PLANNING CONSERVATION ACTIVITIES TO BENEFIT WESTERN POND TURTLES IN WEST EUGENE WETLANDS, LANE COUNTY, OREGON

Prepared for the USDI Bureau of Land Management,
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INTRODUCTION

The West Eugene Partnership is a consortium of government agencies and conservation groups combining their efforts to preserve and restore biodiversity on over 3,000 acres of public and private lands in the City of Eugene, Oregon. Known as the West Eugene Wetlands, the area encompasses one of the largest remaining areas of wetland prairie in the entire Willamette Valley (WREN 2006).

Among the wildlife species of particular interest to conservationists working at West Eugene Wetlands (WEW) is the western pond turtle (*Actinemys marmorata*), also known as the Pacific pond turtle. The western pond turtle has a complex life history that makes the species vulnerable to the environmental impacts associated with urbanization. Fortunately, the West Eugene Partnership and other stakeholders are already undertaking stream and prairie restoration activities in the WEW that should benefit western pond turtle populations.

The purpose of the project is to prepare a preliminary analysis that identifies factors limiting western pond turtle populations in the WEW, and to describe conservation opportunities that will benefit the species in the area. The goal is to create a planning document that will provide a blueprint for future habitat management, monitoring, and public education and outreach at the project area and other wetlands managed by the BLM.

The project objectives for 2008 were as follows:

- Prepare a map of ponds and channels known to be occupied by the western pond turtle and identify areas within West Eugene Wetlands (WEW) likely to provide important habitat resources such as nesting areas, basking sites, and over-wintering areas.
- Identify factors that are likely to be most limiting pond turtle population recruitment and survival in WEW.
- Identify opportunities to conserve pond turtle habitat resources on private and public lands in WEW.
- Identify information gaps hindering pond turtle conservation efforts in the WEW.
- Disseminate the results of this study to local agency managers, conservationists, and the public in order to facilitate working partnerships and community support for protecting western pond turtle populations in Lane County.

The focus of this study is on lands managed by the West Eugene Wetlands Partnership, especially those tracts administered by Bureau of Land Management, the City of Eugene, and The Nature Conservancy's Willow Creek Preserve (Fig. 1). Other habitats known to be (or were) occupied by western pond turtles such as Golden Garden Ponds, Gazebo Pond, and Danebo Pond were not included in this study.

NATURAL HISTORY OF THE WESTERN POND TURTLE

Taxonomy

There is currently some uncertainty surrounding the taxonomy of the western pond turtle. The species has been assigned to the genera *Clemmys* and *Emmys* by various taxonomists and two subspecies have been recognized. However, Stephens and Weins (2003) believed the species should be placed in its own genus, *Actinemys* based on evolutionary distance from other genera and found no justification to warrant diversification into subspecies Bury and Germano (2008) reviewed the recent genetic studies pertaining to the western pond turtle and agreed with Stephens and Weins (2003).

Description

The carapace length (CL) of adults typically range from 120-190 mm (5.5-7.5 in); males being larger on average (Bury and Germano 2008). Hatchling CL range from 20-30 mm (0.79-1.2 in; Bury and Germano 2008). Males usually have a cream-pale yellow throat without markings; throats of juveniles and females have dark flecking, typically over a yellow background (Holland 1994). The carapace of females is higher (more dome-like) than males; females have a flat plastron, while the plastron in males tends to be slightly concave (Bury and Germano 2008).

Distribution in Oregon

The western pond turtle has been found throughout the Willamette Valley and surrounding foothills of the Western Cascades and Coast Ranges; the Klamath, Rogue, and Umpqua basins; isolated localities in central and eastern Oregon probably represent introductions (Holland 1994).

Habitat Relationships

Western pond turtles inhabit a variety of aquatic habitat types, including; ponds, rivers, reservoirs, intermittent streams, seasonal wetlands, and flooded gravel pits (Holland 1994). In riverine habitats, western pond turtles select slower-moving waters such that occur in side-channels and alcoves (Holland 1994, pers obs.); in streams, turtles occupy deep pools more often than swift water (Bury and Germano 2008). Basking sites used by turtles for thermoregulatory behavior are an important component of aquatic habitats; rocks, logs, and emergent vegetation are utilized (Bury and Germano 2008). Underwater refugia such as undercut streambanks, mud substrates, logs, and dense patches of aquatic plants are used to avoid predators (Bury and Germano 2008, pers. obs.).

Western pond turtles may overwinter at the bottom of a pond or move on to land. In northern California, some individuals were known to spend as much as seven months of the year in terrestrial habitats (Reese and Welsh 1997). Observations suggest that western pond turtles that inhabit streams and rivers during summer are more likely to leave the watercourse in fall; turtles occupying lacustrine habitats tend to remain in the waterbody all year (Holland 1994). The use of terrestrial habitats may reflect a behavioral adaptation that evolved to avoid fast-moving water and dynamic conditions typical of western rivers in winter (Holland 1994, Reese and Welsh 1997). Patches of dense vegetation, forest litter, and mammal burrows are used as hiding cover while turtles overwinter on land

(Holland 1994, Reese and Welsh 1997). Radio-telemetry studies have shown that western pond turtles in the WEW utilize both aquatic and terrestrial overwintering sites (Holland 1994).

Females may travel more than 400 m (1,312 ft) from water to excavate a nest; although most nests are within 50 m (164 ft; Bury and Germano 2008). Nests tend to occur on sites with low slopes or south-facing aspects. Nest sites rarely have shrub or tree cover (Holte 1988, Holland 1994, Reese and Welsh 1998). Ground cover vegetation is usually sparse (Holland 1994); but this is not always the case (Holte 1988).

Diet

The primary prey of western pond turtles are aquatic invertebrates such as the larvae of caddisflies, dragonflies, stoneflies, beetles, and crayfish (Bury and Germano 2008). The carcasses of fish and anurans are scavenged when available (Bury and Germano 2008). Plants compose a minor portion of the diet, but western pond turtles have been observed feeding on catkins from alder and willow, and filamentous green algae (Holland 1994).

Predation

Predators of juvenile and adult western pond turtles include largemouth bass (*Micropterus salmoides*), bull frogs (*Rana catesbeiana*), osprey (*Pandion haliaetus*), raccoon (*Procyon lotor*) and others (Holland 1994). Non-native bullfrogs have been repeatedly mentioned as a significant threat to western pond turtle populations, but Bury and Germano (2008) believe the level of predation by bullfrogs may be overstated. Nests are preyed upon by raccoons, striped skunks (*Mephitis mephitis*), and coyotes (*Canis latrans*; Holland 1994).

Reproduction & Growth

In the Willamette Valley, females typically oviposit in the period between late-May to mid-July. Clutch size varies between 1-13 eggs (Holland 1994). As observed in other turtle species, the sex determination of western pond turtles is dependent upon incubation temperature; mean temperatures >27° C (80.6° F) cause a higher proportion of females to develop (Bury and Germano 2008). Eggs typically hatch in late-summer, but hatchlings overwinter in the nest and do not emerge until the following spring in the northern portion of the species' geographic range (Holte 1988; Bury and Germano 2008). Growth rates are highly varied. Western pond turtles have been reported to attain adult size in as little as three years (Germano and Rathbun 2008); however some individuals may require more than ten years to reach the same size (Holland 1994). Maximum life span of western pond turtles in the wild is reported to be at least 40 years (Holland 1994).

PHYSICAL AND BIOLOGICAL SETTING

Geomorphology & Hydrology

Historic Conditions

The WEW study area is located within the Upper Amazon Subbasin of the Long Tom River watershed, a major tributary to the Willamette River. Historically, seasonal high waters along the Willamette River extended across a floodplain 1.5- to 3.5-km wide during the winter; the width being greatest near the southern end of the river basin (Benner and Sedell 1997, reviewed by Taft and Haig 2003). The riverine landscape was characterized by a complex network of side channels, alcoves, sloughs, and oxbow ponds (Taft and Haig 2003). Along the upper Willamette River (Albany to Eugene), the area comprised by these aquatic habitats in 1995 had been reduced to approximately 33% of their area in 1850 (Oetter 2002).

