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Memorandum

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Subject: Formal conference on the effects of the issuance of an Enhancement of Survival Permit for the Old Mill District Candidate Conservation Agreement with Assurances on Oregon spotted frog and spotted frog proposed critical habitat (1-7-14-FC-0247)

1.0 INTRODUCTION

This document represents the U.S. Fish and Wildlife Service's (Service) Conference Opinion based on our review of the proposed "Old Mill District Oregon spotted frog (*Rana pretiosa*) Candidate Conservation Agreement with Assurances" (CCAA) in Deschutes County, Oregon, and its effects on Oregon spotted frog (*Rana pretiosa*) (spotted frog) in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 *et seq.*). This Conference Opinion is based on information provided in the final CCAA dated September 10, 2014, the August 29, 2013, proposed rule to list the spotted frog as Threatened and the proposed rule to designate critical habitat, and other sources of information in our files. A complete record of this consultation is on file at the Service's Bend Field.

Action Area

The action area consists of 170 acres of land in the Old Mill District mixed-use commercial complex as shown on Figure 1 of the CCAA and includes 6,909 linear feet along both banks of

the Deschutes River, upstream and downstream of the Colorado Street Bridge, in the city of Bend, Deschutes County, Oregon.

CONFERENCE OPINION

2.0 DESCRIPTION OF THE PROPOSED ACTION

This section provides a brief summary of the proposed action and its scope. The proposed action is the issuance of an Enhancement of Survival Permit (Permit) to the Permit Applicants (see CCAA) upon approval and signing of the Old Mill District Oregon Spotted Frog CCAA.

Activities covered under the CCAA include a variety of current and proposed land uses and activities and conservation measures associated with management of the stormwater system and other areas of existing and potential spotted frog habitat within the Old Mill District, a 170-acre mixed-use development complex including shops, galleries, restaurants, trails, and events in Bend, Oregon. For details on the proposed action refer to the CCAA, specifically Section IV covered activities and Section V Changed Circumstances. The entire CCAA is incorporated by reference herein.

The purpose of the CCAA is to protect and manage spotted frog habitat to maintain and/or enhance the existing spotted frog population while operating the Old Mill District mixed-use development complex.

The objectives for the agreement are:

- To provide the Permittees with regulatory assurances from the Service that if the spotted frog becomes listed under the ESA, the activities on the covered lands can continue as outlined in the agreement.
- To implement the conservation measures contained in the CCAA to provide a benefit to the spotted frog.
- To avoid and minimize take of spotted frogs while conserving and managing their habitats to benefit spotted frogs.

The CCAA outlines conservation measures for private landowners in the Old Mill District to voluntarily implement. Lands covered under the CCAA where conservation measures will be implemented include: a Casting Pond and pond perimeter, Les Schwab Amphitheater (LSA) Marsh, Deschutes River riparian zone, and existing ponds and bioswales (see Figure 1 of the CCAA). Conservation measures and management also may be applied to other riparian areas and bio-swales/ponds developed over time as part of the Old Mill District storm water system. Key features and conservation measures in the CCAA include:

- Maintaining a consistent water level in the Casting Pond that enables breeding through metamorphosis for spotted frog;

- Maintaining adequate water levels in the Casting Pond to protect developing embryos and larvae during the breeding and summer season;
- Maintaining adequate water level in the Casting Pond during the winter to help protect overwintering spotted frogs from freezing;
- Management of Casting Pond vegetation to support open water areas and hiding cover will provide habitat for spotted frog breeding and rearing habitat;
- Improvement of Casting Pond perimeter to include natural barriers and sedges to manage human access where appropriate;
- Protection of the riparian zones and the continued biological successional changes of the river banks to provide cover used by the spotted frog during the summer active season; and
- Protection and maintenance of the LSA Marsh to enable breeding through metamorphosis for spotted frog.

The Service proposes to issue an Enhancement of Survival Permit for the Old Mill District CCAA. The purpose of the Permit is to provide these landowners an exemption to section 9(a)(1)(b) of the ESA prohibiting “take” of Oregon spotted frog – in the event that this species is listed under the ESA in the future and such prohibitions against take are put in place – while carrying out otherwise lawful activities to maintain and use covered lands as described in the CCAA within the Old Mill District. If the species is listed, this Conference Opinion may be adopted by the Service as a final Biological Opinion. The CCAA is in effect for 20 years from the date of approval and signing. The associated Permit authorizing take of the species would also have a term of 20 years from the date the Permit is issued. This Conference Opinion considers effects on spotted frog from issuance of a Permit for covered activities described in the Old Mill CCAA pursuant to section 10(a)(1)(A) of the ESA and the Service’s CCAA final rules (64 FR 326726, June 17, 1999, 69 FR 24084; May 3, 2004) for covered activities in the CCAA in Deschutes County, Oregon.

3.0 ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

3.1 Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this opinion relies on four components: (1) the *Status of the Species*, which evaluates the Oregon spotted frog rangewide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the Oregon spotted frog in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Oregon spotted frog; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the Oregon spotted frog; and (4) *Cumulative Effects*, which

evaluates the effects of future, non-Federal activities in the action area on the Oregon spotted frog.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The jeopardy analysis in this Conference Opinion emphasizes consideration of the rangewide survival and recovery needs of the Oregon spotted frog and the role of the action area in the survival and recovery of the Oregon spotted frog. It is within this context that we evaluate the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

3.2 Adverse Modification Determination

This Conference Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to proposed critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Conference Opinion relies on four components: 1) the *Status of Critical Habitat*, which evaluates the range-wide condition of the proposed designated critical habitat for the Oregon spotted frog in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the proposed critical habitat overall; 2) the *Environmental Baseline*, which evaluates the condition of the proposed critical habitat in the action area, the factors responsible for that condition, and the recovery role of the proposed critical habitat in the action area; 3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected proposed critical habitat units; and 4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected proposed critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on Oregon spotted frog proposed critical habitat are evaluated in the context of the rangewide condition of the proposed critical habitat, taking into account any cumulative effects, to determine if the proposed critical habitat rangewide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the Oregon spotted frog.

The analysis in this Conference Opinion places an emphasis on using the intended rangewide recovery function of Oregon spotted frog proposed critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of

the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

4.0 STATUS OF THE SPECIES - OREGON SPOTTED FROG

4.1 Listing Status

The Oregon spotted frog has been a candidate for listing under the Endangered Species Act (ESA) since 1993. On August 29, 2013 the spotted frog was proposed for listing as threatened under the ESA (78FR53582). A final listing determination occurred on August 29, 2014, with an effective date of September 29, 2014.

4.2 Taxonomy

The scientific name *Rana pretiosa* (order Anura; family Ranidae) was first applied to a series of five specimens collected in 1841 by Baird and Girard (1853, p. 378) from the vicinity of Puget Sound. Subsequently, the “spotted frog” was separated into two species, *Rana pretiosa* (Oregon spotted frog) and *Rana luteiventris* (Columbia spotted frog) based on genetic analyses (Green *et al.* 1996, 1997).

Phylogenetic analyses, conducted on samples of Oregon spotted frogs collected from 3 locations in Washington and 13 locations in Oregon, indicate that there are two well-supported clades (a group of biological taxa (as species) that includes all descendants of one common ancestor) nested within the Oregon spotted frog: the Columbia clade (Trout Lake Natural Area Preserve (NAP) and Camas Prairie) and the southern Oregon clade (Wood River and Buck Lake in the Klamath Basin) (Funk *et al.* 2008).

Blouin *et al.* (2010) performed genetic analyses on Oregon spotted frogs from 23 locations in British Columbia, Washington, and Oregon for variation at 13 microsatellite loci and 298 base pairs of mitochondrial DNA. Their results indicate that *Rana pretiosa* comprised six major genetic groups: (1) British Columbia; (2) the Chehalis drainage in Washington; (3) the Columbia drainage in Washington; (4) Camas Prairie in northern Oregon; (5) the central Cascades of Oregon; and (6) the Klamath basin (Blouin *et al.* 2010, pp. 2184–2185). Within the northern genetic groups, the British Columbia (Lower Fraser River) and Chehalis (Black River) populations form the next natural grouping (Blouin *et al.* 2010, p. 2189). Recently discovered locales in the Sumas, South Fork Nooksack, and Samish Rivers occur in-between these two groups. While no genetic testing has been done on these newly found populations, it is reasonable to assume that they are likely to be closely related to either the British Columbia or Chehalis group, or both, given their proximity and use of similar lowland marsh habitats (USFWS 2013, p. 53584).

4.3 Physical description

The spotted frog is named for the black spots that cover the head, back, sides, and legs. The dark spots are characterized by ragged edges and light centers that grow and darken with age (Hayes 1994, p. 14). Body color also varies with age. Juveniles are usually brown or, occasionally, olive green on the back and white, cream, or flesh-colored with reddish pigments on the underlegs and abdomen developing with age (McAllister and Leonard 1997, pp. 1–2). Adults

range from brown to reddish brown but tend to become redder with age. The spotted frog is a medium-sized frog, ranging from 44 to 100 millimeters (1.74 to 4 inches) in body length. Females are typically larger than males and can reach up to 100 millimeters or more (4 inches) (Rombough et al. 2006, p. 210).

