Timber Harvest

National Forest Timber Management

Timber has been managed on National Forest lands in the Pine Creek watershed for the past several decades. Pine Ranger District records show commercial timber sales as far back as 1948, the majority of activity has occurred from the 1970's to the present. An estimated 348 million board feet (mmbf) have been harvested in 123 recorded sales of various sizes; 40 percent have been salvage sales. This harvest has affected approximately 65,000 acres. While management direction has changed through time, in general, past management has sought to harvest mature trees, reduce individual stand stocking, favor certain tree species over others, allow for obtaining firewood, and salvage damaged and high risk trees. Aside from regeneration harvest, stands have been managed at or near full stocking. Other timber management activities that have occurred throughout the watershed are: precommercial thinning, pruning, site preparation, tree planting, animal control, and tree improvement.

The timber volume sold from National Forest lands in the Pine Creek watershed is depicted in graphic figure 9a, page 42. It is an estimate and does not represent all the timber volume offered locally by the District because some years or decades there have been concerted efforts in other watersheds. Also, District boundaries have changed at least twice during this time and some records may have been displaced.

Currently over 20,000 acres of forest land north of Halfway, Oregon is heavily infested with Douglas fir beetles and Tussocks moth. This level of insect infestation is causing large areas of tree mortality. There should be a link tying together the effects to the forest land ecosystem and large insect populations (Arvid E. Anderson).

In the last two decades, in recognition of effects of timber harvest on stream resources, techniques have changed to reduce direct impacts to the soil. Skyline systems are used on steep terrain, new roads are located near ridgetops to accommodate this, and many old draw bottom roads have been closed and revegetated. Recent amendments to the Forest Plan provide for no-activity buffers for all types of streams.

Since May 1992, clear-cutting has been eliminated as a timber harvest method, and partial cutting has been modified to reserve additional medium- and large-sized trees to enhance biodiversity. In addition, salvage harvesting of weather, fire, or insect killed stands has been modified to reserve additional dead trees for snag-dependent wildlife.

Monitoring of timber harvest impacts has occurred primarily in the form of on-the-ground inspections by district forest service personnel during and following harvest completion.

Timber harvest proposals have been identified in portions of the Pine Creek watershed. Forest plan standards and guidelines, improved logging methods, and protection measures to retain streamside vegetation and trees for shade, bank stability, and large organic debris have reduced impacts to fish habitat, water quality, and soil resources from timber harvest activities. Road construction requirements and maintenance practices, closing roads to traffic, and obliterating roads from the transportation system are techniques used to reduce road densities, decrease input of sediment to streams, and improve wildlife and fish habitat.

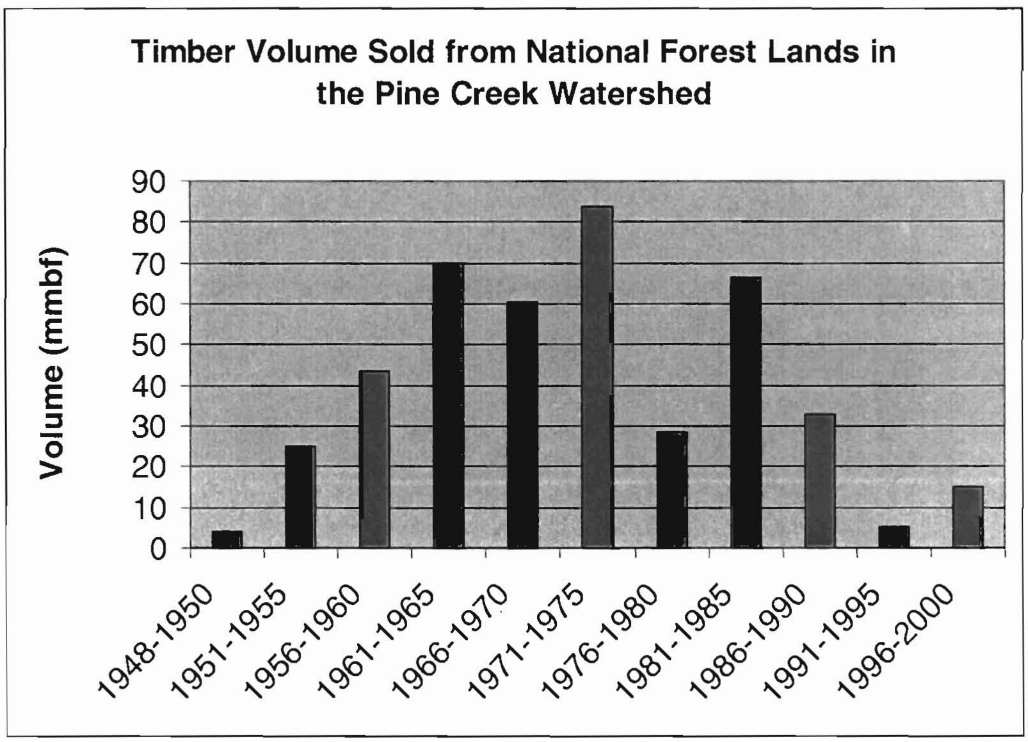


FIGURE 9a

Non-Federal Forest Land Management

Between 1990 and 2000, forest operations have occurred on 25 percent (4,300 acres) of the private forest land base (17,000 acres) in the Pine Creek watershed. Seventy-eight (78) operations were carried out by nearly 50 different, mostly nonindustrial landowners to accomplish a variety of objectives such as forest health, salvage, monetary, and fuels reduction.

The majority of forest management activity occurring on these lands between 1990 and 2000 consisted of partial harvesting (selective cutting) where 66 operations accounted for 3,981 acres of the 4,300 total (93 percent). Precommercial thinning occurred on 3 operations that accounted for 40 acres. Clearcutting occurred on two parcels totaling 90 acres. Road construction and/or reconstruction occurred on less than 10 operations. Slash treatment occurred on a majority of the operations in the form of tractor piling and burning. However, with the recent ability to utilize more of the wood harvested, the amount of slash created has diminished considerably. Of the 78 total operations, only 14 included activity within 100 feet of a fish-bearing stream.

Of the 78 total operations between 1990 and 1999, 46 percent encompassed areas of 10 acres or less, 24 percent occurred on areas of 50-100 acres, 18 percent on areas of 51-100 acres, and only 9 percent on areas of 101 or more acres.

Harvesting methods on privately owned property within the Pine Creek watershed have varied from traditional ground based yarding systems such as tractor logging, horse logging, and more recently mechanical harvesting, to other systems including helicopter and high lead (line) logging. The largest percentage of harvest operations within the watershed have utilized ground based yarding systems. Cost effectiveness, topography, access, and aesthetics play a role in determining the type of harvest system used.

Of the 78 operations that occurred between January 1, 1990, and December 31, 1999, four partial harvests and two clearcuts reduced stocking levels below minimum specifications requiring reforestation as per the Oregon Forest Practices Act.

On private forest land a total of 14 operations occurred within 100 feet of fish-bearing streams in the Pine Creek watershed between January 1, 1990, and December 31, 1999. The operations have consisted of 13 partial harvest and one precommercial thinning along portions of Pine Creek, East Pine Creek, North Pine Creek, Clear Creek, and the West Fork of Dry Creek. The operations have encompassed portions of approximately 9,500 feet of stream length (each side). On each of the operations minimum vegetation retention standards were applied as per the Oregon Forest Practices Act. No harvesting occurred within 20 feet of the high water mark on operations after September of 1994. A total of 7 stream crossings were allowed as part of the operations, 4 low water truck fords, and 3 "log" skid trail crossings. In addition, less than 400 feet of road construction occurred on the operations (total) within 100 feet of the stream high water mark of the streams. A specific breakdown by stream is as follows:

Pine Creek: Seven partial harvest operations were conducted within 100 feet. These activities encompassed portions of 3,800 feet of stream length (on each side). Six of the operations were partial harvests of conifers in which vegetation retention standards applicable to a large fish- bearing stream were applied as per the Oregon Forest Practices Act. One of the operations was noncompliant with provisions within Oregon Forest Practices Act. No harvesting activity occurred within 20 feet of the high water mark of the stream on 4 of the 7 operations. Three of the operation were conducted prior to the "new" rules implemented in September 1994 (20 feet no cut rule did not apply). One temporary low water truck ford was allowed.

East Pine Creek: Three partial harvest operations were conducted within 100 feet. Two of the operations were a partial cut of coniferous trees, and one operation was a partial cut of cottonwood trees. Total length of stream within the operation was 3,400 feet (each side). All of the activity was partial harvest in which vegetation retention standards applicable to a large fish bearing stream were applied as per the Oregon Forest Practices Act. No harvesting activity occurred within 20 feet of the high water mark of the stream. Two temporary low water truck fords were allowed.

Clear Creek: One partial harvest operation was conducted within 100 feet. Total length of stream within the operation was 1,300 feet (each side). Vegetation retention standards applicable to fish bearing streams were applied as per the Oregon Forest Practices Act.

West Fork Dry Creek: One precommercial thinning operation was conducted within 100 feet. Total length of stream within the operation was 300 feet (each side). Vegetation retention standards applicable to a small fish bearing stream were applied as per the Oregon Forest Practices Act. No harvest activity occurred within 20 feet of the high water mark of the stream.

Tributary to West Fork of Dry Creek: One partial harvest operation was conducted within 100 feet. Total length of stream within the operation was 600 feet (each side). Vegetation retention standards applicable to a small fish bearing stream were applied as per the Oregon Forest Practices Act. One temporary "log" crossing was allowed, and no harvesting activity occurred within 20 feet of the high water mark.

North Pine Creek: One operation was conducted within 100 feet. The operation consisted of partial harvesting of conifers along short portions of the stream totaling approximately 800 feet on the east side and 300 feet on the west side. Vegetation retention standards applicable to a large fish bearing stream were applied as per the Oregon Forest Practices Act. No harvesting activity occurred within 20 feet of the high water mark of the stream. One temporary low water truck ford was allowed.

Commercial cottonwood harvesting has occurred along portions of two fish bearing streams (Pine and East Pine Creeks) as noted above. Of the 9 cottonwood harvesting operations that have occurred within the Pine Creek watershed since 1994, the majority (80 percent) have taken place along manmade structures such as ditches, and not along natural stream courses.

ODF maintains maps of stream classification (size and type), National Wetlands Inventory, Vegetation Inventory, and aerial photographs (1998), as well as information on fire suppression and forest management activities carried out on private forest land.

Structural Stage Analysis

Timber management activities are also reflected in existing structural stages in the Pine Creek watershed. Forty percent of the watershed is in natural nonforest openings, ranging from less than an acre to several hundred acres intermixed with the forested stands. The variation in forested stand structure has resulted from natural disturbances and human influences. Natural disturbances have included wildland fire and insect and disease outbreaks. Human influences have included timber management and fire suppression.

Structural Stage Analysis

Every vegetation project on the forest that could result in a timber sale, goes through a screening process and Historic Range of Variability Analysis (HRV). Project evaluations are based on descriptions and characterizations of current and historical landscape vegetation patterns and disturbance processes to determine whether the proposed action moves affected landscapes toward or away from historical ranges of variability.

Presented is a short step-by-step explanation of the HRV analysis:
1–the watersheds that forested stands occur in are delineated;
2–major biophysical environments within the watersheds are classified–biophysical environments are described by plan association groups in generalized landscape settings, and then delineated by watersheds;

For each biophysical environment:
3–the dominant historical disturbance is described;
4–the landscape pattern and abundance of structural stages (in this case, the stages of plan succession as a forested stand develops through time) maintained by the disturbance regime are characterized and mapped under historical disturbance influences;
5–map the current pattern of structural stages and calculate their abundance by biophysical environment;
6–characterize the difference in percent composition of structural stages between historical and current conditions;
7–identify biophysical environments that are outside the range of historical variability to set priorities for treatment.

The natural and human disturbances in the watershed have resulted in a forest structure that is quite different than the historic (pre-Euro-American settlement) forest. The existing area of forest structural stages on National Forest lands in the Pine Creek watershed is outside the historic range in five of seven defined stage classes (table 6, page 46).

The "stand initiation" stage is higher than the historic range, largely due to the 1994 Twin Lakes fire which burned approximately 10,900 acres in the Elk Creek and Lake Fork Creek subwatersheds. "Understory reinitiation" and "stem exclusion open canopy" stages are outside the historic range due to fire suppression. The largest deviation in the historic range comes from the lack of single-stratum large trees common to the "structural stage." Uneven age management activities and fire suppression have tended to move these areas toward multi stratum stages.

Fire history data for National Forest land in the Pine Creek watershed from 1971 to 1995 shows 316 fire starts which burned 12,284 acres. Only four of these fires were over 100 acres.

Table 6. Historic and Existing Structural Stage Distribution (National Forest Lands in Pine Creek Watershed)

Structural Stage	Historic Condition		Existing Condition (acres)	Difference (existing - average) (acres)
	Range (acres)	Average (acres)		
Stand Initiation	755 – 9,816	6,045	10,222	4,177
Stem Exclusion Open Canopy	2,268 – 9,073	4,538	1,125	-3,413
Stem Exclusion Closed Canopy	1,480 – 10,262	4,765	2,535	-2,230
Understory Reinitiation	1,963 – 12,061	7,384	16,297	8,913
Multistratum Large Trees Uncommon	13,822 – 30,104	21,360	18,931	-2,429
Multistratum Large Trees Common	6,170 – 20,563	12,634	22,315	9,681
Single Stratum Large Trees Common	6,978 – 26,674	18,761	2,305	-16,456

Recreation

The Pine Creek watershed provides a wide variety of recreational opportunities. Recreational use has evolved from the traditional spring-through-fall hunting use to include a very active skiing and snowmobiling public. Primary activities recreationists engage in are fishing, hunting, camping, sightseeing, hiking, and picnicking.

A small water-based recreational facility at Fish Lake accommodates local people and the summer influx of tourists visiting the historic Cornucopia Mining District and the southern Wallowa Mountains.

Social/Cultural Aspects

The Pine Creek watershed is home to approximately 1,000 people. The population of Halfway is about 350. Principal industries of the county are agriculture, lumber, and recreation-related employment. The Federal government is the single largest land owner in the Pine Creek watershed.

Rural Development

The last 30 years have seen significant changes in the rural landscape; however, the Pine Creek watershed remains relatively rural due to its distance from main transportation corridors and large population centers.

Transportation System

The road system on the portion of the Pine Creek watershed administered by the WWNF provides access for various uses, including recreation, livestock management, timber harvest, fuelwood cutting, and all associated travel for administrative purposes.

Approximately 28 percent of the watershed is roadless and lies within the Eagle Cap Wilderness and back country. Open and closed roads total 624 miles in the entire watershed. Of this total, 360 miles occur on land administered by the WWNF, and the remainder occur on private, State, and BLM land.

The overall total road (open and closed) density for the watershed including all ownerships is 2.1 miles per square mile. The total road density for the National Forest is 2.6 miles per square mile (table 7).

Table 7. Road Densities by Subwatershed on all Ownerships and National Forest System (NFS) Lands

Subwatershed	Area (mi^2)	Open Roads (mi)	Total Roads (mi)	Open Road Density (mi/mi^2)	Total Road Density (mi/mi^2)	NFS Area (mi^2)	NFS Total Roads (mi)	NFS Total Density (mi/mi^2)	NFS Open Road Density (mi/mi^2)
Pine Creek-mouth	18.2	6.8	6.8	0.4	0.4	4.3	0.5	0.1	0.1
Lower North Pine	25.4	36.3	48.6	1.4	1.9	25.3	44.0	1.7	1.1
Lake Fork Creek	16.0	11.2	13.7	0.7	0.9	16.1	16.0	1.0	0.8
Elk Creek	15.4	10.6	14.2	0.7	0.9	16.5	13.7	0.9	0.5
Upper North Pine	29.4	49.3	93.2	2.1	3.2	29.1	93.2	3.2	2.0
Pine Creek Canyon	46.9	35.0	35.0	0.8	0.7	0.1	0.4	3.5	3.6
Fish-Long Branch	15.4	37.9	45.8	2.4	3.0	9.5	38.3	4.0	2.9
East Pine Creek	27.2	67.5	107.8	2.5	4.0	20.1	92.8	4.6	2.3
Dry Creek	13.0	25.8	43.0	2.0	3.3	7.2	32.1	4.5	2.1
Clear Creek	32.1	56.7	101.5	1.8	3.2	23.8	80.2	3.4	1.6
Pine Creek Valley	32.1	66.4	86.8	2.1	2.7	6.8	42.1	6.2	3.0
Upper Pine Creek	31.2	16.3	34.0	0.5	1.1	31.5	35.8	1.2	0.6
Total	302	420	625			188	498		
Weighted Average				1.4	2.1			2.6	1.5

In the past, early roads accessed mining claims and cabins along Pine Creek near the historic mining town of Cornucopia. The original road to Cornucopia was on the west side of the creek, while the current county road is on the east side. Forest Road 66 encompasses a large loop beginning north of Halfway, ascending to about an elevation of 6600 feet, past Fish Lake and Twin Lakes, then dropping down to North Pine Highway (Forest Road 39) before circling back up Pine Creek to Halfway (see Pine Creek Watershed (partial) Roads Map; figure 10, page 49).

