APPENDIX F – BIOLOGY

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1. Introduction

Appendix F describes historical and existing biological use of Endangered Species Act (ESA) listed species within the assessment area as well as limiting factors by geomorphic reach. A number of fish species inhabiting streams in the Grande Ronde basin and Catherine Creek subbasin have been listed under the ESA. Those relevant to this Tributary Assessment (TA) include populations of spring/summer Chinook salmon and summer steelhead. Spring Chinook salmon are part of the Snake River Spring/Summer Chinook Evolutionarily Siginificant Unit (ESU) which has five major population groupings (MPG) including: Lower Snake River, Grande Ronde/Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River group. The Catherine Creek population is a spring run and one of seven remaining Chinook salmon populations in the Grande Ronde/Imnaha MPG (Interior Columbia Technical Recovery Team [ICTRT] 2010). Catherine Creek summer steelhead are part of the Upper Grande Ronde steelhead population of the Grande Ronde MPG of the Snake River steelhead Distinct Population Segment (DPS).

2. Spring Chinook Salmon

2.1 Historic Conditions

Historically, the Grande Ronde basin supported an abundance of salmonids including spring, summer and fall Chinook salmon, sockeye salmon, coho salmon, and summer steelhead (Favrot et al. 2010). Favrot et al. (2010) further state that "during the past century, numerous factors have led to a reduction in salmonid stocks such that the only viable populations remaining are spring Chinook salmon and steelhead." Spring Chinook salmon populations in the Grande Ronde have declined in size and are substantially depressed from historic levels.

Figure 1 illustrates the current and historic spring Chinook distributions in the Grande Ronde basin. According to the Northwest Power and Conservation Council (NPCC) (2004), changes in Chinook distribution are "somewhat subtle and difficult to map." Some areas historically used for Chinook spawning are now used primarily for seasonal rearing and migration due to human modification of the habitat which limits its use for spawning (NPCC 2004).

According to NPCC (2004), it is estimated that prior to the construction of the Snake and Columbia River dams, more than 20,000 adult spring Chinook salmon returned to spawn in the Grande Ronde basin annually. Spring Chinook spawning escapement in the basin was estimated at 12,200 fish in 1957 (NPCC 2004). Recent escapement levels have numbered fewer than 1,000 fish. Estimated escapements for the Grande Ronde basin during 1979 to 1984 ranged from 474 to 1,080 (Howell et al. 1985). These low levels prompted listing of spring Chinook salmon under the ESA, including Grande Ronde spring Chinook salmon in 1992.

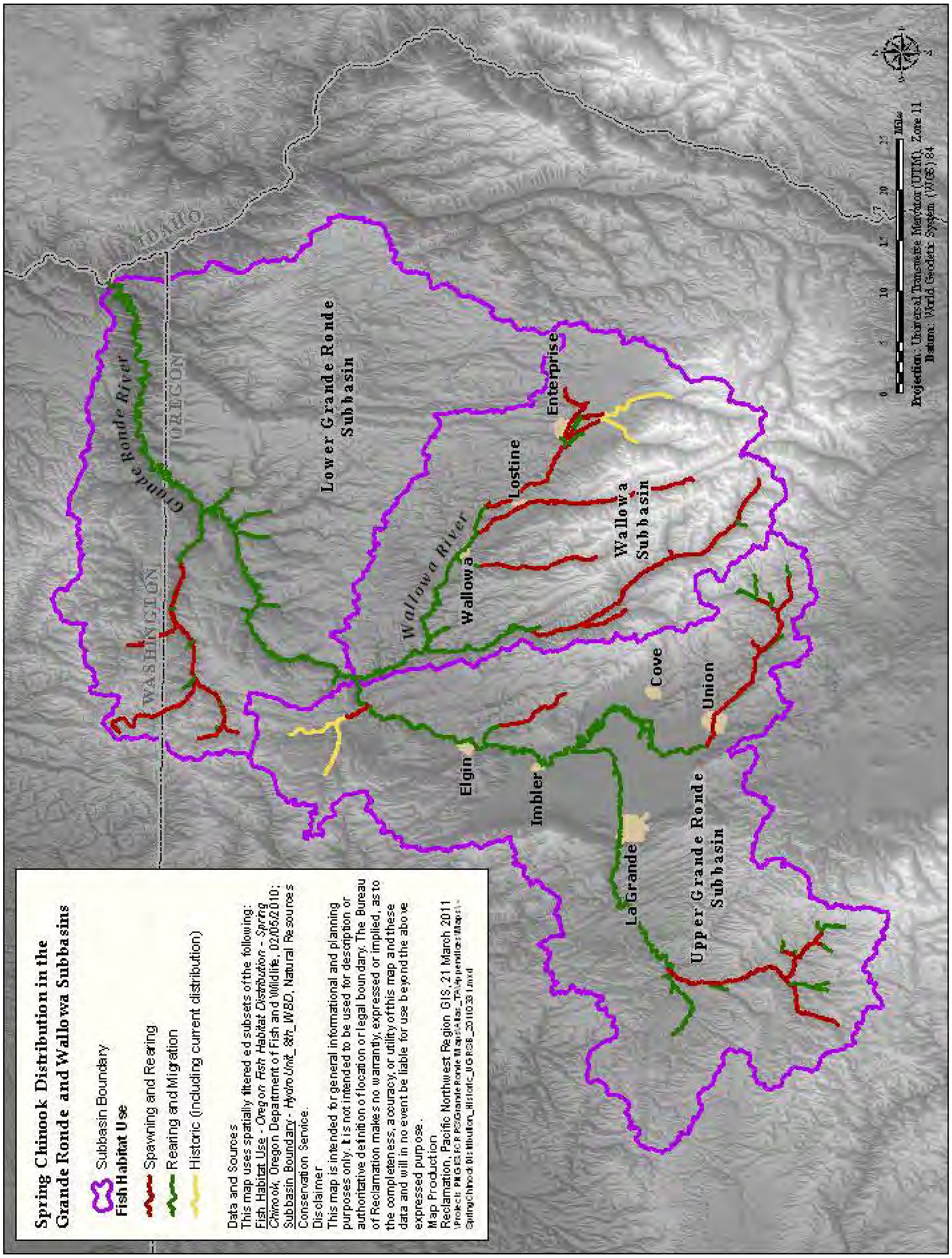

Figure 1. Spring Chinook salmon distribution in the Grande Ronde and Wallowa subbasins.