4.4 Life history

Adult Oregon spotted frogs begin to breed by one to three years of age, depending on sex, elevation, and latitude. Male Oregon spotted frogs are not territorial and often gather in large groups of 25 or more individuals at specific locations (Leonard *et al.* 1993, p. 132). Breeding occurs in February or March at lower elevations and between early April and early June at higher elevations (Leonard *et al.* 1993, p. 132). Females may deposit their egg masses at the same locations in successive years, in shallow, often temporary, pools of water; gradually receding shorelines; on benches of seasonal lakes and marshes; and in wet meadows. These sites are usually associated with the previous year's emergent vegetation, are generally no more than 14 inches (35 centimeters (cm)) deep (Pearl and Hayes 2004, pp. 19–20), and most of these sites dry up later in the season (Joe Engler, FWS, pers. comm. 1999). Shallow water is easily warmed by the sun, and warmth hastens egg development (McAllister and Leonard 1997, p. 8). However, laying eggs in shallow water can result in high mortality rates for eggs and hatchling larvae due to desiccation or freezing.

Eggs usually hatch within three weeks after oviposition. Tadpoles metamorphose into froglets during their first summer. Tadpoles are grazers, having rough tooth rows for scraping plant surfaces and ingesting plant tissue and bacteria. They also consume algae, detritus, and probably carrion. Post-metamorphic spotted frogs feed on live animals, primarily insects.

Similar to many North American pond-breeding anurans (belonging to the Order Anura, which contains all frogs), predators can strongly affect the abundance of larval and post-metamorphic Oregon spotted frogs. The heaviest losses to predation are thought to occur shortly after tadpoles emerge from eggs, when they are relatively exposed and poor swimmers (Licht 1974, p. 624). However, the odds of survival appear to increase as tadpoles grow in size and aquatic vegetation matures, thus affording cover (Licht 1974, p. 624).

Licht (1974, pp. 617–625) documented the highly variable mortality rates for spotted frog life-history stages in marsh areas in the lower Fraser Valley, BC: embryos (30 percent), tadpoles (99 percent), and post-metamorphic (after the change from tadpole to adult, or “metamorphosis”) frogs (95 percent). Licht (1974, p. 625) estimated mortality of each life stage and predicted only a 1 percent chance of survival of eggs to metamorphosis, a 67 percent chance of juvenile survival for the first year, and a 64 percent adult annual survival with males having a higher mortality rate than females. An average adult between-year survival of 37 percent was estimated by a mark-recapture study at Dempsey Creek in Washington between 1997 and 1999 (Watson *et al.* 2000, p. 19).

4.5 Habitat

The Oregon spotted frog is highly aquatic; it is almost always found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and cover.

Watson *et al.* (2003, p. 298) summarized the conditions required for completion of the Oregon spotted frog life cycle as shallow water areas for egg and tadpole survival, perennially deep, moderately vegetated pools for adult and juvenile survival in the dry season, and perennial water for protecting all age classes during cold wet weather.

Oregon spotted frogs breed in shallow pools (2–12 in (5–30 cm) deep) that are near flowing water, or which may be connected to larger bodies of water during seasonally high water or at flood stage. Characteristic vegetation includes grasses, sedges, and rushes, although eggs are laid where the vegetation is low or sparse, such that vegetation structure does not shade the eggs (McAllister and Leonard 1997, p. 17). While native vegetation is the preferred substrate, the frog may also use short, manipulated reed canarygrass/native vegetation mix (J. Engler, pers. comm: 1999). Full solar exposure seems to be a significant factor in breeding habitat selection (McAllister and White 2001, p. 12; Pearl and Hayes 2004, p. 18). The availability of the unique characteristics of traditional egg-laying sites is limited, and adults may have limited flexibility to switch sites (Hayes 1994, p. 19). This may make the Oregon spotted frog particularly vulnerable to modification of egg-laying sites (Hayes 1994, p. 19).

After breeding, during the dry season, Oregon spotted frogs move to deeper, permanent pools or creeks (Watson *et al.* 2003, p. 295). They are often observed near the water surface basking and feeding in beds of floating and submerged vegetation (Watson *et al.* 2003, pp. 292–298; Pearl *et al.* 2005a, pp. 36–37).

Known overwintering sites are associated with flowing systems, such as springs and creeks, that provide well-oxygenated water (Hallock and Pearson 2001, p. 15; Hayes *et al.* 2001, pp. 20–23, Tattersall and Ultsch 2008, pp. 123, 129, 136) and sheltering locations protected from predators and freezing (Risenhoover *et al.* 2001b; Watson *et al.* 2003, p. 295). Oregon spotted frogs burrow in mud, silty substrate, clumps of emergent vegetation, woody accumulations within the creek, and holes in creek banks when inactive during periods of prolonged or severe cold (Watson *et al.* 2003, p. 295; Hallock and Pearson 2001, p. 16; McAllister and Leonard 1997, p. 17); however, they are intolerant of anoxic (absence of dissolved oxygen) conditions and are unlikely to burrow into the mud for more than a day or two (Tattersall and Ultsch 2008, p. 136) because survival under anoxic conditions is only a matter of 4–7 days (Tattersall and Ultsch 2008, p. 126). This species remains active during the winter in order to select microhabitats that can support aerobic metabolism and allow it to evade predators (Hallock and Pearson 2001, p. 15; Hayes *et al.* 2001, pp. 20–23; Tattersall and Ultsch 2008, p. 136). In central Oregon, where winters generally result in ice cover over ponds, Oregon spotted frogs follow a fairly reliable routine of considerable activity and movement beneath the ice during the first month following freeze-up. Little movement is observed under the ice in January and February, but activity steadily increases in mid-March, even when ice cover persists (Bowerman 2006, pers. comm.; Hallock 2009, pers comm.; Hayes *et al.* 2001, pp. 16–19).

Movement studies specific to Oregon spotted frogs are limited in number and scope. Results of a habitat utilization and movement study at Dempsey Creek in Washington indicate that adult frogs made infrequent movements between widely separated pools and more frequent movements between pools in closer proximity (Watson *et al.* 2003, p. 294), but remained within the study area throughout the year. Home ranges averaged 5.4 ac (2.2 ha), and daily movement was 16–23 ft (5–7 m) throughout the year (Watson *et al.* 2003, p. 295). During the breeding season (February–May), frogs used about half the area used during the rest of the year. During the dry season (June–August), frogs moved to deeper, permanent pools, and occupied the smallest range of any season, then moved back toward their former breeding range during the wet season (September–January) (Watson *et al.* 2003, p. 295). Individuals equipped with radio transmitters stayed within 2,600 ft (800 m) of capture locations at the Dempsey Creek site (Watson *et al.* 1998, p. 10) and within 1,312 ft (400 m) at the Trout Lake NAP (Hallock and Pearson 2001, p. 16).

Recaptures of Oregon spotted frogs at breeding locations in the Buck Lake population in Oregon indicated that adults often move less than 300 ft (100 m) between years (Hayes 1998a, p. 9). However, longer travel distances, while infrequent, have been observed between years and within a single year between seasons. Three adult Oregon spotted frogs (one male and two females) marked in a study at Dempsey Creek and the Black River in Washington moved a distance of 1.5 mi (2.4 km) between seasons along lower Dempsey Creek to the creek's mouth from the point where they were marked (McAllister and Walker 2003, p. 6). Adult female Oregon spotted frogs traveled 1,434 ft (437 m) between seasons from their original capture location at the Trout Lake Wetland NAP (Hallock and Pearson 2001, p. 8). Two juvenile frogs at the Jack Creek site in Oregon were recaptured the next summer 4,084 ft (1,245 m) and 4,511 ft (1,375 m) downstream from where they were initially marked, and one adult female moved 9,183 ft (2,799 m) downstream (Cushman and Pearl 2007, p. 13). Oregon spotted frogs at the Sunriver site routinely make annual migrations of 1,640 to 4,265 ft (500 to 1,300 m) between the major egg-laying complex and an overwintering site (Bowerman 2006, pers. comm.).

While these movement studies are specific to Oregon spotted frogs, the number of studies and size of the study areas are limited and haven't been conducted over multiple seasons or years. In addition, the ability to detect frogs is challenging because of the difficult terrain in light of the need for the receiver and transmitter to be in close proximity. Hammerson (2005) recommends that a 3.1-mile (5-km) dispersal distance be applied to all ranid frog species, because the movement data for ranids are consistent. The preponderance of data indicates that a separation distance of several kilometers may be appropriate and practical for delineation of occupancy, despite occasional movements that are longer or that may allow some genetic interchange between distant populations (for example, the 6.2-mi (10-km) distance noted by Blouin *et al.* 2010, pp. 2186, 2188). Based on the best available scientific information, the Service considers that Oregon spotted frog habitats are connected for purposes of genetic exchange when occupied/suitable habitats fall within a maximum movement distance of 3.1 mi (5 km) (USFWS 2013, p. 53587).

4.6 Distribution

Historically, the Oregon spotted frog ranged from British Columbia to the Pit River basin in northeastern California (Hayes 1997; p. 40; McAllister and Leonard 1997, p. 7). Oregon spotted frogs have been documented at 61 historical localities in 48 watersheds (3 in British Columbia, 13 in Washington, 29 in Oregon, and 3 in California) in 31 sub-basins (McAllister *et al.* 1993, pp. 11–12; Hayes 1997, p. 41; McAllister and Leonard 1997, pp. 18–20; COSEWIC 2011, pp. 12–13).

Currently, the Oregon spotted frog is found within 15 sub-basins ranging from extreme southwestern British Columbia south through the Puget Trough, and the Cascades Range from south-central Washington at least to the Klamath Basin in southern Oregon (Table 1 in USFWS 2013, pp. 53587 - 53588). Oregon spotted frogs occur in lower elevations in British Columbia and Washington and are restricted to high elevations in Oregon (Pearl *et al.* 2010 p. 7). In addition, Oregon spotted frogs currently have a very limited distribution west of the Cascade crest in Oregon, are considered to be extirpated from the Willamette Valley in Oregon (Cushman *et al.* 2007, p. 14), and may be extirpated in the Klamath and Pit River basins of California (Hayes 1997, p. 1).