Road condition information which may affect water quality is available through Baker County, State of Oregon, USFS and BLM offices (G. Summers).

PINE CREEK WATERSHED
(partial) Roads Map
(by old subwatersheds)

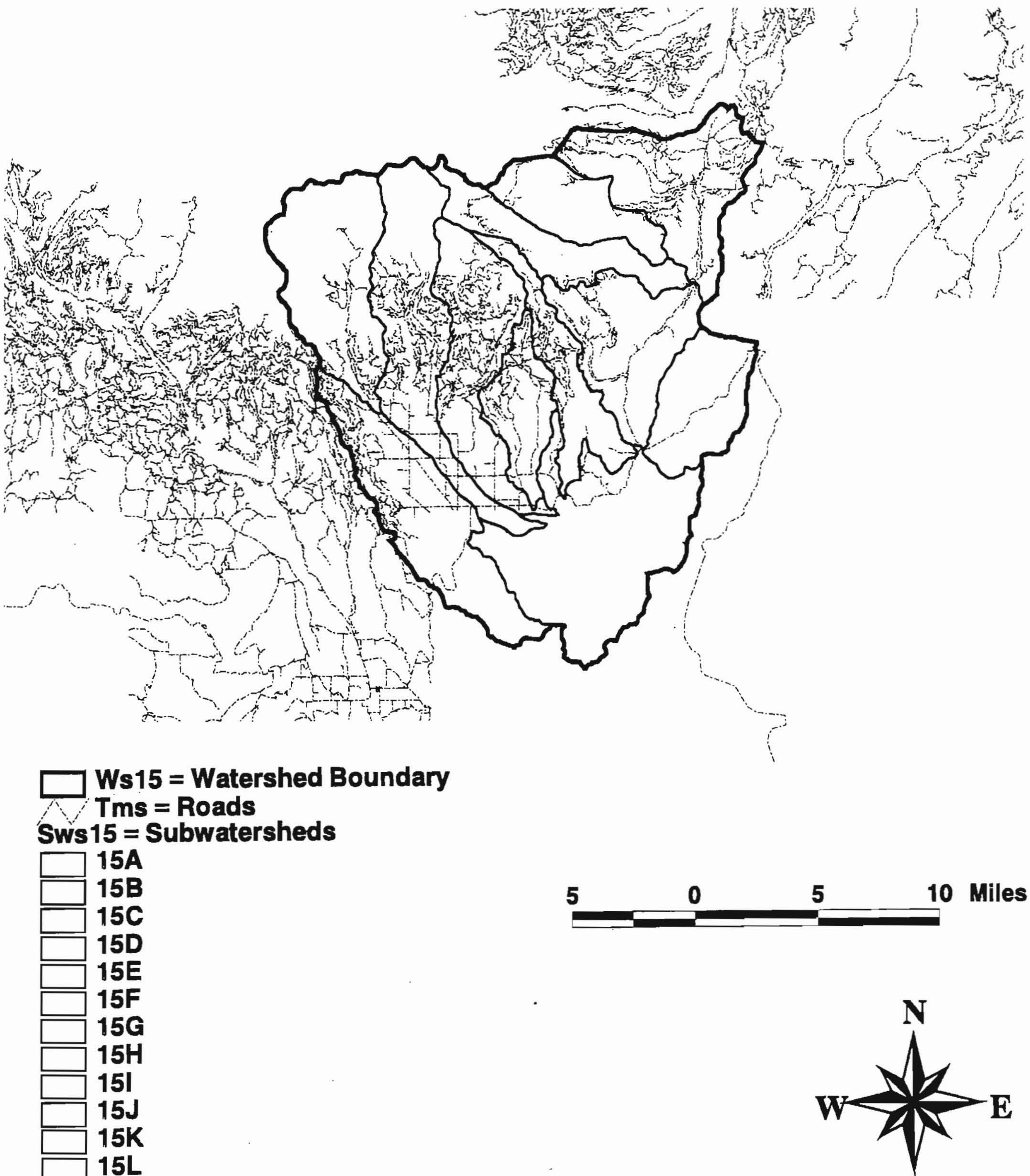


FIGURE 10

WATERSHED ISSUES

The applicable issues from the Council's basinwide list are:

- **Water Quality Impaired Streams on 303(d) List**
- **Bull Trout Recovery**
- **Fish Screens**
- **Noxious Weed Invasions**
- **Over-Appropriation of Water**
- **Unauthorized Water Use**

Issues identified by Assessment Committee are:

- **Potential Additions to 303(d) List**
- **Fish Passage**
- **Reservation of Surface Water for Future Economic Development**
- **Riparian Area Health**
- **Hydrologic Function**
- **Soil Productivity**

Issue Identified by Others:

- **Effects of Uncontrolled Runoff**

Water Quality Impaired Streams On 303(d) List

The Federal Clean Water Act requires ODEQ to maintain a list of water-quality limited water bodies (WQLW's) for nonpoint sources of pollution. The first state-wide list of potential WQLW's was published in 1988. In 1994, EPA required ODEQ to develop listing criteria and a formal list of WQLWs. Due to delays, the first list was published in 1996. It was designated as the 1994/1996 list. The first biennial update was in 1998. The next update is planned for 2002.

The 1998 list of WQLWs for the Pine Creek watershed is shown in table 8, page 53. This information was obtained from ODEQ's 1998 303(d) List Decision Matrix.

The only parameters listed at this time are temperature summer, both for bull trout (50 °F) and for other salmonids (64 °F). Note that Pine Creek is listed for both, from mouth to East Fork Pine Creek.

The listed segments are shown on the "Pine Creek Watershed Water Quality Limited Streams from 1998 303(d) List" (figure 11, page 55).

EPA (1996) and ODEQ (1996) have developed guidelines for removing waters from the 303(d) list. ODEQ plans to work on TMDL and the Water Quality Management Plan (WQMP) for the Brownlee Reservoir subbasin (which includes the Pine Creek Watershed) in the year 2005. The

Oregon Department of Agriculture (ODA) will develop the SB1010 plan for agricultural lands before that date. The planning process and final documents are anticipated to be similar to those that were completed in 1999 for the Upper Grande Ronde subbasin.

The Pine Creek Watershed Action Plan can be developed with objectives that will help local residents of the Pine Creek Watershed prepare for and actively participate in the ODEQ TMDL/WQWP and ODA SB1010 planning processes.

The 303(d) section of the Pine Creek Watershed Action Plan actually covers point source pollution; whereas, the 319 section addresses nonpoint sources; the ramifications of this should be explored. The Federal District Court for the Northern District of California (Guido A. Pronsolino and Betty J. Pronsolino vs EPA, No. C 99-01818 WHA, March 30, 2000) stated that EPA has authority to require TMDL on substandard streams that have only nonpoint source return flow contributions.

The 303(d) listing is not infallible and can be changed if supported by credible data. If credible data is obtained through a monitoring program, this data can be used to support delisting or shortening of stream segments. Shortening of stream segments has occurred in the Malheur River basin and on the WWNF. The 2000 303(d) list has been postponed until 2002, so there is time to propose changes. ODEQ is hiring a new coordinator to work on the 2002 303(d) list. Refer to bibliography, ODEQ 1998b and EPA 1998.

Table 8. Final 1998 Oregon Section 303(d) List Decision Matrix

Basin: Powder			Subbasin: Brownlee Reservoir				
Name & Description	**Waterbody Segment**	**Parameter**	**Criteria**	**Season**	**Basis for Consideration of Listing**	**Supporting Data or Information**	**Listing Change From 1994/96**
Aspen Creek Mouth to headwaters	32E-ASPEO	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data	USFS Data (site at mouth): 7-day average of daily maximums of 62.2 °F in 1995 exceeded temperature standard for bull trout (50 °F)	Addition
Beecher Creek Mouth to headwaters	32E-BEECO	Temperature	Rearing 64 °F (17.8 °C)	Summer	USFS Data	USFS Data (site at mouth): 7-day average of daily maximums of 69.5 °F in 1995 exceeded temperature standard (64 °F)	Addition
Big Elk Creek Mouth to headwaters	32E-BELKO	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data	USFS Data (site at mouth):7-day average of daily maximums of 58.4 °F in 1995 exceeded temperature standard for bull trout (50 °F)	Addition
Clear Creek RM 9 to headwaters	32E-CLEAO	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	NPS Assessment - segment 369: severe, observation (DEQ, 1988); USFS data	USFS site at RM 11; 7-day avg max stream temperature in 1995 was 57.5 °F and in 1996 was 63.9 °F both years exceeded bull trout temperature standard of (50 °F)	Addition
Elk Creek Mouth to headwaters	32E-ELKO	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data	USFS Data (3 sites): 7-day average of daily maximums of 59.3/60.6/58.3 °F in 1995 exceeded temperature standard for bull trout (50 °F)	Addition
Lake Fork Creek Mouth to Pole Creek	32E-LKFKO	Temperature	Rearing 64 °F (17.8 °C)	Summer	USFS Data	USFS Data (Site below Pole Creek): 7-day average of daily maximums of 69.3/71.1/64.8/64.5 °F in 1991/92/93/95 all years exceeded temperature standard (64 °F)	Addition
Meadow Creek Mouth to upper end of Schneider Meadows	32E-MEAD	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data bull trout Habitat	USFS Data: 7-day average of daily maximums of approximately 65.8 °F exceeded bull trout temperature standard (50 °F) in 1992	
Okanogan Creek Mouth to unnamed stream at Section 35 NW 1/4	32E-OKANO	Temperature	Rearing 64 °F (17.8 °C)	Summer	USFS Data	USFS Data (Site at FSR 6625): 7-day average of daily maximums of 70.0 °F in 1992. 1995 was 67.1 °F and 1996 was 68.2 °F all exceeded temperature standard (64 °F)	

Basin: Powder			Subbasin: Brownlee Reservoir				
Name & Description	**Waterbody Segment**	**Parameter**	**Criteria**	**Season**	**Basis for Consideration of Listing**	**Supporting Data or Information**	**Listing Change From 1994/96**
Pine Creek Mouth to headwaters	32E-PIEFO	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data	USFS site in 1995: 7-day avg maximum temperature was 55.3 °F exceeded temperature standard for bull trout (50 °F)	Addition
Pine Creek Mouth to Clear Creek	32E-PINEO	Temperature	Rearing 64 °F (17.8 °C)	Summer	NPS Assessment - segment 365: Moderate, observation (DEQ, 1988); SWCD data	SWCD site below Pine Valley: 7-day avg max temperature was 78.1/80.0 °F in 1995/96, site did not meet temperature standard (64 °F)	Addition
Pine Creek Clear Creek to Pine Creek-East Fork	32E-PINE15	Temperature	Rearing 64 °F (17.8 °C)	Summer	NPS Assessment - segment 370: severe, observation (DEQ, 1988); SWCD data	SWCD site an Langrell: 7-day avg max temperature was 69.6/61.3 °F in 1995/96, site did not/did meet temperature standard (64 °F).	Addition
Pine Creek-East Fork to headwaters	32E-PINE32	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data	Two USFS sites in 1995: 7-day avg max temperature was 55.6/54.6 °F exceeded temperature standard for bull trout (50 °F).	Addition
Pine Creek, East Mouth to Okanogan Creek	32E-PIEO	Temperature	Rearing 64 °F (17.8 °C)	Summer	USFS Data; NPS Assessment - segment 368: severe, observation (DEQ, 1988)	USFS Data: (6 sties) 7-day average of daily maximums of 65.9 °F in 1992; 74.6 °F in 1995; 68.1/69.3/72.1/66.4 °F in 1996 all exceeded temperature standard (64 °F).	Segment Modification
Okanogan Creek to headwaters	32E-PIE20	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data bull trout Habitat	USFS Data (3 sties) 7-day average of daily maximums of 55.2/59.6/63.1 °F in 1992; 4 sites in 1995 were 62.5/61.3/61.5/56.2 °F; 3 sites in 1996 were 63.4/63.1/55.3 °F all exceeded bull trout temperature standard (50 °F).	Segment Modification
Trail Creek Mouth to headwaters	32E-TRAIO	Temperature	Oregon bull trout 50 °F (10 °C)	Summer	USFS Data	USFS Data: 7-day average of daily maximums of 55.8 °F in 1995 exceeded temperature standard for bull trout (50 °F).	Addition
Trinity Creek Mouth to West Fork	32E-TRIN	Temperature	Rearing 64 °F (17.8 °C)	Summer	USFS Data	USFS Data: 7-day average daily maximum of 65 °F exceeded temperature standard (64 °F) in 1992.	

PINE CREEK WATERSHED
Water Quality Limited Streams from 1998 303(d) List

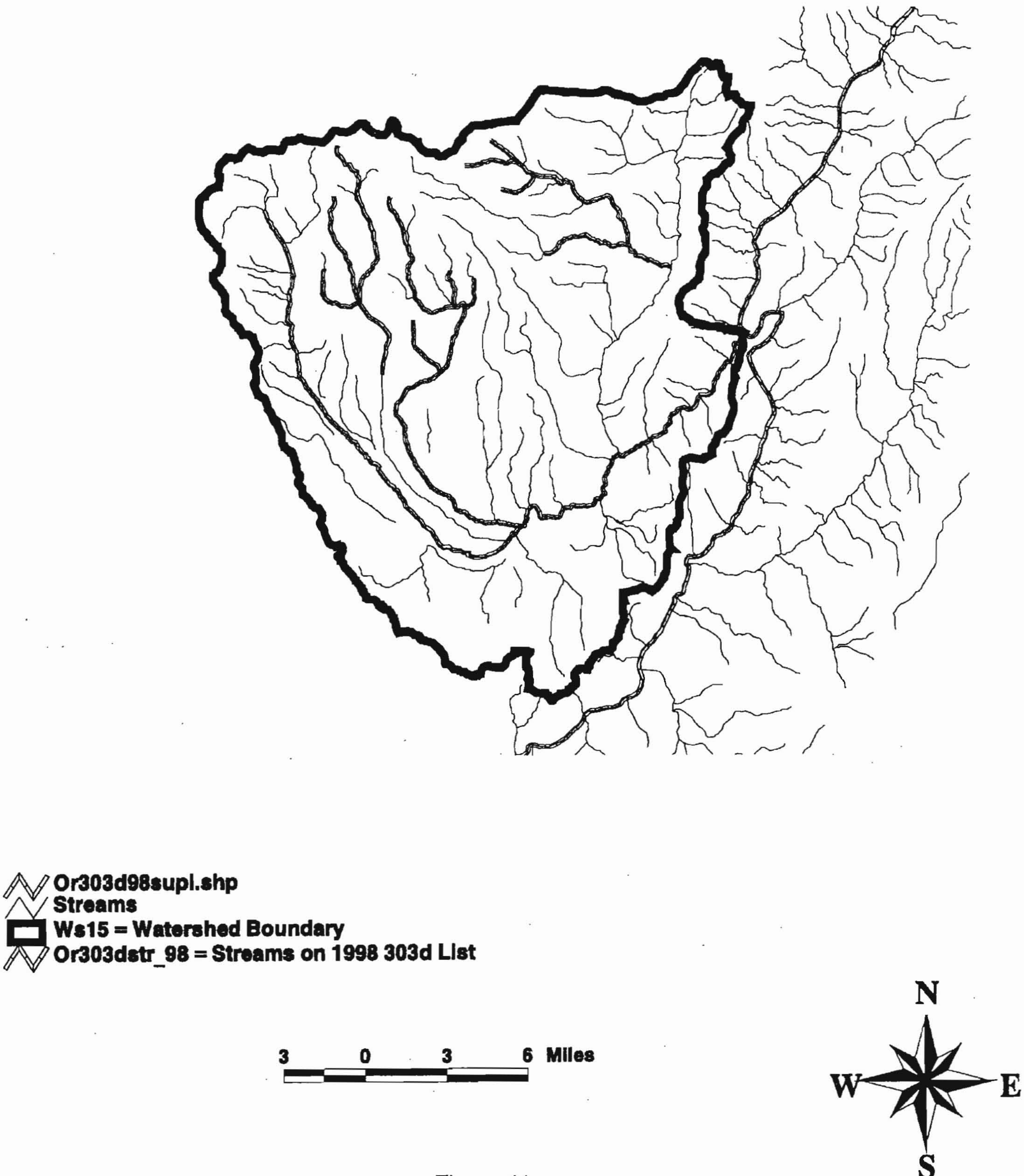


Figure 11

Nonpoint Sources of Pollution in the Watershed

"Nonpoint Source" pollutants include contaminants of widespread origin which are transmitted through groundwater, as seepage, or as surface runoff. Potential nonpoint source pollutants in the watershed include soil eroded from cultivated fields, roads, skid trails, ditches, streambanks, gullies, and grazed lands, metals and oils washed from roads.

