between a male red-eared slider (left) and a female red-eared slider (right).

Photo Credit: ODFW

Turtles Found Crossing Roads or Trails

Often a turtle found on land is believed to be in need of help. On the contrary, most turtles on land are instinctively headed somewhere for a specific purpose (e.g., a gravid female headed to nesting habitat or a turtle headed to an upland forest to overwinter) and are not in need of any human intervention. Sometimes however, turtles moving across a road or trail are at real risk of getting struck by a vehicle or illegally removed from the wild. It is reasonable to take action when a turtle is found crossing a road or trail and it is deemed at immediate risk. In this situation, a turtle can be picked up and moved onto the side of the road or trail and pointed *in the same direction it was headed*. When picking up a turtle, do so without jeopardizing the safety of yourself or others. Also, be aware that turtles can bite and carry certain diseases (e.g., Salmonella), some of which are transmissible to humans, so be careful and clean your hands before and after handling them.

A female western pond turtle crossing a road.

Photo Credit: ODFW

Watching / Viewing Turtles

ODFW encourages everyone to enjoy watching wildlife by viewing them in a manner that does not result in disturbance to them or their habitats. Turtles can be disturbed even by wildlife viewing activities. When basking on a log, turtles absorb solar radiation to raise their body temperature sufficiently for bodily functions, such as egg development, food digestion, and body growth. Turtles will enter the water if approached too closely thereby cooling their bodies and slowing their metabolic processes. Disturbance that results in frequent changes in body temperature costs a turtle energy, affecting fat storage, egg formation in females, and overall health. If a turtle is seen on land, it may be in the process of laying eggs, and may stop doing so if it sees you or if a dog is present. View turtles from a distance using binoculars or a spotting scope. Be quiet and avoid turtle viewing with even leashed dogs.

Photo Credit: Port of Portland Sarah Wilson

Beavers and Turtles

Turtle abundance is positively correlated to the presence of American beaver activity. One study concluded that aquatic turtles were 84 times more abundant along streams with beaver impoundments than along streams without beaver impoundments (Haemig 2012). Beaver damming and tree felling activity creates and maintains suitable aquatic habitat (foraging, hiding cover and overwintering) and basking structures for turtles. Beaver dams are passable by turtles – they may go up and over, around, or through. Pond turtles are known to use beaver burrows and lodges as refuge. Beaver ponds provide a rich source of food for turtles as they attract frogs, fish and insects. They also provide deep and shallow water which turtles require. The benefits of beaver are numerous – from water quality to flood control. Beaver activity provided habitat for a host of other wildlife species including ESA-listed fish. ODFW encourages promotion of natural beaver activity yet recognizes there are challenges to living with beaver, especially in an urbanizing landscape where many streams have been constrained by under-sized culverts and development that has been allowed to occur too close to a stream channel. When deciding to dismantle a beaver dam, take into consideration the timing of removal, expected duration of drawdown, and effects on water quality (sedimentation) and corresponding effects on various fish and wildlife, including turtles, in the immediate area and downstream. While dismantling a beaver dam may be an appropriate and necessary action to alleviate an immediate threat to existing infrastructure, long-term sustainable solutions that allow beaver to persist in a system are strongly encouraged. For more information on living with beaver see: www.dfw.state.or.us/wildlife/living_with/beaver.asp

A western pond turtle takes advantage of the abundant woody material in a beaver pond.

Photo Credit: Raianne and Ron Gamma

Livestock and Turtles

There has not been much scientific study on the effects of livestock on turtles and their habitats, but anecdotal evidence indicates both negative and positive effects. One study (Lindsay and Dorcas 2001) on the effects of cattle on turtles focused on the impacts of cattle on aquatic habitat, specifically farm ponds that cattle had access to and that were occupied by several species of turtles. The study concluded that phosphate, ammonia, nitrate/nitrite, pH, dissolved oxygen, and sedimentation negatively affected habitat quality and the overall health of some species of turtles. Health indicators negatively affected were turtle body condition, body size, egg size, and clutch size. It is well known

that cattle can degrade water quality and alter water chemistry such that certain aquatic invertebrates are negatively affected and primary production (plant growth) can increase. It is likely that different turtle species respond differently and response differs also by life stage. Grazing by livestock (e.g., cows, goats) can be used as a tool to maintain suitable turtle nesting habitat (low sparse vegetation with patches of bare ground) if managed properly. Hatchling turtles have been observed in small pools of water gathered in depressions made by livestock hooves. Hatchling turtles have also been found in indentations made by elk hooves (Monroe M. pers. comm. 2014). There is some concern that livestock could crush hatchlings that have emerged from their nest and are on their way to water. It is recommended that, except under very controlled conditions, livestock be kept out of streams, wetlands, and other waterbodies to protect water quality and habitat for the benefit of fish and wildlife.

Chemical Contaminants and Turtles

While the scale-covered skin of turtles decreases direct absorption of chemical substances from the environment, they can drink contaminated water and absorb it through the cloaca. Turtles may also be adversely affected through ingestion of contaminated prey. Toxicology studies of various species of aquatic and semi-aquatic turtles have confirmed that chemical contaminants such as industrial chemicals, heavy metals, and pesticides are harmful to turtles. Negative effects include suppressed immune systems, smaller eggs, reduced growth rates of hatchlings, endocrine disruption (altered sex determination), behavioral effects, changes in blood chemistry, and depression in enzyme activity. Turtles are exposed to toxins in both their aquatic and terrestrial habitats. As long-lived higher order predators, turtles are thought to be particularly susceptible to contaminants through bioaccumulation. It has been documented that contaminants in female turtles can be off-loaded to eggs through the yolking process (Bryan at al. 1987). Releases of chemicals into aquatic and terrestrial environments should be prevented and sites known to be contaminated should be cleaned up according to applicable federal, state and local laws and policies.

Blood was drawn from this trapped red-eared slider as part of a study on mercury levels in semi-aquatic turtles.

Photo Credit: ODFW

Angling and Turtles

Turtles are attracted to fish bait, especially live worms, and are sometimes found with fish hooks embedded in their mouths or even swallowed entirely. Waterbodies open to and/or managed for angling should be managed with turtles in mind. Ideally, angling would not occur in key turtle areas to reduce risk to turtles. Alternatively, post signs for anglers with instructions on what to do if they

hook a turtle. If you inadvertently catch a turtle on your fishing line, carefully remove the hook and immediately return the turtle to the water. Please report your turtle encounter to ODFW or use the on-line turtle reporting tool. If you think the turtle is too injured to return to the water, or you are unable to remove the hook call your local ODFW wildlife biologist for assistance (See Appendix A). Alternatively, immediately transport the turtle to the closest ODFW-licensed wildlife rehabilitation facility that can accept turtles. See www.dfw.state.or.us/wildlife/rehabilitation/docs/wildlife_rehabilitators.pdf to find a facility near you. Do not leave the hook embedded in the turtle's mouth. Cutting the line and leaving the hook in the turtle may cause life-threatening internal damage, infection, and/or possibly starvation because the mouth is too sore or swollen to eat.

A western painted turtle (female) with a fish hook embedded in mouth.

Photo Credit: Hillary Darland

How Do I Remove a Fish Hook from a Turtle?

Carefully as turtles can bite, even with a hook in its mouth! Also beware of sharp turtle claws and the hook itself. Crimp the hook barb (if present) with needle-nosed pliers. Grasp the hook with pliers and gently remove it from the turtle by pushing the hook back the way it went in. If the hook is embedded without the point visible, finish pushing it through, cut or crimp the barb, and then back the hook out the way it went in. It is helpful to have one person hold the turtle while another person removes the hook.

Efforts to remove a fish hook from this western painted turtle were successful.

Photo Credit: Hillary Darland

Boating and Turtles

Turtles need to bask to accomplish basic metabolic functions such as food digestion, growth, and egg formation. Basking is also important for skin, eye, and shell health. Repeated disturbance can make a big difference in the quality of a turtle's life and its ability to reproduce. Boaters, even those with non-motorized vessels, can inadvertently disturb turtles to the point that fitness may be compromised. Boat wakes can push turtles off basking structures or prevent turtles from climbing on structures to bask. Boaters sometimes get too close to turtles and

interrupt basking. Depending on the frequency and timing of disturbance some turtles may suffer serious consequences such as delayed egg development. Waterbodies that are open to boats should be managed with turtles in mind. Post educational signage at boat ramps and launches to educate boaters on the presence of turtles, their plight, and how boaters can help protect them. Boaters should take care to stay away from basking turtles. Non-motorized vessels should stay at least 10 boat lengths away or approximately 75 ft (23 m) from them, and motorized vessels even farther.