In British Columbia, Oregon spotted frogs no longer occupy the locations documented historically, but they currently are known to occupy four disjunct locations in a single sub-basin, the Lower Fraser River (Canadian Oregon Spotted Frog Recovery Team 2012, p. 6).

In Washington, Oregon spotted frogs are known to occur only within six sub-basins/watersheds: the Sumas River, a tributary to the Lower Fraser River; the Black Slough in the lower South Fork Nooksack River, a tributary of the Nooksack River; Samish River; Black River, a tributary of the Chehalis River; Outlet Creek (Conboy Lake), a tributary to the Middle Klickitat River; and Trout Lake Creek, a tributary of the White Salmon River. The Klickitat and White Salmon Rivers are tributaries to the Columbia River. The Oregon spotted frogs in each of these sub-basins/watersheds are isolated from frogs in other sub-basins (USFWS 2013, p. 53588).

In Oregon, Oregon spotted frogs are known to occur only within eight sub-basins (scale equivalent to Hydrologic Unit Code 8): Lower Deschutes River, Upper Deschutes River, Little Deschutes River, McKenzie River, Middle Fork Willamette, Upper Klamath, Upper Klamath Lake, and the Williamson River. The Oregon spotted frogs in most of these sub-basins are isolated from frogs in other sub-basins, although Oregon spotted frogs in the lower Little Deschutes River are aquatically connected with those below Wickiup Reservoir in the Upper Deschutes River sub-basin. Oregon spotted frog distribution west of the Cascade Mountains in Oregon is restricted to a few lakes in the upper watersheds of the McKenzie River and Middle Fork Willamette River sub-basins, which represent the remaining 2 out of 12 historically occupied sub-basins west of the Cascades in Oregon (USFWS 2013, p. 53588).

In California, this species has not been detected since 1918 (California Academy of Science Museum Record 44291) at historical sites and may be extirpated (Hayes 1997 pp. 135). However, there has been little survey effort of potential habitat since 1996, so this species may still occur in California (USFWS 2013, p. 53588).

4.7 Population Dynamics

The Services' proposed rule to list the Oregon spotted frog estimated the total minimum breeding adult populations within each of the 15 occupied sub-basins using egg mass counts from known breeding locations (USFWS 2013, pp. 53588 - 53592). However, there are weaknesses to using egg mass data to evaluate population size and status at the site level and sub-basin scale. Egg mass counts do, however, indicate that many breeding locations within sub-basins have small numbers of breeding adults. Adams et al. (2013) recommends assessing trends in amphibian populations by documenting the change in the number of populations rather than a change in abundance using occupancy modeling. However, population trends for Oregon spotted frog using occupancy modeling are not yet available.

Modeling across a variety of amphibian taxa suggests that pond-breeding frogs have high temporal variances of population abundances and high local extinction rates relative to other groups of amphibians, with smaller frog populations undergoing disproportionately large fluctuations in abundance (Green 2003, pp. 339–341). The vulnerability of Oregon spotted frog egg masses to fluctuating water levels (Hayes *et al.* 2000, pp. 10–12; Pearl and Bury 2000, p. 10), the vulnerability of post-metamorphic stages to predation (Hayes 1994, p. 25), and low overwintering survival (Hallock and Pearson 2001, p. 8) can contribute to relatively rapid population turnovers, suggesting Oregon spotted frogs are particularly vulnerable to local extirpations from stochastic events and chronic sources of mortality (Pearl and Hayes 2004, p. 11). The term “rapid population turnovers” refers to disproportionately large fluctuations in abundance.

Oregon spotted frogs concentrate breeding efforts in relatively few locations (Hayes *et al.* 2000, pp. 5–6; McAllister and White 2001, p. 11). For example, Hayes *et al.* (2000, pp. 5–6) found that 2 percent of breeding sites accounted for 19 percent of the egg masses at the Conboy Lake NWR. Similar breeding concentrations have been found elsewhere in Washington and in Oregon. Moreover, Oregon spotted frogs exhibit relatively high fidelity to breeding locations, using the same seasonal pools every year and often using the same egg-laying sites. In years of extremely high or low water, the frogs may use alternative sites. For example, the Trout Lake Creek and Conboy Lake frogs return to traditional breeding areas every year, but the egg-laying sites change based on water depth at the time of breeding. A stochastic event that impacts any one of these breeding locations could significantly reduce the Oregon spotted frog population associated with that sub-basin.

Egg mass count data suggests a positive correlation and significant link between site size and Oregon spotted frog breeding population size (Pearl and Hayes 2004, p. 12). Larger sites are more likely to provide the seasonal microhabitats required by Oregon spotted frogs, have a more reliable prey base, and include overwintering habitat. The observation that extant Oregon spotted frog populations tend to occur in larger wetlands led Hayes (1994, Part II pp. 5, 7) to hypothesize that a minimum size of 9 acres (ac) (4 hectares (ha)) may be necessary to reach suitably warm temperatures and support a large enough population to persist despite high predation rates. However, Oregon spotted frogs also occupy smaller sites and are known to occur at sites as small as 2.5 ac (1 ha) and as large as 4,915 ac (1,989 ha) (Pearl and Hayes 2004,

p. 11). Smaller sites generally have a small number of frogs and, as described above, are more vulnerable to extirpation. Pearl and Hayes (2004, p. 14) believe that these smaller sites were historically subpopulations within a larger breeding complex and Oregon spotted frogs may only be persisting in these small sites because the sites exchange migrants or seasonal habitat needs are provided nearby.

Most species' populations fluctuate naturally in response to weather events, disease, predation, or other factors. However, these factors have less impact on a species with a wide and continuous distribution. Small, isolated populations are generally more likely to be extirpated by stochastic events and genetic drift (Lande 1988, pp. 1456–1458).

Funk *et al.* (2008, p. 205) found low genetic variation in Oregon spotted frogs, which likely reflects small effective population sizes, historical or current genetic bottlenecks, and/or low gene flow among populations. Genetic work by Blouin *et al.* (2010) indicates low genetic diversity within and high genetic differentiation among each of the six Oregon spotted frog groups (British Columbia, Chehalis and Columbia drainages, Camas Prairie, central Oregon Cascades, and the Klamath Basin). This pattern of genetic fragmentation is likely caused by low connectivity between sites and naturally small population sizes. Gene flow is very limited between locations, especially if separated by 6 mi (10 km) or more, and at the larger scale, genetic groups have the signature of complete isolation (Blouin *et al.* 2010, p. 2187). At least two of the locations sampled by Blouin *et al.* (2010) (Camas Prairie and Trout Lake) show indications of recent genetic drift.

Movement studies suggest Oregon spotted frogs are limited in their overland dispersal and potential to recolonize sites. Oregon spotted frog movements are associated with aquatic connections (Watson *et al.* 2003, p. 295; Pearl and Hayes 2004, p. 15). Oregon spotted frogs rely on an aquatic connection between breeding sites to maintain population viability. Where Oregon spotted frog locations have small population sizes and are isolated, their vulnerability to extirpation from factors such as fluctuating water levels, disease, and predation increases.

4.8 Reasons for Proposed Listing

Large historical losses of wetland habitat have occurred across the range of the Oregon spotted frog. Wetland losses are estimated from between 30 to 85 percent across the species range with the greatest percentage lost having occurred in British Columbia. These wetland losses have directly influenced the current fragmentation and isolation of remaining Oregon spotted frog populations.

Loss of natural wetland and riverine disturbance processes as a result of human activities has and continues to result in degradation of Oregon spotted frog habitat. Historically, a number of disturbance processes created early successional wetlands favorable to Oregon spotted frogs throughout the Pacific Northwest: (1) rivers freely meandered over their floodplains, removing trees and shrubs and baring patches of mineral soil; (2) beavers created a complex mosaic of aquatic habitat types for year-round use; and (3) summer fires burned areas that would be shallow water wetlands during the Oregon spotted frog breeding season the following spring.

Today, all of these natural processes are greatly reduced, impaired, or have been permanently altered as a result of human activities, including stream bank, channel, and wetland modifications; operation of water control structures (e.g., dams and diversions); beaver removal; and fire suppression.

The historical loss of Oregon spotted frog habitats and lasting anthropogenic changes in natural disturbance processes are exacerbated by the introduction of reed canarygrass, nonnative predators, and potentially climate change. In addition, current regulatory mechanisms and voluntary incentive programs designed to benefit fish species have inadvertently led to the continuing decline in quality of Oregon spotted frog habitats in some locations. The current wetland and stream vegetation management paradigm is generally a no-management or restoration approach that often results in succession to a tree- and shrub-dominated community that unintentionally degrades or eliminates remaining or potential suitable habitat for Oregon spotted frog breeding. Furthermore, incremental wetland loss or degradation continues under the current regulatory mechanisms. If left unmanaged, these factors are anticipated to result in the eventual elimination of remaining suitable Oregon spotted frog habitats or populations. The persistence of habitats required by the species is now largely management dependent.