Nonpoint source pollution also includes thermal pollution of water. All of the streams included on the WQLW list for Pine Creek (table 8, page 53) were listed for increased summer water temperature. These temperature increases are attributed in part to vegetation removal in riparian areas, activities that cause the stream channel to become wider and shallower, irrigation water withdrawals from streams, and warm water inflows from reservoirs, ditches, and overland return flows.

Point Sources of Pollution in the Watershed

"Point Sources" are defined as a location where pollution is occurring from a specific identifiable source. DEQ approves general and individual permits for disposal of wastewater within the state. Permits fall into one of three categories. Confined animal feeding operations are regulated by Oregon Department of Agriculture (ODA). Industrial permittees considered to be "major" dischargers are covered by National Pollutant Discharge Elimination System (NPDES) permits. Sources which discharge wastes using land application are covered under Water Pollution Control Facility (WPCF) permits. There is one point source under permit in the watershed which is the city of Halfway Waste Water Treatment Plant.

Water Temperature

Water temperature data are available for 54 stations on 19 streams and tributaries in the watershed, from 1991 to 1999 (appendix J). Seven-day average maximum temperatures from stations located in areas where bull trout spawning, rearing, or adult holding takes place are presented in table 9, page 57.

Temperature monitoring stations are listed in appendix J by stream name, subwatershed, elevation, and a legal description. Future versions of assessment should include a map of station locations. Most stations were placed in the "upper reaches" of the stream system. All except 5 stations listed in appendix J are within the National Forest boundary. Many spot measurement sites are listed in Hutchinson, James M., et al. 1967 referenced in the bibliography.

Table 9. Seven-day average maximum water temperatures (deg. C) for stations in occupied bull trout habitat; and seven-day average maximum air temperatures for Halfway, Oregon

Stream	Station ID	Sub-watershed	1992	1993	1994	1995	1996	1997	1998	1999	Elevation (feet)
Aspen	1	15D				16.8				17.2	5,440
Big Elk	1	15D				14.7			18.3	16.6	5,680
Elk	2	15D			16.1	15.2			17.2		4,560
Elk	3	15D			15.6	15.9			18.3	16.8	5,360
Elk	4	15D			13.2	13.5			16.0	14.7	5,760
East Pine	5B	15H					14.9	14.6	16.7	14.9	4,400
East Pine	6	15H			16.1	13.4	12.9	12.5	14.2	13.6	5,200
Clear	1	15J			20.8				16.7	16.4	3,360
Clear	2	15J			18.3	14.2					4,400
Clear	3	15J			18.7						4,480
Clear	4	15J			18.3				15.8	14.6	5,760
Meadow	1	15J			15.2	12.5				12.4	4,400
Meadow	2	15J	19.4	15.7	18.8	14.2	14.7		16.6	14.3	5,440
Meadow	3	15J	16.6		16.3	13.3	12.8		16.1	12.7	5,460
Trail	1	15J			16.4	13.2			14.7	13.4	4,480
E.Fk. Pine	1	15L			16.3	12.9			14.4	12.7	4,880
Pine	1	15L			15.3	13.1				12.4	4,800
Pine	2	15L			14.9	12.5				12.7	4,880
Halfway		15K	34.8	31.0	38.0	32.7	36.8	34.2	37.1	35.6	2,670

The Powder River Basin 1995/1996 Water Quality Monitoring Report contains information on water temperature monitoring for 4 sites in Pine Creek.

Temperature trend analysis would also require a longer period of record and trends are difficult to detect due to the many factors that influence water temperatures and data quality. The only conclusion that can be made from current data is that all stations in bull trout rearing areas clearly exceed the State standard of 10 °C/50 °F. A graphic representation of selected stations through time is presented in figure 12, page 58.

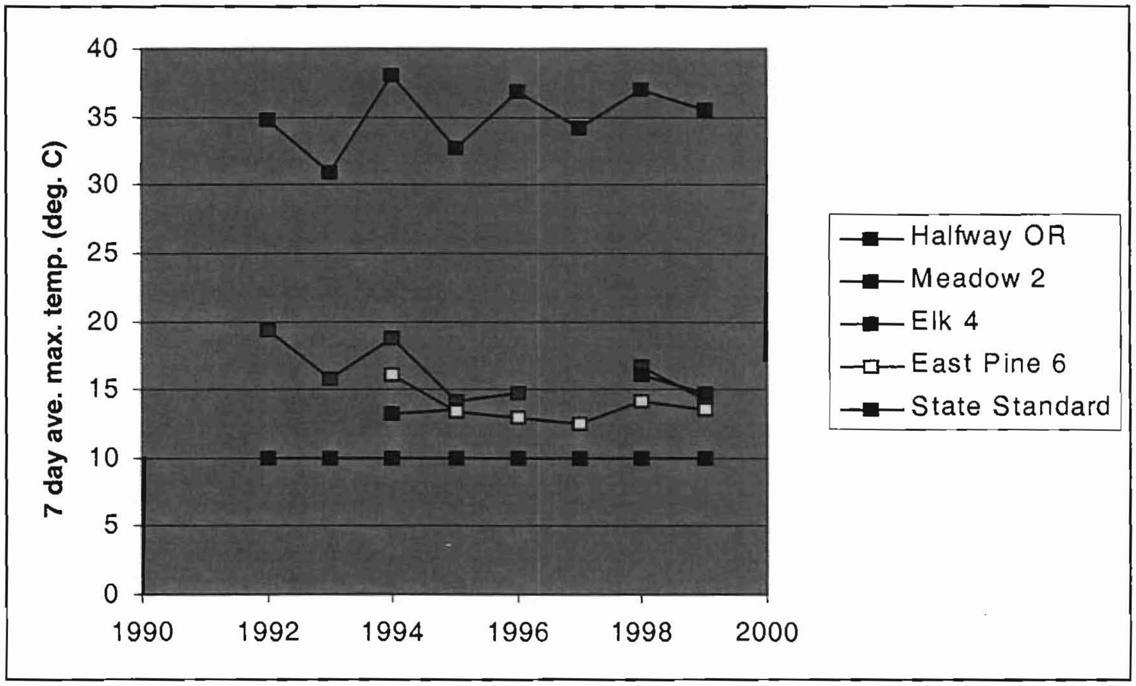


Figure 12. Seven-day average maximum temperatures (°C) for selected stations in the Pine Creek Watershed as compared to seven-day average maximum air temperatures in Halfway, and the State standard for Oregon bull trout waters.

Waters downstream from bull trout rearing areas are expected to meet the State standard for salmonid rearing, which is a 7-day average maximum of 17.8 °C/64 °F. Portions of North Pine Creek, Duck Creek, and the Fish Lake Fork of Lake Fork Creek do not meet this standard, ODEQ may evaluate the data for a listing decision.

For most streams water temperatures naturally increase as streams flow to lower, warmer elevations downstream from the source (figure 13, page 59). Some watersheds appear to differ from the East Pine example above. Lake Fork Creek and Clear Creek have higher temperatures at the uppermost stations, with some cooling downstream. This may be a result of warm water being released from the reservoirs above the stations and a cooling effect of tributary streams. Further study is needed to confirm this supposition. Elk Creek also appears to cool slightly below the Twin Lakes Fire area (figure 14, page 59).

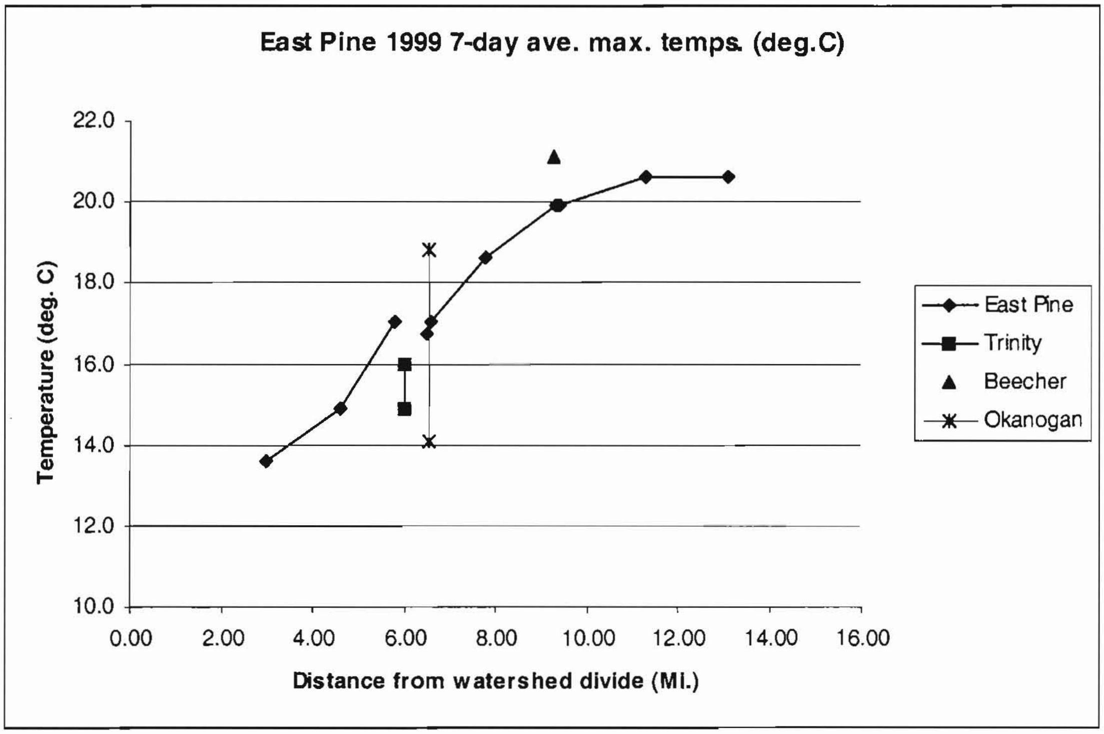


Figure 13. Seven-day average maximum water temperatures for East Pine Creek and tributaries, 1999.

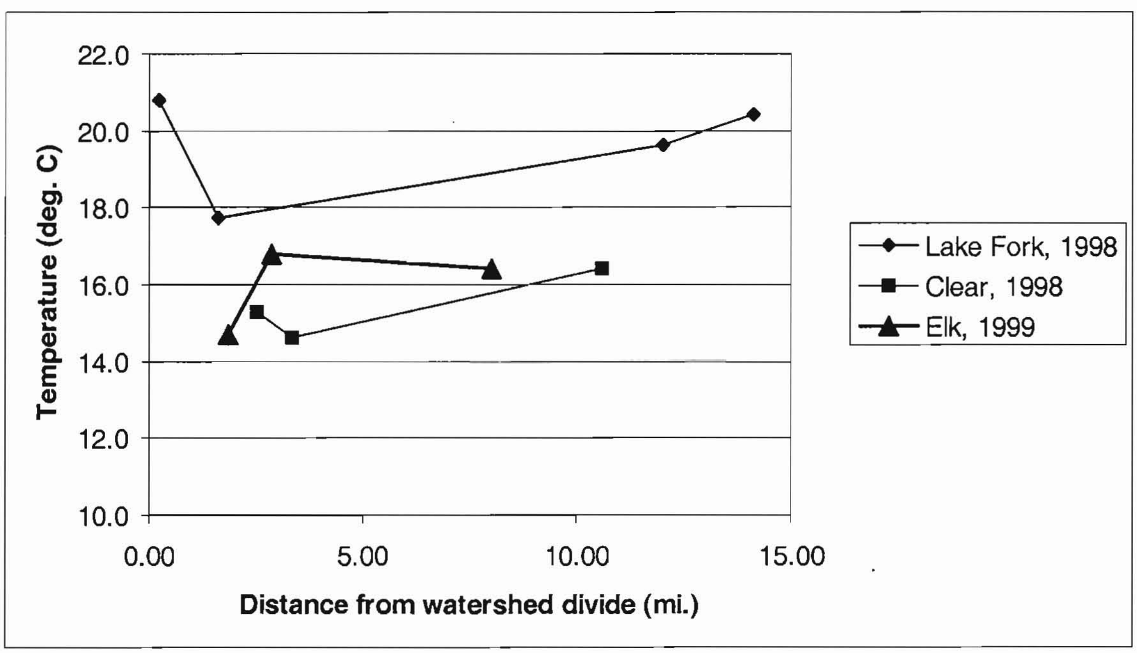


Figure 14. Seven-day average maximum water temperatures for selected streams and stations.

Hicks (1998) recommends 7-day average daily maximum water temperatures during the bull trout spawning to fry emergence period of 6 °C/42.8 °F, with a single daily maximum of no more than 8 °C/46.8 °F. He also recommends 7-day average daily maximum water temperature during the bull trout rearing period of 11 °C/51.8 °F with a single daily maximum of no more than 13 °C/ 55.4 °F.

There are many different ways to analyze water temperature depending upon questions of concern. The data has been analyzed in relation to state standards.

Studies are indicating that the bull trout are tolerating much higher temperatures than those ODEQ set for current population standards (cited Rapid River, Idaho population study). However, criteria are based on the state of knowledge at the time of rulemaking. ODEQ has set up an interagency team to review the bull trout water temperature standard as part of the triennial review of water quality standards, because new data suggests 50 °F may be too conservative or that separate spawning and rearing standards may be more appropriate.

The earliest water temperature data of any value in the Pine Creek watershed was obtained by ODFW in the 1960's. See Hutchinson, James et al. 1967 in the bibliography. All major reservoirs listed in table 3, page 22, predate this study. Partial information on these reservoirs suggests some were enlarged after the ODFW study. All reservoir construction was completed before season-long water temperature data was collected beginning in the 1990's.

The watershed has the following natural characteristics which contribute to high water temperatures during the summer months:

- Most of the watershed has a southerly aspect, which intercepts more solar radiation.
- The headwaters of several streams are in alpine grassland.
- Most tributary streams flow north to south or south to north, which allows them to intercept intense midday solar radiation.
- Major streams have wide channels to accommodate high snowmelt runoff. Many rocks are exposed in these channels during the low flow period. The sun warms the stream by heating rocks in contact with the water and shallow groundwater along the streambed. For example, Pine Creek at the old gage near Oxbow has an average peak flow of about 2,000 cfs in June compared to an average low flow of about 20 cfs in August; a 100-fold change in flow. Excessive flooding in North Pine Creek and lower Pine Creek in 1997 exacerbated this condition.
- Wide stream channels discussed above also produce less effective shade, especially in areas of recent excessive flooding which removed much of the near-stream shade.
- The south side of the watershed is mostly low-elevation rangeland where air temperatures are hotter and solar radiation is more intense. The elevation range of the southern part of the watershed is 1700 to 3500 feet. Shade is produced mostly by cottonwoods and willows, compared with conifers at higher elevations to the north.
- It is Paul Josephs' understanding that cooler water exists in the valley floor streams, due in part, to groundwater return flows from flood irrigation.