Golf Courses and Turtles

Despite being artificial and areas of periodic high human use, golf courses can provide suitable habitats for turtles. Turtles have been observed in golf course ponds and low-growing turf grass in sunny areas that can provide suitable nesting habitat. Studies of turtle presence at golf courses indicate that several wetland variables influence turtle presence and abundance: wetland size, the amount of shoreline, and the types of vegetation in and around the pond. Golf course managers are encouraged to improve wetland habitat characteristics to benefit turtles (and other wildlife). Other factors, such as the amount of nearby grassland and forest as well as the distance to major roads, are also important though not easily altered by golf course managers. If lacking, managers are encouraged to install basking structures, especially in areas that receive the most sun exposure. More information can be found in a brochure jointly produced by the U.S. Golf Association in partnership with the National Fish and Wildlife Foundation (see: www.rooseveltstation.org/urbanturtles/wp-content/uploads/2011/03/Turtle_management_brochure.pdf)

Turtles and Water Intakes, Control Structures and Outfalls

Turtles may attempt to pass through water control structures to get to where they want to go. Some structures are designed such that they are hazardous to turtles. Double board systems which are sometimes used to reduce water leakage have been known to entrap turtles. Water intake pipes can trap and cause small turtles to drown due to the suction force. Water outfalls should have a drop less than 1 ft (0.3 m) at mean flow conditions to prevent injury to turtles exiting the outfall structure. Screening of water intakes is recommended to protect turtles and other wildlife (e.g., amphibian larvae). Pipes that are screened to comply with fish conservation regulations are probably adequate to protect small turtles, but check with an ODFW wildlife biologist to verify this. Water control structures should be checked regularly for trapped turtles or other wildlife. Double board systems should be avoided or modified to prevent entrapment of turtles.

Scientific Research and Turtles

An ODFW Wildlife Scientific Taking Permit (STP) is required when conducting any educational or scientific related activity with wildlife (dead or alive), including Oregon's native turtle species. When applying for a Wildlife STP for wildlife-related research, your application must demonstrate that the proposed project is justified and will not result in unnecessary harm, stress, etc. to wildlife or negatively affect local or regional native wildlife populations. A Wildlife STP is not necessary for visual study or wildlife observation only. Coordinate with your local ODFW biologist and ODFW's Wildlife Permit Coordinator as needed. Some fish research studies and fish salvage projects are conducted in waterbodies where turtles are known to occur or that provide suitable habitat and turtles are likely present. Fish

research activities may impact turtles (e.g., electro-shocking, seining, etc.) therefore impacts to turtles and other non-target species need to be considered and addressed in the application for these activities. In addition to the joint NOAA Fisheries/ODFW Fish STP, a Wildlife STP should be obtained for waterbodies where turtles are likely present and could be inadvertently captured during fish research or salvage efforts, or for other scientific activities. For more information see www.dfw.state.or.us/wildlife/license_permits_apps/.

An ODFW Wildlife Scientific Taking Permit is required for projects involving the capture of wildlife.

Photo Credit: David Vesely

Injured or Sick Turtles

If an injured or apparently sick turtle is found, call your local ODFW wildlife biologist for assistance (See Appendix A). Alternatively, immediately transport the turtle to the closest ODFW-licensed wildlife rehabilitation facility that can accept turtles. For a list of authorized wildlife rehabilitation facilities, contact ODFW at 503-947-6300 or go to: www.dfw.state.or.us/wildlife/rehabilitation/docs/wildlife_rehabilitators.pdf Anyone treating or caring for injured wildlife must have a valid Oregon Wildlife Rehabilitation Holding Permit (OAR 635 Div. 44).

This western pond turtle was found with multiple injuries to its shell.

Photo Credit: Erika Landorf Kelly

Sick or Injured Turtles.

Just like other animals, sometimes turtles get sick or injured and can benefit from the help of ODFW-licensed wildlife rehabilitators. Human intervention is warranted when illness and injury is human-caused, such as shell punctures or chewed limbs from domestic dogs and shell fractures from vehicle collisions. Some turtles may suffer from respiratory infections, eye infections, and shell rot. These infirmities have been linked to wild turtles interacting and coming into contact with released pet turtles.

Public Education and Turtles

The decline or disappearance of a rare native species, particularly one that uses a variety of wetland and upland habitats, can indicate collapses in other parts of the local ecosystem which supports not only many other species of plants and animals, but humans as well. Protecting native biodiversity is a means to the larger end of preserving the integrity and resilience of ecosystems. Turtles play a unique role in the maintenance of biological communities as both predators

and prey. Educating the general public about turtles, what they need to survive, what threatens their existence, and their ecological significance can increase awareness and support for native turtle conservation efforts. Turtles are a charismatic species and people of all ages tend to find them fascinating and interesting creatures. This makes them an iconic species for communicating conservation messages to the public.

An educational turtle tank with unreleasable western painted turtle and ODFW permit on display.

Photo Credit: ODFW

Turtles in the Classroom and as Pets

Turtles have a long life span, require year-round specialized care, and have specific housing and nutritional needs. They are prone to certain diseases and ailments (i.e., shell rot, eye infection, respiratory illness), many of which are often related to improper housing and care, although even turtles being properly cared for succumb to infection. These factors make turtles quite challenging as a classroom or personal pet. Educators and other individuals thinking about acquiring a turtle as a pet should first determine what species are legal according to ODFW's wildlife rules (www.dfw.state.or.us/OARs/56.pdf). If unsure, contact your local ODFW wildlife biologist for assistance. Housing and care requirements (e.g., space) should also be researched before taking on a turtle as a pet. Consideration should be made for the care of pet turtles when the main care-giver is on vacation or on a school break. As a reminder, native turtles may not be taken out of the wild, even for educational purposes, without a permit from ODFW. Additionally, it is illegal in Oregon to have turtle species that are native to Oregon even if they are captive bred. Many non-native turtle species are classified as "Prohibited" and require an ODFW permit prior to importation or possession. It is important to note that turtles and tortoises less than 4 in (10 cm) carapace (top shell) length may not be possessed in Oregon, even by educators (OAR 603-011-0420). The U.S. Food and Drug Administration also regulates the possession and sale of turtles under 4 in (10 cm) carapace length for public health reasons.

Importation of turtles from an out-of state source may require a Wildlife Import Permit from the Oregon Department of Agriculture and proof that the turtle was legally obtained, as well as a separate wildlife permit from ODFW. A pet turtle should never be released deliberately or allowed to escape into the wild, regardless of where it originated or what kind of turtle it is. ODFW has produced an informational brochure on the topic of wildlife in the classroom: www.dfw.state.or.us/conservationstrategy/invasive_species/docs/wildlife_in_classroom_bro.pdf. Educators are encouraged to provide this brochure to co-workers and students.

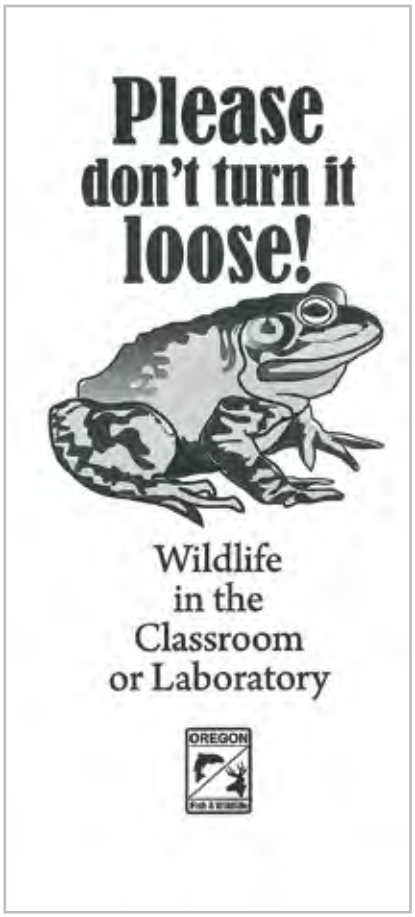


Photo Credit: ODFW

The Oregon Conservation Strategy Explained.