The study area lies near the southern extent of the Willamette Valley physiographic province. Most of the area lies on the Calapooyia geomorphic surface formed as a result of the Missoula Floods approximately 10,000 years ago. Soils have heavy clay subsoil horizons with silty surface horizons (LCOG 1999a). The heavy clay layer creates a perched water table throughout the WEW. The shrink/swell properties of the clay soils creates a microtopography characterized by elevated mounds interspersed among poorly-drained lower areas. The Calapooyia surface of western Lane County is relatively flat, causing slow drainage through shallow swales and as sheet flow. Because there are so few natural topographic features to constrain watercourses, streams flowing through the area meandered widely across their floodplains prior to flood control projects in the watershed (LCOG 1999a).

Historically, Amazon Creek and its natural tributaries in the study area, Willow Creek and Dead Cow Creek, typically were dry during summer and early fall. The Long Tom River was characterized by very low streamflows and high water temperatures during this season (Thieman 2000). However, main channels throughout the watershed regularly exceeded bank-full capacity during winter storms (Thieman 2000).

Current Conditions

As early as 1913, The City of Eugene was undertaking efforts to constrain the main channel of Amazon Creek (Theiman 2000). Major USACE flood control and channelization projects in WEW were begun in the 1940's. Modifications have included: channel straightening and deepening; construction of dams and weirs; removal of sandbars and natural obstructions; construction of levees, and placing riprap on banks to prevent erosion. The Fern Ridge dam and reservoir were completed in 1941 (Thieman 2000). The construction of the main trapezoidal channels (i.e., "A" Channel, Diversion Channel, and "A-3" Channel) were completed by 1959. The portion of the historic Amazon Creek channel below Royal Ave. is now referred to as the "A" Channel. Amazon Creek originally flowed directly into the Long Tom River, but this natural connection was disrupted with the construction of the Diversion Channel to Fern Ridge Reservoir.

It is estimated that 36% of streams in the Upper Amazon basin and 62% Lower Amazon basin have undergone significant modification (Thieman 2000). As a result of these efforts to reduce flooding and channelize the stream, Amazon Creek has less sinuosity and habitat complexity than it had prior to flood control projects. Today, reaches of the A Channel form a continuous, wetted channel only during winter high flow events. Bank-full stream capacity is now rarely exceeded along Amazon Creek or its tributaries as a result of flood control projects (LCOG 1999a)

Vegetation and Landcover

Historic Conditions

The WEW study area was dominated by wet prairie and upland prairie plant communities prior to European settlement. Prairies and savannas in the Willamette Valley were maintained through regular burning by the Kalaypua Indians to improve conditions for hunting and growing important plants (Johannessen et al. 1971). Historically, wet prairies in the region were typically dominated by tufted hairgrass (*Deschampsia cespitosa*), creeping spikesedge (*Eleocharis palustris*), and meadow barley (*Hordeum brachyantherium*) (Wilson 1998a). Common grasses that were likely to be widespread on upland sites prior to European settlement were Roemer's fescue (*Festuca idahoensis* Elmer ssp. *roemeri*), California oatgrass (*Danthonia californica*), blue wildrye (*Elymus glaucus*), and Lemmon's needlegrass (*Achnatherum lemmonii*) (Franklin and Dyrness 1988, Wilson 1998b). Most plant diversity in prairie and savannas were represented by perennial and annual forbs.

Most of the common, native grasses dominating Willamette Valley are of low-stature (average height = 20 cm), although there are exceptions (e.g., blue wildrye max. height 1400 cm). Prairie communities display little vertical stratification, but are characterized by a high degree of horizontal spatial complexity (Wilson 1998a, Wilson 1998b). Spaces between individual bunchgrasses may be occupied by other plant species or remain bare soil. Even slight variation in topography can cause abrupt changes in species composition and result in a mosaic of discrete vegetation patches. Wilson et al. (1998b) also describes a "pedestal" microtopography characteristic of wet prairies in which bunchgrass and other dominant plants grow from small mounds elevated as much as 20 cm above the lower ground level. Seasonal flooding may submerge much of the ground in winter, while the "pedestals" remain above water.

Current Conditions

The WEW landscape was reshaped by agricultural activities during the period from the late-nineteenth century to the mid-1950's (LCOG 1999b). Farmers drained wet prairies by deepening natural stream channels and excavating ditches. Early crops were barley, wheat, hay, as well as livestock grazing. Annual ryegrass became important in the 1940's and 50's. Agricultural practices leveled most of the microtopography that characterized historic wet prairies in the study area.

As the City of Eugene expanded westward, much of the WEW study area was zoned for industrial use during the 1950's (LCOGb 1999). Extensive areas of wet prairie were converted to accommodate new buildings and roads. Currently, the WEW landscape can be characterized as a mosaic composed of semi-natural wetlands and upland fields juxtaposed with light and heavy industrial developments, residential neighborhoods, and a major commercial district. An extensive network of roads, a railroad right-of-way, and utility lines overlays the WEW study area.

STATUS OF THE WESTERN POND TURTLE IN THE WEW

There is cause for concern about whether western pond turtle populations will be able to persist in the WEW study area. Alterations to streams and wetlands, and the elimination of native prairie plant communities by agricultural practices, flood control projects, and urban development undoubtedly has had significant impacts on habitat quality and availability for the species. However, a review of available information has failed to reveal any reliable estimates of the size, density, or trends of western pond turtle populations in WEW based on standard mark-recapture models and parameter estimation techniques.

Locality Records

Prior to 1991, there were only 35 documented western pond turtle localities within the entire Willamette Basin, although anecdotal observations indicate the distribution of the species was far more extensive in the region (Holland 1994). The earliest records of the western pond turtle in the WEW study area were from 1991 as a result of two different biological evaluations: one performed for the construction West Eugene Parkway project (Galen 1994), and another for the construction of the West Beltline Highway (CH2M Hill 1993, reviewed by Galen 1994). These two reports identified several streams and wetland sites as occupied by western pond turtles, including: Stewart/Grimes Pond Area in Bertelsen Nature Park, "A-3" Channel, Danebo Pond, Gazebo Pond (approximately 500 yards NE of Danebo Pond), multiple locations in Amazon Creek, the Diversion Channel, "Turtle Swale", and Finn Pond (near the intersection of Green Hill Rd and the Southern Pacific RR tracks).

The principle source of recent turtle observations in the WEW study area are unpublished records compiled by John Applegarth sightings by himself and other volunteers during 2005-2007. The records include 222 sightings of western pond turtles and 75 of red-eared sliders. OWI used Applegarth's records to create a spatially-explicit database and map of turtle locations (Fig. 2).

None of these three information sources (Galen 1994, unpublished records by Applegarth) documented sites where observations were made, but failed to detect turtles. Such information is essential to understanding if the local spatial distribution of pond turtles is changing over time.

Population Size, Structure, and Recruitment

Although there are no reliable estimates of the size of the western pond turtle population in WEW, a 1994 study reported there were at least 30 individuals present in channels and seasonal ponds within the area based on visual counts and live-trapping (Galen 1994). The 222 western pond turtle sightings from 2005-2007 by Applegarth and others can not be used to attain a more recent estimate of minimum population size because it can not be determined how many of the observations are re-sightings of the same individuals.

A 1991 USACE research project captured 89 individual western pond turtles at Fern Ridge reservoir and adjacent wetlands (Holland 1994). The reservoir is approximately 3.5 stream miles from the historic channel of Amazon Creek via the Diversion Channel.

Western pond turtles are usually classified as adults when they attain a carapace length (CL) >120 mm; most adults range between 120-190 mm (Bury and Germano 2008). Hatchlings typically range between 20-30 CL (Bury and Germano 2008). The only records of measured CLs from turtles captured in WEW (n = 16) ranged between 119-188 mm (Galen 1994). Notes compiled by Applegarth on 222 sightings of western pond turtles visually observed during 2005-2007 also indicate that most individuals in the population appeared to be adults based on their size.

The age/size class structure of western pond turtle populations in Oregon is often strongly skewed toward larger and presumably older individuals. Holland (1994) considered this finding as evidence for a decline in population recruitment, and this assertion has been repeated elsewhere (Marshall 1996, Oregon Zoo 2007, NatureServe 2008). However, hatchlings and juveniles are known to use microhabitats segregated from those used by adults (Holte 1988; Holland and Bury 1998, reviewed by Bury and Germano 2008) and are more difficult to detect. Furthermore, there is evidence that CL is an unreliable predictor of age and some populations contain more juveniles than would be expected based on visual observations at a distance (Geramano and Bury 2001). Therefore, statements regarding the structure of any western turtle population in the absence of age-unbiased sampling and procedures to accurately measure the age of individuals must be considered conjectural.