Sediment

Proper functioning condition (PFC) surveys were conducted on a total of 54.4 miles of stream across the Pine Creek Watershed over a 3-year period. Surveys focused on streams listed as water quality limited for temperature and are on the State 303(d) list, bull trout stream reaches, and those listed by the ODEQ as needing more data. Seventy-nine percent of the streams were classified as being in a properly functioning condition. Problem areas or areas of concern have been noted and plans have been made for further study or for restoration. An additional 40 miles of stream will be surveyed in the year 2000. Results from the surveys across the watershed from 1997, 1998, and 1999 are summarized in table 10, page 62.

In 1997, a PFC evaluation (BLM 1993) was conducted by an interdisciplinary team for the upper reaches of Meadow Creek on National Forest land (table 10, page 62). The team concluded that the stream was functioning at risk (FAR) due to high levels of fine sediments. The reasons for the high sediment levels were noted as a poorly placed and badly eroding road in the headwaters and a noxious weed infestation which is causing poor soil conditions. The road is scheduled for decommissioning and the weeds are to be treated.

High levels of fine sediment have also been noted in other headwater streams including the uppermost reaches of Trail Creek and East Pine Creek. Poor upland conditions as a result of historic and current livestock grazing practices and increasing numbers of elk appear to be the cause of this situation. A recent review of the uplands of East Pine Creek subwatershed by the USFS area ecologist confirmed poor vegetation and soil conditions as the causes of the problems observed (Johnson, internal memo, 1998 included as appendix K).

No sediment data are available for Elk Creek and tributaries following the Twin Lakes Fire. Observations during 1998 PFC evaluations were that high flows and new inputs of large wood have caused recent bedload movement and channel changes. High levels of fine sediments were not observed.

Table 10. Summary Results From Proper Functioning Condition Evaluations, 1997-1999								
Sub-watershed	Stream	River Mile	Survey Year	Bull Trout Reach	Determination*	Trend	Primary Adverse Influence	Comments
15C	Lake Fork	0-2.0	1998	No	PFC			Recent major flooding
15C	Lake Fork	2.0-5.5	1999	No	PFC			Aquatic fauna threatened by brook trout in Fish Lake and unscreened irrigation diversions. Diversions may contribute to high temps. And reduced flows. Fish Lake dam failure and ditch blow-outs are potential and reoccurring problems.
15D	Elk	0-3.0	1998	Yes	PFC			
15D	Elk	3.0-5.2	1998	Yes	PFC			Recent major flooding and fire influenced
15D	Elk	5.2-6.2	1998	Yes	PFC			Veg. early seral stage due to fire.
15D	Cabin	0-1.3	1998	Yes	PFC			Fire influenced.
15D	Big Elk	0-2.0	1998	Yes	PFC			Fire influenced, stream temperature a concern.
15D	Aspen	0-1.5	1998	Yes	FAR	Upward	Hydrologic	Fire influenced, presumed elevated stream temperatures
15E	Duck	0-3.0	1997	No	PFC			Later seral stage
15E	Duck	3.0-5.5	1997	No	PFC			At potential natural condition
15G	Fish	6.3-6.8	1997	No	FAR	Not Apparent	Hydrologic	Flow modification by irrigation diversion
15G	Fish	6.8-7.8	1997	No	FAR	Not Apparent	Vegetative	Browse pressure by domestic livestock
15G	Fish	7.8-8.3	1997	No	PFC			Within livestock exclosure (0-.5 mi.)

Table 10. Summary Results From Proper Functioning Condition Evaluations, 1997-1999								
Sub-watershed	**Stream**	**River Mile**	**Survey Year**	**Bull Trout Reach**	**Determination***	**Trend**	**Primary Adverse Influence**	**Comments**
15H	East Pine	7.7-8.8	1999	No	PFC			Risk from noxious weeds. Risk posed by unscreened irrigation ditch near bottom of reach (5-point)
15H	East Pine	8.8-10.8	1999	No	PFC			Dispersed campsites, old roads above culverts, noxious weeds, old logging within riparian floodplain
15H	East Pine	10.8-11.3	1999	No	FAR	Upward	Hydrologic	Noxious weeds; width/depth ratio problem
15H	East Pine	11.3-12.3	1997	No	PFC			Late seral stage
15H	East Pine	12.3-13.1	1997	No	PFC			At potential natural condition
15H	East Pine	13.1-14.7	1997	No	PFC			Late seral stage
15H	Beecher	0-2.2	1999	No	FAR	Upward	Hydrologic Vegetative	Seed tree units may be contributing to high stream temps. System is slowly recovering from high levels of past livestock grazing. Current use is light but bank damage and trailing is still apparent. Road system needs to be improved.
15H	Okanogan	0-0.5	1997	No	PFC			Late seral stage
15H	Okanogan	0.5-1.4	1999	No	FAR	Upward	Vegetative Hydrologic Erosion/ Deposition	Lacks large wood and old structure for large wood replacement. Past sloughing is revegetated.
15H	Okanogan	1.4-1.9	1999	No	FAR	Upward	Vegetative Erosion/ Deposition	Lack of wood, very large flood event
15H	Okanogan	1.9-2.7	1999	No	PFC			Stream in good shape

Table 10. Summary Results From Proper Functioning Condition Evaluations, 1997-1999								
Sub-watershed	Stream	River Mile	Survey Year	Bull Trout Reach	Determination*	Trend	Primary Adverse Influence	Comments
15H	Trinty	0-2.6	1999	No	PFC			From west fork Trinity downstream livestock use apparent although not heavy, mostly trailing and mostly out of stream. One clearcut on west side ~300 feet long. Pretty good brush cover for shade. Lots of good pools, high gradient system. Temperature may be slightly affected by clearcut and shelterwood harvest, but riparian ecosystem is probably within historic range of variability.
15H	East Fork East Pine	0-1.0	1998	Yes	PFC			Lots of bare soil (historic sheep grazing area)
15H	East Pine	14.7-16.3	1998	Yes	FAR	Upward	Hydrologic	Sedimentation from headwaters and upland influences
15H	East Pine	16.3-16.8	1998	Yes	PFC			At potential natural condition
15H	East Pine	16.8-17.8	1998	Yes	PFC			Upland bare soils/ historic grazing
15J	Clear	8.5-10.0	1998	Yes	FAR	Upward	Hydrologic	Sedimentation from roads; above grazing utilization standards in some places
15J	Clear	10.0-11.2	1998	Yes	PFC			Grazing high in meadow areas; some bank erosion
15J	Clear	11.2-12.7	1998	Yes	PFC			Late seral stage
15J	Clear	12.7-14.2	1998	Yes	PFC			Old skid trails & roads are revegetated
15J	Clear	14.2-15.2	1998	Yes	PFC			Late seral stage, very functional

Table 10. Summary Results From Proper Functioning Condition Evaluations, 1997-1999								
Sub-watershed	**Stream**	**River Mile**	**Survey Year**	**Bull Trout Reach**	**Determination***	**Trend**	**Primary Adverse Influence**	**Comments**
15J	Clear	15.2-15.8	1998	Yes	PFC			Late seral stage, very functional
15J	Trail	0-2.8	1998	Yes	PFC			Fine sedimentation possibly from poor upland conditions and shallow soils
15J	Meadow	0-1.8	1998	Yes	PFC			Ditch diversion halfway through reach
15J	Meadow	1.8-2.4	1997	Yes	FAR	Upward	Erosion/ Deposition	Sedimentation from poor upland sources
15J	Meadow	2.4-2.9	1997	Yes	FAR	Not Apparent	Erosion/ Deposition	Sedimentation from roads; presence of noxious weeds
15L	East Fork Pine	0-0.8	1998	Yes	PFC			Middle to late seral stage
15L	East Fork Pine	0.8-2.1	1998	Yes	PFC			A few avalanche pathways
15L	East Fork Pine	2.3-3.6	1998	Yes	PFC			System in balance

*Evaluation methodology from USDI Bureau of Land Management, 1993.
PFC - Proper Functioning Condition
FAR - Functioning at Risk

Chemical Contamination

There are no known chemical contamination or nutrient problems in the Pine Creek watershed; however, there is no evidence to support this conclusion (M. Fedora, USFS). Lake Fork Creek was considered for listing by ODEQ as a "water body of concern" for toxics (ODEQ 1988).

Historic mining activities along Pine Creek near Cornucopia used cyanide to process ore. A report by the Oregon Fish Commission stated that the use of cyanide by the mining industry was probably an important factor in the decline of former runs of spring chinook in Pine Creek (Thompson and Haas 1960). There are still mine tailings within the Riparian Habitat Conservation Area (RHCA) of Pine and East Fork Pine Creeks that are listed as hazardous waste by ODEQ. It is not known whether these tailings continue to leach toxins into Pine Creek. It is not known what impacts these potential toxins may have on the current fish population.

Bull Trout Recovery

Subpopulation Size

Widely scattered spot sampling for bull trout, brook trout, and interior redband trout was accomplished by ODFW in 1990 and by Pine Ranger District personnel from 1994-96 (USFS, 1996) in many streams within the Pine Creek watershed. The collection methods used included electro-fishing, snorkeling, and direct observation.

The survey of forest service lands was conducted during the summer of 1994 (USFS 1998) and population estimates were made for summer resident bull trout (table 11, page 67). Population estimates were made for each subwatershed by extrapolating results of having sampled every third pool by electro-fishing. The maximum population on USFS lands in the summer was estimated to be 1,305 bull trout. The actual count of 348 fish would result in a minimum estimate of 435 fish (see table 12, page 68). Population estimates using statistical sampling analysis were not done. The miles of stream sampled is not known; therefore, the average fish per mile cannot be determined. Young (1995) reported that trout populations during summer months are often unstable due to species specific movements and that sampling results during the summer months often lead to highly variable population estimates. One-time basinwide inventories cannot account for trout mobility.

Juvenile fish comprised 30 percent of the samples and maturing and mature fish comprised 70 percent of the sample. Adult (mature and maturing) fish were determined to be those fish 6 inches and larger (Buchanan, et. al. 1997). The proportion of juveniles sampled ranged from a low of 20 percent in the Upper Pine subwatershed (which contained the highest number of fish per pool) to 70 percent in the Elk Creek subwatershed. Size estimates could be greater than indicated by the sample. The sampling indicates a population that is productive and self-sustaining. Because juvenile fish are less likely to be captured than larger fish, it is concluded that the size of the total population could be greater than indicated by the sample.

Table 11. Bull Trout Electro-Fishing Summary

Stream	Reach	Length (Miles)	Pools Sampled	Size Class (inches)								Total Sampled
				0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	
East Pine	4	2701	21									0
East Pine	5	1069	12									0
East Pine	6	3222	24				1					1
East Pine	7	1143	15			7	5	3				15
East Pine	8	3122	36		1	10	22	6	2			41
E. Fk East Pine	1	436	3					2	1			3
Subtotal				0	1	17	28	11	3	0	0	60
Aspen	1	2712	20			4	10					14
Big Elk	1	4193	13		6	10	1					17
Elk	1	3500	16									0
Elk	2	3999	24			1	2					3
Elk	3	5999	60		15	33	10	5	1			64
Subtotal				0	21	487	23	5	1	0	0	98
Clear	2		22				5	4				9
Clear	3		24			1	2					3
Clear	4		34		1	2	2	3	3	3		14
Clear	5	3663	18			3	2	1	3	1		10
Meadow	1	5546	61	1	2	16	18	5				42
Trail	1	3669	23			7	5	8				20
Subtotal				1	3	29	34	21	6	4	0	98
East Fk Pine Creek	1		23		6	5	14	15				39
Middle Fk Pine	1		17		1	4	9	11	2			27
Pine Creek			4			3	8	5	3			18
West Fk Pine			5				1	5	2			8
Subtotal				0	7	11	32	36	6	0	0	92
Total				1	32	105	117	73	16	4	0	348

Table 12. Bull Trout Frequency

Location	Total Pools	Total Bull Trout	All Fish Per Pool	Adult Fish Per Pool
	487	435[1]	0.72	0.43
Elk Creek, East Pine Creek, and Clear Creek	–	–	0.5 to 0.71	–
Upper Pine Creek	–	–	1.88	–
overall reproduction was evident in all streams sampled.				

[1] 435 = 348 x 1.25

Growth and Survival

The estimate from the above section of the percentage of juveniles in the population sample indicates that the bull trout population is productive. No fish were collected over 14 inches in length. Since we do not know the age of each size class, it is arbitrary to estimate growth and survival based on age classes. Buchanan, et. al., (1997) indicates that 6 inch and larger fish are maturing/mature in summer resident populations. Historic records include much larger bull trout in the Pine Creek watershed which are assumed to have been the migratory population segment that may have been lost. Growth appears to be similar to other subpopulations of resident bull trout (Buchanan, et.al. 1997) and the population contains a healthy cross section of size classes. Further evaluation is needed to determine the following: 1) the total number of bull trout in the watershed versus carrying capacity, 2) the effects to long term population dynamics, and 3) survival of resident fish from the loss of the anadromous salmon, steelhead, and migratory bull trout from the ecosystem. Reproduction based on immature size classes in the surveys and the cross section of several size classes indicates growth and survival is stable and the species has persisted fairly well. However, the lack of a 10-year trend showing a stable or increasing population indicates the population is "functioning at risk."

Electro-fishing during the summer of 1994 identified bull trout in 9 creeks (East Fork Pine, East Pine Creek, Aspen, Elk, Clear, Meadow, Trail, Middle Fork Pine, Pine, and West Fork Pine). There could be bull trout in Lake Fork, however electro-fishing surveys in 1990 by ODFW and in 1994 by the USFS detected only eastern brook trout, native redband trout, and sculpins. Eastern brook trout have a competitive advantage over bull trout which may have resulted in hybridization and eventual extirpation from Lake Fork. Activities that are occurring on state, Federal, county, and private lands that affect bull trout include mining, road management, livestock grazing, agricultural practices, and water diversions for consumptive uses.

Since salmon are no longer in the watershed, the size of bull trout could be affected. Bull trout likely thrived and survived on the eggs, fry, smolts, and carcasses that the salmon and steelhead populations provided.

A potential threat to bull trout is the impact resulting from continuing the sport fishery in bull trout streams. Current regulations protect bull trout (release if caught). However, many anglers are unlikely to be able to identify bull trout, and the hooking, landing, and handling can have immediate direct effects upon the fish. Longer term indirect effects may include delayed mortality and possible impairment to feeding and other normal activities. The use of bait which is often swallowed by the fish, and lures with multiple treble hooks can cause direct physical harm which could lead to death, infections, and crippling. The angling pressure on these fish is low. Many of the waters where bull trout are located have limited or difficult access.

Life History Diversity and Isolation

Prior to the Snake River complex of dams, anadromous fish species including salmon and steelhead, and migratory bull trout (ODFW 1993), historically moved between the Snake River and upper tributaries of the Pine Creek watershed (figure 15, page 71, shows known bull trout streams and other fish bearing streams). The anadromous species have disappeared from the watershed and populations of large migratory bull trout became scarce throughout the basin within a few years of the blockages created by the dam complex.

The Hells Canyon Dam complex has isolated the Pine Creek bull trout from the rest of the Columbia River populations. Populations of the smaller resident bull trout have persisted in the upper cool water streams. The resident and migratory fish, being of the same species, very likely coexisted with an ecological dependence on each other. The relationships between the resident and migratory bull trout are not documented or well known with the historic enumeration of large bull trout lacking. It is reasonable to assume that changes that took place after building of the Hells Canyon complex of dams resulted in reduction of large bull trout but this is difficult to prove as a fact. Conditions that supported large bull trout declined after the closure of Hells Canyon Dam (loss of connectivity to the Snake River, elimination of anadromous fish, etc.). Neither is the role of anadromous fish species with bull trout, be it providing food supplies during spawning or many other possible ecological interactions.