In order to receive funds through the federal Wildlife Conservation and Restoration Program and the State Wildlife Grants Program, Congress requires each state and territory to have a State Wildlife Action Plan. These proactive plans assess the health of each state's wildlife and habitats, identify the problems they face, and outline the actions that are needed to conserve them over the long term. The Oregon Conservation Strategy (OCS), approved in 2006, is Oregon's Wildlife Action Plan and provides a statewide blueprint for conserving Oregon's natural resources in a manner that maintains or improves those resources over time. The OCS provides a non-regulatory proactive approach to species and habitat conservation. It describes the issues affecting the highest priority species and habitats, key actions that will help these species and habitats, and the monitoring needed to measure success. The OCS weaves existing plans, scientific data, and local knowledge into a broad vision and conceptual framework for long-term conservation of Oregon's fish, wildlife and habitats. Every Oregonian has a role in implementing the OCS. The OCS is in the process of being reviewed and updated.

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Appendix A:
ODFW Region District and Field Offices

WEST REGION

Central Point Rogue Watershed District Office
1495 E. Gregory Road
Central Point, OR 97502
Tel: 541-826-8774 Fax: 541-826-8776

Charleston Field Office
63538 Boat Basin Drive
P.O. Box 5003
Charleston, OR 97420
Tel: 541-888-5515 fax: 541-888-6860

Clackamas North Willamette Watershed District Office
17330 SE Evelyn Street
Clackamas, OR 97015
Tel: 971-673-6000 Fax: (971)-673-6070

Corvallis South Willamette Watershed District Office
7118 NE Vandenberg Avenue
Corvallis, OR 97330-9446
Tel: 541-757-4186 Fax: 541-757-4252

Gold Beach Field Office
29907 Airport Way, PO Box 642
Gold Beach, OR 97444
Tel: 541-247-7605 Fax: 541-247-2321

Newport Field Office
2040 SE Marine Science Drive
Newport, OR 97365
Tel: 541-867-4741 or 541-867-0300 Fax: 867-0311

Roseburg Umpqua Watershed District Office / West Region Office
4192 N. Umpqua Hwy
Roseburg, OR 97470
Tel: 541-440-3353 fax: 541-673-0372

Sauvie Island Wildlife Area/North Willamette Watershed Wildlife District
18330 NW Sauvie Island Road
Portland, OR 97231
Tel: 503-621-3488 Fax: 503-621-3025

Springfield Field Office
3150 E Main Street
Springfield, OR 97478-5800
Tel: 541-726-3515 Fax: 541-726-2505

Tillamook North Coast Watershed District Office
4907 Third Street
Tillamook, OR 97141
Tel: 503-842-2741 Fax: 503-842-8385

EAST REGION

Baker City Field Office
2995 Hughes Lane
Baker City, OR 97814
Tel: 541-523-5832 Fax: 541-523-5874

Bend Deschutes Watershed District Office
61374 Parrell Road
Bend, OR 97702
Tel: 541-388-6363 Fax: 541-388-6281

Enterprise Field Office
65495 Alder Slope Road
Enterprise, OR 97828
Tel: 541-426-3279 Fax: 541-426-3055

Heppner Field Office
54173 Hwy 74, PO Box 363
Heppner, OR 97836
Tel: 541-676-5230 Fax: 541-676-9075

Hines District Office
237 Highway 20 South, PO Box 8
Hines, OR 97738
Tel: 541-573-6582 Fax: 541-573-5306

John Day Field Office
PO Box 9
John Day, OR 97845
Tel: 541-575-1167 Fax: 541-575-0948

John Day Watershed District Office
73471 Mytinger Lane
Pendleton, OR 97801
Tel: 541-276-2344 Fax: 541-276-4414

Klamath Watershed District Office
1850 Miller Island Road
Klamath Falls, OR 97603
Tel: 541-883-5732 Fax: 541-883-5521

La Grande Grande Ronde Watershed District Office / East Region Office
107 20th Street
La Grande, OR 97850
Tel: 541-963-2138 Fax: 541-963-6670

Lakeview Field Office
101 N "D" Street, PO Box 1214
Lakeview, OR 97630
Tel: 541-947-2950 Fax: 541-947-4632

Ontario Field Office
3814 Clark Blvd.
Ontario, OR 97914
Tel: 541-889-6975 Fax: 541-889-8133

Prineville Field Office
2042 SE Paulina Hwy
Prineville, OR 97754
Tel: 541-447-5111 Fax: 541-447-8065

Summer Lake Field Station
PO Box 69
Summer Lake, OR 97640
Tel: 541-943-3324 Fax: 541-943-3324

The Dalles Field Office
3701 W 13th Street
The Dalles, OR 97058
Tel: 541-296-4628 Fax: 541-298-4993

Appendix B. Oregon Laws that Apply to Turtles

Turtles are regulated by the following Oregon Revised Statutes (ORS) and Oregon Administrative Rules (OAR):

- It is unlawful to remove wildlife from their natural habitat or acquire and hold in captivity any live wildlife unless permitted by the Oregon Department of Fish and Wildlife. (ORS 497.308)
- Wildlife is state property; taking, angling, hunting or trapping in violation of wildlife law or rules is prohibited. (ORS 498.002)
- The chasing or harassing of wildlife is prohibited. (ORS 498.006)
- The purchase, sale or exchange of wildlife (or parts thereof) is prohibited. (ORS 498.022)
- Releasing domestically raised or imported wildlife without a permit from the Oregon Department of Fish and Wildlife is prohibited. (ORS 498.052)
- It is unlawful for any person to hunt, trap, pursue, kill, take, catch, angle for, or have in possession, either dead or alive, whole or in part any Nongame Protected Wildlife. (OAR 635-044)
- Non-native turtles are considered wildlife by ORS definition and are regulated by ODFW as Prohibited, Non-Controlled or Controlled. (OAR 635-056)
- The Oregon Department of Agriculture does not allow the importation of turtles of any kind with a carapace length of less than 4 inches. (OAR 603-011)

ANSWER to the Turtle ID Quiz from Figure 8 (page 61): Red-eared Slider

Appendix C: Recommended Plant List for Turtle Habitats

Floating Forbs - provides hiding cover for adults and juveniles, used as food by some adults, small juveniles may use larger floating mats for basking

- Mexican water fern
  Azolla microphylla
- Floating marsh pennywort
  Hydrocotyle ranunculoides
- Common duckweed
  Lemna minor
- Greater duckweed
  Spirodela polyrrhiza
- Northern (dotted) water meal
  Wolffia borealis

Emergent Forbs - provides cover, may be used as basking structures by some juveniles

- Water smartweed
  Persicara amphibia
- Waterpepper
  Persicaria hydropiperoides
- Wapato
  Sagittaria latifolia
- American brooklime (speedwell)
  Veronica americana

Submerged Forbs - provides hiding cover for adults and juveniles, used as food by some adults, small juveniles use for basking

- Water shield
  Brasenia schreberi
- Canadian waterweed
  Elodea canadensis
- Yellow pond lily
  Nuphar polysepala
- Ribbon leaved pondweed
  Potamogeton epihydrus
- Variable pondweed
  Potamogeton gramineus
- Floating-leaved pondweed
  Potamogeton natans

Grasses/Sedges/Rushes - provides cover

- Columbia sedge
  Carex aperta
- Slough sedge
  Carex obnupta
- Tufted hairgrass
  Deschampsia cespitosa
- Ovoid spikerush
  Eleocharis ovata
- Pointed rush
  Juncus oxymeris
- Small-fruited bulrush
  Scirpus microcarpus

Forbs and Wildflowers – for wet prairie habitat

- Common camas
  Camassia quamash quamash
- Willamette Valley bittercress
  Cardamine penduliflora
- Showy downingia
  Downingia elegans
- Coyote (Oregon) thistle
  Eryngium petiolatum
- Fragrant allocarya (popcornflower)
  Plagiobothrys figuratus
- Northwest cinquefoil
  Potentilla gracilis
- Buttercup
  Ranunculus spp. (native species only)
- Western (curvepod) yellowcress
  Rorippa curvisiliqua
- Wedge leaf (Oregon) saxifrage
  Saxifraga adscendens var. oreganensis

Shrub Plant Community – plants that buffer and enhance quality of aquatic habitat

- Serviceberry
  Amelanchier alnifolia
- Red osier dogwood
  Cornus sericea
- Douglas hawthorn
  Crataegus douglasii
- Nootka rose
  Rosa nutkana
- Willow
  Salix spp. (native species only)
- Douglas spirea
  Spiraea douglasii

Nesting Habitat Plant Community - plants that don't take up too much space; seed them lightly. They are great for pollinators too.