There is evidence that western pond turtles continue to breed in the WEW, although survival rates of eggs and hatchings have not been studied. Galen (1994) reported capturing two gravid females on June 14 and 15, 1993 in Grimes Pond (then known as Bertelsen Pond) and tracking them in the pond and nearby A-3 Channel. Galen (1994) also reported finding and protecting two nests with exclosures on the east bank of Grimes Pond. No mention was made about whether these nests were successful. A gravid female was also trapped on June 14, 1993 at "Finn Pond", a small borrow pit just south of the Southern Pacific Railroad tracks between Green Hill Road and Dead Cow Creek (Galen 1994).

Sally Villegas of the BLM, Eugene District reported finding a predated nest as evidenced by egg shell fragments on a south-facing slope near Grimes Pond in April 2004 (Villegas pers. comm.) Applegarth reported finding egg shell fragments indicating a predated turtle nest in January 2006 near “Turtle Swale” in Meadowlark Prairie. The nest was not conclusively identified as to which turtle species had created it.

LIMITING FACTORS IN THE WEW

The urbanized environment of the WEW poses significant challenges for land managers and conservationists concerned for the future of the western pond turtle. The most probable factors limiting pond turtle populations in the study area were identified based on conditions observed during 2008 fieldwork, previous biological evaluations in the WEW, and research on mortality and population viability of freshwater turtles conducted outside of the study area. The objective risk represented by the factors described below can not yet be quantified, nor even ranked in relative order of their threat. The purpose of this section is to focus new research and conservation efforts toward the issues most likely to be affecting the persistence of pond turtle populations in the WEW.

Habitat Quality and Availability

In the WEW, it remains unclear how the extensive history of channel modifications and flood control projects have changed the availability of aquatic habitats for western pond turtles. Manmade alterations have decreased stream sinuosity and the number of oxbows and side channels (LCOG 1999b, Thieman 2000), therefore seemingly would reduce the area of aquatic/foraging habitat for turtles. However, much of the Amazon stream network was dry during summer and fall prior to the flood control projects and may have been uninhabitable by turtles during seasons of the year when they are most active.

Observations made during 2008 indicate that long portions of Amazon Creek and the A-3 Channel are probably too shallow to be occupied year-round by turtles during summer and early-fall. The longest, contiguous stream reaches classified as “Perennial ” habitat are those sections of Amazon Creek flowing through Willamette Daisy meadows / Oxbow area and Meadowlark Prairie, as well as the Diversion Channel flowing towards Fern Ridge reservoir (Fig. 2). Methods for classifying aquatic habitat are described in Appendix I.

Even within reaches classified as Perennial habitat, channel complexity is relatively simple compared to unmanaged, meandering steams. Important habitat elements for turtles such as deep pools, undercut banks, and large woody debris are rare in Amazon Creek, the Diversion Channel, and the “A-3” Channel. Floating mats of algae and riparian willows only offer scattered patches of hiding cover for turtles. Although not a widespread problem in the study area, there are some stream segments from which turtles cannot access terrestrial habitats because of conditions on streambanks. The most common obstacles are riprap, impenetrable vegetation, or deeply incised stream channels.

Observations made during summer and fall 2008 suggested that extensive areas of apparently suitable nesting habitat are available in Meadowlark Prairie, Oxbow Area/Willamette Daisy Meadow, Luk-wah Prairie, and Bertelsen Nature Park (Fig. 2).

Environmental contaminants are another serious habitat quality issue in the WEW, although there is little data to quantify their impact on western pond turtles inhabiting the study area. All of the major streams and manmade channels are identified by the U.S. Environmental Protection Agency (EPA) as impaired under Section 303(c) of the Clean Water Act (EPA 2009). A list of the impaired water parameters reported by the EPA for each of the major WEW streams are as follows:

- Amazon Creek: arsenic, copper, toxic organics, and *E. coli*
- Diversion Channel: arsenic, copper, lead, mercury, and *E. coli*
- A-3 Channel: mercury, dissolved oxygen, fecal coliform, and pH (EPA 2009).

A study that investigated contaminant levels in western pond turtle eggs collected from Fern Ridge reservoir found measurable amounts of organochlorine pesticides, PCBs, and mercury, plus a high level of chromium (Henny et al. 2003). The study failed to demonstrate a correlation between contaminants and egg failure. However, the authors stated that their initial study was limited in the scope of contaminants included in their analysis, and also noted that egg failure may not be the most sensitive indicator of contaminant effects in pond turtles. Henny et al. (2003) review studies of other chelonian species that found that reproductive endocrine functions can be disrupted by water contaminants.

Population Connectivity

Passage barriers within streams and an increasingly hardened landscape across the WEW threatens to divide the local western pond turtle population among a few disconnected refuges across the watershed. Small, isolated wildlife populations experience a number of problems that jeopardize their viability, including:

- Loss of genetic variability—limiting the population's evolutionary capacity to respond to long-term, changing conditions
- Inbreeding depression—often causing a lower rate of reproduction and poorer fitness among offspring
- Demographic stochasticity—the probability that a population will go extinct due to random demographic events increases in small populations
- Environmental stochasticity—the probability that natural (e.g., disease outbreak, drought) or anthropogenic (e.g. conversion of a wetland to parking lot) events will cause extinction increases as population size becomes smaller (Primack 1993).

Research conducted on many different biological populations suggests that the above problems become dire when effective breeding populations are composed of less than 50 individuals (Primack 1993).

In-stream passage barriers to turtle movements have been identified in the following locations:

W. 18th St. Culvert over West Fork of Willow Creek—Appears impassable to turtles during any level of stream flow.

W. 11th St. Bridge over Willow Creek—This remains the only potential passage between the Willow Creek subwatershed and the main channel of Amazon Creek. The streambed is relatively steep and rocky under the bridge and this reach has little water flow during most of the year. Vegetation encroaching in and along the channel is very dense. Further assessment is needed to determine whether turtles are able to pass under the bridge.

Amazon Creek weir near Royal Ave.—This recently constructed weir was constructed to impound stream flow. The resulting pool has become a center of turtle activity. However, the weir, public parking lot, and vehicle traffic on Royal Avenue combine to make an obstacle that turtles are unlikely to pass through to the Lower Amazon Basin.

A-3 Channel weir east of Bertelsen Ave—Galen (1994) reports this weir is impassable to turtles. It was not inspected during fieldwork for this report.

In addition to the barriers noted above, long reaches of Amazon Creek, Willow Creek, and the A-3 Channel had water depths <8-in during August-September 2008 (Fig. 2). Such conditions have probably been typical during summer and early fall in the Upper Amazon basin (Thieman 1999). Nevertheless, western pond turtles may be unable to successfully make long distance movements through such extremely shallow waters that also lack hiding cover.

Western pond turtles are capable of traveling more than 400 m across land to seek nesting sites or overwintering areas (Bury and Germano 2008). However, the literature review for this report did not reveal any evidence that western pond turtles make long-distance dispersal movements or migrations over land. Even if turtles did engage in such behavior, long-distance terrestrial movements between Perennial aquatic habitats are now unlikely to be successful in the WEW because of the obstacles posed by vehicle traffic, industrial developments, and high-density residential neighborhoods.

Given the barriers described above, turtles occupying the ponds in Bertelsen Nature Park and the adjacent reach of the A-3 Channel are already isolated from the larger population in the Upper Amazon basin. Turtles that may be present in Willow Creek also are isolated from the population in Amazon Creek by commercial developments along W. 11th St. Fieldwork conducted in Amazon Creek for this study was only performed upstream to approximately Seneca Ave.; it was not determined if western pond turtles inhabiting the uppermost reaches of Amazon Creek can move into the study area.

Traffic-Related Mortality

Vehicles have been reported to be a leading cause of mortality to western pond turtles (Holland 1994). Because of their nesting movements overland, females have been found to be at greater risk. As a consequence, some turtle populations in the northeastern U.S. are reported to have become sex-biased towards males (Steen and Gibbs 2003). Two turtles were reported to have been killed by vehicles during the construction of West Beltline Avenue and the frequency of traffic-related mortality was expected to increase in this area (CH2M Hill 1993, reviewed by Galen 1994).