In the Proposed Rule to list the frog as threatened (USFWS 2013), the Service determined that the Oregon spotted frog is impacted by one or more of the following factors to the extent that the species meets the definition of a threatened species under the Endangered Species Act:

- Habitat necessary to support all life stages is continuing to be impacted and/or destroyed by human activities that result in the loss of wetlands to land conversions; hydrologic changes resulting from operation of existing water diversions/manipulation structures, new and existing residential and road developments, drought, and removal of beavers; changes in water temperature and vegetation structure resulting from reed canarygrass invasions, plant succession, and restoration plantings; and increased sedimentation, increased water temperatures, reduced water quality, and vegetation changes resulting from the timing and intensity of livestock grazing (or in some instances, removal of livestock grazing at locations where it maintains early seral stage habitat essential for breeding);
- Predation by nonnative species, including nonnative trout and bullfrogs;
- Inadequate existing regulatory mechanisms that result in significant negative impacts such as habitat loss and modification; and
- Other natural or manmade factors including small and isolated breeding locations, low connectivity, low genetic diversity within occupied sub-basins, and genetic differentiation between sub-basins.

4.9 Consulted-on Effects

Consulted-on effects are those effects that have been analyzed through section 7 consultation as reported in a biological opinion. These effects are an important component of objectively characterizing the current condition of the species. The Oregon spotted frog was proposed for listing on August 29, 2013 and on August 29, 2014, the Service published a final rule listing the

Oregon spotted frog as threatened. No biological opinions have been written on the species to date. However, a Conference Opinion has been provided to the Deschutes National Forest on the Ryan Ranch project. This project consists of a proposed 70-acre wetland restoration project, that if implemented is expected to provide long term benefits to the Oregon spotted frog.

5.0 STATUS OF PROPOSED CRITICAL HABITAT

The U.S. Fish and Wildlife Service proposed to designate critical habitat for Oregon spotted frog on 68,192 acres and 24 stream miles in Washington and Oregon on August 29, 2013 (78FR53538). Critical habitat for Oregon spotted frog is proposed within 14 units, delineated by river sub-basins where spotted frogs are extant: (1) Lower Chilliwack River; (2) South Fork Nooksack River; (3) Samish River; (4) Black River; (5) White Salmon River; (6) Middle Klickitat River; (7) Lower Deschutes River; (8) Upper Deschutes River; (9) Little Deschutes River; (10) McKenzie River; (11) Middle Fork Willamette River; (12) Williamson River; (13) Upper Klamath Lake; and (14) Upper Klamath. The proposed rule for critical habitat provides descriptions of ownership, acreages and threats for each Unit (pp. 53546 – 53551).

5.1 Physical or Biological Features and Primary Constituent Elements

When designating critical habitat, the Service considers “the physical or biological features [PBFs] essential to the conservation of the species and which may require special management considerations or protection” (50 CFR §424.12; USDI FWS 2013, p. 53541). “These include, but are not limited to: 1) space for individual and population growth and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing (or development) of offspring; and 5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species” (USDI FWS 2013, p. 53541). The proposed rule for critical habitat identifies the physical and biological features that are essential to the conservation of Oregon spotted frog (USDI FWS 2013, pp. 53541 – 53543). Primary Constituent Elements are those specific elements of the physical and biological features that provide for a species’ life history processes and are essential to the conservation of the species.

The following are the PCEs of proposed critical habitat for the Oregon spotted frog:

1. Nonbreeding (N), Breeding (B), Rearing (R), and Overwintering Habitat (O) - Ephemeral or permanent bodies of fresh water, including, but not limited to natural or manmade ponds, springs, lakes, slow-moving streams, or pools within oxbows adjacent to streams, canals, and ditches that have one of more of the following characteristics:
 - Inundated for a minimum of 4 months per year (B, R) – timing varies by elevation but may begin as early as February and last as long as September. Inundated from October through March (O).
 - If ephemeral, areas are hydrologically connected by surface water flow to a permanent water body (e.g., pools, springs, ponds, lakes, streams, canals, or ditches) (B, R).

- Shallow water areas (less than or equal to 30 cm (12 inches), or water of this depth over vegetation in deeper water (B, R).
 - Total surface area with less than 50% vegetative cover (N).
 - Gradual topographic gradient (<3% slope) from shallow water toward deeper, permanent water (B, R).
 - Herbaceous wetland vegetation (i.e. emergent, submergent, and floating-leaved aquatic plants), or vegetation that can structurally mimic emergent wetland vegetation through manipulation (B, R).
 - Shallow water areas with high solar exposure or low (short) canopy cover (B, R)
 - An absence or low density of nonnative predators (B, R, N).
2. Aquatic movement corridors - Ephemeral or permanent bodies of fresh water that have one or more of the following characteristics:
- Less than or equal to 5 km (3.1 miles) linear distance from breeding areas
 - Barrier free (barriers may include, but are not limited to dams, abundant predators, or lack of refugia from predators).
3. Refugia habitat – Nonbreeding, breeding, rearing, or overwintering habitat or aquatic movement corridors with habitat characteristics (e.g., dense vegetation and/or an abundance of woody debris) that provide refugia from predators (e.g., nonnative fish or bullfrogs).

5.2 Special management considerations

Threats to the physical or biological features that are essential to the conservation of this species and that may warrant special management considerations or protection include, but are not limited to: 1) habitat modifications brought on by nonnative plant invasions or native vegetation encroachment (trees and shrubs); 2) loss of habitat from conversion to other uses; 3) hydrologic manipulations; 4) removal of beavers; 5) livestock grazing; and 6) predation by invasive fish and bullfrogs. These threats also have the potential to affect the PCEs if conducted within or adjacent to designated units.

6.0 ENVIRONMENTAL BASELINE

Regulations implementing the Endangered Species Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress.

6.1 Status and threats in the Upper Deschutes River sub-basin

Oregon spotted frogs in the Upper Deschutes River sub-basin occur in high-elevation lakes up to 5,000 ft (1,524 m), wetland ponds, and riverine wetlands and oxbows along the Deschutes River. There are less than 20 known breeding locations within four watersheds (HUC 10) in the sub-basin: Charleton Creek, Browns Creek, Fall River, and North Unit Diversion Dam. Most of the known breeding locations are on the Deschutes National Forest in lakes, ponds and riverine wetlands that drain to the Crane Prairie and Wickiup Reservoir complex. Above the reservoir system, threats to Oregon spotted frogs include primarily lodgepole pine encroachment and non-native predatory fish introductions.

In the Upper Deschutes River sub-basin, regulated water releases from Crane Prairie and Wickiup Reservoirs result in extreme seasonal fluctuations in stream flows that have affected the amount of overwintering and breeding habitat available for Oregon spotted frogs along the mainstem Deschutes River between Wickiup Reservoir and Bend, Oregon. Prior to the construction of Wickiup Dam in 1947, the Deschutes River below the current dam site exhibited stable flows averaging approximately 730 cubic feet per second (cfs) (20.7 cubic meters per second (cms)) and 660 cfs (18.7 cms) during summer and winter, respectively (Hardin-Davis 1991). The current system of water storage in the reservoirs during winter, dam releases in the spring, and water diversions for irrigation results in extremely low winter flows (October through March) in the Deschutes River below Wickiup Dam of approximately 20–30 cfs, (0.6–0.8 cms), and high summer flows (July and August) of approximately 1,400 cfs (39.6 cms). Dam releases have altered the relationship between the Deschutes River and adjacent floodplain pond and marsh habitats. This reach of river experiences high volumes in channel and on floodplain during summer and winter flows that are approximately one-tenth of the estimated historic base flows. Low winter flows typically drain surface water from floodplain ponded habitats, and frogs are limited for overwintering habitat. Because water releases from Wickiup Reservoir typically occur in early to mid-April, potential breeding habitats downstream of Wickiup Dam on the mainstem Deschutes River may not have sufficient water during the breeding season. Additionally, management of regulated water in Crane Prairie and Wickiup Reservoirs results in unnatural wetland hydroperiods along the margins of both reservoirs that affects the availability of breeding habitat for Oregon spotted frog.

There are approximately five known breeding sites downstream of Wickiup Dam in riverine wetlands along the Deschutes River, extending to Bend, Oregon: Dead Slough, La Pine S.P. SW, Sunriver, Slough Camp and the Old Mill pond, including Les Schwab Amphitheater (LSA) Marsh. The detection of post-metamorphic spotted frogs at Bull Bend, approximately 3 miles below Wickiup Dam and upstream of Dead Slough, in 2013 indicates that there is likely another breeding site at that location.

Dead Slough and La Pine S.P. SW breeding locations were first documented in 2013 in La Pine State Park by the USGS. Dead Slough and La Pine S.P. SW egg mass counts (2013) were 19 and 2, respectively. Wetland habitats in the area of La Pine State Park that support Oregon spotted frogs experience an unnatural hydroperiod due to regulated flows from Wickiup Reservoir. The sites are located just above the confluence with the Fall River, which discharges an average of 139 cfs into the Deschutes River.

Sunriver, located at the confluence of the Deschutes River and the Little Deschutes River, has the largest population of Oregon spotted frogs in the Upper Deschutes River sub-basin with a population of at least 1,454 breeding adults based on 2012 egg mass surveys (J. Bowerman dataset 2012). Oregon spotted frog habitat in Sunriver consists of excavated ponds and the Sun River, an old riverine oxbow that connects ponds and water features within the 3,300 acre community. Sunriver maintains a system of weirs that allow the water levels to be maintained or raised from the time of oviposition through hatching, which is a key factor in the persistence of a robust population of Oregon spotted frogs. Bull frogs have been increasing in Sunriver, despite active management to eliminate them and the first breeding population was confirmed in 2010.