2.2 Present Conditions

2.2.1 Population

Catherine Creek supports a depressed population of ESA-listed Snake River spring/summer Chinook salmon. Recent population estimates vary from year to year but remain at very low levels when compared to historic estimates. Figure 2 shows abundance (number of adult spawning in natural production areas) of spring Chinook salmon in Catherine Creek ranging from 27 in 1994 to 2,947 in 1960. Abundance estimation methods have varied through time. Prior to 1998, spawner abundance estimates were based on redds observed during spawning ground surveys conducted annually since 1955. From 1998 to present, spawner abundance was estimated based on weir counts, mark-recapture estimates, and redd counts with adjustments for pre-spawning mortality estimated from carcass recoveries (Feldhaus 2011).

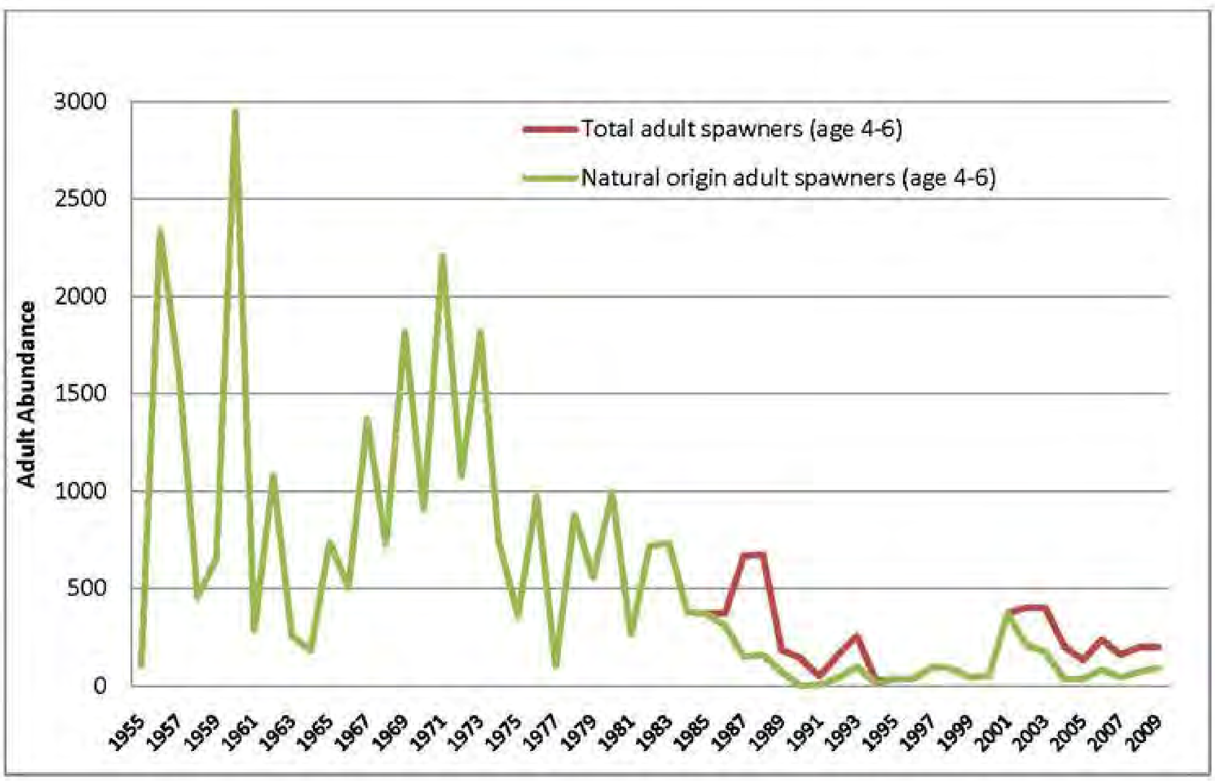

Figure 2. Catherine Creek Spring Chinook Salmon population spawner abundance estimates (1955-2009).

2.2.2 Life History

Most Grande Ronde adult spring Chinook salmon pass Bonneville Dam and enter the Columbia Basin in April and May (NPCC 2004). By June or July, the adults are holding in the Grande Ronde basin near spawning tributaries. Spawning usually occurs in August and September (NPCC 2004).

Following spawning, eggs incubate in the gravel over the winter and fry emerge between March and May. Spring Chinook salmon juveniles usually rear in the Grande Ronde basin for one year before migrating to the ocean as smolts from March through May. Some juveniles begin their downstream migrations June through October of their first year (NPCC 2004), then continue to rear in freshwater prior to smolting the following spring. Studies have shown that smolts from the Grande Ronde basin arrive at Lower Granite Dam about mid-June. Adult spring Chinook salmon return at ages 3 to 6 (after 1 to 4 years in the ocean), although age 4 is the dominant age class among spawners (NPCC 2004).

Naturally-produced age-0 fall migrants account for 78 percent of the fish (Yanke et al. 2008) that leave during the fall to overwinter downstream of Davis Dam in lower Catherine Creek. In the spring, they migrate out of Catherine Creek and the Grande Ronde watershed to migrate to the ocean as age-1 juveniles. Another group of naturally-produced juvenile Chinook overwinter in upper Catherine Creek and associated tributaries and then leave Catherine Creek at age-1 in the spring for the ocean. They return from the ocean to their natal streams 2 to 3 years later from June through August as 3- and 4-year old adults. Spawning occurs in the reaches above Davis Dam in August and September. The majority of Chinook salmon spawning occurs from Union, Oregon to the confluence of north fork Catherine and middle fork Catherine creeks (Figure 3).

The ICTRT identified two major spawning areas and two minor spawning areas within the Catherine Creek spring Chinook population (Figure 3). According to ICTRT (2010), 50 percent of the historic major spawning areas are occupied and none of the minor spawning areas are occupied.