- Large flowered blue eyed Mary
  Collinsia grandiflora
- Roemer's fescue
  Festuca roemeri var. roemeri
- Bluefield gilia
  Gilia capitata capitata
- Alumroot
  Heuchera micrantha
- Oregon iris
  Iris tenax
- Two color (miniature) lupine
  Lupinus bicolor
- Slender tarweed
  Madia gracilis
- Sea blush
  Plectritis congesta
- Northwest cinquefoil
  Potentilla gracilis
- Western buttercup
  Ranunculus occidentalis
- Bloomer's buttercup
  Ranunculus orthorhynchus
- Western blue-eyed grass
  Sisyrinchium idahoense
- Western longspur violet
  Viola adunca

Moist Forest / Upland Dry Shrubs and Trees – plants that buffer aquatic habitat, serve as overwintering and aestivating habitat, and provide sources of basking structures.

Shrubs:

- Vine maple
  Acer circinatum
- Red osier dogwood
  Cornus sericea
- Osoberry (Indian plum)
  Oemleria cerasiformis
- Pacific ninebark
  Physocarpus capitatus
- Red-flowering currant
  Ribes sanguineum
- Thimbleberry
  Rubus parviflorus
- Salmonberry
  Rubus spectabilis
- Trailing (Pacific) blackberry
  Rubus ursinus
- Elderberry
  Sambucus spp. (native species only)
- Common snowberry
  Symphoricarpos albus

Trees:

- Bigleaf maple
  Acer macrophyllum
- Red (Oregon) alder
  Alnus rubra
- Oregon ash
  Fraxinus latifolia
- Black cottonwood
  Populus trichocarpa
- Douglas fir
  Psuedotsuga menziesii
- Oregon white oak
  Quercus garryana
- Western red cedar
  Thuja plicata

Source of common and scientific names: Oregon Flora Project, www.oregonflora.org/

Appendix D. Example Artificial Basking Structures

Example 1

Source: Sue Beilke, NERI

Artificial Turtle Raft - Materials List & Assembly Directions

1. One 10’ long piece of 3” ABS pipe (Cut into two 3’ lengths and two 2’ lengths)

2. PVC cement, 1 pint

3. Four 3” ABS elbows

4. Three pieces of 8’ x 1” x 6” cedar fencing
   - cut one 8’ piece into 6” to 16” lengths for ramps
   - cut one more 16” length from each of the remaining two 8’ pieces
   - cut the remaining two long pieces in half, yielding four ~40” sunning decks

5. One old bicycle tire (dirt bike type)
   - cut into ~6” lengths to connect ramps to deck ends

6. Hardware: one box of 100 #8 woodscrews 1 ½” long (use washers or collars to help attach tire pieces to wood.)

7. Two ~40” lengths of 1” x 2” wood (rough) (after gluing the ABS pipe, wire and glue each 40” length to the top of each long side of pipe. The four deck pieces will be screwed into these two wood strips.)

Example 2

Source: Sue Beilke, NERI

Turtle Basking Raft

Materials:

- Seven 30” long 1”x 6” cedar planks
- One 30” PVC pipe with 2 end caps
- One cinder block
- Nylon rope to secure the raft to the cinder block
- 3 plastic semi-circle braces to attach the PVC pipe to the raft

How to Assemble:

1. Line up five of the cedar planks to create a 30” x 30” square.
2. Nail each plank to a cross plank on two sides
3. Attach the end caps to the PVC pipe and seal with caulking to prevent water logging.
4. Tie one end of nylon rope around PVC pipe
5. Secure the PVC pipe float to one side of the raft. Space the brackets evenly on the raft.
6. Tie the other end of the rope to the cinder block and place in pond at least 5’ from shore.

** One end of the raft will be slightly submerged; this allows easy access for the turtles to climb.

** To prevent water logging, let wood dry out for 6 months to a year prior to using.

Photo Credit: Oregon Turtle Conservancy

Example 3

Source: Jim Holley, Independent Contractor

Turtle Raft Recipe

Note: This recipe is based on my notes from all of my previous endeavors building turtle rafts (TR). This list of ingredients is for temporary (semi-permanent) turtle rafts.

Ingredients for One TR:

- One wooden pallet
- 15' of ½" nylon rope (or 4 ferrules and 15' steel cable)
- Four thick zip ties (or 4-7/16" steel hose clamps)
- One half cinder block
- 3' length of 4" PVC
- Two 4" PVC caps
- 3' lengths of 3" PVC
- Two 3" PVC caps
- PVC glue

All materials should be cleaned, rinsed with 10% bleach solution, and dried before being placed. For semi-permanent placements, the pallets should be varnished and steel cable and steel clamps should be used. One float should be placed on an end and the second in the middle enabling one end of the TR to dip into the water. Some planks of the pallets should be removed if there is a chance of a turtle becoming lodged when trying to escape into the water.

Appendix E: Turtle Habitat Assessment Tools

Example 1. Turtle Habitat Survey Form and Site Ranking

Source: Rachel Kutschera. March 2010. "Habitat assessment and conservation recommendations for the western pond turtle (Actinemys marmorata marmorata) and the western painted turtle (Chrysemys picta bellii) within the urban growth boundary of Portland Oregon. PSU Dept. of Environmental Science and Managmenet. 77 pp.

Turtle Habitat Survey Sheet		**Name:**
Date:	**Site Name/Address:**	**Time:** **AM / PM**
Water Body	Circle: Flowing (Creek/River/Channel/Slough, etc.) Stagnant (Pond/Lake/pool,etc.) Inlet or Outlet present Y / N Site is man-made or altered Y / N Check one: Intermittent _____ Perennial_____ Acreage_____	**Notes and Comments** Include: Turtles seen (#, sex, age group-hatchling/juvenile/adult), behavior observed (nesting, basking, terrestrial movement and direction), animal sign (scat, tracks, predated nests, invasive species), Human use (trails, roads, trash).
Bottom Substrate	Estimate Percent of Each: Mud _____ Rocks_____ Sand_____ Other (bottom not visible, obscured by aquatic vegetation, etc.)_____ Water Clarity (circle one): <1 ft. <2 ft. >2 ft.	
Basking Habitat	Indicate Number of Each (approximate if many) that are at least 6 in. wide, 1 ft. long, and less than 50% decomposed. Emergent logs surrounded by water_____ Emergent logs connected to shore_____ Logs on or near shore, not in water_____ Boulders, man-made surfaces, sandy/rocky shoreline present Y / N	
Vegetation Aquatic	Estimate Percent of Each: Open water_____ Floating veg._____ Emergent veg._____	
Terrestrial	Trees/Shrubs (>2 ft.)_____ Distance from shore (ft.)_____ Forbs/Grasses(<2ft.)_____ Distance from shore (ft.)_____ Bare ground/moss_____ Distance from shore (ft.)_____ Litter layer: Distance from shore (ft.)_____ Depth of litter (in.)_____	**Aquatic Vegetation Types Present** **Terrestrial Vegetation Types Present**
Nesting/Juvenile Habitat	Applies only if bare/mossy ground or vegetation <1ft. tall is present and has no canopy Estimate area (sq. ft)_____ Degree of Slope_____ Aspect_____ List any barriers to vegetation types or nesting areas (fencing, vertical slopes, etc.): _____ % shoreline water < 2 ft. deep_____ % with aquatic vegetation_____	**Photo Documentation** List photos and compass bearing of each.
Other	Riparian Zone: (shortest distance from shore to a disturbance): _____ft. Connected by water to other habitat? Y / N If N, distance to nearest aquatic habitat outside site boundary (if applicable)_____ft./mi.	

Instructions and Definitions

Use the following guidelines in the order listed to help you fill in the survey form. If you are not sure, leave the space blank or indicate with a "?"

1. If there are multiple water bodies on the site, fill out one form for each. Size/acreage is recorded once for the site.

2. On the aerial photo of the location provided, sketch, mark, or highlight main components. Use "x" for basking logs, hash marks for aquatic vegetation, and circle nesting areas.

3. Walk perimeter of the property and the water body (if dense vegetation is in the way, observe from other side or as closely as possible).

4. Note anything listed in the "Notes and Comments" section with anything else you think is relevant. A summary of the area, descriptions, interesting elements (an abundance of one plant type, high or low water, etc.). More is better than less!

5. Acreage can be determined by the aerial photograph, maps, or the site owner.

6. Circle the type of **aquatic habitat (water body)** found at the site; elaborate if you are able. **Intermittent** waters flow only during certain times of the year, and **perennial** waters are permanent.