Slough Camp on the Deschutes National Forest is located 7.5 miles downstream of Sunriver along the Deschutes River at 4,000 feet elevation and approximately 17 miles upstream of the LSA Marsh and Old Mill pond, which is currently the downstream most distribution of Oregon spotted frogs in the Upper Deschutes River sub-basin. Slough Camp currently has two main breeding locations for Oregon spotted frogs: a 14-acre marsh located south of the parking area on the west side of the river and a 64-acre wetland complex on the east side of the Deschutes River. The SW Slough area retains water year round and is likely an overwintering site for Oregon spotted frogs. The Slough Camp marshes located on the east side of the Deschutes River are seasonally inundated and affected by regulated flows from Wickiup Reservoir. Overwintering at this location may be difficult for Oregon spotted frogs due to the rapid drop in water elevation at the onset of the irrigation water storage season in mid-October.

Oregon spotted frogs were first detected at Slough Camp in 2010 on the east side of the river (East Slough). In September 2010, approximately 42 frogs were found (21 adults with 3 being positively identified as breeding females and 21 juveniles). Breeding was confirmed in 2011 when 33 egg masses were located by the Forest Service at East Slough and 5 were located in a wetland south of the parking area at Slough Camp (SW Slough). Surveys on both sides of the river in 2012 and 2013 yielded 14 and 41 egg masses, respectively. In 2013, a single egg mass and dead Oregon spotted frog were located in a small wetland south of Ryan Ranch and north of Slough Camp on the west side of the Deschutes River.

The downstream most extent of Oregon spotted frog distribution within the Upper Deschutes River sub-basin is located in the vicinity of the Old Mill District in Bend, Oregon. In 2012, Oregon spotted frogs were discovered in a man-made storm water pond and riverine marsh on the Deschutes River. The Oregon spotted frog was historically known to occur 34 miles downstream of the Old Mill District where NW Lower Bridge Way crosses the Deschutes River (Hayes 1997). In 2013 breeding surveys were conducted downstream from the Old Mill District between the Colorado Street Bridge and Tumalo State Park, a distance of 7.8 miles (Biota Pacific Environmental Sciences, Inc. and Smayda Environmental Associates Inc. 2013). Oregon spotted frogs were not detected during these surveys which confirmed that the Old Mill District is the most downstream extent of spotted frog distribution in the Upper Deschutes sub-basin. Given that Slough Camp is approximately 17 miles upstream of this location, it appears that this population is isolated from others in the sub-basin.

6.1.1 Status of the species within the Action Area

In August 2012, spotted frogs were detected in the Old Mill District Casting Pond on the east side of the Deschutes River on the covered lands. Subsequently, Biologist Jay Bowerman began to study spotted frogs in the Casting Pond and nearby riparian habitat. Between October 2012 and February 2013, numerous juvenile and adult spotted frogs were detected in a large marsh known as the Les Schwab Amphitheater Marsh, on the west side of the Deschutes River across from the Casting Pond. Telemetry data revealed that some spotted frogs move between these sites and that summer foraging territories exist within the riparian habitat on both sides of the river. (Bowerman pers. comm. 2013a).

Initial surveys in 2012 indicated that there were 30-50 adults and over 200 juveniles using the Casting Pond and LSA Marsh. Mark and recapture estimates and egg mass counts since 2012 indicate that there are over 100 breeding adults and approximately 945 juvenile spotted frogs using habitat within the LSA Marsh and Casting Pond (Bowerman pers. comm. 2014a). Telemetry data revealed that some spotted frogs move between these sites and that summer foraging territories exist within the riparian habitat on both sides of the river (Bowerman pers. comm. 2013a).

6.1.1.1 Habitat within the CCAA Covered Lands

The Casting pond provides breeding, rearing and overwintering habitat for the Oregon spotted frog. The vegetation in the Casting Pond consists mostly of cattails with some shrubs and sedges over native soils and gravel fill. The pond edge transitions into a mowed lawn landscape and is vulnerable to erosion due to the high public foot traffic in the area. Cattail encroachment into the pond was considered to be a threat to the limited breeding habitat for the spotted frog. In the winter of 2013, approximately half of the cattails in the Casting Pond were mechanically removed. The Casting Pond is within 20 ft. (6 m) of the Deschutes River. Muskrats utilized the pond in 2012, with a den located under the northern bank of the Casting Pond near the storage house. The muskrat den provided an overwintering location for spotted frogs, as determined by telemetry (Bowerman pers. comm. 2013b). Another overwintering site within the Casting Pond was located (via telemetry) within the rock walkway leading into the pond. Low water levels followed by freezing temperatures during the winter of 2013 resulted in the mortality of 29 spotted frogs that had attempted to overwinter in the walkway. The walkway has since been modified to reduce the potential for overwintering and mortality.

The LSA marsh is located on the west bank of the Deschutes River directly upstream of the Colorado Street Bridge. Vegetation within the marsh consists predominately of cattails. Water levels within the marsh fluctuate with storage and release of regulated flows from Wickiup Reservoir. However, the fluctuation of surface water in the marsh is relatively stable compared to upstream reaches of the river. According to hydrologists working on a proposed water park downstream of the bridge, the average fluctuation of the water level is approximately four inches. Openings within the dense cattails, created by beaver and muskrats, provide at least two breeding locations for Oregon spotted frogs (Bowerman pers. comm. 2014b).

There are approximately 6,909 linear feet of river bank adjacent to the Deschutes River within the Old Mill District. The riparian area within this developed area is mostly fenced to limit access to the river, reduce erosion, and protect the native vegetation along the river's edge.

6.1.2 Role of Covered Lands in the Conservation of Oregon spotted frog

The CCAA covered lands contain habitat suitable for supporting all life stages of the Oregon spotted frog. The estimated adult breeding population (100) represents only 0.028 percent of the estimated population (3,530) within the Upper Deschutes River sub-basin. However, this Old Mill District breeding location is currently the most downstream extent of the known occupied range of the spotted frog in the sub-basin. Maintaining a healthy Old Mill District population is important to the conservation of the spotted frog because it could provide a source population for re-colonization of historically occupied habitat both downstream to Lower Bridge and upstream to Slough Camp.

6.2 Status of the proposed critical habitat within the action area

The Old Mill District is within the Upper Deschutes River sub-basin Subunit 8A of proposed critical habitat. This subunit includes 2,366 acres (958 ha). This subunit consists of the Deschutes River and associated wetlands downstream of Wickiup Dam to Bend, Oregon, beginning at the outlet of an unnamed tributary draining Dilman Meadow. All of the essential physical or biological features are found within this sub-unit but are impacted by hydrologic modification of river flows, reed canarygrass, predaceous fish and bullfrogs.

There are approximately 26 acres of proposed critical habitat on private lands within the Old Mill District. These acres of proposed critical habitat do not include acreages of proposed critical habitat within the Deschutes River, which flows between the private lands that are covered within the CCAA. The downstream most extent of proposed critical habitat within the Upper Deschutes River sub-basin terminates at the Colorado Street Bridge, which is within the Old Mill District.

Habitat components of PCE#1 exist within the Casting Pond, LSA Marsh and Deschutes River. The Casting Pond and LSA Marsh areas function as breeding and rearing habitat (B-R). PCE #1 - characteristics such as high solar exposure, shallow water areas, gradual topographic gradient, and herbaceous wetland vegetation are all present. The Deschutes River functions as an Aquatic Movement Corridor (PCE #2) between the Casting Pond and LSA Marsh and provides overwintering habitat (PCE#1) for Oregon spotted frogs.

Current threats to physical and biological features of proposed critical habitat at the Old Mill District include ongoing regulated water releases from Wickiup Dam that influence water levels in the LSA Marsh and Deschutes River.

7.0 EFFECTS OF THE ACTION

The effects of the action include the direct and indirect effects of implementing the federal action (issuance of a 10(a)(1)(A) permit to implement the CCAA) on the Oregon spotted frog and its proposed critical habitat, together with the effects of other activities that are interrelated or

interdependent with this action that will be added to the environmental baseline (50 CFR 402.02).

7.1 Effects to the Oregon spotted frog

Management of covered lands and implementation of conservation measures outlined within the CCAA are designed to avoid most impacts to Oregon spotted frogs and their habitat and improve habitat conditions. However, the Service recognizes that all effects to the species and its habitat cannot be avoided. The following activities will not result in adverse effects to the species: (1) maintenance of fencing of the riparian area along the Deschutes River and LSA Marsh (see Conservation Measure 7); and (2) annual egg mass surveys and other monitoring of spotted frogs in the Casting Pond, the LSA Marsh and other existing or future ponds or bioswales that may be utilized for breeding because it can be conducted from shoreline and will not disrupt individuals or egg masses.

Although the Old Mill District is an area of high use by pedestrians, the areas inhabited by the spotted frog are not easily accessible. The riverine areas, including LSA Marsh are fenced and signed to be protective of the fragile riparian area. A buffer of vegetation surrounding the Casting Pond is protective of frog habitat and a rock walkway into the pond provides access to open water casting areas. Some improvement to the buffer area surrounding the Casting Pond are not likely to adversely affect the spotted frog and are intended to improve the long-term condition of the habitat and avoid erosion of the edges of the Casting Pond (Conservation Measure 5). The Service does not anticipate that spotted frogs will be adversely affected by pedestrians on the walkway or in open water areas where fly casting will occur. The CCAA includes conservation measures to avoid unintentional impacts from on-site visitor use through public information, on-site signs, and use of temporary fencing, if needed (Conservation Measure 6).