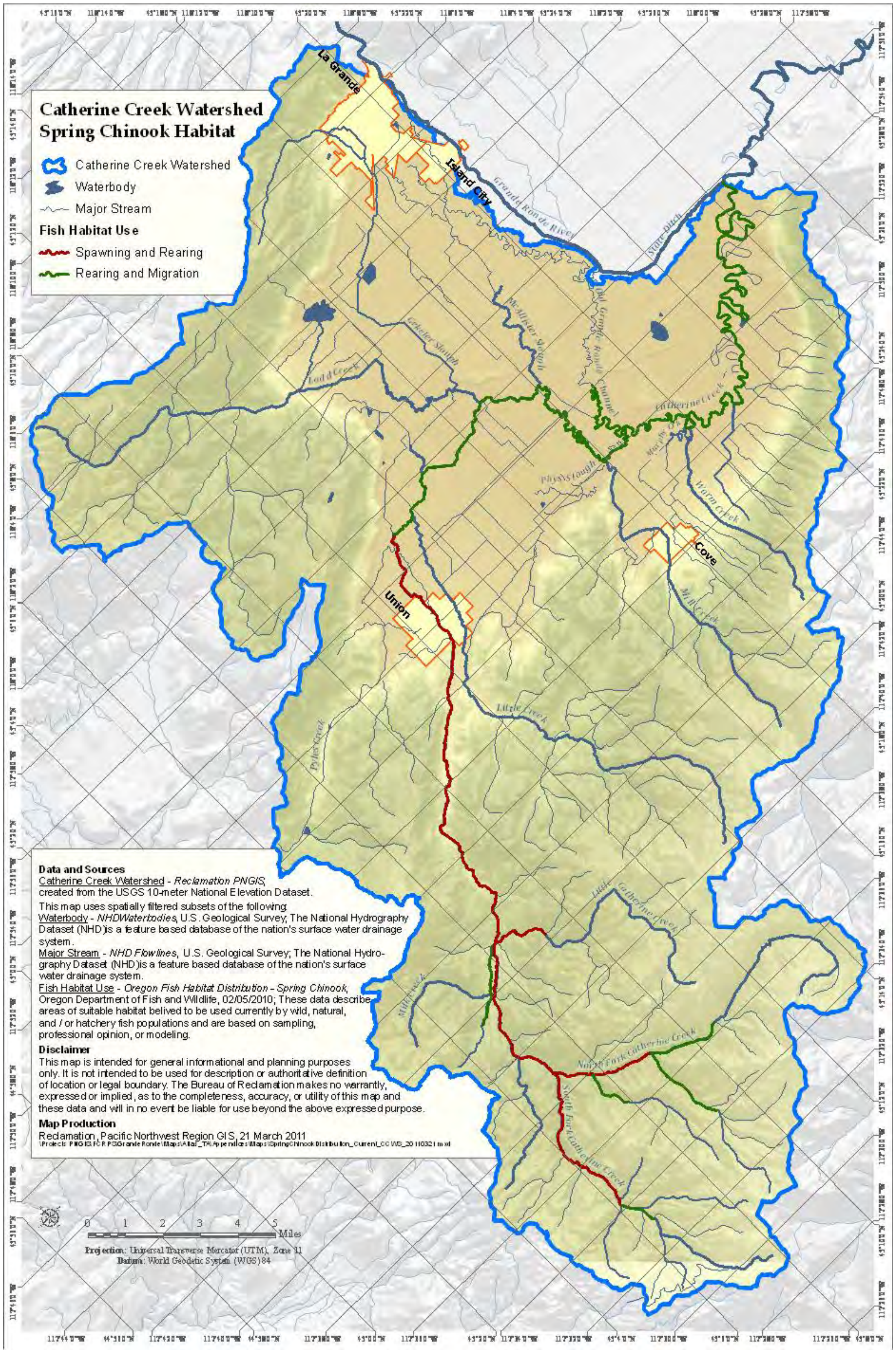

Figure 3. Catherine Creek watershed spring Chinook habitat.

2.3 Artificial Production

As a result of dramatic declines of Grande Ronde salmon and steelhead populations, the Nez Perce Tribe, Oregon Department of Fish and Wildlife (ODFW), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) have implemented conservation hatchery and supplementation programs that functioned within the framework of regional programs. The Lower Snake River Compensation Plan, Northeast Oregon Hatchery program, Grande Ronde Endemic Supplementation program, and Captive Broodstock programs have been integrated together in the Grande Ronde basin in an attempt to improve salmon and steelhead populations and prevent extinction of the Catherine Creek Chinook salmon population. According to NPCC (2004), ESA listings, continued declines in natural production, poor performance of hatchery programs (especially for spring Chinook), and increasing concerns about hatchery/wild interactions have contributed to changes in hatchery mitigation programs. Although agencies are continuing to pursue mitigation goals in the long term, they are placing increasing short-term emphasis on use of hatcheries for conservation and recovery of ESA-listed species (NPCC 2004). Annual adult mitigation, broodyear specific smolt-to-adult return and total survival rates, and annual smolt production goals were established to compensate for the estimated annual loss of 48 percent of the basin adult production.

According to Carmichael et al. (2010), the low productivity of naturally spawning fish and low abundance of natural-origin adults are significant challenges limiting the success of the Catherine Creek spring Chinook salmon hatchery program. These factors limit smolt production. Carmichael et al. (2010) also states: "There are no short-term or simple solutions for improving productivity.…Productivity can only be enhanced by improving survival across the entire life cycle." Two challenges faced by the Catherine Creek Spring Chinook Salmon Hatchery program include low smolt-to-adult survival and high smolt mortality between the release location on Catherine Creek and Lower Granite Dam (Carmichael et al. 2010). Work is presently underway by the ODFW to identify the location and potential causes of mortality that occurs in the Grande Ronde Valley low gradient habitat.

2.4 Limiting Factors and Threats

NPCC (2004) indicated that the carrying capacity and survival of anadromous fish have been reduced within the Grande Ronde basin by land management activities which have contributed to riparian and instream habitat degradation. Favrot et al. (2010) states "stream conditions in Catherine Creek, below the city of Union, consist of highly modified meandering and channeled reaches of stream flowing through agricultural land." Many low-elevation portions of the Catherine Creek watershed and Grande Ronde Valley historically were composed of expansive wet meadow, emergent wetland, and open water complexes (NPCC 2004). Pioneer farmers drained these wetlands in the late 19th century which contributed to decreases in water quality, base flows, and large wood inputs (NPCC 2004). Most notable of these wetlands was Tule Lake, a 20,000-acre complex within the Ladd Creek drainage, of which only a small portion remains as part of the Ladd Marsh Wildlife Area (NPCC 2004).

Results from McIntosh et al. (1994) comparing historic and current stream habitat conditions in the upper Grande Ronde River Valley indicated that from 1934 to 1992, pool frequency decreased by 66 percent in managed (non-wilderness) watersheds, substrate composition shifted towards finer substrates, and habitat diversity decreased significantly.