In the WEW, there are several areas in which turtle activity centers are in close proximity to roads with high volumes of traffic:

- W. 11th Ave. between Terry St. and W. Beltline Avenue.
- Green Hill Road from Royal Ave north approximately 3500 ft
- Royal Ave. between Green Hill Road and Terry St.
- Roosevelt Ave. between Danebo Ave. and W. Beltline Ave.
- Danebo Ave. from Roosevelt Ave. south approximately 800 ft
- W. Beltline Ave. between Royal Ave. and Southern Pacific RR tracks
- Bertelsen Ave. between 1st Ave. and 11th Ave.

Human Disturbance & Illegal Collection

The relatively dense human population in the WEW study area may potentially have important impacts on western pond turtle populations. Turtles may interrupt important behaviors such as basking when approached too closely by humans (Bury and Germano 2008). However, observations of turtles basking on rafts placed in Amazon Creek demonstrated that at least some individuals habituate to the regular presence of cyclists and pedestrians within 150 ft (pers. obs.)

Turtles are also vulnerable to collection as pets, shooting, and incidental capture during recreational fishing (Holland 1994). Turtles believed to be “lost” by passing motorists or pedestrians are frequently removed from their home range and delivered to ODFW or translocated to a distant pond (Holland 1994; pers. obs.).

Several areas within the WEW managed for prairie restoration or wildlife habitat improvements are in close proximity to centers of turtle activity. Personnel conducting fieldwork may unintentionally disturb turtles during nesting movements or at their overwintering sites.

Predators and Competitors

There is insufficient information available to quantify the threat posed to western pond turtle populations by predators and competitors. However, observations made at WEW and relevant research from outside the study area suggest that other wildlife species may be a significant source of mortality and also be able to exclude western pond turtles from important habitat elements.

Some native predators such as raccoons, foxes, and coyotes have successfully adapted to conditions in urbanizing landscapes and have been able to expand their populations to a degree that they have locally depleted some prey species (Ferguson et al. 2001). These predators are known to consume turtle eggs and hatchlings and are present in the WEW. During 2008 fieldwork, eastern bullfrogs were sighted in every stream reach and pond occupied by western pond turtles in WEW. Introduced, warm-water fishes are ubiquitous throughout the major tributaries to the Willamette River, and so should be presumed to be present in WEW. Visual observations from the banks of these waterbodies suggest that underwater hiding cover for turtles may be scarce, although this should be confirmed through snorkel surveys.

More that 75 sightings of red-eared sliders have been made recently in the WEW. On average, the red-eared slider is larger than the western pond turtle and has been known to exclude the latter species from basking sites (Spinks et al. 2003). Because of the scarcity of basking platforms in Amazon Creek and the Diversion Channel, this is a particularly serious issue. It seems likely that western pond turtles could also be displaced by sliders from important underwater habitats such as feeding areas and hiding cover. Red-eared sliders and other non-native turtles purchased from shops or online also have been identified as a vector for diseases in native turtle populations (Hays et al. 1999, Spinks et al. 2003).

CONSERVATION OPPORTUNITY AREAS

Ensuring the long-term persistence of western pond turtles in the WEW requires a number of individuals with a sex and age-class structure to compose an effective breeding population, sufficiently large areas of habitat, and connectivity to adjacent western pond turtle populations to prevent genetic isolation.

My field observations and assessment of limiting factors lead me to recommend three areas that appear to be the best candidate sites for managing sustainable western pond turtle populations in WEW:

- Meadowlark Prairie and the Amazon Creek/Diversion Channel confluence
- Oxbow/Willamette Daisy Meadow/Amazon Creek
- Bertelsen Nature Park

These "Conservation Opportunity Areas" areas share four characteristics facilitate long-term management of turtles and habitat. First, all three areas are known to be occupied by western pond turtles, or turtles were observed in the area during the recent past (<5 years ago). My experience with past habitat restoration projects causes me to have reservations about the short-term success of these efforts unless there are source populations of the focal species already in close-proximity to the site. Secondly, these conservation opportunity areas are in public ownership and unlikely to be converted to industrial/residential developments in the foreseeable future. The owners of these areas have already taken prairie or aquatic restoration activities that have demonstrated a commitment to natural resource management. Thirdly, the three areas contain all three primary habitat components: aquatic/foraging, nesting, and overwintering habitats. Finally, these areas are relatively distant from roads having high traffic volumes and high posted speed limits. Site specific details are described below.

Meadowlark Prairie

Meadowlark Prairie is composed of several land parcels administered by the BLM and the City of Eugene. The total area of the combined parcels is 351 ac. The area is traversed by several major waterways: Amazon Creek, the Diversion Channel, the A Channel, and A-3 Channel. These channel segments represent most of the perennial aquatic habitat of pond turtles in the WEW and the confluence areas are important centers of turtle activity (Fig. 3). The area also contains one of the few turtle nests observed in the WEW. The

BLM and City of Eugene have already conducted some stream restoration and wetland enhancement activities in Meadowlark Prairie, including levee removal along Amazon Creek, the Diversion Channel, and the A Channel; removal of fill material and re-grading to elevation of adjacent wetland areas; and restoring wet prairie/riparian plant community composition. These efforts have enhanced conditions for western pond turtles in Meadowlark Prairie, although the projects were not specifically designed to improve turtle habitat. The size of Meadowlark Prairie, the quality of existing habitat, and it's watershed location, make this area the single most important stronghold for western pond turtles in the WEW.

During 2008 fieldwork, extensive areas of suitable turtle nesting and overwintering habitat were observed along Amazon Creek and the Diversion Channel. These terrestrial habitats are generally accessible from channels, although dense vegetation may be impenetrable to turtles on some streambanks. Site-specific, underwater habitat conditions were not inspected; snorkeling surveys would be necessary. However, very few natural platforms are available to turtles for basking.

Conservation Opportunities:

- Maintain and enhance suitable conditions for turtle nesting within 100-ft of channels. Western pond turtles require open areas with sparse groundcover vegetation; south/southwest aspects preferred. The extensive stands of reed canary grass (*Phalaris arundinacea*) south of Amazon Creek could be reduced to improve nesting conditions near the confluence area.
- Conduct surveys for nests to locate existing sites used by females. Focus habitat management on these sites; protect nests from predators and human disturbance during June-July.
- Place additional basking platforms in the Diversion Channel and Amazon Creek. Basking platforms can be large-diameter logs fixed in permanent positions or manmade rafts that can be removed during winter highflows.
- Create off-channel ponds and alcoves near the confluence of Amazon Creek and the Diversion Channel. Turtles use these features to escape fast water in winter; deep, off-channel pools also could provide important summer refugia during low water levels in the mainstem channels. The lower reach of Dead Cow Creek and Turtle Swale seem like natural locations for creating pools. Flood control devices already installed on these channels are left open in spring to drain the adjacent prairies. Closing the devices to retain water during the summer and increasing water storage capacity by excavating new ponds near these channels would increase aquatic habitat precisely at the greatest concentration of turtle activity.

Oxbow/Willamette Daisy Meadows

The 157 acre Oxbow/Willamette Daisy Meadows area is composed of several land parcels administered by the BLM and City of Eugene (Fig. 4). Amazon Creek bisects the area into east and west units. Western pond turtles have been observed in the channel numerous times since 2005. The area supports extensive areas of tufted hairgrass prairie and suitable areas for nesting and overwintering by western pond turtles. Two, manmade basking rafts have been placed in this reach of Amazon Creek and are frequently used by western pond turtles and red-eared sliders.

The pedestrian/bike path along the west bank of Amazon Creek presents a serious obstacle to turtles attempting to access terrestrial habitats. Although the path does not pose a significant physical barrier to turtles, the frequent human presence along the path is likely to discourage turtles from climbing the west bank to use nesting or overwintering sites in this area.