The implementation of the Old Mill District Casting Pond maintenance activities including the temporary water reduction for pond repairs and removal of cattails every three years may result in adverse effects to Oregon spotted frog and its habitat. Based on information gathered during the winter of 2012-2013, the removal of cattails from the Casting Pond can reduce the water retention capacity of the pond and water levels may drop. Spotted frogs are at risk to dropping water levels during the overwintering, breeding, and rearing periods of their life cycle. During the overwintering period of 2012-2013, low water levels and subsequent freezing temperatures caused spotted frog mortality in a rocked walkway into the pond after implementation of the cattail removal work. Although there have since been modifications to the walkway that have reduced the potential for spotted frogs to overwinter in a location that may cause mortality, frogs continue to overwinter in muskrat dens along the pond banks. In order to reduce adverse effects to spotted frogs that may be overwintering in muskrat dens during the pond vegetation removal and maintenance water drawdown in the pond will be limited to a 24-hour period during the winter when temperatures are above freezing (Conservation Measure 3). The pond will be refilled with water immediately post-work to reduce the duration of an effect to overwintering frogs.

Conservation measures 1 and 2 within the CCAA are intended to maintain stable water levels within the Casting Pond year-round. During the breeding season, egg masses deposited in shallow water are at risk of freezing or desiccation if water levels become too shallow. Shallow water during the rearing period can cause stranding of tadpoles in vegetation or create unsuitably warm temperatures that can reduce survival of tadpoles. Maintaining pond water levels at approximately 40-45 cm is likely to have a positive effect on Oregon spotted frogs and their habitat.

Vegetation removal in the Casting Pond is necessary to prevent encroachment of cattails to an abundance that limits Oregon spotted frog breeding habitat. Vegetation encroachment into breeding habitat has been indicated as a threat to Oregon spotted frogs across the range. Although rearing habitat for Oregon spotted frogs may be affected by the removal of vegetation, the habitat will likely be improved as breeding habitat. Conservation Measure 3 within the CCAA will retain 30 percent cover of vegetation on the pond and provides methodologies and timeframes to minimize impacts to spotted frogs. Therefore, vegetation cover within the pond should provide rearing habitat that is sufficient for tadpoles, juveniles and adults utilizing the pond through spring, summer and fall. The periodic (every three years) vegetation removal should have a long-term benefit to spotted frogs in the Casting Pond.

Covered activities also include maintenance and enhancement of existing landscaping in the vicinity of the Casting Pond, other bio-swales, LSA Marsh, and other riparian zones.

In order to prevent an introduction of non-native Oregon spotted frog predators to the Casting Pond, Conservation Measure 4 within the CCAA is designed to rapidly detect and remove non-native predators. Annual monitoring for non-native fish and bull frogs will occur at the Casting Pond under the CCAA, which should have a long-term benefit to the spotted frog population in the Old Mill District.

Since the CCAA is a 20-year, voluntary agreement, there are conditions within the CCAA that provide for Changed Circumstances that may affect Oregon spotted frogs on lands covered under the CCAA within the Old Mill District. Two changed circumstances have been identified and are provided for in the CCAA. These are: geotechnical failure of Casting Pond base material and spotted frog occupancy of existing or newly constructed stormwater ponds that are not suitable to supporting their life cycle. Changed Circumstances Conservation Measures (CCCM) 1, 2, and 3 are included in the CCAA under covered activities to address these changed circumstances.

Geotechnical failure of the Casting Pond base material could occur and result in failure of the pond to maintain desired water levels. If water loss occurs during the breeding season, egg masses deposited in shallow water are at risk of freezing or desiccation if water levels become too shallow. Shallow water during the rearing period can cause stranding of tadpoles in vegetation or create unsuitably warm temperatures that can reduce survival of tadpoles. CCCM 1 provides for the active restoration of the existing bank and silt base to the Casting Pond to maintain desired water levels as described in Conservation Measures 1 and 2. CCCM 2 provides for salvage of spotted frogs prior to the repair of the pond base as needed. These

CCCMs are designed to limit the level of potential mortality of egg masses, tadpoles and frogs from the lowering of water levels resulting from geotechnical failure of the Casting Pond base material and its repair.

The Old Mill District is an area where development along the Deschutes River will continue. The CCAA outlines conservation measures where existing and future bioswales may be utilized by Oregon spotted frogs. Although existing and future storm water ponds and bioswales do not currently provide habitat for the spotted frog, there is potential for them to be used by spotted frogs for breeding if there is standing water in the spring. Monitoring of bioswales will be conducted during the spring breeding season to determine if spotted frogs are using these areas and if they are at risk to dropping water levels that may strand egg masses. CCCM 3 outlined in the CCAA allow for two options in bioswales where breeding is detected: 1) Water levels may be maintained at levels similar to the Casting Pond to allow for successful breeding and metamorphosis; or 2) The Permittee will work closely with the Service to develop a course of action for implementing a salvage plan. These conservation measures are designed to limit the level of mortality if egg masses are detected in bioswales within the Old Mill District.

7.2 Effects within Critical Habitat

There are 26 acres of proposed critical habitat on private lands within the Old Mill District that include the Casting Pond, LSA Marsh and Deschutes River. Most of the covered activities including the conservation measures outlined in the CCAA have no effect to proposed critical habitat because the habitat is not being removed, modified, or adversely affected. However, management and maintenance on the Casting Pond will have some short term adverse effects to PCE1. Specifically, the vegetation removal within the pond will have a short-term adverse effect on rearing habitat within the pond. Some improvements to proposed critical habitat also are expected through implementation of conservation measures within the CCAA.

As explained above, adverse effects to proposed critical habitat within the Old Mill District are concentrated within the 0.25-acre Casting Pond. The effects to PCE1 will be short-term and periodic (i.e., every 3 years). Although rearing habitat will be slightly reduced through vegetation removal, breeding habitat will be increased in the Casting Pond. The CCAA Conservation Measure for this treatment aims to maintain 30 percent of the pond as rearing habitat which should provide the habitat components that are necessary for the breeding and rearing life stages of the spotted frog. Hence, the proposed critical habitat within the pond will maintain its function. None of the analyzed effects to proposed critical habitat for Oregon spotted frog would affect the function of critical habitat at the sub-unit scale

Conservation measures within the CCAA are designed to improve proposed critical habitat within the Casting Pond and along the Deschutes River. Specifically, improving the water levels in the Casting Pond will increase the quality of breeding, rearing and overwintering habitat (PCE1). Monitoring the Casting Pond for non-native predator such as bull frogs will facilitate the maintenance of the Casting Pond as refugia habitat (PCE3). Reducing the amount of bank trampling from high public use with fencing along the Deschutes River has and will continue to have a long-term benefit to the aquatic movement corridor (PCE2).

Overall, the implementation of management and conservation measures outlined in the CCAA will have long-term benefits to proposed critical habitat. Conservation measures include monitoring and maintaining sufficient water levels in the Casting Pond to support breeding, rearing and overwintering habitat; reduction of vegetation encroachment into the Casting Pond to maintain open water areas for breeding; removal of nonnative predators in the pond should they be discovered during annual surveys; and protection of the riparian zone along the banks of the Deschutes River, including marsh habitat occupied by spotted frogs, within the covered lands, through the use of signs and temporary fencing. These activities reduce or eliminate threats to proposed Oregon spotted frog critical habitat by creating or maintaining PCEs that are essential for the life stages of Oregon spotted frog. Implementation of the CCAA will not reduce the function of proposed critical habitat within the Old Mill District, at the sub-unit, unit or rangewide scale.

7.3 Interrelated and Interdependent Actions

Regulations implementing the Endangered Species Act of 1973, as amended, require that the Service consider the effects of activities which are interrelated and interdependent to the proposed Federal action (50 CFR §402.02). The Endangered Species Act defines interrelated activities as those which are part of a larger action and depend upon the larger action for their justification, and interdependent activities as those projects which have no independent utility apart from the action that is under consideration. Both interrelated and interdependent activities may be assessed by applying the "but for" test, which asks whether any action and its associated impacts would occur "but for" the proposed action. No interdependent and interrelated effects were identified for this action.

8.0 CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private activities that are reasonably certain to occur within the action area considered in this Conference Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act. At this time, there are no known future State, local or private activities that are reasonably certain to occur within the action area.

9.0 CONCLUSION

After reviewing the current status of Oregon spotted frog, the environmental baseline for the action area, the effects of the proposed Old Mill CCAA and the cumulative effects, it is the Service's Conference Opinion that the issuance of a Enhancement of Survival permit for the Old Mill CCAA, as proposed, is not likely to jeopardize the continued existence of the Oregon spotted frog, and is not likely to destroy or adversely modify proposed critical habitat. We have reached this conclusion based on the following reasons. Management of covered lands and implementation of conservation measures outlined within the CCAA are designed to avoid most impacts to Oregon spotted frogs and their habitat and improve habitat conditions.

Overall, the implementation of the management and conservation measures outlined in the CCAA will have long-term benefits to proposed Oregon spotted frog and critical habitat by: 1) monitoring and maintaining sufficient water levels in the Casting Pond to support breeding, rearing and overwintering habitat; 2) managing vegetation encroachment in the Casting Pond to maintain open water areas for breeding; 3) removal of nonnative predators in the pond should they be discovered during annual surveys; and 4) protection of the riparian zone along the banks of the Deschutes River within the covered lands, through the use of signs and temporary fencing.

10.0 INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service as an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Endangered Species Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.[50 CFR §402.14(i)(3)]

The prohibitions against taking the species found in section 9 of the ESA do not apply until the species is listed. This incidental take statement would become effective upon the effective date of the listing of the Oregon spotted frog and following adoption of this Conference Opinion as a Biological Opinion. If this Conference Opinion is adopted as a Biological Opinion following a listing or designation, these measures, with their implementing terms and conditions, will be nondiscretionary, and must be undertaken by the Service so that they become binding conditions of any permit issued to the Permittee, as appropriate for the exemption in section 7(o)(2) to apply. The Service has the continuing duty to regulate the activity covered by this incidental take statement. If the Service (1) fails to assume and implement the terms and conditions or (2) fails to require the Permittee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Service must report the progress of the action and its impact on the species as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

10.1 Amount of Extent of Take

Based on the analysis of potential threats associated with implementation of the covered activities including the conservation measures in the CCAA, we believe that most impacts to Oregon spotted frog habitat and take of Oregon spotted frog individuals will be avoided.