7. **Basking** is a turtle behavior of lying in the sun on logs, boulders, or occasionally a sandy shoreline.
Emergent logs are any that are partially in the water but extend out to form a potential basking surface.

8. **Floating vegetation**, such as lily or duckweed**,** is not attached to the bottom. **Emergent vegetation**, such as cattail and reed, grows out of the water but is rooted in the substrate.

9. The **litter or duff** layer is composed of dead leaves and grass, pine needles and cones, sticks, and other humic materials under the forest canopy. Take an average of 5 litter measurements around the site, or 5 from each separate forested area.

10. **Canopy** is the topmost layer of the forest, composed of the crowns of trees.

11. The r**iparian zone** is the land directly adjacent to the water body**.** A **Disturbance** can be trails, roads, fishing platforms, houses, walls/fences, etc. within the site boundary.

12. A **connection** to other habitat would be undisturbed similar vegetation or landscape that would allows turtles to move between habitats without crossing roads or traversing large areas of open space where they could be easily viewed or harmed by humans or animal predators. Can also be connected by water (stream/creek, wetland) or human constructs such as undercrossings or greenways

13. **Photo documentation** can be digital photos of habitat components surveyed or notable findings and the direction you were standing when the picture was taken.

Background: Based on a literature review, Rachel developed the Habitat Survey Form and a value for the habitat components documented during the field survey. The Habitat Form is a two-sided document. Data is filled in on the front and explanations of some habitat components and tips on surveying in the field are listed on the back. Factors not included in the Habitat Survey Form were also addressed at the end of the literature review; presence of any invasive plants or animals and type was noted during field site visits in a "Notes and Comments" section on the Habitat Survey Form used to list variables that could not be quantified. Rachel advised that use of the Survey Form always include noting access to the site and any landowners or managers contacted during the survey. To rank surveyed sites, Rachel then developed a method that assigned values to each of the 10 habitat components.

Site Ranking: Sites were ranked according to a scale modeled after Evers et al. (2002). Based on the Habitat Survey Form, 10 habitat variables were surveyed for each water body: Water Availability, Water Bottom Substrate, Aquatic Vegetation, Terrestrial Vegetation, Basking Areas, Nesting Areas, Hatchling and Juvenile Habitat, Site Area, Riparian Zone, and Connectivity. The quality of each variable was assigned a point value based on the breakdown below. Seven variables could earn up to two points, two variables (Terrestrial Vegetation and Connectivity) could earn up to three points, and one variable (Area) could earn only one point. Two variables (Basking and Nesting)

were given weighted values by doubling the assigned points since those variables are highly limiting in determining the presence of a healthy turtle population. To score all variables equally in the ranking, a scaled weighting system was used. For example, if a two-point score was given to Terrestrial Vegetation, it would be divided by three, the highest possible value for that variable, to constrain it between 0 and 1. A three-point score divided by three equals one, and so on, so that all variables were constrained between 0 and 1, the lowest "high" value for any variable. To calculate the final ranked score, total points for each waterbody or site were divided by total possible points (varying depending on known and unknown variables), resulting in a value between 0 and 1.00. Due to doubling the values for Basking and Nesting, it was possible to score a value of over 1.00. Unknown values were eliminated to avoid a negatively biased ranking due to missing information.

Other models for turtle habitat have been designed, such as Vesely and Chiller's (2000), but most authors warn that their design is site specific, differing even from most Habitat Suitability Index (HSI) models. The ranking developed in this project is based on site assessment methodology and designed to be used on any site where native Oregon turtle habitat is desired or needs to be appraised. Despite the usefulness of this ranking method for prioritizing sites for conservation, purchase, or management, care should be taken in any situation when using the Habitat Survey Form and this ranking methodology. Even if all habitat variables are present, the lack of one limiting factor, such as connectivity, can render a site unsuitable for establishing or maintaining a viable turtle population. Each habitat component missing or of poor quality should be examined in conjunction with available funds and manpower to restore it before undertaking a turtle conservation program or considering reintroductions.

The 10 Habitat Components

1. **Water**
   - 0 = No water present
   - 1 = Water present intermittently; dries or is drained completely at some point annually
   - 2 = Water present perennially
2. **Bottom Substrate**
   - 0 = No water present or substrate is man-made (i.e. concrete)
   - 1 = Rocks, sand, or mixed substrates
   - 2 = Mud or organic materials
3. **Basking**
   - 0 = None (no surfaces emergent from or adjacent to water)
   - 1 = Logs present are <6 in wide and 1 ft long, >50% decomposed, only connected to shore (not isolated in water), OR basking habitat is composed of boulders, sand banks or other material
   - 2 = Logs present are >6 in wide and 1 ft long, <50% decomposed, and isolated within the water body
4. **Aquatic Vegetation**
   - 0 = None (all open water or no water present)
   - 1 = Floating OR emergent vegetation present on at least 5% of water or shoreline.
   - 2 = Floating AND emergent vegetation present on at least 5% of water and shoreline.

5. Terrestrial Vegetation

0 = None (soil or man-made substrate only)

1 = At least two types of vegetation present with 5% coverage or more, OR a litter layer is present.

2 = All types at least 5% present with a litter layer of at least 2 cm (.075 in), but separated from water by a barrier (fence, steep slope, etc.)

3 = All types with at least 5% coverage and a litter layer present and accessible from some part of shoreline

6. Nesting

0 = None (no bare ground or vegetation <1 ft tall and without canopy cover)

1 = Present, but on a slope of >25°, not SE facing, or barrier to it is present

2 = Present on slope of <25° and SE facing with no barriers between water and habitat

7. Hatchling and Juvenile

0 = None (No water <2 ft deep)

1 = Shoreline has water <2 ft deep, but with little accompanying aquatic vegetation, or access in and out of water is limited.

2 = Shoreline has water <2 ft deep with emergent or floating vegetation and easy access in and out of water (low slopes from shoreline or other emergent structures nearby)

8. Riparian Zone and Disturbance

0 = Site is used by motorized or non-motorized vehicles, domestic animals, paved trails, etc. Human presence dominates site and is evidenced by buildings, paved trails, trash, etc. to shoreline.

1 = Light human uses such as fishing or hiking/walking is allowed; there is less than 1/3 mi (1760 ft) from shoreline to such users or access trails/roads.

2 = Public access does not reach shoreline, or distance from shoreline to any disturbance is at least 1/3 mi (1760 ft) with vegetation in between.

9. Area/Home range

0 = Total size of site including water is less than 2.5 ac (1 ha)

1 = Total size of site including water is greater than 2.5 ac (1 ha)

10. Connectivity

0 = None (site is isolated from other wet habitats by heavy development such as industrial areas or neighborhoods, highways, etc.)

1 = Closest habitat is inaccessible due to development not used by motorized vehicles, or is characterized by movable elements such as fences, dirt trails, etc.

2 = Site is connected but distance is longer than 91.4 m (300 ft), has no vegetative covering, or is a geographical barrier such as a steep slope

3 = Site is connected to other wet areas within 91.4 m (300 ft) by undeveloped land with vegetative covering, water, or road under-crossings.

Total points possible: 10

Example 2. Western Pond Turtle Habitat Assessment Survey Form

Source: Bury, B. B., H. H. Welsh, Jr., D.J. Germano, D.T. Ashton (eds). 2012. Western Pond Turtle: Biology, sampling techniques, inventory and monitoring, conservation and management. Northwest Fauna No. 7. Soc. for Northwstern Vertebrate Biology. 128 pp.

Western Pond Turtle Habitat Assessment Survey Form

FOR BASIC AND ENHANCED MONTORING **Date** _____

Site # _____ **UTM x** _____ **UTM y** _____ **USGS HUC** _____

T, R, S, ¼ _____ **Landowner** _____ **Observers** _____

Type of System: _____ **SITE, Width** _____ **Length** _____ **Photo record: y/n #** ____

(stream, pond, lake, reservoir) (m) (m)

TERRESTRIAL HABITAT

RIPARIAN

Moisture: wet / mesic / dry **Forest**: young /mature / old

List the 2 most common tree, shrub, forb grass species present:

Shrub _____ **Tree** _____

Grass _____ **Forb** _____

UPSLOPE

Moisture: wet / mesic / dry **Forest**: young / mature / old

List the 2 most common tree, shrub, forb, grass species present:

Shrub _____ **Tree** _____

Grass _____ **Forb** _____

AQUATIC HABITAT

List the 2 most common aquatic and emergent plant species present:

Aquatic _____ **Emergent** _____

Types of Basking Structures Available _____

Types of Aquatic Cover Structure Available _____

Shade: **open** _____ **light** _____ **mod** _____ **heavy** _____
(0-10%) (11-40%) (41-70%) (>71%)

ROADS

Type: dirt / gravel / paved **Use level**: low / med / high **Proximity to aquatic site** _____

POTENTIAL DISTURBANCE _____ **Intensity** _____
(activity type) (low, med, hi)

Comments _____

Example 3. Western Pond Turtle Nesting Habitat Survey Form

Source: Bury, B. B., H. H. Welsh, Jr., D.J. Germano, D.T. Ashton (eds). 2012. Western Pond Turtle: Biology, sampling techniques, inventory and monitoring, conservation and management. Northwest Fauna No. 7. Soc. for Northwstern Vertebrate Biology. 128 pp.