Conservation Opportunities:

- Maintain and enhance suitable conditions for turtle nesting within 100-ft of channels. Focus management efforts on the east bank because of the lower level of human disturbance on this side of Amazon Creek.
- Consider placing signs along the pedestrian/bike path with information about the natural terrestrial movements of turtles and asking the public not to approach turtles on land.
- The Oxbow reach of Amazon Creek is so named because of a historic meander on the east side of the main channel. Aerial photos show the oxbow had been filled by the 1990's and was marginally connected to the channel at that time. LCOG (2001) describes a plan to excavate the oxbow and restore riparian vegetation; however the project has not yet been implemented. Such a project would enhance aquatic habitat near a major turtle activity center and is adjacent to suitable nesting habitat.
- The close proximity of Oxbow/Willamette Daisy Meadows to Meadowlark Prairie makes it likely that individual turtles are making in-stream movements between the two areas. A program of active habitat management in both of these areas has the potential to result in an important stronghold for western pond turtles in the Long Tom basin.

Bertelsen Nature Park

Bertelsen Nature Park is a large open space administered by the BLM that offers opportunities for the public to enjoy a natural setting within the larger urban landscape. The Park, and adjoining, undeveloped parcels administered by the Oregon Department of Transportation (ODOT) have a total area of 170 acres. Bertelsen Nature Park contains several permanent and seasonal wetlands, as well as segment of the A-3 Channel approximately 2000-ft in length (Fig. 5). The Channel reach passing through the Park is named "Bertelsen Slough" and meanders through emergent wetlands and shrubby riparian areas. The Park is composed of several habitat types that include: black cottonwood/Oregon ash woodland, Oregon white oak woodland, emergent wetland, and area currently undergoing restoration to native wet and upland prairie communities. The largest, perennial waterbody in the Park is Grimes Pond, approximately 0.8 acres in area. This pond has extensive areas emergent vegetation, underwater hiding cover, and numerous natural objects for basking. Stewart Lake and several other seasonal wetlands offer suitable habitats for turtles during winter and spring.

The A-3 Channel and Grimes Pond are known to have been occupied by western pond turtles in the recent past. A telemetry study conducted in the area during 1993-1994 (Galen 1994) tracked movements of two gravid females using Grimes Pond and the Channel. Two turtle nests were found on the east bank of Grimes Pond during the study and protected with predator exclosures. Western pond turtles were also observed by Applegarth in Grimes Pond during 2005 and 2006. Observations for turtles were made on three different days during the summer of 2008, without detection. I recommend more intensive basking surveys in the future to determine an estimated minimum population size.

If western pond turtles do still exist at Bertelsen Nature Park, they are functionally disconnected from the larger population inhabiting Amazon Creek. The wetland habitats of Bertelsen Nature Park are more than 11,000-ft distant from Amazon Creek via the A-3 Channel and there is at least one weir that is probably impassable to turtles (Galen 1994). Furthermore, long segments of the A-3 Channel are dry most of the year which increases the difficulty for turtles migrating along this route. The Park is located within a landscape dominated by light industrial developments and roads with high-traffic volumes. Turtles making overland movements out of the Park face a very inhospitable environment. Nevertheless, the size of the Park and quality of aquatic and terrestrial habitats, present an opportunity to maintain a small, separate population of western pond turtles.

Conservation Opportunities:

- Although Bertelsen Nature Park is isolated from more extensive areas of habitat along Amazon Creek, the Park could support a small, “reserve” population of western pond turtles. Such a reserve could become ecologically significant if a catastrophe (e.g., hazardous waste spill) were to extirpate the main population in Amazon Creek and the Diversion Channel.
- If surveys reveal western pond turtles are still present in wetlands at the Park, conduct nest searches near Grimes Pond and suitable habitat along the A-3 Channel. Install predator exclosures and monitor nests until hatchlings emerge.
- Improve and maintain turtle nesting habitat near Grimes Pond.
- The BLM is planning to construct new recreation and interpretive facilities at Bertelsen Nature Park that include trails and wildlife viewing platforms. Planners should avoid constructing new trails or structures near known turtle nesting areas in the vicinity of Grimes Pond. New facilities should also avoid disrupting overland movements by turtles between permanent and seasonal ponds in the park.

ADDITIONAL MANAGEMENT RECOMMENDATIONS

Supplemental Basking Platforms

Natural basking platforms are rare in Amazon Creek and the Diversion Channel. At least two manmade rafts have been placed near turtle activity centers, but these are also used by non-native red-eared sliders. Placing additional basking platforms such as logs or rafts in perennial aquatic habitat will ensure that western pond turtles are able to engage in this essential thermoregulatory behavior. Basking platforms should be placed away from streambanks and be accessible to turtles at all water levels.

Limiting Direct Impacts of Human Disturbance

Land managers could undertake several actions to buffer western pond turtles from human disturbance in WEW:

- Establish and/or maintain shrubby riparian vegetation to create a visual buffer between turtles and humans. Dense patches of riparian vegetation could be used to discourage humans from approaching stream reaches frequented by turtles.
- Post signs along pedestrian/bike paths, parking areas, and interpretive sites asking visitors to not approach turtles on land or on basking platforms.
- Avoid mechanized land management activities in known or most probable nesting areas from June 1 to July 15.

Hatchling/Juvenile Habitats

There has been little research on habitat use by western pond turtles <1 year old; however there is some evidence that hatchlings and juveniles are spatially-segregated from older age-classes (Holte 1988; Holland 1994). After emerging from their nest in late-winter or early-spring, hatchlings have been observed in dense grass; shallow, emergent wetlands; and very small, ephemeral pools (e.g., a flooded footprint from a cow). Temporary pools are less likely to be inhabited by bullfrogs, an important predator of turtles. Creating small, seasonal pools near potential turtle nesting habitats may offer hatchlings an important refuge before they move into major channels and ponds.

Nesting Surveys

Some female western pond turtles display fidelity to certain nesting areas (Bury and Germano 2008, pers. obs.). Locating nesting areas is important for two reasons: nests can be protected with predator exclosures, thereby increasing the probability of egg/hatchling survival; and land managers can focus habitat treatments in areas that are known to be used by female turtles. My experience with past habitat restoration projects leads me to believe that these efforts are unlikely to have short-term benefits for western pond turtles unless located at sites already used by the species. For example, a 1000-ft river alcove and 2-acre nesting area designed for western pond turtles (as well as other species) were constructed at the confluence of the McKenzie and Willamette Rivers in 2001 (Vesely 2003). Surveys prior to the habitat improvements indicated that the confluence area supported a major concentration of western pond turtles. Nevertheless, no turtles were observed using the alcove or nesting areas in 5 years since the project was completed in spite of annual nest searches and monitoring surveys.

Monitoring Population Size and Connectivity

The increasing degree of urbanization across WEW is likely to exacerbate the fragmentation of wetland habitats and threatens to disrupt dispersal and seasonal migrations by western pond turtles. Monitoring western pond turtles is essential for understanding the species' response to the changing environment is the WEW.

I identified possible barriers to turtle movements based on field inspections performed in 2008. However, these preliminary results should be confirmed through radio telemetry studies and analysis of habitat use. Such an analysis could improve local conservation planning for turtles and project implementation:

- Movement studies can be used to determine whether all three major habitat components (i.e., aquatic/foraging, nesting sites, and overwintering areas) are accessible to turtles at conservation opportunity areas.
- Understanding precisely which ponds, stream reaches, and terrestrial habitats are used by western pond turtles will allow land managers to focus restoration efforts in areas most likely to benefit the species.
- Radio telemetry studies may be used to identify road crossings frequently used by turtles and guide efforts to minimize traffic-related mortality.
- Tracking patterns of turtle movement would improve understanding of population connectivity within WEW; and also aid in determining whether turtles are moving between WEW and Fern Ridge reservoir. Such information is necessary for assessing the resilience of the WEW population to environmental stochasticity and genetic risks associated with small, isolated populations.

I also recommend a mark/recapture program to attain periodic estimates of the size of the western pond turtle population in WEW. Understanding the response of focal species to habitat management and restoration practices is essential to measuring program success, yet population monitoring is not often integrated into conservation projects. When monitoring is included as a component of wildlife management, habitat characteristics are measured far more often than wildlife response. Yet the condition or acreage of habitat is practically never predictive of population trends or viability (Van Horne 1983). Given the scope and cost of habitat restoration projects envisioned by the West Eugene Wetland Partnership (WEWP 2007), monitoring the distribution and abundance trends of focal species such as the western pond turtle seem prudent.

ACKNOWLEDGMENTS

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Figures

Figure 1. West Eugene Wetlands Partnership Lands, Lane County, Oregon.