Catherine Creek is on the 303(d) Stream List based on concerns of high temperatures, habitat and flow modifications, and low dissolved oxygen (NPCC 2004). Lower sections of Catherine Creek downstream of Union are heavily silted due to extensive erosion associated with agricultural, forest management practices and mining activities (Yanke et al. 2008). This reach of Catherine Creek is currently listed as an Oregon Water Resources Department (OWRD) flow restoration priority, as irrigation withdrawals in the Grande Ronde Valley generally reduce Catherine Creek flows by up to 90 to 95 percent during irrigation season (Favrot et al. 2010).

Favrot et al. (2010) reported that winter rearing habitat quantity and quality in Grande Ronde Valley may be important factors limiting spring Chinook salmon smolt production in Catherine Creek. Alterations to lower Catherine Creek (e.g., isolated oxbows, irrigation diversions, artificial levees) may degrade the ability of spring Chinook salmon to successfully emigrate into the Grande Ronde River (Favrot et al. 2010).

Within the Grande Ronde basin and Catherine Creek, riparian and instream habitat degradation has severely affected spring Chinook salmon production potential (NPCC 2004). Water withdrawals for irrigated agriculture, human residential development, livestock overgrazing, mining channelization, low stream flows, poor water quality and road construction are major problems affecting salmon production. According to NPCC (2004), “many of these impacts have been reduced in recent years with management practices becoming more sensitive to fish and aquatic habitats.” However, the effects of some past management activities remain.

2.5 Overview By Reach

Lower Catherine Creek flows through a low gradient unconfined valley. This area has been highly modified (NPCC 2004). In the late 1800s, the State Ditch was constructed as a flood control cut-off channel. This portion of Catherine Creek has been diverted into the old main Grande Ronde channel (Figure 4). There is extensive agricultural use and water diversions throughout lower Catherine Creek. This reach, as previously mentioned, is listed as an OWRD flow restoration priority. Most of the impacts to Catherine Creek occur below the town of Union where there is extensive agriculture that has impacted the riparian area, reducing shade and confining the channel (NPCC 2004). Water withdrawals also result in flow reductions of about 25 percent starting in June, 50 percent by mid-July, and 90 to 95 percent from the third week of July through the end of September.

In an effort to collect further information on habitat conditions for Catherine Creek, the ODFW utilized its aquatic inventory program that is designed to provide quantitative information on habitat condition for streams throughout Oregon. Aquatic habitat surveys were conducted on Catherine Creek in 1991, 1995, and 2010. All surveys described the channel morphology, riparian characteristics, and features and quality of instream habitat during summer flow, following the methods described in Moore et al. (2010). Different portions of Catherine Creek were surveyed in 1991 and 1995. The 2010 survey began at the confluence of Catherine Creek and State Ditch while the 1991-95 survey did not encompass the lower 11 miles (Kavanagh, Jones, and Stein 2011).

According to Kavanagh et al. (2011), Catherine Creek has changed little between the two surveys: "The lower section of the creek continues to be a meandering stream constrained by terraces and agricultural activities with little undercut, riparian shading, or large wood.….The substrate and bank material is fine sediment, some of which is actively eroding.…Active erosion may have decreased since 1995 due to increased shrub growth."

The middle section of Catherine Creek transitions from an agriculture landscape to a reach with agriculture and urban land uses. Catherine Creek has five dams and diversions in this section (Kavanagh, Jones, and Stein 2011). Streamside shade, coarse substrate, and stream gradient increases in the middle reach. The upper reach changes dramatically with an increase in the number of multiple channels. The channel geomorphology and dimensions, habitat types, and substrate composition changed little between survey years (Kavanagh, Jones, and Stein 2011). Approximately half the amount of wood was observed during the 1991-95 survey in contrast to the 2010 survey, although the amount of overall wood was still low. The percent of pools was similar for both surveys (Kavanagh, Jones, and Stein 2011).

Kavanagh et al. (2011) utilized the HabRate model (Burke, Jones, and Dambacher 2010) to integrate habitat attributes as a method to assess overall habitat quality relative to freshwater life stages of Chinook and steelhead. For spring Chinook salmon, the availability and quality of spawning habitat in Catherine Creek did not change in the three sections surveyed between 1991-95 and 2010. HabRate indicated that spawning habitat is poor in the lower section and fair in the middle and upper sections of Catherine Creek. The abundance of fines and lack of coarse material lowers the quality of the few riffles that are present in the lower section (Kavanagh, Jones, and Stein 2011). Riffles are prevalent in the middle and upper sections and the substrate has few fines and more gravel, but with little cobble (Kavanagh, Jones, and Stein 2011). Kavanagh et al. (2011) rated the lower section (mouth to Davis Dam) fair for 0+ summer rearing and overwintering for spring Chinook salmon. Pools in this section were nearly non-existent, and availability of instream cover was poor. The few pools that were present had good complexity. The middle (Davis Dam to Brinkler Creek) and upper (Brinkler Creek to North and South Forks Catherine Creek) sections also rated fair for rearing and overwintering (Kavanagh, Jones, and Stein 2011). These sections lacked suitable pool area, undercut banks, large wood, and cobble substrate.

Table 1 below provides information of fish usage by life stage and limiting factors on a reach-by-reach basis for spring Chinook salmon. The limiting factors were determined following a Habitat Work Session meeting conducted on February 10, 2011, in La Grande, Oregon.

There are multiple physical variables that control the lack of habitat availability. For example, lack of juvenile rearing habitat can imply insufficient off-channel habitat, in-channel habitat complexity produced by large woody debris, pool-forming elements, protective cover, velocity refugia, or other variables. In general, impacts to juvenile Chinook salmon in this reach are attributed to low flow, high water temperatures, lack of protective cover, lack of pools, juvenile outmigration delays, and entrainment into unscreened diversions as a result of high flow events.

Table 1. Spring Chinook salmon fish usage by life stage and limiting factors on a reach-by-reach basis.

Reach	RM	Life Stage Usage	Limiting Factors
1	0 to 22.5	Migration, juvenile rearing	Low flows High water temperatures Predation Protective cover Outmigration delays Silt substrate
2	22.5 to 37.2	Migration, juvenile rearing	Passage delays Turbidity/siltation Lack of juvenile rearing habitat Protective cover High summer water temperatures Overgrazing Entrainment Predation Productivity
3	37.2 to 40.78	All	Low summer flow/fish passage Lack of juvenile rearing habitat High summer water temps Anchor ice Overgrazing Flooding
4-7	40.78 to 54.9	All	Lack of juvenile rearing habitat Lack of adult holding habitat Anchor ice Lack of deep pools

The following issues were summarized following the February 10, 2011 Habitat Work Session for Catherine Creek:

Reach 1 – Mouth of Catherine Creek (RM 0) to Old Grande Ronde Channel (RM 22.5)

1. Possible juvenile Chinook salmon outmigration delays from the mouth of Catherine Creek to Elmer Dam resulting from high flows in Grande Ronde River backing up lower Catherine Creek flow.