Western Pond Turtle Nesting Habitat Survey Form

Date _____

Site # _____ **UTM x** _____ **UTM y** _____

Observers _____ **USGS HUC** _____

T, R, S, ¼ _____ **Photo record: y/n #** _____

Type of System: _____ **SITE, Width** _____ **Length** _____
(stream, pond, lake, reservoir) (m) (m)

Landowner: USFS/BLM/state/private/other

TERRESTRIAL HABITAT

Moisture: wet / mesic / dry **Elevation** _____ **Slope (%)** _____ **Aspect** _____

Dimensions of opening _____m X _____m **Percent cover of grass/forbs** _____

List the 2 most common shrub, forb, grass species present: **Shrub** _____

Grass _____ **Forb** _____

ROADS

Type: dirt / gravel / paved **Use level**: low / med / high **Proximity to nesting habitat** _____

POTENTIAL DISTURBANCE _____ **Intensity** _____
(activity type) (low, med, hi)

NESTING HABITAT DETERMINATION:

Nesting detected / Nesting not detected, but possible / Nesting not detected, poor habitat quality

Comments _____

Appendix F: Turtle Survey Protocols and Data Forms

Survey Protocols: Visual

Example 1. Visual Encounter Survey

Source: Chapter 4 (pages 29-35) in Bury, R. B., H. H. Welsh, Jr., D. J. Germano, and D. Ashton (eds.). 2012. Western Pond Turtle: Sampling Techniques, Inventory and Monitoring, Conservation and Management. Northwest Fauna 7. (Book). Society for Northwestern Vertebrate Biology. 128 pp.

Note to Reader: Please see the visual encounter survey protocol in the above referenced source, or contact your ODFW Regional Conservation Biologist to request a copy.

Survey Protocols: Visual

Example 2. Presence / Absence Surveys

Source: Conservation Plan for Native Turtles in the Columbia Slough, Portland, Oregon. Version 1.0, July 2012. Report prepared by D. Rosenberg and J. Gervais (Oregon Wildlife Institute) and submitted to the City of Portland BES, Metro, Port of Portland, Oregon Wildlife Heritage Foundation, Oregon Zoo, and ODFW. 126 pp.

An excerpt from pages 22-24:

"Five observers performed the surveys from May 10 to June 24, 2011. Before any surveys were begun, one observer visited each site to determine where observations stations would be located. Stations were chosen so that a maximum amount of shoreline and number of basking sites could be seen from a distance of < 50' away. Observers performed "walking surveys" along ditches at which stationary observation points were not effective in determining occupancy by turtles. At these sites (Elrod Ditch, Children's Arboretum, and Leadbetter), an observer walked from two established points that could be walked in 30 minutes, with the observer searching for turtles in any aquatic habitat that allowed visibility.

All sites in the Columbia Slough watershed were surveyed four times by at least two different observers. Sites in the Johnson Creek watershed were surveyed only once.

Because of the relatively low detection probability for a single survey (see Results), only those sites surveyed four times are included in the analyses of occupancy and habitat associations. To maintain similar seasonal effects of detection, each of the four survey rounds was completed at all sites before the next survey round was begun. Logistical constraints imposed by traffic and other accessibility issues dictated the order in which sites were visited, which varied among surveys. We varied the time of day that a survey was conducted within the four replications at a particular site.

We conducted surveys for turtles between 09:00 and 16:00, when turtles were most likely to be basking, and therefore most detectable. We required that the air temperature be a minimum of 12 °C (55 °F) to conduct a survey. If the Beaufort scale indicated winds in excess of 12 mph (3 on the Beaufort scale), observations were discontinued.

Observers began watching for turtles while they approached the observation station. Once they arrived at the station, observers used binoculars and 20-60X spotting scopes to locate, count, and identify to species and size class each turtle observed during a 30-minute observation period. Size classes recorded were small juveniles, large juveniles, or adults. Observers also noted disturbances such as passing recreationists and responses by the turtles. After the half-hour observation period, observers recorded air and water temperatures. Air temperatures included sun and shade measurements if the weather was clear, and water temperatures were taken at approximately 1 foot depth and 5 feet from shore. Water temperatures were not obtained when shorelines were inaccessible.

We trained observers to identify four species: western painted turtles, red-eared sliders, western pond turtles, and common snapping turtles. Of these, the western painted turtle and sliders were most likely to be indistinguishable during surveys. If the determination of either slider or painted turtle was not certain based on a good visual observation of marking patterns on the head, then they were identified as "PTRES" on the data form as opposed to "UNK", which meant the observer was unable to distinguish any identifying characteristics to determine species.

We scored each survey as either "detected" or "undetected" based on whether any turtles of any species were seen at that site during the survey. We defined a site as "occupied" if any turtles were observed during he four surveys. Occupancy rate is the proportion of sites that are occupied at any given moment during the surveys. We then estimated occupancy rates and site-level detection probabilities (Mackenzie et al. 2006) using Program MARK (White and Burnham 1999). We modeled the probability of detecting turtles at any site as a function of turtle abundance (high versus low), allowing detection probability to remain fixed or vary independently or linearly with time. Because observers always observed turtles at sites with large populations, we fixed the probability of detection at the high-density sites at 1.0 in models that estimated detection probability separately for site density. We evaluated all occupancy models in Programs Mark (Table 3)."

Survey Data Forms

Example 1. Turtle Presence / Absence Surveys

Source: Oregon Wildlife Institute. P. O. Box 1081, Corvallis, OR 97339.

TURTLE PRESENCE/ABSENCE SURVEYS

Location:_____ Station No: _____ Observer: _____
Survey Date:_____
Start Time:_____ End time: _____ Wind (Beaufort scale): _____
Weather (circle one) sun pt sun cloudy misty
Air temp, Shade _____ °C Sun _____ °C Water temp: _____ °C
Estimated amount of water body under observation from station (%): _____
Size classes: <3"=H, 3-4"= SJ, 4-6"=LJ, >6"=A
Species: PT=painted, RES=slider, POND, SNAP, UNK=Unknown, PTRES=painted or slider

Time	No. turtles visible	Size Class	Species	Basking structure (log, bank, water etc.)	Disturbance? Any potential within 100ft	Turtle response? Y/N and describe	Comments

Survey Data Forms

Example 2. Oregon Native Turtle Working Group – Presence/Absence Surveys 2014

Source: Oregon Native Turtle Working Group – Lower Willamette Chapter.

Lower Willamette Valley Turtle Working Group – Presence/Absence Surveys 2014

Date:				**Site name/Observation Pt:** *(e.g., Nyberg Preserve_OP1)*	
Surveyor names(s):					
Cloud cover (circle): <25% 26-50% 51-75% >75% **Ambient air temperature:**		**Wind (circle):** Calm Light Gusts developing		**Notes (access):** **Start time:** **End time:**	
Time	**Species***	**# of Turtles**	**Age class** (A, J, H)	**Confidence in Count and ID** (high, med, low)	**Notes: behavior, habitat, etc.**
Date:				**Site name/Observation Pt:** *(e.g., Nyberg Preserve_OP1)*	
Surveyor names(s):					
Cloud cover (circle): <25% 26-50% 51-75% >75% **Ambient air temperature:**		**Wind (circle):** Calm Light Gusts developing		**Notes (access):** **Start time:** **End time:**	
Time	**Species***	**# of Turtles**	**Age class** (A, J, H)	**Confidence in Count and ID** (high, med, low)	**Notes: behavior, habitat, etc.**

***UNK** = Unknown, **PT** = Western painted turtle (*Chrysemys picta bellii*), **POND** = Western Pond turtle (*Actinemys marmorata*), **RES** = Red-eared slider (Trachemys scripta elegans), **SN** = Snapping Turtle (*Chelydra serpentina*)

p. _____ **of** _____

Survey Data Forms

Example 3. Western Pond Turtle Nest Site Survey Form

Source: Page 119 in Bury, R.B., H.H. Welsh, Jr. D.J. Germano, and D. Ashton (eds.). 2012. Western Pond Turtle: Sampling Techniques, Inventory and Monitoring, Conservation and Management. Northwest Fauna 7. (Book). Society for Northwestern Vertebrate Biology. 128 pp.