The introduction of the eastern brook trout (*Salvelinus fontinalis*), a non-native species probably played a role in the decline of native bull trout through competition for habitat and hybridization. The four local populations of native bull trout in upper Pine Creek, Clear Creek, and East Pine Creek may have limited interchange between the populations, based on 1-year of recent tagging studies. No physical barriers preclude their movement during all times of the year.

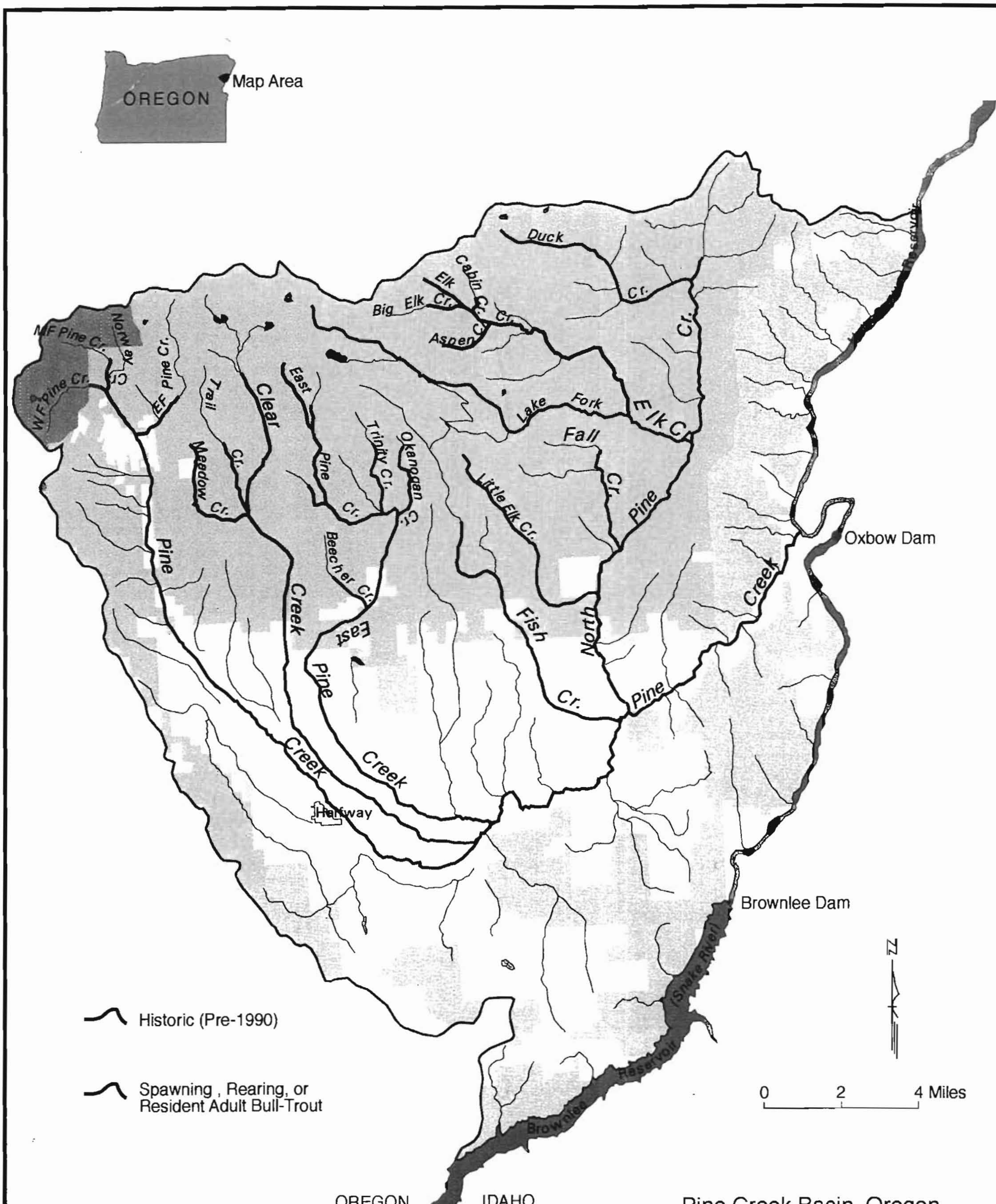
Persistence and Genetic Integrity

Spruell and Allendorf (1997) conducted genetic studies of Oregon bull trout and suggested that genetically the Pine and Powder basin fish appear to be more similar to the inland populations than they are to the Malheur River populations. Bull trout in the Pine and Powder Rivers may be more similar to bull trout in the Grande Ronde River system than to those in the Malheur River system.

The Snake River could have served as the gathering area from which fall migrants moved into streams different from their origin which created genetic mixing with other populations such as in Indian Creek, Idaho. With the probable decline of migratory bull trout in the Pine Creek watershed, there is less chance of gene flow among local populations. However, the resident populations have persisted for 30 years since completion of the Hells Canyon Dam complex. Buchanan et. al., (1997) found no known documents that mentioned bull trout in the Pine Creek watershed prior to the 1960's although it is suspected that they were native throughout the watershed as were salmon and steelhead. Bull trout were not a species of interest to many early fishery investigators (focused primarily on salmon or steelhead).

Bull trout become sexually mature between 4 and 7 years (Reimon 1993). Average life span is approximately 12 years (personal communication with Sam Lohr, bull trout recovery biologist, USFWS, Boise, Idaho).

Brook trout have been in the system for many years and there have been a few documented cases of hybridization between brook trout and bull trout in the Clear Creek subwatershed.



Pine Creek Basin, Oregon

BULL TROUT DISTRIBUTION

Figure 15

Considerations

The Meadow Creek Ditch and the upper segment of the Hooker Flat Ditch (out of Aspen Creek) have the only two unscreened points of irrigation diversion within occupied summer habitat of bull trout on National Forest lands.

Implementation of activities on National Forest lands in the Pine Creek watershed are now modified to limit impacts to bull trout through consultation with USFWS under Section 7 of the ESA. In the future, activities on private lands may require consultation through Section 10 of the ESA.

The draft document "Movements and Spawning Observations of Bull Trout in the Pine Creek Basin, Eastern Oregon", a cooperative venture between the USFS, ODFW, and Idaho Power Company in coordination with the Pine Creek Bull Trout Work Group (March 1999) is a good reference document on bull trout.

During the February 2000 Council public meeting in Halfway, Art Sappinton indicated he had found a document that inferred that bull trout were planted as food for miners and may not be indigenous. In contrast ODFW has evidence suggesting bull trout are indigenous (Jeff Zakel ODFW). No data are available or are known to support the assertion that bull trout are nonindigenous. Bull trout are found in watersheds above and below the Pine Creek watershed along the Snake River system. There were salmon and steelhead in Pine Creek and bull trout are associated with these species in adjacent drainages. Adequate habitat exists in the watersheds for the species and, therefore, recovery efforts are likely to continue (Jeff Zakel ODFW). The draft recovery plan objectives are: 1) secure existing bull trout populations and their habitat, 2) reestablish connectivity within the Pine and Powder subunits, respectively, and to the Snake River for both subunits; and 3) establish additional populations within the recovery unit in suitable habitat within the species "native range" (M. Hanson ODFW). If bull trout were found to be nonindigenous to Pine Creek and its tributaries, how would that affect the plan (public meeting question)?

Fish Screens

State laws governing fish screen installation and maintenance are found in ORS 498.306 and ORS 498.311: for stream diversions under 30 cfs, fish screens are encouraged; for stream diversions over 30 cfs, fish screens can be required. In addition, pursuant to their authority under the ESA, the USFWS can require fish screens where necessary to protect any listed fish species. The USFWS could require fish screens on any ditch in the Pine Creek watershed where bull trout are known or suspected to be present during any time of the year.

ODFW has a cost share program for screening diversions under 30 cfs. Cooperative funding for fish screen installation can also be obtained through NRCS and OWRD. Landowners usually have to cost share on fish screen facilities.

Fish populations are known to increase after fish screens are installed. State concerns about the impacts of water developments on anadromous fish stocks in the watershed resulted in installation of fish screens by ODFW on major ditches during the 20-year period preceeding completion of Hells Canyon Dam (1959-1962). After the completion of Hells Canyon Dam, these screens were removed by ODFW.

The Federal Ditch Bill[2] (1986), allowed owners of certain ditches to apply for permanent easements on public lands. Several applications have included ditches in the Pine Creek watershed. Currently, processing of these applications requires consultation with USFWS. USFWS has indicated terms and conditions for approval of these easements will include a requirement to install fish screens if the diversion is located in bull trout habitat.

ODFW and USFWS have not yet developed a list of diversions that will require screening. ODFW cannot arbitrarily require fish screens on diversions. For new water right applications and transfers, OWRD consults with ODFW regarding screening of diversions. If ODFW requests that screening be required, OWRD will include such a condition in the Final Order. The applicant must agree to this condition before the Final Order will be approved by the Water Resource Commission.

There are 9 diversions with fish screens in place. A list of screened irrigation diversions was not developed for this Assessment (one should be appended to this document in the future). A program has been started to construct at least 6 more fish screens during 2000 pending design approval by USFWS. The USFWS has not yet decided what their design criteria should be for bull trout.

[2] Public Law 99-545, 43 USCA §1761, Grant, issue, or renewal of rights-of-way

Noxious Weed Invasions

Noxious weeds pose an increasing problem to the Pine Creek watershed. Negative ecological and economic impacts are expected to worsen without increased public awareness and management.

When noxious weeds dominate a landscape, they displace native plants, reduce biodiversity, alter normal ecological process (e.g., nutrient cycling, water cycling), decrease wildlife habitat, reduce recreational value, reduce property values, and increase soil erosion and stream sedimentation (Sheley, Olson, Hoopes 1998).

Noxious weeds are legally declared a menace to the public welfare by ORS 570.505. Noxious weeds have the capability to establish themselves and spread rapidly causing injury to public health, agriculture, recreation, wildlife, or any public or private property.

Figure 16, page 79, shows the Inventory of Noxious Weed Sites map for private lands (Dave Clemens).

All of the noxious weeds listed below are introduced, non-native plant species.

- Rush Skeletonweed

This weed is new to the area and presents an immediate threat to the watershed. The first sightings of the plant occurred in 1993 near Halfway and has been mapped both inside and outside the watershed in an area of 70,000 gross acres.

The weed is being found in rangeland but can become an economic pest in croplands and forest areas. It spreads rapidly and is difficult to control.

- Whitetop

Whitetop is not widespread in the northern part of watershed. It is found in small clusters and isolated patches throughout the area, but most frequently in the south rangelands. It is capable of establishing on many soil types and conditions and is expected to expand across the basin, without aggressive control.

- Diffuse Knapweed

Diffuse knapweed is a rapid spreader and a threat to pastures and rangelands. Diffuse knapweed infests roadsides, waste areas, and dry rangelands and is highly competitive and threatens to exclude many desirable forage species.

Diffuse knapweed can be found in Pine Valley along North Pine Creek and Pine Creek. Presently the populations are limited to an estimated 300 acres, scattered over several sites.

- Spotted Knapweed

Spotted knapweed is similar to diffuse knapweed in that it spreads along roads, but seems to grow better in higher moisture conditions. There is a serious infestation of spotted knapweed in Pine Valley, including the city of Halfway and along Pine Creek. It can be found in sites along North Pine Creek Road. This is a worrisome situation because spotted knapweed is known to grow in similar environments in Montana where it is a widespread menace.

- Dalmation Toadflax

A population of this weed has established itself in the vicinity of the old Melhorn Mill site in the East Pine Creek drainage. Less than 100 acres are infested at this time, and prompt control is recommended because this plant is difficult to control due to its deep and extensive root system.

- Yellow Toadflax

This species is being found in increasing numbers at higher elevation in the watershed. There are sights around Cornucopia, Schneider Meadow, and elsewhere.

- Medusahead Rye

This annual grass is a serious problem in rangelands adjacent to the Snake River. It is spreading into the southern basin rangelands and has the potential to completely dominate grass sites.

- Puncturevine

Puncturevine produces sharply pointed burs that stick painfully in bare feet, hoofs, tires, etc. This plant is a menace in and around Pine Valley. It can be a problem to livestock, crops, and recreation sites.

- Scotch Thistle

Scotch thistle stands are dense and practically impenetrable due to the weed's spiny nature and large size. It generally inhabits moist sites or drainages.

- Canada Thistle

This weed is widespread and damaging to crops and rangeland. It grows in a wide range of soils and conditions, occurring on roadsides, ditch banks, and stream courses. It is aggressive and spreads by seed and roots.

- St. Johnswort

St Johnswort is on the increase in the watershed with the potential to invade pastures, non-crop areas, and grazeable woodlands. However, before it becomes a major problem, St. Johnswort is expected to be controlled by a biological agent called the chrysolina beetle. This weed is known to be toxic to livestock.

- Sulfur Cinquefoil

Sulfur cinquefoil is an aggressive introduced weed that is also spreading in the watershed. It is invading meadows in the ponderosa pine zone and in drier rangeland sites. Once established the weed produces dense populations that seriously reduce more desired vegetation. Little is known about population size and locations.

- Mediterranean Sage

A population of Mediterranean sage was found along North Pine Creek in 1998. The population is approximately 5 acres in size and is spreading in the riparian zone. This weed also has a history of aggressive behavior and has the potential to spread into rangelands.

Weed Surveys and Treatment Programs

The Tri-County Weed Management Area, along with cooperators, are in the process of systematic mapping of weed sites. The inventory and mapping stage of weed management is an ongoing process that will require help from landowners and others. Many weed sites on private lands have not been mapped. A weed mapping system is evolving using GPS and computer software. Maps will become available as they become ready. Weed problems can be described in general terms where they occur in the watershed.

The Tri-County Weed Coalition can be strengthened with new members.

Effect of Weeds on Land Values

Presently weed infestations have little affect upon land values. However, the above identified weeds have the potential to expand, create environmental havoc, and defy control. Typical control costs can exceed $30 per acre per year. Weeds will damage rangeland values and wildlife habitat.

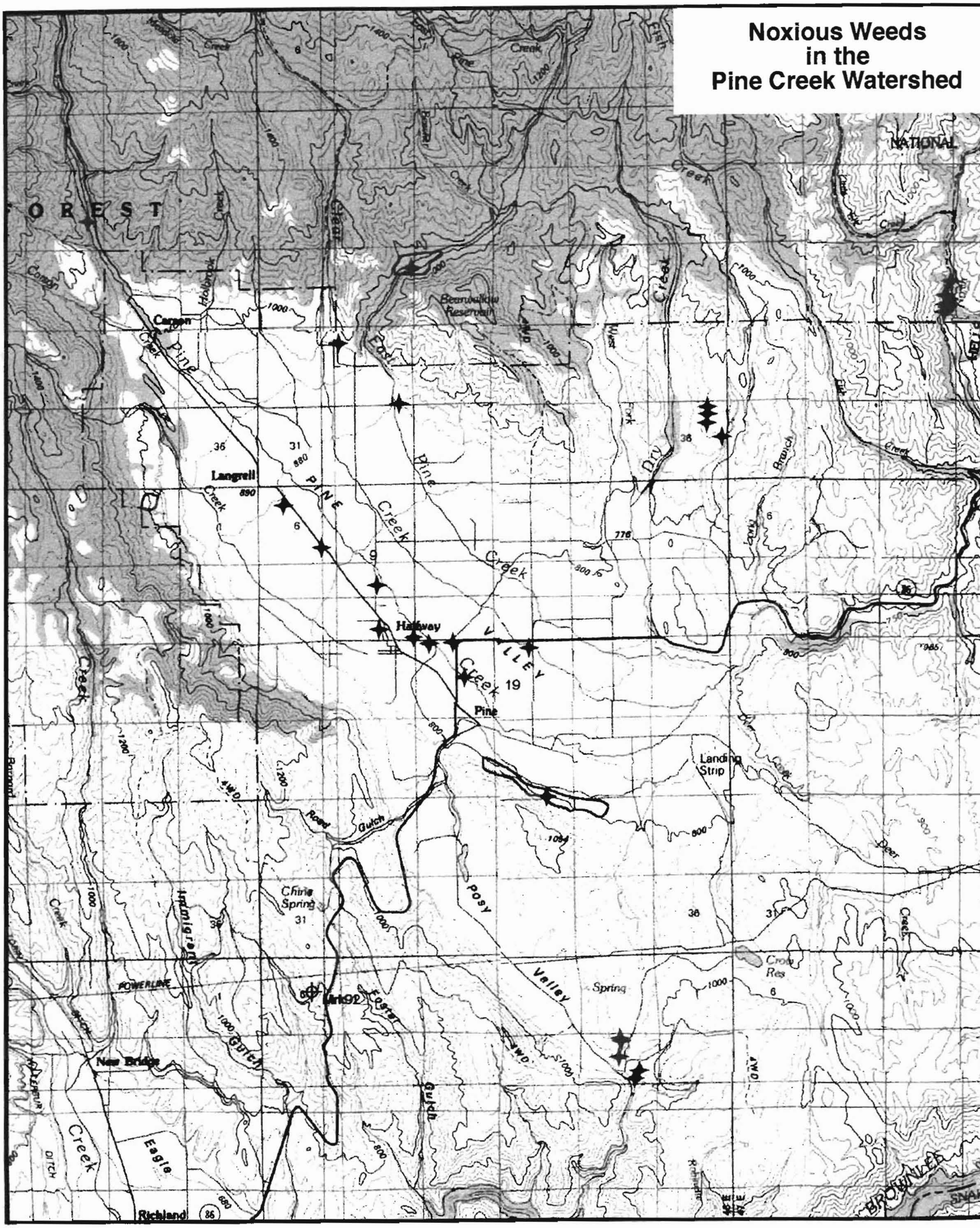
Knowledgeable land buyers will recognize the cost of weed control and would logically request compensation for future weed control expense.