2. Isolated unscreened oxbows that are operated for storage can strand/delay juvenile Chinook salmon migration.

3. Instream structure is very limited.

Reach 2 – Old Grande Ronde Channel (RM 22.5) to Pyles Creek (RM 37.2)

1. Low flow delays for late adult spring Chinook migrants.

2. Juvenile Chinook salmon entrainment into overflow ditch near Sherman property.

3. Heavy livestock use impacting riparian zone.

4. Should stop logs remain in place at Davis Dam during late fall early winter to provide habitat for juvenile Chinook salmon?

5. Lower Little Creek providing winter refugia for juvenile Chinook salmon.

Agriculture dominates reaches one and two of Catherine Creek. Extensive irrigation diversions, which alter natural streamflows and channels, exist within the mainstem and several of the tributaries within this reach (NPCC 2004). Historically, many of the stream channels in this reach had a high sinuosity; however, this sinuosity has been reduced as a result of agriculture and road development (Lovatt 2003). McIntosh et al. (1994) reported a 61 percent decrease in frequency of large pools in the mainstem of Catherine Creek. Overall, limiting factors include low summer flows, elevated summer temperatures, poor water quality (low dissolved oxygen levels), low abundance of pool habitat, poor passage for returning adults, excess sediment, substandard streambank and riparian conditions, and a lack of habitat diversity (Huntington 1994; GRMW 1995; NPCC 2004).

StreamNet (2006) indicates that the main stem of Catherine Creek within this reach is being used by spring Chinook salmon primarily for rearing and migration. Spring Chinook have been documented using the lower 2 to 3 miles of Gekeler Slough for rearing (StreamNet 2006) and lower Little Creek for rearing (Favrot et al. 2010). Of the limiting factors indicated above, poor water quality, low abundance of pool habitat, and lack of protective cover limit winter rearing for juvenile Chinook.

Reach 3 – Pyles Creek (RM 37.2) to Swackhammer Dam (RM 40.8)

1. Low flow issues in summer as juvenile Chinook salmon move upstream to cooler water.
2. Anchor ice formation in shallow riffles.
3. Heavy livestock use near sewage treatment plant to Hefner property.
4. Fish passage criteria being met at diversion dams?

Reach 4-7 – Swackhammer Dam (RM 40.8) to Forks (RM 54.9)

1. Limited pools.
2. Riparian conditions needing improvement.

From Pyles Creek upstream to the confluence of Catherine Creek's North and South Forks, rural residences and Highway 203 constrain portions of Catherine Creek (NPCC 2004), reducing the number of pools, and creating long shallow runs. Irrigated agriculture and logging dominate this portion of the watershed (NPCC 2004), which is primarily in private ownership. Agriculture, grazing, irrigation diversions, the highway, and impacts from residences within the riparian area are the primary threats within this reach (GRMW 1995; NPCC 2004). Limiting factors include low summer flows, excess fine sediment, elevated summer temperatures, poor water quality (low dissolved oxygen levels), low abundance of pool habitat, poor passage for returning adults, substandard streambank and riparian conditions, and reduced channel complexity (GRMW 1995; Huntington 1994; NPCC 2004).

As mentioned previously, this reach is used for spawning and rearing by spring Chinook salmon. Of the limiting factors outlined above, low summer flows and elevated water temperatures likely limit summer rearing while excess sediment/substrate embeddedness may limit survival during incubation. Additionally, poor spawning conditions created by excess sediment and barriers that may prevent returning adults from accessing upstream spawning habitat may limit spawning success.

2.6 Discussion

The decline in the Catherine Creek spring Chinook salmon population has been primarily attributed to passage problems at Columbia and Snake River dams (NPCC 2004). These fish must pass a total of eight dams; four on the Columbia River and four on the Snake River, during up and downstream migrations. Out of subbasin harvest and habitat degradation have also contributed to the population decline. However, recent information by Favrot et al. (2010) indicates that winter rearing habitat quantity and quality in the Grande Ronde Valley may be more of an important factor in limiting spring Chinook salmon smolt production for Catherine Creek. According to ICTRT (2010), there are currently two primary life history stages pathways for the freshwater juvenile life stages: fish rear from fry to smolt in the upper reaches of Catherine Creek or fish leave the upper reaches of Catherine Creek in the fall and overwinter in the Grande Ronde Valley reaches, including lower Catherine Creek. There is speculation that there have been reductions in the variation of juvenile pathways such as the loss of ability of fry and summer parr to move downstream from the upper rearing reaches into the Grande Ronde Valley. Favrot et al. (2010) indicated that early migrant survival (fish overwintering in the Grande Ronde Valley) to Lower Granite Dam is typically lower for the Catherine Creek population than other Chinook salmon populations in the Grande Ronde basin. Previous research estimated that travel times through the Grande Ronde Valley reach (lower Catherine Creek included) were considerably greater than any other reach, and accounted for 42 percent of the mortality incurred in freshwater for naturally-produced Chinook salmon (Monzyk et al. 2009). Research is underway that will provide a better understanding of the timing, location, and source of mortality for this depressed population of spring Chinook salmon.

Catherine Creek adult spring Chinook salmon migration and spawn timing has likely shifted and has reduced variability relative to historic timing as a result of lower flows and temperature changes (warmer water) in the summer season (ICTRT 2010). Significant changes in habitat attributes have occurred in Catherine Creek relative to historic conditions. Flow and temperature patterns are altered with much reduced flow in summer and increased temperatures. These factors have significantly influenced adult and juvenile migration opportunity as well as availability of adult holding habitat. Selective pressures against fry and summer downstream movement and late adult migration are likely significant and affect 25 percent or greater of the individuals that historically expressed these traits (ICTRT 2010).

The primary in-basin factors limiting spring Chinook salmon populations in the Catherine Creek and middle Grande Ronde River systems are water temperature, sediment, altered hydrologic function, predation, food, and habitat complexity (GRMW 1995; Huntington 1994; NPCC 2004). Altered hydrologic function primarily is the result of irrigation water management, which results in reduced instream flows during critical summer months, contaminated return water, elevated stream temperatures, and passage barriers. Habitat complexity issues primarily are due to reduced wetted widths and a lack of pools and large woody debris (GRMW 1995; Huntington 1994; Kavanagh, Jones, and Stein 2011; NPCC 2004). Some reaches of Catherine Creek have been channelized and armored to accommodate road construction, homesteads, and irrigated agriculture.