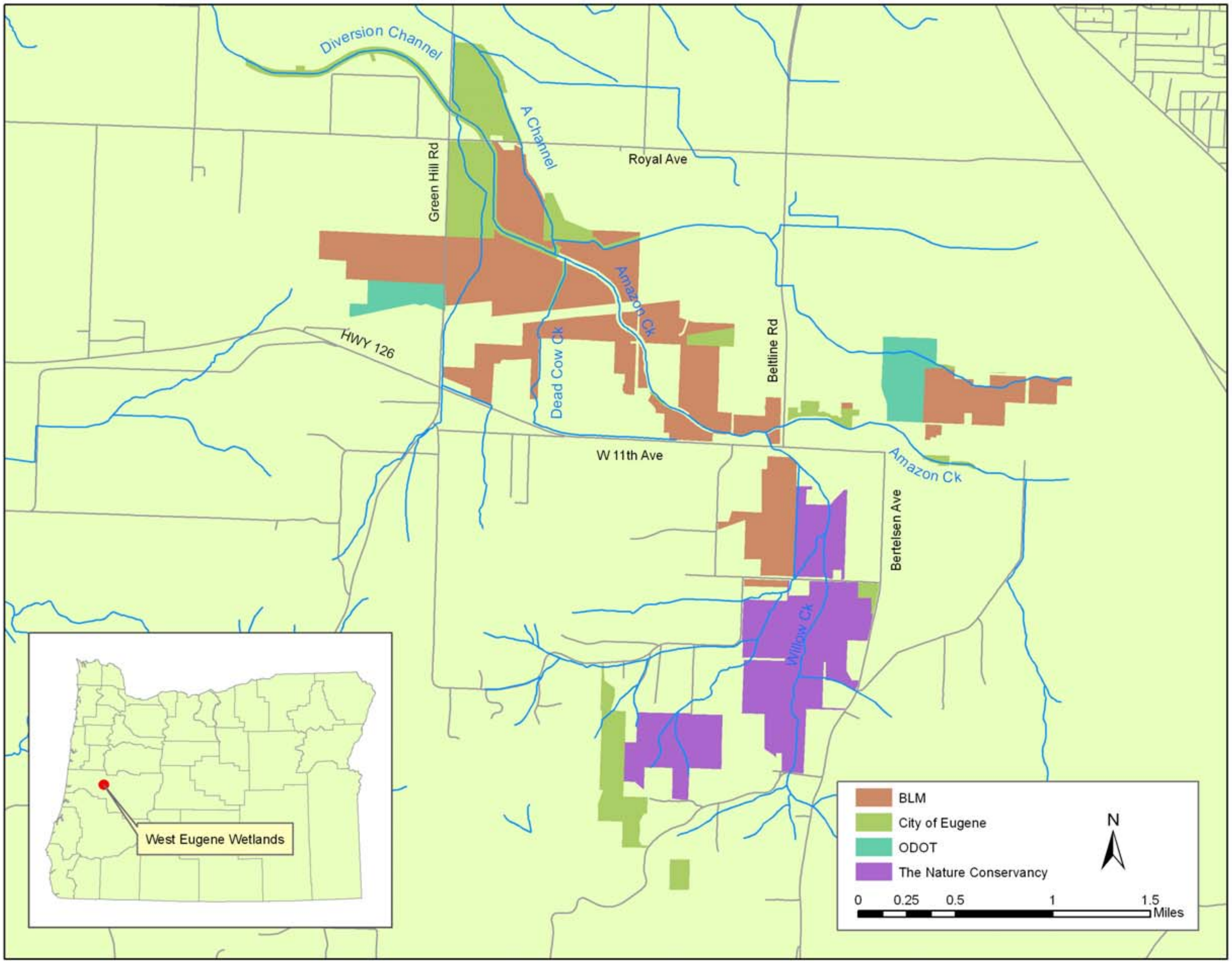


Figure 2. Turtle sightings and delineation of western pond turtle habitat in West Eugene Wetlands, Lane County, Oregon. Data sources habitat classification methods described in Appendix I.

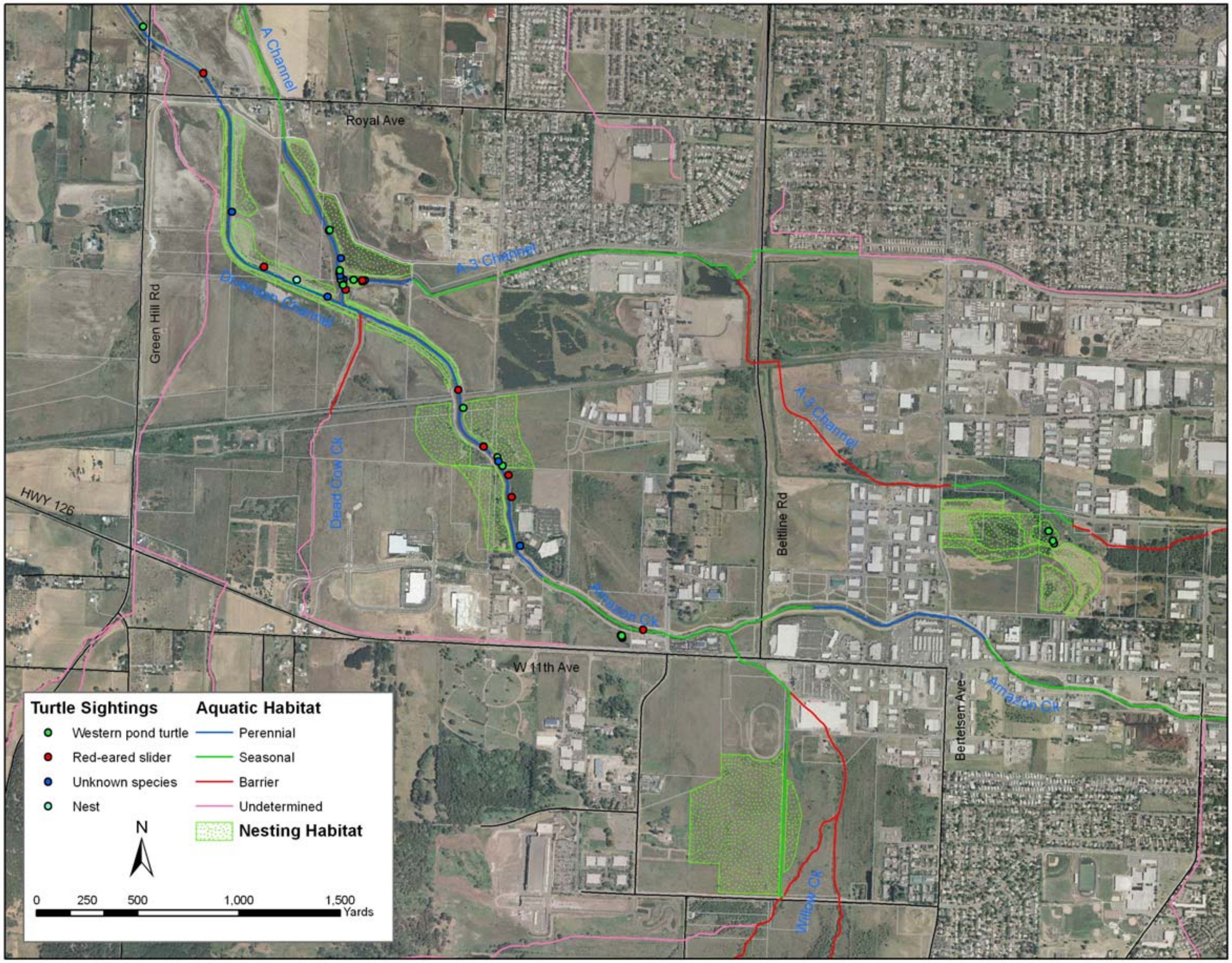


Figure 3. Meadowlark Prairie, West Eugene Wetlands, Lane County, Oregon.