Summary

Experience and research indicate that invasive weeds can create havoc to relatively undisturbed ecosystems (Duncan, 1997). The noxious weed situation in the western states has been described by some as a biological disaster, "an explosion in slow motion" (Asher, 1998). If aggressive management is not implemented, the noxious weed situation in the Pine Creek watershed is likely to follow the predictive pattern of early introductions, followed by periods of rapid expansion, and then becoming widespread over large areas.

Noxious weeds that are listed all have the potential to cause serious economic and ecological problems. However, it is important to recognize that most of the weed populations described above are manageable. Baker County's noxious weed control rating system has been included in appendix L.

Landowners with "A" rated weeds can receive cost-share funds. Special funds have been identified to help with 50 percent of the costs for controlling spotted knapweed, rush skeletonweed, and Mediterranean sage.



Noxious Weeds
in the
Pine Creek Watershed
FOREST
NATIONAL
Carson
Langrell
Halfway
Pine
PINE
VALLEY
Pine Creek
East Pine Creek
Holbrook Creek
Clear Creek
Dry Creek
West Fork
Landing Strip
Road Gulch
Chinie Spring
Posy Valley
Spring
Crow Res
POWERLINE
New Bridge
Richland
Eagle Creek
BROWNLEE

Figure 16

Over-Appropriation of Water

Definitions of Over-Appropriation

Over-appropriation of water has been a much debated issue in the Pine Creek watershed. It relates to several topics, including but not limited to, junior appropriators being shut off by the watermaster, new water right applications being denied, ODFW instream water rights applications, reservations of water for future economic development, and bull trout conservation.

Over-appropriation is a very broad and complicated issue. There can be confusion regarding the difference between over-appropriation and exceedence. Over-appropriation means that if all the valid water rights on a source of water were exercised at their full rate at the same time, the water source would not be able to provide water for all the rights, all the time. Fifty (50) and eighty (80) percent exceedence are the standards used to determine whether new water rights should be allowed, based upon what percentage of time (in a specific time period) water is available, or not already "spoken for".

To understand the issue, Mack Kerns (rancher) recommended the term "over-appropriation" be clearly defined. The State of Oregon has defined over-appropriation in the context of 80 percent and 50 percent exceedence and groundwater recharge, which are discussed below. There are also other definitions or concepts with which the Council should be familiar. Several concepts are discussed below; most are based on State law (ORS) or rule (OAR), or Federal law. All of the definitions or concepts affect water use in the Pine Creek watershed.

State Definitions or Concepts

Official policy of the State of Oregon is:

> "The waters of the state shall be allocated within the capacity of the resource and consistent with the principle that water belongs to the public to be used beneficially without waste. Water shall be allocated among a broad range of beneficial uses to provide environmental, economic, and social benefits. The water of the state shall be protected from over-appropriation by new out-of-stream uses of surface water or new uses of groundwater" [OAR 690-410-070 (1)].

Several principles [OAR 690-410-070 (2)(a), (b), (c), (d)] further define the intent of this policy with respect to surface water, groundwater, and storage.

Eighty (80) Percent Exceedence Flows

The official definition for 80 percent exceedence for surface water reads:

- "Over-appropriated" means a condition of water allocation in which:

- The quantity of surface water available during a specific period is not sufficient to meet the expected demands from all water rights at least 80 percent of the time during that period.
- The standards for determining over-appropriation described in (a) shall apply to water availability determination for permit applications submitted after July 17, 1992 [OAR 690-400-000 (11)(a)(A) & (b)].

Early water rights allowed up to full appropriation of live streamflow (0 percent exceedence), as needed. Appropriation of live streamflow was limited to 50 percent exceedence sometime after passing of the State water code, which was changed to 80 percent exceedence in 1992. A comparison of the "Detailed Reports on Water Availability" in appendices C and D for any stream shows the effects of the change from 50 percent to 80 percent exceedence on water availability for new applications for use of live streamflow. Some limited appropriation of water for domestic and stock use may be allowed through basin programs even when a stream is fully or over-appropriated at 80 percent exceedence, similar to provisions for the Burnt River in the Powder Basin Program [OAR 690-509-000(4)].

Appropriation Exceeding Fifty (50) Percent Exceedence Flows

Current OWRD "policy" requires use of the 50 percent exceedence flow for any month or half-month to determine water availability for water right applications for storage (Tom Byler, OWRD, personal communication). This policy has not been written into law or rule. Principles of water allocation in OAR 690-410-070(2)(c) & (d) indicate "new allocations of water for storage facilities may be allowed" if a stream is over-appropriated under the 80 percent exceedence rule if existing water rights and instream uses are protected. Because OWRD bases instream water rights on the 50 percent exceedence threshold, a stream is considered to be over-appropriated for new storage projects during any month or half-month that water availability is less than 50 percent exceedence. For example, the "Detailed Reports on Water Availability"in appendix D show that ODFW instream water rights requests resulted in negative water availability in some months for 50 percent exceedence, which portrays historic legal over-appropriation for that month based on a comparison with the new rules. However, the "STOR" (storage opportunity lines) in the tables in appendix D show that none of the streams are fully or over-appropriated for storage.

Groundwater Withdrawal exceeds Groundwater Aquifer Recharge

The official definition for groundwater over-appropriation reads:

(a) "Over-appropriated" means a condition of water allocation in which (B) the appropriation of groundwater resources by all water rights exceeds the average annual recharge to a groundwater source over the period of record or results in the further depletion of already over-appropriated surface waters. [OAR 690-400-000 (11)(a)(B)]

No groundwater over-appropriation is reported to exist in the Pine Creek watershed.

Not Having Minimum Flows for Fish Habitat

ODFW instream water rights and pending applications are discussed in the Water Rights section of this assessment. Priority dates are 1970, 1990, and 1992. ODFW modeled minimum stream flows for fish based on the "Oregon Method." OWRD approved requested minimum stream flows if they did not exceed modeled 50 percent exceedence flows. When ODFW minimum stream flows were less than OWRD 50 percent exceedence flows, ODFW requests were reduced to the 50 percent exceedence level. ODFW views the reduced requests as inadequate to protect fish life (Jeff, Zakel, ODFW, personal communication).

The "Detailed Reports on Water Availability" in appendix D show negative water availability in late summer for some streams because senior out-of-stream appropriations exceeded 50 percent exceedence flows. Advocates of instream water rights view this as over-appropriation. State policy reads, "where stream flows have been depleted to the point that public uses have been impaired, methods to restore the flows are to be developed and implemented." [OAR 690-410-0320(1)]

Water Rights Exceeding Natural Streamflow Anytime of Year

Another concept is when water rights of record for out-of-stream uses for any point on a stream exceed natural streamflow (i.e., more than 0 percent exceedence), usually sometime between high flow in the spring and low flow in the autumn, often requiring OWRD to tag off diversions in favor of a senior appropriator. This type of "over-appropriation" is legal, and is based on laws in effect at the time of water-right establishment. This is not defined by the State as over-appropriation, but some consider it to be so when compared with current laws and regulations. This type of over-appropriation may be seasonal or annual, or may occur in drought, normal, or wet years, depending on the water rights of record before July 17, 1992 [OAR 690-300-010(57)].

Federal Definitions or Concepts

Not Having Optimum Flows for Listed Fish Species

The most conservative optimum flow concept is used by Federal agencies that enforce the Endangered Species Act. For example, the USFWS and National Marine Fisheries Service (NMFS) have used their regulatory authority to stop the exercise of valid state water rights. This has happened in streams in the western United States during the past several years where they believe the existence of a listed fish species would be jeopardized by exercise of those water rights. Under this concept over-appropriation is simply any use of natural flows that jeopardizes listed species, whether use is instream (such as suction dredging) or out-of-stream (such as irrigation). See "The Effect of the Federal Endangered Species Act on State Water Rights," (Estes) for a discussion on the legal background for this concept. This concept could be applied to bull trout conservation efforts in the Pine Creek watershed.

NMFS recently published the following definition in the Federal Register which applies to the watershed:

Endangered and Threatened Fish, Wildlife, and Plants; Definition of "Harm."
Summary: This final rule defines the term "harm" which is contained in the definition of "take" in the Endangered Species Act (ESA)... This final rule... provides clear notification to the public that habitat modification or degradation may harm listed species and, therefore, constitutes a take under the ESA as well as ensuring consistency between NMFS and the Fish and Wildlife Service (FWS). This final rule defines the term "harm" to include any act which actually kills or injures fish or wildlife, and emphasizes that such acts may include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife.
Dates: This rule is effective on December 8, 1999. [Vol. 64, No. 215, pg. 60724, November 8, 1999]

Not Having Adequate Flows for Purposes of Federal Reservations

The United States of America claims Federal reserved water rights for the Wallowa Forest Reserve established May 6, 1905; Imnaha Forest Reserve established March 1, 1907; Eagle Cap Wilderness established September 3, 1964; and Hells Canyon National Recreation Area established December 31, 1975, as described in the water rights section of this assessment. OWRD policy has been to not regulate for or against Federal claims until they are adjudicated. When Federal reserved water right claims for the Pine Creek watershed are accepted by OWRD at some indeterminate future date, any water rights issued under state law for points of diversion located on or upstream from National Forest lands might be viewed as over-appropriation if they are junior to and injure federal claims. No evaluation has been made to determine if any existing water rights issued under state law would be affected by potential Federal claims to consumptive and instream water rights in the watershed.

Over-Appropriation in the Watershed

Water rights in the watershed (appendix F) were established under the "prior appropriation" doctrine, which allowed appropriation of water to the 0 percent exceedence level (i.e., all streamflow during any year), if desired. This practice was not viewed as over-appropriation; the over-appropriation concept did not exist during the initial European settlement period. Water was used mostly for human consumption, crops, livestock, and mining.

Looking back in time while using the modern value systems discussed in the previous section, one can draw different conclusions about when water was "over" appropriated. Any such analysis is beyond the scope of this assessment. The purpose of this assessment is to present facts and let the reader choose the value system against which the facts will be compared.

It is well documented that most or all of the average natural flow (i.e., 50 percent exceedence) of many streams in the Pine Creek Watershed has been fully appropriated for out-of-stream uses during late summer. OWRD water availability tables (appendix C) show that water rights of record for Pine Creek (above Long Branch Creek), East Pine Creek (above Pine Creek), Clear Creek (at Pine Creek), and Clear Creek (above unnamed stream) exceed the 30-year average natural water yield for the 1960 to 1990 period.

When total high flow rights for any stream exceeds streamflow during a low flow period, the "first-in-time" water right doctrine applies, which requires regulation or turning off of junior rights. Regulation occurs on the above streams (preceding paragraph) and on several other streams in the watershed; insufficient information was available to make a complete list of these streams for this assessment. OWRD acknowledges that exercise of irrigation water rights, almost all of which are senior to State instream water rights, results in dewatering or near dewatering of some stream reaches. A well known example is East Pine Creek. Summertime water shortage have encouraged residents of the watershed to develop additional water resources as discussed in an earlier section entitled "Limited Water Supplies for Economic Development and Environmental Improvement." Development of some storage projects listed in table 3 diminished or stopped streamflow in some stream reaches during part of the year; insufficient information was available to make a list of these streams for this assessment. Early groundwater rights were granted without an evaluation of impacts to ground water hydrologically connected to streams and springs; no such impacts were reported for this assessment.

Unauthorized Water Use

Oregon Statutes state that any point of diversion, rate of diversion, type of use, duty, or place of use not specifically authorized in a water right is an unauthorized use of water. A list of problem sites was not provided by the watermaster for this assessment. State law requires the watermaster to regulate against unauthorized uses to protect the water rights of others, including ODFW and OWRD instream water rights. In 1998, Baker County hired an assistant watermaster to work with water users in the Pine Creek watershed, to regulate against unauthorized water use and waste, and to encourage installation of water measurement devices. Rate and duty limitations need to be enforced with the use of measuring devices. The has not been a concern in the past but in the future July–October water use may come under scrutiny (Jerry Rodgers, OWRD, Eastern Region Manager, December 1999)

OWRD cannot arbitrarily cancel a water right. They must have evidence that the water has not been used for five consecutive years within the previous fifteen years. It is much easier for the water right holder to submit a signed affidavit, voluntarily canceling a water right.

Unauthorized water use during the late summer low streamflow period negatively impacts aquatic resources. Stream flows may be greatly reduced or eliminated which adversely effects water quality and fish passage.

The Assessment does not insinuate landowners are over-using water in the context of consumptive use. However, the duty allowed in the Decree is generous compared with other decrees and with estimated consumptive use, and landowners admit to large seepage loss inefficiencies. Future studies beyond the scope of this Assessment could be done to determine if improved water transmission efficiency could eliminate most late season water shortages.

Recent changes in State water law solved many of the unauthorized water use problems in the watershed. The 1993 and 1995 ponds bills allowed landowners to register small ponds as exempt uses or to obtain water rights. Many reservoirs on the WWNF, BLM Vale District, and private lands were registered under these two laws. Other favorable laws established an expedited application process for small reservoirs requiring water rights, exempted livestock water developments on springs and streams if they met certain design criteria, and expanded exempt uses from wells. Many livestock water developments on private and Federal lands qualified under the livestock exemption.

Water Rights

In the Pine Creek watershed, there has been a decrease in irrigation of lands from 20,688 acres in 1966 to 18,224.11 acres in 1997. The reason for the decrease has not been determined. There has been no cancellation of recorded water rights. Exercise of municipal use water rights from surface water has decreased. This appears to have occurred because the users want a supply with more reliable water quality; use has shifted from surface to groundwater supplies. Groundwater rights for municipal use have increased from 0.25 cfs to 2.59 cfs. Industrial rights have increased from 2.6 cfs to 2.8 cfs. Mining water rights show a significant decline from 95.5 cfs to 43.23 cfs.

Senior water rights are not legally affected by new applications including instream water rights. Division 33 rules affect new applications filed after July 17, 1992, restricting direct (natural) flow withdrawal from April 15 to September 30. It is unlikely that OWRD will approve new diversions or natural flow water rights during this period.

Current irrigation diversion maps, Pine Creek Watershed water rights in the Pine Creek Decree and reservoir water rights are available in the Oregon State Watermasters office in Baker City.

Water Rights Under State Law

Water rights in the Pine Creek watershed are described in the 1930 and 1932 Pine Creek Decrees for water uses established by February 24, 1909, and in water right permits and certificates issued since passage of the 1909 State water code. Copies of these water rights are available in the Baker County Watermaster Office. Most of the water rights in Pine Valley predate the Federal Ditch Bill (1986). The majority of the water rights are dated 1870 to 1910.