Western Pond Turtle Nest Site Survey Form Date _____

Site Number _____ Watercourse Name _____ Basin Name _____

Temp.; Air_____C, Water_____C. Weather___ ___ ___, Event no. _____ Type: pond/river

Observers_____, Affiliation_____, Phone_____

Township_____, Range_____, Section_____, ¼_____, 1/16_____

UTM x_____, UTM y_____, Land ownership_____

Bullfrogs detected Y/N; Bass detected Y/N, species Smallmouth/Largemouth/Unk; Other exotic Y/N

Nest #	Distance to water (m)	Percent vegetative cover	Soil type	Intact or predated	Predator exclosure	# eggs	Comments

Appendix G: Land Use Code for Turtle Conservation

Example 1. Wasco County, Oregon

Source: Page 3.970-1, Sections 3.970, EPD-13, Pond Turtle Overlay zone. January 5, 2005.

Section 3.970 Division 13 - Pond Turtle Sensitive Area Overlay

In any zone which is in the Pond Turtle Wildlife Overlay (EPD-13), the requirements and standards of this Chapter shall apply in addition to those specified in the underlying zone.

If a conflict in regulation or standards occurs, the provisions of this Section shall govern.

A. Purpose: The purpose of this overlay district is to conserve important wildlife areas by providing supplementary development standards; to protect the core water areas, nesting sites, connecting corridors, and hibernation sites of the Western Pond Turtle; and to permit development compatible with the protection of the wildlife resource.

B. Application of Provisions and Definition of Sensitive Habitat Areas: The sensitive habitat area is the area identified in the Wasco County Comprehensive Plan inventory and site specific ESEE [Economic, Social, Environmental, and Energy] for both the core habitat and upland management areas. The sensitive habitat, including both core habitat which extends between 150 and 600 feet from an important water body or connecting corridor and upland management area which extends as far as ¼ mile or 1320 feet from an important water body or connecting corridor in it furthest reaches. The specific size of the sensitive habitat area and rationale for identifying the distinction between core habitat and upland management area is discussed in the ESEE analysis. The need for variation in the program adopted to protect these areas is also explained in the ESEE analysis.

   Significant sensitive habitat located within the Columbia River Gorge National Scenic Area is not subject to the provisions of this Section. The relationship between the habitat area inside the National Scenic Area [NSA] and that protected by this goal 5 program is noted. Protection measures have been developed to provide compatible protection measures inside and outside the NSA. Unless identified for interim protection under subsection E of this section, only inventoried sites determined to be significant and evaluated for protection through a site specific ESEE analysis are afforded Goal 5 protection.

   Sensitive resource plan review requirements are applicable to all uses in the underlying zone(s). Any use permitted or permitted conditionally in the zone is subject to the sensitive resource plan review procedure if located within the sensitive habitat area identified for the inventoried significant site. Land divisions of parcels including sensitive habitat area shall be reviewed to determine the need for sensitive resource plan review specifically considering review criteria in sub section D of this section. The sensitive resource plan review requirement is applicable in addition to and shall be applied concurrently with all other applicable standards and criteria in the county LUDO [Land Use Development Ordinance].

If setbacks or buffers specified in this ordinance overlap or conflict, they should be varied in a manner to achieve, to the greatest extent possible, the overall protection of affected resources and public interest.

Forest practices subject to ORS 527.610 to .770 and farm practices defined by ORS 30.947(2) are not regulated by the sensitive habitat overlay.

C. Procedure for Applying the Overlay Zone

1. Sensitive resource plan elements and description required for completed sensitive resource plan review application include the following:

   a. A plot plan drawn to scale showing the location of all development including existing and proposed roads, driveways and structures.

   b. Description of the general slope and aspect of the ground within the upland management area.

   c. Description of the operating characteristics of the proposed use including times when activity within the sensitive turtle habitat area would potentially disturb surface soil, generate vibration, or create a need for traffic in core habitat or potential nesting areas (exposed south facing slopes within the upland management area).

   d. Description of steps taken to avoid impacts to sensitive areas where possible and to minimize and mitigate for impacts in sensitive areas where impacts cannot be avoided.

   e. Timing of construction activities including grading or filling land, hauling materials and building.

   f. Description of existing vegetation and vegetation to be removed for the proposed development.

   g. Description and location of proposed grazing activities.

2. Completed plot plan and sensitive resource plan review requests shall be submitted by the County to ODFW for comment. ODFW shall have 20 days from the date that the sensitive resource plan is mailed, to submit written comments to the County. If the County does not receive a response form ODFW within this time period, the County shall proceed to process the applicant's request.

3. Based upon the record, and evaluation of the proposal based on applicable criteria and review of the site specific ESEE analysis in the Comprehensive Plan, the Planning Director or designee shall approve or reject the sensitive resource rejected the applicant may alter the sensitive resource plan and protection measures to achieve compliance with the applicable criteria.

4. Submittal of an altered sensitive resource review request will be considered a new application and will not be subject to limitations on resubmittal of similar applications.

5. Once deemed complete, the County will proceed to process altered sensitive resource plan review requests as a new land use application.

D. Criteria applicable within Sensitive Pond Turtle Habitat Area

1. In the area designated Core Habitat

a. This area is determined to be a "no disturbance" area. New uses shall be prohibited on lands designated Core Habitat. Prohibited uses include but are not limited to:

(1) new building construction;

(2) new agricultural cultivation on land not zoned EFU;

(3) expansion of existing buildings into core habitat areas;

(4) new ground disturbance, except for accepted agricultural practices on land zoned EFU [Exclusive Farm Use];

(5) new landscaping;

(6) motor vehicle use, except for those required to maintain existing utilities and roads, use of existing roads, and use for enhancement projects;

(7) livestock use/grazing on land not zoned EFU.

b. Alteration, and/or restoration of a lawfully established dwelling which does not result in new ground disturbance within the core habitat area may be allowed subject to the sensitive resource plan review criteria listed in this section.

c. Implementation or completion of a ground disturbing or mitigation activity permitted subject to the required sensitive resource plan review and applied protection measures is allowed in accordance with the terms and conditions of the permit.

d. Replacement of a lawfully established dwelling. Any replacement dwelling shall be located outside of the core habitat area if possible and shall be permitted development standards of the underlying zone. If it is not possible to replace the dwelling outside the core habitat area, replacement within the core habitat will be considered through the sensitive resource plan review process applied in the upland management area and impacts shall be minimized. Mitigation may be required to balance unavoidable impacts to the core habitat area.

e. Any use allowed within the core habitat area shall be reviewed through the sensitive resource plan review process in sub section C. of this section and will only be permitted upon a determination that:

(1) the base zone otherwise authorizes the use,

(2) there is no other location on the tract that that can be used to practicably accommodate the use,

(3) the use has been proposed in a manner that will minimize the impact of the proposed use on the resource, and

(4) the proposal includes a plan for mitigation of unavoidable impacts prepared by a qualified professional that includes a monitoring plan designed to confirm the success of the mitigation effort.

2. In the area designated Upland Management Area

The following standards shall apply to any new ground disturbing activity. This includes: expansion, maintenance, replacement of existing structures or new structures: replacement or maintenance of existing utilities: new utilities; and septic installation requiring a building permit or septic permit; new grazing; new landscaping; and new cultivation.

a. New ground disturbances proposed within the upland management Area shall be subject to a sensitive resource plan review by the Oregon Department of Fish and Wildlife in accordance with the sensitive resource plan review process in sub section c. of this section.

b. Avoidance of ground disturbance within the entire sensitive habitat area, including both the core habitat and upland management areas, precludes the need for any sensitive resource plan review.

c. The following factors shall be considered when sensitive resource plans and proposed protection measures are reviewed:

(1) Where possible new ground disturbances will be located to avoid impact to open south and west facing slopes within the upland management area. If location of a new ground disturbance is necessary on a south or west facing slope the County will work with ODFW and the applicant to identify necessary steps to minimize potential impacts to habitat values in the upland management area.