However, we do anticipate that impacts to habitat and individuals cannot be fully avoided and that some adverse effects, including incidental take of Oregon spotted frogs will occur. The following activities are not likely to result in take:

- No take is anticipated in the LSA Marsh and the riparian zone of the Deschutes River within the Old Mill District covered lands since there are no activities planned within the marsh that could result in take and the area receives little human use. The Owners will continue to protect the riparian zone along the banks of the Deschutes River through existing measures and direct and manage visitor access to avoid impacts to the habitat.
- Egg mass surveys and other monitoring of spotted frogs in the Casting Pond, the LSA Marsh and other existing or future ponds or bioswales that may be utilized for breeding by spotted frogs are not likely to result in take.

The Service anticipates that incidental take of Oregon spotted frogs will likely occur as a result of implementation of the CCAA covered activities however it is not expected to nullify the conservation benefits. Authorization for incidental take under the EOS permit is limited to the covered lands and activities described in the CCAA. The Service anticipates that authorized take associated with the CCAA would be up to 12 adult or juvenile frogs and up to 8,400 tadpoles over the 20-year term of the EOS permit as described in this conference opinion.

We considered three primary types of incidental take: (1) injury or death; (2) harm in the form of habitat fragmentation, loss, or degradation, and (3) harassment in the form of human activities that significantly disrupt normal behavioral patterns such as breeding, feeding, or sheltering. For each type of take we describe the associated covered activities and conservation measures that will minimize the take.

Injury and mortality

Casting Pond

The implementation of the Old Mill District Casting Pond maintenance activities including the removal of cattails and temporary water reduction for pond repairs every three years may result in “take” of spotted frogs overwintering along the perimeter of the Casting Pond. Telemetry studies indicate that none to only a few frogs overwinter in the Casting Pond since 2012, when 29 frogs that were overwintering in a rock crevice within a path into the Casting Pond were killed when the water level dropped and temperatures were below freezing. Since that time, modifications have been made to the pathway to reduce the potential for overwintering in this unsafe area. Current conditions within the pond that support overwintering are limited to muskrat burrows in the bank. Telemetry studies indicate that most frogs leave the pond in the fall to overwinter in the banks of the Deschutes River. There is a slight chance that vegetation management activities could impact overwintering frogs therefore the Service anticipates that up to 2 frogs could be taken during Casting Pond maintenance activities. Since these activities are scheduled to occur once every three years or approximately six times over the 20-year term of this agreement, therefore take of up to 12 adult or juvenile frogs is anticipated.

Take will be avoided or minimized by: 1) maintaining adequate water levels in the pond except for the 24-hour period of vegetation management and repairs; 2) conducting vegetation management and repairs during the spotted frog overwintering period from December to February on days when temperatures are above freezing; 3) limiting vegetation management and pond repairs to a 24-hour period once every three years; 4) refilling the Casting Pond with water immediately following the repairs; 5) maintaining the integrity of the geotechnical base material of the Casting Pond and protecting the edges of the pond from erosion; 6) managing for 30 percent aquatic vegetation and 70 percent open water habitat in the Casting Pond; and 7) avoiding known overwintering sites.

Other stormwater ponds and bioswales

Although existing and future storm water ponds and bioswales do not currently provide habitat for the spotted frog, there is potential for them to be used by spotted frogs for breeding if there is standing water in the spring. The Service anticipates that a single egg mass or resulting tadpoles will be stranded annually when water levels drop in existing or future ponds or bioswales over the 20-year period of this CCAA. We assume that each egg mass is comprised of 600 eggs with an embryonic survival rate of 70 percent during the first season (Licht 1974). Assuming that standing water remains long enough to allow the 420 surviving eggs to become tadpoles, the Service estimates that 420 tadpoles will be taken annually resulting in 8,400 tadpoles will be taken over the 20-year period of this CCAA.

Take will be avoided or minimized through monitoring of stormwater ponds and bioswales during the breeding season. If breeding is detected, there are two options to avoid or minimize the likelihood of “take”: 1) water levels will be maintained at levels similar to the Casting Pond to allow for successful breeding and metamorphosis; or 2) the Owner will work closely with the Service to develop a course of action for implementing a salvage plan.

Harm The Service does not anticipate that take in the form of harm will occur through implementation of conservation and management measures at the Old Mill District. No habitat for Oregon spotted frog will be removed from covered lands under this CCAA.

Harassment The Service does not anticipate that take in the form of harassment will occur through implementation of conservation and management measures at the Old Mill District. Although the Old Mill District is an area of high use by pedestrians, the areas inhabited by the spotted frog are not easily accessible. The riverine areas, including LSA Marsh are fenced and signed to be protective of the fragile riparian area. A buffer of vegetation surrounding the Casting Pond is protective of frog habitat and a rock walkway into the pond provides access to open water casting areas. The Service does not anticipate that spotted frogs will be harassed on the walkway or in open water areas where fly casting will occur.

10.2 Authorized Incidental Take

As a part of the CCAA, specific authorization of incidental take from covered activities described in this CCAA is provided in the EOS permit issued by the Service, if the spotted frog is listed.

10.3 Impacts of taking

The Service estimates that the following total amount of “take” of Oregon spotted frogs in the form of mortality over the 20 year period of this CCAA will be 12 adult/juvenile spotted frogs and 20 egg masses or up to 8,400 tadpoles. Based on information gathered through mark-recapture and egg mass surveys since 2012, the population of spotted frogs in the Old Mill District consists of approximately 100 breeding adults and 945 juveniles. Our estimated amount of take represents 1.1 percent (i.e., 12/1045) of the current adult/juvenile population of spotted frogs in the vicinity of the Old Mill. Oregon spotted frogs occur throughout the Upper Deschutes River sub-basin. Population estimates conducted in 2012 indicated that there is a minimum breeding adult population of 3,530 frogs in the Upper Deschutes River sub-basin (USFWS 2013). A loss of up to two adults in one year due to vegetation work at the Casting Pond represents two percent of the estimated adult population at the Old Mill District and only 0.057 percent of the estimated adult population in the Upper Deschutes sub-basin. Authorizing this level of take will not adversely affect the population of frogs that occur in the vicinity of the Old Mill District because the majority of the population resides in the LSA marsh, which will be unaffected by management actions that result in take.

The Service estimates that 50 egg masses are deposited by the Old Mill spotted frog population of 100 individuals. Assuming that each egg mass is comprised of 600 eggs with an embryonic survival rate of 70%, there are approximately 21,000 tadpoles ($30,000 \times 0.7$) following the breeding season. As stated above, we assume that 420 tadpoles could be stranded each year in bioswales. The loss of 420 tadpoles annually due to undetected breeding occurring in bioswales within the Old Mill District represents two percent of the current tadpole population. However, if breeding is detected in bioswales in the future, the conservation measures would allow for the maintenance of water levels similar to the Casting Pond or the salvage of the egg masses or tadpoles. Authorizing this level of take will not adversely affect the population of spotted frogs that occur in the vicinity of the Old Mill District because the majority of the population resides in the LSA marsh, which will be unaffected by management actions that result in take.

10.4 Effect of the Take

The Service determined that this level of anticipated take is not likely to result in jeopardy to the proposed Oregon spotted frog or destruction or adverse modification of proposed critical habitat. If this Conference Opinion is adopted as a Biological Opinion following a listing these measures and their terms and conditions, will be nondiscretionary.

11. REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

The Service believes the following reasonable and prudent measures and their implementing terms and conditions are necessary and appropriate to minimize the incidental take of Oregon spotted frogs. The prohibitions against taking the species found in section 9 of the Endangered Species Act do not apply until the effective date of the final rule listing the Oregon spotted frog as threatened. In order to be exempt from the prohibitions of Section 9 of the ESA, the Service must condition the enhancement of survival permit to ensure that implementation of the CCAA

complies with the following terms and conditions which implement the reasonable and prudent measures.

Reasonable and Prudent Measures:

1. Provide a report that all actions are in compliance as described within the CCAA including numbers of dead or injured Oregon spotted frog.

Terms and Conditions

1. All implementation reports including summary of compliance are due to the Fish and Wildlife Service by June 1 for the previous calendar year.
2. If a dead, injured, or sick endangered or threatened species is located, initial notification must immediately be made to the Service's Division of Law Enforcement in Oregon at (503) 682-6131. Instruction for proper handling and disposition of such specimens will be issued by the Division of Law Enforcement. Care must be taken in handling sick or injured Oregon spotted frogs to ensure effective treatment and care must be taken in handling dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured Oregon spotted frogs, or the preservation of biological materials from dead Oregon spotted frogs, the Service has the responsibility to ensure that information relative to the date, time, and location of the spotted frog when found, and possible cause of injury or death of each Oregon spotted frog be recorded and provided to the Service Law Enforcement.

12.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service recommends that the following conservation measures be implemented:

1. The Service should continue the close coordination between the Owners and their contractors in monitoring the Old Mill District area for Oregon spotted frog.
2. The Service will work with our partners to facilitate development of an Oregon spotted frog movement study using telemetry to determine how Oregon spotted frogs are utilizing the Deschutes River.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or that benefit listed species or their habitats, the Service's Bend Field Office will notify the Oregon Fish and Wildlife Office of the implementation of any conservation recommendations.