Existing rights-of-way for ditches and canals were consolidated and codified as section 661, title 43, United States Code (Confirmation of Western Water Rights, Sections 2339 and 2340, Revised Statutes). This act allowed the construction of waterways through public lands. A following act in 1891 allowed the right-of-way for these waterways plus a 50-foot ditch side right-of-way. The Federal Ditch Bill (1986) does not supercede the 1866 acts. The cumulative amount of surface water allocated to storage, out-of-stream, and instream uses for different quantification points in the Pine Creek watershed is shown in appendices C and D. Many of the irrigation rights in the watershed are listed in appendix F.

ODFW instream water rights are listed in appendix G. These water rights have three priority dates, discussed below.

In 1970, OWRD amended the Powder Basin Program to include the 4 minimum stream flows for four points on 4 streams in the Pine Creek watershed: Clear Creek, East Pine Creek, North Pine Creek, and Pine Creek. These minimum stream flows were based on ODFW studies in the mid-1960's (Hutchinson & Fortune, 1967). In the mid-1990's these minimum stream flows were converted to water rights by the legislature (see OAR 690-76).

In 1990 and 1992, ODFW requested 11 instream water rights to protect fishery resources in 7 creeks (Clear, Duck, East Pine, Elk, Lake Fork, Little Elk, and Pine Creeks). These water right applications were developed using the "Oregon Method" which included estimates of minimum and optimum stream flows for fish for evaluated stream channel cross-sections. ODFW only requested minimum stream flows in the applications for the Pine Creek watershed (Jeff Zakel, ODFW, personal communication).

OWRD's water availability analysis rule for instream water right applications allows water rights to be established for the "estimated average natural flow" by month or half-month, unless "high flow events that allow for fish passage or migration over obstacles" are needed. Prior appropriation of water is not to affect allocation of instream water rights. [See OAR 690-77-015(4); ORS 537.332 to 537.360 (OWRD, 1995)]. OWRD policy has been to use 50 percent exceedence flows to develop "estimated average natural flows." Average natural flows and 50 percent exceedence are not the same, but are similar for snowmelt dominated streams in NE Oregon (Rick Cooper, OWRD, personal communication). OWRD approved the eleven instream water right applications, but the requested flows were reduced for some applications in months that the requested flows were not available at the 50 percent exceedence level.

Those who would admit to not using their water rights over the years may be concerned about improving stream flows and riparian areas, or those who find out they cannot transfer water use to a new location or reinitiate water use after long-term nonuse without an appeal to the watermaster by an injured party or concerned citizen. OWRD is responsible for determining nonuse. There is almost no discussion of possible abandoned water rights in the assessment because it is sensitive subject matter.

Water Rights Under Federal Law

The United States also claims certain water rights under Federal law that are referred to as "reserved" water rights. These rights apply to Federal lands reserved from the public domain that did not later pass out of Federal ownership. Types of reserved water rights claimed for National Forest lands are described in Forest Service Manual 2541. Claims to Federal reserved water rights for National Forest lands with reserved status were recently approved by the State of Oregon in the Klamath Adjudication. They include consumptive and instream uses. If the instream concepts developed for the Klamath Adjudication were applied to a future adjudication of Federal claims in the Pine Creek watershed, the United States would make the following types of claims for the portions of the Wallowa Forest Reserve (of 1905) and the Imnaha Forest Reserve (of 1907), Eagle Cap Wilderness, and Hells Canyon National Recreation Area within the watershed. (The two forest reserves, created by presidential proclamation, are now within the

WWNF administrative boundaries). Some of these claims may duplicate ODFW's instream water rights.

The United States would claim "favorable conditions of flow" under the 1897 Organic Act as the minimum amount of water needed to maintain stream channels in an open condition over time to ensure the delivery of water to downstream users. Priority dates would be May 6, 1905, for the Wallowa Reserve and March 1, 1907, for the Imnaha Reserve.

The United States would claim median monthly flows from about May into November as the minimum amount of water needed for the purpose of providing fire barriers, thereby supplying a "continuous supply of timber" under the 1897 Organic Act. Priority dates would be May 6, 1905 for the Wallowa Reserve and March 1, 1907 for the Imnaha Reserve.

The United States would claim all water not previously appropriated at the time of designation of Eagle Cap Wilderness on September 3, 1964. The headwaters of West Fork Pine Creek, Middle Fork Pine Creek, Norway Creek in the Pine Creek watershed, and Blue Creek in the Imnaha River watershed from which water is diverted into the Pine Creek watershed, are in Eagle Cap Wilderness.

The United States would claim all water not previously appropriated at the time of designation of Hells Canyon National Recreation Area as of December 31, 1975. Lower Lake Fork Creek, lower Fall Creek, and most of North Pine Creek and its minor tributaries are located on National Forest lands within Hells Canyon National Recreation Area.

Surface Water Rights

There are 88 irrigation diversion points regulated by the OWRD and 12 reservoirs within the watershed. One of these diverts water from the Blue Creek in the Imnaha watershed into the Pine Creek watershed. Late in the irrigation season, flows from the reservoirs augment the flows of Pine Creek, Clear Creek, and Lake Fork Creek. Flows from Lake Fork Creek are diverted into Fish Creek, significantly affecting its summer flows. Lower in Fish Creek, the water is removed and mostly dewaters over two miles of the stream on National Forest lands (BLM, 1998). The Pine Creek, Clear Creek, and East Pine Creek drainages have tabulated information showing ditch, priority year, acres, flow and cumulative flow (appendix F).

Instream Water Rights

Instream water rights were established to reserve water to support aquatic life, maintain recreation, and minimize pollution. Although the OWRD has determined that the pending instream rights are warranted to maintain aquatic and fish habitat most of the protests were not about quantity of water but the methodology and the mistaken belief that these water rights would be senior rights.

Potential Additions to 303(d) List

The first statewide list of nonpoint sources of pollution was published by ODEQ in 1988. Many of the streams/parameters included in the assessment were based on "observation only." In 1995, ODEQ developed and applied new decision criteria to an updated 1988 list to determine if any streams/parameters should be added to the state's 1994/1996 303(d) list of WQLWBs. The criteria were used to make one of three decisions for each stream/parameter on the 1988 list: (1) include on 303(d) list as WQLW; (2) okay to remove from further consideration; and (3) defer decision because further data is needed before a decision can be made. When the 1994/1996 303(d) List was published, ODEQ also published a list of Waterbodies of Concern (ODEQ 1995b). When sufficient data is obtained, some of these streams/parameters could be added to the 303(d) list.

The current list of "Needs Data" streams/parameters is shown on Oregon's Approved 1998 Section 303(d) Decision Matrix (ODEQ 1998d), and is summarized in abbreviated format on the right side of table 5 on page 29. Seven streams are shown on the concern list: Clear Creek, Dry Creek, Duck Creek, East Pine Creek, Lake Fork Creek, Long Branch Creek, and Pine Creek. The WWNF does not believe there is a "toxic" condition in Lake Fork Creek, and since ODEQ did not describe what the toxic chemical was believed to be, no monitoring has been done to evaluate the presence/absence of the chemical.

When the USFS and BLM completes water quality management plans or gathers new water quality data, they are required to give this information to ODEQ, who can use the information to add streams/parameters to the 303(d) list or to the need data list (see table 5).

Several lower elevation streams in the Pine Creek watershed that are not included on the 303(d) List Decision Matrix are similar in condition to streams already included on the Decision Matrix. This suggests that more streams from the Pine Creek watershed may be added to the Concern List and/or 303(d) List by the time ODEQ completes the Water Quality Management Plan for the Powder Basin in 2005. If these streams were identified in the *Pine Creek Watershed Action Plan*, and objectives were established to improve these streams, perhaps watershed condition could be substantially improved before ODEQ begins the TMDL/WQMP process and perhaps some of them could be kept off of the 303(d) list.

Fish Passage

Several small diversion dams, including push-up, board, and concrete dams, which are used to divert water from streams for irrigation and mining purposes, are reported to not provide for fish passage as required by State law (ORS 509.605). Pine Creek fish passage problems on National Forest lands are identified in appendix J. As per the Oregon Forest Practices Act, permanent and temporary crossing structures installed on private forest land for purposes of commercial forest management will allow for both adult and juvenile fish passage. The USFWS may require some fish passage improvements in the near future to stimulate recovery of small, isolated, bull trout populations in the watershed. Other fish species, especially salmonids, would also benefit from fish passage improvements.

There are also 12 reservoirs in the watershed (table 3, page 22): Upper Pine Lake, Lower Pine Lake, Red Mountain, East Lake, Laird, Clear Creek, Melhorn, Lost Lake, Bear Wallow, Crow, Sugarloaf and Fish Lake. Upstream fish passage is not possible to Pine Lakes, East Lake, Clear Creek Reservoir, Melhorn, and Sugarloaf because of physical barriers. Many of the remaining reservoirs are located above distribution of fish and little or no additional fish habitat would be gained from reservoir fish passage. None of these reservoirs provide upstream fish passage. These reservoirs do provide incidental downstream fish passage as water is released.

Many irrigation canals, small reservoirs, and culverts may also block fish passage, but there is no general inventory on private lands of these structures and their passage needs. The blockage which can cause the most problems for fish are seasonal problems at culverts and diversion structures which keep the fish from moving to spawning and rearing areas and/or to escape poor water quality.

The streams in Pine Valley have had reduced flows due to irrigation since the 1870's. This usually takes place from mid-July to the end of the irrigation season, October 1st. Prior to 1995, when the irrigation season ended, the ranchers who had been without adequate water resumed irrigating. Prior to the Hells Canyon Complex of dams on the Snake River in the 1960's, salmon and steelhead were plentiful. Agriculture is believed by some to have had very little negative effect upon these fish. The anadromous fish adapted to the changes in water volumes and travel upstream toward the cooler temperature water during the late summer months (G. Summers).

There are two dewatering situations. One situation is where water is diverted from a stream into a ditch or canal by a structure across the stream. The other situation is where the "pushed up" bank of a ditch or canal intercepts the flow from a tributary to the ditch so there is seasonal or annual interception of stream flow.

A "Pine Creek Watershed Fish Migration Barrier Evaluation" was completed in 1998 by Mark Fedora, Pine District Hydrologist, for National Forest lands in the Pine Creek watershed (appendix M).

Reservation of Water for Future Economic Development

On November 6, 1992, the ODA submitted a request to the Oregon Water Resource Commission (OWRC) for a reservation of water for future economic development from multi-purpose storage in the Powder Basin pursuant to ORS 537.356 and 537.358. The basinwide reservation still has not been approved by ODA and OWRC due to questions about reservations outside of the Pine Creek watershed. The original basinwide reservation request includes the following reservations in the Pine Creek watershed:

- 6,000 acre-feet in the Clear Creek watershed
- 4,000 acre-feet in the East Pine Creek watershed

In June 1999, OWRD recommended the specificity of the reservation requests be reduced by applying reservation requests to larger watersheds.

The criteria ODA used for selection of potential storage sites for water availability analysis for the reservations included:

1. Water must be available to be stored.
2. Dam sites must:
   - Be in the upper stream reaches or dam sites must be on streams having little known anadromous and other fish species
   - Be on predominantly public land or have minimal impact upon private land use
   - Have a high storage-to-cost ratio
   - Not adversely affect infrastructure such as roads, power lines, and pipelines
   - Have multi-purpose storage ability
   - Provide for in stream flow improvement as well as flat water recreation opportunities
   - Provide flood control benefits

ODA and OWRD used the Melhorn Mills storage site to model water availability for Clear and East Pine Creeks. The proposed storage sites are located on the WWNF.

Environmental issues that might prevent exercise of the reservations were not included in the ODA's analysis; ODA intended these issues to be addressed at the time of development. Two important environmental issues affecting the reservations are water quality limited streams and bull trout.

The Oregon 303(d) list includes Clear Creek and three upper East Pine Creek tributaries (Beecher Creek, Okanogan Creek, and Trinity Creek) as water quality limited for temperature. The 303(d) list decision matrix also lists concerns about flow modification and sedimentation in Clear Creek, and habitat modification and sedimentation in Dry Creek (another East Pine Creek tributary). ODFW is also concerned about flow modification in East Pine Creek below irrigation withdrawals.

Bull trout were listed as a "threatened species" under the ESA in 1998. Federal and State agencies are studying bull trout habitat and species recovery needs in Clear Creek and East Pine Creek where the reservations are located.

Potential benefits of multi-purpose storage include flood water storage and water for crops, fish and wildlife (including instream flow augmentation), recreation, and groundwater recharge. Potential adverse effects include alteration of fish habitat to favor non-native species which some may consider beneficial, loss of riparian and instream habitats, fragmentation of fish population units, and changes in water quality. There is a lack of data that relates to the understanding of the effects of existing reservoirs on water quality.

Riparian Area Health

The health of riparian areas in the Pine Creek watershed has been adversely affected by both natural events and human activities. Natural events include spruce budworm infestations, wildfires, and catastrophic floods. Human activities may have aggravated the severity of these events in some cases. Other human activities such as livestock grazing and other agricultural practices, historical timber harvesting and road building, mining, reservoir development and uncontrolled placement of small push-up dams, and increasing recreation use have placed additional stress on the riparian habitat. ODF vegetation inventory data and aerial photographs would help provide information on inventory of riparian area on private lands within the watershed.

A partial inventory of riparian conditions was completed by the WWNF on National Forest lands; however, little is known about the condition or potential of lands administered by other agencies. Baker County vegetation inventory of private and BLM lands can provide some information on current conditions of private lands. This inventory and color aerial photographs were completed during June 1999 and are available through the Baker City office of ODF (Paul Joseph). Past management practices have kept riparian vegetation in an earlier seral condition to maximize forage production for livestock. Some fencing and changes in management practices have taken place in cooperation with state and Federal agencies.

Riparian area potential on private forest land can be partially addressed with reference to forest management based on existing rules within the Oregon Forest Practices Act: The purpose of the water protection rules within the Oregon Forest Practices Act is to "...protect, maintain, and where appropriate, improve the functions and values of streams, lakes, wetlands, and riparian areas". Refer to the Act for specifics.

Grazing

The Pine Creek watershed contains all or part of 12 grazing allotments that are administered by the USFS. These allotments are managed under different management systems which permit livestock grazing during specific seasons. A small portion of the private land is managed in conjunction with the USFS lands. Approximately 4,479 animal unit months (AUM's) are grazed on the National Forest within this watershed.

The Pine Creek watershed has 9 BLM range allotments. No information was summarized for these allotments.

Cattle grazing has resulted in some streambank disturbances, soil compaction, and a reduction in the amount and variety of upland and streamside vegetation. The effects of grazing are particularly evident around water sources such as springs, seeps, and along some streams. Domestic livestock grazing has decreased since the early 1900's when large bands of sheep grazed across the watershed. Cattle are the primary domestic grazing stock; elk and deer are the primary non-domestic grazers.

For the past 10 years, riparian issues have been of concern. Riparian protection improvements such as fences, water troughs, and stock ponds have been constructed and maintained to better control distribution, utilization, and duration of livestock use in sensitive riparian areas.

Prior to 1992, monitoring of grass utilization occurred periodically. Monitoring presently occurs on a regular basis, with grazing permittees participating in the monitoring and documenting their results in accordance with their annual operating plans. Utilization standards for riparian shrubs were initiated between 1989 and 1992.

Livestock grazing related activities include spring developments in the uplands to lure livestock and wildlife away from riparian areas and riparian planting and fencing to restore shading along streams. Projects have been identified to add large woody material to stream channels and riparian areas to restrict livestock movement into and use of riparian areas.

Hydrologic Function

Several activities in the watershed have altered hydrologic function of streams. Summer streamflow is augmented in the upper reaches of several streams by releases of stored water. In contrast, summer streamflow in the lower reaches of larger streams is greatly reduced by irrigation and mining water use withdrawals. ODEQ may need to evaluate the effects of these flow modifications using its section 303(d) listing criteria. Timing, duration, and quantity of peak and low streamflow have also been affected by reduced ground cover due to wildfire, livestock grazing, timber harvest, insect and disease mortality, roads, and mining; by floodplain confinement from dikes, road fills, and gullies; and by extension of the drainage network by road ruts and ditches, irrigation and mining ditches, and rills and gullies. Insect and disease defoliation/mortality are having an effect on ground cover. Quantitative changes in hydrologic function have not been modeled as part of this assessment process.