Key questions that are critical towards recovering Catherine Creek spring Chinook salmon are:

1. Are habitat conditions for juvenile spring Chinook salmon (Age 0- fry) in rearing areas upstream of Pyles Creek limiting to where those conditions are forcing these fish downstream earlier than what they experienced historically?
2. Are habitat conditions downstream of Pyles Creek unfavorable for the above indicated early migrants?

2.7 Spring Chinook Population Risk Assessment

Ecosystem Diagnosis and Treatment (EDT) is a system for rating the quality, quantity, and diversity of habitat along a stream, relative to the needs of a focal species such as Chinook salmon. The methodology includes a conceptual framework for decision making and a set of modeling tools used to organize environmental information and rate the habitat elements with regard to the focal species. EDT can identify the potential for a stream under a set of conditions such as those that occur presently or those that might occur in the future. The result is a scientifically-based assessment of conditions and a prioritization of restoration needs.

EDT analysis for Catherine Creek identified impacts for the “middle” reach. The highest priority impacts were dams, riparian function, lack of wood, high water temperature, competition with hatchery fish, low flow, predation and sediment (NPCC 2004). Life history stages most affected were the age 0 inactive, age 0 active and age 1 migrants. NPCC (2004) stated, “EDT rated the middle Catherine Creek geographic area as an overwhelming priority for restoration (with a predicted 5,000+ percent increase) for spring Chinook salmon abundance.”

3. Summer Steelhead

The Upper Grande Ronde River summer steelhead population is part of the Snake River Basin Steelhead DPS that includes all naturally spawned populations of steelhead in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho (62 FR 43927), and were federally listed as threatened in 1997 and reaffirmed on January 5, 2006. Critical habitat for Snake River Basin steelhead, including Catherine Creek, was designated in 2006.

3.1 Historic Conditions

The Grande Ronde basin historically produced large runs of summer steelhead (NPCC 2004). The size of those runs is unknown but an estimate of nearly 16,000 to the mouth of the Grande Ronde River was given for 1957, prior to construction of the lower Snake River dams (NPCC 2004). The ICTRT (2010) classified the Upper Grande Ronde River steelhead population as "Large" based on historical habitat potential. A steelhead population classified as "Large" has a mean minimum abundance threshold of 1,500 naturally produced spawners.

3.2 Present Conditions Summer Steelhead

3.2.1 Population

Recent estimates have estimated the upper Grande Ronde River summer steelhead escapement at about 1,800 fish (NOAA Fisheries 2006). The watershed is currently managed for wild fish production only with no hatchery fish released to the stream.

NPCC (2004) indicated that the current condition of Snake River summer steelhead population abundance, growth rate/productivity, spatial structure, and diversity are as follows:

- The abundance of returning adults is uncertain due to a lack of data for adult spawners. Dam counts are currently 28 percent of the interim recovery target for the Snake River basin (52,000 natural spawners).
- Diversity within the Snake River population is of concern. Displacement of natural fish by hatchery fish (declining proportion of natural-origin spawners) is a concern and efforts are underway to reduce this. There is also evidence of homogenization of hatchery stocks within the basins, and some stocks exhibiting high stray rates.

3.2.2 Life History

Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning. Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation during that time (NPCC 2004). Steelhead eggs may incubate for 1.5 to 4 months prior to hatching, depending on water temperature. Juveniles rear in freshwater from 1 to 4 years and then migrate to the ocean as smolts. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types (NPCC 2004). Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood.

Most summer steelhead rear for two years in the Grande Ronde River system before migrating to the ocean. Most smolt migration occurs from April through June (NPCC 2004). Juveniles may move upstream to find cool water refugia during the summer (NPCC 2004).

Adult summer steelhead spend 1 to 3 years in the ocean before returning to spawn. Those returning to the Grande Ronde pass Bonneville Dam during July and John Day Dam primarily during August through October (NPCC 2004). According to NPCC et al. (2004), Grande Ronde River summer steelhead migrate through the lower Snake River during two periods; a fall movement that peaks in mid-to-late September and a spring movement that peaks during March and April. Some adult summer steelhead enter the lower Grande Ronde River as early as July but most adults enter from September through March.

Wild adult summer steelhead returning to the Grande Ronde are generally 4 years of age at maturity, having spent 2 years in freshwater, 1.5 years in the ocean, and 0.5 year migrating to the subbasin and holding there until spawning. Spawning occurs from March through mid-June, with peak spawning taking place from late April through May (NPCC 2004). Fry emerge from May through July (NPCC 2004).

Summer steelhead are presently distributed throughout the Grande Ronde basin and in Catherine Creek (Figure 5). Figure 4 represents adult summer steelhead that were passed above the Catherine Creek weir trap from 2003 through 2010.