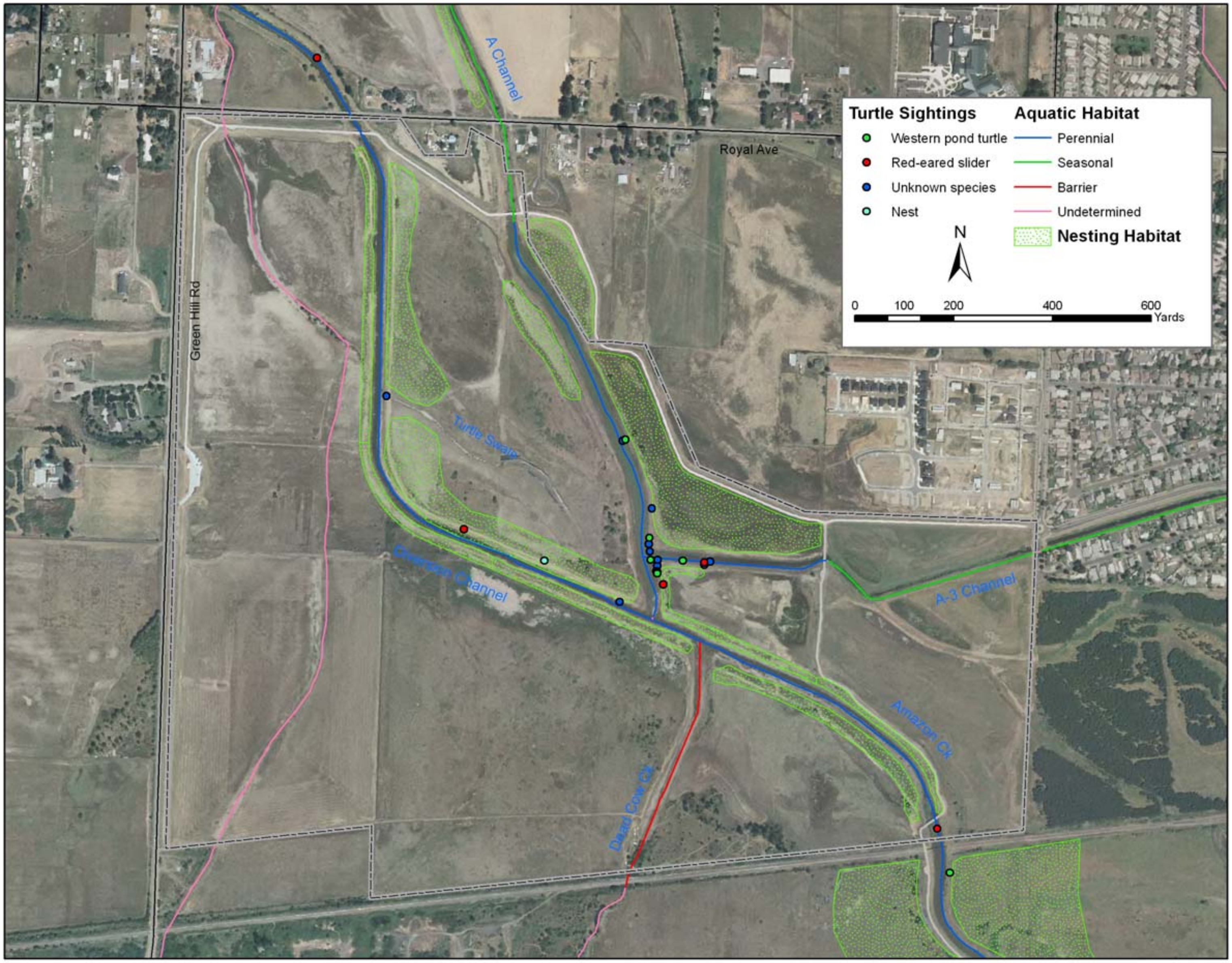


Figure 4. Oxbow/Willamette Daisy Meadow, West Eugene Wetlands, Lane County, Oregon.

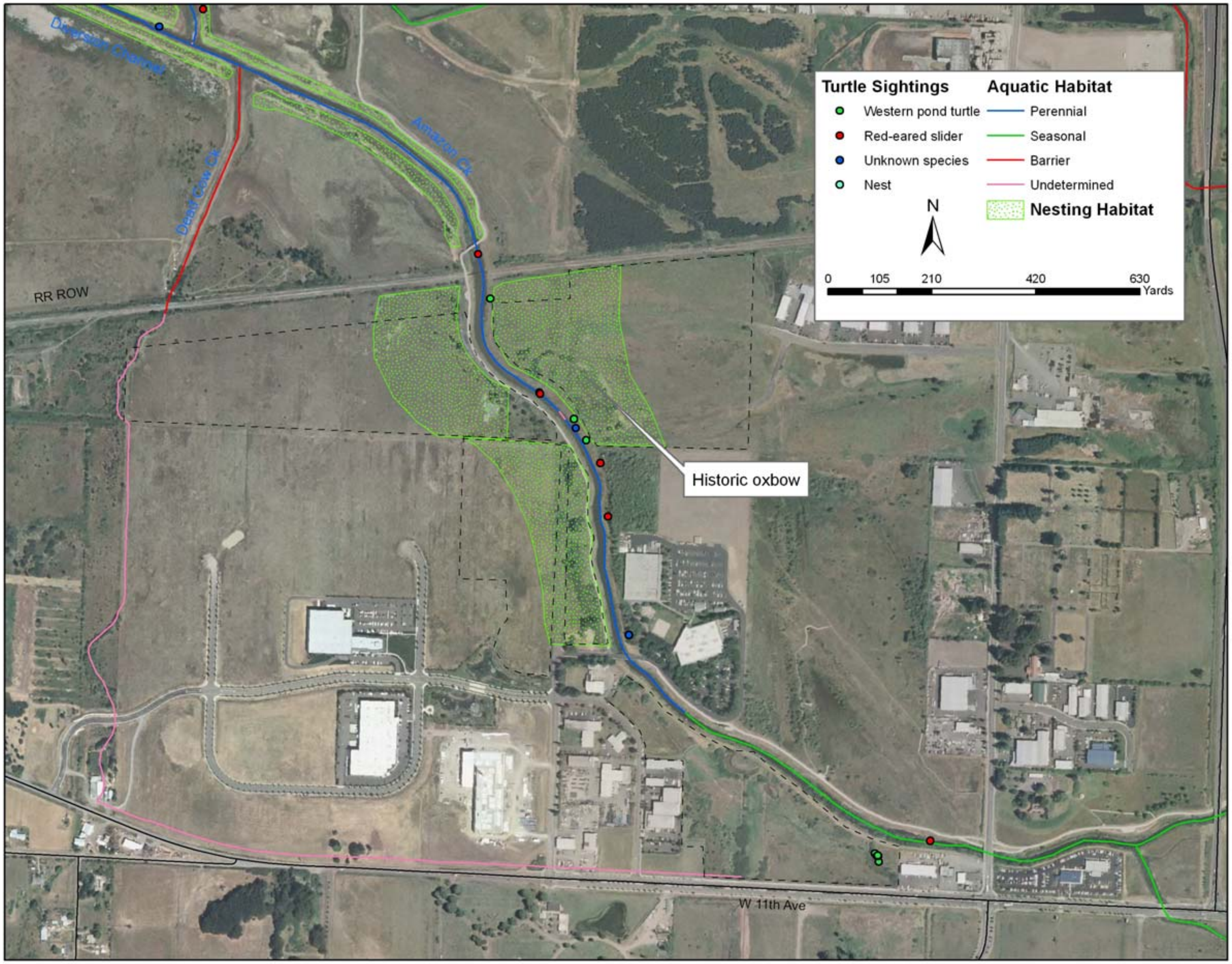
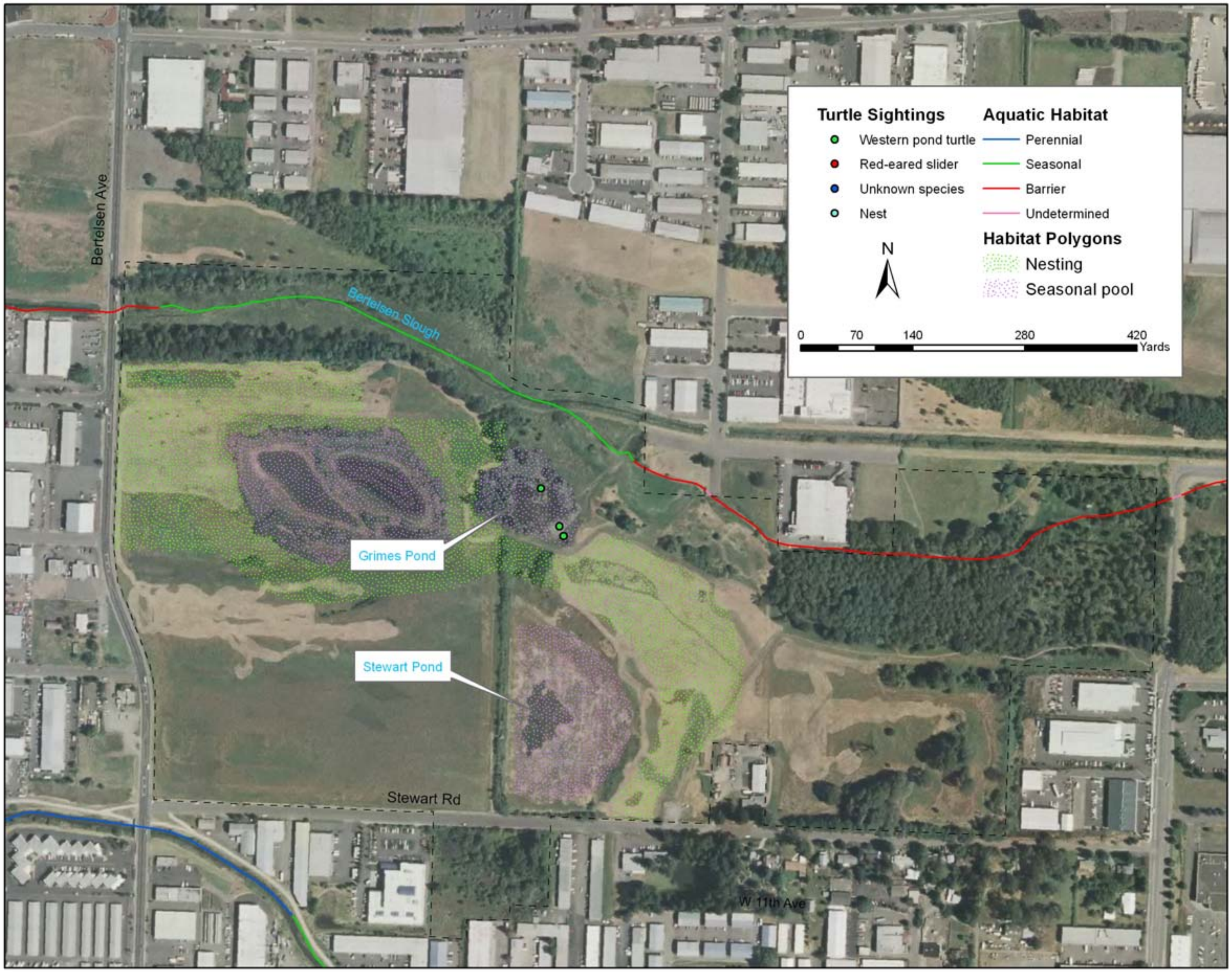