Floodplains and Flood Frequency

Although flooding is a natural, frequent hydrologic process, the definition of "flood" is subjective. Most people equate flooding with property damage or inundation of wide floodplains, fields and roads. These major events are usually 25-year to 100-year (or larger) return interval events. However, any flow above bankfull (i.e., about the 2-year return interval event) is a flood because the water begins to flow onto the floodplain. Flooding problems become more pronounced as the size of the watershed above the evaluation point increases because there is more potential to accumulate water and synchronize flows from subwatersheds.

Floodplain width and configuration differ by the type of stream channel. The classification system known as the "Rosgen Stream Channel Classification System"[3] is used to categorize stream channels in the Pine Creek watershed. Rosgen stream channel types A, B, F, and G (representing

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[3] For a detailed explanation of the Rosgen stream channel classification system see: Rosgen, Dave. 1996. *Applied River Morphology*. Wildland Hydrology Books, Pagosa Springs, Colorado.

narrow floodplains) and steam channel types C, D, and E (representing wide floodplains) are found in the watershed.

The 1978 U.S. Department of Housing and Urban Development (HUD) Flood Hazard Boundary Maps for Baker County (numbered 8, 9, 15, and 16) show major floodplains within and downstream from Pine Valley, including Pine Creek, McMullen's Slough, McMullen's Ditch, Clear Creek, Holbrook Creek, Boulder Creek, East Pine Creek, Dry Creek, and North Pine Creek. These maps show floodplain widths of 200 to 3,000 feet, with the widest spot being the confluence of Clear Creek, Pine Creek, and the McMullen Ditch. The narrow floodplains common to most streams in the watershed are now shown because they are less than 200 feet wide.

Flood Damage

Peak flood flows usually occur in April, May, or June, with flooding lasting for several days. Occasionally, summer precipitation causes high flows of short duration.

Constant surveillance and maintenance are required to keep the diversions and canals functional during the early part of the irrigation season. Bedload material and floating debris often destroy or damage irrigation structures, cross-channel fences, and bridges when streamflow is high. Debris removal at the many bridges is an annual maintenance problem. Sediment accumulates in diversion structures and canal systems, and is carried onto croplands when floodwaters are used for irrigation. High velocities during major flood events have caused bank cutting at several locations on the principal watershed streams, generally worse in areas with poor riparian cover, at several locations on the principal watershed streams. Upper watershed areas also contribute sediment to the stream channel through logging operations, road construction, or when cover is damaged by fire or overgrazing.

Approximately 800 acres are flooded in the watershed on an average of one year in five. About one-half of this area is forested and has minor damage. There are 400 acres of cropland that receive moderate damage from sediment deposition and erosion. Streambank erosion affects some pastures and croplands. Irrigation diversions and other facilities receive moderate flood damage from erosion and sedimentation. Roads, bridges, and buildings normally receive minor damage.

The city of Halfway is located within the floodplain of Pine Creek. Carson Creek and Lee Creek, as well as all the runoff from the Westwall mountain range head right toward the city of Halfway. In rapid snow melt or excessive rainfall situations a lot of water drains through the city toward Pine Creek.

The Posy Valley and Foothill Ditches irrigation canals that run north to south parallel with the west wall, divert some of the runoff to the south around the city. If these irrigation canals were not present, the flooding problem would be much worse.

A solution to this problem was proposed (and surveyed) many years ago and involved a flood control canal running from the west wall area north of the city over into Pine Creek. This would intercept a lot of the west wall water before it could reach the city. This would be a viable solution to the problem should the city ever choose to fund such a project.

Most culverts on National Forest land in the watershed were designed for 25-year return interval events. Major flood events periodically plug some of these culverts and/or wash out road fills. New culverts installed on National Forest lands must now pass the 50-year or 100-year return interval event. Most bridges and dams have been designed to withstand the 100-year return interval event.

As per the Oregon Forest Practices Act, culverts and bridges installed on private forest lands during road construction or reconstruction for purposes of commercial forest management are required to pass the 50-year return interval peak flow without ponding; and provide for both adult and juvenile fish passage.

Healthy vegetated riparian zones and uplands protect stream banks and help prevent erosion and bank cutting during flood events.

Sediment in Streams

Accelerated sediment deposition and turbidity in streams in the watershed is believed to be caused in part by altered hydrologic function due to past and current land use activities (roads, farming, mining, timber harvest, and grazing practices), and natural events such as fires and flooding. At this point in time, sedimentation and turbidity have not been shown to be serious enough to merit a listing under section 303(d) of the Federal Clean Water Act(ODEQ 1998c), that is, there is not enough data to show impairment of beneficial uses. See Pine Creek Watershed Analysis (USFS 1998) and Draft Biological Assessment for Bull Trout, Pine Creek, Section 7 Watershed (USFS 1998).

Ranchers in Pine Valley believe little erosion is caused by farm and ranch operations. Most cattle in the valley are confined to pastures. Most livestock watering is accomplished by diverting water from streams to ditches where livestock drink; a limited number of livestock are reported to drink from streambanks. Most of Pine Valley is devoted to pasture and hay; little land is plowed and open to erosion (G. Summers).

Erosion problems on private forest land road systems are related to surface water drainage, and historical road location. Sediment delivery into waters of the state occurs most often as a result of these problems.

Surface water drainage: Because of high recreational use during wet portions of the year (hunting season) traditional water barring of native surface mainline roads is often inadequate to provide sufficient drainage. This has prompted seasonal road use restrictions and construction of rolling dips, grade changes or other more permanent drainage structures such as ditching with cross drainage. In addition to being prudent activity, maintenance of forest roads is required by the Oregon Forest Practices Act. The Act states that "operators shall maintain active and inactive roads in a manner sufficient both to provide a stable running surface, and keep the drainage system operating as necessary to protect water quality". Several rules within the Act specifically address these concerns.

Historical road location: The common historical practice of locating roads in draw bottoms and/or near stream courses has, in site specific location, led to various problems from occasional sedimentation into stream courses, to being unusable after being totally washed out.

Mining Tailings and Mining of Stream Channels

In 1881, a rich deposit of gold was discovered on Pine Creek in the Cornucopia area. Waste rock from the mines was dumped into the floodplain of Pine Creek. In 1912, a slime cyanide plant was constructed. At least four processing mills operated during this time. Some processed tailings were washed directly into Pine Creek during operations and still remain in the riparian area of Pine Creek. These tailings are listed as hazardous waste by ODEQ.

In the 1930's, placer mining activities took place south of Cornucopia. A new channel was cut using a drag line with a 4-ton bucket to divert Pine Creek away from mining activities. Approximately 5 miles of the stream channel and riparian area along Pine Creek have been disturbed by mining activities. Natural vegetative recovery has taken place over much of this length. Some reaches are confined by dikes that require frequent inspection and periodic maintenance and repair.

Placer mining operations on Upper Pine Creek in 1992 involved rerouting segments of the main stem and one tributary. Recent disturbances along about 2 miles of stream have drastically altered channel morphology and riparian vegetation. A portion of the recently mined area has been reclaimed, but other areas remain in a disturbed condition.

Very little mining occurs in the watershed outside of the Cornucopia Mining District, with the exception of rock pits on National Forest, state, county, and private lands.

A reclamation project was planned for Pine Creek Placer Mine in 1998. The mining reclamation project was completed, however, past project monitoring shows little success of tree survival. Further planting will be necessary in future years.

Road Construction and Maintenance

Road building and maintenance activities have contributed to watershed health problems in the Pine Creek watershed. Roads and ditches have enlarged the drainage network, decreasing response time from storm events mostly on National Forest land.

Between 1990 and 2000 private forest landowners conducted less than 10 road construction or reconstruction operations associated with commercial forest management activities. In general, little new road construction has been necessary as most of the privately owned forest land in the watershed has a good existing transportation network in place. Road reconstruction is a more common practice as older roads with inadequate drainage or poor location problems are corrected. The majority of road systems on privately owned land are native surface roads generally wide enough for one vehicle with occasional turnouts. A few roads have been rocked for all season use. Most native surface road systems provide an adequate alternative for meeting landowners management objectives. Native surface roads are useful during most of the year with the exception of fall rains or spring snow melt (breakup), and because of snow depth most of the timber harvesting or other management activity within the basin takes place during the dry summer and fall months. Native surface roads require more persevering and stringent maintenance than all weather (rocked) roads.

In terms of sediment issues specific to forest roads, there are BMP's within the Forest Practices Act specifically designed to regulate road design, construction and maintenance. The bulk of the BMP's are directed at minimizing sediment delivery to channels. Refer to the Act for specifics.

Soil Productivity

Major long-term changes in soil productivity are induced by activities or events that cause changes in basic soil characteristics. These changes include: soil density, structure, solum depth, topsoil thickness, microbiota (mites, bacteria, algae, etc.), macrobiota (worms, etc.), fertility (nitrogen, phosphorus, potassium, etc.), organic matter (soil wood, litter, humus, etc.), or water table. Known soil management problems in the watershed include: 1) soil compaction by off-road vehicles (including logging equipment) and livestock, 2) soil displacement associated with timber harvest, road construction, and mining, 3) soil erosion (i.e., sheet, rill, and gully erosion) of road surfaces, fills and ditches, irrigation ditches, cultivated fields, stream channels and banks, and uplands where ground cover is below potential, and 4) inadequate subsurface drainage for 2,500 acres of arable lands, i.e., problems with closed drains and outlets. In addition, ecosystem changes due to aggressive noxious weeds may increase soil erosion. This assessment does not include a site-specific inventory of these problems.

Some soil management problems that adversely affect soil productivity also relate to other identified problems. For example, accelerated erosion of upland, inchannel, or streambank can cause unacceptable levels of instream sedimentation which can adversely affect fish and aquatic life. If inchannel erosion lowers a streamside water table, water retention within the stream banks of the streams within the watershed may decrease and the riparian zone may shrink; both effects may increase water temperature. If streambank erosion widens a channel, the riparian zone may shrink and water is shallower; both effects may increase water temperature. Soil compaction affects hydrologic function or surface water and ground water runoff. These and other synergistic effects should be kept in mind as further work is done on the assessment and on the action plan.

Effects of Uncontrolled Runoff

Erosion, Turbidity, and Sediment Deposition

Concern has been expressed by some Council members that high springtime snowmelt runoff in the Pine Creek watershed is a watershed health issue because annual flooding causes a substantial increase in erosion, turbidity, and sediment deposition. This assessment process found some information related to this issue.

Before this data is presented, it must be emphasized that erosion from rainfall and snowmelt, turbidity, and sedimentation are natural processes in the watershed. Natural processes of streams include transporting dissolved solids, bedload sediment and suspended sediment, and creating channels, banks and floodplains through erosion/sedimentation of topsoil, sand, gravel, cobble, and organic detritus. Many riparian plant communities, including cottonwoods and certain willow species, and aquatic plants and animals rely on these natural processes for their survival.

Consider the following data for the Pine Creek Gage. Table 13 (page 99) shows instantaneous stream discharge for several return intervals, with exceedence shown as percent. The 1.25-year return interval event (80 percent exceedence) is 2,010 cfs. The 2-year return interval event (50 percent exceedence) is 3,020 cfs. The 50-year return interval event is 8,590 cfs. (As a point of interest, the Forest Practices Act requires culverts be large enough to pass the 50-year return interval event). The highest measured peak flow during the period of record was 7,110 cfs in 1968 which was less than a 25-year event. The flows in 1997 were estimated to be higher than a 100-year event. Looking at table 2 (page 15), note that the table at the bottom shows mean daily discharge from 5 percent exceedence (20-year return interval) to 95 percent exceedence which occurs many times each year. Also, note that the 10-year return interval event for instantaneous peak flow in table 13 is 5,750 cfs compared with 1,530 cfs mean daily discharge for June in table 13a, which shows that a mean daily discharge can be much less than an instantaneous peak. Limited data is available for analysis points higher in the Pine Creek watershed. Appendices C and D show estimates of streamflow for 80 percent and 50 percent exceedence (1.25 and 2.0 return interval) for 6 other analysis points. The high peak flows of concern are not represented in these tables. Some ODFW data may include higher flows (Hutchinson, et. al., 1967).

It must also be kept in mind that all stream channels in the watershed have their own unique characteristics. The same return interval event will cause different effects in different stream types in the watershed. Streams with fine textured substrate, a gullied channel, and/or little riparian vegetation will be sensitive to erosion by common events, such as the 1.25-year return interval event (80 percent exceedence flow). Streams with cobbly substrate in glacial moraine or outwash and good riparian tree/shrub vegetation can withstand the 10 to 25-year return interval events. Also, streams undulate from flatter to steeper reaches; the flatter reaches have finer textured more erodible soils, but also naturally accumulate sediment more than steeper reaches.

No streams in the Pine Creek watershed are included on the 303(d) list for sediment. However, the WWNF stream survey has identified some stream segments with higher than desired fine sediment on National Forest lands, and there are gullies in dryer parts of the watershed where erosion and sedimentation may be a concern.

Table 13. Pine Creek Basin

13290190 Pine Creek Near Oxbow, OR

LOCATION–Lat 44°57'13", long 116°52'21", in NE 1/4 SW 1/4 sec.17, T.7. S., R.48 E., Baker County, Hydrologic Unit 17050201, 1.8 mi south of Oxbow, and at mile 1.9.

DRAINAGE AREA–230 square miles (mi^2), approximately.

PERIOD OF RECORD–November 1966 to 1987.

GAGE–Water-stage recorder. Datum of gage is 1850.48 feet above National Geodetic Vertical Datum of 1929 (levels by Idaho Power Co.,). Prior to August 24, 1967, nonrecording gage at site 1.7 mi downstream at different datum.

REMARKS–Diversions upstream from station for irrigation of about 19,000 acres (1966 determination).

AVERAGE DISCHARGE–20 years, 378 cfs, 273,900 acre-feet/year.

EXTREMES FOR PERIOD OF RECORD–Maximum discharge, 7,100 cfs, February 21, 1968, gage height, 9.82 feet; minimum discharge, 10 cfs, August 17-24, 1977, gage height, 2.12 feet.

Statistical Summaries
(n = number of values used to compute statistics)

Table 13a. Magnitude and Probability of Annual Low Flow Based On Period of Record 1968-1987

Period (Consecutive Days)	n	Discharge, in cfs, For Indicated Recurrence Interval, in Years, and Annual Non-Exceedence Probability, in Percent					
		2 (50%)	5 (20%)	10 (10%)	20 (5%)	50 (2%)	100 (1%)
1	20	36	25	20	16	12	--
3	20	36	25	20	16	12	--
7	20	38	26	21	17	13	--
14	20	40	27	21	17	13	--
30	20	42	29	24	20	16	--
60	20	49	34	27	22	17	--
90	20	56	40	32	26	20	--
120	20	65	47	39	33	27	--
183	20	100	72	60	51	42	--

Table 13. Pine Creek Basin (continued)

Table 13b. Magnitude and Probability of Annual High Flow Based On Period of Record 1968-1987

Period (Consecutive Days)	n	Discharge, in cfs, For Indicated Recurrence Interval, in Years, and Annual Exceedence Probability, in Percent					
		2 (50%)	5 (20%)	10 (10%)	25 (4%)	50 (2%)	100 (1%)
1	20	2550	3600	3980	4240	4350	--
3	20	2180	2840	3010	3100	3130	--
7	20	1870	2260	2330	2360	2360	--
15	20	1580	1830	1860	1860	1870	--
30	20	1320	1520	1540	1550	1550	--
60	20	1120	1260	1270	1270	1270	--
90	20	992	1120	1130	1130	1130	--

Table 13c. Discharge, in cfs, For Indicated Recurrence Interval, in Years, and Annual Exceedence Probability, in Percent

1.25 (80%)	2 (50%)	5 (20%)	10 (10%)	20 (5%)	50 (2%)	100 (1%)
2010	3020	4590	5750	7330	8590	--

Systematic n = 21
Historical n = 0
Weighted skew = 0.099