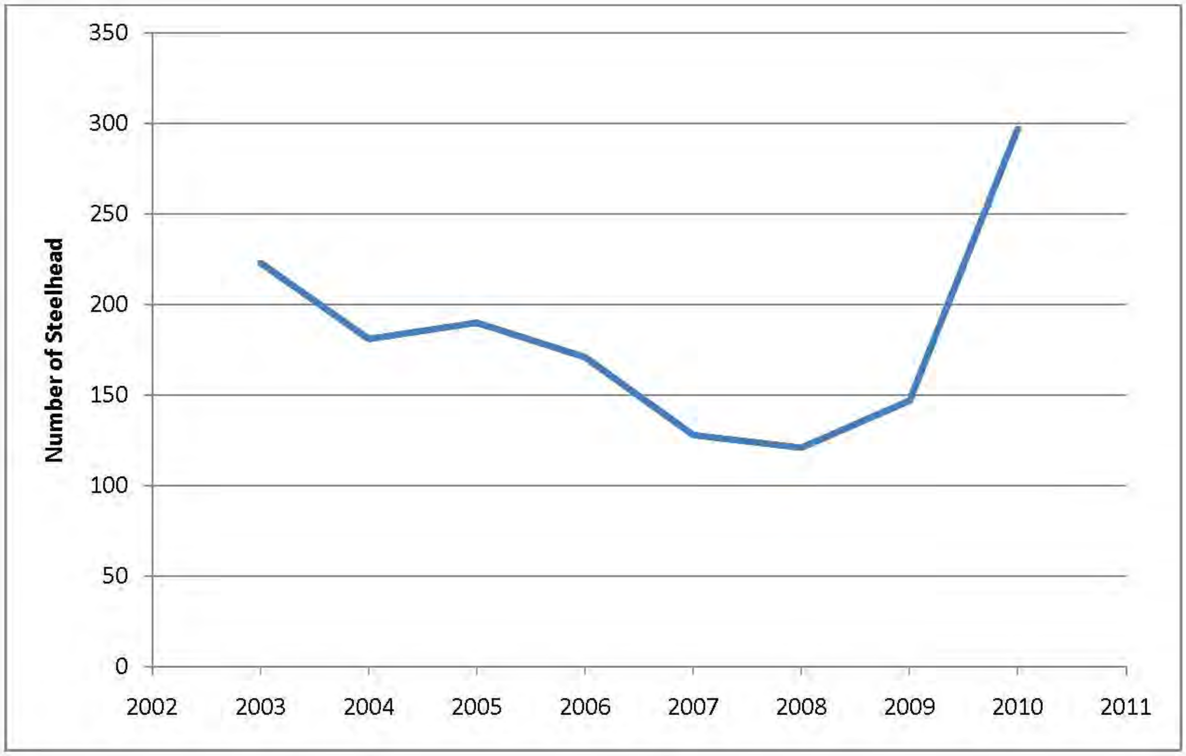

Figure 4. Adult steelhead passed above Catherine Creek weir 2003 through 2010.

Summer steelhead spawn and rear upstream of the town of Union. Steelhead utilize Catherine Creek downstream from Union for migration and rearing. Approximately one-third overwinter in downstream areas and are considered early migrants (Yanke et al. 2008).

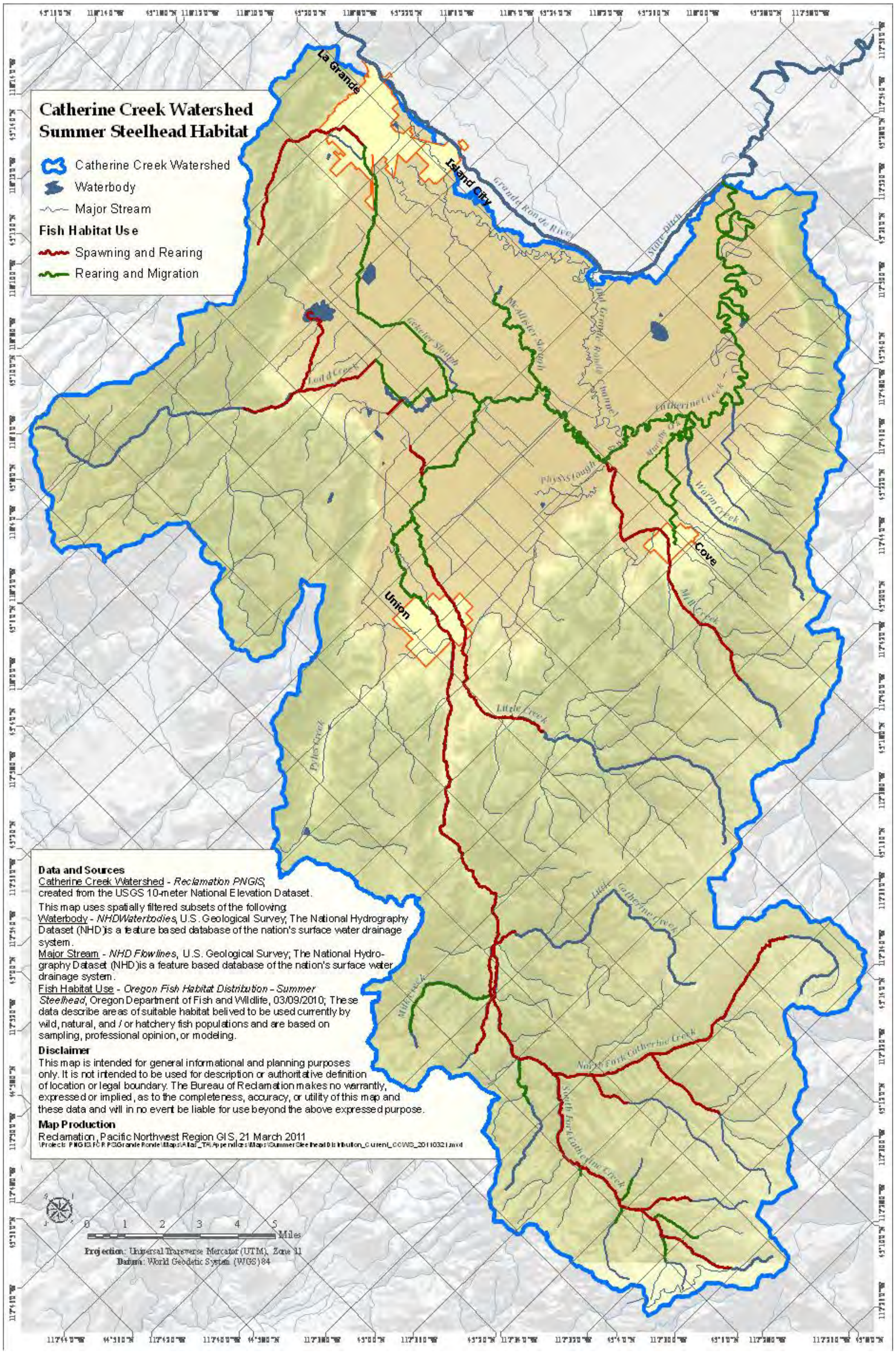

Figure 5. Catherine Creek watershed summer steelhead habitat.

3.2.3 Steelhead Population Risk Assessment

The EDT model attribute summary indicated that sediment and habitat quantity are the largest and most widespread impacts on the Upper Grande Ronde summer steelhead population (NPCC 2004). Limiting factors identified previously for Catherine Creek spring Chinook salmon are likely applicable to summer steelhead found in Catherine Creek. Those would include habitat quantity and quality, sediment conditions, water quality, and water quantity.

Kavanagh et al. (2011), following their 2010 aquatic habitat survey, found that for summer steelhead HabRate values remained about the same between 1991 to 1995 and 2010 (Kavanagh et al. 2010). The lower section of Catherine Creek contained poor habitat for steelhead spawning, incubation and emergence. Habitat quality for summer and winter rearing for age-0 and age-1 juvenile steelhead was also poor in the lower section and fair in the middle and upper sections. Spawning habitat quantity and quality was fair in the middle and upper sections. Conditions were somewhat better in the middle and upper sections as a result of increased habitat complexity.