Figure 5. Bertelsen Nature Park, West Eugene Wetlands, Lane County, Oregon



APPENDIX I

MAPPING KNOWN LOCATIONS AND SUITABLE HABITAT OF THE NORTHWESTERN POND TURTLE IN THE WEST EUGENE WETLANDS

By David Vesely
Oregon Wildlife Institute

INTRODUCTION

The Oregon Wildlife Institute (OWI) is collaborating with the Bureau of Land Management, Eugene District and the West Eugene Wetlands Partnership to prepare a conservation plan for the western pond turtle (*Actinemys marmorata*) in the West Eugene Wetlands (WEW), Lane County, Oregon. I conducted seven field inspections in the WEW to observe areas of turtle activity and to gather information needed to prepare maps of aquatic habitat and potential nesting areas. Habitat delineations were performed only on West Eugene Wetland Partnership lands. This report describes data sources, mapping turtle localities, and methods used to classify western pond turtle habitat..

TURTLE LOCATIONS

A spatially-explicit database containing 340 records of the western pond turtle (WPT) sightings in WEW was prepared from a dataset provided by John Applegarth, retired BLM wildlife biologist. The observations were made by Applegarth and other volunteers during 2005-2007. The records are useful in determining the locations of concentrated turtle activity in WEW. However, the information does not indicate where the volunteers made observations without sighting turtles. Therefore, there is no direct evidence from the Applegarth dataset that can be used to determine which aquatic features are not occupied by the WPT.

I performed observations for basking turtles in September 2008. The 2008 observations resulted in several new sightings of the WPT and the red-eared slider, as well as locations where observations were made, but no turtles were detected.

HABITAT MAPPING

Suitable aquatic and nesting habitats for the WPT were identified and mapped using aerial photographs, field inspections, and turtle observation data. Habitat mapping was conducted according to the following procedures.

Aquatic Habitat

Potentially suitable aquatic habitats for the WPT in the WEW were initially identified by importing a BLM 1:24,000 scale hydrography dataset that included waterbodies (polygons) and watercourses (lines) into an ArcGIS 9.2 geographic information system (GIS). Permanent channels and waterbodies were distinguishable from intermittent types by using attributes recorded for each aquatic feature. Several of the original BLM watercourse segments were split when field inspections revealed that the corresponding channel contained reaches of different habitat quality for the WPT. One map segment located in lower Willow Creek south of 11th Ave was realigned to more closely correspond to the actual position of the channel observed in September 2008.

To identify aquatic habitats occupied by the WPT, the 2005-2007 turtle sighting data (UTM point coordinates) were overlaid on the modified BLM hydrography datasets.

Extensive field inspections of channel conditions were made along Amazon Creek, the Amazon Diversion Channel, the A-3 Channel, and lower Willow Creek. Inspections were also made of the wetland complex in Bertelsen Nature Park. The primary objective of these inspections was to determine approximate water depth and watercourse continuity during the dry season (August and September). Channel bottom substrates, underwater hiding cover, availability of basking platforms, and bank conditions were also noted.

Using watercourse/waterbody periodicity attributes from the BLM datasets (i.e., permanent vs intermittent flooding) and field observations, each reach of the major watercourses flowing through WEW was classified as one of four possible lotic habitat types according to the following criteria:

Perrenial—Stream or manmade channels that are suitable foraging/cover habitats for the WPT all year. Water depth >50 cm in late summer; channel contiguous >100 m; underwater hiding cover and emergent basking platforms available; open or semi-open vegetation canopy above channel.

Seasonal—Channels that may provide suitable foraging/cover habitat during spring and early summer, but do not meet one or more criteria for permanent habitat. These channels generally have water depths ≥10 cm and may allow turtles to make long-distance movements throughout the year.

Barriers—Channel reaches that were found to be de-watered for more than 200m during September 2008.

Undetermined—Channels that were not inspected.

Terrestrial Habitat
The WPT uses terrestrial habitats for dispersing between wetlands, overwintering, and nesting. Mapping overland movements would be useful for identifying risks (e.g., road crossings) and areas important for ensuring population connectivity. However, such a map depends upon data gained from more comprehensive radio telemetry studies than have been previously conducted in the WEW. WPT populations in the Willamette Valley commonly spend much of the winter on land resting in underground burrows or under deep leaf litter (Holland 1994). WPT typically select woodland and shrubby habitats for overwintering areas because these areas offer more terrestrial hiding cover (Holland 1994). Overwintering areas in the WEW were not mapped because shrub patches are well distributed throughout the WEW and I assumed that the availability of overwintering sites is not a significant limiting factor to WPT in the WEW.

Suitable nesting sites are crucial for the persistence of the WPT in the WEW. Nests are usually placed above the average annual floodplain in sites with sparse vegetation and complete exposure to the sun. Nests have been discovered more than 400 m from any waterbody, but are usually much closer (Holland 1994).

To identify potential nesting habitat in WEW, 2005 one-half meter color orthoimagery of the WEW was acquired from the Oregon Geospatial Data Clearinghouse and imported into a GIS. I examined the imagery for unwooded, upland areas appearing to be suitable nesting habitat based on my experience performing WPT nest searches. I performed field inspections at areas that were initially identified from the aerial imagery. The criteria for delineating nesting habitat were: short (height <1 m) or sparse vegetation; evidence that the habitat area was above the average annual flooding elevation; soil texture (rocky/gravelly soils were excluded); and accessibility from aquatic habitats by turtles. Observations made during the field inspections were used to refine the original map of potential nesting habitat.