(2) The location, size, scope, configuration or density of new uses shall be regulated to protect wildlife species. The timing and duration of all construction and all uses shall also be regulated to ensure that they do not occur during the time of the year when wildlife species are most sensitive to disturbance.

(3) Proposed livestock grazing on non EFU ground will be reviewed to ensure livestock are controlled to prevent overgrazing of vegetation. Restrictions on livestock may be necessary on non EFU ground because they are known to crush turtles in hibernation or in transit from pond to pond.

(4) New driveway/road access will be reviewed along with the timing for increased construction traffic on existing roads or driveways located or proposed to be located within the Upland management area. The purpose of the review will be to avoid adverse impacts to turtles most likely to result from vehicles crushing them and to avoid impeding movement of the turtles along the riparian corridors, to other ponds, and to nesting sites. If potential adverse impacts cannot be avoided, the County will work with ODFW and the applicant to identify necessary steps to minimize potential impacts to habitat values in the upland management area.

(5) Existing vegetation or other landscape features within the upland management area, which are confirmed to provide critical habitat values, shall be preserved and maintained. A restrictive covenant to preserve and maintain vegetation shall be required when specified in the ESEE for the site.

(6) No partitions or subdivisions shall be permitted which would force location of a dwelling structure or other ground disturbing activity, not otherwise permitted on the site to be allowed within the sensitive habitat area.

(7) The sensitive resource plan and proposed protection measures shall conform to the requirements of the ESEE analysis for the specific type of significant sensitive habitat area impacted.

d. Alteration, restoration, or replacement of a lawfully established dwelling. Any replacement dwelling may be allowed so long as it complies with applicable sensitive resource plan review criteria and other applicable provisions in the County's LUDO.

e. The applicant shall, as a condition of approval, record a deed restriction form adopted as Exhibit A, with the county clerk of the county restricting the use of the area identified as "Core Habitat".

f. The applicant shall, as a condition of approval, record the conditions of approval determined through the sensitive resource plan review process, with the county clerk of the county.

g. Maintenance and repair of existing structures not requiring a construction permit, permitted work conducted within a closed structure, or repair of a failing septic system are exempt from sensitive resource plan review criteria.

E. Interim Protection of Sensitive Habitat Area: Any parcel identified as having sensitive pond turtle habitat, not yet included on the inventory or deemed significant, but acknowledged for interim protection under the applicable Comprehensive Plan policy, shall forego any land ground disturbing activity regulated by this section, except for emergency repairs, until such time as the County has the opportunity to consult with ODFW. Consultation with ODFW will be held to determine whether an unacceptable level of interference would result from approval of the proposed action or activity. Only those activities deemed to have no more than an acceptable level of interference with the use or long term value of the potentially significant sensitive habitat area will be permitted.

Interim wildlife protection granted under this section is only valid for a maximum of 120 days from the date the County acknowledges the need for interim protection to be applied.

Appendix H: Additional Resources

British Columbia Ministry of Water, Land and Air Protection. 2004. Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia. 159 pp. www.env.gov.bc.ca/wld/BMP/herptile/HerptileBMP_final.pd

Beilke, S. G., and A. Christensen. 2007. Surveys for Oregon's two imperiled turtle species, the western painted (Chrysemys picta bellii) and western pond (Actinemys marmorata) turtles. Unpublished report submitted to The Oregon Zoo, Portland, OR.

Beilke, S. G., and A. Christensen. 2008. Surveys for Oregon's two imperiled turtle species, the western painted (Chrysemys picta bellii) and western pond (Actinemys marmorata) turtles. OR. Unpublished report submitted to The Oregon Zoo, Portland, OR.

Canadian Wildlife Service Ontario Region. 2000. A Framework for Guiding Habitat Rehabilitation. www.on.ec.gc.ca/wildlife/docs/framework3.html

Center for Biological Diversity. 2012. Petition to list 53 amphibians and reptiles in the United States as threatened or endangered species under the Endangered Species Act. 454 pp. www.biologicaldiversity.org/campaigns/amphibian_conservation/pdfs/Mega_herp_petition_7-9-2012.pdf

Colorado State Parks. 1998. Planning Trails with Wildlife in Mind – A Handbook for Trail Planners. 51 pp. www.fs.fed.us/outdoors/naturewatch/start/planning/Trails-for-Wildlife-Handbk.pdf

Conservation and Trade Management of Freshwater and Terrestrial Turtles in the United States. Workshop Presentation Abstracts. Sept 20-24, 2010. Convened and hosted by the USFWS, International Wildlife Trade Program. www.fws.gov/international/pdf/archive/workshop-terrestrial-turtles-presentation-abstracts.pdf 24 pp.

Defenders of Wildlife. 2003. Integrating Land Use Planning and Biodiversity. 59 pp. www.defenders.org/publications/integrating_land_use_planning_and_biodiversity.pdf?ht=

Evers, D. C., L. Attix, C. Howard, G. Christian, L. Savoy, and W. Goodale. 2002. Mitigating the Loss of Common Loons From a Marine Oil Spill: Identification of Breeding Habitat in Maine. Report BRI 2002-01 submitted to the U.S. Fish and Wildlife Service-Gulf of Maine Office. BioDiversity Research Institute, Falmouth, Maine.

Hall, R. J. 1980. Effects of Environmental Contaminants on Reptiles: A Review. USDI U.S. Fish and Wildlife Service. Spec. Sci. Report - Wildlife No. 228. 12 pp.

Hayes, M. P., S. G. Beilke, S. M. Boczkiewicz, P. B. Hendrix, P. I. Ritson, and C. J. Rombough. 2002. The western painted turtle (Chrysemys picta bellii) at the 34 Rivergate Industrial District: Management options and opportunities. Unpublished report.

Holland, D. C. 1994. The western pond turtle: habitat and history. Unpublished final report, U.S. Dept. of Energy, Portland, Oregon.

Jackson, S. D. and C. R. Griffin. 2000. Wildlife crossing toolkit. A strategy for mitigating highway impacts on wildlife. www.wildlifecrossings.info/sa005.htm

Jones & Stokes. 2004. Western Pond Turtle Habitat Management Plan. December. (J&S 04254.04.). San Jose, CA. 27 pp. www.nuqu.org/lib/site27workplan20050126attachment2turtle.pdf

Knutson, M. G., W. B. Richardson, S. E. Weick, D. M. Reineke, J. R. Parmelee and D. R. Sutherland. 2002. Ecological Communities and Water Quality Associated with Agricultural Farm Ponds in Southeastern Minnesota. www.umesc.usgs.gov/terrestrial/amphibians/chapter1.html

Kutschera, R. 2010. Habitat assessment and conservation recommendations for the western pond turtle (Actinemys marmorata marmorata) and the western painted turtle (Chrysemys picta bellii) within the urban growth boundary of Portland, Oregon. PSU Dept. of Environmental Science and Management. 77 pp.

Masin, S., A. Bonardi, E. Padoa-Schioppa, L. Bottani, and G. F. Ficetola. 2013. Risk of invasion by frequently traded freshwater turtles. Biol. Invasions. DOI 10.1007/s10530-013-01515-7.

Natural Resources Conservation Service. 2005. Restoring and Managing Habitat for Reptiles and Amphibians. www.nrcs.usda.gov/wps/portal/nrcs/detail/ia/newsroom/factsheets/?cid=nrcs142p2_008529

Oregon Biodiversity Information Center. 2013. Rare, Threatened and Endangered Species of Oregon. Institute for Natural Resources, Portland State University, Portland, Oregon. 114 pp. http://orbic.pdx.edu/documents/2013-rte-book.pdf

ODFW Invasive Species Fact Sheet: Common Snapping Turtle www.dfw.state.or.us/conservationstrategy/invasive_species/docs/snapping_turtles_fact_sheet.pdf

ODFW Invasive Species Fact Sheet: Red-eared Slider www.dfw.state.or.us/conservationstrategy/invasive_species/docs/red-eared_slider_fact_sheet.pdf

ODFW Please don't turn it loose! Wildlife in the Classroom or Laboratory. www.dfw.state.or.us/conservationstrategy/invasive_species/docs/wildlife_in_classroom_bro.pdf

ODFW Sensitive Species List: www.dfw.state.or.us/wildlife/diversity/species/sensitive_species.asp

ODFW Threatened and Endangered Species List: www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_species.asp

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