4. Bull Trout

4.1 Historic Conditions

There is limited information on bull trout population productivity and abundance in the Grande Ronde basin. Historically, bull trout were distributed throughout the basin, and although they were never abundant as other salmonids, they were certainly more abundant and more widely distributed than they are today (NPCC 2004). As a result of declines in populations, bull trout were listed under the ESA in 1998 as threatened primarily due to habitat threats. Bull trout in the Grande Ronde basin fall into the “Mid-Columbia” recovery unit. In 2010, critical habitat for bull trout was designated by the U.S. Fish and Wildlife Service (USFWS) from the mouth of Catherine Creek to headwater locations. Critical habitat receives protection against Federal agencies carrying out, funding, or authorizing the destruction or adverse modification of critical habitat.

4.2 Life History

Bull trout in the Grande Ronde basin have both resident and migratory life history patterns. Resident bull trout complete their entire life cycle in a tributary stream. Migratory bull trout spawn in tributary streams where juveniles rear for up to 4 years before migrating to a river or lake. Migrating bull trout return to spawning tributaries from the end of June into October. Spawning occurs between mid-September and early November. Resident and migratory bull trout can be found together in spawning grounds and can spawn together. Offspring can express either life history. Bull trout can live longer than 12 years and prefer the coldest water (typically l5˚C or less). All life stages of bull trout are associated with complex forms of cover and pools.

Complete historical distribution for bull trout is undocumented. It is thought that bull trout occupied all major tributaries in the upper Grande Ronde (including Catherine Creek) and a seasonal connection existed with the Snake River (Buchanan et al. 1997). Current known spawning and resident distribution of bull trout is spread throughout the headwater streams of the Grande Ronde basin, though most populations are concentrated in the Wallowa River basin (NPCC 2004). Figure 6 shows bull trout distribution in the Catherine Creek watershed. Potential for inter-population connection exists through major migratory corridors and large rivers, however, bull trout use of these rivers is limited by high water temperatures and low flow during the summer months (NPCC 2004). Presence and absence data from Catherine Creek suggest low population densities (NPCC 2004).

Catherine Creek supports both life history forms of bull trout. The fluvial form found in Catherine likely utilize lower reaches downstream of Union as a migratory corridor based on habitat conditions. Distribution (spawning and rearing) of bull trout is restricted to headwater areas and rivers with high quality habitat and water quality, primarily on National Forest lands. Bull trout spawning in Catherine Creek would occur in headwater locations.

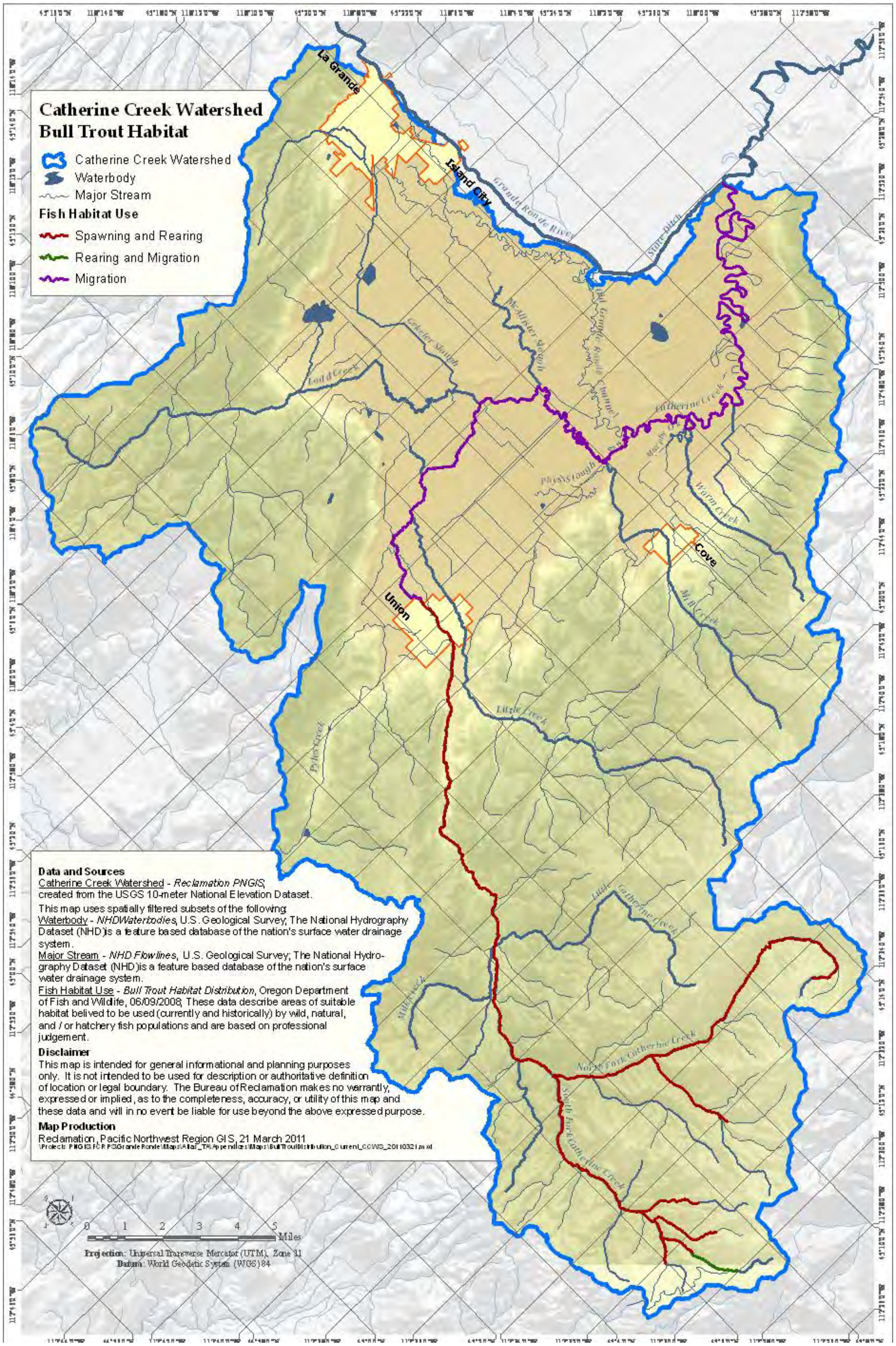

Figure 6. Bull trout distribution in the Catherine Creek watershed.

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