13.0 REINITIATION NOTICE

This concludes the conference on the Old Mill CCAA. If the Oregon spotted frog is listed as Threatened or its critical habitat is designated the Service will review the proposed action to confirm the Conference Opinion as a Biological Opinion issued through formal consultation. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the Conference Opinion on the project and no further section 7 consultation will be necessary.

After listing of Oregon spotted frog as threatened or designation of critical habitat for Oregon spotted frog and any subsequent adoption of this Conference Opinion, the Federal agency shall request re-initiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this Conference Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Conference Opinion; or (4) a new species is listed or critical habitat designated that may be affected by this action.

The incidental take statement provided in this Conference Opinion does not become effective until the species is listed and the Conference Opinion is adopted as the Biological Opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the Oregon spotted frog has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the Oregon spotted frog may occur between the effective date of the listing of the Oregon spotted frog and the adoption of the Conference Opinion through formal consultation, or the completion of a subsequent formal consultation.

LITERATURE CITED

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- Adams, M.J., D. W. Miller, E. Muths, P. S. Corn, E.H. C. Grant, L. L. Bailey, G. M. Fellers, R. N. Fisher, W. J. Sadinski, H. Waddle, and S. C. Walls. 2013. Trends in Amphibian Occupancy in the United States. PLoS ONE 8(5): e64347.
- Baird, S.F., and C. Girard. 1853. Communication regarding *Rana pretiosa* and *Bufo columbiensis*. Proceedings of the Academy of Natural Sciences Philadelphia 6:378–379.
- Blouin, M., I.C. Phillipsen, and K.J. Mosen. 2010. Population structure and conservation genetics of the Oregon spotted frog, *Rana pretiosa*. Conservation Genetics 11:2179–2194.
- Canadian Oregon Spotted Frog Recovery Team (COSFRT). 2012. Recovery strategy for the Oregon Spotted Frog (*Rana pretiosa*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 59 pp.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2011. COSEWIC assessment and status report on the Oregon spotted frog *Rana pretiosa* in Canada. COSEWIC. Ottawa. xi + 47 pp. (www.sararegistry.gc.ca/status/status_e.cfm).
- Cushman, K.A. and C.A. Pearl. 2007. A conservation assessment for the Oregon spotted frog (*Rana pretiosa*). U.S. Department of Agriculture Forest Service Region 6, U.S. Department of Interior Bureau of Land Management Oregon and Washington. 46 pp.
- Funk, W.C., C.A. Pearl, H.M. Draheim, M.J. Adams, T.D. Mullins, and S.M. Haig. 2008. Range-wide phylogeographic analysis of the spotted frog complex (*Rana luteiventris* and *Rana pretiosa*) in the northwestern North America. Molecular Phylogenetics and Evolution 46:198–210.
- Green, D.M., T.F. Sharbel, J. Kearsley, and H. Kaiser. 1996. Postglacial range fluctuation, genetic subdivision and speciation in the western North American spotted frog complex, *Rana pretiosa*. Evolution 50:374–390.
- Green, D.M., H. Kaiser, T.F. Sharbel, J. Kearsley, and K.R. McAllister. 1997. Cryptic species of spotted frogs, *Rana pretiosa* complex in western North America. Copeia 1997:1–8.
- Hallock, L., and S. Pearson. 2001. Telemetry study of fall and winter Oregon spotted frog (*Rana pretiosa*) movement and habitat use at Trout Lake, Klickitat County, Washington. Unpublished report to Washington State Department of Transportation and Washington Department of Natural Resources Natural Areas Program. 20 pp.

- Hammerson, G.A. 2005. Population/Occurrence delineation for ranid frogs. Available on-line at NatureServe Explorer <http://www.natureserve.org>. [Accessed 6 March 2012].
- Hayes, M.P. 1994. The spotted frog (*Rana pretiosa*) in western Oregon. Part I. Background. Part II. Current status. Oregon Department of Fish and Wildlife Technical Report 94-1-01. Unpublished Report.
- Hayes, M.P. 1997. Status of the Oregon spotted frog (*Rana pretiosa sensu stricto*) in the Deschutes basin and selected other systems in Oregon and northeastern California with a rangewide synopsis of the species' status. Final report prepared for The Nature Conservancy under contract to the U.S. Fish and Wildlife Service, Portland, Oregon. Unpublished Report. 57 pp.
- Hayes, M.P. 1998a. The Buck Lake Oregon spotted frog (*Rana pretiosa*) population (Spencer Creek System, Klamath County, Oregon). Final report prepared for the Bureau of Land Management and The Nature Conservancy under contract to Winema National Forest. Unpublished Report. 22 pp.
- Hayes, M.P., J.D. Engler, D.C. Friesz, and K. Hans. 2000. Oregon spotted frog (*Rana pretiosa*) oviposition at Conboy National Wildlife Refuge (Klickitat County, Washington): management implications of embryonic mortality. Final report to U.S. Fish and Wildlife Service. Lacey, Washington. 14 pp.
- Hayes, M.P., J.D. Engler, S. Van Leuven, D.C. Friesz, T. Quinn, and D.J. Pierce. 2001. Overwintering of the Oregon spotted frog (*Rana pretiosa*) at Conboy Lake National Wildlife Refuge, Klickitat County, Washington, 2000-2001. Final Report to Washington Department of Transportation. June 2001. 86 pp.
- Hayes, M.P., J.D. Engler, S. Van Leuven, D.C. Friesz, T. Quinn, and D.J. Pierce. 2001. Overwintering of the Oregon spotted frog (*Rana pretiosa*) at Conboy Lake National Wildlife Refuge, Klickitat County, Washington, 2000-2001. Final Report to Washington Department of Transportation. June 2001. 86 pp.
- Lande, R. 1988. Genetics and demography in biological conservation. *Science* 241:1455-1460.
- Lavergne, S. and J. Molofsky. 2006. Control strategies for the invasive reed canarygrass (*Phalaris arundinacea* L.) in North American Wetlands: the need for an integrated management plan. *Natural Areas Journal* 26(2): 208-214.
- Licht, L.E. 1974. Survival of embryos, tadpoles, and adults of the frogs *Rana aurora aurora* and *Rana pretiosa pretiosa* sympatric in southwestern British Columbia. *Canadian Journal of Zoology* 52:613-627.

- Leonard, W. P., H.A. Brown, L.L.C. Jones, K.R. McAllister, and R.M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, Washington. 168 pp.
- McAllister, K.R., and W.P. Leonard. 1997. Washington State status report for the Oregon spotted frog. Washington Department of Fish and Wildlife, Olympia. 38 pp.
- McAllister, K.R. and H.Q. White. 2001. Oviposition ecology of the Oregon spotted frog at Beaver Creek, Washington. Unpublished report. Washington Department of Fish and Wildlife, Olympia. 24 pp.
- Pearl, C.A. and R.B. Bury. 2000. The Oregon spotted frog (*Rana pretiosa*) in the Three Sisters Wilderness Area, Oregon: 1999 findings. Unpublished report to U.S. Fish and Wildlife Service, Portland, Oregon. 14 pp.
- Pearl, C.A. and M.P. Hayes. 2004. Habitat associations of the Oregon spotted frog (*Rana pretiosa*): A literature review. Final Report. Washington Department of Fish and Wildlife, Olympia, Washington, USA.
- Pearl, C., D. Clayton, and L. Turner. 2010. Surveys for presence of Oregon spotted frog (*Rana pretiosa*): background information and field methods. Unpublished report. 49 pp.
- Risenhoover, K.L., T.C. McBride, K. McAllister and M. Golliet. 2001b. Overwintering behavior of the Oregon Spotted Frog (*Rana pretiosa*) along Dempsey Creek, Thurston County, Washington. Unpublished report submitted to Washington Department of Transportation, Olympia. 26 pp. + appendices.
- Tattersall, G.J. and G.R. Ultsch. 2008. Physiological ecology of aquatic overwintering in ranid frogs. *Biological Reviews* 83:119-140.
- Watson, J.W., K.R. McAllister, D.J. Pierce, and A. Alvarado. 1998. Movements, habitat selection, and population characteristics of a remnant population of Oregon spotted frogs (*Rana pretiosa*). Annual Progress Report. Washington Department of Fish and Wildlife, Olympia, Washington. 19 pp.
- Watson, J.W., K.R. McAllister, D.J. Pierce, and A. Alvarado. 2000. Ecology of a remnant population of Oregon spotted frogs (*Rana pretiosa*) in Thurston County, Washington. Final Report. Washington Department of Fish and Wildlife, Olympia, Washington. 84 pp.
- Watson, J.W., K.R. McAllister, and D.J. Pierce. 2003. Home ranges, movements, and habitat selection of Oregon spotted frogs (*Rana pretiosa*). *Journal of Herpetology* 37:292-300.

Personal Communications and In litt

Bowerman, Jay. Sunriver Nature Center, October 4, 2006, email communications with Deanna Lynch, USFWS Western Washington Fish and Wildlife Office, Regarding Oregon spotted frog – update on activities.

Engler, Joe. USFWS Conboy Lake National Wildlife Refuge, July 22, 1999, written communication with Dr. L. Karolee Owens, USFWS Western Washington Fish and Wildlife Office, comments on Oregon spotted frog proposed rule.

Hallock, Lisa. Washington Department of Natural Resources, February 11, 2009 email communications with Deanna Lynch, USFWS Western Washington Fish and Wildlife Office, Regarding Annual update of Oregon spotted frog species assessment.